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JULY 1988–FIFTH ANNIVERSARY

VOL. 6 NO. 7 $3.95

PC TECH JOURNAL®

FOR SYSTEMS DEVELOPERS AND INTEGRATORS

MAC CONNECTIONS

MACS IN A PC WORLD

3+ FOR MACINTOSH

DCA'S MACIRMA LINK

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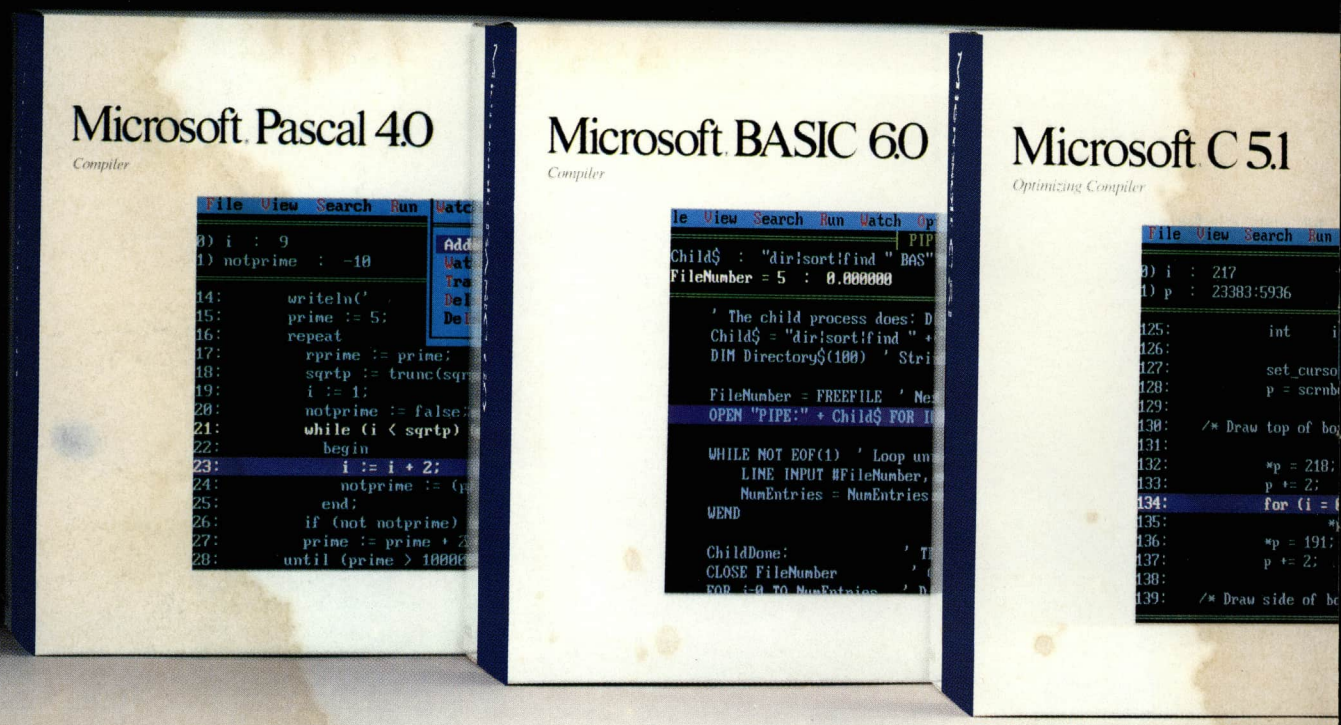
Introducing Mic for OS/2



The people who co-developed the industry's most powerful personal computer operating system are now proud to announce programming languages to match.

Introducing Microsoft® Macro Assembler 5.1, C 5.1, Pascal 4.0, FORTRAN 4.1 and BASIC Compiler 6.0.

Five industrial-strength, stand-alone languages that combine the implementation flexibility you've enjoyed under MS-DOS® (which, of course, they still support) with the advanced capabilities you've anticipated from OS/2.

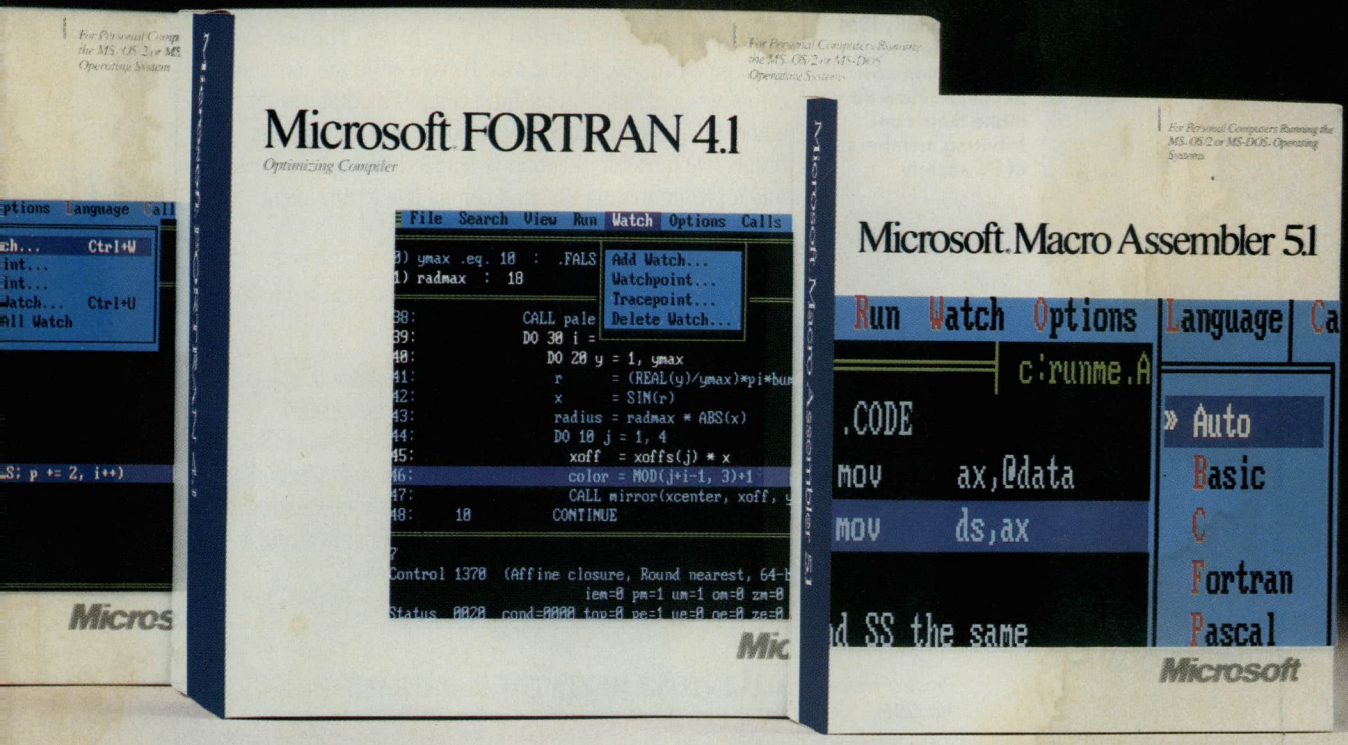
Capabilities such as the ability to develop large, sophisticated applications which go beyond the 640K barrier, taking advantage of up to 16MB of RAM, and utilizing the potential of today's microprocessors.

Just like their MS-DOS predecessors, these five new languages are equipped with powerful, professional features you work with, not around:

Support of direct calls to the operating system, and inter-language calling for mixing multiple languages on the same project.

Access to OS/2 system calls and a full complement of utilities, including an incredibly fast incremental linker and the

rosoft Languages systems.



first protected mode programmer's editor that works equally well in real mode.

Microsoft CodeView,® our popular, advanced debugger that lets you untangle program logic at the source code level, no matter what code you're using.

(It even lets you debug protected mode programs up to 128MB of virtual memory, and larger programs than ever before in real mode.)

As the perfect complement to our new languages, we're also offering the Microsoft OS/2 Programmer's Toolkit.

It contains a parameter-by-parameter breakdown of all OS/2 system calls and samples to get you started.

All the tools you need for turning out larger, more powerful, more complex OS/2 applications.

(And, incidentally, all the tools we rely on for creating our own commercial software.)

For the name of your nearest Microsoft professional languages dealer, simply call 800-541-1261, Dept. C16.

Ask him for some more information on our OS/2 family.

He'll show you some languages you can really swear by.

JULY 1988

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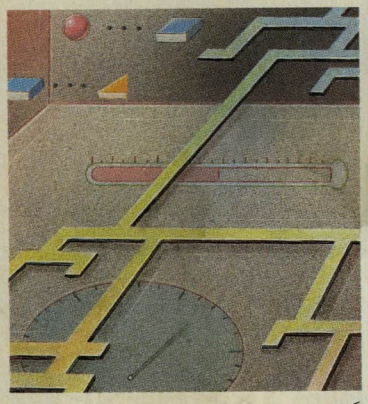


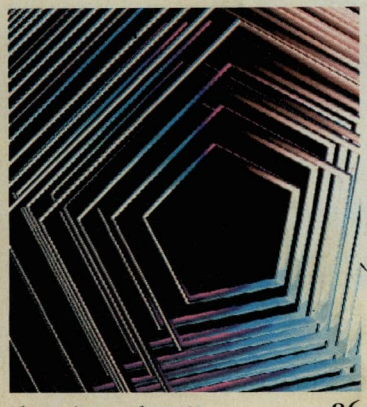
COVER SUITE: MAC CONNECTIONS

The Apple Macintosh is popping up on thousands of desks in traditionally IBM business territory. The question now becomes: How do we make them contributing members of PC society.

ENTER THE MACS

WILLIAM CASEY

The IBM world's attitude toward Macintosh computers has never been congenial—they were okay, as long as they didn't show up in the neighborhood. Times change. The new and more powerful Mac SE and Mac II have given the renegade computers a presence in business computing that cannot be ignored. For the first time in *PC Tech Journal*'s five-year history, we turn our attention to Mac technology and how it fits into a predominantly IBM and compatible environment.



PC-MAC LINK

HOWARD MARKS

One of the first PC network vendors to recognize the Macintosh is 3Com. The latest extension to its 3+Share network operating system is 3+for Macintosh, which allows PCs and Macs to coexist with a common server. Our examination and LAN performance tests show this to be a good networking solution for the mixed environment, sure to grow stronger with the multitasking and memory features of OS/2.

MACINTOSH MEETS THE MAINFRAME

PAUL FIRGENS

Mac users have been out of luck in the corporate environment in which an IBM mainframe looms over them. DCA comes to the rescue with MacIRMA, a 3270 terminal emulator. We test it on a Mac II and find that MacIRMA gives Mac users the same access to data as PC users have long had—and represents a giant step toward corporate acceptance of the Macintosh.

OPERATING ENVIRONMENTS

EMS 4.0 PULLS TOGETHER

TED MIRECKI

EMS 4.0 melds the best of the earlier Lotus/Intel/Microsoft version and the enhanced version from AST/Quadram/Ashton-Tate into a new and improved expanded memory specification. This blessed union provides a memory standard and task-switching capability that should mean a brighter future for those developing DOS applications.

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Cover Illustration · Ned Shatzer

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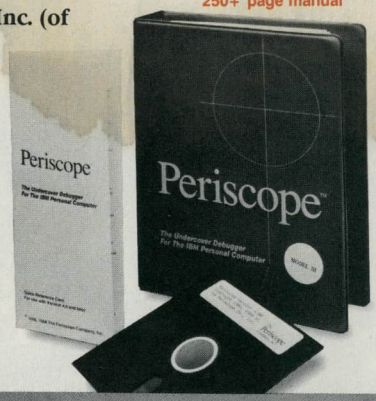
Periscope's *New* Version 4

...Gives you all the right stuff for debugging! No matter which model you pick, you have the same powerful software to help you track down hard-to-find bugs fast.

David Nanian, President of Underware, Inc. (of BRIEF fame) says this about the new Periscope Version 4:

"Periscope has always been an unbelievable assembler-level debugger. Version 4 has turned it into a terrific source-level debugger as well. Aside from major enhancements like the source-level improvements, all the little changes make a really big difference, too. For instance, symbol lookups and disassemblies are noticeably faster, and highlighting the registers that have changed really makes life easier. Once again, Periscope has raised the industry standard for debuggers!"



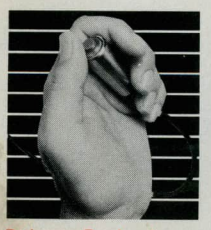
Periscope software & 250+ page manual

Periscope's software is solid, comprehensive, and flexible.

It helps you debug just about any kind of program you can write... thoroughly and efficiently.

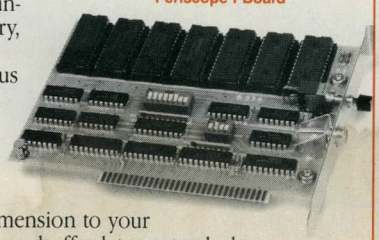
Periscope's the answer for debugging device-drivers, memory-resident, non-DOS, and interrupt-driven programs. Periscope works with any language, and provides source and/or symbol support for programs written in high-level languages and assembler.

Periscope's hardware adds the power to solve the really tough debugging problems.


Periscope Break-out Switch

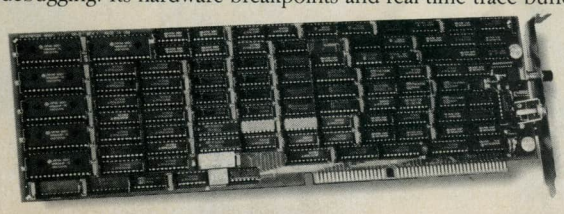
The break-out switch lets you break into the system any time. You can track down a bug instantly, or just check what's going on, without having to reboot or power down and back up. That's really useful when your system hangs! The switch is included with Periscope I, Periscope II, and Periscope III.

Periscope I has a board with 56K of write-protected RAM. The Periscope software resides in this memory, safe from run-away programs. DOS memory, where debugger software would normally reside, is thus freed up for your program.


Periscope I Board

Periscope III has a board with 64K of write-protected RAM, which performs the same function as the Periscope I protected memory. AND...

The Periscope III board adds another powerful dimension to your debugging. Its hardware breakpoints and real-time trace buffer let you track down bugs that a software-oriented debugger would take too long to find, or can't find at all!


Periscope III Board

What's New in Periscope Version 4:

- View local symbols from Microsoft C (Version 5)
- Debug Microsoft windows applications
- Set breakpoints in PLINK overlays
- Improved source-level support
- Monitor variables in a Watch window
- 80386 debug register support
- Debug using a dumb terminal
- PS/2 watchdog timer support
- Use mixed-case symbols
- Set breakpoints on values of Flags
- Much more!

- **Periscope I** includes a half-length board with 56K of write-protected RAM; break-out switch; software and manual for $345.
- **Periscope II** includes break-out switch; software and manual for $175.
- **Periscope II-X** includes software and manual (no hardware) for $145.
- **Periscope III** includes a full-length board with 64K of write-protected RAM, hardware breakpoints and real-time trace buffer; break-out switch; software and manual. Periscope III for machines running up to 10 MHz is $1195.

REQUIREMENTS: IBM PC, XT, AT, or close compatible (Periscope III requires hardware as well as software compatibility); DOS 2.0 or later; 64K available memory; one disk drive; an 80-column monitor.

Call us with your questions. We'll be happy to send you free information or help you decide on the model that best fits your needs.

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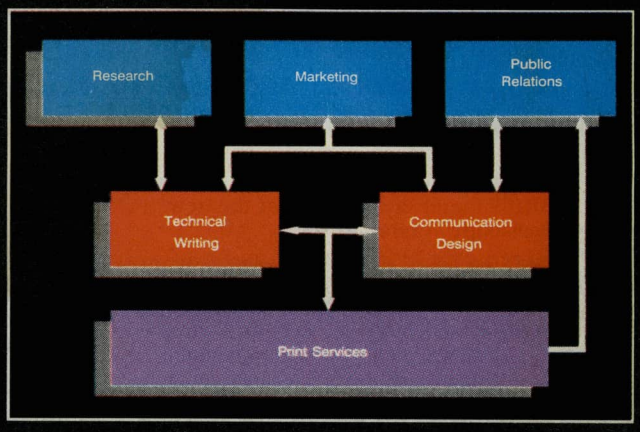
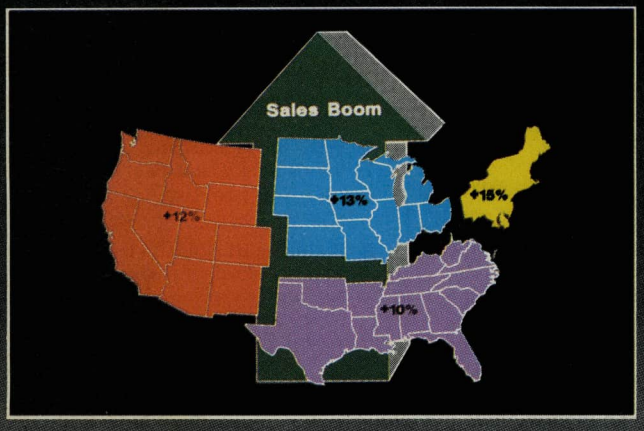
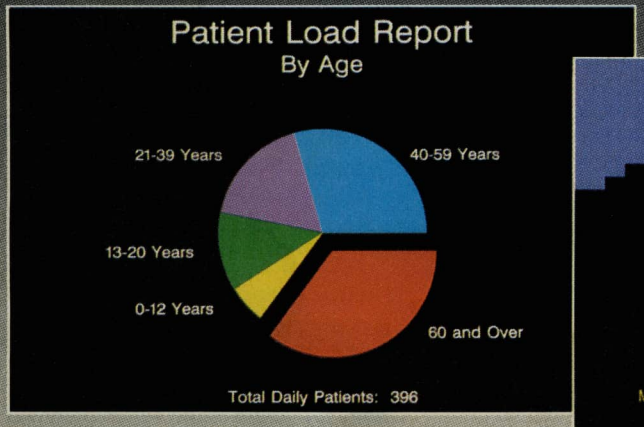


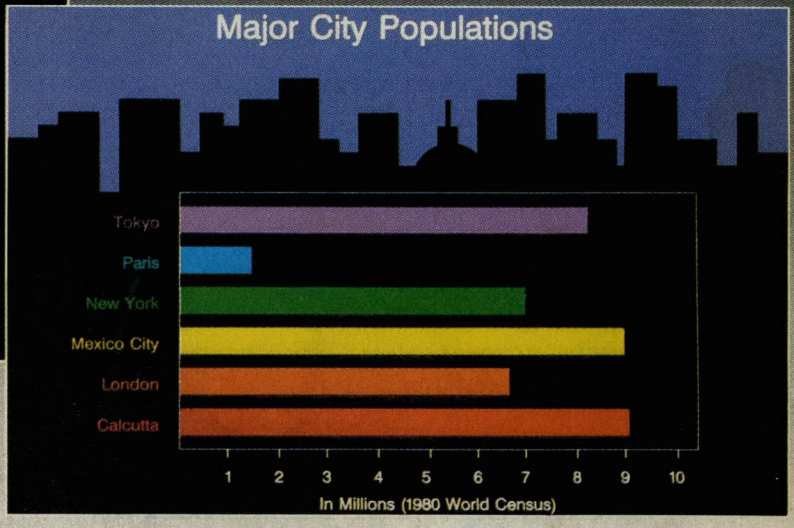


Productive.

The SAS System has integrated applications to use "as is" or customize to fit your needs. Plus a built-in micro-to-host link just for your PC.

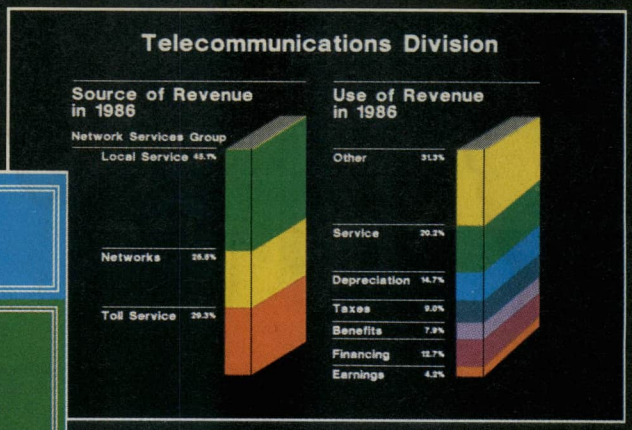
Read data in any format from any file including dBASE® and Lotus® 1-2-3.® Then analyze and display your data through interactive windows.

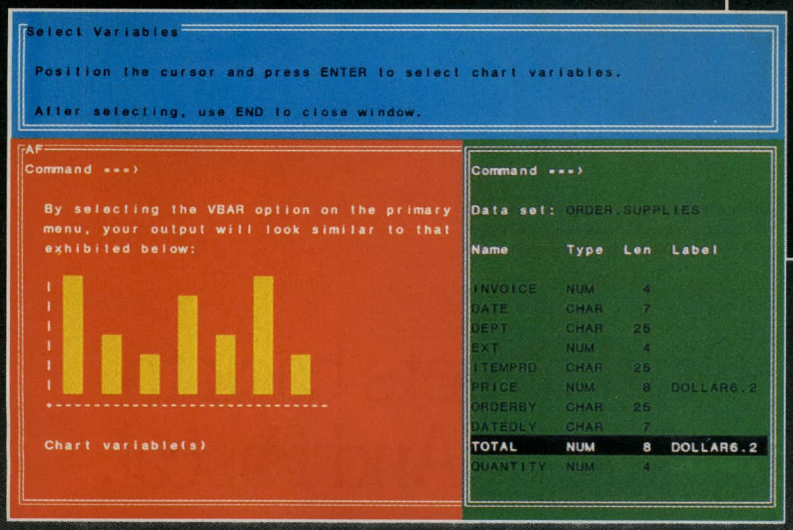




The SAS System runs on the IBM PC AT, XT, and PS/2; IBM 370/30xx/43xx and compatible mainframes; Digital Equipment Corporation's VAX™ series minicomputers and workstations; Data General Corporation's ECLIPSE® MV series; and Prime Computer, Inc.'s 50 series. Not all products are available for all operating systems.

system





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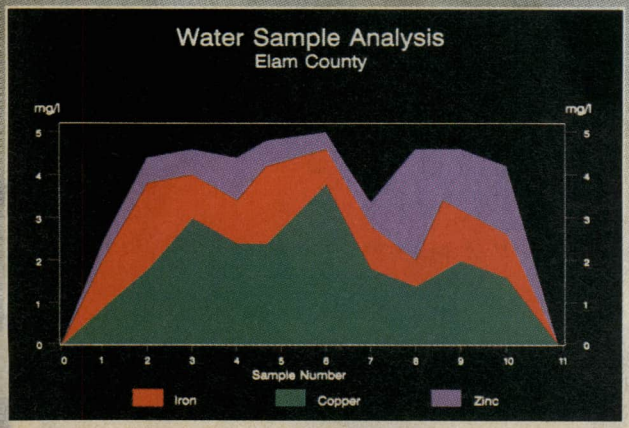

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Like Btrieve, XQL offers features like multi-user support, fault tolerance, comprehensive documentation, and expert technical support. And you never pay royalties on your XQL applications.

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JULIE ANDERSON

SYSTEMS PERSPECTIVE

Mac Comes to Town

The Macintosh is here, with serious intentions, and the PC world must take serious notice.

An Apple Macintosh on the cover of *PC Tech Journal*'s fifth anniversary issue may surprise some of you. It took us a while to get used to the idea ourselves. But the Mac on the cover is not meant to shock—only to show how much we and the computer industry have evolved since our first issue in July 1983.

In the beginning, the only desktop computers considered worthy for business applications were those stamped with the IBM label. Gradually, Compaq and a few other IBM compatibles manufacturers gained the respect of business by producing reliable computers with added features at lower prices.

Incompatibilities were rare, even when the market was flooded by clone manufacturers who produced commodity items with proven BIOS and off-the-shelf hardware components. The risk in buying a non-IBM machine was no longer the big issue it once was.

It is this maturing of the manufacturing arm of the industry plus years of increasing confidence in microcomputers that allows the Mac, which is a wholly different architecture, to gain a foothold in corporations. Our research shows that Macs have penetrated about 20 percent of our readers' companies—a presence we cannot ignore.

The question is, just how should *PC Tech Journal* treat the Mac. Because the magazine's mission is to cover issues of systems design, development, and integration, the answer, of course, depends on how businesses are using their newly acquired Macs.

At the MacWorld show in San Francisco in January, I asked many attendees what they do with their Macs. Their answers revealed two primary applications. The first and most obvious is in-house desktop publishing. The Mac's graphics are visually enticing to artists and some would-be artists, and the large-screen monitors available from Radius Inc., SuperMac Technologies, and other companies make true WYSIWYG possible.

The other popular role for the Mac is as a low-end CAD workstation. Again, graphics capabilities are a key factor. And when the Mac is outgrown, a natural migration path leads to the more powerful Sun workstation.

In more isolated cases, the Mac is serving as a personal productivity station. Chosen for its ease of use and reduced training requirements, the Mac is certainly adequate at running spreadsheets and word processors on the nontechnical end user's desk.

Regardless of the reason Macs got in the door, their users now want to be connected into the "real" data. They need to publish graphs based on corporate numbers, determine costs of CAD designs, and share documents with their PC-owning colleagues.

The focus of our cover suite this month, therefore, is how to connect these Macs that have crept into the corporation with work-group and corporate data. The first article, "Enter the Macs," by William Casey, describes the Macintosh line and presents options and problems in connecting Macs to PCs. In "PC-Mac Link," Howard Marks examines 3Com's 3+ server software that allows Macs and PCs to reside on the same network and share resources. Finally, Paul Firgens looks at Mac-3270 connections ("Macintosh Meets the Mainframe"), comparing DCA's MacIRMA to its IBM sibling.

Our intent in this coverage is not to sell you on Macintosh computers, but to recognize that the days of single-architecture microcomputers are gone. The question is not which architecture will win out, because I don't believe any one architecture will prevail. The issue today is how to manage multiple architectures so that they can effectively coexist in one system.

As much as the industry and end users cry out for standards, the best that we can hope for is a family of standard platforms with a family of standard interfaces that allow the platforms to exchange data. This means that workstations with different architectures need to interface with each other at the hardware, operating system, and application levels.

DEVELOPING, ANYONE?

Our cover suite focuses on *integrating* Macs, because few companies are using them for developing. Our research shows only about 15 percent of our readers are developing on the Mac, and I could find no companies at MacWorld

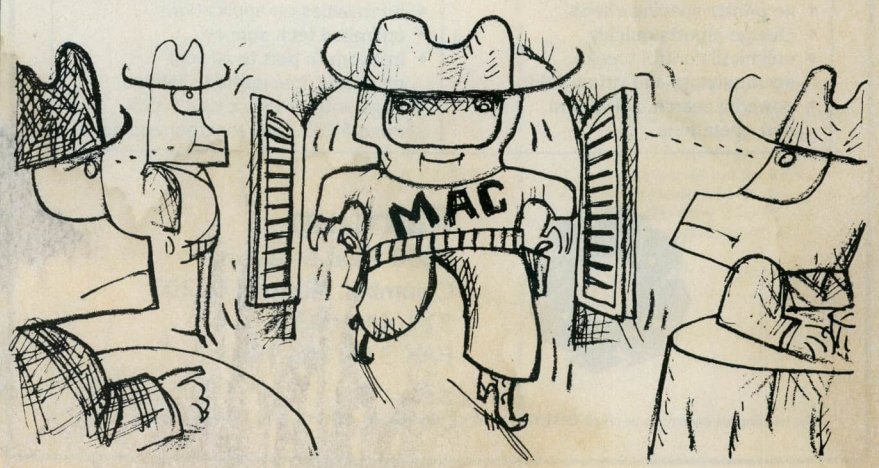


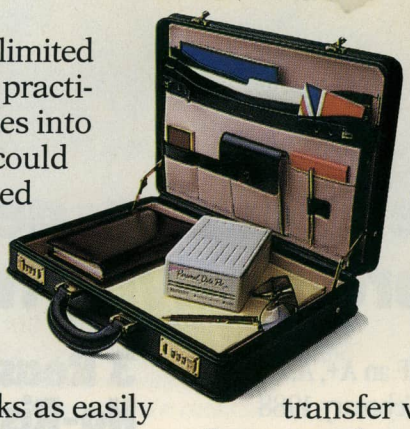
ILLUSTRATION • MACIEK ALBRECHT

"A Cure For The Common Cold"

that were. This should not be surprising; only recently have Fortune 1000

"Unlimited."

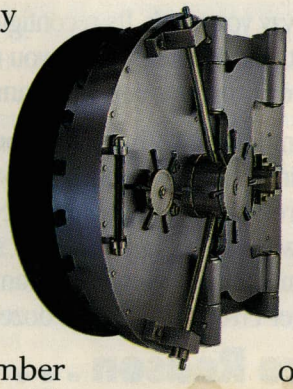
un•lim'i•ted, a. [L. limitus]: ***The ability to expand your personal computer's storage capacity beyond your wildest imagination.***



Up until now, the concept of unlimited PC storage capacity was about as practical as cramming all your office files into your briefcase. Storage capacity could only be stretched as far as the fixed capacity of your hard disk. Or to the limit of your patience for shuffling through stacks of floppies.

But imagine instead that you could insert and remove hard disks as easily as a VCR cassette—your PC's storage capacity would then be virtually limitless.

That's exactly the idea behind the Tandon Personal Data Pac, the world's first and only portable, Winchester hard disk. Just attach a low-cost Ad-PAC drive receptacle to your PC, and its powers of memory are totally transformed. You can choose from a number of self-contained, portable Personal Data Pacs that can be inserted and removed as easy as a floppy. Now a whole business worth of software and data can fit neatly into your briefcase. Ready to go anywhere your business will take you.



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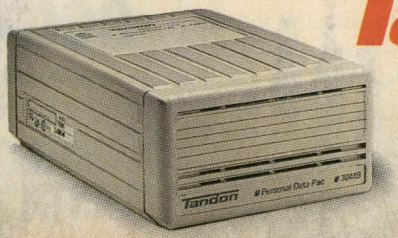

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- The best programs are not always written in the best languages.

Any discussion of language is actually a discussion of how some programmers do their craft, not of absolute rights and wrongs. People reveal what they like, what they are most comfortable with, and why a particular language fits their mentality and personality. Sometimes the syntax may be the issue. Take LISP—it has too many parentheses for me and is too recursive. I think more hierarchically than recursively, so I can't think in LISP terms; I can't write LISP statements.

I feel more comfortable with procedural languages that have conditional statements, ways of selecting among several alternatives, and that can be arranged hierarchically. Because of the type of programming I am doing now, I am moving from a hierarchical orientation to a collateral one—where entities all exist at the same time and any of them can be active and interrelate with one another.

As another example of being comfortable, I have a friend who does not know much about computers. He bought one machine and acquired WordPerfect to help run his business. He eventually got to the point where he was using WordPerfect (just the standard package, not any additional programs or keyboard enhancers) as an integrated database tool. He could manage thousands of names and generate letters selectively to them all or to some subset. His macros permitted him to quickly look up any name by any field—and his fields were nothing more than WordPerfect files.

The advantages of C include:

- Support for structures. If it did not have this, I would not have chosen it.
- Ease and modularity of functions. PL/1 taught me to write small functions and build my own libraries. C also lets me do this. Pascal has the COBOL tendency of bloating rapidly, of including every function in all the modules regardless of whether you need them or not.
- Preprocessor. I really like the idea of using the preprocessor to dynamically compile differently depending on other conditions. This was one area where PL/1 was sorely deficient. The PL/1 preprocessor was difficult to understand, difficult to use, and too much of a potentially good thing.
- Availability of add-on libraries. Because of the ease with which functions can be accessed in C, there seem to be more add-on libraries for C than for other languages.
- Flexibility. More than anything else, C gives me the feeling that PL/1 had given me in the old days: that I could do anything I wanted.

The deficiencies in C include:

- Simplistic file structures. This is the "file sequence of bytes" problem. Granted, this is the easiest to implement on the greatest variety of machines, but when I need a complicated file structure, I really need it. Resorting to file managers such as Btrieve (if it weren't for Btrieve, I would not have chosen C either) doesn't quite do it, because it is another layer between the application and the data. Complex file structures should be in the operating system and in the language. In this area, C reflects the simplistic approach to I/O of UNIX, which was developed in a computer science environment. OS/2 does not seem to portend a different future. Here is where I miss the mainframe world the most.

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- Not enough business data types. I would love to have the implementation of BCD data type, similar to the Fixed Decimal type of PL/1 or to the packed decimal of the IBM 360 instruction sets—and one where I can set the number of digits that I need. Yes, I know that I can write my own BCD functions, or perhaps buy some, but I want to do the BCD arithmetic directly: not

```
encode + bcd_add(result, a_num,
  b_num)
```

but instead,

```
result + a_num + b_num
```

- Inadequate I/O. In PL/1, I could format data in at least three ways: unformatted (binary, floating point, string, and so on); with format statements similar to those used in FORTRAN; or with pictures (similar to those used in COBOL). One could, for example, declare a structure that corresponds to a line of output. By assigning program variables to the members in the structure, one could achieve in-line conversion to the picture (the 360/370 instruction sets support this kind of conversion elegantly) and output it via in-line I/O instructions. That technique results in truly fast I/O.

So why will I continue to use C? I use it mostly because of its flexibility, because even IBM is putting its money in the C language of OS/2 and beyond, and because a decent PL/1 compiler is not available.

Now we have the situation where the C language is no longer, by and large, connected with the UNIX operating system. It exists in its right with its own force. That is all to the good—it just needs to be made better. IBM could surprise us all and give us that PL/1 compiler that must be filed somewhere in Boca Raton, Hursely, or Armonk under "Micros-Languages."

Ronald Szoc, Ph.D., vice president
Ruesch International
Washington, DC

TURNED ON

We are currently attempting to determine if turning on and off CRTs, PCs, printers, and monitors to reduce energy costs will be offset by possible damage to this equipment.

From the surveys of other data processing centers and hardware vendors, we have found a split opinion on the subject. Those who support turning off the equipment have been unable to provide any documentation to support their beliefs. Those who oppose turning off emphasize the shortened life of the hardware due to numerous power surges from the practice of powering on and off. Again, those who oppose, are unable to provide documentation.

We plan to incorporate a company-wide policy of only turning equipment off when leaving at night and turning it on when arriving in the morning. Any documentation that supports either side would help us.

Harold Peterson
Financial Information Trust
Des Moines, IA

We were unable to locate documentation supporting either opinion. However, your proposed policy of turning equipment on in the morning and off in the evening is a reasonable compromise between the cost of keeping equipment powered on continuously and the component stress incurred each time power is turned on or off. Leaving equipment powered on 24 hours a day is not recommended unless appropriate fire-safety measures are followed.

—JS

ERRATUM

The author of the MicroCache (Microcosm Research) review in Product Watch (May 1988, p. 153) was incorrectly identified. The author was Paul Firgens, a regular contributor to this magazine. *PC Tech Journal* deeply regrets the error.

COMMENTS, TIPS WELCOME

All letters to the editor should be directed to Editor, *PC Tech Journal*, Suite 800, 10480 Little Patuxent Parkway, Columbia, MD 21044. Correspondence also can be submitted over MCI Mail to PCTECH. Please keep letters brief and include name, mailing address, and telephone number; when a letter is lengthy, a diskette is appreciated.

Readers are also invited to submit short solutions to technical problems that are appropriate to the technical expertise of our audience. Submit these items to the attention of Ted Mirecki, at the same address. Illustrations by code fragments or *short* complete programs are welcome. Text files may be in WordPerfect, Word, WordStar or plain ASCII format; source code must be plain ASCII ready for input to a compiler or assembler.

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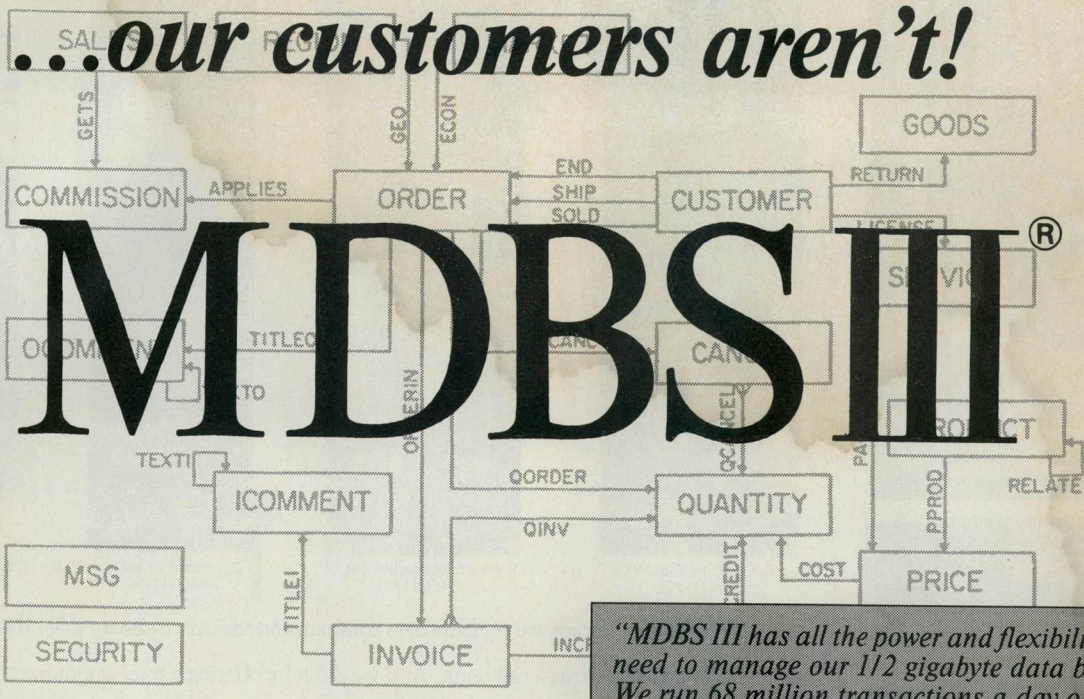

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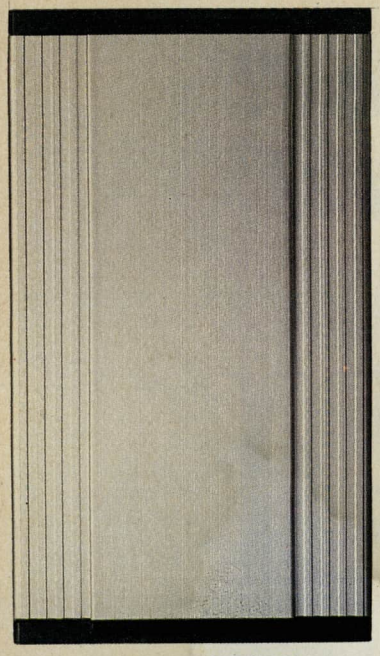

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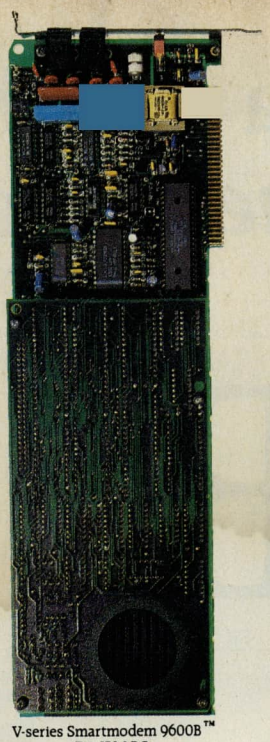

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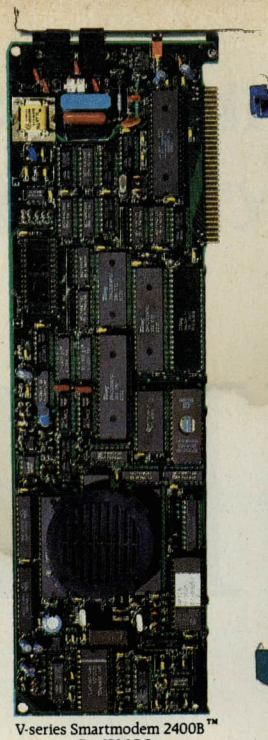

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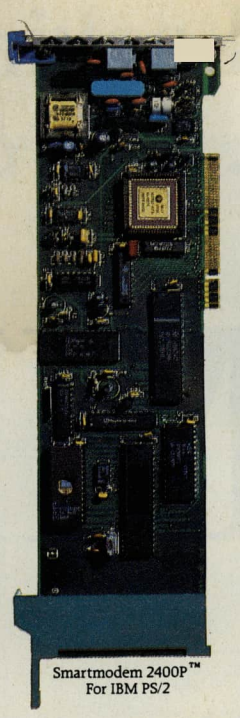

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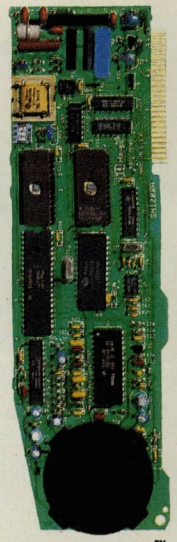

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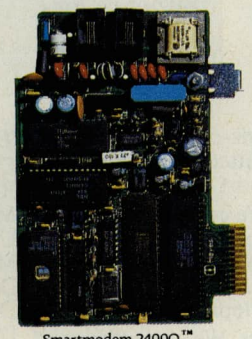

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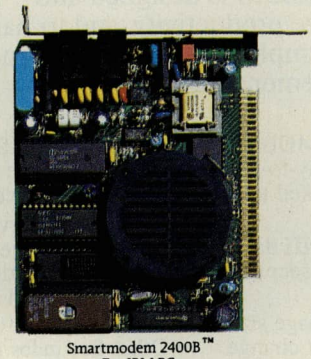

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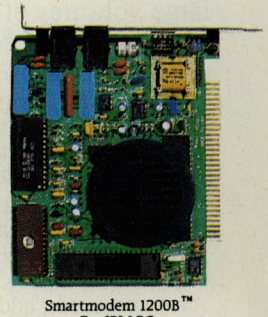

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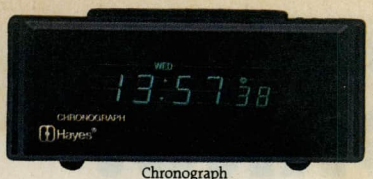

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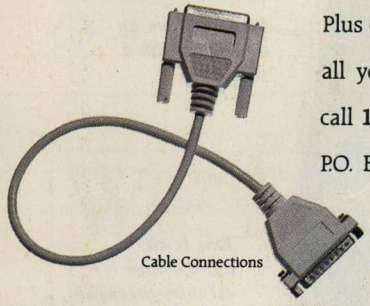

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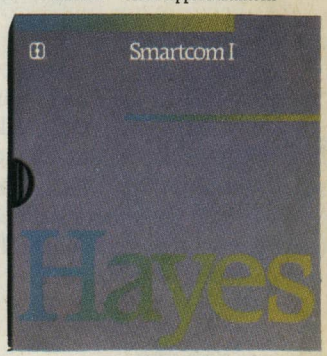

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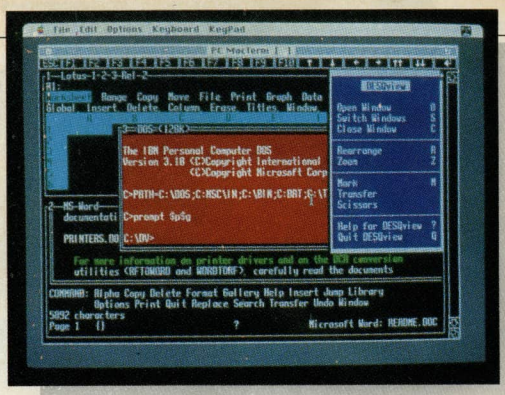
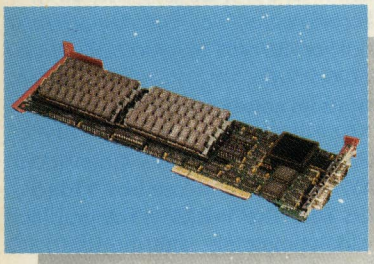


PC MACTERM screen from DMA

tion to 256 colors at 640-by-480 pixel resolution. Video Seven will bundle software drivers to support Microsoft Windows and Windows/386, as well as Autodesk's AutoCAD and AutoShade applications at these resolutions. $799.
Video Seven Inc., 46335 Landing Parkway, Fremont, CA 94538; 800/238-0101; 800/962-5700; 415/656-7800

CIRCLE 314 ON READER SERVICE CARD

Two memory products available from **Orchid Technology** provide PS/2 users with the additional memory they need to run extended memory and OS/2 and EMS 4.0 applications. **RamQuest Extra** is a multifunction board for the IBM PS/2 Models 50, 60, and 80. It provides as much as 8MB of memory



RamQuest Extra from Orchid Technology

using 256KB or 1MB single in-line memory modules (SIMMs) and has two serial ports. **RamQuest II** has 1MB of memory that can be upgraded to 2MB using 256KB DIP chips. Both memory boards can be installed in less than five minutes. RamQuest Extra: 0KB, $599; 512KB, $899; 1MB, $1,199. 1MB RamQuest II, $849.
Orchid Technology, 45365 Northport Loop West, Fremont, CA 94538; 415/683-0300

CIRCLE 316 ON READER SERVICE CARD

A Micro Channel-compatible memory board for IBM PS/2 Models 50 and 60 is being shipped by **Boca Research Inc.** The **BOCARAM 50/60** is available in 1MB and 2MB configurations (expandable to 4MB with 1-megabit, 120-ns DIP RAM chips. It includes software for the Lotus/Intel/Microsoft EMS emulation, a menu-driven installation program, and a diagnostic package. 0KB, $295; 1MB, $645; 2MB, $995; 4MB, $1,695.
Boca Research Inc., 6401 Congress Avenue, Boca Raton, FL 33487; 305/997-6227

CIRCLE 318 ON READER SERVICE CARD

CONNECTIONS

10NET Communications, a division of Digital Communications Associates Inc. (DCA), has unbundled its **10NET LAN** software for use on the IBM Token-Ring and PC Network boards. 10NET LAN adheres to NETBIOS standards and supports server message block (SMB) protocol suites. Utilities included are mail, calendar, spooling, user-to-user communications, broadcast communications, and remote job submission. Servers can be dedicated or nondedicated, and each PC on the network can share data and peripherals. Per node, $395; bundled with software documentation, tap box, cable, and interface board, $695 per node.
10NET Communications, 7016 Corporate Way, Dayton, OH 45459-4223; 513/433-2238

CIRCLE 308 ON READER SERVICE CARD

PCs and Macintoshes have been brought closer by **Dynamic Microprocessor Associates Inc.**'s introduction of **PC MACTERM**. The remote-computing software package works with DMA's PCANYWHERE III product to let any user run a PC from a Macintosh via a modem, direct cable connection, or an AppleTalk network. PC MACTERM runs on the Macintosh, while PCANYWHERE runs on the PC. The product also allows a Macintosh user to run peripherals attached to the PC and all internal boards (such as IRMA and network adapter boards). $99.
Dynamic Microprocessor Associates Inc., 60 E. 42nd Street, New York, NY 10165; 212/687-7115

CIRCLE 311 ON READER SERVICE CARD

Digital Communications Associates Inc. (DCA) has developed the **DCA Select OS/2 Communications Server** (Select CS), a product that will provide end users with PC-to-mainframe SNA connectivity and PC-to-asynchronous host connectivity in OS/2-based LANs. With Select CS, DOS and OS/2 users on an OS/2 LAN can have IRMA-type PC-to-IBM mainframe access and Crosstalk-type PC-to-non-IBM mainframe access. Select CS includes both DOS and OS/2 client and stand-alone workstations; each workstation type provides the user with IBM 3270 terminal and printer emulation, bidirectional file transfer, and API support. Its DOS workstations are fully compatible with DCA's IRMALAN products.

Select CS implements advanced program-to-program communication (APPC), logical unit 6.2, and physical unit 2.1 for OS/2 LAN users. It supports multiple concurrent connection types within one server, including workstation access through an SDLC, DFT, or 802.22 Token-Ring gateway connected to stand-alone workstations. Select CS also supports a host-to-LAN print spooler and an asynchronous gateway to non-IBM hosts. The price per server for an entry-level server (supports as many as eight concurrent users, five sessions per user, and all gateway types) is less than $3,000.

DCA also announced the **DCA Select MS OS/2 LAN Manager** (Select LM), a product based upon Microsoft's OS/2 LAN Manager, which has been licensed by DCA. Select LM will allow both DOS and OS/2 workstations to share resources, such as hard disks and

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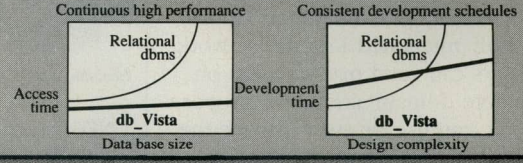

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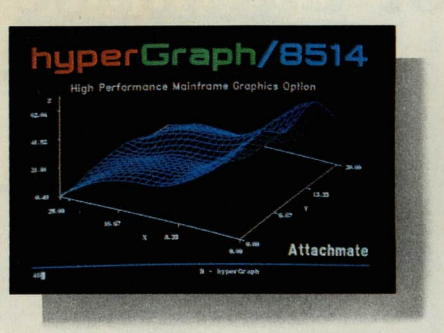
PT 78

Torus Systems' Tapestry II network software package



HyperGraph/8514 screen from Attachmate

printers, that are attached to a server. Price per server for an unlimited number of workstations is less than $3,000. Both Select CS and Select LM will be available the first quarter of 1989. *Digital Communications Associates Inc., 1000 Alderman Drive, Alpharetta, GA 30201-4199; 800/241-4762; 404/442-4000*

CIRCLE 313 ON READER SERVICE CARD

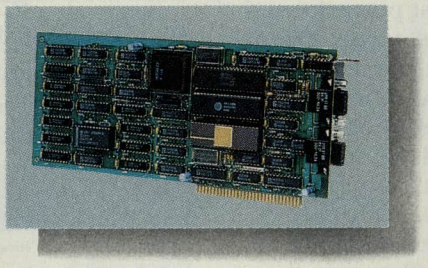
An icon-based network software package that supports OS/2 on both workstations and servers is available from **Torus Systems Inc.** The **Tapestry II Domain Manager Pack** introduces *domain management*, in which domains are logical groupings of PCs rather that physical groupings; domains can be managed from any station on the network, given proper privilege and access. Tapestry II allows any SMB file server, SMB printer, NETBIOS gateway, or NETBIOS interconnect bridge to be fully integrated into the network.

Users can send mail to users on the remote domain, and given proper privilege, can use or even manage the remote domain's resources. Remote users can access a network across telephone lines. The filing system provides comprehensive facilities for managing the contents of local and network drives and allows simple but secure access to shared data on file servers. The Tapestry II electronic mail system allows communication of data among users of the entire network, whether at single or multiple sites.

Tapestry II also features telephone directory management and a multiuser time-management system that offers personal diaries, action lists, and a meeting scheduler. A Tapestry II network consists of a Domain Manager Pack and any combination of extension packs. Tapestry II Domain Manager Pack, $695; prices for 1-, 5-, 20-, and 50-station extension packs, $395, $1,750, $5,995, and $12,500, respectively. Contact the company directly for the price of PS/2 server support. *Torus Systems Inc., 240B Twin Dolphin Drive, Redwood City, CA 94065; 800/872-5335; 415/594-9336;*

CIRCLE 310 ON READER SERVICE CARD

The **Hercules Network Card Plus** is now shipping from **Hercules Computer Technology Inc.** The PC add-in board combines the graphics and text functionality of the Hercules Graphics Card Plus with an AppleTalk network port, allowing networking of PCs to other PCs, Apple Macintoshes, and Sun



Hercules Network Card Plus add-in board

UNIX-based systems using the TOPS network software. The Network Card Plus includes all features of the Hercules Graphics Card Plus, including 720-by-348 pixel resolution and RamFont, Hercules' technology that combines graphics and text modes. The Network Card Plus also allows users to share resources, such as laser printers and hard-disk storage. The integration of video and networking frees an additional card slot and saves PC users the cost of a separate network board. $369. *Hercules Computer Technology Inc., 921 Parker Street, Berkeley, CA 94710; 800/532-0600; 415/540-6000*

CIRCLE 309 ON READER SERVICE CARD

Microcomputer-mainframe software that allows a PS/2 to display mainframe graphics at higher resolutions and speed while consuming less memory than before has been released by **Attachmate Corporation**. The **HyperGraph/8514**, a 3270 software add-on to Attachmate's EXTRA! connectivity software, is designed to take advantage of the IBM 8514 monitor and 8514/A graphics adapter for the PS/2. The software translates mainframe graphics images into special commands used by the on-board processor of the IBM 8514/A adapter, resulting in a 1,024-by-768 pixel resolution. HyperGraph software can significantly speed the drawing of complex images and graphs, and by off-loading some of the image processing to the graphics adapter, it can reduce memory consumption of the software running in the PS/2. $895. *Attachmate Corporation, 3241 118th Avenue SE, Bellevue, WA 98005; 800/426-6285; 206/644-4010*

CIRCLE 307 ON READER SERVICE CARD

Quantum Software Systems Ltd. has introduced **QTERM**, a communications package for QNX—Quantum's multiuser, multitasking, networking realtime operating system. QTERM comprises three software programs: **Qterm**, **QCL**, and **QCP**. Qterm connects the keyboard and screen to any serial or X.25 port; it can manage in excess of 10,000 serial and X.25 devices, providing terminal emulation even for users at dumb terminals, and it allows communication with a remote computer.

QCL, an interpreter for the QNX communications language, is a fully structured, high-level language with communications functions, pattern matching, and file I/O. QCL allows programmers to write scripts that automatically log in to remote systems and perform a set of operations on those systems.

QCP, the QNX communications protocol, implements a highly secure, error-free communications protocol for transferring files over a serial link between QNX systems. QCP provides the error-checked file-transfer protocol

PolyAWK™ – The Toolbox Language™.

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We call PolyAWK our "toolbox" language because it is a general-purpose language that can replace a host of specialized tools or programs. You will still use your standard language (C, Pascal, Assembler or other modular language) to develop applications, but you will write your own specialized development tools and programs with this versatile, simple and powerful language. Like thousands of others, you will soon find PolyAWK to be an indispensable part of your toolbox.

A True Implementation Under MS-DOS

Bell Labs brought the world UNIX and C, and now professional programmers are discovering AWK. AWK was originally developed for UNIX by Alfred Aho, Richard Weinberger & Brian Kernighan of Bell Labs. Now PolyAWK gives MS-DOS programmers a true implementation of this valuable "new" programming tool. PolyAWK fully conforms to the AWK standard as defined by the original authors in their book, *The AWK Programming Language*.

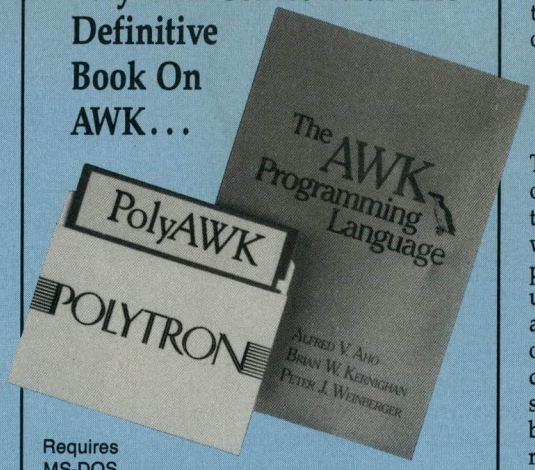
A Pattern Matching Language

PolyAWK is a powerful pattern matching language for writing short programs to handle common text manipulation and data conversion tasks, multiple input files, dynamic regular expressions, and user-defined functions. A PolyAWK program consists of a sequence of patterns and actions that tell what to look for in the input data and what to do when it's found. PolyAWK searches a set of files for lines matched by any of the patterns. When a matching line is found, the corresponding action is performed. A pattern can select lines by combinations of regular expressions and comparison operations on strings, numbers, fields, variables, and array elements. Actions may perform arbitrary processing on selected lines. The action langauge looks like C, but there are no declarations, and strings and numbers are built-in data types.

Saves You Time & Effort

The most compelling reason to use PolyAWK is that you can literally accomplish in a few lines of code what may take pages in C, Pascal or Assembler. Programmers spend a lot of time writing code to perform simple, mechanical data manipulation — changing the format of data, checking its validity, finding items with some property, adding up numbers and printing reports. It is time consuming to have to write a special-purpose program in a standard language like C or Pascal each time such a task comes up. With PolyAWK, you can handle such tasks with very short programs, often only one or two lines long.

PolyAWK Comes With The Definitive Book On AWK...



Requires MS-DOS 2.0 or above & 256K RAM. **$99**

When you order PolyAWK you receive a copy of *The AWK Programming Language* written by the authors of the original UNIX-based AWK. The book begins with a tutorial that shows how easy AWK is to use, followed by a comprehensive manual. Because PolyAWK is a complete implementation of AWK as defined by the book's authors, you will use this book as the manual for PolyAWK.

You can purchase PolyAWK and the book, *The AWK Programming Language*, for $99. If you already have the book, you can order PolyAWK software only for $85, which is $14 off the regular $99 purchase price. (The book serves as the User's Manual, so you you should already have a copy of the book if you are ordering the software only.)

PolyShell Bonus!

PolyShell gives you 57 of the most useful UNIX commands and utilities under MS-DOS in less than 20K. You can still use MS-DOS commands at any time and exit or restart PolyShell without rebooting. MS-DOS programmers — discover what you have been missing! UNIX programmers — switch to MS-DOS painlessly! PolyShell and PolyAWK are each $99 when ordered separately. Save $50 by ordering the PolyShell + PolyAWK combination package for $149. *Not copy-protected.*

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Prototype With PolyAWK, Translate To Another Language

The brevity of expression and convenience of operations make PolyAWK valuable for prototyping even large-sized programs. You start with a few lines, then refine the program, experimenting with designs by trying alternatives until you get the desired result. Since programs are short, it's easy to get started and easy to start over when experience suggests a different direction. PolyAWK has even been used for software engineering courses because it's possible to experiment with designs much more readily than with larger languages. It's straightforward to translate a PolyAWK program into another language once the design is right.

Very Concise Code

Where program development time is more important than run time, AWK is hard to beat. These AWK characteristics let you write short and concise programs:

- The implicit input loop and the pattern-action paradigm simplify and often entirely eliminate control flow.
- Field splitting parses the most common forms of input, while numbers and strings and the coercions between them handle the most common data types.
- Associate arrays use ordinary strings as the index in the array and offer an easy way to implement a single-key database.
- Regular expressions are a uniform notation for describing patterns of test.
- Default initialization and the absence of declarations shorten programs.

Large Model Implementation

PolyAWK is a large model implementation and can use all of available memory to run big programs or read files greater than 64K.

Math Support

PolyAWK also includes extensive support for math functions such as strings, integers, floating point numbers and transcendental functions (sin, log, etc.) for scientific applications. Conversion between these types is automatic and always optimized for speed without compromising accuracy.

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Hardware-level break points
REAL-TIME break points on memory locations, memory ranges, execution, I/O ports, hardware and software interrupts. More powerful break points than ANY software-only debugger on the market. Soft-ICE gives you the power of an in-circuit emulator on your desk.

Break out of hung programs
With a keystroke - no external switch necessary. Even with interrupts disabled.

Breaks the 640K barrier
Soft-ICE uses ZERO bytes of memory in the first 1MB of address space. This is especially useful for those subtle bugs that change when the starting address of your code changes. With Soft-ICE your code executes at the same address whether the debugger is loaded or not.

Works with your favorite debugger
Soft-ICE can be used as a stand-alone debugger or it can add its powerful break points to the software debugger you already use. You can continue to use your favorite debugger until you require Soft-ICE. Simply pop up the Soft-ICE window to set powerful real-time break points. When a break point is reached, your debugger will be activated.

Solve tough systems problems too
Soft-ICE is ideal for debugging TSRs, interrupt handlers, self booting programs, DOS loadable device drivers, non-DOS operating systems, and debugging within DOS & BIOS. Soft-ICE is also great for firmware development because Soft-ICE's break points work in ROM.

How Soft-ICE Works
Soft-ICE uses the power of the 80386 to surround your program in a virtual machine. This gives you complete control of the DOS environment, while Soft-ICE runs safely in protected mode. Soft-ICE uses 80386 protected mode features, such as paging, I/O privilege level, and break point registers, to provide real-time hardware-level break points.

"Soft-ICE is a product any MS-DOS developer serious enough to own a 386 machine should have."
Dr. Dobb's Journal -- May 1988

NEW! NEW! NEW! NEW!

RUN CODEVIEW IN ONLY 8K

CodeView is a great integrated debugger, but it uses over 200K of conventional memory. MagicCV uses advanced features of the 80386 microprocessor to load CodeView and symbols in extended memory. This allows MagicCV to run CodeView using less than 8K of conventional memory on your 80386 PC.

Don't let 640K be your limit!
If you are closing in on the 640K limit and would like the power of CodeView, MagicCV is for you.

Don't let the debugger hide the bug!
Even if you're not closing in on the 640K limit, running CodeView with MagicCV makes your debugging environment much closer to the end user's program environment. You can use CodeView to locate subtle bugs that only occur when there is plenty of free memory, or those difficult bugs that only occur when your program is running with a couple of TSRs loaded.

How MagicCV works
MagicCV uses the 80386 to create a separate virtual machine for CodeView. MagicCV uses between 4K & 8K of conventional memory as a bridge between the DOS environment and CodeView.

MagicCV is easy to use
If you are a CodeView user, you already know how to use MagicCV too. Just type MCV instead of CV; everything else is automatic.

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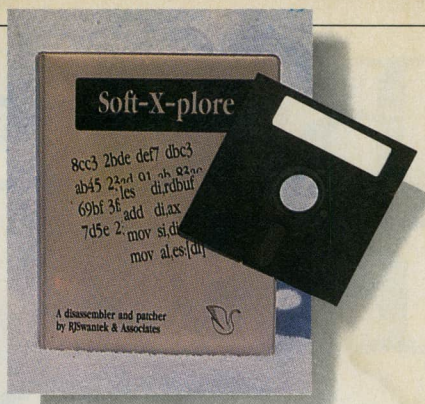
Both require 80386 AT compatible or IBM PS/2 Model 80.
MagicCV requires at least 384K of extended memory.
CodeView is a trademark of Microsoft Corporation.

MagicCV with Soft-ICE
Using Soft-ICE with CodeView gives you the features necessary for professional level systems debugging. MagicCV and Soft-ICE can work in concert with CodeView to provide the most powerful debugging platform you will find anywhere. As an extra bonus, by ordering both MagicCV and Soft-ICE together you **save $86.**



Disassembler from RJSwantek

Digitalk's Smalltalk/V286 programming language

needed by Qterm or QCL to transmit or receive files. QTERM, $150; 4- and 16-node network versions, $300 and $600, respectively.
Quantum Software Systems Ltd., 175 Terrence Matthews Crescent, Kanata, Ontario, Canada K2M 1W8; 613/591-0931
CIRCLE 312 ON READER SERVICE CARD

SOFTWARE DEVELOPMENT

An automated disassembler and patcher from **RJSwantek & Associates**, **Soft-X-plore**, uses four algorithms to separate code from data at a rate of 10,000 lines per minute on a hard disk. Other features include processing for the 80386/87 instruction set, creation of MASM-ready output, automatic generation of comments for DOS and BIOS services, I/O port commands, error messages that explain how to fix the problem, and separate filing of patches for documentation purposes. $99.95.
RJSwantek & Associates, P.O. Box 1032, Hartford, CT 06111; 800/446-4656; 203/560-0236
CIRCLE 323 ON READER SERVICE CARD

The latest version of **SoftPC**, a software product that allows Apple Macintosh II users to access DOS applications, has been unveiled by **Insignia Solutions Inc.** SoftPC's file-sharing architecture makes it possible for the user to integrate DOS and MAC/OS file systems; any file can be accessed transparently through either operating system. SoftPC with DOS 3.3, $595.
Insignia Solutions Inc., 1255 Post Street, Suite 625, San Francisco, CA 94109; 415/771-7001
CIRCLE 322 ON READER SERVICE CARD

An 80286- and 80386-based implementation of the Smalltalk object-oriented programming language is offered by **Digitalk Inc. Smalltalk/V 286** runs in protected mode and can address as much as 16MB directly. Smalltalk/V 286 is designed to operate with both DOS and OS/2 and is compatible with Smalltalk/V. It includes multitasking and supports separately loadable applications, providing developers an environment in which they can distribute their applications. Developers can use it to build systems with more than 32,000 objects, and objects can be larger than 64KB due to the expanded memory capacity. $199.95; upgrade from previous versions, $75.00.
Digitalk Inc. 9841 Airport Blvd., Los Angeles, CA 90045; 800/922-8255; 213/645-1082
CIRCLE 321 ON READER SERVICE CARD

An enriched version of **Media Cybernetics**' library of graphics subroutines, **HALO '88**, features the ability to manipulate and control scanners and scanned images. HALO '88 has added hardware support for the IBM PS/2, 43 graphics adapter boards, 20 printers, and 11 scanners, bringing the total number of supported devices to 144. A disk-based virtual raster interface for EMS, as well as system memory, has been added. Extended character-set support enables software developers to address IBM's full 255 characters in graphics and to design foreign-language fonts. $325; update, $150.
Media Cybernetics, 8484 Georgia Avenue, Silver Spring, MD 20910; 800/992-4256; 301/495-3305
CIRCLE 325 ON READER SERVICE CARD

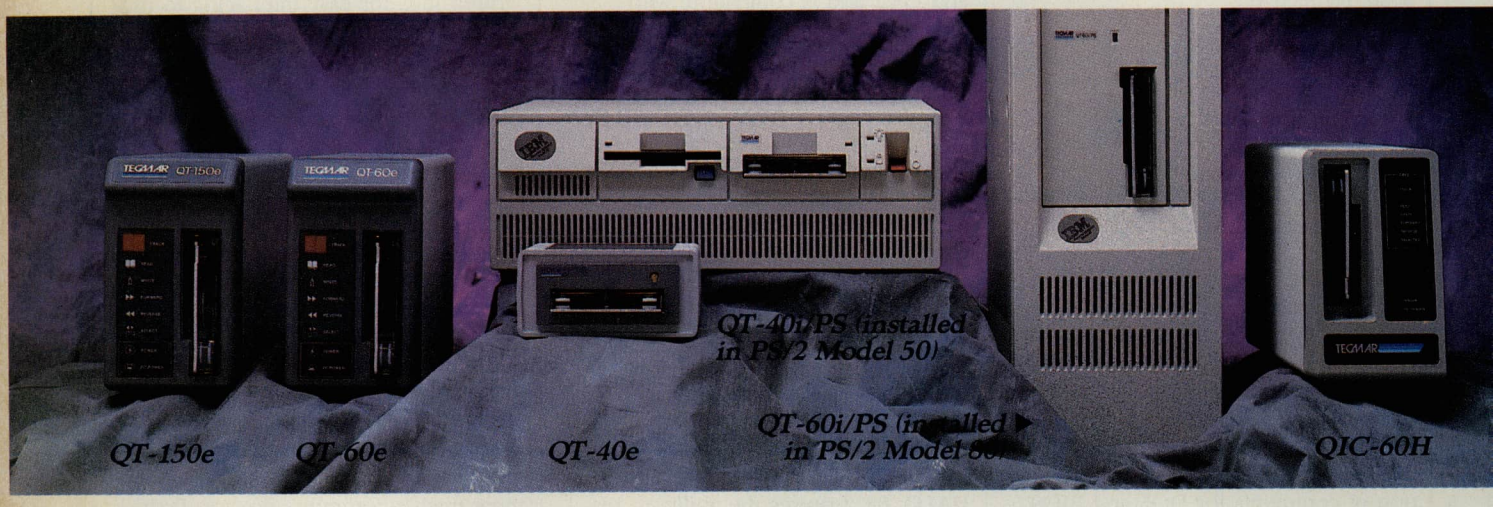
A full implementation of **OPS83**, an AI expert system programming language previously available only on larger systems (such as the DEC VAX, HP 9000/33, AT&T 3B, Masscomp, Stratus, Sun 3, and Apollo Domain), will now run on the PC, according to **Production Systems Technologies Inc.** As a compiled language, OPS83 offers small application program code size. The OPS83 runtime system, linked to an application program, requires only 50KB of memory on the PC. OPS83 is written in C for easy interfacing to programs written in other languages. PC version, less than $2,000.
Production Systems Technologies Inc., 5001 Baum Blvd., Pittsburgh, PA 15213; 412/683-4000
CIRCLE 324 ON READER SERVICE CARD

Polytron Corporation has introduced the **Polytron Version Control System 2.0** (PVCS), a configuration and management system that stores the revision history of source files and maintains chronological records of changes. PVCS 2.0 can reconstruct any prior revision of a module, define a version as specified revisions of various modules, and support multiple lines of development from a common ancestor. Disk space is conserved because only the differences between successive revisions of a module are stored. The latest revision of a program is instantly available, and any prior revision can be reconstructed quickly.

The enhanced package includes a screen-oriented menu interface and the ability to use aliases (a name defined to be equivalent to a list of one or more file names). An alias can be used in configuration files, command files, or on the PVCS command line to change a particular variable automatically. After each logical line of configuration file or command file is read, the aliases in it are replaced by their equivalent text strings. Single-user version, $395; 5-station LAN, $995; upgrade from previous version, $50.
Polytron Corporation, 1700 N.W. 167th Place, Suite 2110, Beaverton, OR 97006; 800/547-4000; 503/645-1150
CIRCLE 319 ON READER SERVICE CARD

OASYS Inc. and **Sierra Systems** have signed an agreement under which OASYS will make available its **Sierra C**

Tecmar Backs Up the PS/2™ Inside and Out.



An advanced personal computer like the PS/2 demands advanced data protection. That means Tecmar tape backup.

Long the leader in backup for XT®s and AT®s, Tecmar also offers a wide selection of both internal and external tape systems for the PS/2. And, with over 30,000 PS/2-compatible units in the field, we're already the leader in PS/2 backup.

Inside...

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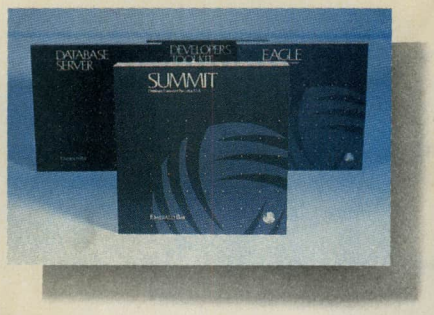

Migent's Emerald Bay database products

68020 Cross Development Package for the IBM PC/AT. Designed for embedded systems development, it includes an optimizing 68020 C Compiler with C preprocessor and ANSI C extensions, an assembler, linker, absolute address mapper, configurable command driver, libraries in source format, and serial and parallel downloaders.

OASYS also announced that native and cross-development toolkits for the Intel 80386 microprocessor are now available on 68000- and 80386-based workstations. **OASYS 80386** compilers provide full support for the Intel 80387 and the Weitek 1167 and have interlanguage calling capability. Contact the vendor directly for prices.

OASYS Inc., 230 Second Avenue, Waltham, MA 02154; 617/890-7889

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Sierra Systems, 6728 Evergreen Avenue, Oakland, CA 94611; 415/339-8200

CIRCLE 333 ON READER SERVICE CARD

A translator that automatically converts PL/M code into logically equivalent C code is available from **Micro-Processor Services Inc. PLC86** features a syntax analyzer that scans the PL/M 86 input file for syntactic errors, generates a listing file of the PL/M 86 program, and flags the errors with English messages in the listing file. $475.

Micro-Processor Services Inc., 92 Stone Hurst Lane, Dix Hills, NY 11746; 516/499-4461

CIRCLE 335 ON READER SERVICE CARD

A complete library of compiled functions for Borland's Turbo Pascal 4.0 has been announced by **Blaise Computing Inc. POWER TOOLS PLUS/4.0** includes interrupt support procedures to allow programmers to install a Turbo Pascal procedure as an interrupt service routine or as intervention code to be triggered at certain times of the day or when hot keys are pressed. Features include precise cursor control, setting of screen attributes, support for multiple display pages, vertical and horizontal scrolling, screen input and output, and fast video access without video interference. Both EGA and VGA are supported in text mode, including 43- and 50-line modes. Multiple windows can be constructed with borders, attributes, and cursor control. $129.

Blaise Computing Inc., 2560 Ninth Street, Suite 316, Berkeley, CA 94710; 415/540-5441

CIRCLE 334 ON READER SERVICE CARD

Blueprint, a data-access architecture that will enable PC users to link directly with a range of data sources from within their Lotus applications, will be available in the fourth quarter of 1988 from **Lotus Development Corporation**. The Blueprint toolkit will allow developers to build Blueprint drivers for data sources ranging from live data feeds and CD-ROM disks to PC, minicomputer, or mainframe data management systems. Blueprint Toolkit, including Blueprint specification and related code libraries, $250.

Lotus Development Corporation, 55 Cambridge Parkway, Cambridge, MA 02142; 617/577-8500

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DATA MANAGERS

Emerald Bay is a database technology comprising four products that will allow microcomputer users in a network to share the same information, even when working in different applications or on noncompatible operating systems, according to **Migent Inc.**

The language-independent **Emerald Bay Database Server** enables all Emerald Bay applications to provide multiuser service. The **Eagle** is Emerald Bay's database language, and the **Developer's Toolkit for C Language** is a set of utilities that provides access to the database engine. Both the Eagle and the Toolkit include a personal engine, report writer, form generator, database administrator, and import/export capabilities. **Summit**, a Lotus 1-2-3 add-in, links the spreadsheet to Emerald Bay databases and gives the user multiple views of the data. Database Server, $695; Eagle, $495; Toolkit, $495; Summit, $195.

Migent Inc., 865 Tahoe Blvd., Call Box 6, Incline Village, NV 94850-6062; 800/777-2027; 702/832-3700

CIRCLE 326 ON READER SERVICE CARD

A fourth-generation language relational data management system, **D the data language**, is offered by **Caltex Software Inc.** Features include a three-step data-manipulation process (isolate, arrange, and report), extensive file import/export capabilities, unlimited number of data files per database, and an on-line example database. $395.

Caltex Software Inc., 3131 Turtle Creek Blvd., Suite 1101, Dallas TX 75219; 214/522-9840

CIRCLE 327 ON READER SERVICE CARD

MUST Software International has announced the release of **PC NOMAD 2.0**, a fourth-generation language data manager. Major enhancements include virtual and extended memory management capabilities, cooperative processing facilities for building applications that distribute functions and procedures between microcomputer and mainframe, enhanced windowing facilities, reverential integrity to ensure validity, and multiple tools. $795.

MUST Software International, 101 Merritt 7, Norwalk, CT 06856; 203/845-5000

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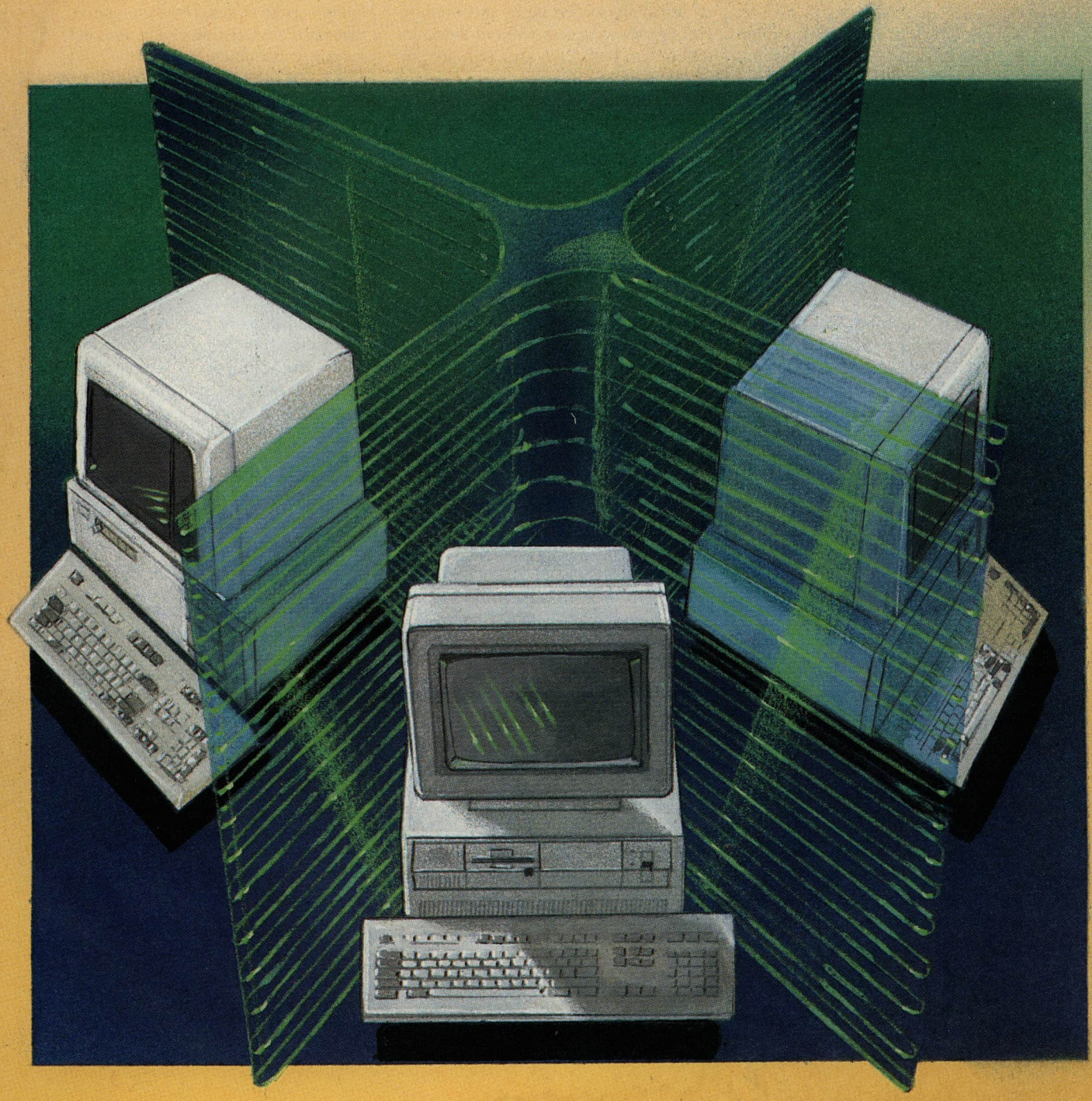
The material that appears in Tech Releases is based on vendor-supplied information. These products have not been reviewed by the PC Tech Journal *editorial staff.*

Enter the Macs



In the world of high-performance desktop computing, brains and good looks are not always enough to get what you want—sometimes you have to have connections.

ILLUSTRATION • NED SHATZER

WILLIAM CASEY

Long regarded as an industry counterculture by the PC-based majority, Apple Computer stepped squarely into the business arena with its release of two powerful, second-generation Macintosh models in early 1987. The Macintosh II and Macintosh SE are faster, more powerful, and offer better functionality than their predecessors. Not only that, they have system units that can be opened to the light of day—a move with intriguing ramifications. Apple continues to base its machines on the Motorola 68000 family, which complicates their integration into Intel-based environments; nevertheless, their higher profile will help establish their hold in many offices and thus force the issue.

Many organizations already wrestle with some variation on a theme of shared heterogeneous information processing. These issues take on various faces in a world of PCs, PS/2s, and compatibles—integrating with mainframes and minicomputers, connecting to each other via networks, achieving operating system and application software stability. The growing presence of the Mac compels the systems integrator to figure it into the equation as well.

The Macintosh II, Macintosh SE, and their older sibling, the Macintosh Plus, make up this complete family of general-purpose business machines. (The three machines are shown in an accompanying photo; table 1 lists their specifications along with those of an IBM PS/2 Model 80 for comparison.) Both the Mac Plus and the SE feature a single 3.5-inch diskette drive; the SE can accommodate a second diskette drive or a 20MB hard disk. The Macintosh II, which runs at 15.7 MHz (twice the speed of the Plus and the SE), is comparable to the 80386-based Model 80. The Mac II supports one or two 3.5-inch diskette drives and a 20MB, 40MB, or 80MB internal hard disk; it is also the first Mac to offer a *separate* monochrome or color monitor.

As recently as three years ago, connecting PCs and Macs was an interesting notion at best, but 1987 changed that. According to the market-research firm Dataquest, Apple shipped more than 1.2 million units (of all kinds) last year in the United States alone. The comparable number of IBM and compatible units shipped was 5.9 million. Of the 1.2 million Apple units shipped, Macs accounted for 630,000—quite a jump from the 371,000 shipped in 1986. The PC-to-Mac ratio is not so disparate as it once was.

A roundup of projections for 1988 reveals that the Macintosh is the machine of the hour. The Palo Alto Research Group, for example, projects an installed base of more than 2.2 million Macs by the end of 1988, with 65 percent predicted to go into business situations. Another firm, Genesis Research Associates of Los Altos, predicts the sale of 690,000 Macs in 1988 (23 percent of those Mac IIs), with 53 percent going to business. Whatever the actual numbers turn out to be, the trend is clear: corporate America is embracing the Mac with growing enthusiasm, and the connection of PCs and Macs is a question that must be addressed by the third-party contingency.

This month's cover suite, entitled "Mac Connections," includes two other articles that address available PC-Mac connectivity options. The first article, "PC-Mac Link" (Howard Marks, p. 52), takes a close look at 3Com's 3+ for Macintosh, which reaches out to Macs from 3Com's well-established 3+ Share network operating system. 3Com is a leader in networking the Macintosh, having shipped its first Mac network product, EtherMac, September 1985. The second article, "Macintosh Meets the Mainframe" (Paul Firgens, p. 66), considers the Mac connection to IBM mainframes via the MacIRMA board and software from Digital Communications Associates.

FATAL ATTRACTION

Macs always manage to attract attention—even of loyal PC users. If the icon-based interface doesn't catch your eye, then maybe the unusual sound capabilities will speak to you. Or maybe it will be the crowd of curious onlookers that draws you closer. What is beginning to *keep* more users in front of the machine is the increased power, performance, and software options.

Tultex Corporation, a major apparel manufacturer headquartered in Martinsville, Virginia, is one company dealing with a Mac invasion. Tultex has roughly 300 IBM PCs and compatibles on which it runs a variety of stand-alone and connected applications. Theirs is a sophisticated, large-scale, data-processing operation centered around IBM mainframes, but which is moving toward Digital Equipment Corporation (DEC) hardware as well. The

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This slot often is used to support a large video display, especially for desktop publishing, but it also can accommodate third-party boards for color displays or networks. Besides SCSI hard disks, an Apple 20MB hard disk is available with the SE.

The Mac II carries little from its ancestors. It is largely a machine that breaks new ground, yet it retains the essence of what has made the Apple line special. Powered by a 15.7-MHz Motorola 68020, the Mac II also has a standard MC 68882 floating-point math coprocessor. From a hardware perspective, the Mac II is commonly (and appropriately) compared with the Intel 80386-class of processors. The Mac II is fast, with a throughput generally 3 to 4 times that of a Mac Plus.

Also standard with the II is an 800KB 3.5-inch diskette drive, with an option for a second. The 20MB, 40MB, and 80MB internal and external SCSI hard disks are options. Apple opened the hardware box even farther with the Mac II, which has slots for six expansion boards. One is filled by a video display controller board; video display memory is on this board rather than in the main portion of RAM, a feature that has boosted performance.

The Mac II expansion bus architecture is a 32-bit address and data bus built around a variant of the IEEE-standard NuBus, a design licensed from Texas Instruments. Using this architecture, the Mac II can support a wide range of current and future add-in boards, none of which requires the setting of jumpers and switches for proper interrupt vectors, address ranges, and so on. The relative ease of configuring even a large, elaborate Mac II is impressive.

The Macintosh II comes with 1MB of RAM standard on the system board, expandable to 8MB. Additional memory can be installed on expansion boards; RAM expansion boards of 1MB and 2MB currently are available from Apple. The Mac II will accommodate up to 128MB of RAM on the system board and 2GB on expansion boards when suitable higher-density RAM devices become available.

The traditional Mac footprint has been abandoned with this model for a more standard-looking, 19-inch system unit. In another break from Mac tradition, the screen is not built-in. The user can choose a monochrome monitor (256 shades of gray) or one of several high-resolution color monitors (resolutions beginning at 640-by-480 pixels). Frequent announcements are made of high-end, third-party Mac II color boards (supporting 256 colors from a palette of more than 16 million) and companion monitors in the $5,000 to $7,000 range.

These monitors display as much as two full pages of text and offer resolutions of a million pixels or better. In addition, the Mac II user can have multiple monitors—monochrome, gray scale, color—that can be assigned to contiguous placement on a user's desktop and arranged to suit individual needs. Remarkable flexibility and expandability are hallmarks of the Mac II.

Both the SE and the II can support either the 81- or 105-key keyboard from Apple. The 105-key model is similar in appearance to the 101-key IBM enhanced keyboard, featuring 15 function keys across the top and an inverted T-shaped cursor pad.

The Mac II is largely a machine that breaks new ground, yet it retains the essence of what has made the Apple line special.

On the software side, Apple has stayed on the cutting edge of innovation, having released a number of improved versions of the system software. One of the earliest major improvements was HFS, Apple's Hierarchical File System, which extended the folder and contents metaphor and mechanics for efficient use in the hard-disk world.

The hierarchical file system speeds up access to files stored on large volumes by storing files in directories, which also can contain subdirectories. HFS file directories are presented to the user as folders on the visual desktop. HFS provides more efficient access to files on large volumes than the original Mac file manager. That version used a flat file system, with the organization of folders being maintained by the Finder.

HFS was a welcome, but predictable, development. Switcher, first released in 1985, was a more significant step. Like much Mac software, Switcher supported context switching, enabling the user to load, for example, Excel and MacWrite into RAM and move between them easily. (Without the PC's 640KB limitation, a Mac user could divide a megabyte or more of memory into pieces of whatever size was convenient and assign them to as many as four application programs.)

Switcher floated around user groups and on bulletin boards, and ultimately Apple packaged it and ensured its widespread use, despite its tendency to behave erratically when hardware or software environments changed.

The 1987 introduction of MultiFinder, Apple's first multitasking operating system, eclipsed Switcher in both function and reliability. Another Apple innovation released in 1987, Hypercard, is best described as an associative information environment, enabling the user to tap into many levels of software. Both products have been important to the company and its users. Determined to give and maintain a high profile for its products, Apple has supported its recent technological advances with effective promotion.

PEACEFUL COEXISTENCE

So, you have a PC or two, and that Mac nearby looks awfully inviting for manipulating and displaying data living in the PCs. Or, you have a Mac Plus or Mac II, and you have been composing, calculating, drawing, cutting, and pasting. At some point, you may be compelled to reach out for non-Macintosh-based files. What do you do now?

At least two levels of data exchange are available: low-level transfer of appropriate data files, and translation between different data formats at an application level. The lower level is a problem with the Macintosh machines because their physical file representation is different from the IBM world—the Mac cannot read an IBM-format 3.5-inch diskette in its drive and vice versa. Even though the two systems use the same physical media, they format and access it differently.

Mac 3.5-inch diskettes are either single- or double-sided with a formatted capacity of 400KB or 800KB, respectively. They use 512-byte sectors and contain 80 tracks divided into 5 groups of 16 tracks each. Each group of tracks is accessed at a different rotational speed, so that the linear speed of the media passing under the read/write head is the same for each group. PS/2 3.5-inch diskettes are double-sided with a formatted capacity of 720KB or 1.44MB, contain 80 tracks with 9 or 18 512-byte sectors each, and are accessed using a constant rotational speed.

PC and Macintosh users can handle low-level data movement in several ways. One method is to make transfers

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via telecommunications or direct serial cable. Getting data files through a modem on a file-by-file basis is still the most prevalent method. Basic communications software such as MacTerminal (still owned by Apple), Microphone (Software Ventures), or a dozen others can handle external services and corporate mainframes and can do file transfer with corresponding products on the PC side (Crosstalk, Smartcom) as well.

The results are not fancy but the data get through. On the cable side, Dataviz (with MacLink Plus) and other suppliers make a substantial business of selling the basics of connecting PCs to Macs via a serial-port-to-serial-port cable, with software programs on each machine to move and translate data.

Reading and writing alien diskettes is another approach. Central Point Software markets an option board that writes Mac-format 3.5-inch diskettes in a PS/2 Model 30, and Micro Solutions offers a PC expansion board that permits a Mac-format 3.5-inch diskette drive to be used with a PC.

Apple stresses the diskette approach with its Apple File Exchange, for which the key piece of hardware is Apple's PC 5.25 Drive, which connects to a Mac SE or Mac II via an expansion slot and reads and writes DOS files. Dayna markets several drives, both 3.5-inch and 5.25-inch, that plug directly into the Mac's SCSI port. Peripheral Land's Infinity diskette drives also attach to the SCSI port and have a 10MB capacity; they can read both 360KB and 1.2MB IBM 5.25-inch diskettes. The drive is designed primarily as a Mac storage device; any data translation must be performed by application packages.

For direct transfers using the SCSI interface, Quickshare from Compatible Systems consists of a PC expansion board and appropriate software for the PC and Mac to allow the transfer of files between the two. In addition, Quickshare can be configured to allow the Mac to access and even boot from a portion of the PC's hard disk as if the disk were directly attached to the Mac.

Some local area networks (LANs) also support transfer and sharing of data between the two architectures. LANs are especially appropriate for frequent transfer or sharing of data among PCs and Macs. Current products include TOPS and 3Com's 3+ for Macintosh. These networks support electronic mail and message services and allow the sharing of resources, such as modems and printers, in addition to the transfer and sharing of data.

Data also can be transferred to and from a mainframe from both machines. Particularly in large corporations, the data to be manipulated on the Mac are stored on a mainframe computer or a PC attached to the mainframe. Tri-Data's Netway 1000A emulates an IBM 3274 terminal controller, permitting AppleTalk-connected Macs to communicate with System/370 mainframes. DCA's MacIRMA provides similar services using an expansion board and a coaxial cable connection to a 3274 terminal controller or an IBM 9370 workstation controller.

The real challenge in data conversion comes in at the application level or higher. Higher program intelligence is required, in the sense that file structures and encoding techniques become issues. This level involves interchangeability of application program data, which can be a problem even on a single machine: How does a user convert a MultiMate document to Microsoft Word without writing out a plain ASCII file and thus losing formatting and other special features?

Although Apple guards its technology aggressively, chances are good that Macintosh clones will appear on the market before long.

The solution is a list of translators that fit into an overall file interchange architecture. For example, Apple uses what appears to be Dataviz's shell for its File Exchange software, but it includes only a few translator modules (WordStar, MultiMate); the user is encouraged to contact Dataviz for additional modules. Dataviz also provides this software basis for Dayna's Dayna-File peripherals. Apple provides software support for IBM's Document Content Architecture (DCA) format, another widely used standard for moving text files between systems.

Such generalized methods are not always necessary for the PC-Mac user, however. Increasingly, application vendors are addressing the data translation issue, with Microsoft in the lead. Microsoft Word users can write files on the Mac in one of six formats besides normal and can read from a number of other word-processor or file-interchange modes. Excel (on the Mac) can read .WKS files directly, handling formulas and most display formats. The desktop publishing industry also will figure prominently in the sharing of high-level data because these packages must be able to import from a variety of common word processor sources. The results are not always perfect, but these methods are in widespread use and should improve steadily.

A BITE INTO THE FUTURE

Talking to Macs may not be at the top of every systems manager's to-do list right now, but transferring and sharing data among Macs and PCs is fast becoming a serious issue in numerous corporate environments.

Apple's philosophy and market strategies may play an interesting role in the positioning of its Macintosh machines against IBM models. For example, it was no coincidence that Apple introduced the new Macs in March 1987, just one month before IBM's new PS/2 line was unveiled. Apple felt the heat of IBM's impending announcement and moved quickly to release its new machines first.

In addition, chances are good that Macintosh clones will appear on the market before long. Although Apple continues to guard its technology aggressively, it is only a matter of time before the functionality of its rather complicated Mac ROM is duplicated. Some Apple observers contend that the company is foolish not to recognize that the success of the IBM architecture was due in large part to its widespread availability in lower-priced compatibles.

As a rather pragmatic consideration, although IBM machines and compatibles are still the dominant machines in the business arena, every year a new group of young professionals in all disciplines is graduated from an educational system that continues to be dominated by Apple.

No, the Macs haven't just come to visit, they're here to stay.

Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, CA 95014
408/996-1010
Macintosh II; Macintosh SE;
Macintosh Plus

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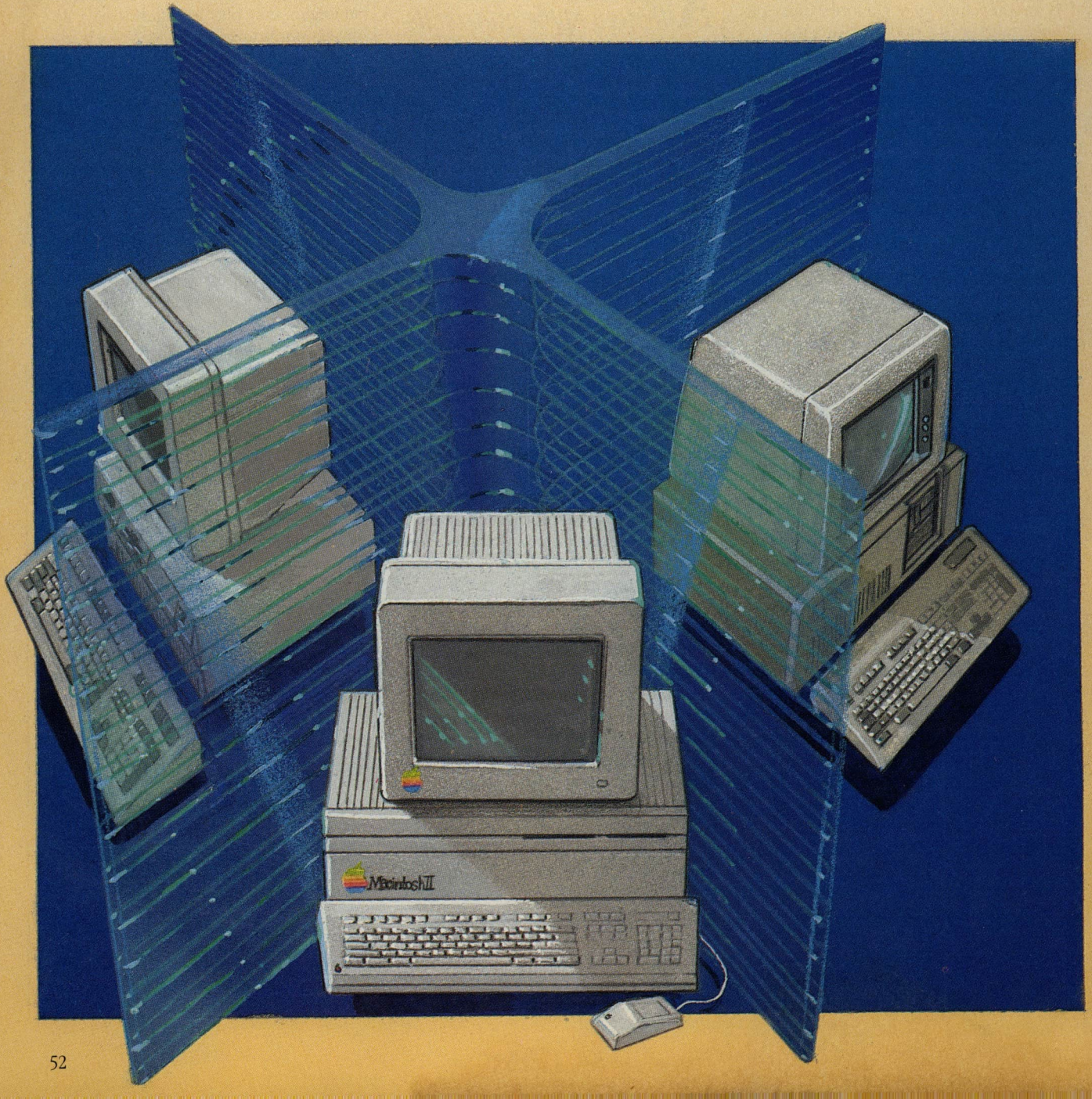
William Casey lives in Minnesota where he heads SystemCraft Inc., consulting on large and small systems issues. He has 20 years of experience with IBM mainframes and a variety of microcomputers.

PC-Mac Link



A forerunner in an exciting new arena, 3Com's 3+ for Macintosh connects Macs and PCs on the same network, with one caveat: Mac services are not yet up to par with PC network functionality.

HOWARD MARKS

Users of stand-alone Macintoshes may prefer Apple's icon-driven graphics interface and powerful desktop functionality, only to be disappointed when they cannot access LAN file servers, mainframe gateways, and other network resources that are commonly available to PC users. What all users really want is a quality interface and network services on the workstation of their choice.

Mixed networks of PCs and Macs make this possible but require advanced network products and substantial integration efforts on the part of systems personnel. With 3+ for Macintosh (3+Mac), 3Com Corporation brings advanced network services and PC resource sharing to the Macintosh.

3+Mac is an extension of 3Com's 3+Share network operating system (NOS), which runs primarily on 3Com's 3Server line of dedicated file servers and supports Ethernet, Token-Ring, and AppleTalk. 3+Share is a derivative of the Microsoft Network (MS-NET) software; its performance is best on the 3Server, but it will operate on PC servers as well.

With no screen or keyboard (see photo on page 54), the 3Server is a production machine that supports multiple 100MB and 150MB drives and is designed for medium- to large-scale PC networks. 3+Mac extends the 3Server's file, mail, print, tape, and administrative services to Macintosh users on both mixed networks of PCs and Macs and Mac-only networks.

3+Mac supports the Macintosh II, Macintosh SE, and Macintosh Plus using either the built-in AppleTalk port or Ethernet. 3Com manufactures a board for the SE, and Ethernet boards are available for the SE and Plus from third-party vendors such as Kinetics.

Like other high-end network vendors, one of 3Com's corporate strategies is to provide uniform levels of client services to PC, Macintosh, and other major workstation types. 3Com's product philosophy is aligned with the needs of organizations grappling with the problems of multivendor configurations. In such environments, workstation choice often is based on personal preference of user interface or immediate application requirements. In the long term, however, information system managers and network supervisors must deal with the complex connectivity and interoperability concerns created by mixed workstation networks.

As an early entrant into the Mac networking market, 3Com was including an AppleTalk port as a standard feature on its Ethernet-based servers by 1986. EtherMac was supported by the EtherSeries operating system, the forerunner to 3+Share. Following the release of the IBM PC Network and Microsoft's OEM version, MS-NET, 3Com redesigned its software to support the new standards. 3+Share uses the MS-NET redirector and server message block (SMB) protocol. 3+Share and 3+Mac now replace EtherSeries and EtherMac.

According to the market research firm DataQuest, 3Com held approximately 15 percent of the PC LAN market in 1987. Statistics for 3Com's Macintosh market share were not available, but some idea of the demand for Mac support can be gauged by a 3Com-supplied figure indicating that about one-third of all 3Servers shipped to date (an estimated 12,000) are configured with Mac software. Exactly how many of these servers currently support Macs and the average number of Macs per node is difficult to estimate.

The company promotes 3+Mac as a higher-performance alternative to AppleShare, Apple's own file-server system, and Sun Microsystems' TOPS network. AppleShare uses a dedicated Mac as its file server, linking computers with its twisted-pair LocalTalk media or third-party Ethernet cards. TOPS is a peer-to-peer network for PCs and Macs; stations on a peer network can act as both client and server—no one computer need be dedicated as the file server. One capability TOPS provides that 3+Mac does not is Epson-to-PostScript translation for PCs printing to Apple LaserWriters.

CLICKING ON SERVICES

3+ for Macintosh extends the Mac electronic desktop environment to include the distributed resources of PC networks. The Mac's mouse and icon interface is quite effective for rapid manipulation of local objects such as files, file folders (directories), printers, and modems. Moving, copying, or deleting files, for example, takes a fraction of the time it does with the DOS command-line interface. The network extensions of 3+Mac are close enough to the Mac's native interface that the user can easily lose track of whether objects are local or remote.

3Com has created several new icons for network objects, such as users, groups, mailboxes, and aliases (nicknames). Macs access the 3Server in the same way they access the AppleShare file-server system. Folders and files can be saved to the server and

ILLUSTRATION • NED SHATZER

printed to shared LaserWriters or other PostScript-compatible printers.

Mac folders stored on the 3Server appear as DOS directories, and PC users are thus able to access them. Mac users can access files and directories created by PC users, and Mac applications that understand PC file formats can open files created by PC users with PC software. For example, a Mac running Microsoft Excel can open files in Lotus 1-2-3.

Although the basic Mac services work well, many of 3Com's PC services are not yet available to Mac clients, including remote dial-in, 3270 gateways, modem sharing, and routing to remote networks via 3Com's low-speed links.

3+File. The user installs the 3+Mac file and print service files in the Mac's system folder with a simple copy operation from the 3Com distribution diskette. The Mac's system folder holds the files that make up the Mac operating system, its shell (the Finder), and other utilities. When the Mac boots, it loads the RAM-resident portions of the system, including 3+Mac routines, from the system folder into memory.

Once the 3+Mac files are installed and loaded, the 3Server is accessed through the Mac's built-in LocalTalk port. If Ethernet is required, a board is installed and additional drivers are loaded. The memory-resident portions of 3+Mac occupy a little less than 115KB of RAM, including an Ethernet driver. This would be excessive for a PC network interface but should not present a problem for Macs, which now ship with at least 1MB of RAM and are populated with 4MB or more of addressable memory.

The File icon represents the 3+Mac file services, which include a network-management utility called Network Window, drivers for 3Com's Xerox Network System (XNS) protocol stack, and an external file system that is the Apple equivalent of the MS-NET redirector in the PC network environment. The Mac operating system passes calls to the external system when it determines they are for external network volumes. When the external system receives requests, it translates them into the SMB protocol and passes them to the XNS network software for routing to the server.

A Mac user logs into a 3Server with the Apple Chooser utility, accessed from the accessory menu on the extreme left-hand side of the Mac's pull-down menu bar. The login function is selected by clicking the mouse on the Login button as in photo 1. After a user name and password are entered, the Network Window appears. It presents the standard Mac dialog box to let users establish their network environment by linking to resources on the server. The dialog box provides a hierarchical view of the file system, allowing quick access to any folder on the 3Server; the Mac user links to file folders by highlighting the folder's name and clicking on the link button.

The current version of 3+ for Macintosh runs on 3Com's dedicated server, the 3Server Model 3S/200 shown in this photo. The ample documentation provided in the 3+ for Macintosh package is divided into administrator and user manuals.

When linked, folders on the server appear as icons on the Mac desktop just as an additional disk drive would. A user's configuration can be saved from the Network Window with the Quick-Start feature. The saved configuration is regenerated each time the Mac is powered up, eliminating the need for the Mac user to perform the logins and links every time.

A new 3+Mac network user is assigned a home folder on the 3Server—the equivalent of a home directory on a DOS network. The (Mac-based) administrator enters a user's name, home folder, and other account details. The user can create any number of new folders in the home folder and copy files from local or remote disks to these folders.

Through the Network Window, a user can share network folders with other users. As shown in photo 2, the user assigns a shared folder a *share name*, which identifies it to other users, and an optional password that must be supplied each time the folder is linked. Access rights for shared folders include read-only, write-only, read/write, read/write/create, write/create, shareable, or private.

Multiple users can access folders concurrently, making multiuser applications possible. Files in shared folders with any type of write access are susceptible to data corruption if applications do not coordinate updates. This is also the case for folders given shareable access rights, which allow all types of operations (read, write, create) by multiple users.

Any user can create subfolders in folders with shareable rights. Those folders shared with read-only rights can be read, but not altered, by other Mac users on the network. Read-only folders are a good way for 3+Mac users to make their files available to other users without fear of data corruption. Folders with private rights can be accessed only by their creator.

When a 3+Mac user logs in and links shared and/or private folders, applications can be launched with a double click of the mouse from local drives or the 3Server. Files or entire folders can be moved or copied freely among local and network drives with only one restriction. Folders or applications cannot be moved from a network volume to the desktop directly; they can, however, be moved to the desktop after being copied to a local folder (on a local drive). The net effect of this restriction is that applications on network volumes cannot be launched from the desktop—they can be launched only after opening a network folder. This restriction is necessary in part because a file dragged from a shared folder to the desktop would not be accessible to other users.

Once a 3+Mac session is finished, the Mac can be shut down immediately from the Special selection on the menu bar at the top of the Mac screen—without logging out or unlinking network folders. The 3+Mac software takes care of this housekeeping chore.

3+Print. Like the file services, the 3+Mac print service files are copied to the system folder during installation and have their own icon, called

3+Print. The 3+Print file includes a LaserWriter driver and works very much like the native Mac printing service. A Mac application outputs data to the printer with QuickDraw calls in much the same way it draws the Mac screens. When an application prints, it makes calls to Apple's ROM-based Print Manager. The Print Manager accepts these data and directs them to the driver for the active printer. The driver converts the QuickDraw calls to a format acceptable to the printer, which could be an ImageWriter, a LaserWriter, or other Apple-compatible device.

With 3+ for Macintosh, network printers are selected from Apple Chooser, just as local printers are. When a network printer is selected, the 3+Print driver becomes the active driver and converts QuickDraw format data into PostScript format for the LaserWriters on the 3Server. Print jobs can be directed to network printers from within applications or from the File selection of the pull-down menu. Print configurations such as paper source and page range also are set from the menu bar and work interchangeably with 3+Mac network printers and local printers.

3+Mac supports all PostScript printers that work with Apple's standard LaserWriter driver as spooled serial printers connected to the 3Server. Once spooled, the print job is handled by the 3Server, freeing the Mac for application tasks. Printers interface with serial ports on the 3Server at 9,600 bits per second (bps). Housekeeping, such as printer initialization, is handled automatically. 3+Mac does not support spooling from the 3Server to a LaserWriter from the LocalTalk port, but 3+Mac clients on LocalTalk can print directly to LocalTalk-based printers.

As with the file services, the 3+Mac Quick-Start feature is used to select a network printer to be linked to automatically when the Mac boots. The 3Server's print queue can be viewed from the Apple Chooser (screen shown in photo 3), which includes a list of the jobs on the queue and each job's owner, size, and status. 3+Mac users can delete jobs, defer jobs for later printing, and change form type and job priorities.

3+Mail. 3Com's electronic mail (E-mail) product, 3+Mail, is a full-featured, store-and-forward system that provides mail services to PC and Mac clients anywhere on an internetwork. Sold as an add-on product to 3+Mac, it installs on the Mac and the 3Server as an extra service. Mac users of 3+Mail have available all the functions that PC users have. Mail messages and attachments can be sent to any local or remote user registered in the name service. Attachments can be ASCII files, application data files, or binary files of any kind. A Mac user attaches files to a message with the dialog box window, by scrolling through any folder to which the user has rights and making attachments.

Unlike other LAN E-mail systems—which keep all mail in a central post office file through which a PC mail program searches for the user's mail—3Com uses a mail-service process in the 3Server. When mail is sent to a user, the application program on the client station sends the message to the 3+Mail process on the file server. The mail service then looks in the name-service database and places the message in the correct mailbox.

3Com has created several excellent icons for 3+Mail, including different symbols for read and unread mail, registered mail, and attachments. The icons make editing, sending, and reading mail quick and straightforward. Like many Mac applications, the mail program is well done and should require little learning time. Mac users with the MultiFinder window system can run 3+Mail as a pop-up application.

When users receive mail, they are notified of its arrival by a desktop accessory called 3+Mail Minder, which notifies them of mail receipt via a pop-up window or by sounding a tone. The interval between mail notification reminders can be set to 1 minute, 5 minutes, or 15 minutes.

3+Backup. 3+Mac users configure and initiate backup sessions to the tape drive built into the 3Server. The server supports 60MB and 150MB tape drives—well matched to the 100MB and 150MB hard disks on the server. A 3Server with a tape drive can back up data from its own disk drives or disk drives on other 3Servers. Data backed up on one server can be restored to other servers, with some restrictions. Mac users can execute incremental or

SPECIFICATIONS AND PRICES

Client hardware. Macintosh II, Macintosh SE, or Macintosh Plus.
Server hardware. 3Com 3Server Model 3S/20*x*.
Server processor. 80186, using real mode only.
Server operating system. DOS with 3Com extensions.
Resource management. Centralized.
Name-service type. Centralized.
Client-server protocols. Microsoft server message block (SMB).
Transport protocol. Sequenced Packet Protocol (SPP), which is a Xerox Network System (XNS) derivative.
Network protocol. Internet Datagram Protocol (IDP), which is also an XNS derivative.
Media-access methods. Macs access media with Ethernet or AppleTalk; 3Servers may be connected using Ethernet or IBM Token-Ring.
Cable systems. Thick Ethernet, thin Ethernet, Apple LocalTalk cable system, or telephone twisted-pair cable.
Mac memory requirements. 115KB.
Maximum memory (3S/20*x*). 3MB.
Maximum number of printers. Two parallel, five serial (not available with some configurations).
Maximum number of disks. Nine (using SCSI controller).
Maximum server network channels. Three (Token-Ring, Ethernet, and AppleTalk).
Maximum server storage. 900MB.
Tape-drive capacities. 60 or 150MB.
Disk-drive capacities. 100 or 150MB.
Hardware pricing.
3Server 3S/200 (80186, 2MB memory, 100MB hard-disk drive): $7,995
3Server 3S/201 (same features as the 3S/200, except with a 60MB tape drive): $9,745
3Server 3S/202 (same features as the 3S/200, except with a 150MB tape drive): $9,995
1MB expansion memory card for 3Server: $1,795
Expansion cabinet with 150MB hard-disk drive: $5,295
Optional 150MB add-in drive: $3,995
Expansion cabinet with 100MB hard-disk drive: $3,995
Optional 100MB add-in drive: $2,495
150MB tape drive for 3Server: $2,395
Port expansion card: $525
TokenLink card for server: $1,295
3Station: $1,895
EtherLink card: $495
EtherLink II card: $495
EtherLink Plus: $895
EtherLink/NB for Macintosh II: $595
Software pricing.
3+ for Macintosh: $495
3+Route: $1,250
3+Mail 1.3 (server): $595
3+Mail for Macintosh (client): $595
3+Reach/MCI (MCI gateway for 3+Mail): $595

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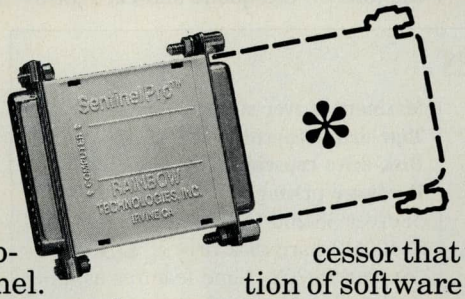

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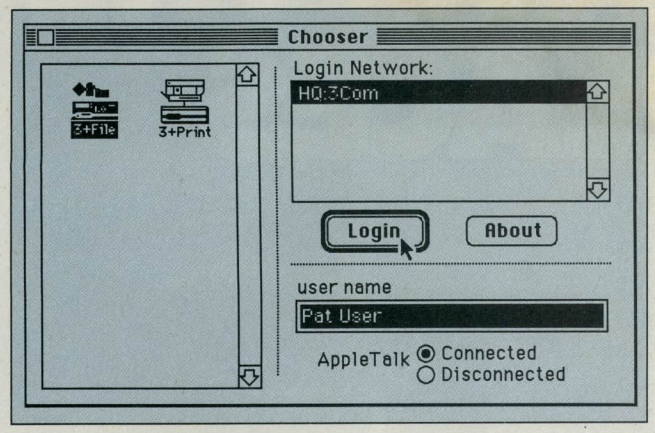
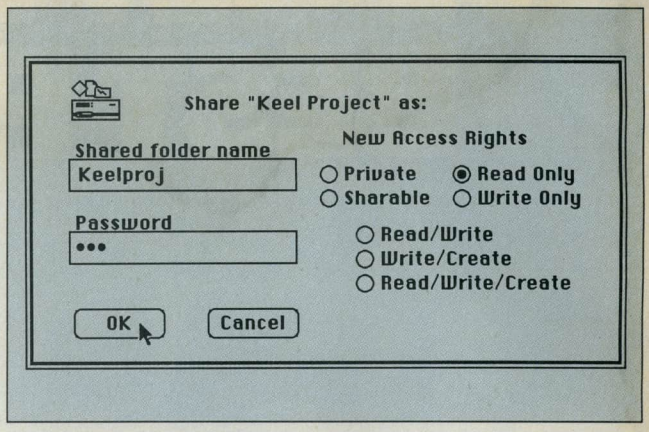
PHOTO 1: *3+ for Macintosh Login Screen*



Mac users access 3+File and 3+Print management utilities from the Apple Chooser menu. Clicking the mouse on the 3+File icon brings up this login screen, which lists servers.

PHOTO 2: *Folder-sharing Facility*



Folders are shared from this screen with mouse and keyboard input. Shared rights each have a "mouse button." Here, Read Only rights are enabled for the Keelproj folder.

full backups of network volumes. Backups take place immediately or on a prescheduled basis. Once scheduled, backups require no additional interaction with the Mac workstation because the tape backup routine runs as an independent process on the 3Server.

This server-based backup process is an excellent approach to network archiving. There are many difficulties inherent to backing up Mac files and folders on DOS drives, however, and 3+Backup needs much improvement before it can be considered a full-feature tape service. For example, the automatic backup feature allows only one session per day. Also, the service does not back up open files in read-only directories as do some PC tape products. Further, only entire directories, not individual Mac files, can be restored.

3+Name. The 3+ for Macintosh name service lets users access network objects with familiar names, regardless of their location. The name service shields users from complex and changing network addresses, thus enabling consistent access procedures. Each name consists of three parts, separated by colons:

Name : Domain : Organization

The total length may not exceed a combination of 58 characters, including spaces, with the name portion limited to 40 characters, and domain and organization limited to 20 each. Each network object, such as a user, group, printer, or shared directory, has a unique name—for example,

Jane Smith : Headquarters : XYZ Corp.

or

LaserWriter : Art Department : XYZ Corp.

When a user accesses a resource, it is referred to by its name, and no knowledge of the network's physical connection is required. Resources in a user's default domain can be accessed with just the first part of the name. Objects also may be assigned nicknames called *aliases,* so users do not need to remember long names.

3Com has enhanced its name service in the Mac environment with name-service icons. Icons are especially useful here because they give the user a standard set of visual objects to represent network entities. 3+Mac often juxtaposes the name-service icon with the textual name of a network object in its management utilities to assist in identification.

Administration. Administrative functions are the least developed of the 3+Mac services. 3Com provides a utility for making user accounts (see photo 4), but does not have a full complement of advanced system management features. The name-service area, in particular, needs improvement. For example, once a network domain is created, it cannot be renamed; a domain name can be changed only by deleting all of its users and resources and building a new domain. This inability to modify domain names may be inconvenient for an organization that makes frequent departmental changes.

The 3Com name service is required on only one server in a multiserver network. Its highly centralized nature is a drawback at many sites where large Ethernets are built with low-level bridges. These bridges can create enormous Ethernets by electrically segmenting networks and filtering packets between local segments. On a large network such as this, which often encompasses an entire building, a single name service represents a vulnerable point of failure.

Other vendors approach name service in a distributed fashion that automatically updates names maintained on every major file server. 3Com supports additional name servers on networks separated by 3Com routers, but these services do not update each other automatically and must be maintained manually by administrators. Many sites use low-level, protocol-independent bridges because other vendors' equipment will not communicate through 3Com's protocol-specific routers. When two 3Com name services are united on a single network, even with a remote bridge, conflicts will undoubtedly arise.

Security is another problem area for 3+Mac. When a user chooses a password, the system does not prompt for a second entry of the password for verification. This can lead to problems if an incorrect key has been pressed, because the user cannot be assured that the intended password has been entered. Users who enter an incorrect (nonmatching) password lose rights to the system without help from the administrator.

Some administrative deficiencies in 3+Mac stem from the MS-NET architecture upon which it is based. MS-NET segments users' home work areas into isolated logical root directories that cannot be viewed as a whole by a network client. As a result, when a user account is deleted without deleting its home folder, the folder still exists but is inaccessible to any user. 3+Mac warns administrators not to attempt

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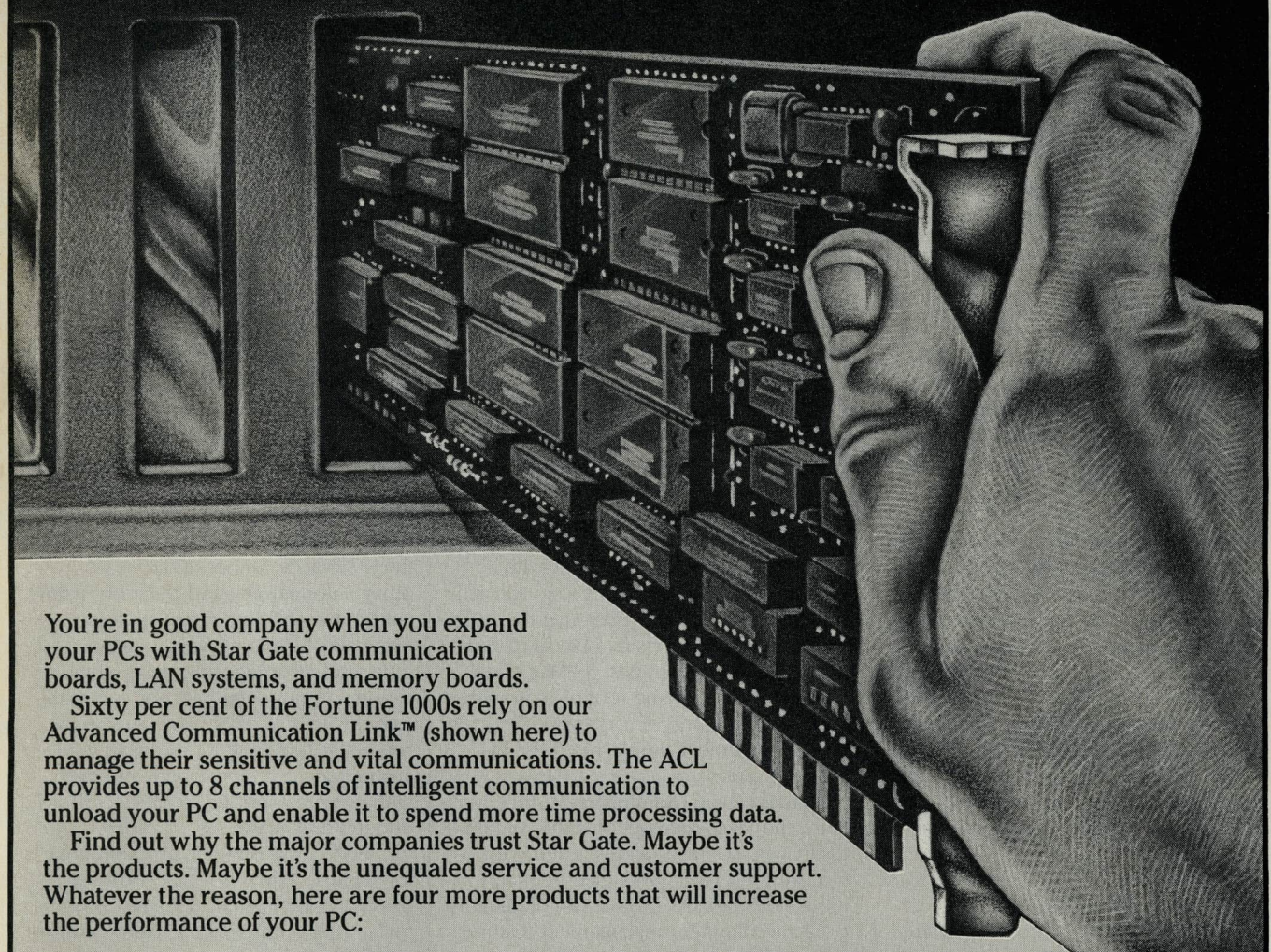

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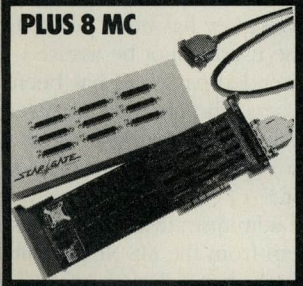

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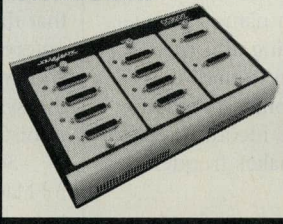

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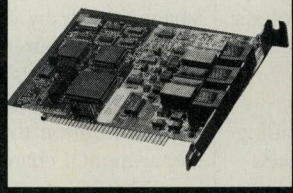

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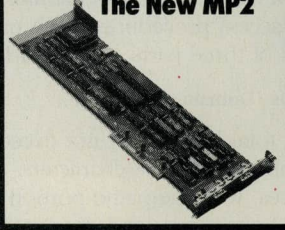

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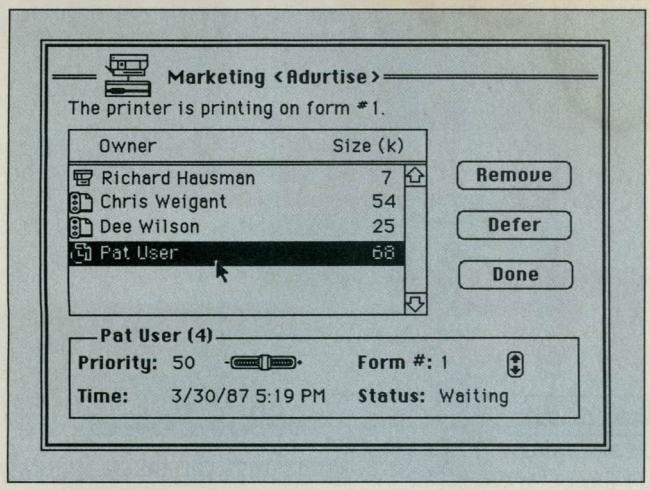
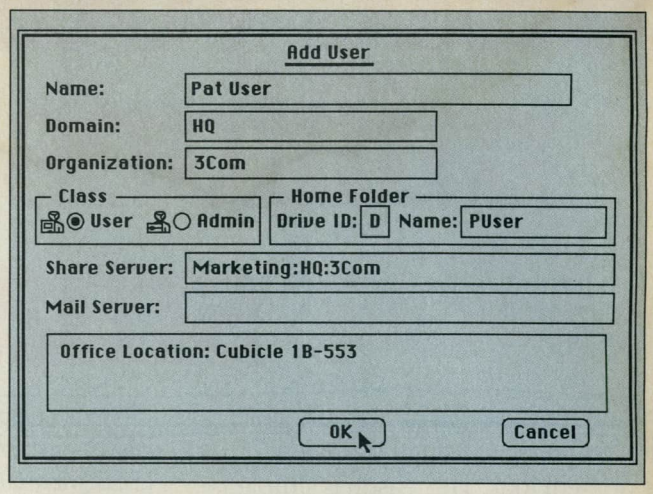
CIRCLE NO. 177 ON READER SERVICE CARD

PHOTO 3: *3+ for Macintosh Print Service*



The print queue status box displays the status of four current print jobs. Icons to the left of each job indicate status such as printing, waiting to print, and printer error.

PHOTO 4: *User Administration Screen*



Administrative functions can be performed by Mac-based users. Each user is assigned a home folder and default server. Class of user is selected with mouse buttons.

deleting a user without purging the user's folders.

MS-NET does not provide the facility for centrally managed user security as the Banyan and Novell systems do. Surprisingly, 3Com does not use its name service to maintain profiles of user rights to system resources, such as files, directories, and printers. This lack of centralized user profiles means that each time a secure resource is linked, the user must supply a password. This approach is inconvenient for users who access numerous resources. Many MS-NET systems get around the password problem by not assigning passwords, embedding them in batch files or, in the case of 3+ for Macintosh, Quick-Start files. Neither of these approaches is acceptable for sites with tight security requirements.

The MS-NET security system is a throwback to earlier distributed network management philosophies that were feasible only for small, under-utilized networks. A system in which the users assign and manage passwords for large numbers of system resources is not sufficient for many larger sites and business environments. When a user successfully logs in, the full complement of resources should be available without additional passwords.

In its current implementation, the 3+Mac Quick-Start feature automatically enters all of a user's passwords, or none of them, during boot-up. A better method would be to force the user to enter the login password during start-up and then have the passwords entered automatically for linked network directories.

For some 3+Mac system-management functions, the administrator must log in with the special login name of Server-User. This account lets the administrator create public directories and manage printer links and passwords. It would be more convenient for the administrator if all common system management functions could be executed under a login name.

INTERNAL COMPONENTS

3Com relies on its 3Server to provide network services to Macs under 3+Mac. The 3Server software comprises five major components: multitasking process manager, network-optimized file system, XNS communications protocols, MS-DOS and device drivers, and server-based processes such as 3+Share, 3+Mail, and 3+Backup. DOS is used mainly to load the 3Server's system software. Once the file system, process manager, and XNS stack are loaded, DOS has little use. Some DOS handlers, such as the time and date function, are used, but most of the code in the server is 3Com's.

The 3Server software components reside in the first 896KB of its 1MB of RAM—3Com can exploit more than the standard 640KB because the 3Server needs no video memory (because it has no monitor) and has no devices, such as EGA, 3270, or network boards, that require high memory. The remaining 128KB of conventional memory between 896KB and 1,024KB is divided equally between the 3Com ROM BIOS and accessing the expanded memory specification (EMS) file-caching system that resides in the 1MB or 2MB of expanded memory. The 64KB for caching consists of four 16KB page frames.

I/O requests to the 3Server originating from network clients are queued by the process manager, make their file system calls, and "go to sleep" while disk accesses take place. The process manager is nonpreemptive, relying on the good behavior of the server processes; it occupies approximately 4KB of RAM and is loaded as a device driver. The process manager maintains a run of pending processes and stores stack and register data for the processes it manages. The manager recognizes different priorities for disk requests, store-and-forward mail routines, print spooling, and other processes.

3Com's file system, called CIOSYS for concurrent I/O system, gives the 3Server substantial performance gains over single-tasking, DOS-only servers. CIOSYS loads as a terminate-and-stay-resident (TSR) program and consists of a reentrant function library that supports multiple I/O processes concurrently. Although the DOS file-allocation tables (FATs) and directory tables are present on the 3Server, they are not used by CIOSYS, which maintains and caches its own FATs and directories. Disk accesses are sorted by location on the disk, permitting "elevator" seeking by disk heads.

Mac users can point to a data file with the mouse and click twice to load both the file and the application program that created it. Consequently, Mac files must carry more data than DOS files. Mac files include *creator* information about the application that created them and the type of file they are, as

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specified by the application. The file type is similar to DOS application extensions, such as .WK1 for Lotus 1-2-3 files. Additional functions have been added to CIOSYS for 3+Mac to accommodate the differences between the PC and Mac file structures. Mapping the Mac file system to the DOS file system on the 3Server presents challenges, and CIOSYS handles them well.

Mac files get much of their enhanced functionality from a structure that splits a file into a *data fork*, which stores a file's data, and a *resource fork*, which stores program code and application specifics such as fonts, icons, and menus. Application files, system files, and data files can use resource forks, data forks, or both in the Mac file system. DOS files have no equivalent to forks, which complicates the translation of Mac files to DOS files and vice versa.

CIOSYS stores the Mac resource fork in a separate file and generates a generic resource fork for files created by PCs to be accessed by Macs in shared folders on the 3Server. CIOSYS has a generic document icon labeled "PC" for files created by PCs. Under CIOSYS, Mac folders on network volumes are actually DOS directories and can be viewed as such by PC clients. Both PC and Mac users can access data files that are in a common format, such as text files, Microsoft Excel spreadsheets, or WordPerfect documents (note that WordPerfect now has a Mac version). PC users see only the data fork of Mac files; the resource fork is stored as a hidden file.

CIOSYS creates a small information file for every Mac folder stored on the 3Server. This supplemental file maintains data that the Mac file system needs and that the DOS file system cannot store internally, such as longer Mac file names, file creator, and file type. Every Mac folder on the 3Server has a corresponding directory also on the 3Server. The folder-information file is stored in each DOS directory that corresponds to a folder.

The file forks and supplemental folder files can cause problems for tape restores, among other functions. The 3+Mac tape system can restore entire folders only to the 3Server; restoring individual files would lead to inconsistencies between forks and the folder's supplemental information file. For this reason, 3+Mac tape restores cannot overwrite existing directories and thus must target empty folders.

The Mac file system supports file names up to 31 characters long and can contain spaces and other printable characters (except for the colon, which serves as a delimiter). CIOSYS stores the Mac file names in the supplemental file and translates them into unique PC file names for compatibility with the DOS directories on the 3Server. Under this system, spaces become underscores and sequential numbers can be appended to resolve any file-name redundancies. Thus, PC users see the eight-character DOS file names and extensions they are used to, while Mac users see the full Mac file name.

3+ for Macintosh translates the Mac creator and file type attributes into DOS format, which greatly simplifies file sharing between PC and Mac applications. The administrator can define mappings between creator and type combinations and DOS file extensions when the 3+Mac service is set up. For example, Aldus PageMaker Mac files have a creator of ALD2 and are type PUBF. These files can be converted to a DOS file extension of PUB, which is how the PC version of PageMaker saves files. 3Com also has a utility for DOS clients called MACDIR, which displays full Mac file names, fork names, creator, and file type.

Under CIOSYS, Macintosh folders on network volumes are actually DOS directories and can be viewed as such by PC clients.

3+Mac translates AppleShare sharing mode and byte-range locking calls to the appropriate DOS 3.1 functions, so Macs can open files in various modes and lock records and/or files on the server. PCs and Macs can even access the same files simultaneously with complete locking protection if the application programs are written to the appropriate standards.

3Com has created additional SMB messages to handle those features of the Mac file system, such as resource forks, that have no counterpart in the PC world. The 3+Mac service on the file server interprets these additional messages and performs the appropriate action. When a PC renames a Mac file, DOS renames only the data fork of the file; the 3+Mac service interrupts the request and renames the resource fork as well. The only time this process breaks down is when a PC user copies a Mac file. Only the data fork is copied, and because no corresponding resource fork is present, Mac users cannot use the copied file.

TOPOLOGY AND PROTOCOLS

The 3Com protocol suite is called MINDS, for MS-DOS internal network driver scheme. MINDS is a layered communications architecture that permits individual components to be modified or replaced. For example, the MINDS XNS network and transport layers can be run on top of Ethernet or Token-Ring data link layers. On the 3Server side, 3Com's XNS protocol stack components are loaded into low memory as DOS device drivers specified in a CONFIG.SYS file on the boot volume of the 3Server. On the Mac side, a combination of the 3Com XNS stack and low-level AppleTalk protocols is used. (To avoid confusion, AppleTalk is Apple's protocol suite and LocalTalk is its twisted-pair cable system.)

Mac clients accessing 3Servers with LocalTalk links use XNS for the upper layers, such as network and transport. AppleTalk link access protocol (ALAP) is used to access the LocalTalk media. Macs accessing the 3Server with Ethernet also use XNS for the upper protocols but load an additional EtherTalk driver to drive the Ethernet card.

Both LocalTalk and Ethernet clients support datagram delivery protocol (DDP), an Apple network-layer routing component. Some third-party Mac network products use their own network and transport protocols; thus, support for Apple's high-level protocols does not guarantee interoperability. DDP assists 3+Mac clients with some third-party bridges available for Macs.

The basic configuration for 3+Mac is a string of Macs connected with the built-in LocalTalk to the 3Server. LocalTalk twisted-pair cables are available from Apple in varying sizes. Third-party products such as Farallon Computing's PhoneNet allow LocalTalk to run on telephone system wires. Macs on a LocalTalk tributary communicate with the server at speeds of less than 300 kilobits per second (Kbps). These Macs can print to either LocalTalk- or 3Server-based LaserWriters. LocalTalk-based Macs also can route through the 3Server and access files on other 3Servers running 3+Mac.

Mac clients on Ethernet can use the services available on the 3Server to which they are attached but not on other 3Servers on the same network.

Applications were launched from local diskette drives, local hard disks, and 3Server drives by the Mac II and the Mac SE in Ethernet and AppleTalk environments. Mac performance on 3+Mac was generally good, particularly on Ethernet. The best performance was obtained from local hard disks; the worst from AppleTalk. The Mac SE, for example, was able to load Microsoft Word (350KB) from the 3Server across AppleTalk in an average of 15 seconds. The same application loading from the SE's local hard disk was twice as fast, loading in 7 seconds.

Load times for large applications over AppleTalk can take an excessive amount of time. Aldus PageMaker (910KB) took more than 45 seconds to load on the Mac SE through AppleTalk. By comparison, PageMaker loaded from the local hard disk on the same machine in 14.2 seconds. AppleTalk's 230-Kbps speed does not compare well with the fast hard drives contained in the Mac SE and Mac II.

Operations not bound by slow peripherals were 50- to 100-percent faster on the 68020-based Mac II than the 68000-based SE. The Mac II's 15.6-MHz processor, full 32-bit architecture, and other enhancements translated into better performance, both on the network and locally.

The built-in drives on both Macs performed very well, exceeding performance on Ethernet. The Mac II, for example, could load Microsoft Word in 3.7 seconds from its local hard disk, but took nearly 6 seconds for the same operation through Ethernet to the 3Server drive. Long, sequential operations, such as file loads, cannot be cached in the server. Ethernet could be expected to perform better for cached file operations.

The variation in performance turned in by assorted Apple workstations and network types was considerable. This can create extra work for persons evaluating or planning Mac-based networks. Performance-sensitive applications should be tested for the specific configuration on which they are intended to run.

AppleTalk may be fast enough for users with light- to medium-application throughput requirements. These users should find the performance for login, linking, and launching of network applications such as mail, word processing, and data managers to be quite adequate. On the other hand, users with applications that load the network with long or frequent file I/O or print requests might want to consider Ethernet. As Macintosh processing power and application sophistication increases, Ethernet becomes more appropriate.

3+MAC FORECASTS

The integration of PCs and Macintoshes that is realized with 3+ for Macintosh is excellent, and the translation of Mac files to DOS format for storage on the 3Server works quite well, making the sharing of data between the two types of workstations possible. 3+Mac is a reliable product for a wide range of network applications.

3Com's 3+Mail is particularly useful in uniting PC and Mac clients with the same user for the exchange of mail and any type of attachment. The 3+Mac print services, which provide spooling to the 3Server, should prove a substantial improvement to Mac users familiar only with Apple's native print services. 3+Mac's tape and administrative services leave much room for improvement, but even these deficiencies fall in the natural upgrade path of 3+Mac and do not represent flaws in the primary function of the product.

Other LAN vendors are making efforts to enter the Mac network market, but 3Com has garnered a substantial lead.

Like many products in the LAN industry, 3+ for Macintosh is greatly affected by the turbulence of the operating system and network communications software products that support it. Many areas of concern with 3+Mac are directly related to the 3Server and 3Com's PC network architecture. Large sites with many servers on an extended Ethernet may have problems with the current state of 3Com's name service and internetworking functions. The trend with large Ethernets is to segment with low-level bridges that allow multivendor protocols to pass through. In this environment, the name service should be distributed to any server and globally updated automatically. 3Com's present implementation of a single, centralized server per network is not ideal for large Ethernet sites.

The future of 3+ for Macintosh is closely tied to developments for the 3Server and its system software. The OS/2-based 3+Open should improve 3+Mac and other 3Com services. OS/2 will give 3Com more memory for its server-based processes by running on 286 or 386 processors in protected mode. This environment is just the type needed by 3Com's services, which have been increasingly restricted by DOS.

From this perspective, 3Com has played its cards well in deploying its network technology. Having made the short-term sacrifice of developing its services under DOS to stay in tune with the industry standards set by Microsoft, its server processes should now be able to flourish in the memory-rich, multitasking OS/2 environment. The close relationship that 3Com has with Microsoft and LAN Manager will help to insure this.

Though many enhancements are possible, 3+ for Macintosh proves that it is feasible for Macs and PCs to coexist productively on a common file server. During testing for this review, the efficient user interface of the Mac and the reliable network services of the 3Server demonstrated that they add up to a remarkably powerful combination. The Mac's icon-driven interface encourages experimentation and intuitive learning while at the same time providing easy access to the 3Server's considerable resources.

Other vendors (such as Banyan and Novell) are making efforts to enter the Mac network market, but 3Com has garnered a substantial lead. Whether this lead will ultimately translate into a superior product is not yet clear and will be impossible to determine until later this year or next year, when other vendors' Mac-networking products become available for evaluation.

For sites that already have 3Servers and Macintoshes, interconnection should be a given. For those sites that have Macs and rigorous production applications, the recommendation is to consider 3Com's 3+ for Macintosh and the 3Server. For sites that have no PCs or Macs, users may have a tough decision between the two systems. PCs have a long way to go to catch up with the Macs in some key areas.

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Howard Marks is a New York City-based consultant specializing in LANs. The name of his firm is Networks Are My Life.

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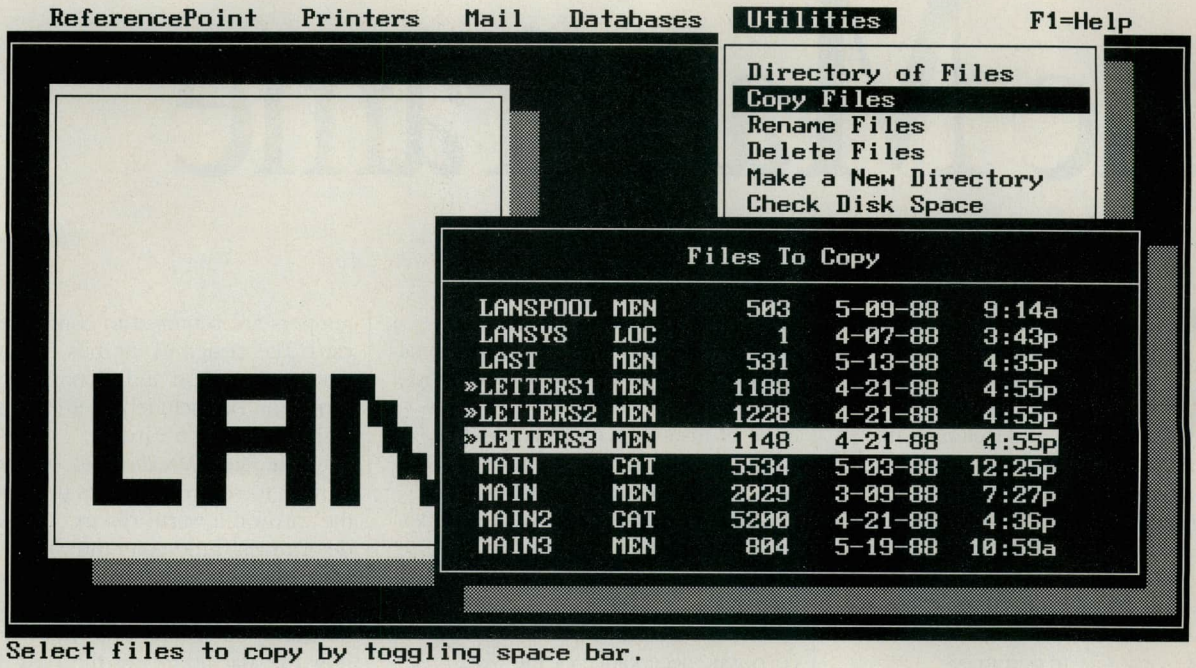

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Macintosh Meets the Mainframe

The Apple Macintosh became popular, in part, because of the allure of its graphics interface. Devoted fans helped spawn the next generation, the Macintosh SE and Macintosh II, powerful general-purpose computers that are even better at running the sophisticated graphics and desktop publishing applications that many companies find useful. Unfortunately for Mac users, the data they need are often inaccessible because the database resides in the corporate mainframe.

That information need not be inaccessible anymore. With MacIRMA hardware and software from Digital Communications Associates Inc. (DCA), Mac users now can connect directly to an IBM 3*x*74 cluster controller sitting in the nearest closet. PC users have had this access for several years through emulators for IBM 3270-type terminals. Emulators help consolidate several functions into one device and usually support data transfers to and from the mainframe. Mac aficionados had to be content with other more indirect means, such as dial-up connections or downloading data from a PC.

MacIRMA is similar to the IRMA package for the PC offered by DCA. Table 1 compares MacIRMA 1.0 and IRMA 2, the latest PC version. Both Mac and PC users can transfer files to and from a mainframe and can copy mainframe screen displays to microcomputer files, to a printer connected directly to the microcomputer, or to a printer connected to the controller. However, MacIRMA is strictly a Mac application and has the same features that made the Mac famous: the mouse, pull-down menus, resizable windows, and copy-and-paste operations.

ILLUSTRATION • NED SHATZER

It may seem an odd combination—the most individualistic personal computer available, with its point-and-click interface, wired to the embodiment of institutionalized computing. While not a predestined marriage, it isn't a shotgun wedding either. The MacIRMA package works well—it links the two machines without major compromises in the usual ways of using either machine. Moreover, a connection to the IBM mainframe is a factor in the corporate acceptance of the Mac.

RIDING THE NUBUS

The Mac II is the most expandable model in the Macintosh line. Unlike previous models, its packaging parallels that of the IBM PC: the keyboard, monitor, and system unit all come as separate pieces. The Mac II system unit can hold six expansion cards (the MacIRMA card uses one slot) and uses Apple's adaptation of the NuBus architecture. The NuBus specification, which is the result of the efforts of an IEEE committee (with input from Apple), began as a design for minicomputers but has been adapted to support microcomputers.

Among other features, NuBus allows for a 32-bit address space, and the bus design is not tied to any specific processor. It allows any card on the bus to assume control of the system, even at system initialization time. Its address space is unreserved for specific processes (address ranges are not dedicated for video pages or CPU areas, for example). Specific address ranges are dedicated to "slot space." Each possible slot has a dedicated 16MB region.

Because each card is assigned an address location based on the slot into which it is installed, no switches or jumpers are required to configure a card. The design of the bus requires that configuration and identification information be included in ROM on the NuBus expansion cards.

The MacIRMA card has only one jumper to set that controls the status of the card on a warm restart. The setting determines if the communications line is reset or left uninterrupted if the system is reset. Setting the jumper is optional, however, and does not affect how the Mac addresses the card.

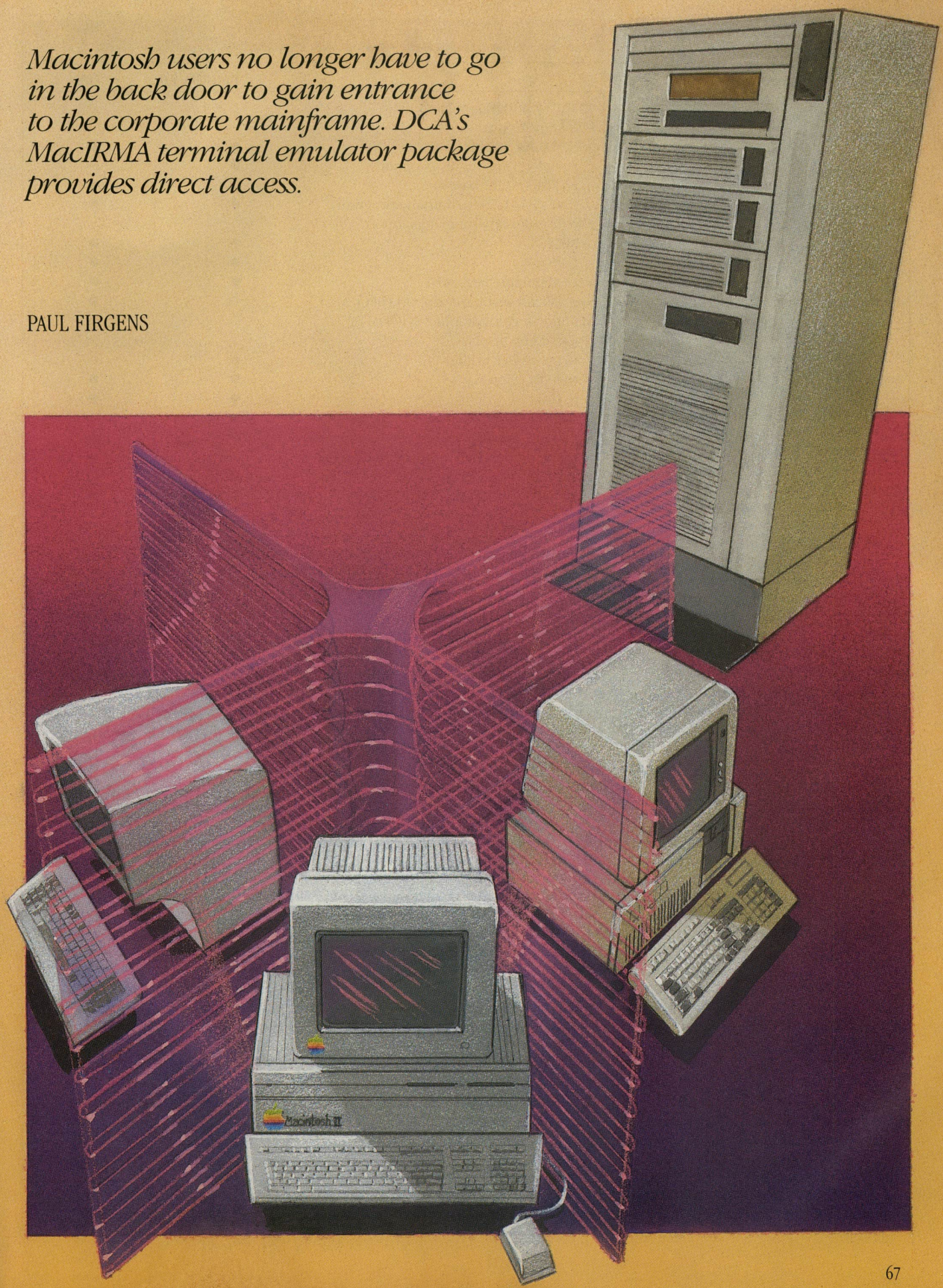
The MacIRMA card is solidly constructed; it has no soldered-on leads or last-minute fixes. Installation is not difficult—a screwdriver opens the cover of the Mac II. MacIRMA software installation is also easy. A user can run the program directly from the diskette, or it can be copied into an appropriate folder on a hard disk. The software is not copy protected, comes on a single 800KB diskette, and uses 192KB of RAM when it runs.

The documentation is generally clear but could be more complete. For example, the manual lists possible error messages but does not discuss possible causes or cures. Fortunately, DCA has a reasonably good support system in place; support received through a toll-free phone number was both helpful and knowledgeable.

MacIRMA diagnostic routines are invoked from a menu included as a standard part of the application. No external programs must be loaded and run. The diagnostics verify that a MacIRMA card is installed and its RAM and microprocessor are working properly, check the data path on its transmitter and receiver, and make sure the line to the controller is active.

Macintosh users no longer have to go in the back door to gain entrance to the corporate mainframe. DCA's MacIRMA terminal emulator package provides direct access.

PAUL FIRGENS



The MacIRMA software runs as a task in a Mac window (see photo 1). Within that window, it operates like an IBM 3270-type terminal with many of the same features—a status line at the bottom of the window, reverse video, bold characters, and similar colors.

However, the background on an IBM terminal is dark, while the MacIRMA background is white, like the standard Mac background. Some of the colors on the IBM terminal, intended to contrast against a dark background, are difficult to read on the white Mac display. DCA will offer a black-screen background option with the release of version 1.1.

MacIRMA emulates IBM 3278 and 3279 terminals (models 2, 3, 4, and 5) connected to 3174, 3274, or 3276 controllers. The 3278 display is monochrome, and the 3279 display is color. A model 2 display is 24 lines by 80 characters; a model 3 is 32-by-8; a model 4 display is 43-by-80; and a model 5 is 27-by-132.

One disappointment in the MacIRMA product is that it cannot display mainframe graphics, such as IBM's Graphical Data Display Manager (GDDM), or similar applications. This is an unfortunate situation because the Mac is graphically oriented and its users tend to expect applications that make good use of this capability.

TABLE 1: ***MacIRMA and IRMA 2 Comparison***

	MacIRMA 1.0	IRMA 2
3278/79 models emulated	2, 3, 4, 5	2, 3, 4, 5
File/transfer methods		
IRMAlink (mainframe program)	●	●
ForteNet (mainframe program)	●	○
FT78X (editor based)	○	●
IBM's FT/3270 (mainframe program)	●	●
File/transfer environment support		
MVS	●	●
CMS	●	●
Reconfigurable keyboard	●	●
Specialized keyboard support (RPQ, APL)	○	●
Mainframe color graphics (GDDM)	○	○
Copy screen displays		
to controller printer	●	●
to local printer	●	●
to disk	●	●
Diagnostic support	●	●
Light-pen support	○	●
Application program interface (API) support	○	●
Copy-and-paste support	●	○
Alternate I/O address	N/A	●

● = *Yes* ○ = *No*

MacIRMA emulates four 3278/79 terminal models. It offers Mac users many of the same features PC users have with DCA's IRMA 2, plus copy-and-paste support.

INTEGRAL KEYBOARD

Mac users also may be a little frustrated because MacIRMA does not allow them to use the mouse as much as they are accustomed. Version 1.1 of the product will take better advantage of the mouse.

The Mac keyboard is also very different from that of the IBM 3278. In standard emulator style, DCA maps the specialized terminal keys to combinations of keystrokes. (The F1 key on 3270-type terminals is equivalent to holding the Ctrl key while pressing the number 1 key on the Mac, for example.) This arrangement is more awkward than dedicated keys, but anyone who has been able to adapt to the PC IRMA keyboard will have little trouble using the MacIRMA keyboard.

To simplify matters, Apple supplies a utility called Easy Access that allows a user to type keystroke combinations without pressing the keys simultaneously. A *modifier* key (*control*, *shift*, *option*, or the *Apple* key) followed by a standard key produces the same effect as if the keys are pressed simultaneously. This feature is particularly useful with MacIRMA because keystroke combinations (of a modifier and a regular key) are an integral part of the package. It's a nice touch.

Even simpler yet is using a mouse with the Quick Pad menu, as DCA calls it. The user pulls down a menu and clicks the mouse pointer on the square with the name of the desired function.

The Mac user can easily change the default key assignments using another pull-down menu to call up a window that displays a 3278 and a Mac keyboard (see photo 2). To assign an IBM-key value to a Mac key, the user points to an IBM key with the mouse, clicks and holds the mouse button, and rolls the pointer to the desired Mac key. The key changes are effective immediately. The user can change the Quick Pad layout the same way.

MacIRMA does not give as much control over redefining the keyboard as does IRMA 2. With IRMA 2, users can redefine the PC keyboard two ways. The easiest method is to create keystroke macros. The user also can remap the keyboard by replacing the interrupt 9H BIOS keyboard processor with a customized handler provided with the package. The first method is simple and has the advantage of being dynamic. The second method, while more complicated, gives the most flexibility and control.

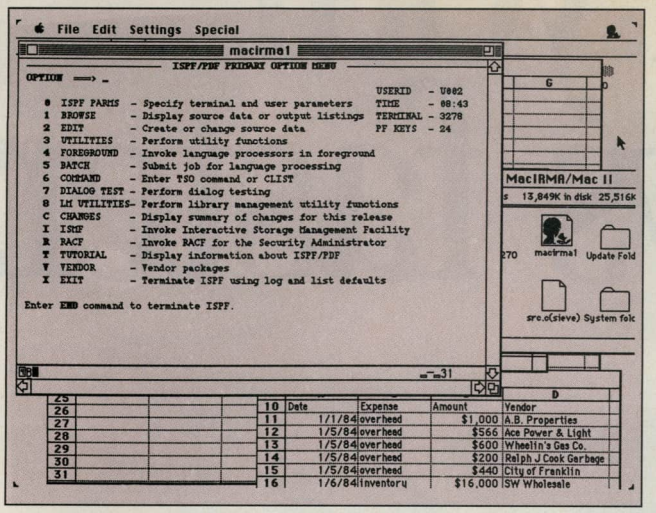
Both IRMA 2 methods work outside of that program, whereas the MacIRMA procedure does not work outside of the MacIRMA application window. The MacIRMA procedure, however, is easier to use because the basic operations are much more intuitive: the user merely looks at a map of the keyboard, picks up new key values, and replaces the original keys.

The PC version documents the IRMA card's screen buffer and I/O port and even includes sample access programs that allow the user to access the mainframe. Unfortunately, that information is not included in the MacIRMA package. DCA does not plan to supply this information for MacIRMA but intends to release an application programming interface during the third quarter of 1988, which may provide MacIRMA much of the same flexible access now available with IRMA.

TALKING TO BIG BROTHER

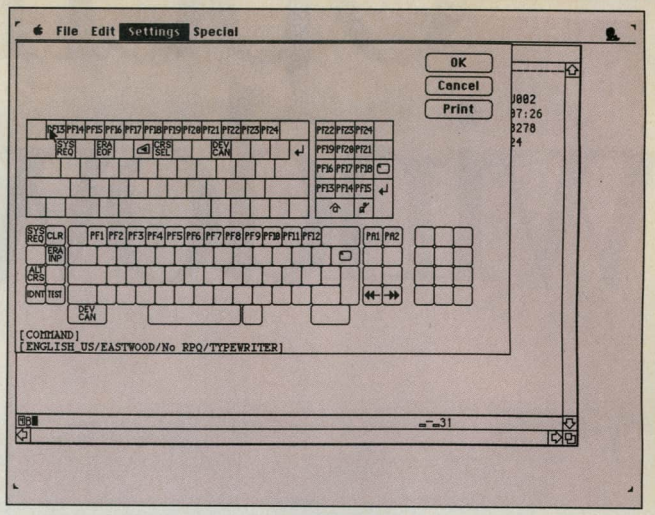
For this review, MacIRMA 1.0 was installed in a Macintosh II with 5MB of memory, a color monitor, and a standard 85-key Macintosh keyboard. (Another version of the MacIRMA program is available for the Macintosh SE.) The Mac II was connected to an IBM 3090 series mainframe directly through a 3274 controller.

PHOTO 1: *Mainframe Window*



MacIRMA runs as a task in a window on the Mac. The familiar 3270-type terminal display appears in the window, complete with the status line at the bottom. Features supported include reverse video, bold characters, and color.

PHOTO 2: *Macintosh Key Assignment*



To assign a particular IBM 3270 terminal key value to a Mac key, a user points to the appropriate IBM key with the mouse, clicks and holds the mouse button, rolls the pointer to the Mac key, and releases the mouse button.

Used continuously for one month with a variety of mainframe software, MacIRMA had no problems with the standard terminal communications functions. It also got along well with other Mac software, such as Apple's MultiFinder, and when using copy-and-paste operations.

MultiFinder, a limited form of multitasking, does not provide a complete memory-protected environment but does let applications share some of the machine resources. Not all Mac applications cooperate with MultiFinder, but MacIRMA does. A user can copy information between applications without quitting and saving the first application before starting the second.

Mainframe applications also can run in a MacIRMA window while other Mac applications run in other windows. For example, a user can run a lengthy spreadsheet recalculation while working on the mainframe. When MultiFinder runs with other Mac applications, no problems originate with MacIRMA, although the emulator does not allow background data transfers.

Mac applications generally let users copy portions of their windows and paste them into other applications. MacIRMA is no exception. Pieces of mainframe displays can be copied directly into Mac applications; data also can be pasted from a Mac application onto the mainframe window.

Copying from a mainframe window to a Mac application works with no problems, as does pasting to a mainframe window when the operation covers the entire width of the window. Problems are encountered, however, when pasting pieces of data narrower than the width of the window, such as a table onto a text file. The new text is displayed in the window in the place marked for it, but when it is saved, only the first line pasted in the window can be retrieved. DCA plans to fix the problem in a future release.

MacIRMA supports three protocols for moving data between the Mac and the mainframe: IRMAlink and ForteNet (both DCA products), and FT/3270 from IBM. All three require special software on the mainframe to assist in the file-transfer process. The mainframe editor-compatible transfer programs included with PC IRMA are not available with MacIRMA. Editor-compatible transfer programs require no special software on the mainframe; however, transfers are not as fast or reliable as with host-assisted programs.

DCA supplies its IRMAlink software to each mainframe site at no extra cost. File transfers tested with the IBM package FT/3270 through time-share option (TSO) worked without a hitch. According to DCA, MacIRMA works with versions of FT/3270 available for CICS and VM/CMS. Files transferred can be binary or text. The original source can be a mainframe, PC, or another Mac.

The user invokes the transfer operation from within the MacIRMA window by selecting the FILE pull-down menu and choosing the appropriate SEND or RECEIVE option. The user can choose source and destination options as well as transfer protocols and related options. Photo 3 shows the menu for FT/3270 protocol and available options, such as ASCII/EBCDIC character translations and carriage-return/line-feed insertions and deletions.

Another MacIRMA file-transfer option, unique to the Macintosh, is the Resource Format choice, which is shown in the lower left of the screen in photo 3. This option moves a Mac file with its *resources*, which describe what kind of data the file contains (text, a photo, an application program, and so on), and the icons and fonts associated with the file. Resources must be included if the user wants to reconstruct the original Mac application after a transfer. They are not needed to transfer some types of files—word processing documents, for example.

Choosing the Configure option displays another menu (photo 4) where the user can include specific parameters about the mainframe data set, the length of time MacIRMA waits for activity from the mainframe before it quits the transfer procedure, and the command sent to the mainframe to start the file transfer.

MacIRMA transfers files in a reasonable amount of time; a 406KB spreadsheet was downloaded to the Mac in 3 minutes 15 seconds with the MVS/TSO version of IBM's FT/3270 through a locally attached controller.

An acceptable speed in transferring files is not enough, however, for successful data sharing. The target application must be capable of processing the

Open your windows faster.

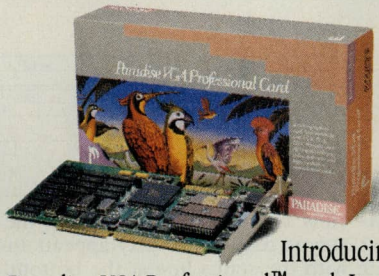


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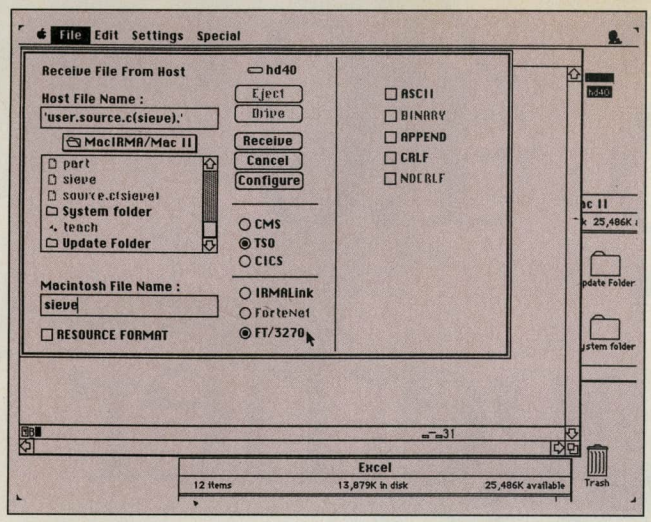
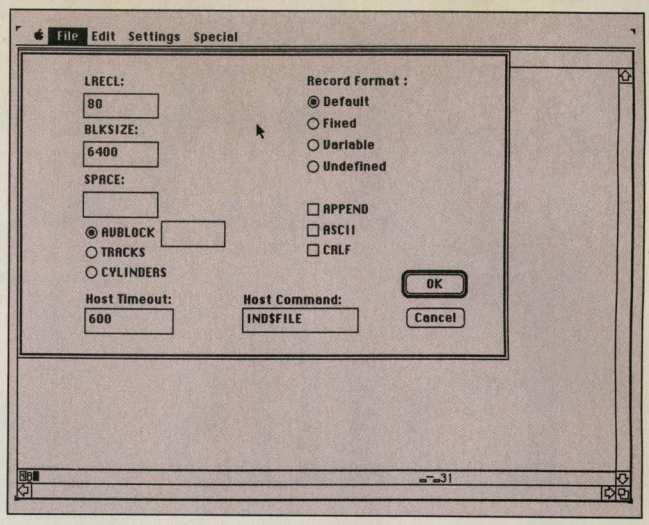
PHOTO 3: *File-transfer Protocol*



MacIRMA supports IRMAlink, ForteNet, and FT/3270 file-transfer protocols. The protocol and options require special file-transfer software on the mainframe; DCA supplies the IRMAlink mainframe software to each site at no extra cost.

PHOTO 4: *File-transfer Parameters*



The file-transfer configuration menu specifies parameters about the mainframe data set, the length of time MacIRMA will wait for activity from the mainframe, and the command sent to the mainframe that is used to start the file transfer.

data in those files; generally, the transferred data must be converted to formats usable by the new application.

File-transfer software begins this process by converting mainframe EBCDIC text to ASCII text for the microcomputer. However, binary files (such as spreadsheets and word processing documents containing control codes) present a different situation because the file-transfer software does not do any conversion and only transfers these files to the target machine. If the files are not executable programs, other handlers must convert them to a usable form.

To solve this problem, Apple supplies a utility for converting files from one format to another—WordStar to MacWrite or IBM document content architecture to MacWrite, for example. Apple expects third-party developers to supply other conversion routines.

Fortunately, some applications can use foreign format files without a conversion utility. Microsoft's Excel running on a Mac can read Lotus 1-2-3 files directly, including most of the 1-2-3 macro formulas, and can reproduce the original spreadsheet. Such a setup makes data sharing between Mac and PC users even more efficient.

MACIRMA 1.1 ENHANCEMENTS

Version 1.0 of MacIRMA was tested for the article. As the review was being completed, DCA announced the release of version 1.1, which includes several worthwhile enhancements. (DCA is offering the upgrade from 1.0 at no charge if it is made within the 90-day warranty period; otherwise, the cost is $75.) The following comments are based on a trial of a beta version.

An optional black-screen background is included with this release. It makes the screen easier to read, particularly when color is used, and might make regular 3270 terminal users feel more comfortable with the Mac display.

With the new release, the mouse does more of the work. It can position the cursor; when the mouse button is clicked, the cursor moves to the selected position on the screen (the position is indicated by the I-beam cursor). This saves a user from having to tab multiple times through a screen full of options. The user can move the I-beam to the required position and click to move the cursor there. The mouse also can be set to default to simulate a light pen; the usual I-beam displays as a light pen in the MacIRMA window.

IBM Dual Session mode (RPQ) and international keyboard layouts are now supported. If the controller is properly configured, this added support enables the emulator to provide two sessions. The MacIRMA session sounds a tone when the Poll/Alarm command is sent from the controller. The monkey screech (a standard Mac sound option) beeps when you make an error on the terminal.

THE BIG PICTURE

MacIRMA works well. It is a viable and useful product and continues the same high-quality tradition set by the original IRMA products. With MacIRMA, Mac users now can have access to the same mainframe data and applications that PC users have enjoyed for many years, and the Mac can take another step toward acceptance in the corporate world.

Moreover, widespread acceptance of Macintosh-type graphics interfaces can play an even larger role in the future of microcomputing. A Mac running MacIRMA is a history lesson in user interfaces. IBM's plans for the future of application design centers around Systems Application Architecture (SAA), with OS/2 Extended Edition 1.1 as the PC implementation of these plans. The OS/2 Presentation Manager is similar to the Macintosh's user interface. (For additional information, see "The User at the Controls," Ed McNierney, March 1988, p. 64; and "SAA: IBM's Road Map to the Future," Dennis Linnell, April 1988, p. 86.) If the Presentation Manager is successful, the Macintosh environment represents the future of application design, and the mainframe terminal screen displayed in the MacIRMA window represents the past.

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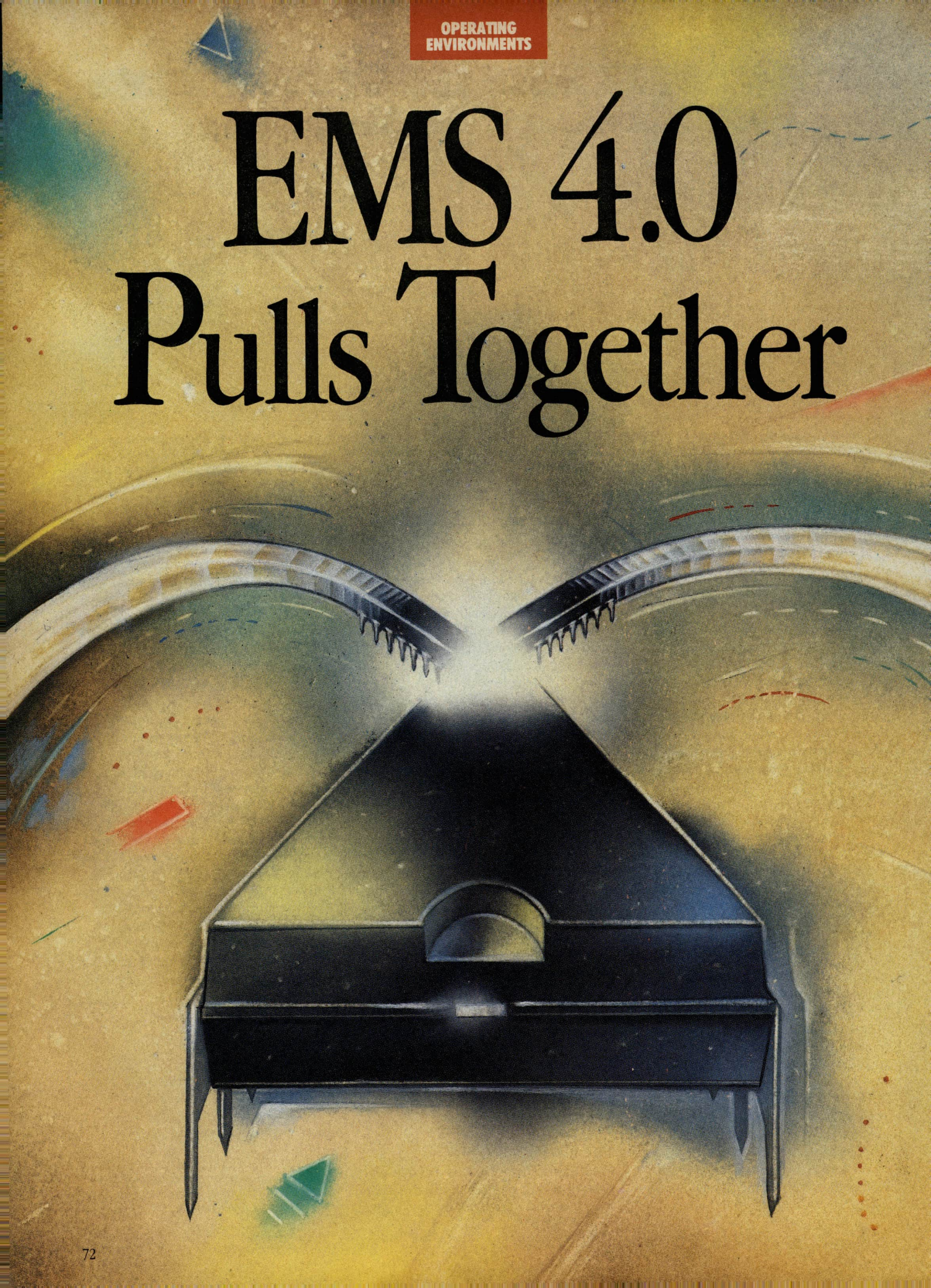
Paul Firgens, a senior database analyst for a Wisconsin firm, does extensive work in a PC-mainframe environment.

EMS 4.0 Pulls Together



In search of supernumerary memory for DOS applications, EMS 4.0 unites something old, something borrowed, and something new.

TED MIRECKI

Until applications arrive that fulfill the promise of OS/2, many users are searching for alternatives that can run widely available DOS applications, yet overcome the limitations of that operating system. Expanded memory is the technology that gives such alternatives a large part of their power. The Lotus/Intel/Microsoft Expanded Memory Specification (EMS) version 4.0 unites features of earlier EMS versions with strengths of the AST Research/Quadram/Ashton-Tate Enhanced Expanded Memory Specification (EEMS), and it adds some traits of its own to create a new and improved EMS. The new version may open all kinds of doors for DOS applications.

Lotus, Intel, and Microsoft originally developed EMS to relieve the spreadsheet power user's memory crunch. It was intended to provide 8MB of memory beyond the 640KB limit as a repository for data such as spreadsheet cells or a RAM disk. Because most programs of this type already provided their own data space management, expanded-memory management was also left at the application level. Therefore, expanded memory benefited applications only to the extent that they were written specifically to take advantage of it. Such applications and utilities soon proliferated.

However, DOS systems needed additional memory for purposes other than data storage. Programs were growing in size, and users were discovering multitasking in the form of terminate-and-stay-resident (TSR) utilities and task-switching environments that loaded more than one program at a time. Although the original EMS offered the possibility of expanding the memory space by an order of magnitude, the design of its hardware interface with the rest of the system made it inefficient for running multiple programs.

To provide for this further use of expanded memory, AST, Quadram, and Ashton-Tate developed EEMS. For applications and small TSR utilities, EEMS provides the same capabilities, in the same way, as EMS. For system-level control programs that create and manage task-switching or multitasking environments, it efficiently expands memory available for running programs.

The most notable EEMS success is DESQview from Quarterdeck Office Systems. DESQview and Microsoft Windows run on top of DOS and rely on a hardware solution to expanded memory. Either of these, in conjunction with underlying hardware, can provide two features lacking in DOS: a large address space and multitasking. They are among alternatives to OS/2 reviewed in the January issue (see "Choosing An Operating System," and "386 Operating Environments," Ed McNierney, p. 50 and p. 60, respectively, and "The DOS-UNIX Union," William Tropp and Stephen Wright, p. 78).

Quarterdeck's windowing multitasking environment is much like Microsoft Windows, but it is text-based and menu-driven instead of graphics- and icon-oriented. It can simultaneously run—not just hold in memory for task switching but actually execute—as many programs as will fit in available expanded memory. By comparison, Windows versions prior to 2.0 used EMS memory for data storage only, so it could multitask only as many programs as fit in the 640KB of conventional memory space at one time.

DESQview demonstrated that expanded memory could go beyond merely providing data storage space. In recognition of this fact, Lotus, Intel, and Microsoft revised their specification extensively to create EMS 4.0. The major changes are increasing the maximum expanded memory space from 8MB to 32MB, incorporating the same hardware interface as EEMS, and adding multitasking support in software.

Part of the motivation for this revision was undoubtedly the release of Windows 2.0, which takes advantage of the multitasking support provided by EMS 4.0 software running on appropriate hardware. Another reason could have been the design of IBM's 80286 Memory Expansion board for the PS/2 Models 50 and 60, which supports a mapping scheme functionally equivalent to EEMS (but for reasons other than providing expanded memory).

SOMETHING OLD

Understanding expanded memory requires clear definitions of the terms used in describing the memory architecture of a PC system. The *system ad-*

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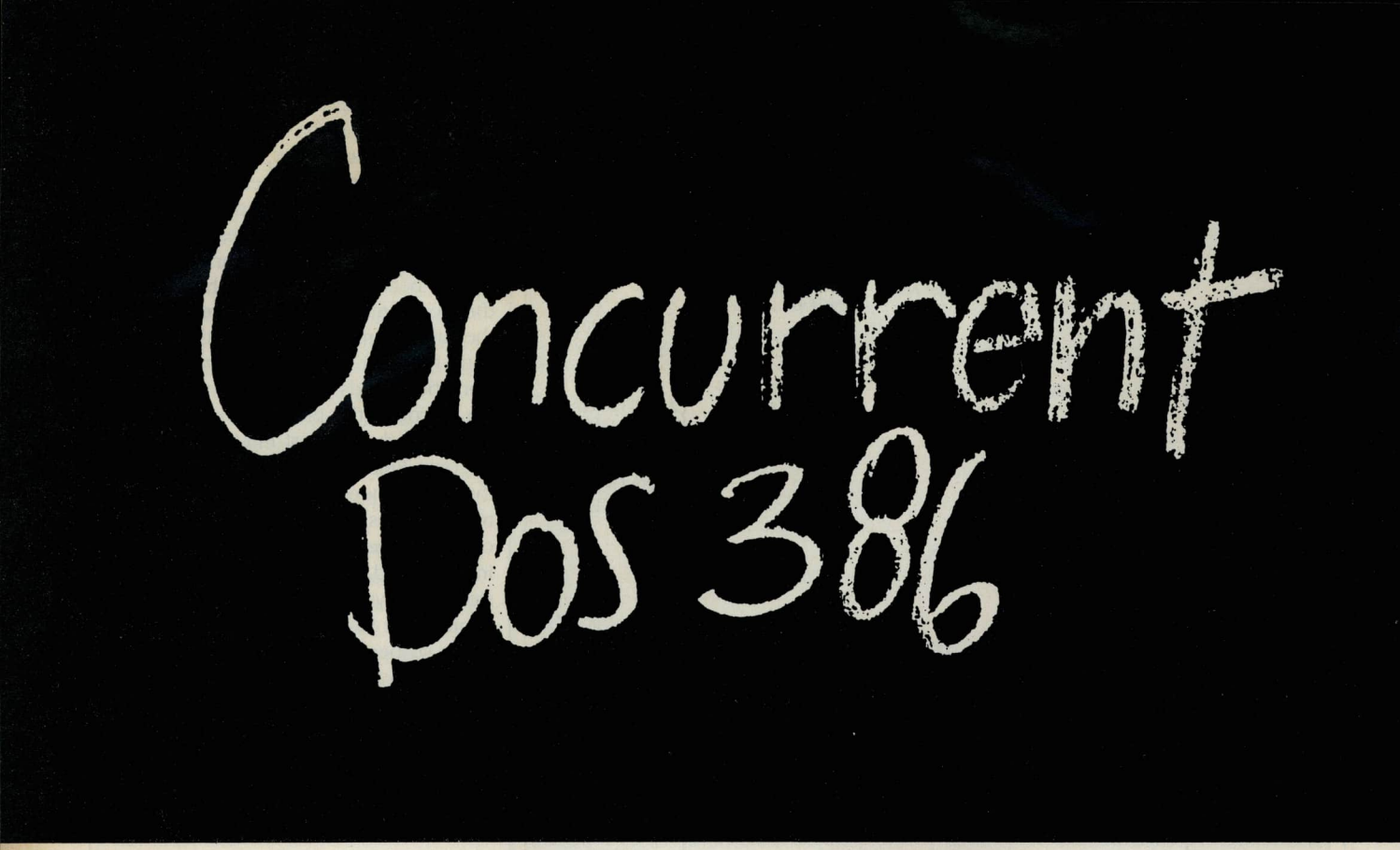

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character name of the user's choice to any handle. The EMM keeps a directory of handle names, and function 21 searches this directory and returns the handle number for a given name. This feature can be used for communication between cooperating programs.

For example, a database program could allocate some pages and store data in them. If the program gives a name to the handle, another program that knows the name (say a word processor or spreadsheet) can find out from the EMM the handle number associated with the name. Knowing the handle, the second program can access the data stored in these pages. The handle number cannot be hard-coded into programs because this number can change at every execution, depending on the order in which various co-resident programs are loaded.

Physical page addressing. In previous EMS versions, page frames in the system address space are identified by frame number. For the configuration shown in figure 1, the four frames in the primary window are numbered from 0 for the frame at segment C800H, to 3 for the one at D400H. In the EEMS implementation, the first four frames are numbered the same way; frames at D800H and DC00H are designated as 4 and 5, respectively, and the ones beginning at 4000H in conventional memory are numbered from 6 upward. When mapping an expanded memory page, a program specifies its location in the system address space by supplying the frame number.

For compatibility, version 4.0 accepts the same frame numbering, but function 17 also allows specifying the location of the frame by its physical segment address. When calling this function to map a page into the lowest frame in conventional memory, a program could pass either 4000H or 6 as the frame argument. A subfunction code specifies the argument type.

Function 25 constructs an array of all page-frame addresses in the system; it is similar, but not identical, to EEMS function 41. Entries in the array returned by function 25 are ordered by physical address and consist of two words: the segment address and the frame number. Function 41 returns an array of bytes containing the high-order six bits of each frame's address; entries are ordered by frame number, with the address for frame *N* in the *Nth* byte of the array. The new method is more convenient for physical addressing of page frames, the old one for addressing them by number.

TABLE 2: ***EMM Functions Added in EMS 4.0***

FUNCTION	DESCRIPTION
16	Save/Restore partial page map.
17	Map/Unmap multiple pages into page frames.
18	Change number of pages allocated to a handle.
19	Get/Set volatility attribute of a handle.
20	Get/Set handle name.
21	Get handle number for handle name.
22	Alter page map and jump to a far address.
23	Alter page map, call a far address, then restore page map.
24	Move/Exchange contents of memory block.
25	Get array of page-frame addresses.
26	Get expanded memory hardware information.
27	Allocate pages in sizes other than 16KB blocks.
28	Control alternate mapping registers.
29	Prepare expanded memory hardware for warm reboot.
30	Disable/Enable system-level EMM functions.

The new EMS 4.0 functions that support the hardware features defined earlier by EEMS are inoperative on existing EMS boards. All EMS boards, however, can benefit from the functions that add software support for multitasking control programs.

Raw page sizes. The division of expanded memory into pages of 16KB is not convenient when the hardware implements a paging scheme with a different page size. For example, the 386 processor performs paging in increments of 4KB. In version 4.0, an EMM can be written to allocate expanded memory in units that are convenient to the hardware, provided that the size of such a unit, called a *raw page*, is a submultiple of 16KB. Function 27 creates a raw handle and allocates to it a specified number of raw pages. All subsequent page operations for this handle, such as mapping pages or changing the allocation, must be specified in raw pages.

Multiple register sets. EEMS memory boards are constructed with two sets of page-mapping registers, so that a multitasking operating environment can switch rapidly between mapping contexts for two applications. Version 4.0 extends this to allow memory boards to provide any number of register sets. For boards with a single set of registers, function 28 simulates multiple sets by storing inactive mapping contexts in memory provided by the calling program. The effect of the simulation is the same as if the caller saved and restored contexts with function 15, but the advantage is that the context-switching method appropriate to the capabilities of the hardware resides in the EMM; the calling program need not incorporate logic for both switching register sets and saving contexts.

An even more significant extension is the capability to dedicate specific register sets for use by the direct memory access (DMA) controller for high-speed transfers to and from expanded memory. A program can allocate a set of mapping registers for use by DMA, initiate a DMA request to or from the memory mapped by that set, and then switch the context by means of function 15 or 28. The DMA process continues to use the memory mapped by the DMA set of registers, while the CPU can access a different set of pages mapped by a different register set.

Version 4.0 does not require that EMS boards provide hardware for multiple register sets for either CPU or DMA access; it merely specifies that the EMM can take advantage of this capability if available. In contrast, an EEMS memory board must have exactly two sets of mapping registers for the CPU to use; a version 4.0 EMM also can use these registers. No boards currently on the market support any DMA registers or more than two sets of CPU registers.

Function 26 provides information about the EMS hardware: the raw page size, the number of alternative register sets (after the first), and the number of DMA register sets.

Manipulating register sets should be done only by the operating system or task-switching executive. The system program can use function 30 to disable or enable functions 26 (get EMS hardware information), 28 (manipulate alternate register sets), and 30. Once disabled, these functions return error codes to all callers, even the system.

When function 30 is disabled, how does the system reenable it? Immedi-

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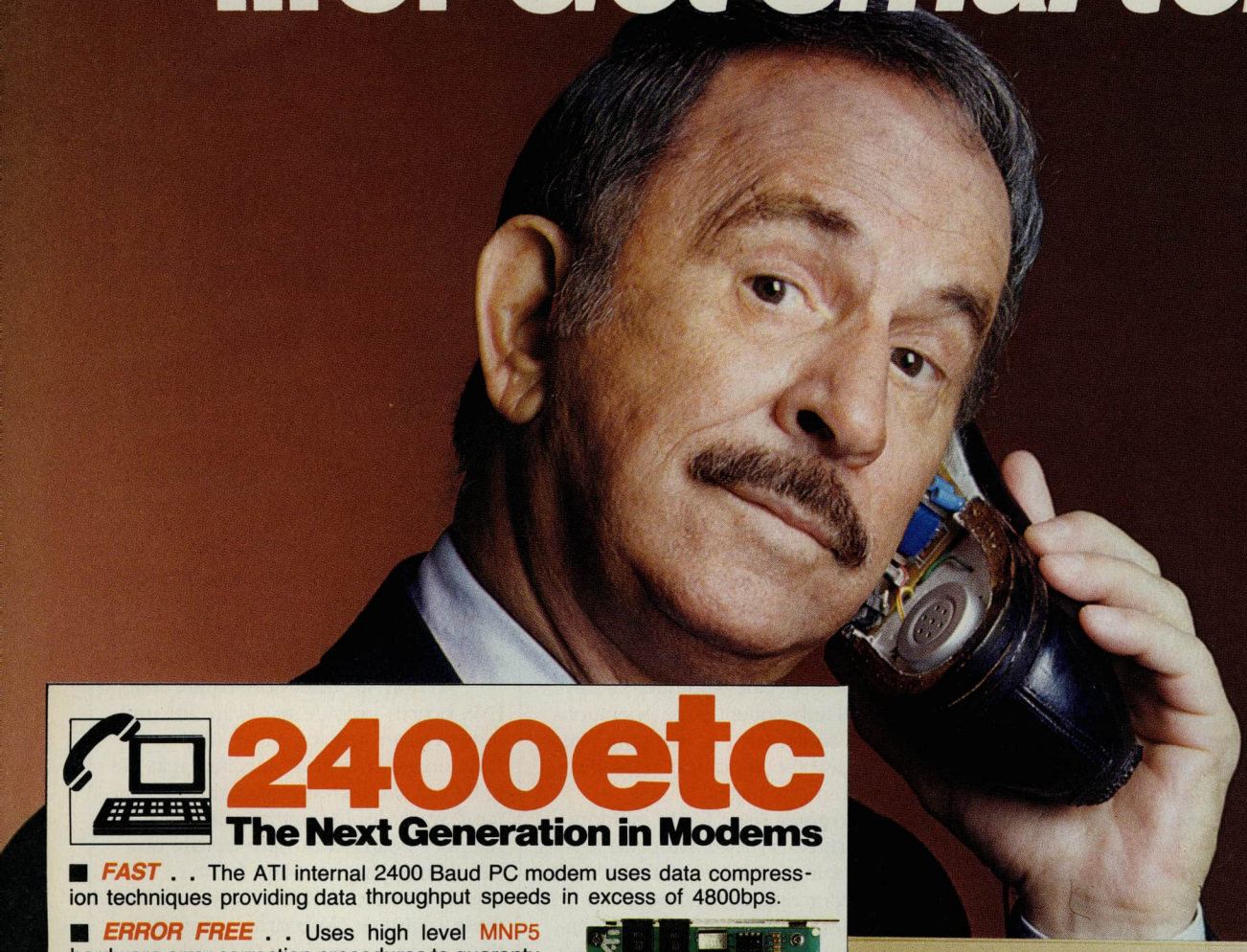

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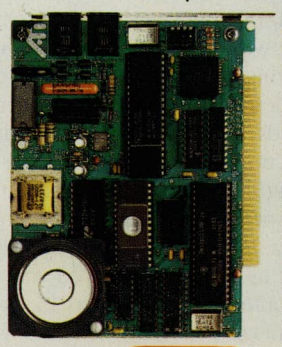

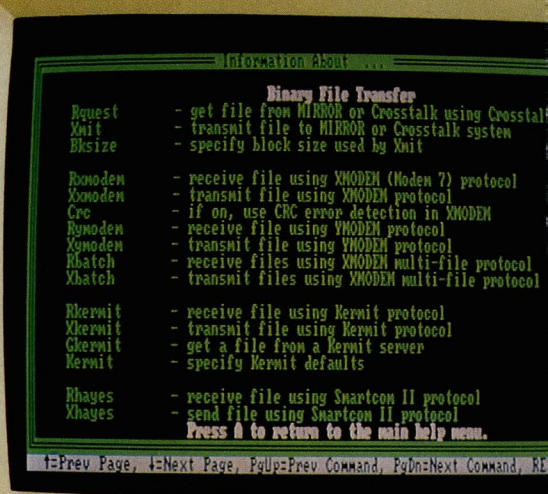

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ately after installation of the EMM, the system-level functions are enabled by default. The first call to function 30 returns a random 32-bit access key that must be used on all subsequent calls to the function. Thereafter, function 30 can be called, even when disabled, if the key value is given as a parameter in the call. During its installation, the operating environment is presumably the first program to call function 30, so it is the only one to obtain the key.

Control and data transfers. In a multitasking environment, transfers of control to various programs often involve changes in the mapping context. For example, when a task-switching executive activates a dormant program, it must map that program's expanded memory into the system address space before branching to the program's code. This capability is also useful within an application—for example, when a small TSR kernel in conventional memory maps in and branches to its main code in expanded memory.

Function 22 automates establishing a new mapping context and jumping to a far address. Logically, it is equivalent to a call to function 27 (map multiple pages), followed by a far jump to an absolute address. The target can be in expanded or conventional memory. As is the case for function 27, the page frames in the new mapping context can be specified either as frame numbers or absolute segment addresses.

Function 23 performs the equivalent of a far call. It saves the current mapping context in a caller-supplied memory area, establishes a new context (in the same way as function 27), and transfers control to a far address. When a far return is subsequently executed, the EMM restores the saved context before returning control to the instruction following the call to function 23.

Function 24 provides a means of efficiently moving or exchanging large blocks of data between expanded and conventional memory or between two areas of expanded memory. In the latter case, the two blocks might belong to different handles. Blocks need not be aligned on page or segment boundaries. Overlapping source and destination blocks are handled properly for a move but generate an error for an exchange. This function is useful for moving data between blocks that span several pages, especially when the blocks are larger than any available contiguous window. The calling program need not save and restore the context before calling this function, nor provide a save area for the EMM to use.

Nonvolatile handles. An EMS board can provide hardware features to maintain the contents of expanded memory through a warm boot created by a keyboard reset or other event that can be trapped by software. Function 19 applies the *nonvolatile* attribute to a handle; only the data in pages belonging to nonvolatile handles survive a reboot.

Function 29 called just prior to reboot saves data on the EMS board; its specific action is not specified in EMS documentation because that depends on hardware implementation. Typically, function 29 writes information into EMS hardware registers that notifies the EMM driver (when it subsequently reinstalls itself) which data are nonvolatile and therefore are not to be erased during initialization.

Calling function 29 requires the detection of an imminent reboot, and this is not possible in all cases. A replacement interrupt 9 handler can detect a keyboard reset, but two other events can cause a reboot. One is to execute a direct jump to the boot code in ROM, the other is to toggle the pro-

TABLE 3: ***Support for EEMS Functions***

EEMS 3.2 FUNCTION, SUBFUNCTION	CLOSEST EMS 4.0 EQUIVALENT	DESCRIPTION
33	None	Get addresses of page frames outside of conventional memory.
34	None	Generic accelerator card support.
41	25	Get addresses of all page frames in system.
42	5	Map a page into any frame.
43, 0	16, 0	Save partial page map.
43, 1	16, 1	Restore partial page map.
43, 2	None	Save and restore partial page map.
43, 3	16, 2	Get size of save array.
43, 4, 5	28, 1, 2	Switch to another set of map registers.
43, 6	18	Deallocate pages mapped at initialization to frames in conventional memory.

Version 4.0 of EEMS incorporates most of the enhancements introduced by EEMS version 3.2. Although these services are functionally similar in both versions, they require different calling sequences and produce output in a different format.

cessor's reset pin with a hardware reset button (this generates a hardware branch to the boot location). Software cannot detect either event, and the boot code, being in ROM, cannot be hooked by overwriting its entry point. Therefore, a keyboard reset is the only event that can be expected to preserve nonvolatile data.

Efficiency improvements. Functions 16, 17, and 18 do not add major functionality to the EMM, but they provide services in a more efficient or convenient manner than is available by other means. Function 16 (save partial mapping context) is similar to 15 (save, restore, or swap EMM status to/from an external buffer), but it saves or restores only a specified subset of page-mapping registers, thereby consuming less conventional memory by storing only the essential portion of any context-switching information.

Function 17 (besides supporting physical frame addressing) can map more than one page at a time. It accepts an array of page numbers and page frames, so pages to be mapped need not be consecutive, nor page frames contiguous. As a result, a single call to function 17 can replace many calls to function 5.

Function 18 allows changing the number of pages allocated to a given handle. In previous versions, the page count per handle is fixed; if a process needs more pages, it has to obtain another handle. Handles are a limited resource (the absolute upper limit is 256 and the EMM typically defaults to a lower limit at installation), and obtaining and releasing them involves some overhead.

STILL AN INDIVIDUAL

Although version 4.0 brings to EMS the major features of EEMS and adds others, it is not a proper superset of EEMS because it does not support all EEMS features (see table 3). The missing ones do not diminish the utility of EMS 4.0; they merely indicate different design philosophies.

One of the primary design goals of EEMS is to maintain compatibility with EMS. Therefore, most extensions are implemented by new EMM function calls, not extensions to EMS-defined functions. The standard set of EMM function calls, shared with EMS (see table 1), handles page frames only above conventional memory. The difference is that EEMS can handle more than four page frames in this area.

All other enhancements are supported by a set of functions with distinct numbers. EEMS deals with two sets of page frames: one containing only those above conventional memory, the other containing all frames in the address space. Each set has a distinct numbering scheme and separate mapping function.

The advantage of this EEMS approach is greater integrity. The upper page frames are for use by applications, the lower by the operating system. Each program has its own set of functions, and although an application is not prevented from accessing any frame, mapping lower memory requires the conscious effort of a different function call. By contrast, version 4.0 considers all the page frames as one set—it has no EMM service equivalent to function 33, which returns an array of addresses of only those page frames

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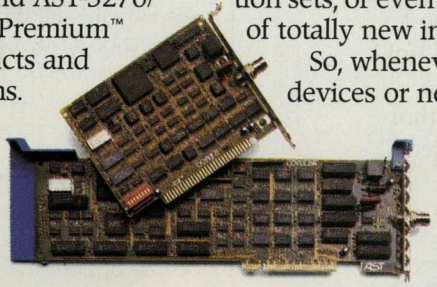

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above conventional memory. Both applications and the system use the same functions (5 and 27) to map upper and lower memory, so an errant program can inadvertently map out a page in conventional memory by supplying a wrong frame number or address.

Although EEMS provides slightly better security than EMS 4.0, all versions of EMS are generally weak in memory protection. This reflects the original purpose of EMS: expanding data storage memory in a single-tasking environment. A program is in no way prevented from accessing expanded memory pages belonging to another program. Access requires only a numeric handle, and any program can obtain a list of active handles. Handle numbers are assigned consecutively from a small range (0 through 255), so a failing program can inadvertently specify a handle belonging to another process. This is especially likely in the case of handle zero, which is owned by the operating system and consists of all pages initially mapped into the back-filled area of conventional memory.

Another feature introduced by EEMS that is not fully incorporated into EMS 4.0 is the interface with caching accelerator boards. Changing the contents of memory by remapping can invalidate the contents of an on-board cache that holds data from the mapped-out location. The caching hardware is unaware of the change because mapping changes the contents of memory by writing to an I/O port, not by direct access to affected locations.

EEMS provides function 34 for communicating with the accelerator board. Support for this function must be provided in both hardware and software by the manufacturer of the accelerator; details are available on request from AST Research. EMS 4.0 does not describe this hardware function, but in the section on EMM implementation guidelines, the documentation states, "the support of function 34, as defined by AST, is encouraged."

JUST THE BEGINNING

Version 4.0 EMM drivers are now available for existing expanded memory boards of both the EMS and EEMS variety. Owners should contact the manufacturers of their boards for information on obtaining updated software.

For this article, four different EMM drivers were tested on five memory boards: Intel's for the Above Board AT, AST's for the RAMpage and RAMpage AT, Quarterdeck's for the IBM 80236 Memory Expansion board for PS/2

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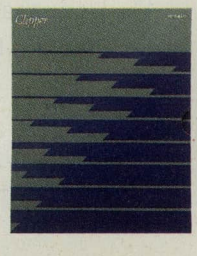

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Models 50 and 60, and Intel's for the Above Board 2 for Models 50 and 60. The boards for the PC and AT were older models originally supplied with version 3.2 drivers. Version 4.0 drivers for the PC and AT ran only with the boards from their manufacturers. The Intel PS/2 driver refused to install itself without an Above Board 2 but could combine memory from the Above Board 2 with memory from an IBM expansion board. The Quarterdeck PS/2 driver worked with either Intel or IBM memory boards or a combination.

All drivers worked well in the tests. The AST and Quarterdeck software supports functions of both the new version 4.0 and older EEMS version 3.2, giving them full functionality with current versions of both DESQview and Windows. Intel's drivers implement only 4.0, so they do not fully support DESQview (which predates version 4.0 and thus issues only EEMS 3.2 calls). The Above Board 2 (but not Above Board models for the PC and AT) provides equivalent context-switching support for Windows 2.03.

Even with an old board, running a new driver provides many innovations, such as named handles, physical addressing, transfer control, and other improvements in efficiency of managing paged memory. These improvements will lie dormant until programs are written to take advantage of them. However, these software features are not 4.0's primary advantages.

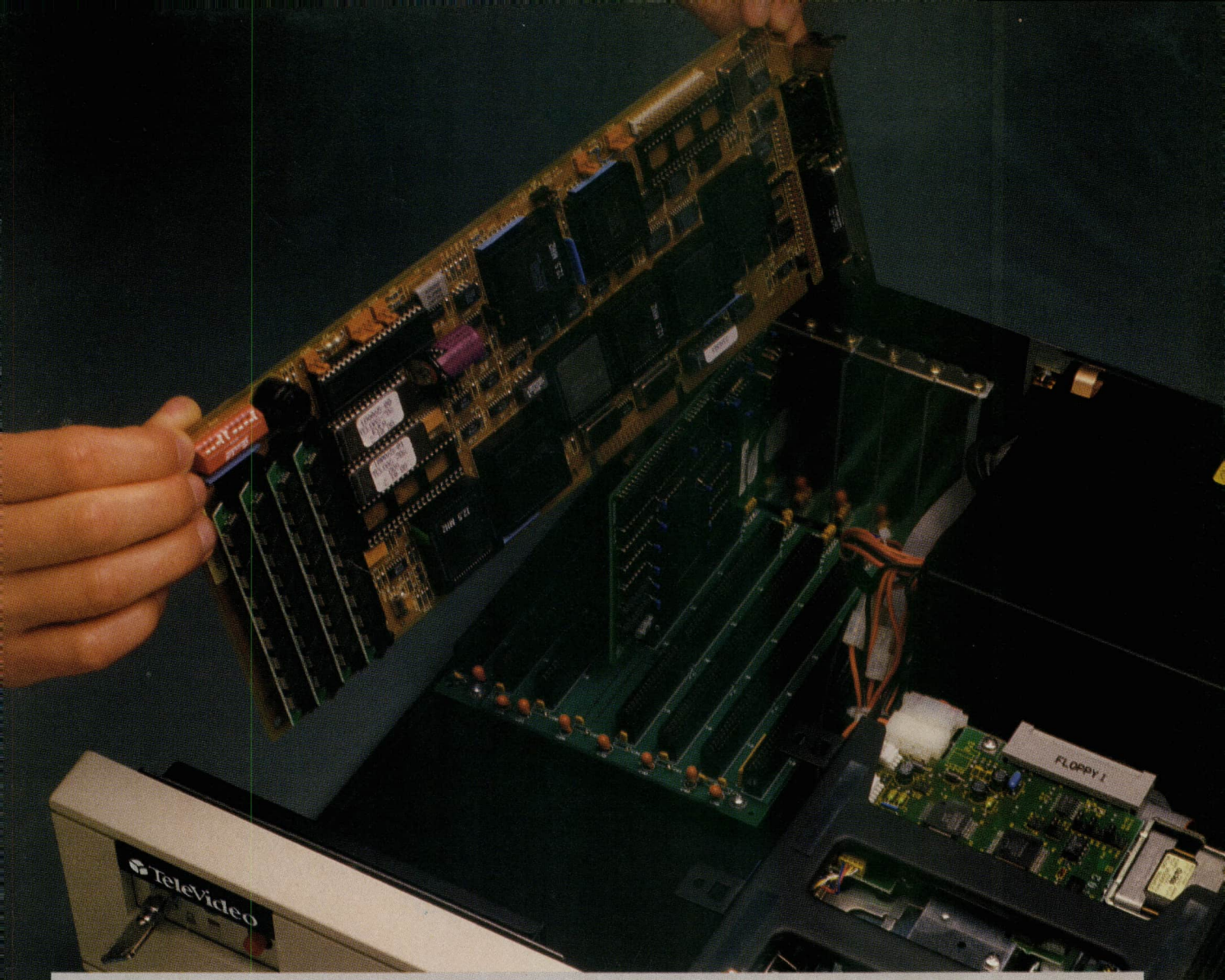
Achieving a spectacular improvement in the performance of DESQview or Windows requires hardware support for mapping conventional memory and multiple register sets; these are not implemented on current EMS boards. Version 4.0 does very little for existing EMS boards because they cannot use the most significant new features. For the most part, the effect of installing a new EMM driver on an old board is that the error response to version 4.0 functions is "not implemented" instead of the old driver's "invalid function."

On the other hand, EEMS boards already have the hardware to support the EMS 4.0 mapping protocol. The only two innovations not already supported by EEMS hardware are more than two sets of general mapping registers and mapping registers that are dedicated to DMA transfers. The EEMS 3.2 and EMS 4.0 drivers for EEMS boards provide the same functionality with one immediate exception: with the older driver, Windows 2.0*x* cannot take advantage of the multitasking hardware features of the board.

For those who already own expanded memory boards, EMS 4.0 does little—EMS boards cannot use the major new features, and EEMS boards already have them. Still, the creation of a single unified standard that incorporates and adds to the features of the better one is undoubtedly a step in the right direction. This unification is just in time to provide a consistent memory standard for IBM's PS/2 series—the memory-mapping capability of the Micro Channel memory expansion board no doubt played heavily in the decision to create 4.0.

The capabilities offered by the newly unified EMS to task-switching environments breathes new life into DOS-based applications, providing the opportunity to design characteristics not otherwise available in this operating system: large memory spaces for both programs and data, rapid switching between co-resident programs, and concurrent execution.

Ted Mirecki is a technical editor for PC Tech Journal, *specializing in systems software.*



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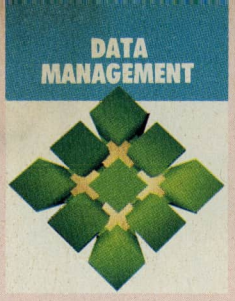


The Evolution of R:BASE

The latest installment of R:BASE carries on Microrim's tradition of flexibility and control for the applications developer.

VICTOR E. WRIGHT

When developing its latest relational data manager, Microrim did not lose sight of what made R:BASE System V popular among programmers—a robust programming language coupled with a flexible generator package that allows developers to design complex applications while writing a minimum amount of source code. R:BASE fans will be happy to learn that none of this has changed.

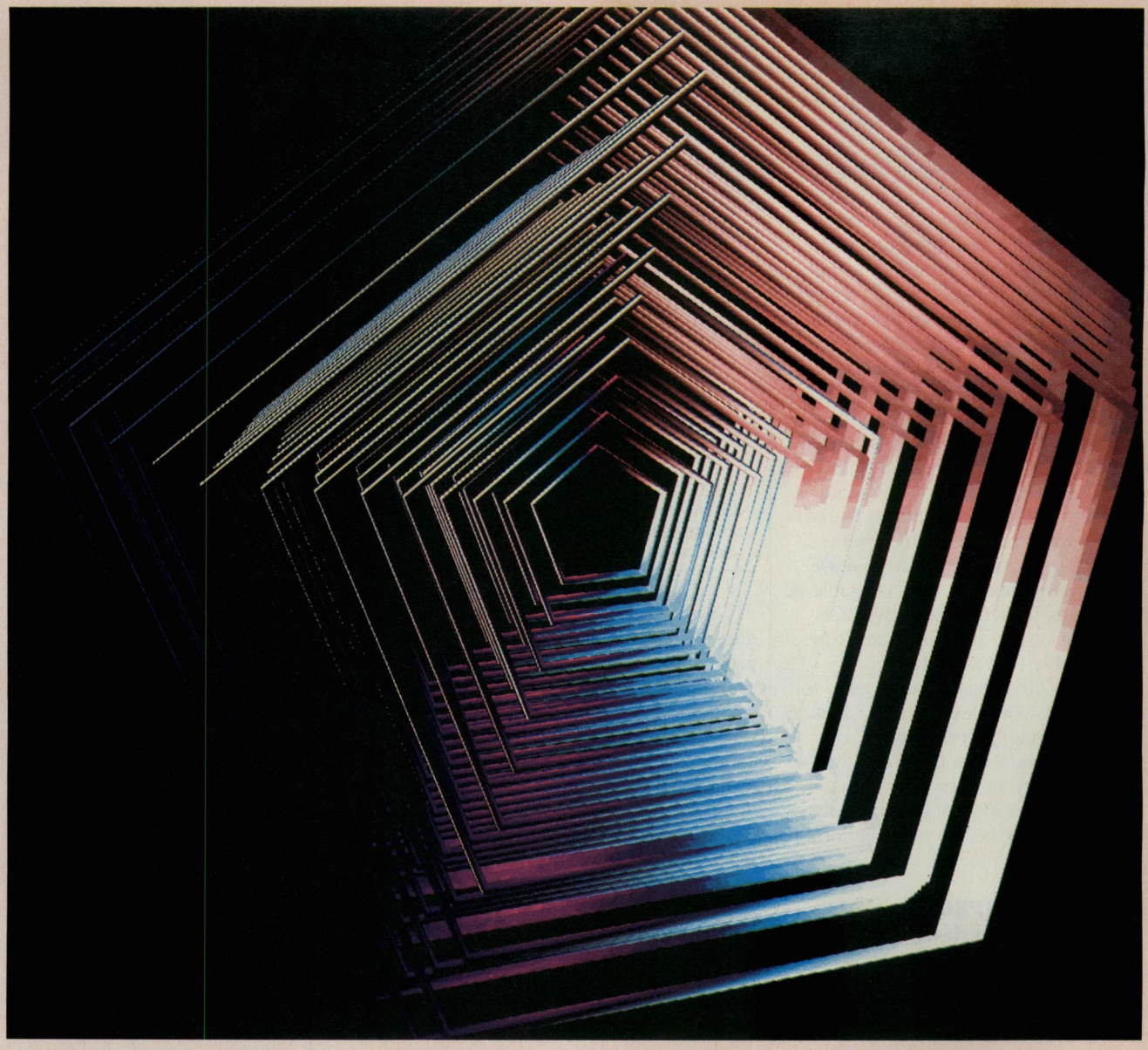
The strengths of System V have been enhanced in R:BASE for DOS with a streamlined prompt-by-example (PBE) user interface, an improved applications generator package, a speedier runtime environment, and some features of the advanced structured query language (SQL) programming language. For an overview to the product, see the sidebar on page 89.

In some cases, these commands provide new capabilities. In others, an existing R:BASE command, such as SELECT, has been extended to include a more SQL-like syntax. For a look at the R:BASE implementation of SQL, see the sidebar, "Integrating SQL Features into R:BASE," on page 98. The new release also is available for OS/2 (see sidebar, "A Closer Look at R:BASE for OS/2," p. 100); a description of Microrim's port of R:BASE from DOS to OS/2 appeared in "Porting to OS/2" (Steven Armbrust, November 1987, p. 140).

R:BASE for DOS is targeted at a wide market, ranging from novice users to professional applications developers. Its programming language is tailor-made for the programmer-developer who wants absolute control for intricate applications, while its modular applications generator should appeal to the more pragmatic developer-user who wants a quick solution and is willing to forego complete control.

R:BASE for DOS is the successor to R:BASE System V, which followed R:BASE 5000 (reviewed in "A Data Manager with Kernel Code Generation," Steven Armbrust and Ted Forgeron, September 1985, p. 82). R:BASE System V represented a major and noticeable overhaul of R:BASE 5000 by providing greater database and file capacities and an enhanced user interface.

For the user, R:BASE for DOS (and for OS/2) represents evolution, not revolution. System V will not be overwhelmed by the new features, even though R:BASE for DOS is a totally new product, completely rewritten in C (previous versions were written in FORTRAN). Microrim says that selected operations—VIEW, SORT, and CROSSTAB—are as much as 20 times faster due to the new implementation in C and the use of heuristic query optimization techniques.



COMPUTER GRAPHIC • DOV JACOBSON

While the new version extends many of the limits of System V and R:BASE 5000, it is compatible with its predecessors as well as with other Microrim R:BASE products, such as DB Graphics, for including presentation graphics (for a review of DB Graphics see Product Watch, this issue, p. 130); CLOUT, for writing natural language queries; Extended Report Writer, for producing complex reports; Program Interface, for interfacing R:BASE with Microsoft C, Pascal, and FORTRAN applications; and Runtime, for publishing applications.

As is the case in the previous versions, the basic application development facility is still the R:BASE command language, a conventional, procedural language with the features developers have come to expect in a data manager, including all the essential characteristics of a general-purpose programming language as well as the R:BASE-specific commands for defining and manipulating the database.

Although the command language is the heart of R:BASE application development, the developer's primary tools are the product's four application generator modules: Definition EXPRESS (for defining or modifying a database), Application EXPRESS (for generating applications), and Forms EXPRESS and Reports EXPRESS (for designing forms and reports, respectively). These menu-driven modules lead the developer or serious user through the process of building an application. They can be selected from the PBE menu or from the R:BASE command prompt.

The system also includes the following utilities: File Gateway (for converting file formats), 3Labels (for creating labels), RBEDIT (for editing text), and CodeLock and Developer's EXPRESS (for increasing the execution speed of applications). The R:BASE system, including the command language, the EXPRESS modules, and the utilities, forms a complete development environment.

DEALING WITH DATA

Like many data managers, R:BASE for DOS uses the relational model, which stores data in tables. Rows in one table can be linked to the rows in another by common columns, without using pointers. Regardless of the number of tables, columns, and keys, R:BASE stores each database in three files: data dictionary, data table, and key. The file names consist of seven user-assigned characters, an R:BASE-assigned number (1, 2, or 3), and the extension .RBF.

A data-dictionary file contains the database schema (structure definition) and disk and directory of the data tables; this file is created automatically

by R:BASE as the developer defines the database. The developer can examine the contents of the data dictionary by querying the dictionary using the LIST command from the R:BASE prompt, or by selecting Query and then List from the PBE menu. (Unfortunately, the List menu does not provide the List All command, so one of the other List commands must be selected and edited.) The database structure information in this file consists of the names, key columns, and number of records in each table, as well as the names, lengths, and data types of each column.

An R:BASE data-table file is comparable to a file in systems such as Ashton-Tate's dBASE; it contains rows and columns that correspond to the records and fields of a dBASE record. An R:BASE database can contain 80 data tables or 800 columns, whichever comes first. A row is limited to 4,096 bytes. The number of rows per table or database is limited only by the DOS limitation on file size. Eight data types are available (see table 1).

A key file contains the indexes for keyed fields. The developer can look at data in this file by listing tables, columns, or keys. R:BASE uses both the data-dictionary and key files constantly during manipulation of the database; these files must be on the same directory as the data file.

TAKING THE EXPRESS

The developer can choose between two user interfaces: the default, a point-and-shoot PBE menu; or the command mode (indicated by an R> prompt), where the user enters R:BASE commands. Selections from the PBE main menu (see photo 1), can be highlighted by pressing the space bar repeatedly, using the cursor keys, or typing the number or letter of the selection. Subsequent PBE menus provide a command-explanation window and command line for selection (see photo 2). The window explains each selection, eliminating any guesswork about what a command does.

When the developer chooses a selection from a PBE menu, R:BASE builds a command by prompting for the necessary elements. For example, choosing Modify Data and then Edit enables the developer to select tabular or form display, sort fields, sort order, and finally, conditional statements. Once constructed, a command can be executed, edited, or aborted. To bypass the PBE hierarchy and enter the command mode, the developer simply has to press Esc at the PBE main menu.

TABLE 1: *Data Types in R:BASE*

TYPE	DESCRIPTION
DATE	30 characters depending upon format.
TIME	20 characters depending upon format.
CURRENCY	23-digit money amount with range of ± $99,999,999,999,999.99.
REAL	Real numbers with 6 digits of precision, with range of $\pm 9*10^{\pm 37}$, stored in binary form. Numbers with 6 or fewer significant digits displayed in decimal form, numbers with more than 6 significant digits displayed in scientific notation.
DOUBLE	Real numbers with 15 digits of precision, with range of $\pm 10^{\pm 307}$, stored in binary form. Numbers with 15 or fewer significant digits displayed in decimal form, numbers with more than 15 significant digits displayed in scientific notation.
INTEGER	Integers with range of ±999,999,999.
TEXT	Alphanumeric data up to 1,500 characters per field.
NOTE	Variable length text column up to 4,092 characters including overhead—net length 4,050 characters.

R:BASE supports all commonly required data types, including text, integer, root, double, currency, and the note type for entering variable-length text fields. The user can define the format and sequence of both the date and time type.

Complete applications can be produced either by entering R:BASE commands in the command mode or by using the EXPRESS modules, which also use the PBE interface and are sophisticated enough to develop moderately complex applications. These modules lead the application developer through the development process with a series of prompts, menus, and forms.

Definition EXPRESS. Although the developer does not need to use Definition EXPRESS to define or modify a database, little is gained by defining a database in the command mode. The Definition EXPRESS module efficiently leads the developer through the process of creating tables, views, and data verification rules—even the most complex database can be defined without having to write a single line of code.

However, a few operations, such as dropping views and tables and using the SQL Grant-Revoke security commands, are missing from Definition EXPRESS. To invoke these operations, the developer must use either the PBE menu or the DEFINE mode (which is signified by a D> prompt) in the command language.

The developer can restructure a database at any time using either the Definition EXPRESS module or the R:BASE commands REDEFINE, ALTER TABLE, DROP, EXPAND, REMOVE, INTERSECT, JOIN, PROJECT, UNION, and SUBTRACT. When redefining existing columns, R:BASE creates a temporary table to effect the modifications, so space must be available for an additional table and column; if the database has reached the limits of 80 tables or 800 columns, restructuring is not possible. For the most part, however, the database can be restructured with single commands. Special conversion utilities are not necessary.

R:BASE automatically verifies data entries according to field type and length. The developer can also create a maximum of 20 data-entry rules per table that can ensure, for example, that all values fall within a specified range, exist in a table, or are equal to a specified value.

A rule can contain 10 conditions, each consisting of a column name, a comparison operator (EQ, NE, GT, GE, LT, LE, CONTAINS, EXISTS, FAILS, EQA, NEA, GTA, GEA, LTA, LEA), and a value or second column. Conditions are connected by the logical operators AND, OR, AND NOT, and OR NOT to form rules. Rules also can display error messages if the data do not pass muster.

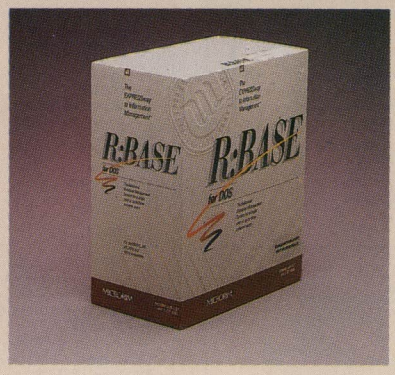
Using Definition EXPRESS, the developer can add or modify data-entry rules at any time, not just when the database is defined. Rules also can be defined in an application or from the Define mode prompt with the RULES statement.

Application EXPRESS. The heart of the application modules, Application EXPRESS is designed to help developers produce menu-based applications, up to three levels deep, that have the same look and feel as R:BASE. Many tasks can be incorporated into an application simply by selecting actions from menus and assigning them to application menu selections. The PBE menu source code, included in the system, can be customized for applications.

R:BASE FOR DOS OVERVIEW

R:BASE for DOS 2.1
Microrim Inc.
3925 – 159th Avenue, NE
P.O. Box 97022
Redmond, WA 98073-9904
206/885-2000
CIRCLE 328 ON READER SERVICE CARD

Product description. R:BASE for DOS is a relational database management system, which includes a procedural programming language, application generators, and utilities.
IBM PC environment. IBM PC, PC/XT, PC/AT, and PS/2; DOS 2.0 or later for single-user applications; DOS 3.1 or later for local area networks; 512KB of RAM for single-user installations; 640KB of RAM for local area network installations; color or monochrome monitor and display adapter; one 10MB hard disk and one diskette drive, or two 1.44MB 3.5-inch diskette drives; dedicated file server required for local area networks.
Other environments. PC-, XT-, and AT-compatible machines.
Network support.
Hardware: IBM PC Network, IBM Token-Ring, 3Com EtherLink, EtherLink Plus, Ungermann-Bass.
Software: IBM PC Network program, Novell Advanced NetWare, IBM PC LAN program, 3Com 3+.
Copy protection. None.
Documentation. Manuals range from step-by-step tutorials for new users and developers to brief summaries for experienced users and developers. They include *Learning Guide, User's Manual, Building Applications/Command, Dictionary, Installation and Startup Guide, Supplement, Command Summary, Worksheets, Error Messages.*
User interface. Screen menus with prompts, screen forms and tables, and command line are available to both developer and end user.



Help facilities. On-line context-sensitive help screens are available to the developer and can be incorporated into applications.
File capacities. Three files constitute a database: dictionary, data, and index. A database can contain 80 tables and 800 columns or fields. A table can contain an unlimited number of rows or records, and each row can be 4,096 bytes in length; text fields are limited to 1,500 bytes. The entire database is limited by operating system and hard-disk capacity.
Field types/capacities. DATE, TIME, CURRENCY (amounts with range of ±$99,999,999,999,999.99), REAL, (real numbers with 6-digit precision), DOUBLE (real numbers with 15-digit precision), INTEGER (integers with range of ±999,999,999), TEXT (as many as 1,500 characters per field), NOTE (variable length text with a 4,092-character limit including overhead—net length 4,050 characters).
Data entry. Data manager checks data type automatically. Developer can define data-entry rules to check ranges, perform table look-ups, and compare data to logical expressions.
Application development facilities. Procedural programming language includes all of the R:BASE commands; GOTO <*label*>, If . . . Else . . . Endif, Set Pointer, While . . . Break . . . Endwhile flow control statements; SET (environment) statements; math and string functions; typed global and error variables; parameter passing to command and procedure files; multiuser environment control. Definition EXPRESS, Application EXPRESS, Forms EXPRESS, and Reports EXPRESS constitute the application generator. Companion products include DB Graphics, CLOUT, Extended Report Writer, Program Interface (for Microsoft C, Pascal, and FORTRAN), and Runtime packages.
Security. Passwords can be assigned to databases, tables, and views.
Querying and sorting. Virtually all R:BASE commands can be used to query the database. Ad hoc queries require a working knowledge of the command language and relational operators when entered at the command prompt. Prompt-by-example Mode guides the user through queries or other R:BASE commands.
Reporting. Reports up to 255 characters wide, with report and page headers and footers, up to 10 breakpoints with optional headers and form feeds, and automatic pagination. Reports EXPRESS provided for report generation.
Utilities. Screen editor; EXPRESS application generator modules.
Data compatibility. Import/export of ASCII fixed-length records, ASCII-delimited records, Lotus 1-2-3 worksheet files, Symphony worksheet files, .DIF files (VisiCalc, TK!Solver), Multiplan SYLK files; import of dBASE II, dBASE III .dbf files and pfs:FILE. With Lotus's The Application Connection (T-A-C), exchange files with mainframe systems: Ramis II, FOCUS, SAS, SQL/DS, NOMAD2, IC/1, ADRS II, APLDI, CMS, QSAM.
Price. $700
Support. Telephone support for 30 days free and through Software Maintenance Plan thereafter.

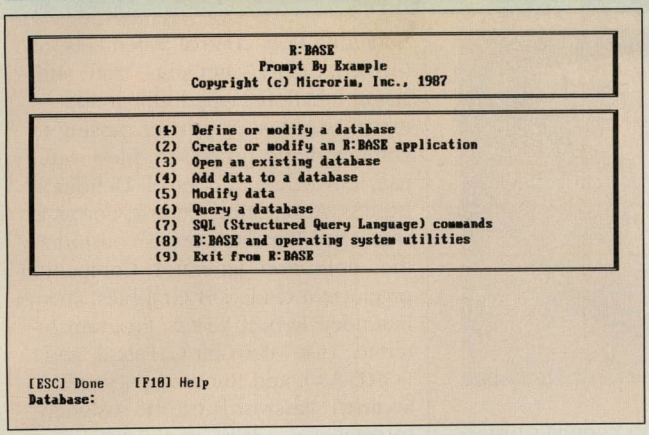
—Victor E. Wright

With Application EXPRESS, the developer easily can build multilevel menus. Horizontal menus can have as many as 12 options of 10 characters each. (Similar menus built outside of the module can have 81 eight-character options.) Vertical menus are numbered lists of as many as nine options, each with a maximum length of 60 characters. After menu definition is complete, the module prompts the developer to type a custom help screen with a maximum of 750 lines of text; the user can display this screen by pressing the F10 key. It is unfortunate that Microrim selected F10 because the F1 key is the proposed standard for help.

Custom help screens can be linked to screen menus, which are displayed by pressing F10. As the developer defines each menu, the module asks if a help screen is desired; if the answer is yes, it invokes RBEDIT to create the help screen. Help text is paged automatically if it exceeds 20 lines. If the F10 key is pressed while a data-entry form is displayed, it displays a general help screen that describes the commands available from the ENTER command menu.

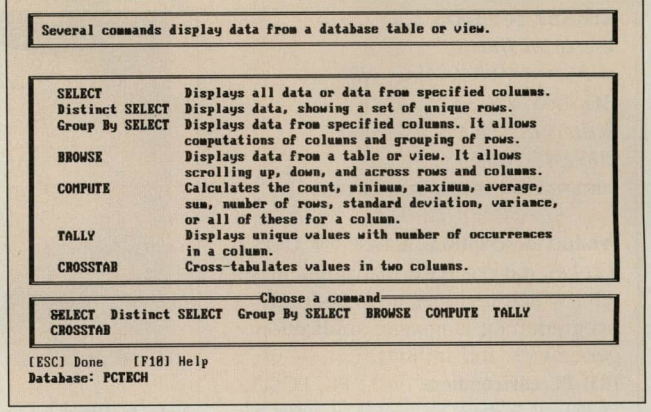
Existing command files also can be assigned to a menu selection from within Application EXPRESS. The *macro* action prompts for an external file and inserts it as a command block. The term macro is appropriate because the

PHOTO 1: *R:BASE PBE Menu*



The point-and-shoot interface of R:BASE's PBE menu is operated with the space bar and Enter key, arrow keys and Enter key, number keys and Enter key, or the mouse.

PHOTO 2: *Sample PBE Screen*



A typical PBE screen displays a list of commands that can be executed, a summary of the capabilities of a group of commands, and a detailed message about each command.

external file is copied into the application file—the application does not "call" the external file.

A *template* file can be assigned to a menu selection. A template is a generic program that Application EXPRESS uses to generate a specific command block. As many as nine placeholders (such as table names, column names, and variables) can be defined in the template file. As Application EXPRESS reads in the template file, it prompts for the actual values, which it then substitutes for the placeholder. Thus, a developer might create a generic order-entry command file, in the form of a template file, which then can be used to generate order-entry command blocks for specific businesses.

The point-and-shoot programming method is best suited to linear tasks—for example, inquiring about the credit status of a customer, entering data on an order-entry form, printing an order picking report, and printing the invoice and packing list. Such sequences are constructed by selecting a series of supported commands from a menu and answering the prompts.

For more complex tasks, such as breaking an assembly down into component parts for production scheduling in an material-resources planning (MRP) system, the developer must resort to programming with the text editor. Application EXPRESS does not provide a method for specifying operations that require program constructs such as If . . . Then or While . . . Endwhile statements. However, the module does provide alternatives.

One of the actions that can be assigned to a menu selection is Custom. Making that selection for a menu action merely invokes RBEDIT, so that a series of commands can be entered into a command block that is inserted into the application file.

Forms EXPRESS. Once an application's structure is defined, data-entry forms can be customized to perform editing functions and table look-up using Forms EXPRESS. The developer creates forms by typing labels and drawing borders on the screen, filling in form characteristic tables, and locating fields (see photo 3).

As with Application EXPRESS, the developer can create data-entry forms without having to write a single line of code. Text is typed in, and fields are located with the function keys.

Forms EXPRESS accommodates the creation of forms with multiline regions that display several rows (records) from a database. It allows the creation of forms as big as five screens in length; each screen can contain as many as 22 lines. A form also can display and update records from a maximum of five different database tables simultaneously.

Reports EXPRESS. With Reports EXPRESS, the developer can draw custom reports on the screen with detail lines and headers and footers for reports, pages, and breakpoints. Although a report is based on a single table or view, called the driving table or view, data can be gathered from other tables as long as each has a column in common with the driving table or view. This relational linkage allows the construction of multiline reports that display data using one-to-many relations—the driving table supplies a value on the one side, and R:BASE finds all the rows on the many side.

Printer control in Reports EXPRESS is accomplished through the use of report variables. A printer-control variable is defined as the decimal values of the required control characters and/or escape sequences that are enclosed in angled brackets (< >) and located in a report field. When the report is printed, the contents of the field are sent to the printer.

Because the custom forms and reports generated with Forms EXPRESS and Reports EXPRESS are easily incorporated into applications generated with Application EXPRESS, most developers will forego the more primitive default forms and reports produced by Application EXPRESS. The default form is simply a screen containing a line for each column (field), with the column name as a label. Default reports are of two types—a columnar report containing a title, column headings, and data in columns, and a row report in which each row appears with each column in a separate line, with rows separated by blank lines. When the user specifies a form or report, Application EXPRESS prompts the user to choose either the default or custom form or report.

Once the application is complete, Application EXPRESS invokes the RCOMP compiler to produce an executable program. Application EXPRESS produces an ASCII version of the file in addition to the compiled version of the program, so that the program can be customized if desired. Just as in earlier R:BASE products, the ASCII file for an application developed under Application EXPRESS can be edited to add or change features, but once edited outside of the module, the user cannot change it again using the module.

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MEDIA INTELLIGENCE

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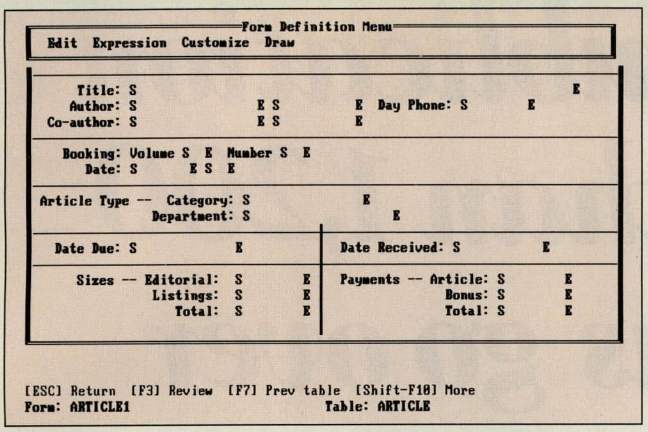
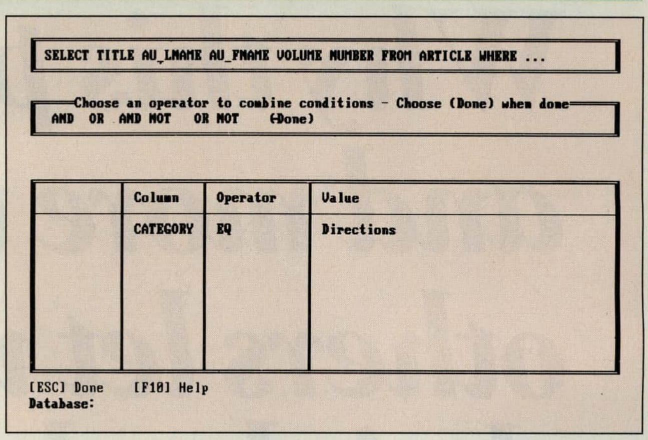
PHOTO 3: ***Form Definition***



The user types in text and draws boxes to create forms with the Forms EXPRESS module. Each form can display and update information from five database tables.

PHOTO 4: ***Constructing a Query with PBE***



A complex command can be constructed quickly with the use of the PBE point-and-shoot interface—only the value "Directions" had to be typed in from the keyboard.

Application EXPRESS maintains three files for each application generated. The definition of the application is contained in a nonreadable file with an .API extension. The code generated is contained in ASCII form in a file with an .APP extension. Finally, the executable version is contained in a binary file with an .APX extension; Application EXPRESS invokes CodeLock to produce this file after it generates the code.

The .APP file can be examined with the TYPE command, from DOS or R:BASE, and edited with a suitable editor—RBEDIT may not be suitable for editing an entire application, as it is limited to 750 lines. However, Application EXPRESS always reads the .API file not the .APP file to retrieve the current definition of an application. Changes made in the .APP file outside of Application EXPRESS are not reflected in the .API file and will be lost the next time Application EXPRESS is used to modify the application.

SPEAKING IN R:BASE

Without question, developers can use R:BASE EXPRESS modules to develop complex, real-world applications. At some point, however, serious developers will find that they have to resort to writing R:BASE code or modifying code gener-