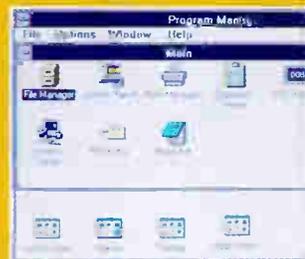


BYTE

A MCGRAW-HILL PUBLICATION

**Sneak Preview:
Windows 3.1**

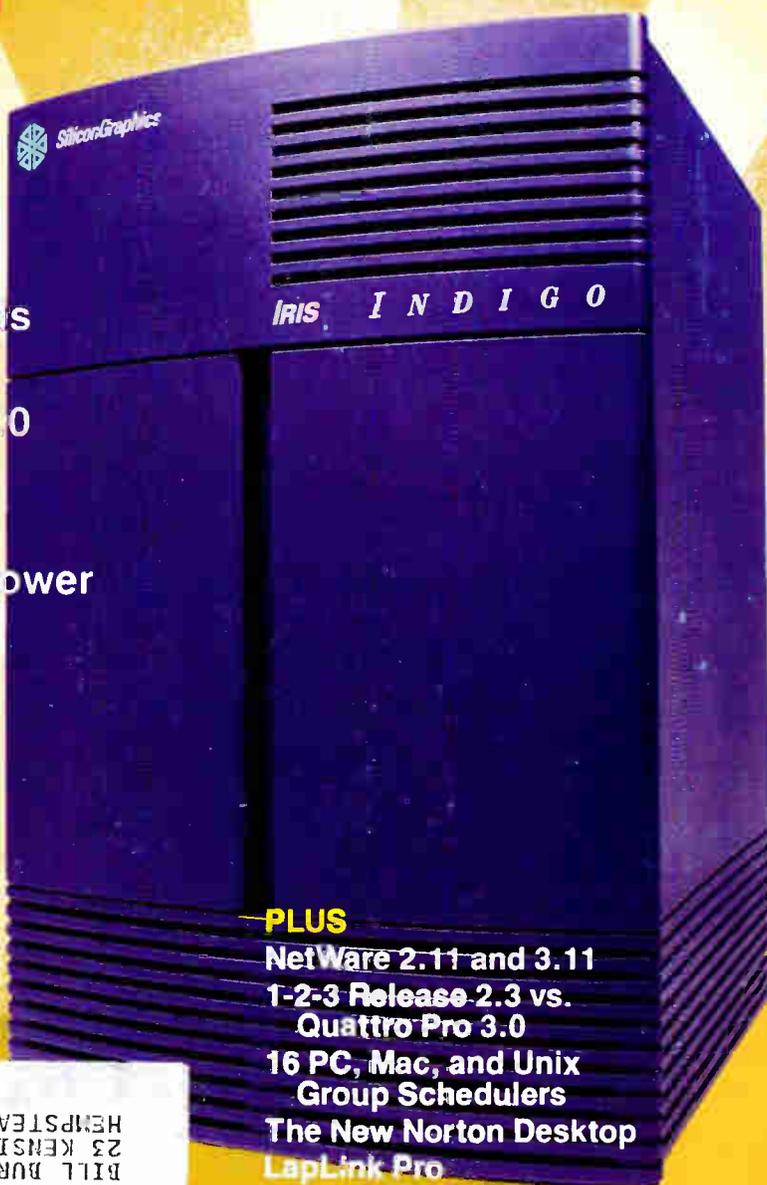
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LapLink Pro
3 New 486SXes
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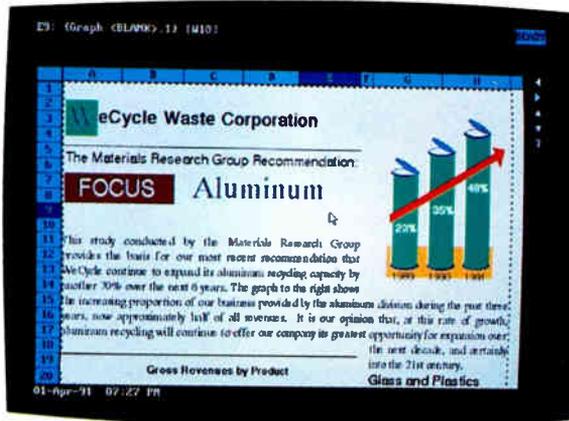
commands, highlight cells or ranges, open dialog

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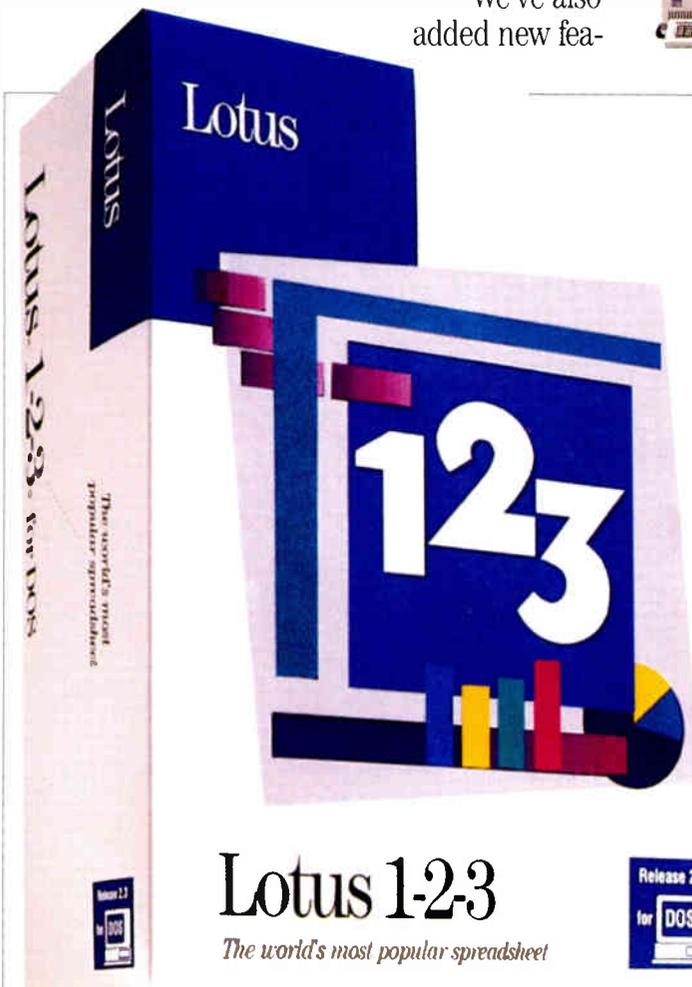
tures in common with our powerful 3D spreadsheet 1-2-3, Release 3.1. Including its superb spreadsheet formatting and publishing capabilities and full mouse support. Along with its popular Auto Compress feature that gives you a trouble-free way of making larger worksheets print on a single page.

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tures you won't find in other spreadsheets. Like the Viewer (based on Lotus Magellan® technology) which lets you view files before retrieving them and makes file linking as easy as point and click. And a very helpful Auditor



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Release 2.3
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- Auto Compress, for a trouble-free way of making larger worksheets print on single page
- Dialog Boxes for an easier, more interactive way of working
- Text-editing for easy on-sheet word processing, including automatic word wrap, even around graphs
- The Auditor for documenting or highlighting your spreadsheet logic
- Improved memory management for building larger worksheets up to 12 MB in size
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WeCycle Waste Corporation
 The Materials Research Group Recommendation:
 FOCUS: ALUMINUM

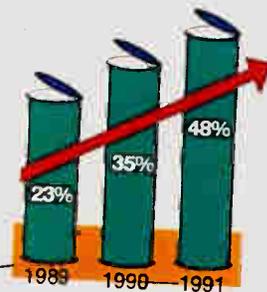
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This study
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WeCycle Waste Corporation

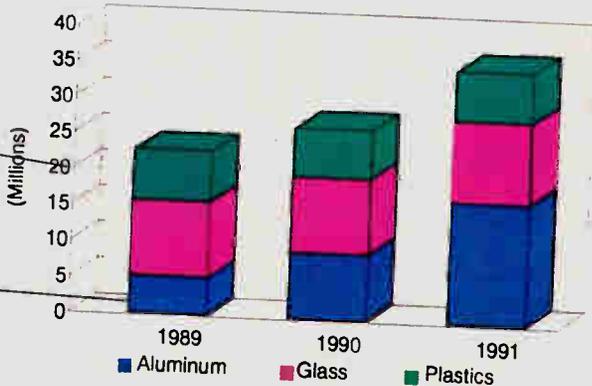
The Materials Research Group Recommendation:

FOCUS Aluminum



This study conducted by the Materials Research Group provides the basis for our most recent recommendation that WeCycle continue to expand its aluminum recycling capacity by another 70% over the next 6 years. The graph to the right shows the increasing proportion of our business provided by the aluminum division during the past three years, now approximately half of all revenues. It is our opinion that, at this rate of growth, aluminum recycling will continue to offer our company its greatest opportunity for expansion over the next decade, and certainly into the 21st century.

Gross Revenues by Product



Glass and Plastics

As can be inferred from the graph to the left, glass and plastics recycling has been holding steady throughout this same period, and has consequently become a smaller proportion of our overall sources of revenue.

Although this group would strongly recommend that WeCycle Waste Corporation do all that is necessary to increase its activities in these areas, our studies have shown that aluminum will become increasingly the material of choice in the shipping, heavy manufacturing and container industries.

Aluminum

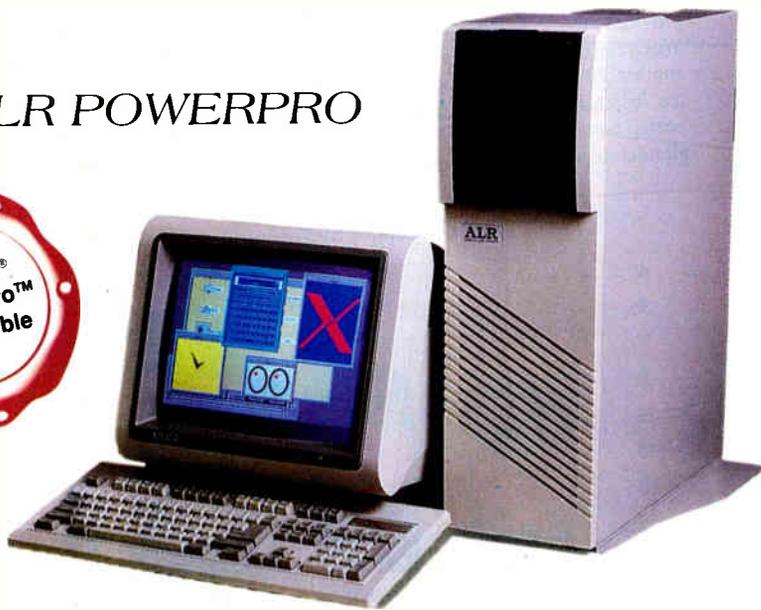
It is our opinion that sources of aluminum products will be pressed close to their limits over the next decade.

Therefore, we propose that WeCycle Waste Corporation invest in more aluminum capacity during the next five years in order to take the best advantage of this increasing market demand.

WECYCLE PRODUCT	1989	1990	1991
Aluminum			
East	2,323,426	4,019,527	7,315,539
Central	1,372,347	2,374,160	4,320,972
West	1,726,492	2,986,831	5,436,033
Total	5,422,265	9,380,518	17,072,544
Glass			
East	2,496,721	2,567,821	2,798,925
Central	3,598,757	3,217,693	3,507,285
West	4,217,635	4,471,294	4,873,710
Total	10,313,113	10,256,808	11,179,920
Plastics			
East	2,897,493	3,171,243	3,234,668
Central	1,873,938	1,823,697	1,860,171
West	2,378,942	1,967,421	2,006,769
Total	7,150,373	6,962,361	7,101,608

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power, while the POWERPRO's **ten industry standard expansion slots** and large floor-standing chassis give you all the room you'll ever need for customization. Factor in the POWERPRO's **32-bit EISA bus** and **32-bit ESDI disk controller** (standard on hard drive models), and you have one unbeatable system.

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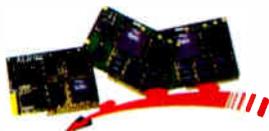


Manufacturer Model	ALR [®] POWERPRO VM 386/33	Compaq [™] SYSTEMPRO [™] 386/33	AST [™] Premium [™] 386/33TE
CPU	33-MHz i386	33-MHz i386	33-MHz i386
BUS Architecture	EISA	EISA	EISA
RAM Standard	5-MB	4-MB	4-MB
Floppy Standard	1.2-MB	1.44-MB	1.2-MB
Total Slots	12	11	10
Starting List Price	\$4995	\$11,999*	\$6495
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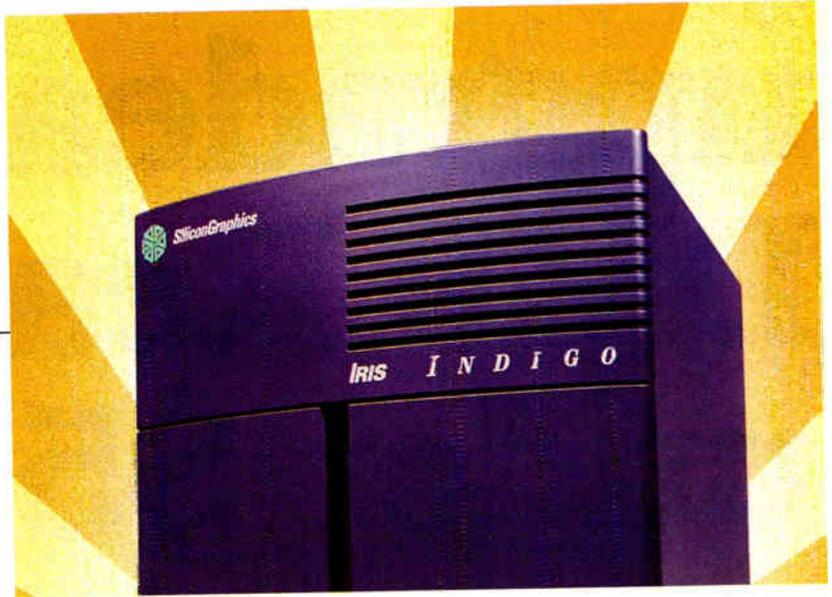
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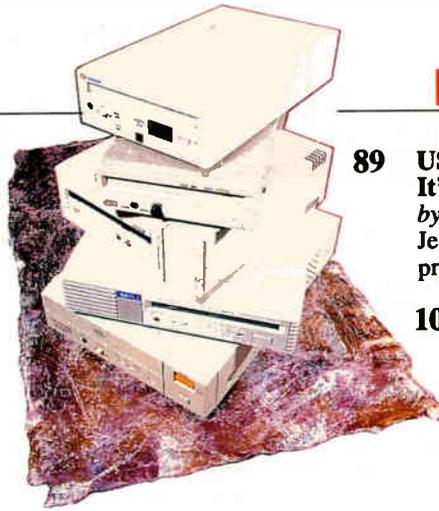
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INSIDE **BYTE**

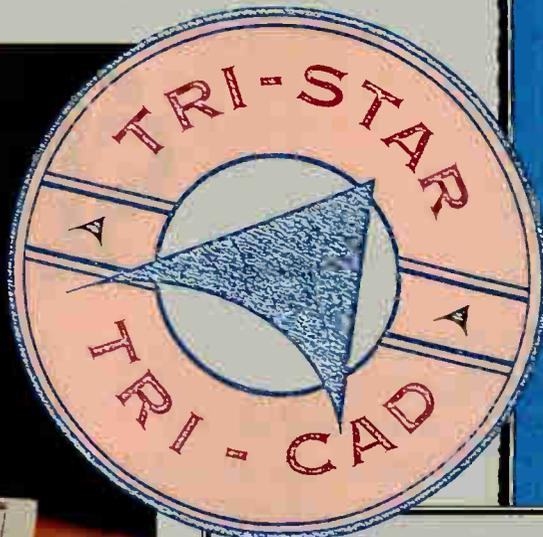
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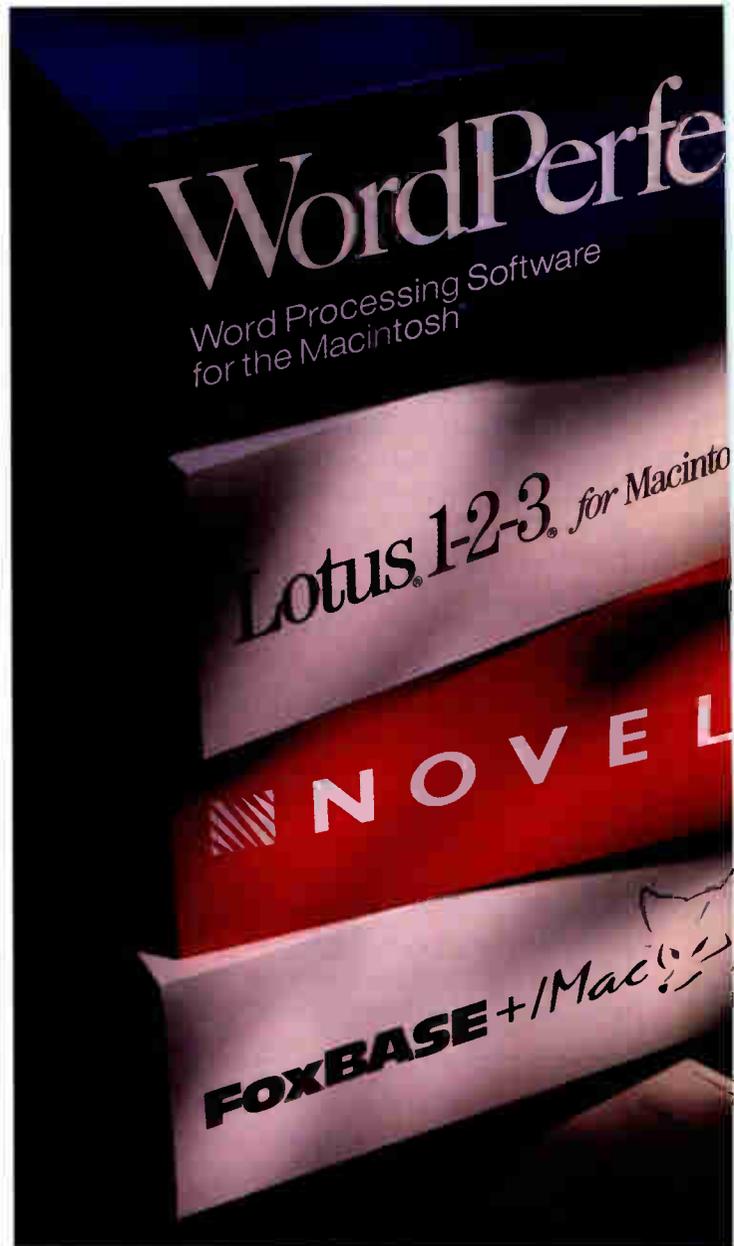
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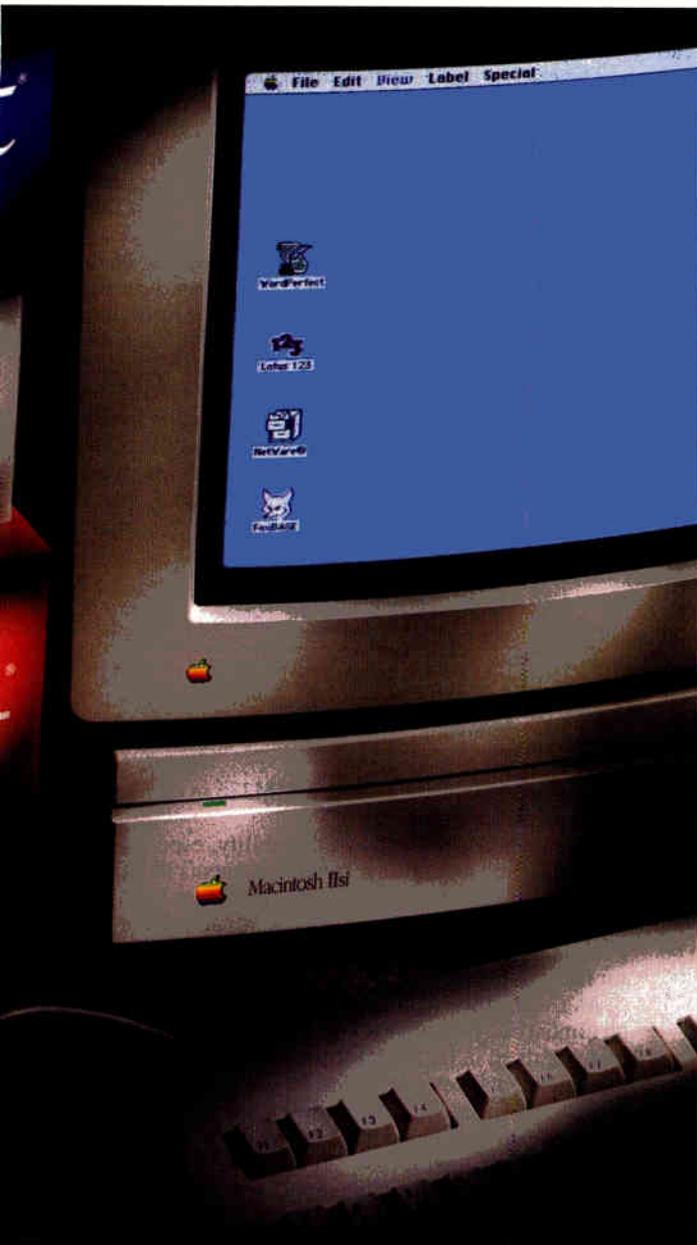
For example, a graphics and drawing package is built



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DOS computer Macintosh.



right into the program. Which means graphic images, charts and sidebars can be added and edited without any reformatting hassles.

There's also the powerful new FoxBASE+/Mac, which is up to 10 times faster than most other database packages. It takes full advantage of the graphic, intuitive Macintosh way of working, and allows Macintosh and DOS users to access the same data simultaneously. And it can read dBASE files, too.

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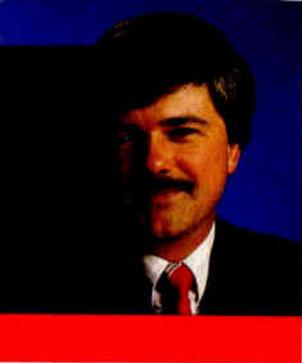
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EDITORIAL

FRED
LANGA

THANKS FOR THE MEMORY

What a feeling. I'd installed V Communications' Memory Commander software and gone through its optimizing process. I'd then run CHKDSK and was seeing something I had never seen before: 792,636 bytes free. Wow!

OK, maybe I need to get out more. (I can almost hear the Mac and Unix folks chuckling in the background.)

A once-obscure element of DOS—memory management—moves into the mainstream

But still, a lot of us live with DOS, and we all too often struggle to jam just one more driver or TSR program into that 640-kilobyte closet—or struggle to achieve a larger, more useful DOS box from within Windows. After hassles like that, suddenly finding almost 800 KB of conventional "low" memory free for DOS feels like finally being able to take off too-tight shoes. (Yes, there's a catch to Memory Commander's amazing numbers. I'll get to that later.)

Memory Commander is one of a slew of new or updated DOS memory managers that got a new lease on life when DOS 5.0 moved the once-obscure realm of DOS memory management into the mainstream. Out of the box, DOS 5.0's ability to load itself into high memory can give you in excess of 600 KB available.

Of course, the idea of loading software high (into unused regions of memory between 640 KB and 1 megabyte) isn't new. Many products that predate DOS 5.0 let you do this. (Quarterdeck's QEMM-386 and Qualitas's 386Max are the two top dogs in the field.)

And although there still can be an element of black magic in configuring these products and in wringing out the last iota of performance, many machines can be up and running acceptably well in minutes. For example, I finished a plain-vanilla installation of QEMM on my newest home machine—a DOS 5.0-equipped 486—in about 10 minutes.

As a quick experiment, I also tried plain-vanilla installations of DOS 5.0's extended and expanded memory managers (HIMEM and EMM386, respectively) and Memory Commander. I ran each as they came out of the box, accepting whatever defaults were offered or built in. Thus, the numbers in the table represent the baseline performance, not the best case. Still, the results were interesting.

Clearly, you can't go far wrong with any of these products: All offer more—or much more—breathing

room than you could get under old versions of DOS.

The catch with Memory Commander is that the 792 KB is available only to the simplest programs—those that require only one page of text memory. More complex programs (i.e., those using graphics, especially high-resolution graphics) yield much smaller workspaces. But even that is more than you get with DOS 5.0's own memory management tools.

QEMM, Memory Commander, and the rest of the new crop of memory managers offer other benefits, too. For example, all are much easier to optimize than DOS 5.0; many let you map slow ROMs into fast RAM for a noticeable performance boost; some automatically convert RAM from extended to expanded and back again on demand, on the fly (so you never have to be concerned with how much of what type of memory your software might require); and most are much

CHKDSK MEMORY AVAILABLE			
	DOS 5.0 + EMM386 + HIMEM	DOS 5.0 + QEMM	DOS 5.0 + Mem. Cmndr.
Plain DOS	614 KB	636 KB	792 KB
DOS Window in Windows 3.0	607 KB	619 KB	619 KB
DOS Window in Desqview	424 KB	573 KB	465 KB

faster—up to 70 percent—than EMM386 in manipulating expanded memory.

It all boils down to increased usability, especially in task-switching or multitasking environments like DOS-Shell, Windows, or Desqview. Your programs run better—often faster. Swapping is reduced. And large programs may now work where before they'd simply abort for lack of space.

As I write this, new memory managers are showing up almost daily here at BYTE. We'll be taking a look at many of them in the near future. We'll put them head-to-head and tell you the results.

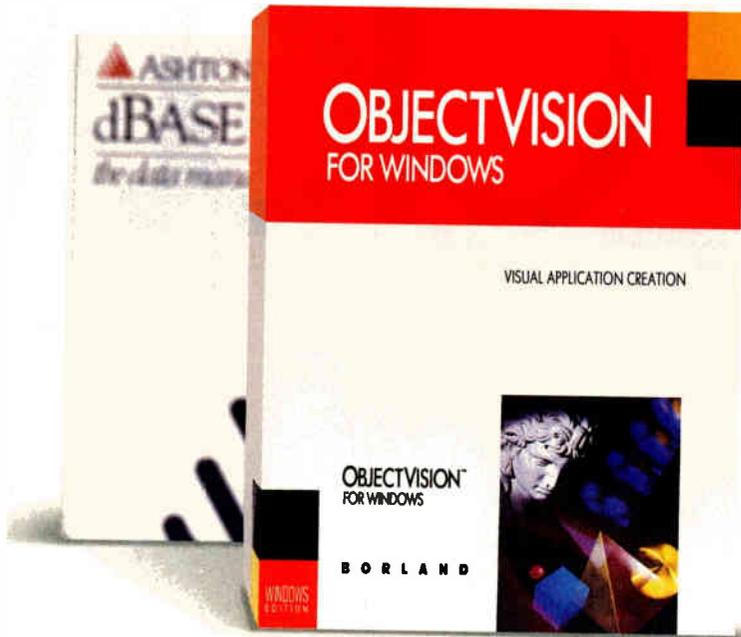
But if you need space, don't wait: Any memory management software is better than no memory management software; and almost all software is better than the relatively primitive tools supplied with DOS 5.0.

Here, at least, is one area where you almost can't lose.

—Fred Langa
Editor in Chief
(BIX name "flanga")

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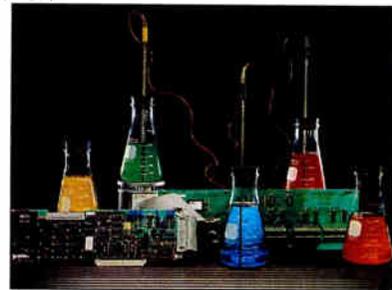
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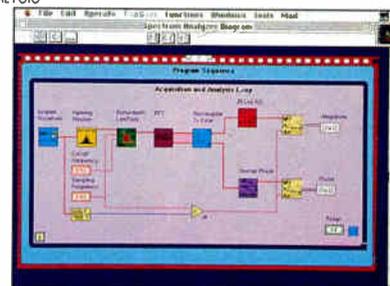
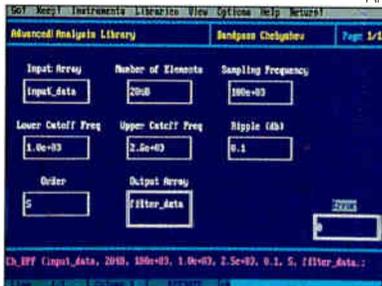
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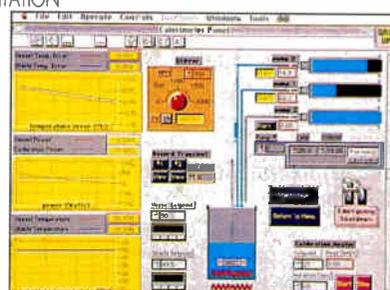
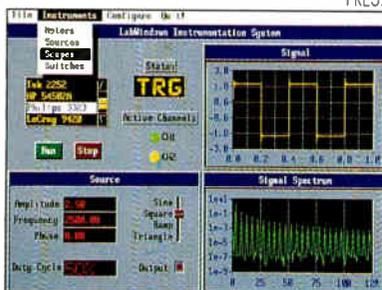


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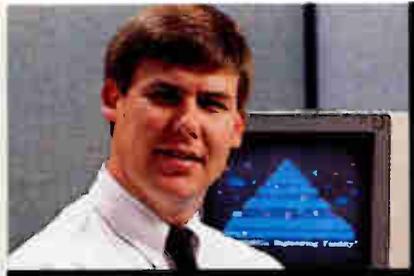
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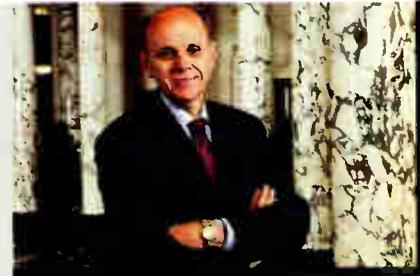
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"The strengths of the IEF are clear-cut. One obvious quality advantage is that application changes are made to diagrams, not code. This ensures ongoing integrity—the specification always matches the executing system."

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Computer Task Group



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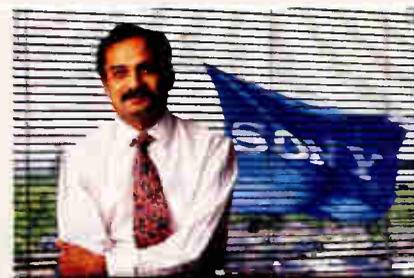
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Study shows zero code defects.

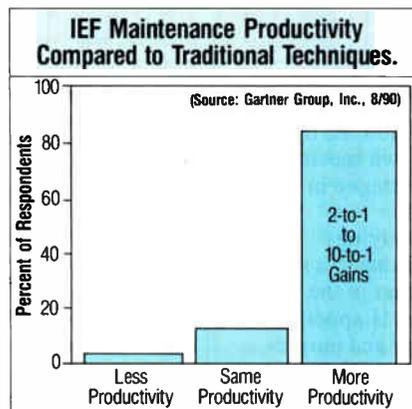
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Maintenance productivity gains of up to 10-to-1.

In this same study, developers were asked to compare IEF maintenance productivity with their former methods. *Of those responding, more than 80 percent had experienced gains of from 2-to-1 to 10-to-1.* (See chart.)

Specifications always match the executing application.

With the IEF, application changes are made to diagrams, not code. So, for the life of your system, specifications will always match the executing application. The Gartner Group research showed that *all* IEF users who reported making application changes made *all* changes at the diagram level.



Developers were asked to compare IEF maintenance to former methods. Of those responding, more than 80% reported productivity gains of from 2-to-1 to 10-to-1.

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TEXAS 
INSTRUMENTS

LETTERS

Lonely Geniuses

I was very moved by Hugh Kenner's poignant and bittersweet story of the mathematicians G. H. Hardy and Ramanujan (*Print Queue*, June). What makes the story so appealing is that it mattered little that Hardy was the deductive genius from England and Ramanujan was the intuitive genius from India. Their common interest transcended all other detractions.

I cannot help but compare the occult genius of Ramanujan and the more social genius of John Keats, the [nineteenth-century] English literary giant. Both were dying of tuberculosis in England and wanted to go south to shed their affliction. Both were at the peak of their own special genius when they died: Keats at 25 and Ramanujan in his early thirties.

We know Keats's thoughts when he was dying through "Ode to a Nightingale." He is talking to a singing bird outside his window: "O for a beaker of the warm South, / full of the true, the blushful Hippocrene, / With beaded bubbles winking at the brim, / and purple-stained mouth; / That I might drink, and leave the world unseen, / And with thee fade away into the forest dim." A beautiful legacy.

But what of Ramanujan? His life seems to have ended with a comma. I'm sure that his mind was racing with those things he loved most, but, unlike Keats, there was no one there who understood them. A lonely business indeed.

Frank D. McLaughlin
El Segundo, CA

Trumped ACE

The first *Microbytes* item of the June issue ("Will ACE Become King of the Workstations?") involves a fantasy world.

The best description I've heard of the Advanced Computing Environment (ACE) consortium (especially the dominant three players: DEC, Compaq, and Microsoft) was a reference to an old German saying about "an egg-laying, woolen, milk cow." The output of this group effort will probably be an egg with hair—and as sterile as a mule.

DEC has the most to gain from this scam. However, users may come to realize that DEC seems unable to stand on its own feet and give the industry any direction

WE WANT TO HEAR FROM YOU. Please double-space your letter on one side of the page and include your name and address. Letters two pages in length or under have a better chance of being published in their entirety. Address correspondence to Letters Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. You can also send letters via BIXmail c/o "editors."

Your letter will be read, but because of the large volume of mail we receive, we cannot guarantee publication. We also reserve the right to edit letters. It takes about four months from the time we receive a letter until we publish it.



(something expected from the second-largest computer firm), preferring instead to hide its intentions and lack of strategic direction in consortia such as Open Systems Foundation and ACE and in a confusing plethora of incompatible products.

What does ACE give us as a "standard"? Two operating systems. Two hardware architectures. A dissenting group that prefers yet a third operating system. Twenty-one companies to add to the confusion. Grandiose promises. Offers of "near-compatibility" (users will love hearing, "Well, it'll almost run on your system"). Sorry, ACE, I'll trump your dark card with a much more sunny one—one that has a clear picture of its market and users.

John Neubert
*Director, Academic Computing
Drew University
Madison, NJ*

Bubble Sort Postscripts

I wish to express my appreciation for "A Fast, Easy Sort" (April). I adapted Richard Box and Stephen Lacey's True BASIC routines for bubble sort and Combsort to QuickBasic on my Gateway 386/20 under DOS 4.1. My test data input consists of an array of 500 numeric elements in descending sequence from 9999 to 9500. Sorting places them in ascending order. The bubble sort required over 18 seconds to execute, whereas the Combsort required less than 1 second.

I commend you for providing an article that offers an excellent method for programmers who need a fast sorting capability.

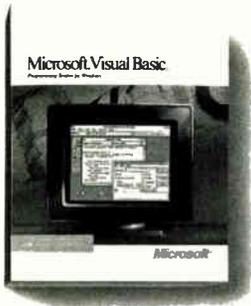
George A. Pohl
Oneida, NY

I was very impressed with "A Fast, Easy Sort" by Box and Lacey. Their Combsort algorithm (C-code listing 1) is improved when the iterations for which the gap is greater than 1 are separated from the iterations in which the gap is 1. This lets you remove some unnecessary tests and operations from each set of iterations.

For the iterations in which the gap is greater than 1, the test for a gap of 0 and the test for whether or not exchanges have occurred are removed. The final iterations, in which the gap is 1, are a conventional bubble sort. In the bubble sort, tests for a gap of 9 or 10 are removed. Also, the division of the gap by the shrink factor, testing the gap for 0, and resetting it to 1 are removed.

The preceding modifications reduce the sorting time for an integer array by about 20 percent and for a float array by about 5 percent. The modified Combsort is comparable in speed to the shell sort with a shrink factor of 1.7. The shell sort is slower for an integer array but faster for a float array.

It was interesting to learn that as the simple insertion sort can be modified to produce the shell sort, so the bubble sort can be modified to form the Combsort. However, in view of the superior performance of the



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WINNER

At the 1991 Spring Comdex/Windows World, the editors of BYTE judged Visual Basic the “Best of Show.” In the July 1991 issue of BYTE, Editor-in-chief Fred Langa called Visual Basic “a milestone product.”

Microsoft

Quicksort, I think it is worth the effort to learn and understand the Quicksort algorithm.

D. A. Hutchinson
Cranbrook, BC, Canada

The bubble sort presented in "A Fast, Easy Sort" does work and is especially easy and quick to do. But there are some other rather simple and effective things that one can do to make even the bubble sort go faster.

First, you might alternate the direction of sort. If you sort in one direction, either up or down, you know that the largest or smallest "item" is at the end. So if you then sort the other way, you know that the smallest or largest item is at the other end. Ah, you have no turtles using this modification! Suddenly you know that in your list of N items, no more than $N-1$ times through will have the list sorted. That all by itself does not seem to help, but there is another feature of this bidirectional work that does help.

Notice that, each time, you do know that you have placed the "mostest" item at the end. You do not have to compare all the way to the end any more. In fact, you are guaranteed that you do not have to start back at the end but can start back one item in from your last comparison, and you can stop one item from the last comparison at the other end. This means that you have only $(N-1) + (N-2) + (N-3) + \dots + N/2$ comparisons, maximum, to make. So it is possible to make fewer comparisons in the slightly modified bubble sort.

Jack Allen Horrigan
Denver, CO

GUIs Continued

I found your June Roundtable ("Who Needs GUIs?") interesting. I think that the ideas pointed out by Jon Udell in his closing comments should be more strongly emphasized.

There are some applications for which a command-line interface is the most appropriate tool (his example of `del*.obj` is a good one). However, a GUI is more appropriate for other tasks, particularly where the user is not familiar with the operation or has to remember a complex series of keystrokes. To me, the interface provided by `SFGetFile` and `SFPutFile` on the Macintosh are among the greatest boons to my productivity. I can name files with long, descriptive names (including the date), and I generally have to type out a filename only once—when I save it the first time. I can also use long, descriptive filenames in Unix or VMS CLIs, but then I have to remember the blasted things when I need to access the files later.

My conclusion is that users should be able to dynamically choose between the GUI and the CLI, depending on the task at hand and their particular mood.

Bruce E. Wilson
Kingsport, TN

Don Crabb made a very important point in the June Roundtable. If you already have learned and mastered a CLI, what is the point of going to a GUI?

I like a GUI in some applications, like desktop publishing, but I don't need one to interface with the operating system. Another important point is compatibility. I

am a shareware author. My programs are written so they are usable by as broad a range of users as possible. I not only write for the CLI, I also include a version in each package that will run on MS-DOS machines that are not fully IBM compatible.

I appreciate BYTE's commitment to putting things in the proper perspective. Even though GUIs have their place, it is not necessary to go entirely to the Mac environment where there is no CLI.

Robert LaFara
Indianapolis, IN

Your June Roundtable was extraordinarily limited in scope—the participants seem to accept that computers are really good only for word processing! A computer interface, as its name implies, is the channel through which human and machine communicate. When the subject under joint discussion is of low complexity (e.g., the stream of text in a word processor), the interface does not necessarily have to be sophisticated—there's not that much to talk about. But when dealing with more complicated subjects, the idea of working through a Teletype becomes ridiculous.

Consider, for example, a computer controlling a chemical plant. The user interface is normally a whole control room full of special displays and controls: screens, maps, panels, sliders, knobs, lights, alarms, and so on. No one would suggest that it would be more efficient to replace the control room with a Teletype, or even a battery of Teletypes. Similarly, controlling a flight simulator with a keyboard is a very poor substitute for regular flight controls—witness the huge sums of money spent on sophisticated flight-simulation gear.

Whether or not to use a Teletype interface on a word processor seems a matter of personal preference, as the conferees seemed to agree. But as the complexity of the task increases, it soon becomes a quite impractical approach.

Duncan M. Butlin
Tulsa, OK

Joseph J. Lazzaro expresses fear that he and others with visual problems may lose access to computers as a result of GUI development (Stop Bit, June). This is a real problem that needs action, but I hope that we can find better responses than the ones he suggests.

Lazzaro wants GUI developers to support the speech synthesizers needed by blind users. I recommend that we take a fresh look at the forest, rather than just this one tree.

In preparing to have a program communicate with users, a dialogue must be developed (i.e., what the program and the user may say to each other). Also, a CLI, GUI, or other interface must be provided (i.e., how they say it). Clarity, economy, and safety are all important.

A well-developed dialogue will be prepared to lead me at a detailed level through a task if I haven't done it for six months, to economize when I do it 20 times in one day, and to let me easily switch between these modes. It also will demand confirmation on dangerous commands but not on safe commands (and let me override defaults on classification of semi-safe commands). With a GUI it is easy to present both a primary message (important) and secondary messages (of possible interest). This extra flexibility can inspire a GUI developer

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to optimize the dialogue.

I suggest that there be a new dialogue interface, one that can be standardized, with programs concerned only with what to say at this interface. Then support for standard GUIs and support for those who cannot read a display and/or cannot use a mouse or keyboard could all meet at the dialogue interface.

Dave Ketchum
Owego, NY

Thanks for the Memory

The "Chips in the Old Block" text box (June, page 156) began with this statement: "In 1966, the Oldsmobile Toronado was the first American car to have front-wheel drive." This shows how youthful your writers and staff really are! The Auburn and Cord both had front-wheel drive about 1930.

Dr. Sidney V. Soanes
Toronto, Ontario, Canada

DR DOS Compatibility

Like Jerry Pournelle ("DOS Decisions," June), I currently use the combination of DR DOS with the Quarterdeck QEMM memory manager—not to use Desqview, but because the commands provided by DR DOS to load TSR programs into high memory simply didn't work. I have tried the combination of relocation of the DOS kernel (DR DOS HIDOS.SYS) plus relocation of TSRs (QEMM + LOADHI) on three systems: a Touche 486 with AMI motherboard and BIOS, a 386SX clone built around a Chicony motherboard with a Phoenix BIOS and Intel chip set, and a Hewlett-Packard QS16S 386SX with a Phoenix BIOS (extended by HP) and a Chips & Technologies chip set.

The combination worked smoothly on the first two systems. The third system rebooted so frequently as to be useless. Thus, my desire for easy use of large amounts of disk memory (large partitions) and system RAM was restricted by some aspect of the proprietary extended BIOS or hardware of the HP system.

I await further discussions of compatibility of DR DOS with specific hardware/software items. Even with the above caveats, I have more free RAM with DR DOS than with any enhanced version of MS-DOS.

Michael E. May
Vanderbilt University
Nashville, TN

U.S.S.R. Insight

Following your cover story on computing in the Soviet Union ("Computing in the U.S.S.R.," April), I thought I would share this information.

I was invited by the Ministry of Health of the Soviet Union to demonstrate dental computer imaging in Moscow last March. I shipped an AST 386ST/16 computer with laser disc storage, Sony RGB monitor, keyboard, graphics board, Sharp thermal printer, and TV camera with light source to the Central Research Institute of Stomatology, where lectures and demonstrations were to be conducted. On entering the country, the equipment was

impounded by customs for one day, until the proper papers were obtained indicating that the equipment would not be sold in the Soviet Union. All the equipment arrived undamaged. The dentists at the institute were quite impressed by the equipment, as it had never been seen in the Soviet Union before.

Following the presentation, I was invited to the apartment of a man who was said to have advanced computer equipment. As I suspected, it was an XT compatible with two disk drives, a Philips monitor, and an Epson LQ-500 printer. Quite a bit of pirated western software was present.

As another note, several BBSes are operating, although sporadically, in the Soviet Union. Additional information is available through CompuServe, in the foreign language forum.

Dr. Tom Frymark
Woodstock, IL

A number of Soviets are personally present on BIX, as well.—Fred Langa

IDE Drive Cautions

Answering David Dunthorn's letter, Roger C. Alford (Letters, June) says that the inability to do low-level formatting on Intelligent Drive Electronics (IDE) disks doesn't matter because "the primary cause of unreliable sector reads . . . is not the weakening of the magnetic sector ID information, but rather the misalignment of the drive read/write heads to the sector data. That is, the heads move slightly off the dead center of the track. . . . Since the only functional purpose for a low-level format is to establish the sector interleave . . . vendors perform this operation at the factory, and it should never need to be done again."

But one of the reasons for doing low-level formatting on a disk is precisely that the heads move slightly off the dead center of the track and so become misaligned with the drive read/write heads. The trick is to do it before the heads move so far as to be unable to read the data at all. Gibson Research makes a living with SpinWrite doing just that. So I remain, like Mr. Dunthorn, worried about IDE disks.

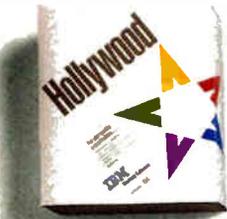
Richard N. Wisan
Oneonta, NY

In your June Letters section on the pros and cons of IDE drives, it was stated that low-level formatting of IDE drives should not be necessary. In a perfect world this would be correct. Working at Kean College in the computer lab, I see a lot of disk drives that have been trashed by viruses.

After the partition table has been destroyed by a virus, a regular high-level format either will not work at all or will work on only part of the disk, the part with a valid DOS partition code. The FDISK utility will not delete some partitions that are marked non-DOS; it seems to think they belong to a different operating system. The only way to fix the problem (for most people) is to perform a low-level format on the disk and then reformat (i.e., do a high-level format).

Mike Keelan
Elizabeth, NJ

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Desktop Software

Future Chips

I have recently encountered a PC program called SDS that does everything David Vannier hopes to achieve and more ("A Talk with Intel," April). It is a free-form text organizer with flexible subject indexing, a conventional keyword search capability, and a calendar. It extends Personal Information Manager technology by integrating the work of individuals with the objectives of the organization for improved communication and coordination of efforts. SDS calls its method Personal and Organizational Integrated Management Support (POIMS) technology.

The most fascinating thing about POIMS is how it connects time, the management process, and people, plus documents, other computer programs, files and business systems, into a single, generic environment.

In light of this, I am curious about the new wonders Mr. Vannier is designing into Intel's chip of the future. Please keep us posted.

Millie Buck
San Francisco, CA

Radiating Floppy Disks

In his March letter, T. D. Craddock reports that a standard diagnostic x-ray machine had no effect on floppy disks even with radiation levels 100 or more times higher than airport inspection machines are likely to produce.

This is perfectly correct as far it goes, but, unfortunately, airport x-ray inspection machines are not physically built the same as diagnostic machines. A standard diagnostic x-ray machine has its high-tension transformer usually hidden somewhere in a corner and is connected by long high-tension cables to the x-ray tube itself. Furthermore, the transformer is enclosed in a welded steel box filled with oil.

On the other hand, the airport x-ray inspection unit has the high-tension transformer mounted together with an x-ray tube, usually in an aluminum housing, and as such they are surrounded by a rather strong 50- or 60-Hz magnetic field. Because of physical size and placement limitations, the x-ray tube is fairly close to the conveyor belt and thus acts as a wonderful large-scale disk erase. So beware! And if you insist on having your disks x-rayed, put them in lead boxes!

Millan Y. Xeno
Sydney, Australia

More on Protocols

Thank you for an interesting appraisal of the relative merits of the CMIP and SNMP protocols ("Dueling Protocols," March). However, I think that Sharon Fisher hasn't given us the whole story.

Everything that SNMP can do can also be done by CMIP, so SNMP is a true subset of CMIP. Using filters in retrieval operations, for example, is an option rather than a requirement of CMIP. I think that this option is a very valuable one, because managed objects often have to be selected by certain attributes or combinations of them. SNMP offers no such option.

Dr. Jeffrey Case states that CMIP's approach is to get the whole database. The opposite is true: It is SNMP that requires you to retrieve the whole database, because every entry will be requested when "get-next" is issued, and it's not possible to know when to stop. The only criterion is the lexicographical ordering of variables in the management information base. If you want to see all variables with certain properties (e.g., all the transport connections established to a certain partner system), you must indeed inspect the "whole MIB" (i.e., all related variables). Using CMIP, you select the entries you want (i.e., objects and relevant attributes), and you will get them and nothing else.

The cost criterion for network management in a wide-area-network environment is primarily a question of network load. There CMIP offers the better alternative because it enables event reporting as well as the bulk transfer of data, whereas SNMP needs polling and requires a "Ping-Pong" protocol for retrieval.

As we have seen, SNMP can manage toasters and CD players, and while that is hardly a requirement for network management, CMIP can handle this job in the same fashion!

Jan Kreppel
Siemens-Nixdorf AG
Munich, Germany

Eyestrain Aid

In his column, Jerry Pournelle has written about the strong eyeglasses he wears and the many monitors he's tried out. I have a tip that will help anyone with vision problems.

A couple of years ago, I asked my optometrist to create a special pair of eyeglasses that would reduce eyestrain when I viewed my computer screen. The best idea he came up with was to apply an antireflective coating to my lenses. It is similar to the coating used on fine camera lenses, and it virtually eliminates reflections on the eyeglass caused by light from the computer screen, lamps, overhead lights, or sunshine.

I was astonished at how much easier it is to see once you're no longer looking through reflections. It's almost like wearing no glasses at all. You can have the coating applied to your current lenses. However, the coating will get dirty easier and is harder to clean, compared to uncoated lenses. But my optometrist gave me a special spray cleaner that helps considerably.

I now have antireflective coatings on all my eyeglasses and would recommend them to any computer user. It's the easiest, cheapest way I know to "upgrade" your monitor.

Bob Miller
Houston, TX

FIX

-
- The correct phone number for Ventek Corp. ("This Digitizer Captures in Color" in What's New, June, page 68) is (818) 991-3868. ■

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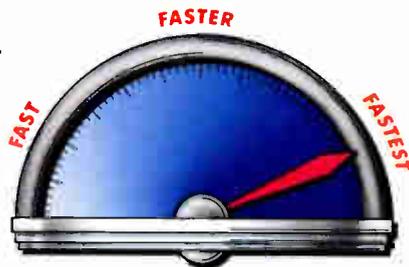
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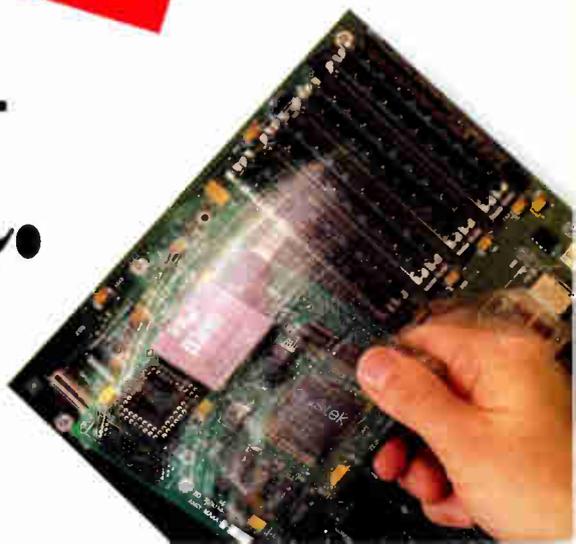
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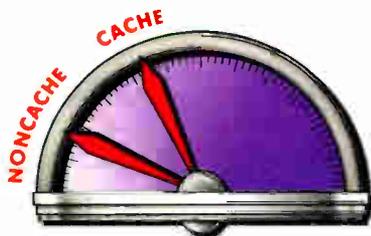
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Because you are also going to be receiving our *seven bay* SpaceSaver desktop case. Loaded

with seven drive bays, this case occupies less room than most five bay cases! Plus,

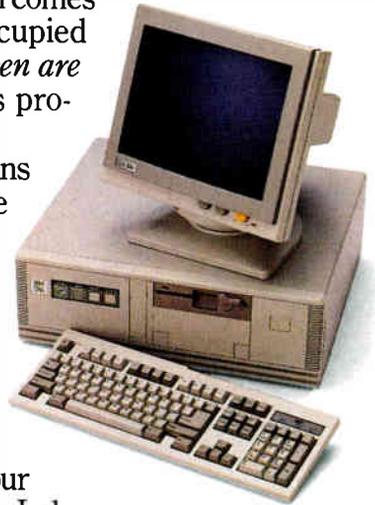
\$1,395

to make sure you have plenty of power, now *and* in the future, we're including the very best *300 watt* power supply that money can buy. If you want the *power* to expand, you want ZEOS power—300 watts and nothing less! And there's more too.

ONLY \$2495

Like plenty of room for you to add expansion cards any time you wish. Because every ZEOS system comes with *eight expansion slots*. One is occupied by your high speed video card and *seven are open for your use*. Your investment is protected in other ways as well.

Take our two *whisper quiet* cooling fans for instance. At ZEOS, we recognize the importance of cooling. So we have built into your system not one but *two cooling fans*. After all, the cooler your computer runs, the longer the components inside will last. It's an extra and it's yours because ZEOS always builds in reliability.



ONLY \$2995

Speaking of reliability *and* safety. Your *entire* computer system is Underwriters Laboratories listed (not just the power supply). Many computer vendors don't offer this important safety listing. We think you'll agree, *not* being UL listed definitely tells you something about the company and the product. Insist on a UL[®] approved system.

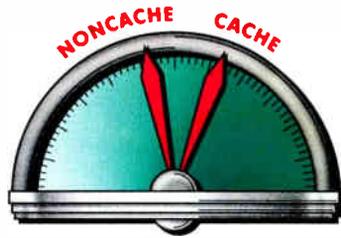
There are many advantages of selecting your new ZEOS 386-25. We've touched on a few of these advantages here while many more are discussed later in the section entitled "*Why ZEOS is your #1 Choice!*" Things like *24 Hour a Day Toll Free Technical Support*, our 30 day Money Back guarantee, warranties and much more. You can be sure of one thing...

Your new ZEOS 386-25 is one incredible system. With performance, quality, price, and support second to none, it might well be the last computer you'll need to buy for quite some time. Select between these packages *plus* our many available options! Why not give us a call right now! Call *Toll free 800-423-5891*.

386-33!

You read it right! The complete amazing blazing ZEOS 386-33MHz modular system starts now at only \$1,495. If you've been thinking you want more power, *this is it*. Power, price, performance *plus* your many other ZEOS advantages!

Like our new modular motherboard design. Now you can upgrade to an even higher performance microprocessor at any time. Businesses find this option very attractive. It nearly eliminates obsolescence and lets them balance their processing power with the changing needs of the users. Whatever *your* needs, you're sure to appreciate your other ZEOS design advantages as well.

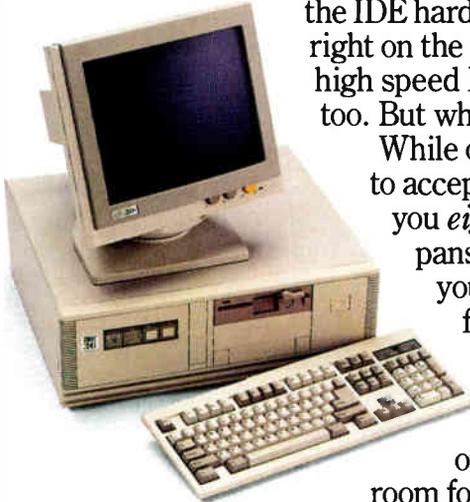


Z•SPEED METER: ZEOS 386-33

Truly high performance ZEOS systems are now in the reach of everyone. The ZEOS 386-33 is a definite winner! Add even more speed with our 128K SRAM cache for only \$200! Incredible!

ONLY \$1495

Using the very latest in surface mount and VLSI (Very Large Scale Integration) technologies, we have increased reliability, lowered costs and made room to do some other very special things. Like integrating the IDE hard disk and floppy drive interfaces right on the motherboard. We've put our high speed I/O ports on the motherboard too. But what about the slots?



While others are trying to get you to accept fewer slots, we still give you *eight*. And of those eight expansion slots, seven are open for your future use while one is used for video (video standards change too rapidly to lock you into video on the motherboard). With all these open slots, you definitely have room for expansion. Plus, you have

the *power* to expand.

ONLY \$2095

Because at ZEOS we have considered the *entire* issue of expansion. That's why we're giving you our *300 watt power supply plus two whisper quiet cooling fans*. Moving more cool air through your system translates into longer component life. A larger power supply gives

\$1,495

you more power stability now *plus* the capacity for future expansion. It's a case of quality. And speaking of cases . . .

Your exclusive ZEOS SpaceSaver case is unquestionably the very best! Providing you with *seven* drive bays it's *actually smaller than most five bay cases!* And this baby is built. We've even gone so far as to specify

ONLY \$2595

the steel to be 0.20mm thicker than the cases used by most of our competitors. Speaking of competitors, here's another important feature many of them don't offer: The UL® safety listing!

Important to you, and anyone else using your system, is the fact that every ZEOS system is *Underwriters Laboratories Listed*.

Not just the power supply. The entire system!

Many computer vendors don't even have the UL® safety listing.

We wonder why?

ZEOS systems carry the UL® seal because quality and safety are important to us. *You* are impor-

ONLY \$3095

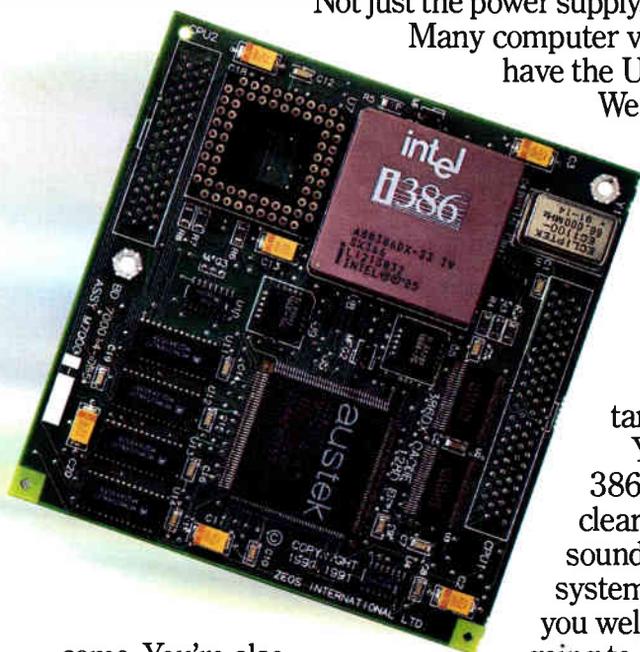
tant to us!

Your new ZEOS 386-33MHz system clearly represents a very sound investment. It's a system that will serve you well for a long time to going to appreciate your tages. Advantages like 24

come. You're also many other ZEOS advan-

Hour a Day Toll Free Technical Support, our 30 day Money Back guarantee, our warranties and much more (be sure to read the section entitled "*Why ZEOS is Your #1 Choice*").

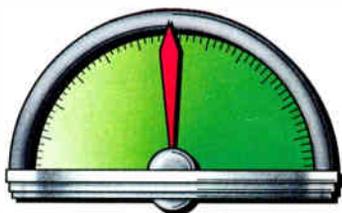
Consider performance and price, consider quality and service and support. Then choose from the systems here or let us add anything you wish from our huge list of available options. Whatever you select, it all comes down to this: The incredible ZEOS 386-33 is the *very best buy* for you. So why not give us a call right now! Your expert ZEOS Systems Consultant is waiting to give you a hand. *Call now Toll Free, 800-423-5891.*



486SX-2

This *definitely* is the real thing! Your own '486SX-20 starting from only \$1,595. If you want to move into the '486 world, this hot new ZEOS system may well be your entry point.

Equipped with it's built in 8K SRAM cache, just like it's bigger '486-33MHz brother, your new '486SX processor delivers dazzling performance at near '386 prices. Add our optional secondary 128K Turbo-Cache and hang on—you're going for the ride of your life!



Z•SPEED METER: ZEOS 486SX-20

If you're interested in owning '486 processing power this is a great place to start! Turbo Charge your 486SX even more with our 128K TurboCache upgrade for only \$200 more!

Racing with you is one of the most advanced system boards in the computer industry. Using the very latest in high integration surface mount technology

and advanced manufacturing techniques, these new systems are *very reliable* and *very expandable!*

ONLY \$1595

Plus with your new ZEOS 486SX-20 you are

able to change processors as your own computing requirements change. In fact, as you will see, ZEOS prepares you for the future like nobody else.

For instance, in addition to upgradable processors, we've placed the interfaces for your high speed IDE hard disk and floppy disks right on the motherboard! We've also placed the celebrated high speed ZEOS I/O board on the motherboard too. Now you have even more room to expand! Then we give you the *power* to expand as well.

Because your new ZEOS 486SX comes packing a full *300 watts* of power. We also are providing you with *eight expansion slots*; seven are open, one slot is for your high speed video card (with video standards



ONLY \$2195

0! \$1,595

changing quickly, we have elected not to put video on the motherboard). Now you have the power *and* you have the space to expand. So let's talk about quality.

Quality means dependable rock solid systems that last a long time. That's why every ZEOS case includes *two whisper quiet cooling fans*. We know that the cooler your system runs, the longer it will last. While we've provided you with plenty of slots and cooling we've also given you extra drive bays as well. In fact your new ZEOS case has *seven drive bays*, yet it's smaller than many 5 bay cases! Not only that, but every ZEOS system is UL® listed.

That's right! Your *entire* ZEOS system is Underwriters Laboratories listed (not just the power supply). Most of our competitor's systems are not UL® listed. A UL® listing says a lot about the *safety* of a product; we believe it says something about the quality as well.

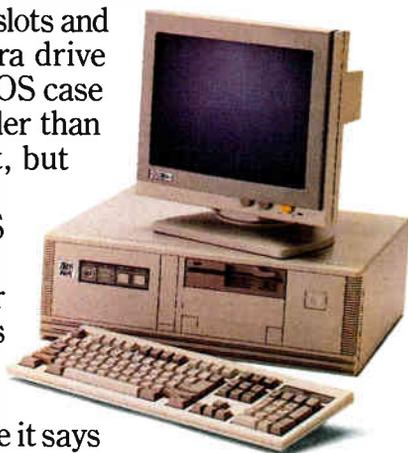
There are many reasons to buy your new ZEOS 486SX-20, not the least of which are Price, Performance and Quality.

Simple things make the difference too. Like *24 Hour a Day Toll Free Technical Support* and our 30 day Money Back guarantee (for even more ZEOS advantages be sure to see the section entitled "*Why ZEOS is Your #1 Choice!*").

Certainly, your decision to purchase the new ZEOS 486SX-20 is an easy one. You can select from any of the money saving packages shown here or add to them from our huge selection of options.

So why not give us a call right now! A friendly and knowledgeable ZEOS Systems Consultant is here to answer all your questions. *Call us now at 800-423-5891.*

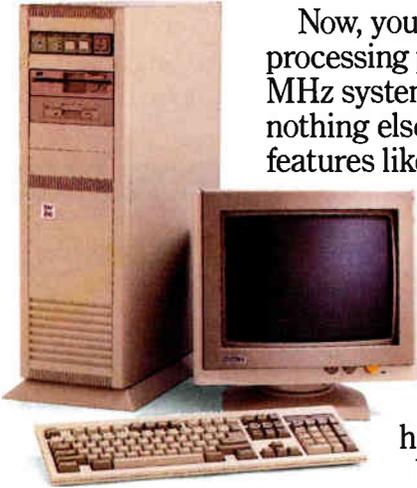
ONLY \$2695



ONLY \$3195



486-33!



Now, you can possess the *incredible* processing power of your own ZEOS 486-33 MHz system for as low as \$1795. There is nothing else like it. And with price and features like this, there probably won't be for quite some time!

There is no question about it. Your new ZEOS 486-33 delivers performance the others only dream about. Opt for the addition of a secondary 128K TurboCache and you'll hit *Hyperspace* and never look back! And if Hyperspace isn't enough, look a little further. You'll

For Vertical Systems add only \$150.

find ZEOS has harnessed technology like nobody else and you're the beneficiary.

Because inside your new ZEOS system rests the very latest advancements in surface mount, high integration technology.

ONLY \$1795

As an example, we have freed two normally occupied expansion slots. We accomplished this by placing our high speed IDE hard and floppy drive interfaces right on the main board. We put the high speed serial, parallel and games ports there too. The result?

Eight expansion slots, *seven* of which are available for your future use! After all, expansion and non-obsolescence are what these great ZEOS systems are all about. That's why we've built in some other very important expansion features for you as well.

Like our *300 watt* power supply. Providing you with all the pure clean power you'll need right now, your ZEOS 300 watt supply also provides you with plenty of power for later as well. Plenty of slots, plenty of power. How about space? This is where ZEOS has performed something akin to magic.

It's your new ZEOS SpaceSaver case! Complete with *seven drive bays*, this incredible case is actually *smaller* than many cases offering only five bays. And we didn't stop there. We've also added a *second whisper quiet cooling fan*. Why? Because whether you add more to your system or

not, the cooler it runs, the longer it will last. Now that's ZEOS *value*. Speaking of which. How about UL® listings?

ONLY \$2395



\$1,795

Right now every ZEOS system is UL® listed. This listing means your entire system (not just the power supply) has met the stringent safety requirements of Underwriters Laboratories. We believe UL® listings also say a lot about quality. And UL® safety listings are something many of our competitors simply don't (or can't) provide. At ZEOS quality and safety are important to us. *You* are important to us.

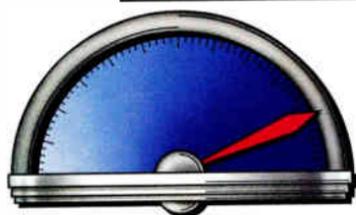
Price. Performance. Quality and Support. There are *many* reasons to buy your new ZEOS 486-33 system. Plus, your ZEOS advantages include *24 Hour a Day Toll Free Technical Support*, our *30 Day Money Back Guarantee* and ironclad warranties, just to name a few (for more ZEOS advantages see the section entitled "*Why ZEOS is Your #1 Choice!*"). You simply can't go wrong!

And, selecting the new ZEOS 486-33 system that best fits your needs is easy. Choose from any of the money

saving packages shown here. Or let your friendly and knowledgeable ZEOS Systems Consultant help you *configure exactly what you want* from our huge selection of upgrades and options. Whatever you select, one thing is for certain.

Buying your new ZEOS 486-33 is perhaps the best purchase decision you'll ever make! So why not pick up the phone and give us a call right now. Incredible ZEOS 486-33 power awaits you! *Call now Toll Free, 800-423-5891.*

ONLY \$2895



Z•SPEED METER: ZEOS 486-33

Top of the charts!

Chances are you've never seen speed like this before. Throw in the afterburners with our 128K secondary TurboCache at only \$200 additional.



ONLY \$3395

Pick Your Package Or Let Us Custom Build to

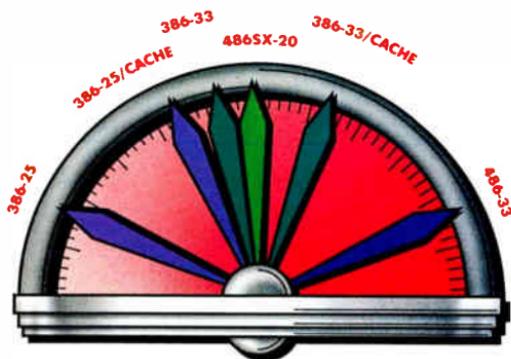
Now, ZEOS lets you pick the power you want for the price you want to pay! And with your new ZEOS modular system, the computer that's right for you today is also the computer that's right for you tomorrow.

You can start by picking the power you need right now. To help you out, we've designed the Z-Speed Meter. You can use the "Z-Meter" to compare the relative performance of each of the processor modules available to you today.

In the future, you can upgrade to even more performance with a new '386 or '486 processor module. And that's only the start of your many ZEOS system advantages. But what more could there be than dazzling performance, incredible prices

and upgradability? From ZEOS there's lots more.

Because your new ZEOS system is not only fast, it's absolutely *loaded with features*. Like our 300 watt power supply, eight expansion slots, twin cooling fans (for even more reliability) and our unique seven bay SpaceSaver case. And, *every ZEOS system is UL® listed.*



Z•SPEED METER

Let the "Z-Meter" help you pick the processing power that's right for you. The comparisons are easy to make. *Fast, Faster or Fastest!*

Power, & Price!

Your Exact Specifications.

TAKE YOUR PICK!

	Pkg. #1	Pkg. #2	Pkg. #3	Pkg. #4
386-25	\$1395	\$1995	\$2495	\$2995
386-33	\$1495	\$2095	\$2595	\$3095
486SX-20	\$1595	\$2195	\$2695	\$3195
486-33	\$1795	\$2395	\$2895	\$3395

Add \$200 to any price for a 128K cache.

We think you'll agree, a UL® listing says something not only about safety, but about quality as well!

In addition to all of these standard ZEOS advantages, you're also receiving our legendary ZEOS Technical Support, *24 Hours a Day, 365 Days a Year*. Plus, our 30 day Absolute Satisfaction Money Back Guarantee and more!

So pick your Power, and your Price then give us a call! Your expert ZEOS Systems Consultant is ready to answer any questions you may have. *Why not give us a call right now Toll Free at 800-423-5891.*

Purchase orders subject to approval. All prices and specifications are subject to change without notice. Please call to confirm pricing, specification and warranty details. Microsoft and Windows are trademarks of Microsoft Corporation. Z-Card, SpaceSaver and ZEOS are trademarks of ZEOS International, Ltd., 530 5th Avenue, N.W., St. Paul, MN 55112 USA © 1991.

INCREDIBLE ZEOS PACKAGE #3

Add even more memory, a larger drive. And more Savings! You now receive:

- 4 full Megabytes of Ultra High Speed 53ns DRAM.
- Our fast 130MB IDE hard drive with built in cache.
- Both Teac® floppies, the 1.2MB and 1.44!
- Your Diamond VGA Plus card with 1MB DRAM.
- ZEOS 14" High Res 1024 x 768 VGA Color Monitor with Tilt & Swivel Base.
- Plus, Microsoft® DOS, Windows and Mouse!

PACKAGE #3

THE ULTIMATE ZEOS PACKAGE #4

Now, Memory goes to 8MB and the drive to 210MB. The ultimate Power User's Dream Machine!

- 8 full Megabytes of High Speed 53ns DRAM.
- Your screaming 210MB IDE hard drive with its own built-in cache.
- Both Teac® floppies, the 1.2MB and 1.44!
- The Diamond Plus VGA color card with 1MB DRAM.
- ZEOS 14" High Res 1024 x 768 VGA Color Monitor with Tilt & Swivel Base.
- Plus, Microsoft® DOS, Windows and Mouse!

PACKAGE #4

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800-423-5891**

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Open 24 Hours a Day,
365 Days a Year!



10 Good Reasons To Buy From ZEOS®

Reason #1

"Overall Excellence"

As *PC Magazine* said "Price is always a consideration. So are benchmark test results. But both factors can be deceiving, which is why we consider them in the context of other aspects that will make the difference months and years down the road."

These are the attributes which *PC Magazine* used in awarding ZEOS the coveted Editor's Choice, not once but *eight* times. And "Overall Excellence" are the very words *PC Magazine* used in describing ZEOS systems comparing them to all others.

Reason #2

Dazzling Performance.

In one recent '386 review, *PC Magazine* awarded ZEOS Editor's Choice. "The ZEOS '386 blows away every other computer... a smart choice" is what they said. And in another recent review, *Government Computer News* said the ZEOS 33MHz '386 is "arguably the fastest MS-DOS and OS/2 micro in the world!"

Dazzling Performance is built into every ZEOS system. It's a key component of ZEOS Overall Excellence.

Reason #3

Exceptional Quality.

PC Resource Magazine put it this way, "ZEOS... provides quality comparable with IBM or Compaq and does so for about 70% of the price." ZEOS uses only the very best components. And every system is fully tested and burned-in right in our own labs.

Reason #4

Value.

InfoWorld says, "We find the ZEOS '386 an excellent value. Speed:

24 HOURS!
ZEOS is Open
24 Hours a Day,
365 Days a Year!
Toll Free!

Excellent. Compatibility: Excellent. Value: Excellent!" *Personal Computing* said, "ZEOS... is the best value we've come across... its performance is right up there with the slickest, most expensive PCs you can buy."

Reason #5

Warranties and Guarantees.

ZEOS believes in its products. That's why we offer each and every customer our 30 Day Absolute Satisfaction Money Back Guarantee, no questions asked. Plus, our One Full Year Limited Warranty and Express Parts Replacement Policy. Optional On Site Service is available too. Call for details.

Reason #6

24 Hour Toll Free Technical and Sales Support.

At ZEOS, the customer is #1. That's why we invented 24 Hour a Day Tech Support. For *your* convenience. If you buy a product from us we feel we should be there to help, any time of the day or night. Give us a call Toll Free! 800-423-5891. Anytime!

Reason #7

Experience.

Almost unique in the mail order computer industry, ZEOS maintains its own chip level Research and Development staff. In addition to Systems Manufacturing, we also operate our own Board Level Manufacturing facility.

ZEOS has been involved in Research and Development since our incorporation back in 1981. Our strong and experienced Research, Manufacturing and Technical Staff translates into superior factory direct computer systems for you.

Reason #8

A Sterling Reputation.

In magazine after magazine and review after review ZEOS systems are cited for Overall Excellence, for Excellent Value, as the Right Choice and so on. All of this is flattering but the most important thing is this: What do our customers think? Frankly, they love us. The systems and the support. That means more to us than anything.

Reason #9

Easy to Buy.

ZEOS systems are easy to buy. You can pick up the phone any time of the day or night and order your new ZEOS computer. And we accept MasterCard, Visa, Discover, American Express, and Corporate Purchase Orders from Fortune 1000 Companies, Colleges, Universities and Governments. Complete Leasing Programs are available as well.

And now the Z-CARD! It's your very own ZEOS Credit Card and you can apply today. With the Z-CARD you can charge your ZEOS purchases and pay in easy monthly installments. It's just like a Bank Card. Why not apply for your Z-CARD now!

Reason #10

You're Going to be Very Satisfied.

When it comes right down to it, you're going to be very satisfied with your new ZEOS system. Our goal is your complete satisfaction. And that's our commitment to you. To quality. To performance. To reliability and support. To *Value*. We don't just say it, *we Guarantee it!*

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day, 365 Days a year.

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NEWS

MICROBYTES

Apple and IBM Plot Portable Possibilities

It could be the most significant partnership since IBM got together with Microsoft. Or it could be yet another alliance that yields sound and fury and ink but little else. Although generally agreeing that the proposed technology-sharing agreement between Apple Computer and IBM could have awesome consequences, industry insiders are taking a wait-and-see approach.

By joining forces with IBM, Apple hopes to place itself squarely in what one Apple executive called "the mainstream." Each area of the tentative agreement offers Apple an opportunity to join or help establish an industry standard. A big partner like IBM would also give Apple someone to share the high costs of R&D and innovation. IBM could gain access to Apple's wealth of expertise in system software, graphical interfaces, digital media, and interapplication communications.

Apple says that it will integrate the Mac into IBM's Systems Application Architecture (SAA), which is IBM's environment for corporate computing. Apple will combine its A/UX with AIX, IBM's version of Unix. In A/UX, Apple has "a standard operating system, but it runs on the 68000," said Roger Heinen, vice president and general manager of Apple's Macintosh software architecture division. "There is a motivation to get it into the mainstream." IBM said that it plans to offer a version of the Mac interface on top of AIX.

Apple has been working for three years on a new object-oriented operating system, code-named Pink. The company would like to see this successor to the Mac OS become an industry standard. According to Ed Birss, Apple's manager of object-based systems, "We chose IBM because we always believed that in order to launch a new platform, to get industry acceptance, you need more than one company. We have been out looking to see the best one to help us get that industry acceptance."

Pink, the germ of Apple's next-century operating system, will have object-oriented structures implemented deeply into its architecture, according to

TERMS OF THE APPLE/IBM AGREEMENT

The Apple/IBM technology-sharing agreement consists of four "areas of general understanding," which are listed here in order of their probable appearance as products. The agreement concerns only these "specific technologies," according to Jim Groff, marketing director in Apple's Enterprise Systems Division. Beyond the listed areas, Apple and IBM "remain fierce competitors," he said.

Integration of the Mac into IBM's enterprise systems. Networking and communications products to extend operation of the Mac in the IBM client/server environment. Joint development of a combined Apple/IBM Posix-compatible version of Unix, consisting of the Mac interface and IBM's AIX operating system.

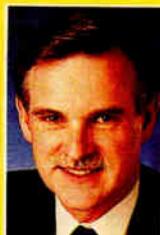
Future RISC-based Macs using a single-chip implementation of IBM's RISC System/6000 chip set. Single-chip implementation of the RISC System/6000, to be called Power PC, will be manufactured by Motorola. Apple and IBM will use the Power PC microprocessors in workstations and file servers.

Common work on data standards for multimedia. Apple and IBM to create and license "platform-independent software environments" for multimedia. The technology "will be made available for use on other vendors' products."

A joint venture to produce a new, object-oriented operating system. Apple's Pink scalable operating system will run on major industry platforms, including Intel 80x86, Motorola 680x0, and IBM's RISC System/6000 Power PC architecture. The system will be offered for sale to run on IBM and Apple computers and "will be marketed widely by the new company for use on other vendors' systems."

NANOBYTES

Intel plans to start sampling its 100-MHz version of the 486 CPU early next year, general manager **David House** told a New York City audience recently. According to House, systems containing the chip should appear by mid-1992. For high performance at a lower price, Intel will introduce next year a new chip that House referred to only as a "486 derivative." House also spoke about the next generation of the Intel processor, which he called the **P5** (also known as the 586). The P5 will contain 3 million transistors and will incorporate mainframe features such as data integrity. It will use a superscalar RISC technology, have expanded capabilities for multiprocessing applications, and be fully compatible with existing 386/486 software, he said. □



You won't have **Ashton-Tate** to kick around anymore. But **dBase** will survive, **Borland** officials promised after announcing a deal to buy up its database competitor, the beleaguered **Ashton-Tate**. "We intend to protect customer investments in each company's products, including **dBase** and **Paradox**," **Borland** chairman **Philippe Kahn** said. Kahn said that Borland plans to continue its **DOS** and **Windows** focus with **Paradox**, **dBase**, languages, and **Quattro**, while aiming **Ashton-Tate's Interbase** server at higher environments such as 32-bit **OS/2**, **Unix**, and **VMS**. □



Heinen. It will be portable and designed to run on multiple processors, including the Intel 80x86, Motorola 680x0, and IBM Power PC, derived from the RISC System/6000 chip set.

According to Birss, the new platform has been designed "up front for portability." Written in C++ (with some assembly for tuning), the new OS will be portable with "less code rewriting than Unix," Birss said. The platform will interoperate with the existing Mac OS, the proposed Apple/IBM AIX, and OS/2 2.0. Interoperability may be accomplished through emulations, but "existing programs will run," Birss added. IBM, although scant with details, has confirmed that applications running on the Mac, AIX, and OS/2 will somehow work in this new environment.

Metaphor Computer Systems, now a part of IBM, will work on this new operating platform, although its role isn't clear yet. Metaphor had been working with IBM on the Constellation Project, another portable, object-oriented platform. That project will be rolled into the Pink project.

In the near term, Apple will continue to advance the Mac, Heinen said. The Mac OS will run on the new IBM Power PC architecture, to be priced in the range of \$1000 to \$3000. It will have improved networking, memory management, and security features, he said.

As for the new chips to be derived from the RISC System/6000 chip set, IBM said that it will develop several models; one for notebook-size computers, one for more powerful desktop PCs and low-end workstations, and one for big servers and midsize workstations.

The first products that are likely to spring out of this partnership are those that will let the Mac operate in "the IBM enterprise environment." Such integra-

tion could take place in two areas: integrating Macs with mainframes and with IBM PCs in a network, said Tom Pin- cence, product manager of micro-to-mainframe products for Avatar.

"My assumption would be that 'the enterprise environment' could imply, certainly, Token Ring connectivity, since that seems to be the stated direction for connecting IBM systems," said Tom Lenahan, senior product manager for Mac products at Digital Communications Associates. "On the software side, I would think that we would see probably a closer integration with things like APPC [Advanced Peer-to-Peer Communications] and APPN [Advanced Peer-to-Peer Networking], and some of the stated technologies in SAA as well," he added. IBM might take advantage of some Apple technologies, said Steve Nelson, director of product marketing for Novell's Macintosh product line, "like the way Apple-Talk automatically comes up and finds its address; they could graft that to SNA [IBM's Systems Network Architecture], or develop separate utilities."

Meanwhile, the industry waits for more details to shake out. Skeptics say this alliance—part business, part politics, and part technology—will never work, because you can't mix pinstripes with T-shirts. According to a Microsoft spokesperson, the company's chairman Bill Gates asked, "How are they going to make money?" As other companies were quick to point out, Microsoft representative Claire Lematta said, "Customers won't see anything [from Apple/IBM] for a long time."

For now, life goes on, and most vendors and users don't need to worry about another operating system or new RISC chips. Anyone trying to look further down the road will see just a purple haze.

—Ellen Ullman and Sharon Fisher

Borland Shows Off dBase Compiler, Paradox for Windows

After announcing their plans to acquire dBase rival Ashton-Tate, Borland officials gave a preview of two new products that illuminate users as to the company's database plans: an object-oriented dBase-compatible compiler and a new Paradox. Both run under Microsoft Windows.

The database product, Object dBase (also called Turbo Xbase), looks like a combination of Paradox, Ashton-Tate's dBase IV, and Borland's Turbo Pascal

for Windows. According to Borland officials, it will be compatible with almost all dBase III+ and IV commands and will run dBase programs both as an interpreter/debugger and as a compiler.

Object dBase will use the same integrated development environment as Borland's Turbo Pascal for Windows.

Both Object dBase and Paradox for Windows make extensive use of object-oriented design. This will let both products access dBase and Paradox files, as

NANOBYTES

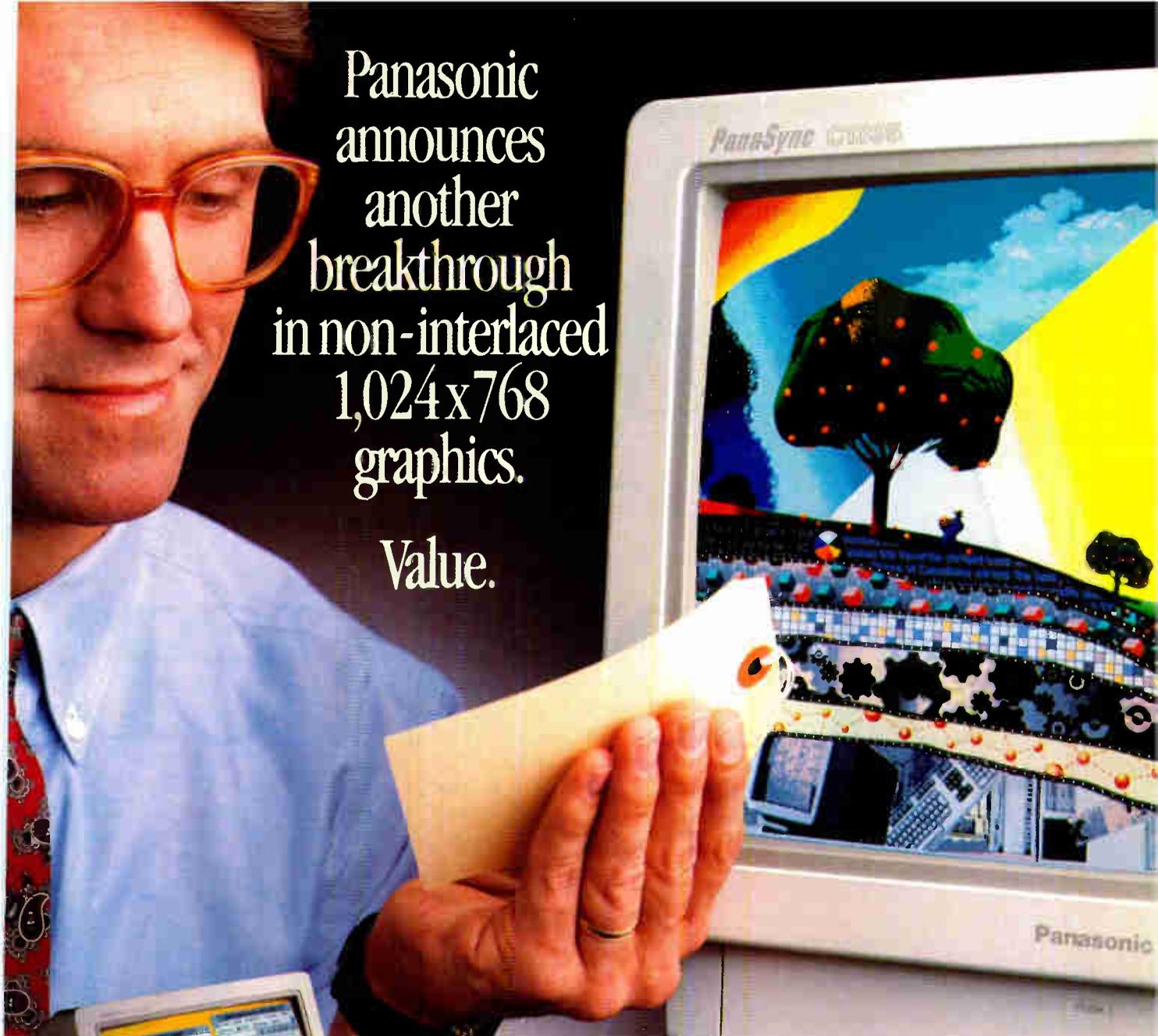
The most common reaction to the Borland buy-up of Ashton-Tate was **astonishment at the price tag** of \$440 million. Lotus senior vice president **Frank King** said that he was "surprised at the price Borland paid for technology that wasn't very modern," especially considering that Borland has its own dBase package. □

Seagate (Scotts Valley, CA) is readying a 3½-inch SCSI hard disk drive with an unformatted capacity of 1.2 gigabytes. The newest drive in the Wren line will be fast, with an average seek time of 12 ms, a spokesperson said. OEM pricing is \$1895. Evaluation units are slated for this quarter. □

Personal computers, cable TV, and other forms of electronic delivery are taking us to the point where the amount of information coming into our lives is overwhelming. One way to manage the data deluge is to use **intelligent information channels**, said Chips & Technologies' CEO **Gordon Campbell**. A computer embedded in every information appliance would control these channels, he said. With the migration of video into the personal computer, Campbell said, "the PC architecture will become the manager of that information." Campbell's talk at the recent Silicon Valley Personal Computer Design Conference focused on the single-chip PC, which he said will arrive this year. □



Computer equipment accounted for only 0.8 percent of the U.S. Gross National Product last year, according to analysts at **DRI/McGraw-Hill** (Lexington, MA). Among their other findings: Since 1986, prices in the computer industry have registered an average compound decline of 9.6 percent, compared with an average price rise of 4 percent per year for other sectors of the economy. □



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IBM also has new ways to improve PS/2 performance, like a new, faster, more user-friendly DOS 5.0 that requires less memory, yet offers more advanced functions*. The new PS/2 3.5" Rewritable Optical Drive utilizes the latest magneto-optical technology, and the new Model 8504 12" monochrome display lets you view it all with amazing clarity.

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well as spreadsheet files, Structured Query Language databases, and many other kinds of files.

Each element of the user interface will behave as an object. Working with the Property Inspector, you can change various aspects of an object, such as color, position, and font. You will also be able to attach a "method" to an object (e.g., modify a data field so that every time the mouse passes over it, the computer would display a small dialog box).

Both products also make use of Borland's new Resource Workshop, a tool

for creating and modifying Windows features such as icons, bit maps, buttons, and so forth. You can use the Resource Workshop to create dialog boxes or buttons for use with Paradox or Object dBase applications, or to modify features in existing applications.

Borland officials would not say when the new Windows products might be available or how much they might cost. But they were quick to point out that Borland will continue to support current dBase and Paradox products.

—Rich Malloy

50-MHz 486: External Cache the Big Win

Intel (Santa Clara, CA) has raised the speed limit to 50 MHz with the newest version of its 486 chip. But the more significant enhancement is a companion external cache module. Since the first 486 system was on the drawing boards, system designers have either had to settle for the 486's 8-KB internal cache or spend time and money adding a bigger, external cache.

The external cache module, which Intel officials say is necessary for the chip to perform up to its potential, can be made to run synchronously or asynchronously. This lets manufacturers design computers in which the systemwide bus runs at a slower speed than the processor bus itself, saving money on the overall design, without affecting the CPU performance within the module; for example, a vendor could build a PC around a current 25-MHz 486 motherboard modified only slightly to take the CPU module. The CPU would still operate at 50 MHz once the data was fed to it from the slower system bus at 25 MHz.

The cache module has been designed with multiprocessing systems in mind. It also uses a write-back cache, where data in the cache is not written to memory until it needs to be removed from the cache or until another part of the system requests it.

The new processor has the same logical design as its slower siblings but shows many changes in layout. Intel is manufacturing the chip using the 0.8-micron, three-level metal, CHMOS-V process that it uses to fabricate the 50-MHz 860 RISC processor.

While Intel's most favored customers expect to have their 50-MHz products out the door soon—IBM with its upgrade card for PS/2s and Compaq with a new Deskpro—other manufacturers say that they probably won't have enough of the high-speed chips to ship their new systems until the end of the year. The 50-MHz 486 is priced at \$665 in OEM quantities of 1000. In a module with a 256-KB cache, it costs \$1314.

—Owen Linderholm

Sun Aims to Get Unix Applications Talking to Each Other

SunSoft, the new Sun Microsystems software subsidiary (based in Mountain View, CA), is working on components that will bring interapplication communications to Unix. ToolTalk, a messaging service for Unix applications, will be the first component in what SunSoft says will be a comprehensive new software environment to be unwrapped later this year.

Similar in outline to interapplications communications offered in Windows 3.0 and Mac System 7.0, ToolTalk is apparently more flexible and more powerful

than the Microsoft and Apple offerings. ToolTalk works over networks. It offers both a generalized message service, for horizontal integration of applications, and an application-specific mechanism, for vertical integration among a set of cooperating applications. Applications will use the ToolTalk service by calling functions from the ToolTalk Application Programmatic Interface, a C-language set of function calls.

ToolTalk offers two type of interapplication communications: multicast messaging and object-oriented messaging.

continued

NANOBYTES

QMS (Mobile, AL) has just rolled out a PostScript laser printer that can generate images and text at 600 or 300 dpi. According to product manager Sarah Young, it's aimed primarily at people who need "good image quality," such as service bureaus and publishers using scanned images. The new QMS-PS 815, powered by a 68020, has serial, parallel, and LocalTalk connectors and can switch automatically from PostScript to Hewlett-Packard's PCL. Suggested list price is \$5495. □

Cirrus Logic (Milpitas, CA) has designed a new VGA controller chip specially for notebook computers. The CL-GD6410 is the smallest and least power-hungry VGA controller on the market, Cirrus Logic says. It allows a complete VGA subsystem to be constructed with only five ICs: a controller, two RAM D/A converters, a clock, and a RAM chip for frame acceleration. The VGA controller supports 256 colors, which are mapped in 64 shades of gray on an LCD panel, and can drive an LCD and external CRT simultaneously. □



Apple's apostle to the developer community is urging software designers to come up with low-price programs for buyers of the low-price Macintoshes and

to think in terms of portable code. Kirk Loevner, director of Apple's Developer Group, said at the MacHack get-together in Ann Arbor, Michigan, that programmers should work on low-cost, "modular" applications and look at mail-order distribution vehicles, like MacConnection, instead of the standard retail channel. Apple officials have been concerned about the Mac-to-package ratio. "Our market research has shown that most Macintoshes are sold with only one application, and those figures include HyperCard," Loevner said. □

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Memory Requirement	7.00	5.41	6.14
Ease of programming	6.48	5.86	6.26
Ability to manipulate data	7.31	6.71	7.00
Sorting capabilities	7.50	6.64	6.68
Provision for software security	6.96	5.25	5.10
Report writing capabilities	6.78	5.33	6.17
Ease of use of interface	7.45	6.19	6.77
Software integration capabilities	7.30	6.23	6.78
Ease of data retrieval	7.50	6.78	7.00
Satisfaction with product profitability	6.81	5.75	6.42
Overall quality of product	7.70	7.18	7.53
Provision for customer support	7.52	5.79	6.22
Charges for training time	6.43	5.60	5.71
Provision for technical support	7.34	5.55	5.95
Provision for marketing support	6.69	5.71	5.93
Documentation & product information	6.90	6.70	6.98
Frequency of updates & revisions	6.59	5.75	6.15
OVERALL AVERAGE	7.09	6.05	6.44

Recently, VARBUSINESS conducted a survey of some people who know more about spreadsheets than anyone.

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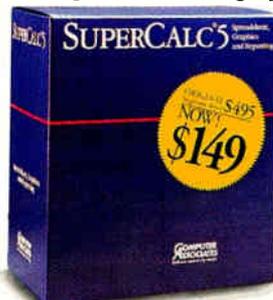
We're not surprised. While Lotus and Microsoft have been fussing over their many different spread-

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Multicast messaging is designed for interoperability among self-contained, independent applications. An application registers with ToolTalk the types of messages it is interested in receiving. The receiving application describes the attributes of pertinent messages, while the sending application simply issues the message to ToolTalk. ToolTalk passes messages on to interested applications by matching message attributes.

Object-oriented messaging is offered to provide a migration path toward distributed, object-oriented processing. Applications using ToolTalk may go on to use the Distributed Object Management Facility, recently described by Sun and Hewlett-Packard in their submission to the Object Management Group, a consortium working on object-oriented software standards.

In addition to a generalized, high-level message facility, ToolTalk can support more application-specific integration through its concept of "message scope." The tool recognizes both session and file

scoping. Within a session, a group of applications may agree on a set of messages that they send and receive, thereby creating a new "application" or "application framework" out of several processes running for an individual user. File scoping is designed for groupware, defining a set of users who have interest in a given file.

SunSoft demonstrated ToolTalk at the recent Design Automation Conference in San Francisco. Lotus, Cadence, Valid, Cadre Technologies, Interactive Development Environments, Saber Software, and Clarity Software all announced their support. ToolTalk will be available for SPARC and other platforms by the end of the year, SunSoft says; pricing hasn't yet been determined.

A robust component platform may invigorate Unix development efforts. With support ranging from Lotus to Cadence, SunSoft may help feed what one industry analyst calls "the application-starved Unix world."

—Ellen Ullman

Multichip Module Means Faster Cycling, Even in PCs

In a development that could bring faster processing to workstations and desktop computers, IBM has revealed a new module that squeezes multiple chips and connections into a small package. Company researchers, who disclosed the development at a conference in Yasu, Japan, said that the thin-film multichip module promises performance gains by reducing a big bottleneck: the distance signals have to travel between chips.

While multichip modules are common in mainframes, the technology has not shrunk to the point that it is practical in personal computers. But IBM researchers say that their prototype device—which can hold up to nine chips and hundreds of feet of connecting wire—measures only 2 inches square. IBM researchers say that the module is made up

of eight layers, alternating aluminum wiring and polyimide insulator.

Packaging density determines the interconnect distances and, thus, the speed of signal propagation between ICs. Faster signal propagation speed means faster cycle times for microprocessors and faster data transfer between processors and memory. The IBM device will enable workstation designers to more than double the speed and number of operations per cycle of the computer's internal clock, the researchers claimed.

IBM officials demonstrated the module in a version of a RISC System/6000 workstation. The wiring density on the prototype board is about 25 times denser than that of the RISC System/6000 board, IBM said.

—D. Barker

At Taipei Show, It Was Notebooks, Notebooks

Notebook computers were the main starring attraction at the recent Computex show in Taipei, Taiwan. More than 100 vendors had notebooks on display, indicating a possible flood of lightweight, low-price PCs into the U.S. and Europe.

Most of the new systems, from compa-

nies such as Mitac, Aquarius Systems, King Phoenix, and Long Shine Electronics, are remarkably similar. They are built around a 386SX CPU with 2 MB of RAM and either a 30- or a 40-MB hard disk drive. There isn't much innovation to separate competing models. In fact, after walking the aisles of the show, I

NANOBYTES

While leading laptop maker Toshiba said that it is lowering its production of systems, Matsushita Electric says it is raising its output. Matsushita, which sells PCs under several brand names, including Panasonic, announced it will jump production from 20,000 units to 27,000 units per month. Of that figure, about 70 percent will be portables. About half will be marked for sale in the U.S., the company said. The company builds systems in Taiwan and the U.S. Toshiba Information Systems, which builds PCs in California, said that it is cutting production down to about 20,000 units per month. □

IBM has started marketing two products from Lotus Development: Lotus Notes, software designed for workgroups, and cc:Mail, a leading E-mail package. IBM said that it will work with Lotus to incorporate parts of Notes and cc:Mail into its OfficeVision products. According to IBM, OfficeVision will allow Notes to have better access to mainframe data. In addition, the two companies have to incorporate "key elements of Notes technology" in upcoming versions of 32-bit OS/2. □

IBM has licensed Borland's ObjectVision forms development tool. ObjectVision for OS/2 2.0 will be available simultaneously with the release of the new operating system, probably in the fourth quarter of this year, according to IBM. IBM will make Borland's ObjectVision "widely available" when the new version of the operating system is shipped. According to IBM vice president Joseph Guglielmi, the company is committed to distributing the Borland product, but the exact nature of the distribution arrangement will be decided when IBM sees the finished program. ObjectVision for OS/2 2.0 will be the first application that will "sing the specific tunes that only OS/2 can understand," said Borland CEO Philippe Kahn. □

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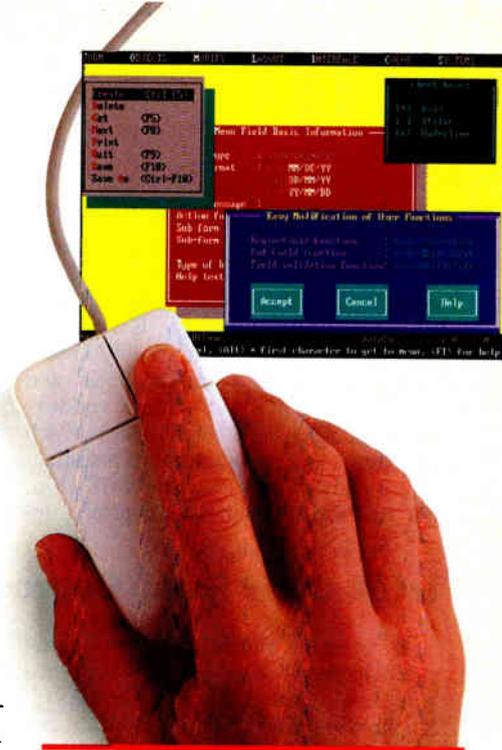
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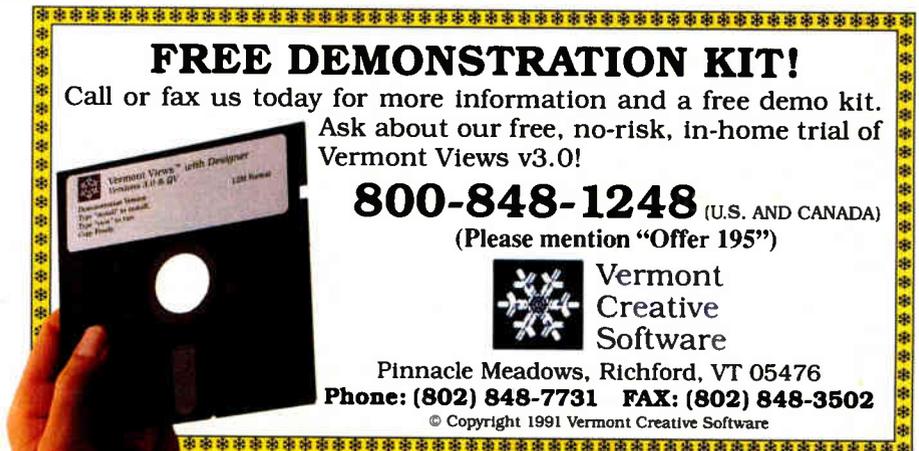
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found that they all began to look alike.

A few companies showed notebook systems based on Intel's new 386SL chip, including Veridata, Twinhead, Sampo, and Tatum. Noticeably absent were systems using Intel's 486SX and AMD's 40-MHz 386. Some vendors were asking visitors at the show which chip they should adopt. Several manufacturers said that they favor the AMD chip, but that's primarily due to price. Be-

cause of Intel's allocation policies, they have to buy chips on the gray market, where the price is higher; as a result, the Intel parts cost more.

Most of the notebook exhibitors were trying to make deals with U.S. and European OEM customers. The competition is so stiff, though, that some of the Taiwanese companies may try selling directly to consumers.

—Dennis Allen

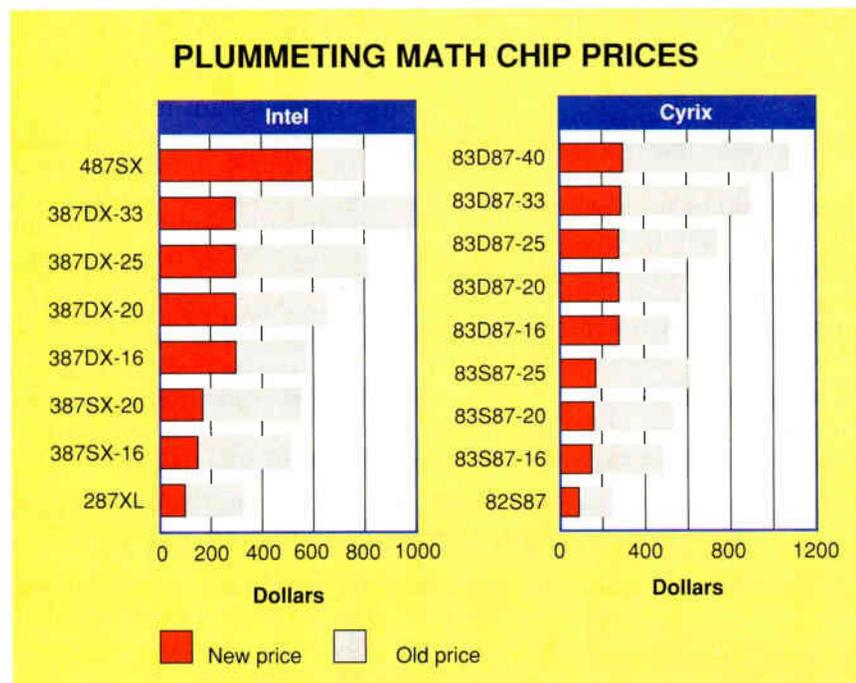
Intel, Cyrix Slash Coprocessor Prices

In separate but related moves that could boost sales of math coprocessors, Intel (Santa Clara, CA) and Cyrix (Richardson, TX) have both made drastic cuts in the prices of their lines of math chips. Intel, admitting that coprocessor prices are perceived as inordinately high, cut prices by as much as two-thirds, with the most notable change being the 33-MHz 387: its price toppled from a towering \$994 to \$299.

Coprocessor competitor Cyrix, which is also battling Intel with a federal an-

trust suit, responded to the Intel news with big price cuts to its FasMath line. "We decided we would maintain our price/performance over Intel," a spokesperson told BYTE. In several cases, Cyrix has undercut Intel by about \$10. The FasMath version of the 33-MHz 387, for example, is now \$289, down from \$894. Cyrix even undercut AMD's 287 (\$99) by pricing its 82S87 at \$89, 10 bucks less than Intel's newly reduced model.

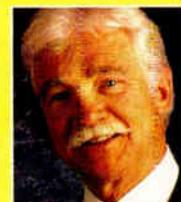
—D. Barker



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Advanced Micro Devices (Austin, TX) has vowed to keep its 25-MHz 386SX chip priced competi-



tively with Intel's 20-MHz part. "We intend to reintroduce normal semiconductor learning-curve pricing for microprocessors

used in IBM-compatible personal computers," said AMD chairman W. J. Sanders III. Intel's recent price cuts put its \$88 SX a buck below AMD's, but the folks in Austin are promising a 30 percent price cut within the next year. "By this time next year, the price will be about \$62," an AMD official told BYTE. □

FutureSoft (Houston) says that it is developing pen-based applications to run on NCR's new 3125 notepad computer, which will work with either Go's PenPoint or Microsoft's PenWindows operating system. FutureSoft vice president Spike Tinsley said that his company's programs will run under Microsoft's pen-based environment. The new programs are DynaComm/Elite, for 3270 SNA communications, and DynaComm Asynchronous, for remote-asynchronous computing. □

RenderMan Meets Mickey: Pixar (Redwood City, CA), the Academy Award-winning animator and graphics software company, has been selected by Walt Disney Studios to produce a feature-length animated film. The film will be developed and generated using computers and, presumably, Pixar's rendering software. Pixar animator John Lasseter will write and direct. A Pixar spokesperson confirmed the project but was less forthcoming when asked about the subject of the upcoming film and the hardware that will be used to produce it (Macs? Suns? Nexts?). "Let's just say that people who know Pixar's work [like the Oscar-winning short film *Tin Toy*] will know what to expect," she said. ■



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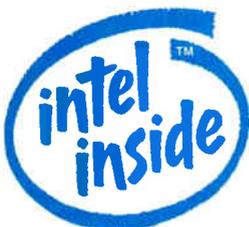
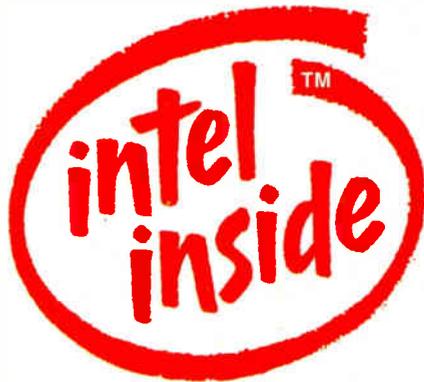
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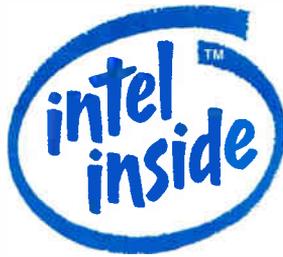
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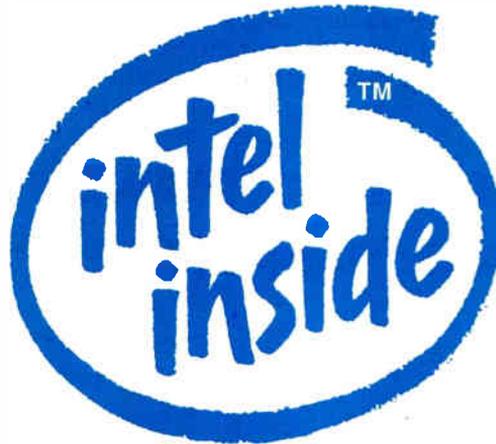


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World Radio History

Repairing the Cracks in Windows

STAN MIASTKOWSKI

A prerelease version of Windows 3.1 discloses new features and speedy performance

are much-needed fixes; some are surprising. One caveat: The forthcoming release version of Windows 3.1 will differ from this early version, so consider the following description a glimpse of what's likely but is still written on water.

Some new changes were immediately apparent. Besides cranking up much faster than in Windows 3.0 (more on that later), the start-up Program Manager

Windows 3.0 is still taking knocks for its performance on some systems, but Microsoft hopes to remedy that with its next version. And, indeed, the early beta copy of Windows 3.1 that I've been working with indicates that the GUI is going to be much zippier.

The package is a substantial step forward from Windows 3.0, adding a host of features and capabilities (see the box).

screen (see screen 1) has a new look, with more colorful and detailed icons. Other minor changes are noticeable in the Control Panel, which includes new port-setting abilities, a built-in multiple-choice screen saver, and more ways to customize the desktop look and feel.

Finally Managing Files

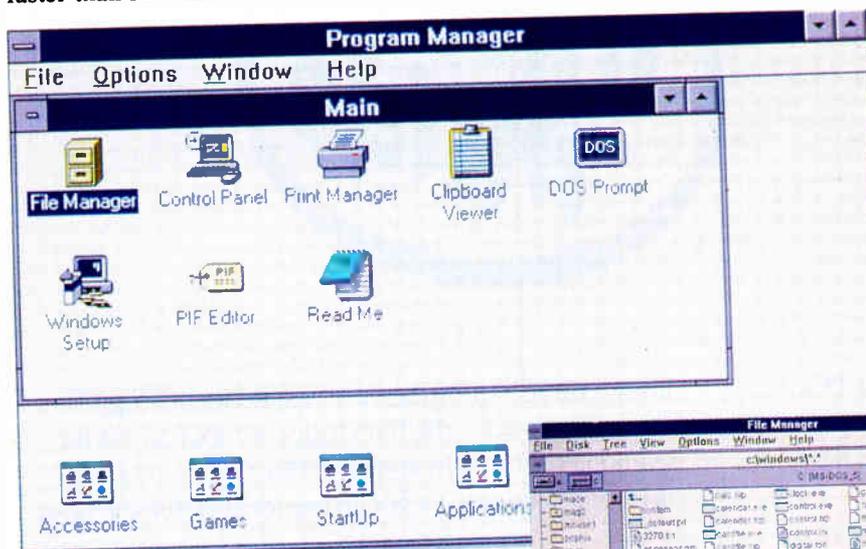
One of the most criticized aspects of Windows 3.0 is its File Manager—and with good reason. It lacks all but the most basic abilities to display and work with files. Its shortcomings have led to a major market in Windows add-ons (see the First Impression of Symantec's Norton Desktop for Windows on page 50). When they have to work with files, many users simply prefer to exit Windows.

That situation will change in version 3.1, which has a drastically improved File Manager (see screen 2). Its most useful feature is the ability to view more than one directory at a time, at the same time viewing trees, icons, file details, or any combination. It also presents much more information on disk space usage, availability, labels, and network connections.

Be True to Your Type

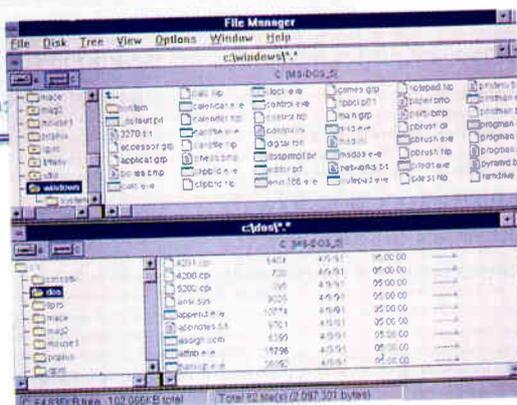
Because it has been talked about so widely by Microsoft officials, one not-surprising feature of Windows 3.1 is the inclusion of TrueType. This is the intelligent outline font technology developed by Apple and included in that company's recently released System 7.0.

TrueType creates screen and printer fonts for true WYSIWYG in Windows. According to a Microsoft document that came with the Windows 3.1 beta copy, the final version will include 13 TrueType fonts.



Screen 1: The Windows 3.1 start-up screen will have some subtle differences from the familiar Windows 3.0 screen, but it will pop up much more quickly.

Screen 2: Windows 3.1's File Manager will be a giant step forward from its predecessor, letting you view multiple directories and enhanced file information.



What's the Object?

Microsoft's Object Linking and Embedding technology is a major step forward in Windows 3.1. OLE, which is similar to Hewlett-Packard's NewWave and Apple's Publish/Subscribe in System 7.0, is essentially a mechanism for incorporating different forms of data (e.g., graphs, databases, and spreadsheet files) in a document. OLE will result in docu-

WINDOWS 3.1 ADDITIONS

Microsoft has added many features and capabilities to Windows 3.1.

Technology Enhancements

- Speed improvements
- FastDisk hard disk driver bypasses DOS and BIOS
- Fewer unrecoverable applications errors
- TrueType fonts
- Object Linking and Embedding
- Pen Windows support
- Laptop power management and LCD/plasma support
- ROMable code
- Support for more than 16 MB of RAM
- Improved laser printer drivers

Program Manager

- More customizable colors
- Screen saver
- Start-up group automatically runs applications
- Advanced COM-port settings
- Easier printer driver installation

File Manager

- More than one directory at a time can be viewed
- More information on files and directories
- Enhanced disk formatting
- File Properties command
- Configuration fonts
- Enhanced associate file features
- File filter
- Connect/disconnect network drives
- "Drag and Drop" prints files

Network Improvements

- Persistent network connections
- Improved file-sharing facilities
- Network administrator features
- Support for OS/2 long filenames on LAN Manager servers
- Customizable menu item disabling
- Read-only file support

ments that are truly greater than the sum of their parts.

Currently, if you want to include an imported element in a document, you normally use the Clipboard. And if the data changes, you have to go back and bring in the new data. With OLE, changing the source data will automatically change the

elements in the final document. And clicking on the elements in a document will take you directly into the associated application. In the Windows 3.1 beta copy, PC Paintbrush and Cardfile included OLE support.

OLE will be an important step forward, providing truly integrated applications and giving Windows some parity with the Macintosh in terms of communications between applications. Unfortunately, most existing applications are left behind because OLE support must be designed into them. But new versions of old favorites are likely to include OLE support soon.

Looking Behind the Curtain

What's hidden behind the GUI is perhaps what's most surprising about Windows 3.1. A frequent complaint about Windows 3.0 is its speed, or more specifically its lack of same when it's run on anything other than a 386- or 486-based system with oodles of RAM. That has changed drastically in Windows 3.1.

To try to get some sense of performance changes, I ran Windows 3.1 on a 16-MHz 386SX system, side by side with a 33-MHz 386 system running Windows 3.0. Both systems had fast-access (16-millisecond) Intelligent Drive Electronics hard disk drives. Almost without exception, Windows 3.1 was noticeably faster than version 3.0 on the faster machine.

Those Dreaded UAEs!

Also apparent in Windows 3.1 is substantial work on eliminating unrecoverable applications errors. The bane of all serious Windows 3.0 users, UAEs happen when applications pass unexpected parameters to Windows, or when (in a multitasking environment) different applications attempt to use the same memory at the same time.

Microsoft has been doing its homework on this problem. Even in this early beta form, Windows 3.1 hasn't shown a tendency to blow up.

Getting By DOS

Another feature promises even greater speed. FastDisk is a new concept for PC users. It's a virtual device driver that bypasses DOS and the BIOS to "talk" directly to the hard disk drive controller. This works in protected mode on 386 processors and intercepts all INT 13 hexa-

decimal (hard disk drive) BIOS calls.

Although FastDisk means enhanced disk speed, it also has a hidden major benefit: It lets you set up a virtual memory paging file. This adds the ability to run more non-Windows applications in the background and switch among them.

Walking a Fine Line

Although Windows 3.1 will be a distinct improvement over version 3.0, Microsoft will be criticized for not going further. For example, the File Manager is still missing lots of file and directory manipulation abilities. However, Microsoft cannot make Windows 3.1 all things to all people. There are two reasons for this. One is technical, and the other is that the company would open itself up to extensive criticism—not to mention further scrutiny by the Federal Trade Commission—if Windows 3.1 was so feature-packed that it put vendors of Windows add-ons out of business.

Windows 3.1 will quiet much of the criticism—most of it well deserved—aimed at Windows 3.0. It still won't be perfect, but it can't be. Current versions of Windows are saddled with the major disadvantage that they still consist of a very sophisticated shell wrapped around an old operating system that was never designed to handle such chores as full-fledged multitasking. It's a disadvantage that IBM is sure to exploit when it rolls out OS/2 2.0. On the other hand, the new features of Windows 3.1, coupled with an expected marketing blitz from Microsoft, are sure to draw even more users into the Windows fold. ■

Stan Miastkowski is BYTE's senior editor for new products. He can be reached on Bix as "stanm."

THE FACTS

Windows 3.1

Price and availability not known at press time.

Microsoft Corp.
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Redmond, WA 98052
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(206) 882-8080
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Unix Goes Indigo

BEN SMITH



interface to professional video systems with the live video option.

The Indigo is a completely new design, from the 14½- by 10- by 11-inch deep-blue case to the core of the new version of Iris, the SGI license of Unix. You don't need any tools to totally disassemble the machine. As with other SGI machines, the hard disk drives (in this case, 3½-inch 236- and 432-megabyte drives) can be exchanged without disassembling the system; they merely slide into three available bays behind the front access door and lock into position with the press of a lever. You can remove the entire front cover by pressing two latches at the top. A single thumbscrew closes the steel CPU and bus cage.

The CPU and graphics cards slide into the card cage with the aid of locking handles at the edge. The rear edge of the CPU card contains all the I/O ports: thick Ethernet, two RS-422 serial ports (38.4-kilobit-per-second with Macintosh-style connectors), and five audio I/O ports (i.e., microphone, headphones, analog in, analog out, and digital in and out).

The bidirectional Centronics parallel port and the SCSI connector are part of the backplane circuitry. The proprietary backplane and bus (GIO32) is synchronous and independently clocked for 33.3 MHz, providing 133-megabyte-per-second data transfer. The CPU board contains a 33-MHz Mips R3000A CPU and R3010 FPU with 32 kilobytes of instruction cache and data cache. The CPU board can handle from 8 MB to 96 MB of interleaved memory. A Motorola 56001 digital signal processor provides 16-bit audio processing.

The graphics card is unlike other SGI graphics hardware: It does *not* contain a dedicated geometry pipeline! Instead, all 3-D rendering operations are done with software in the main processor. This design simplifies the graphics board. The other radical simplification is that the standard Indigo graphics is 8-bit color. Most SGI applications assume 24-bit color. The apparent discrepancy is handled by the SGI REX chip, which creates dithered approximations of the 24-bit colors for 8-bit. The result is fast and cheap (see the BYTE logo in the screen shot).

The Overture

The innovations don't stop with the hardware. For the seasoned SGI user, the most obvious change is in the GUI: The old

The Silicon Graphics Indigo brings three dimensions to general computing

It's no longer just "lights, camera, action!" We now have sound and special effects. I'm not speaking of moviemaking; I'm talking about the Silicon Graphics, Inc. (SGI), entry into the cast of low-cost personal workstations, code name: Hollywood.

Now that the Hollywood has reached the public stage, it has taken on a new name, the Iris Indigo. Although small in stature, this distinctive system is not easily upstaged. It brings the power of the SGI graphics systems (see "Personal Iris: The Dream Maker," July 1990 BYTE) to the general computing, personal workstation budget. The basic stand-alone system costs \$9995 (a diskless system is \$7995). It is no longer necessary to justify an SGI workstation with a display-intensive application. The Indigo is designed (and priced) for ordinary office applications as much as for high-end three-dimensional graphics applications.

The Indigo will run the personal productivity applications (e.g., word processors and spreadsheets) that will be compliant with the Advanced Computing Environment RISC specification. But it will also run the multitude of existing "home-court" applications for animation, CAD/CAM/CAE, chemistry, and the geosciences. In addition, the Indigo comes with high-end data-analysis and visualization and excellent audiovisual generation and editing applications. You can

THE FACTS

Iris Indigo

(includes 8-bit color and a 16-inch color monitor)
 Diskless (with 8 MB of interleaved RAM): \$7995
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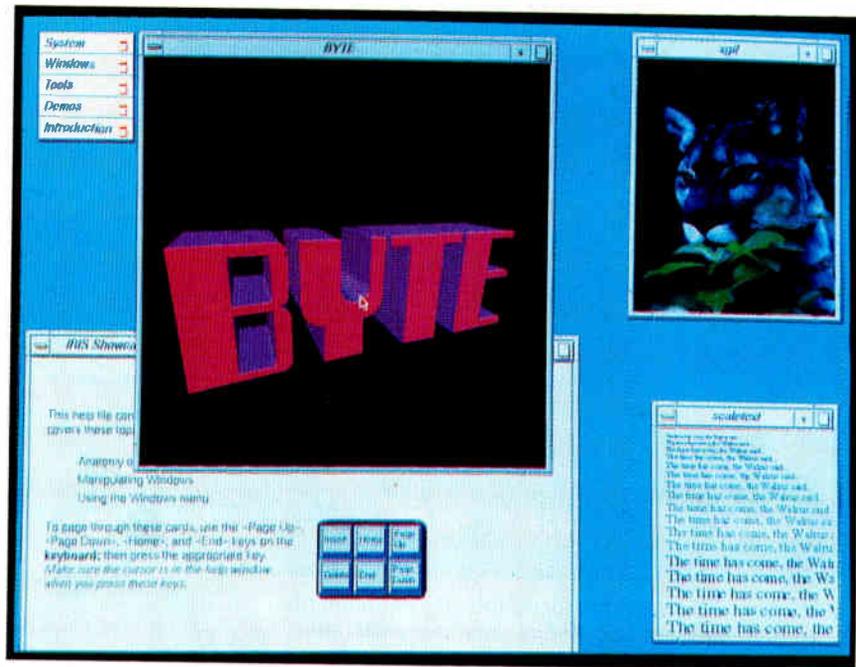
Silicon Graphics, Inc.
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 Mountain View, CA 94039
 (415) 960-1980
 fax: (415) 961-0595
 Circle 1270 on Inquiry Card.

News-based (PostScript) window manager has been dropped in favor of the OSF/Motif window manager, while still supporting Display PostScript and the SGI Iris graphics language.

This impressive feat of legerdemain is accomplished by a single display server that handles all three graphics protocols. Although not new to SGI systems, the three-way server has been vastly improved, and the emphasis is now on the X Window System and the Motif Toolkit 1.1.1. You no longer need to understand Display PostScript to modify your working environment.

Software developers will notice some changes (besides having to link the X libraries to window applications): The compiler is ANSI C; its error trapping helps develop better code and produces very fast executable files. Porting the BYTE rotating-logo program and benchmarks from an Iris 4D with an older version of the operating system and compilers was quick and easy. The only modifications to the source code were corrections to inconsistent function declarations that had escaped notice by the more primitive compiler of the Iris 4D.

The benchmarks ran faster than on an equivalent Mips machine despite the fact that the evaluation Indigo was only at the alpha level of development. The rotation of the Gouraud-shaded 3-D logo was con-



The BYTE logo is written using the standard SGI Graphics Library. Gouraud shading generates 24-bit-color requests that are approximated by hardware dithering to 8-bit color. The xgif file is a standard X Window System application showing the quality achieved with standard 8-bit color. The "scale test" box is displaying the results of PostScript code.

siderably slower than on the Iris 4D. By the time the Indigo is released, SGI expects to have graphics operations at the same performance level as on the Personal Iris.

Song and Dance

Welcome to graphical programming, the icon-based programming environment. You can visualize, slice and analyze, transform, and format your data and graphics without writing a word of programming code.

Explorer is a distributed computing development program that lets you drag and drop data-processing modules on a design window. By tying the modules together into a data-flow network, you can create specialized data-analysis and visualization applications.

Individual modules can run on any kind of machine that is suited to the task, with the data moving over the network. The final display can end up on any SGI machine that you are using, including the low-cost Indigo. The resulting design is automatically implemented in modular source code.

Scene Stealer

The SGI Indigo isn't just a novel-looking machine; it's a novel design for 3-D workstations: fast and inexpensive. The compact workstation box takes up far less space on your desk than the pizza-box workstation. If you don't want to put this attractive box on your desk, you can fit it in a deep bookshelf or even beside the desk. The machine is designed so that you can do your own hardware installation and maintenance without tools or technical know-how.

The shortcomings are few: The color dithering makes you long for true 24-bit color. You may find the Mac-style serial ports a little annoying.

The list of strengths is long and impressive. Along with the 33-MHz R3000 processor, the phenomenal memory and disk transfer rates give this machine very high performance marks. If the new scene is one of 3-D applications, the Indigo steals the show by making professional 3-D affordable and easy. ■

Ben Smith is a BYTE technical editor. He can be contacted on BIX as "bensmith."

LIGHT YEARS AHEAD!

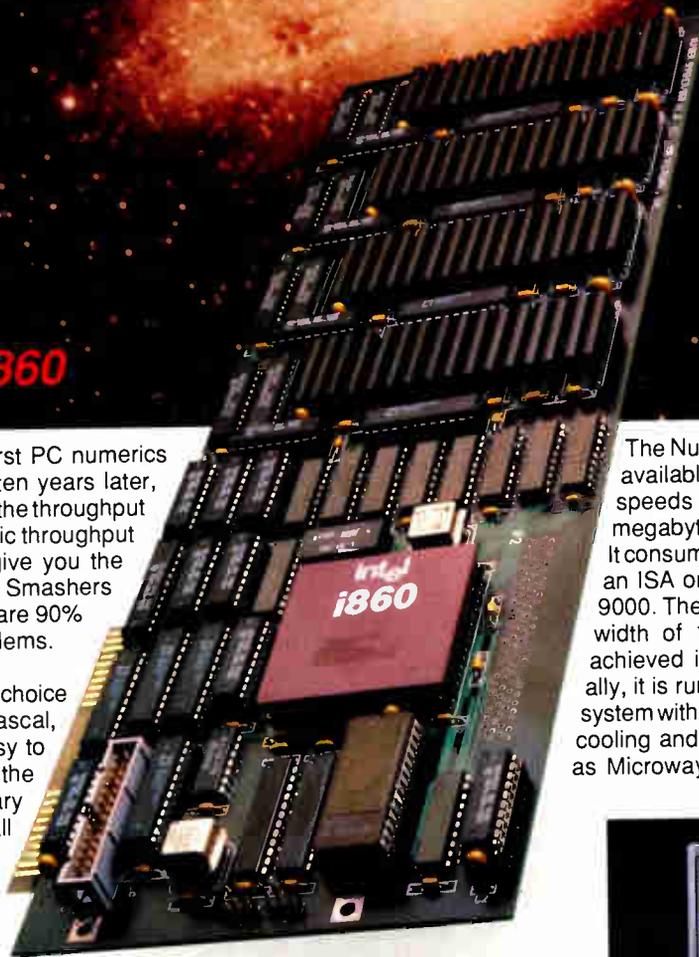
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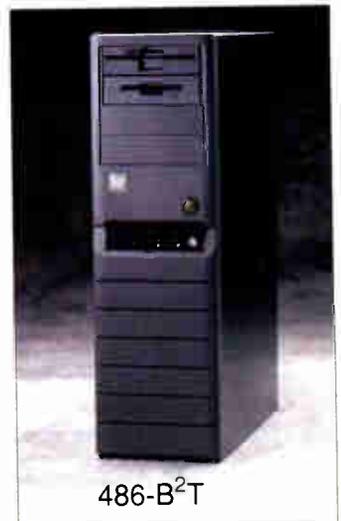
The Number Smasher-860 comes with your choice of Microway's NDP Fortran, C, C++ or Pascal, which feature extensions that make it easy to port applications from the VAX or PC to the i860. Each compiler includes GREX, a library of 200 graphics primitives that runs on all popular PC graphics adapters. Operating system support includes DOS, UNIX, XENIX, SunOS, OS/2 and HP-UX. The MS-DOS version includes XTEND-860, our proprietary i860 DOS Extender.

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The Number Smasher-860 is available in 33 and 40 MHz speeds with either 8 or 32 megabytes of 64-bit memory. It consumes 35 watts running in an ISA or EISA PC or the HP-9000. The peak i860/host bandwidth of 12 megabytes/sec is achieved in the EISA bus. Ideally, it is run in a high quality 486 system with the appropriate power, cooling and fast hard disks, such as Microway's 486-B³ or 486-B²T.



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**LapLink Pro breaks
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new features**

Earlier versions of Traveling Software's LapLink are credited with a long list of "firsts": The program was the first widely successful laptop-to-desktop file transfer utility, the first such utility to "remotely install" itself by way of serial cable, and so on. As such, it has spawned a host of devoted followers and a growing crop of competitors. To keep the program competitive with those numerous rivals, Traveling Software rewrote LapLink "from the ground up" (in CEO Mark Eppley's

words), and the results—LapLink Pro (LLPro) 4.0—are impressive.

Perhaps the flashiest new feature is true remote installation, where *remote* can mean anywhere in the world. Using LLPro and any Hayes-compatible modem, you can now phone another modem-equipped computer, send LLPro across the wire, and get it running on the remote computer. You can then transfer files and

manage the hard disk drives of both computers, just as if they were in the same room and connected by a serial cable. LLPro's built-in data compression (up to 4-to-1) keeps things moving despite relatively slow modem speeds.

That's flashy, but it's not the feature I liked best. For me, the new interface is what really sets this version apart from the earlier ones.

LLPro is now fully mouse-compatible. Yes, it still can be keyboard-driven, which is essential if you have a mouseless laptop like mine. But the mouse-compatible interface vastly streamlines the selection of desktop files for transfer: You just click and drag to mark a group of files, for example, or simply click to change to a sub-directory. Fully developed pull-down menus replace LapLink's formerly cryptic command bar, and context-sensitive help is always just a mouse-click away. Although LLPro is Windows-like, it's not a true Windows application; you run it under DOS or as a DOS application under Windows. LLPro also runs happily inside a Desqview window.

Ever accidentally get a file transfer going in the wrong direction? I sure have. LLPro addresses this with improved screen layout and labeling. For example, each computer connected in an LLPro session is now identified by a user-defined name instead of the terse "local" and "remote" used in earlier versions. The active window is clearly highlighted in color, and an on-screen arrow visually indicates the intended direction of file transfer. With an arrow pointing from, say, a lighted Gateway 486 desktop window to a dark CompuAdd 286 laptop window, it's almost impossible to misunderstand what transfer direction you have chosen.

As you mark files for transfer, LLPro keeps a running total of the number of bytes, and it warns you in advance if you select more files than the target disk can hold. You can simplify repetitive file-marking operations by recording macros (a big improvement over LapLink's earlier batch-file creation process). And new disk-synchronize and disk-clone options completely automate some very complex transfers. Synchronize starts a bidirectional file transfer process, updating both disks until they contain exactly the same files; clone completely overwrites the target disk with a mirror image of the source.

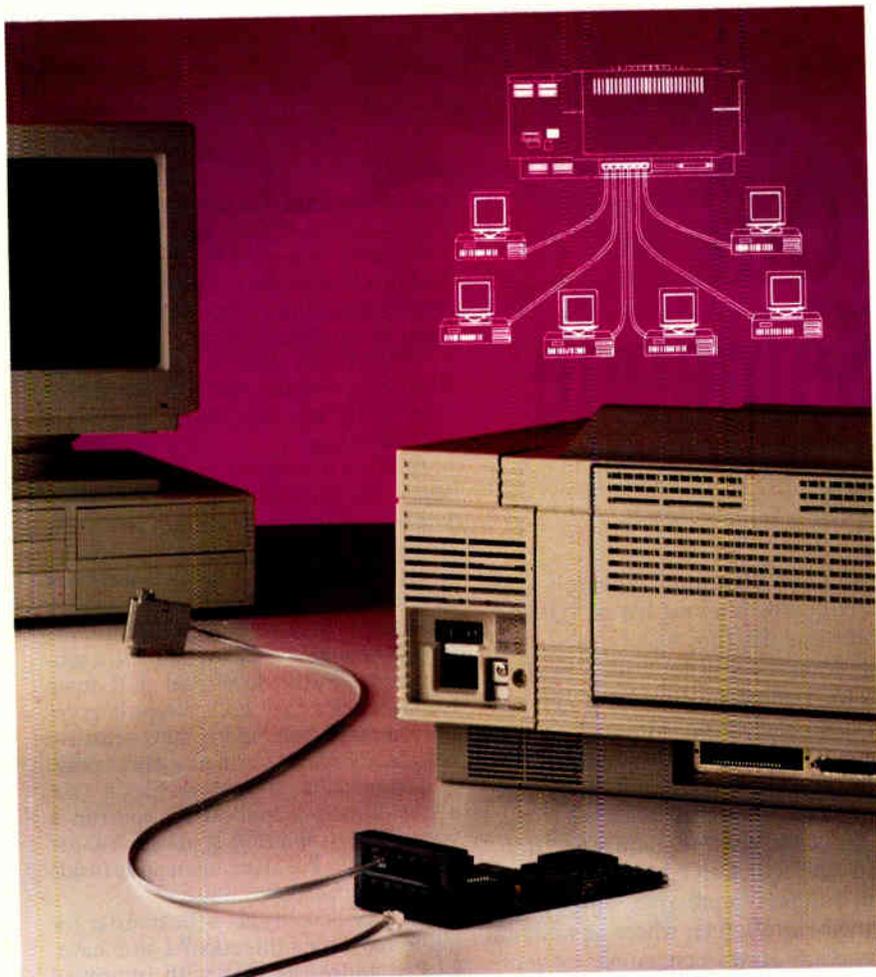
If you make time-sensitive file selections (i.e., all files created before or after



LapLink Pro sports an entirely new (and much improved) user interface, which comes complete with pull-down menus.

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NEWS

FIRST IMPRESSIONS

a certain date and time), LLPro automatically checks to see if the system clocks of both machines agree. If they don't agree, LLPro asks you which one is accurate and adjusts the clock on the other machine.

In the same vein, it automatically detects what's connected where and which ports to use. On my home machine, for example, it recognized that COM1 was in use by a serial mouse, and it configured itself to use COM2.

One of the most intriguing new features in LLPro is a built-in editor. It's not, of course, a full-fledged word processor. But this text editor has a large array of features, including split-screen editing, search and replace, word count, and the ability to globally add or delete hard carriage returns. There's also a "large type" option that displays huge characters.

There's lots more, including thinner cables and a convenient cable-carrying pouch that could speed you through airport security (the cables look packaged and neat, instead of like a bomber's wiring harness).

An intriguing offshoot of LLPro is Mark Eppley's hints about the future: LLPro's transfer engine (code-named Blackbird) will be the heart of a new series of "plumbing-independent" file transfer and communications products that can connect almost any computer to almost any other computer. If the shipping version of LLPro lives up to the beta version, and if the new products maintain that promise, we have lots to look forward to from Traveling Software. ■

Fred Langa is BYTE's editor in chief. He can be reached on BIX as "flanga."

THE FACTS

LapLink Pro 4.0
\$149.95

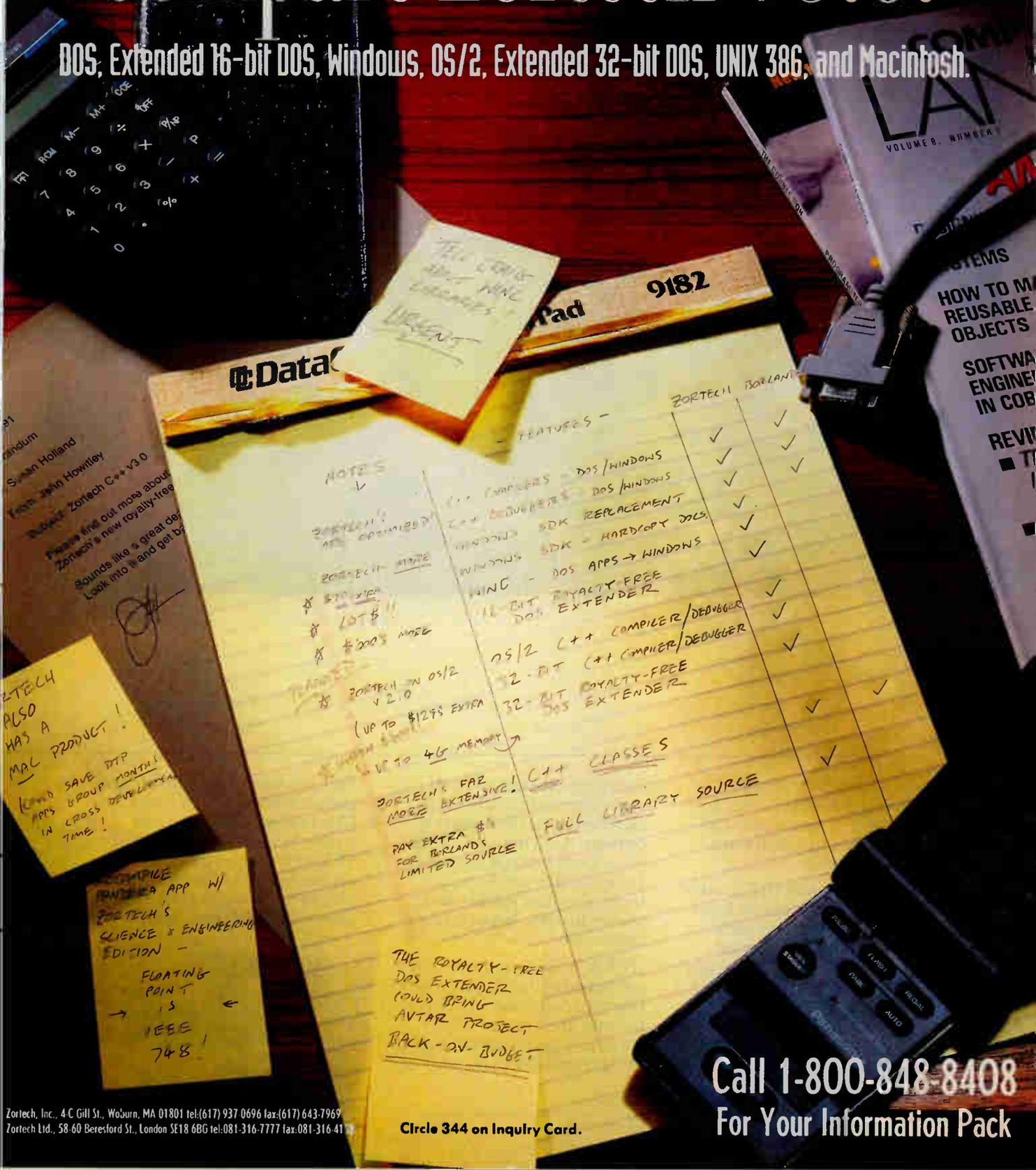
System requirements:
IBM PC, PS/2, or compatible
with DOS 3.0 or higher.

Traveling Software, Inc.
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Bothell, WA 98011
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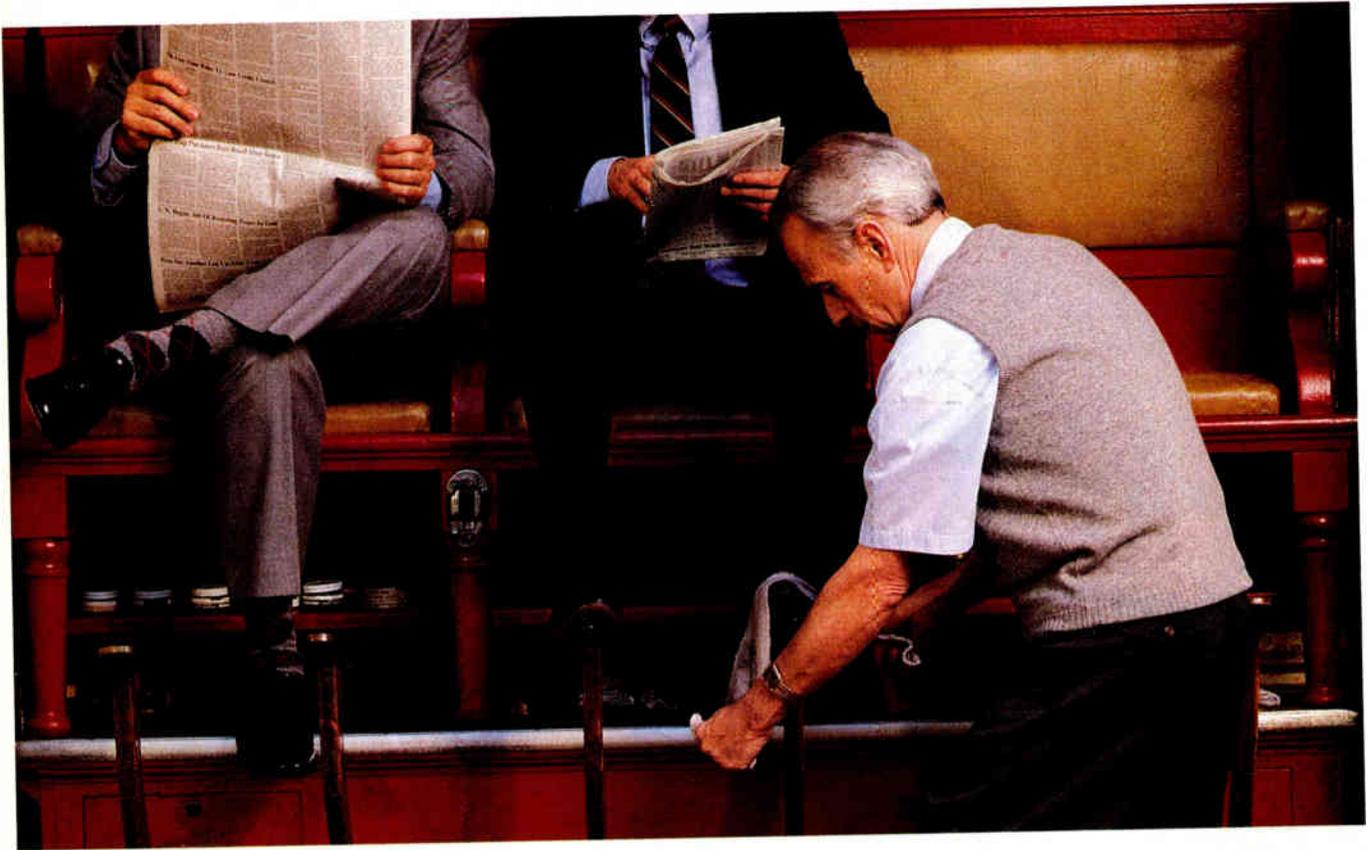
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HP has picked up the throughput speed of this 4 ppm printer. Due to a considerably faster I/O rate, the LaserJet IIIP accepts data as quickly as your PC can transfer it. So you not

only get your output faster, you get your screen back faster. The LaserJet IIIP also has a new 16 MHz processor and PCL5 for on-the-fly typeface scaling and fast vector graphics. These advancements mean this compact printer

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An Acer up the Sleeve



Notebook computers have become a commodity. Nearly every computer maker sells one, and nearly every notebook sports the same all-too-brief list of standard features, not to mention idiosyncratic features that are often annoying. I thus approached the **AcerAnyWare 1120NX** with a healthy dose of skepticism, but I was quickly won over. This machine—if you discount its cute name—is a shining example of a next-generation notebook.

Weighing in at 7½ pounds and based around a 20-MHz 386SX processor, none of the individual features of the 1120NX is earth-shattering or technology-breaking. But taken together, they forge a computer that stands out from the pack.

It may seem minor, but the first thing I noticed about the 1120NX was its large carrying handle. Flip it down, and it tilts the computer up at the optimum typing angle.

The next surprise was the all-important screen. I've seen good, mediocre,

and abysmal notebook screens. Most of them look halfway decent at first glance, but many aren't comfortable to the eyes after several hours of heavy writing. This screen is a conspicuous exception. It's a full 10-inch diagonal (versus 8½ to 9 inches in other notebooks.) It uses triple supertwist technology, meaning you get a bright image from a wide range of viewing angles.

The 1120NX's keyboard has 86 keys. It took a while for me to figure it out, because Acer has followed most other notebook makers and done its own thing with the layout. I was initially disappointed to see that the cursor keys didn't use the ubiquitous inverted-T layout. But the more I used this keyboard, the more I liked it. The full-size QWERTY keys have a large-keyboard feel, and the 12 cursor keys, along with the miscellaneous keys, are ergonomically placed.

Moving down below the front of the keyboard, a flip-down cover protects the 1.44-megabyte floppy disk drive. This

too makes a great deal of sense. Since you seldom use the floppy disk drive in a notebook, why not keep it protected? Also hidden under the cover are three 1½-inch-wide slots. To upgrade the memory, you just slide in Acer's proprietary RAM cards. (Prices weren't available at press time.) Future upgrade possibilities include flash memory for BIOS upgrades or even dedicated applications in ROM.

On the back (behind an extra-sturdy flip-down cover) is a full contingent of ports: dual serial, parallel, PS/2 keyboard, an external drive connector, and a 100-pin connector for an external expansion box.

Battery life is an all-important measure of notebook usability. The 20-MHz 386SX and the hard disk drive take lots of power, but Acer has several clever ways of saving the juice. The 1120NX has two internal battery packs. It also has three power-saving modes: Doze lowers the 386SX speed to 4 MHz, Sleep turns off the display and the hard disk drive, and Suspend turns off everything except the memory.

The proof, of course, is in the using. And I lived with the 1120NX for over a month, carting it back and forth to the office in a soft-sided briefcase and using it for my day-to-day work. (I wrote this First Impression on it.) It worked flawlessly and became a comfortable extension of my personal working style. I hated to return it to the company.

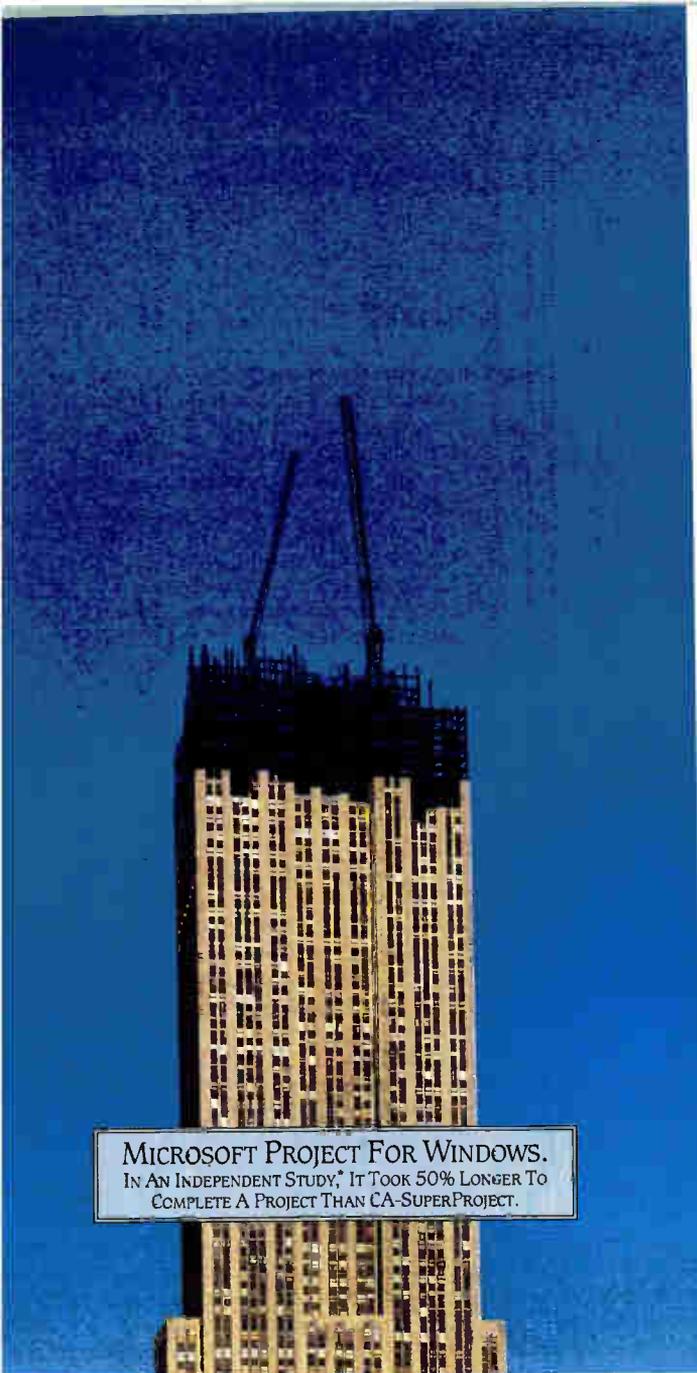
The AcerAnyWare 1120NX isn't the least expensive notebook computer available, but pound for pound it's a real value. Acer has set a standard for comparison that other notebook makers will have to hurry to catch.

—Stan Miastkowski

THE FACTS

AcerAnyWare 1120NX
with 20-MB hard disk drive,
\$2995; with 40-MB drive, \$3395;
with 60-MB drive, \$3795

Acer America Corp.
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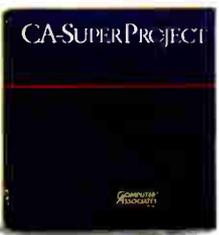
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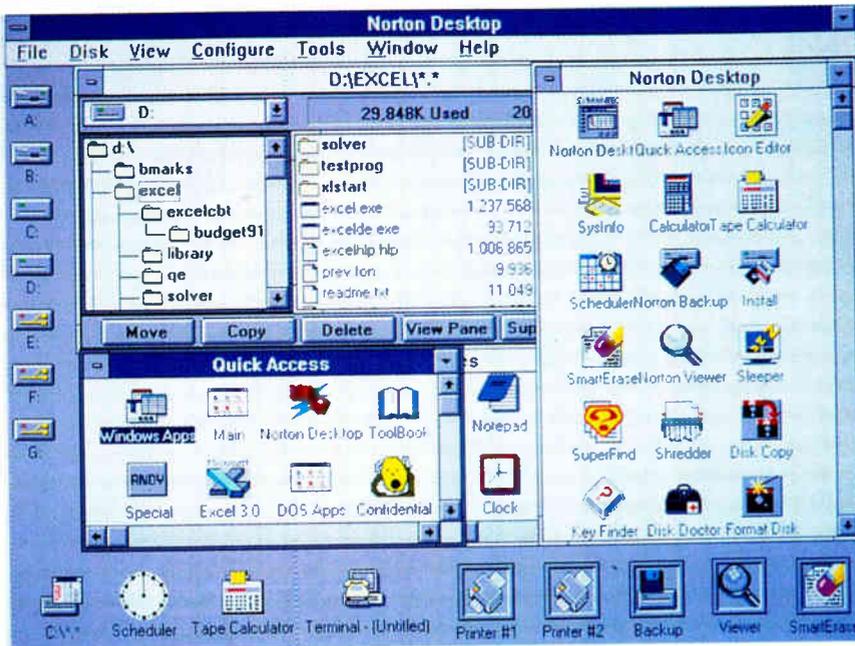
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World Radio History

Add a Kitchen Sink Under Windows



Although many people have likened Microsoft Windows to the Macintosh, the fact remains that Windows' strongest attribute is *not* its user interface. But a dandy software package from the Peter Norton division of Symantec goes a long way toward curing that problem. **Norton Desktop for Windows** wraps a shell around Windows that integrates the functions of the Program Manager and the File Manager into a single drag-and-drop environment. With a simple installation and a little fine-tuning, you can finally realize the full promise of a GUI on DOS-based computers.

To sweeten the deal, Symantec adds a suite of powerful utilities and accessories, including a file finder, a file viewer, an icon editor, a batch script editor, a screen saver, Norton Utilities, and Norton Backup. These bundled applications may cause a few sleepless nights at third-party Windows utility purveyors, but they are a boon to users.

Norton Desktop looks and acts like Windows but enhances it with a more powerful GUI. You first notice several new icons, including four or five in the bottom right of the screen that represent printers, the file viewer, and the SmartErase function—which is a kind of intelligent trashcan. Other icons for Backup or the Shredder (a permanent file eraser for sensitive documents) can be added.

One of the weakest parts of Windows (and one slated to be greatly improved in the upcoming Windows 3.1) is the File Manager. Norton Desktop has adopted the Mac-like approach of putting drive icons on the desktop along with the other windows and icons.

Norton Desktop lets you open two windows at once and drag files or subdirectories between them. If you want to print a file, you drag it to a printer icon at the bottom. The same applies for deleting a file to the brainy wastebin. Want to back up an entire disk? Drag the drive icon to the Backup icon and let 'er rip—in the background, no less. I must confess, it was a real kick to drop a document onto my dot-matrix printer and the network printer and see it come swooshing out on both devices.

The Windows Program Manager also leaves a bit to be desired, so Norton Desktop has improved it. With a menu-and-icon builder called Quick Access, you can create custom program groups, nest them inside each other, and protect them with passwords.

Quick Access lets any Windows user or system administrator create a completely customized workspace in short order. Because files are visible in the Norton Desktop File Manager, you can add them to a group or move them between groups by simply dragging them from one window

to the other. Of course, the organization of Quick Access groups doesn't affect the underlying file structure of the disk, so users sharing a server can organize files to suit their taste without affecting everybody else.

As if all these improvements to the Windows environment weren't enough, Norton Desktop includes a gaggle of nifty utilities. The most inevitable are the data-recovery abilities popularized by Norton Utilities. SmartErase deletes files to a "holding tank," from which they can later be recovered. Norton Desktop lets you specify a maximum number of days to hold the files. Also included is Disk Doctor, which performs diagnostics on hard disk drives, and an "emergency disk" that can be used for repairs on a drive, even if Windows won't load.

Backup will archive files to virtually any type of removable medium and several kinds of tape drives.

Other utilities supplied with Norton Desktop include Scheduler, a very simple program for tracking appointments; System Information, a competitor to System Sleuth that tells you about your hardware configuration; and Sleeper, a nice screen saver but no match for After Dark.

Norton Desktop offers power users a range of features too numerous to describe here and is so powerful that it could become a must-have item for all Windows users. And to top it off, this program is a great deal. Run, don't walk, to the nearest store and snap one up.

—Andy Reinhardt

THE FACTS

Norton Desktop for Windows
\$149

System requirements:

IBM AT, PS/2, or compatible with DOS 3.1 or higher, Windows 3.0 or higher, 1 MB of RAM (3 MB recommended), 4 MB of free disk space, and a mouse.

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fax: (408) 253-4092
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The Next Illustrator



THE FACTS

Adobe Illustrator 3.0
for the Next
\$500

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1585 Charleston Rd.
P.O. Box 7900
Mountain View, CA 94039
(800) 922-3623
(415) 961-4400
fax: (415) 961-3769
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For some years now, the prevailing wisdom has been that if you want to do graphics, you buy a Macintosh. A large part of this view comes from the Mac's close ties with PostScript and the bountiful array of professional graphics software that seems to exist only in that environment. It's interesting, then, that one of the companies to which Apple owes its success, Adobe Systems, has blazed itself an impressive trail on a new platform: the Next computer.

Graphic artists, technical illustrators, and just plain users have praised the existence of Illustrator for years. Version 3.0 of this benchmark Mac graphics program has landed on the Next, and I doubt I could have been more impressed. **Adobe Illustrator 3.0 for the Next** is everything it is on the Mac—and then some (see "An Artist's Old Tool Learns New Tricks," February BYTE). I'll direct you to that review for the common features of Illustrator 3.0; the "then some" part is what I'll cover here.

Illustrator 3.0 benefits most from the higher standard resolution. Anyone who felt cramped running Illustrator on a 640-by 480-pixel Mac screen will find plenty of breathing room on the Next's expansive, 1120-by 832-pixel, gray-scale or color display. This not only gives you more room to work on your drawing, but also opens up space around the drawing window for other programs and icons.

Illustrator also benefits from NextStep, the Next's classy visual interface. Illustrator's Next interface is no mere knockoff of the Mac version; it's been completely reworked to take full advantage of the Next's graphical interface facilities.

Illustrator also gets a charge out of the Nextstation's 25-MHz 68040 processor and Unix underpinnings. Unix makes the most of the 68040, and Illustrator fits particularly well in an environment that permits multiple programs to run at once without the awkwardness of the Mac MultiFinder. NextStep has built into it the ability to view PostScript, Encapsulated PostScript, and TIFF files, and to intelligently pass these images between applications.

To produce the artwork shown in the screen shot, I scanned a BYTE logo on an Abaton Scan 300/GS. I loaded it into Illustrator as a TIFF template file. I then used the Auto Trace feature to turn the TIFF image into collections of Bézier curves.

I stacked three sets of letters with gray-scale shadings that simulated three dimensions and completed the 3-D effect by using the Skew and Scale tools to create a realistic shadow behind the letters. I made a background by creating a shaded rectangle, placing a white highlight on it, and using the Blend tool to make the shape appear to be lit from one side. I then skewed

and scaled the rectangle to give it perspective, and I used the Send to Back option to place the background behind the letters and the shadow.

I was struck by how capable Illustrator 3.0 is. I'm no artist by any stretch, but Illustrator's tools are so intuitive that I was instantly able to translate the image in my mind to one on paper.

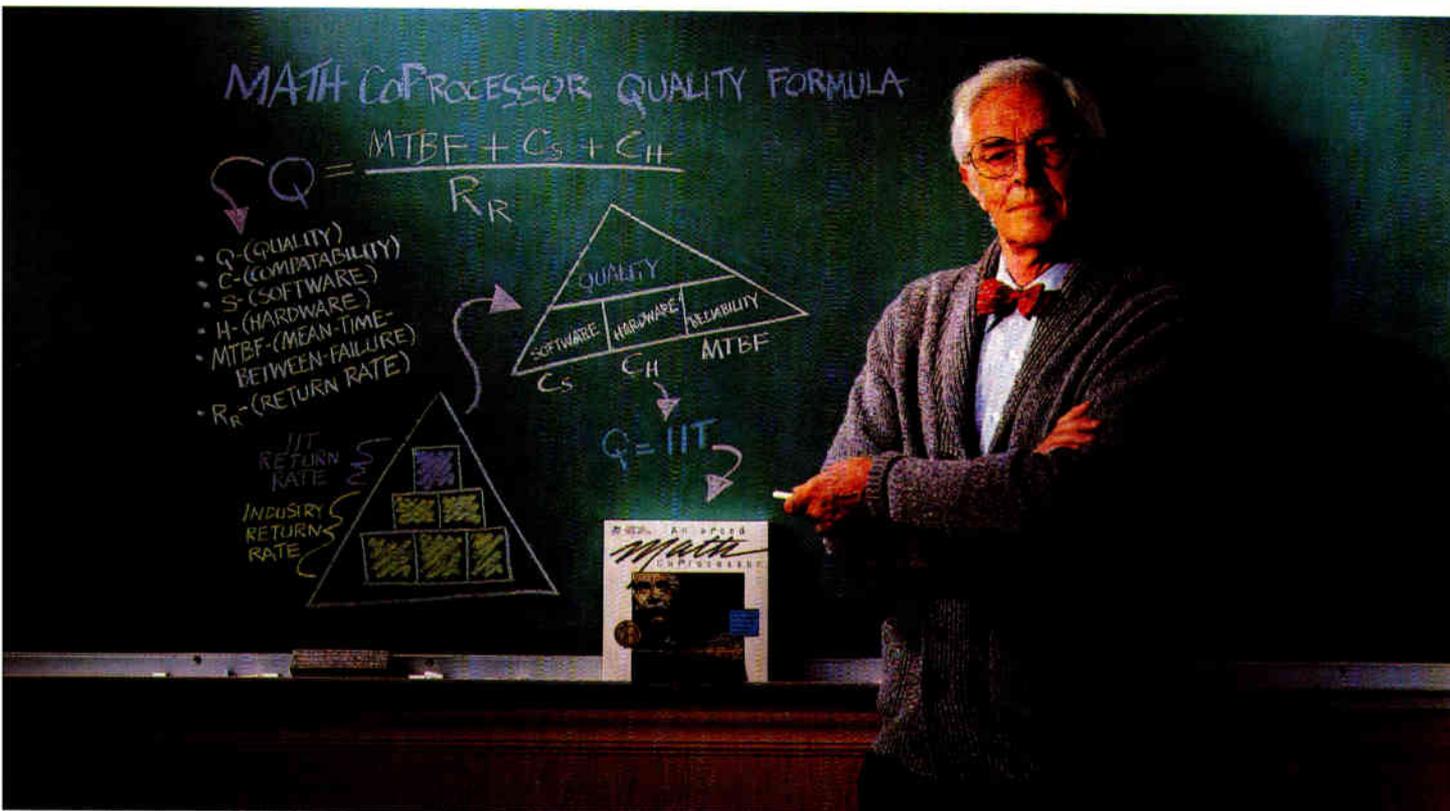
Beyond what I've discussed, Illustrator 3.0 is a complete illustration package. The package works well with both color and gray-scale Next systems, and an included utility turns color images into camera-ready color separations. Unlike with the Mac version, images *can* be modified in preview mode.

To make life a bit easier for those who are already running Illustrator on the Mac, the Next version stores and retrieves files in the same format.

The availability of Illustrator 3.0 for the Next is another clear sign that the Next is not only competing as a Unix workstation, but has the potential to woo away high-end Mac users as well. The Next's low base price, higher speed and resolution, more robust interface, and better standard networking make it a serious contender for Mac users who are looking to upgrade. Illustrator 3.0's excellence gives both Adobe and Next something else to crow about; I recommend the combination highly.

—Tom Yager

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FrameMaker Becomes an Expert Table Maker

FrameMaker has always been one of the pink Cadillacs of desktop publishing. Now it's even better. **FrameMaker 3.0** brings two big changes: tools for building tables and something called *conditional text*. Both are worth the cost of upgrading. If you're thinking of using desktop publishing for highly structured material, this program should be at the top of your list.

If you produce much tabular material—inventory lists, schedules, catalogs, or financial or statistical data—the new table tools alone are worth the price of admission. FrameMaker 3.0 greatly simplifies life in the world of rows and columns.

First, the program comes with basic table templates, so you can just pour data into them, or you can customize them. But if you want to start from scratch, you can also do that. Just as other publishing packages let you set up style sheets for text, FrameMaker 3.0 lets you establish styles for tables.

FrameMaker will also do some of the work for you. For example, you can take a paragraph of text and convert it to a predefined table format. This text can come from most Mac word processors or, say, an Excel worksheet. Contrariwise, the program can also deconstruct a table into paragraphs.

Besides automating much of the work in making tables, the best thing about the

new table functions is that they're easy to use. The interface for the table-formatting module is clean and straightforward. I was able to produce some tables and charts without reading the manual. It's easy to make changes at both the overall and cellular levels.

The other new feature, conditional text, lets you easily generate variations on a document theme. Let's say you're writing manuals for a product that's sold in different countries. Much of the material is the same, but you need to include some information specific to each country, or conditional text. In this case, you could use FrameMaker 3.0 to create a conditional document that holds all the text and images for all the multiple versions. The trick is, you can hide the conditional stuff.

In the end, you have one document that can yield multiple variations of itself.

FrameMaker is a good citizen, capable of importing just about any text or graphics format you're bound to come across, including PCX (from the DOS world) and xwd (from X Window System). FrameMaker 3.0 will run under System 7.0 and can tap a few of its features, like TrueType fonts, but real use of the new operating system (e.g., interapplication links) is slated for the next release.

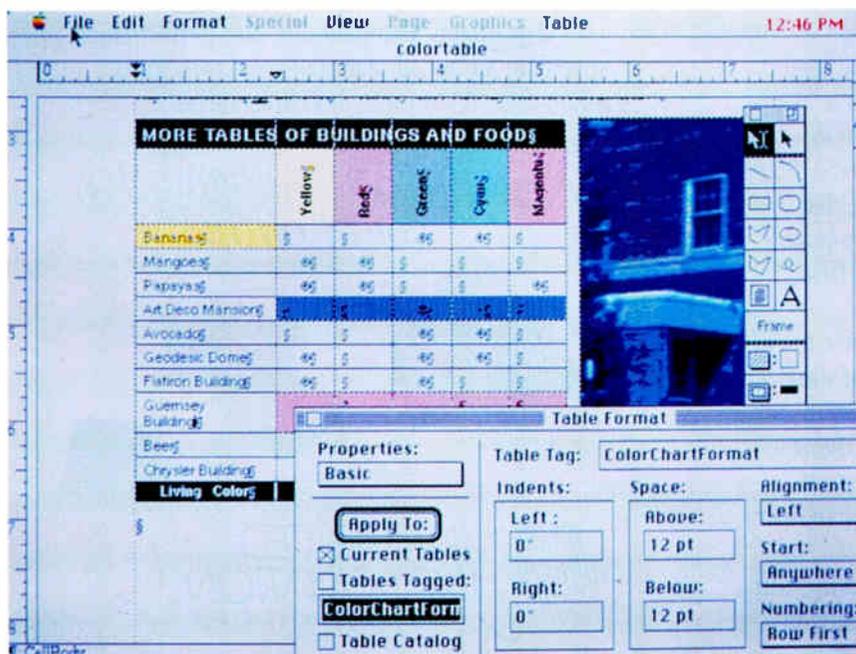
Frame Technology has thrown in a few other neat little tricks, including timed saves, a refined help system, and notifica-

tion of PostScript errors when printing.

While this version is coming out for all of Frame's various Unix platforms, I used the one for the Mac. The program ran neatly on a Mac IIfx. Frame says the minimum suggested RAM is 4 megabytes, and that's no kidding. I had the luxury of working with 8 MB, and that was stretching things; the program was able to chug through redrawing a page loaded with text, tables, and a photo image, but not without flashing the low-memory warning (a little chip icon). You can get by with 4 MB by not installing certain options, but I would suggest buying some SIMMs to go with this software.

People at Frame will tell you straight out that this program is not for casual desktop publishers or studios working primarily with display type and design. Newsletter publishers could certainly get by with something much less expensive. But if you're presenting a lot of tabular material, the difference in price could be worth it. Or if you're tailoring core information for different readers, the conditional-text features would be handy. Other high-end publishing packages have some of the power of FrameMaker, but I have yet to see one that was this sophisticated and still easy to use. FrameMaker is still a pink Cadillac, only now it's even shinier.

—D. Barker



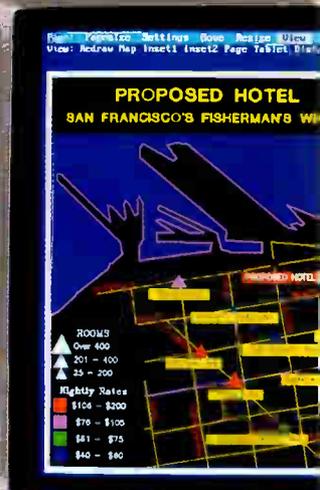
THE FACTS

FrameMaker 3.0
\$795; upgrade, \$150

System requirements:
Mac II with 4 MB of RAM,
System 6.0.2 or higher, and a
hard disk drive with at least
5 MB of free space.

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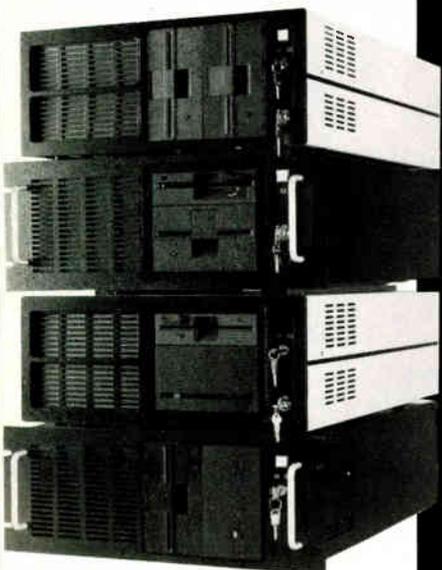
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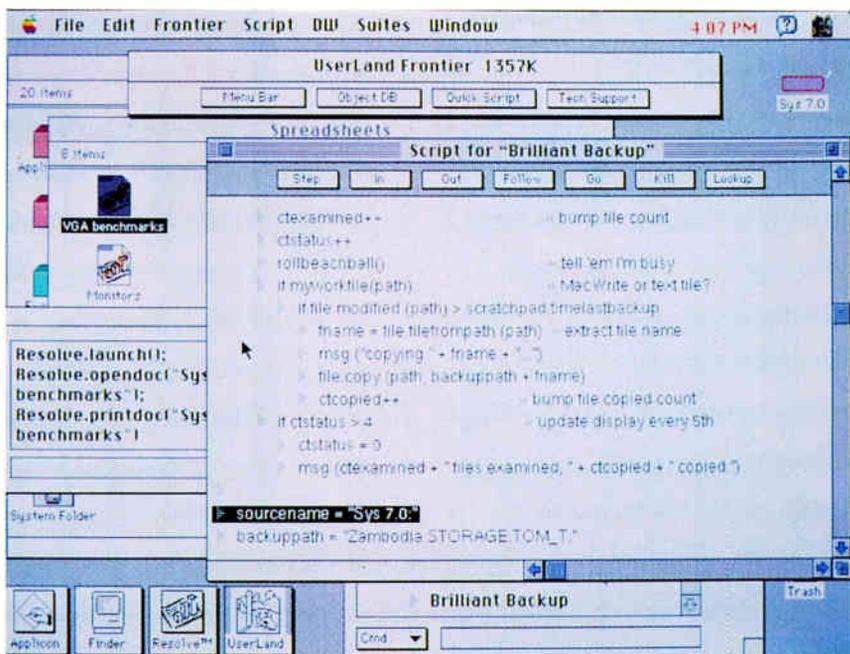
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NEWS

FIRST IMPRESSIONS

Frontier Explores Mac Scripting



While a PC's command-line interface might not be the easiest thing to use, it has one significant advantage over the Mac's GUI: A competent PC user can write batch files—files containing a series of DOS commands—that automate repetitive tasks. Macintosh users have long wished for this capability. UserLand Software's **Frontier 1.0**, a Mac scripting application, provides it.

Frontier lets you write *scripts*—command sequences—that can manipulate files, launch applications, and execute various tasks automatically. It uses Apple's Open Scripting Architecture, which guarantees compatibility with any future Apple software.

Frontier is an application that uses an object-oriented database composed of a collage of objects such as scripts, wp text (i.e., text with formatting information such as typefaces and layout), pictures, and verbs (that implement certain commands) to operate.

Frontier's scripting language smacks of C, and it comes equipped with variables, looping constructs, and flow control statements. And Frontier does more than manage files: With it, you can issue Apple events that "drive" System 7.0-savvy applications through preset operations.

I used Frontier to steer beta versions of Claris's Resolve spreadsheet and Mac-

Write Pro word processor through sequences of events. For example, I wrote a script that examines a folder where benchmark files are stored, checks their dates, launches Resolve, prints the new or recently modified files, and quits Resolve when done. With abilities such as these, it doesn't take you long to start writing scripts to handle *everything*. If Frontier delivers on its potential to merge the command-line interface's strengths to the Mac interface, users stand to get even more done with their Macs. ■

—Tom Thompson

THE FACTS

Frontier 1.0
(price not set at press time)

System requirements:
Mac Plus or higher with 2 MB of RAM running System 6.0.5 or higher. System 7.0 required for application control.

UserLand Software, Inc.
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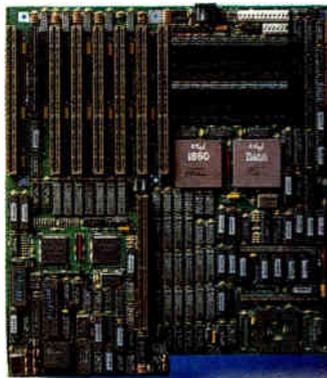
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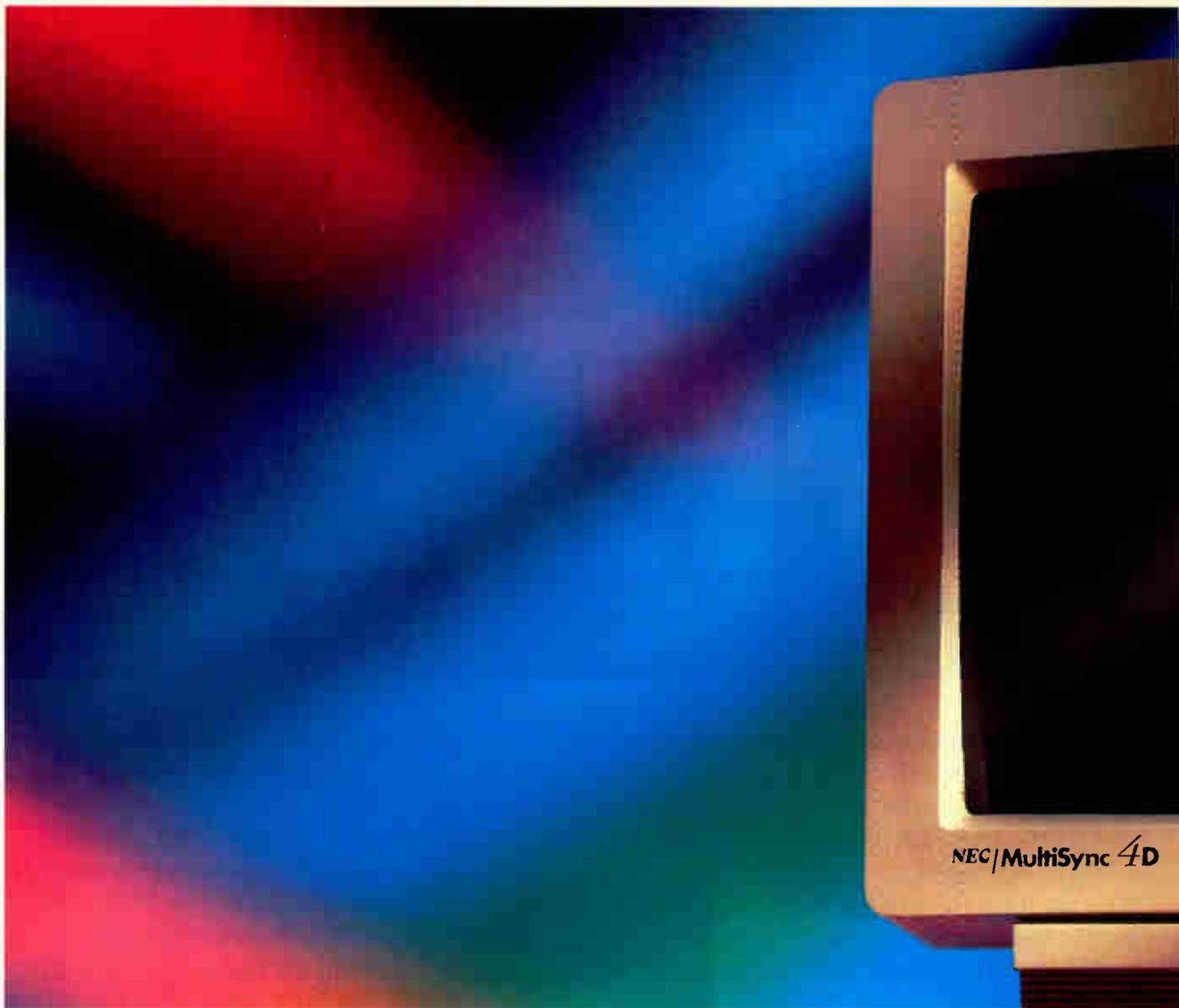
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Price: Slimline, \$2195; tower and desktop, \$2395. **Contact:** Cumulus Computer Corp., 23500 Mercantile Rd., Cleveland, OH 44122, (216) 464-2211; fax (216) 464-2483.

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Small, Silent, and a 386

A 25-MHz microcomputer the size of a loaf of bread, the 386-based MiniSys 3000 comes with 2 MB of RAM, expandable to 16 MB. A low power user with a



Compact and quiet, the MiniSys 3000 operates at 25 MHz.



The Cumulus/486 system is available in slimline, desktop, and tower models.

40-W external power adapter, the machine works without an internal fan.

The MiniSys 3000 has a 3½-inch floppy disk drive and a drive bay for a 3½-inch hard disk drive. It includes a three-quarter-length, 16-bit expansion slot, a floppy disk drive controller, an Intelligent Drive Electronics interface, a parallel and two serial ports, and a VGA adapter on the system board. The adapter, which supports up to 1024- by 768-pixel resolution in 16 colors, has 512 KB of display memory. Software supported by the video drivers includes Windows 3.0, Ventura Publisher, AutoCAD, GEM, Lotus 1-2-3, and Framework.

Price: \$1445; with monochrome VGA monitor and enhanced keyboard, \$1750.

Contact: SIIG, Inc., 5369 Randall Place, Fremont, CA 94538, (415) 657-0567; fax (415) 657-5962.

Circle 1272 on Inquiry Card.

Bell-Ringer 286 Systems

The entry-level Legend 100 and 200 systems from Packard Bell use a 286 microprocessor and run at 8 or 12 MHz. Both models include a 28-ms, 40-MB hard disk drive, a Super VGA graphics adapter with 800- by 600-pixel resolution, 256 KB of video RAM, a two-button mouse, a real-time clock/calendar with battery backup, and an Enhanced 101-key keyboard. The Legend 200 comes with a built-in 2400-bps modem. Both models have a 3½-inch floppy disk drive; the 200 also has a 5¼-inch floppy disk drive.

The motherboard used in the Legend 100 and 200 systems features 1 MB of RAM. Using SIMMs, you can expand the memory up to 3 MB. The systems also include three expansion slots; interfaces include serial, parallel, and VGA video ports, as well as a keyboard connector. **Price:** Legend 100, \$1499; Legend 200, \$1699.

Contact: Packard Bell, 9425 Canoga Ave., Chatsworth, CA 91311, (818) 773-4400; fax (818) 773-9521.

Circle 1273 on Inquiry Card.

Lightweight Notebook Has a Mouse Pad

The 4½-pound, 1½-inch-thick Aquiline Notepad computer has a 40- or 60-MB hard disk drive and 1 MB of RAM (expandable to 4 MB). The 386SX machine's interfaces include serial, parallel, external VGA, and PS/2 mouse ports.

The unit's 10-inch, supertwist, sidelit VGA LCD has 32 gray scales. Just above the keyboard is a mouse pad that you use with the tip of your finger. Included with the computer are FastLynx, FastLock, a battery alert, a phone book, DOS 4.1, and Microsoft Works or Windows 3.0. It also has an AC adapter and a carrying case.

Price: 40-MB version, \$2795; 60-MB version, \$2995.

Contact: Aquiline, Inc., 449 Main St., Bennington, VT 05201, (800) 221-1119 or (802) 442-1526; fax (802) 442-8661.

Circle 1274 on Inquiry Card.



The Aquiline Notepad

A Press of Printers

Three printers capable of different duties are on the shelves. One for laptops, one for Windows, and one for high-end applications, each adds a new dimension to printing.

A thermal-fusion printer that weighs just 2 pounds lets you print from your laptop wherever you may be. The PN48 prints laser-quality text at 1 ppm.

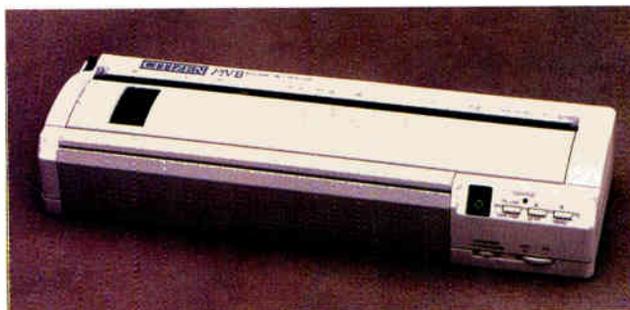
Able to print on almost any type of paper, as well as handle envelopes and transparencies, the PN48 prints quietly, powered by a rechargeable nickel-cadmium battery. The printer has a friction-feed path as well as a bottom-loading straight-path paper feed, and it prints in eight type styles. The PN48 Professional System includes the PN48 printer, a ½-pound AC adapter/recharger, two ribbon cartridges, a battery pack, and a soft carrying case.

Price: \$549.

Contact: Citizen America Corp., 2450 Broadway, Suite 600, Santa Monica, CA 90411, (213) 453-0614; fax (213) 453-2814.

Circle 1275 on Inquiry Card.

If you're craving a printer that works with Windows, you may be pleased with the WinPrinter 400. Using a proprietary host-based architecture, the printer includes a Laser Master Windows direct driver, as well as PostScript and Printer Com-



The Citizen PN48 fits comfortably in your hand.

mand Language emulations.

Designed for Windows work, the 4-ppm WinPrinter 400 prints at 300 and 400 dpi. It includes 50 typefaces, and its PostScript Type 1 fonts are scalable. Rather than having its own coprocessor and RAM, the printer keeps costs down by using your 386 computer for processing power and speed.

Price: \$1995.

Contact: LaserMaster Corp., 6900 Shady Oak Rd., Eden Prairie, MN 55344, (612) 943-8286; fax (612) 944-0522.

Circle 1276 on Inquiry Card.

The CHC-S445 dye-sublimation color printer produces photo-realistic color prints. With a 24-bit palette, the 300-dpi printer from Shinko Electric is being distributed by Mitsubishi International.

Targeted for use in applications such as desktop publishing, CAD/CAM, medical imaging, and mapping, the CHC-S445 printer has plenty of options. One is a



CHC-S445

13-MB PC board or Mac PS box with PowerPage PostScript-compatible software.

Another option is a buffer box with 130 MB of storage that lets you buffer and spool your images.

Price: Base price, \$17,999.

Contact: Mitsubishi International Corp., 701 Westchester Ave., White Plains, NY 10604, (914) 997-4999; fax (914) 997-4976.

Circle 1277 on Inquiry Card.

dynamic beam forming, which reduces elliptical distortion by automatically correcting pixel shapes on the screen. Additionally, the monitor has a microprocessor-based auto-scanning system that aligns the display with a graphics controller's scanning frequency for compatibility with many analog RGB signals. A video scan converter is built into the monitor, which lets it convert standard NTSC, PAL, SECAM, or S-VHS video to 31.5-kHz non-interlaced video.

Price: \$9995.

Contact: Mitsubishi Electronics America, Inc., Information Systems Division, 991 Knox St., Torrance, CA 90502, (213) 515-3993; fax (213) 324-6466.

Circle 1278 on Inquiry Card.

Back Up on Platinum

A 600-MB streaming-tape system for SCSI Macs, the Platinum PST 600 backs up and restores data at speeds comparable to digital audiotape systems at conventional-tape prices, CMS says. The PST 600 includes CMS's AD-Mac backup utility software, as well as all required cables, an external terminator, and a 600-MB tape cartridge.

Price: \$1899.

Contact: CMS Enhancements, Inc., 2722 Michelson Dr., Irvine, CA 92715, (714) 222-6000; fax (714) 549-4004.

Circle 1279 on Inquiry Card.

Auto-scan in Oversize Color

A 37-inch color monitor with a 35-inch viewing area, the Mitsubishi XC-3725C has noninterlaced resolutions of from 640 by 480 pixels to 1280 by 1024 pixels. The range of resolutions makes it compatible with most PCs, PS/2s, Mac IIs, and Unix workstations.

The XC-3725C includes



WinPrinter 400

Super VGA and a Coprocessor Share a Board

Super VGA graphics and 8514/A coprocessor support go together on the Graphics Vantage board. The ISA board includes the ATI Mach 8 graphics engine and the VGAWonder+ controller for dual compatibility.

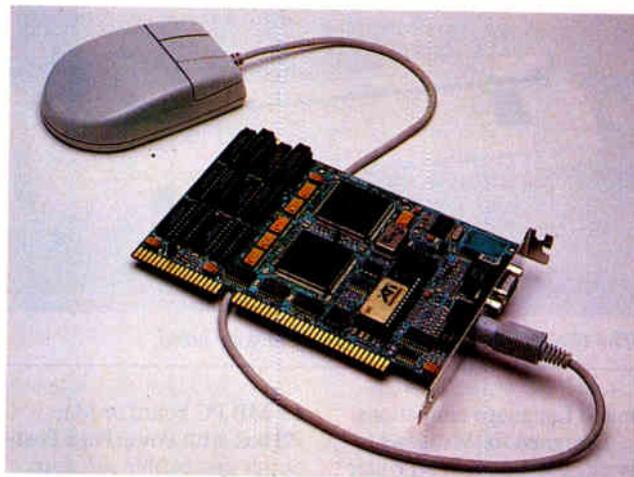
The 8514/A and VGA modes both support 1024- by 768-pixel noninterlaced graphics, as well as 70- and 72-Hz vertical refresh rates. Graphics Vantage uses custom driver software and proprietary VLSI chips to accelerate graphics-intensive environments. A Windows 3.0 driver uses ATI's scalable Crystal Fonts and MIT Media Lab's gray-scale antialiasing techniques. **Price:** 512-KB version, \$499; 1-MB version, \$599. **Contact:** ATI Technologies, Inc., 3761 Victoria Park Ave., Scarborough, Ontario, Canada M1W 3S2, (416) 756-0718; fax (416) 756-0720.

Circle 1280 on Inquiry Card.

Mac Math

Math coprocessor boards that provide inexpensive floating-point acceleration for the Mac LC and IIsi plug into the Direct Slot on the motherboard of each computer. Called the LCFP and the SIFP, both boards give you a choice of standard Motorola math coprocessors (the 16- or 20-MHz 68881 or the 16-, 20-, or 25-MHz 68882).

Compatible with all cur-



The Graphics Vantage board combines VGA and 8514/A coprocessor support and includes ATI's scalable Crystal screen fonts to enhance display quality.

rent Mac software, including System 7.0, the boards increase performance on math-intensive code. With the boards, you can use the machines for spreadsheets, CAD/CAM, graphics, desktop publishing, simulation, and engineering applications. The math chip is socketed, enabling you to upgrade it when you're ready.

Price: \$119.

Contact: Quantum Leap Systems, 8050 Camino Huerfano, San Diego, CA 92122, (619) 457-0781; fax (619) 457-0199.

Circle 1281 on Inquiry Card.

Boot Your OS/2 from a SCSI Controller

SCSI controllers from CE Infosys have always included software for multiple operating systems, including OS/2. Now the boards also support the High Performance File System for OS/2 1.2, 1.2.1, and 1.3 and let you boot your OS/2 operating system from a SCSI device.

Price: \$199 to \$395.

Contact: Computer Elek-

tronik Infosys of America, Inc., 512-A Herndon Pkwy., Herndon, VA 22070, (800) 322-3464 or (703) 435-3800; fax (703) 435-5129.

Circle 1282 on Inquiry Card.

Floating-Point Performance

A floating-point array processor for ATs and compatible machines, the PL2500 operates at 25 MFLOPS and transfers data to and from the host PC at 3 MBps. The processor comes with 256 KB of cache static RAM, with an optional 1 to 4 MB of on-board bulk static RAM.

Built around a 32-bit data bus, the PL2500 includes a 256-KB microcode/table ROM, connectors for the Span32 bus, a 24-bit integer

processor, and a host interface processor. Each PL2500 occupies a 16-bit I/O slot and operates in parallel with the PC.

Price: \$2495.

Contact: Eighteen Eight Laboratories, 1247 Tamarisk Lane, Boulder City, NV 89005, (800) 888-1119 or (702) 294-1051; fax (702) 294-2611.

Circle 1283 on Inquiry Card.

SX Speed Now for Your 286

You can easily upgrade your 286 PC to 386SX speed with the SX/Now 386SX processor upgrade board. Just plug the SX/Now board into the 286 processor socket on your system board, and you've increased your system performance by 250 percent, according to Kingston.

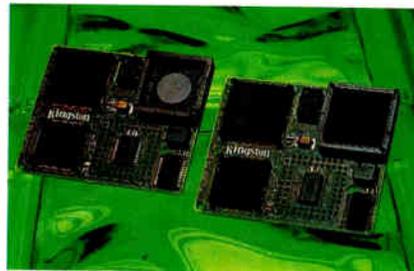
The SX/Now board combines a 16-KB memory cache and an on-board clock with a choice of a 16- or 20-MHz 386SX processor. The board includes a socket for a 386SX math coprocessor and is fully compatible with supported systems, including IBM ATs, AST's Bravo 286, Hewlett-Packard's Vectra ES/12, and DTK's 1230, Kingston says.

Price: 16-MHz version, \$645; 20-MHz version, \$695.

Contact: Kingston Technology Corp., 17600 Newhope St., Fountain Valley, CA 92708, (714) 435-2600; fax (714) 435-2699.

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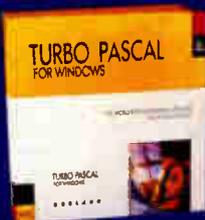
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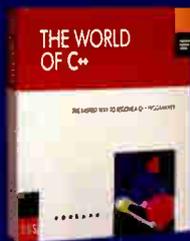


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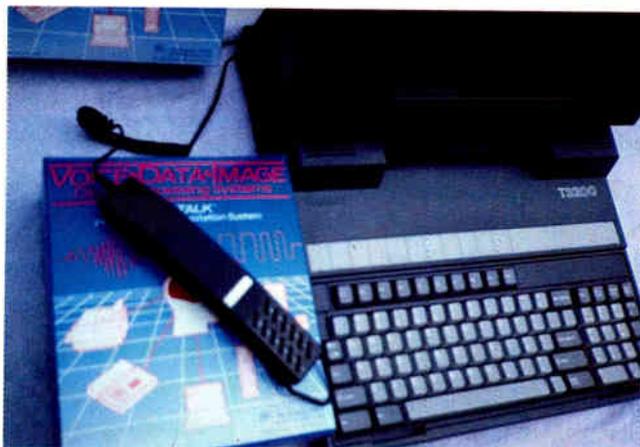
* All prices subject to change without notice.

Talk to Your PC

Digi-Talk, a voice annotation/dictation system for your notebook or desktop PC, lets you send audio messages via disk or LAN. Digi-Talk works with most word processing packages for more than an hour of voice messages on a floppy disk.

Digi-Talk lets you add voice annotations or messages to word processing text files and create voice or text files as talking documents that you can send to other PCs for playback. You can use your PC as a dictation machine, with Digi-Talk providing a biometric voice print to access your PC or a terminal. The system has an RS-232 interface or a jack that connects to a half-size board in your PC. **Price: \$199.**

Contact: Technologia Systems, Ltd., Suite 700, 155 North Michigan Ave., Chicago, IL 60601, (312) 938-1919; fax (312) 938-1024. **Circle 1285 on Inquiry Card.**



Windows 3.0-compatible Digi-Talk lets you merge 40 minutes of voice commentary into 60 pages of text on a floppy disk. Each hour of voice recording uses only 1 MB of memory.

time, duration, and type of problem with the program. **Price: \$99.**

Contact: Sola, 1717 Busse Rd., Elk Grove Village, IL 60007, (800) 289-7652 or (708) 439-2800; fax (800) 626-6269.

Circle 1286 on Inquiry Card.

Flexibility in Font Cartridges

Two font cartridges for laser printers give you additional choices in meeting your printing needs.

A customizable font cartridge that uses flash memory, FontBank Cartridge lets you create your own LaserJet cartridge using your own soft fonts. The cartridge holds 786 KB of data and can be moved from printer to printer.

Power Sleuth works while Windows 3.0 is running other applications.



FontBank stores font data even when your printer and computer are turned off.

You can download and store bit-mapped soft fonts for LaserJet printers through a menu-driven program resident in the cartridge. You can also store PCL 5 fonts in the cartridge and reprogram FontBank to add or delete fonts.

Price: \$299.

Contact: Pacific Data Products, Inc., 9125 Rehco Rd., San Diego, CA 92121, (619) 552-0880; fax (619) 552-0889.

Circle 1287 on Inquiry Card.

ActionSet is a Hewlett-Packard-format font cartridge for desktop publishing. With a library of 102 fonts, ActionSet adds flexibility to small personal laser printers that emulate the HP LaserJet II and have a standard HP font-cartridge slot. ActionSet includes math and tax-form fonts as well as Greek fonts.

Price: \$199.

Contact: Computer Peripherals, Inc., 667 Rancho Conejo Blvd., Newbury Park, CA 91320, (800) 854-7600 or (805) 499-5751; fax (805) 498-8848.

Circle 1288 on Inquiry Card.

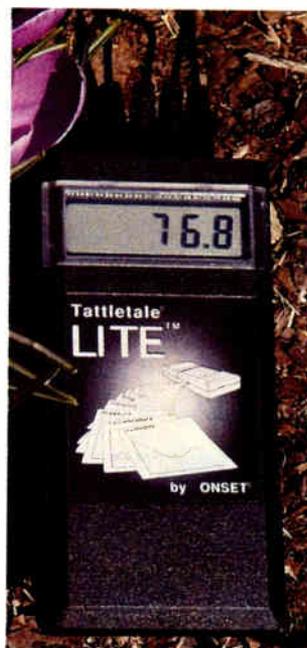
Data Logging by Battery

The PC- and Mac-compatible Tattletale Lite data logger stores from 32 to 512 KB of data from eight 15-bit analog inputs. Available as a kit, it includes eight programmable digital I/O lines, a 9600-bps universal asynchronous receiver/transmitter, an LCD, low-power modes, and the Lite-Language operating system.

The 9-V battery-operated Tattletale Lite operates between 0° and 70°C and connects to your computer via a detachable serial interface cable for launching and data recovery. The unit comes in two speeds: -S for minimum current drain and -F for maximum data collection rate. Built-in software and hardware use dithering and oversampling for converter resolution of 15 bits. **Price: \$490.**

Contact: Onset Computer Corp., 199 Main St., North Falmouth, MA 02556, (508) 563-9000; fax (508) 563-9477.

Circle 1289 on Inquiry Card.



Tattletale Lite



Finally, a fast, powerful text editor that integrates your favorite programming tools and uses no memory!



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Evaluation Copy
Call 1-800-45-VEDIT

- Mouse Support
- Pull-down menus
- Columnar blocks
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- Regular expressions
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- Emulate Wordstar, Word Perfect, Brief, vi, others
- Edit text and binary files of any size and line length
- Powerful macro programming language for instant "off-the-cuff" macros

DOS XENIX UNIX QNX FlexOS

The new VEDIT family of text editors offers stunning performance, versatility and ease of use. Completely written in assembly language, they are small and lightning fast. (3 to 30 times faster than other editors on large files where speed really counts.) Edit text and binary files of any size, even 100+ megabytes. Installation is trivial; VEDIT.EXE and an optional help file are all you need - no overlays, no configuration files, no environment variables.

For programmers, the new compiler support in VEDIT and VEDIT PLUS is a breakthrough. Run not only popular compilers, but debuggers and your favorite tools from within the editor. When shelling to DOS, VEDIT swaps itself and any desired TSRs out of memory to give you more memory than when you entered VEDIT. Only VEDIT offers you the advantages of a powerful editor without giving up the convenience of an integrated environment.

Call for your free, fully functional, evaluation copy today. See why VEDIT has been the choice of 100,000 programmers, writers and engineers since 1980.

VEDIT Jr. - Unmatched performance for only \$29.

All VEDIT editors include a pull-down menu system with "hot keys", context sensitive help, pop-up status and ASCII table, a configurable keyboard layout and flexible, unlimited keystroke macros. Perform block operations by character, line, file or column. Undo up to 1000 keystrokes - keystroke by keystroke, line by line, or deletion by deletion. Automatic indent, block indent and parentheses matching speed program development. Word wrap, paragraph formatting, justification, centering, adjustable margins and printing for word processing. Run DOS programs.

VEDIT - A best value at only \$69.

VEDIT can simultaneously edit up to 36 files and split the screen into windows. Search/replace with regular expressions. The most integrated compiler support available. Run VEDIT PLUS macros.

VEDIT PLUS - Ultimate programmer's tool for only \$185.

VEDIT PLUS adds the most powerful macro programming language of any editor. It eliminates repetitive editing tasks and permits creating your own editing functions. The macro language includes testing, branching, looping, user prompts, keyboard input, string and numeric variables, complete control over windows plus access to hardware interrupts, memory and I/O ports. Source level macro debugging with breakpoints and tracing.

VEDIT PLUS - \$185 for DOS, \$285 for UNIX/XENIX. 30 Day Money-back guarantee. Discount pricing for multiple users, schools and OEMs. VEDIT Jr. site licenses start at only \$250.



An intuitive user interface with pull down menus, hot keys, mouse support and context sensitive help make VEDIT easy to use, easy to learn.



Point and shoot file selection makes it a snap to edit new files, merge and split files, run macros and much more. Select files with the cursor keys or the mouse.



Just about everything about VEDIT is configurable, from the keyboard layout, to the screen colors, to the way control characters, tabs and the end of lines are displayed. Configure VEDIT with easy to use menus.

BENCHMARKS IN 3 MEG FILE

	VEDIT	BRIEF	Sage	QEdit
Simple search	57 sec	1:17 min	28 sec	Cannot
Save and continue	52 sec	3:52 min	1:47 min	Cannot
Load, modify, save, exit	21 sec	49 sec	1:38 min	Cannot
Block-column copy (40x200)	2 sec	30 sec	2 sec	2 sec
Delete one column in file	9:58 min	1:50 hour	1:03 hour	Cannot
60,000 replacements	3:18 min	1:44 hour	1:32 hour	Cannot

VEDIT is a registered trademark of Greenview Data, Inc. BRIEF is a trademark of UnderWare, Inc. Sage Profession Editor is a trademark of Sage Software Inc. QEdit is a trademark of SemWare.

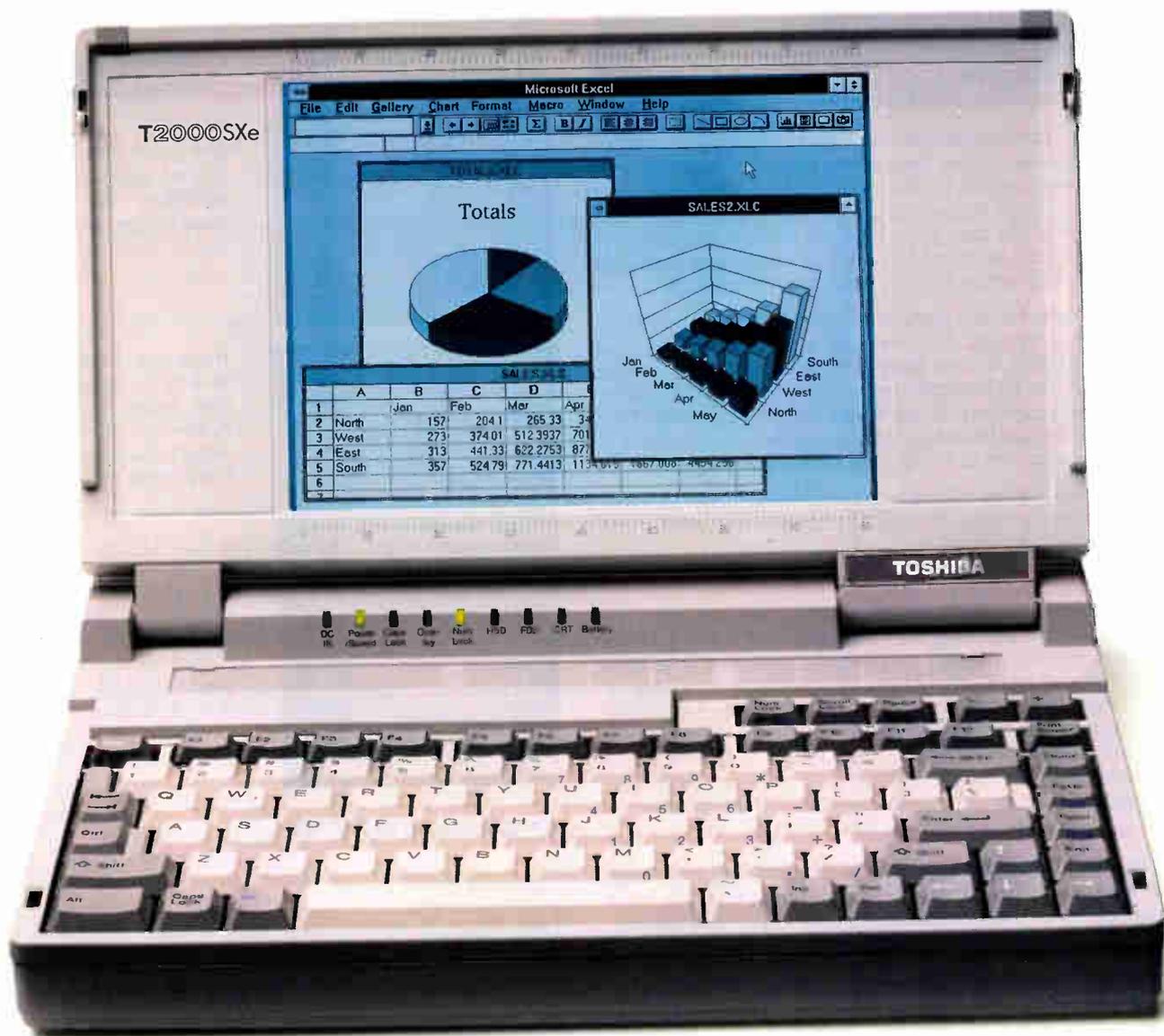
* DOS version also supports Concurrent DOS, DESQview, Microsoft Windows, PC-MOS/386 and most networks. Special CRT terminal version runs over serial lines and modems.

* Free evaluation disk is fully functional and can edit small files.

Greenview Data

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A few months ago we brought you the world's most useful computer—the Toshiba T2000SX.

That computer symbolized what we call “the next generation in personal computing.” A com-

puter that not only allows you the freedom to work where, when, and how you want to. But is so precisely engineered—from its superior keyboard to its easy-to-read VGA screen—

that you'll actually enjoy using it. Well, thanks to the incredible speed of modern technology, here we are once again.

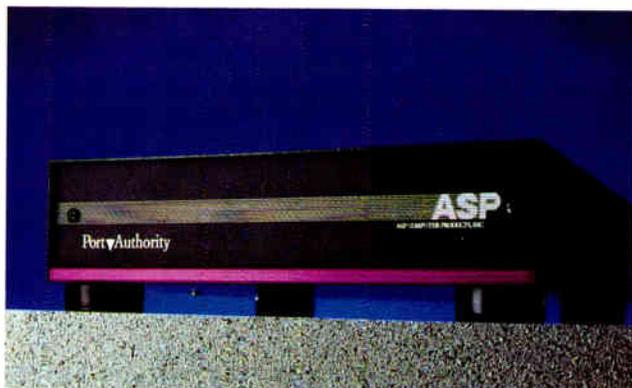
This time to present the new Toshiba T2000SXe.

Connect with Port Authority

The modem-size Port Authority gives you as many as 16 ports for setting up a low-cost network for your PCs, printers, and plotters. You can configure each port as input or output. Available in three models, Port Authority has 4 parallel ports and from 4 to 12 serial ports, depending on the model.

The standard 256-KB buffer—which you can upgrade to 4 MB—accepts data simultaneously from all users, queuing print jobs. Serial data transfer rates are as high as 115,200 bps. Port Authority uses standard RJ-11 cabling and connectors and works at distances as great as 2000 feet. (With longer cable lengths, data transfer rates fall to 9600 bps, ASP says.)

Price: 8-port PA800, \$695; 10-port PA1000, \$875; 16-port PA1600, \$1375.
Contact: ASP Computer Products, Inc., 1026 West Maude Ave., Suite 305, Sunnyvale, CA 94086, (800) 445-6190 or (408) 746-2965; fax (408) 746-2803.
Circle 1290 on Inquiry Card.



Port Authority joins virtually any computer to your printer.

Remote Dial-in for PCs and Macs

NetModem/E provides users of Macs and PCs with secure, transparent, and remote access to AppleTalk and NetWare networks. An integrated network communications server, the stand-alone NetModem/E has an Ethernet interface and a 9600-bps modem that supports V.32bis and V.42bis.

With NetModem/E you can dial in and access your network remotely as if you were directly connected to it. The device automatically adapts to either the AppleTalk or NetWare IPX proto-

col without your intervention. You can also remotely print directly from your Mac or PC to printers on the LAN.

Because NetModem/E sends standard network packets between the network and remote sites, you can run graphical applications such as Windows 3.0 on your remote PC and still have access to network services and data. With a Mac, you can do such things as share files with AppleShare file servers or Macs running System 7.0 and send and receive E-mail.

Price: \$2299.
Contact: Shiva Corp., 1 Cambridge Center, Cambridge, MA 02142, (617) 252-6300; fax (617) 252-6852.
Circle 1291 on Inquiry Card.

Plain-Paper Faxing Stands Alone

If you've been looking for a plain-paper fax machine that is fast and convenient, you may find it in the HP Fax-300. A stand-alone unit, the HP Fax-300 uses

ink-jet technology to produce 300-dpi documents when a compatible 300-dpi machine is on the other end. It is also fully compatible with most 200-dpi units.

With 16 gray scales, the HP Fax-300 runs at 9600 bps and is able to transmit a page every 12 seconds. The unit automatically redials a number up to 15 times at 3-minute intervals and has delayed dialing, enabling you to send as many as 100 transmissions at preset times.

The HP Fax-300 automatically stores as many as 28 documents into its 512 KB of resident memory. Its built-in remote diagnostics function lets you solve most transmission problems by phone, and its error-correction mode automatically re-sends garbled transmissions.

Price: \$2095.
Contact: Hewlett-Packard Co. Inquiries, 19310 Pruneridge Ave., Cupertino, CA 95014, (800) 752-0900.
Circle 1292 on Inquiry Card.

System 7.0 Gets a Carbon Copy

Version 2.0 of Carbon Copy for the Mac, Microcom's remote-control and file transfer software package for Macs, is System 7.0 compatible. The new version has increased file transfer speeds of up to 250 percent over the earlier version and includes virus-detection capabilities.

Price: \$99 per AppleTalk/serial user; \$299 for unlimited network users per each AppleTalk zone.
Contact: Microcom, 500 River Ridge Dr., Norwood, MA 02062, (800) 822-8224 or (617) 551-1000; fax (617) 551-1007.

Circle 1293 on Inquiry Card.



The HP Fax-300 uses plain paper and HP's ink-jet technology.

What makes a Standard?



SINCE MARCH 1990, THE INITIAL LAUNCHING DATE OF THE CARRY-1 BOOK-SIZE DESKTOP COMPUTER. A LINE OF CARRY-1 PRODUCTS: 6000 SERIES, 7000 SERIES, 8000 SERIES, AND 9000 SERIES, HAVE BEEN RELEASED AND IMMEDIATELY RECOGNIZED AS A NEW STANDARD. TODAY, WITH GREAT PRIDE, FLYTECH IS ANNOUNCING ANOTHER EPOCH-MAKING PRODUCT...CARRY-1 9000 DESKSTATION, CARRY-1 9000 DESKSTATION, WHICH IS THE WORLD'S SMALLEST DISKLESS WORKSTATION FOR LOCAL AREA NETWORKS. COMES COMPLETE WITH 80386SX/80286-16/80286-12 MICROPROCESSOR, MATH COPROCESSOR SOCKET, UP TO 4MB RAM, AN EXPANSION SLOT FOR NETWORKING CARD, ONE PARALLEL & TWO SERIAL PORT'S, 1024x768 VGA/CGA/MGA DISPLAY, 84-KEY MINI KEYBOARD WITH 101-KEY FUNCTIONALITY. THE SYSTEM WEIGHS LESS THEN 5 POUNDS, WITH A FOOTPRINT NO LARGER THAN THE AVERAGE HARD-BOUND BOOK (9.4" x 7.3" x 1.8" OR 240MM x 185MM x 45MM).

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THE NEW STANDARD

CARRY-1

THE POWER THAT MOVES YOU...

ZENITH DATA SYSTEMS UPSETS THE BALANCE



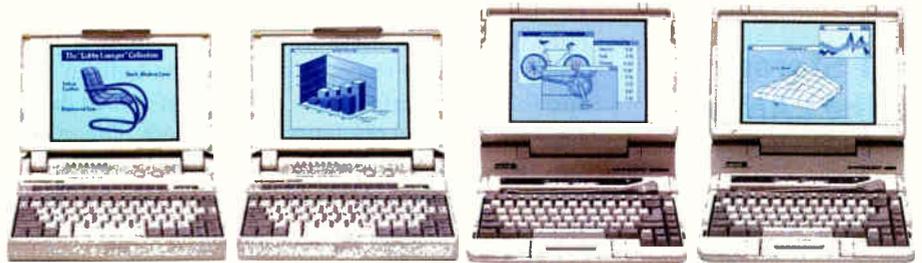
**MastersPort
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The fully-featured notebook that sets the standard for the Intel 386™ SL microprocessor. Its *Premier System Management*—with two separate resume modes—lets you hold work in active memory for weeks at a time.

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The conventional way to look at portable power is from the PC's perspective. The processor. The speed. The memory. At Zenith Data Systems, we believe the proper perspective is yours. How easily you can take full advantage of the power within your PC. A philosophy exemplified by our five new portables. Our breakthrough MastersPort 386SL. The first notebook you can use, and use, without ever thinking about battery life. Our SupersPort battery-powered i486™ laptops — the first ever. Both so advanced, they just might replace your desktop. Plus 286 and 386SX notebooks that are titans on performance. So if you want power without limits, these are the portables to move to. Unquestionably from Zenith Data Systems. For more information and the name of your nearest Zenith Data Systems Medallion Reseller, call **1-800-523-9393** in North America.

OF POWER.



MastersPort 286 MastersPort 386SX SupersPort 486SX SupersPort 486

LOOK INTO THE POWER OF 5 NEW PORTABLES

	MastersPort™ 286	MastersPort 386SX	MastersPort 386SL	SupersPort* 486SX	SupersPort 486
Processor - Speed	286 - 12/6MHz	386SX - 20/10MHz	386SL - 20/5/0MHz	486SX - 20/10MHz	486 - 25/12.5MHz
Co-Processor	80C287 socket	80387SX socket	80387SX socket	Upgradeable to 486-20MHz	Integrated
Memory (Std./Max.)	1MB/2MB	2MB/4MB	2MB/8MB (64K cache)	4MB/16MB	4MB/16MB
Hard Disk Drive	30MB	60MB	60MB	120MB	120MB
LCD/Size	Backlit/8.85"	Backlit/8.85"	Backlit/8.85"	EdgeLit/10.7"	EdgeLit/10.7"
Video/Gray Scales	VGA/16	VGA/16	VGA/32	VGA/64	VGA/64
Power Management	<ul style="list-style-type: none"> • Suspend/Resume • Sleep mode • Low battery operation 	<ul style="list-style-type: none"> • Suspend/Resume • Sleep mode • Low battery operation 	Premier System Management™ <ul style="list-style-type: none"> • Standby/Resume • Rest/Resume • Panic Save • Unattended communications 	Intelligent Power Management™	Intelligent Power Management
Software	MS-DOS® included	MS-DOS included	MS-DOS pre-installed; Microsoft® Windows™ v. 3.0 included	MS-DOS and Microsoft Windows v. 3.0 pre-installed	MS-DOS and Microsoft Windows v. 3.0 pre-installed
Weight (with battery)	6.6 lbs.	6.6 lbs.	6.8 lbs.	15 lbs.	15 lbs.

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Circle 339 on Inquiry Card.

Central Station for LAN Connectivity

Central Station is a small device about the size of a modem that lets you connect a printer, a modem, and a laptop to your NetWare or LANtastic network. You connect the units anywhere on the network via thin or twisted-pair Ethernet cable.

The small box contains the Ethernet connector, two serial connections, and one parallel and one PC interface. You can use all the connections simultaneously. **Price:** \$595.

Contact: Artisoft, Artisoft Plaza, 575 East River Rd., Tucson, AZ 85704, (602) 293-6363; fax (602) 293-8065.

Circle 1294 on Inquiry Card.

DAT Storage on the LAN Is Slimming Down

The 1-gigabyte, half-height, 5¼-inch Slim Line series of digital audio-tape storage devices contains flash memory technology. This lets you upgrade your on-site tape drive firmware in less than 90 seconds simply by inserting a cassette into the drive. You can configure each version of the drive differently on your LAN, depending on your needs and data storage applications.

Price: \$4000 to \$6000.

Contact: GigaTrend, Inc., 2234 Rutherford Rd., Carlsbad, CA 92008, (619) 931-9122; fax (619) 931-9959.

Circle 1295 on Inquiry Card.



A personal Unix workstation, the Protege 425cf is a fully configured system that's expandable.

Protege Workstations

One of Mobius's new Protege cf series of personal Unix workstations, the Model 425cf is a 25-MHz 486 machine. The preconfigured system ships with Interactive Unix System V release 3.2, X Window System, TCP/IP, Network File System, Looking Glass, and Motif Window Manager. The 425cf includes 8 MB of RAM (expandable to 32 MB), a 110-MB hard disk drive (expandable to more than 1 gigabyte), a 1.44-MB floppy disk drive, and built-in thick and thin Ethernet interfaces. Its 14-inch flat-screen display has 1024- by 768-pixel resolution for 16 colors. The workstation also has a parallel and two serial ports, a keyboard, a mouse, and sockets for the Weitek WTL3167 and WTL4167 math coprocessors.

Price: \$5990.

Contact: Mobius Computer Corp., 5635 West Las Positas, Building 4.410, Pleasanton, CA 94588, (800) 662-4871 or (415) 460-5252; fax (415) 460-5249.

Circle 1298 on Inquiry Card.



Available in several versions, GigaTrend's Slim Line DAT storage devices use state-of-the-art technology.

Windows Gets Voice Mail on the LAN

You use InterActive Sound in conjunction with Creative Labs' Sound Blaster board for voice mail on your LAN. The voice-mail software works with PCs running Windows 3.0 and Novell LANs. In addition to a proprietary Windows 3.0 driver for Sound Blaster, InterActive Sound consists of mouse-driven application software to digitize sound, store it on disk, and randomly access, review, organize, and play sound files.

Price: \$295.

Contact: InterActive, Inc., 101 Church Ave., Montrose, SD 57048, (800) 292-2112 or (605) 363-5117; fax (605) 363-5102.

Circle 1296 on Inquiry Card.

Compact Communicator

A 2400-bps pocket modem that's a bit larger than a deck of cards, the Voyager MV214 weighs 6 ounces. It features MNP level 4 error correction and MNP level 5 data compression of up to 4800 bps. CCITT and Bell compatible, the Voyager also supports V.23, letting you connect to the European Minitel system. You can use the Voyager with a standard RJ-11 jack or connect its acoustic interface to a mobile or pay phone.

Price: \$390.

Contact: COM1 Data Communication Corp., 5120 Avenida Encinas, Suite C, Carlsbad, CA 92008, (619) 431-5606; fax (619) 431-5744.

Circle 1297 on Inquiry Card.

WE CAN'T ALL WORK IN THE SAME SHOES. WHY SHOULD WE WORK WITH THE SAME MOUSE?

When you think about it, a one-size-fits-all mouse makes as much sense as a one-size-fits-all shoe. That's why Logitech™ created MouseMan™—the first line of mice designed to fit different kinds of hands. All MouseMan products are ergonomically shaped for comfort and ease of use. They're also totally plug compatible with the Microsoft® mouse. Of course, all come with Logitech's legendary quality and lifetime warranty.

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For more information, call:

800-231-7717 ext. 2606

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Tools That Power The Desktop.

Circle 170 on Inquiry Card (RESELLERS: 171).

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World Radio History



dFacts Are In.

DATABASE COMPARISON TABLE	dBASE IV version 1.1	Paradox version 3.5	FoxPro version 1.02
EASE OF USE			
Control Center organizes data, queries, forms, reports, labels, applications on <u>one</u> screen	Yes	No	No
Create applications <i>without programming</i>	Yes	Yes	No
Modern pulldown menus for all Design Tools	Yes	No	Limited
Query by Example (QBE) for easy access to information	Yes	Yes	No
Context specific help by menu item	Yes	No	No
PRODUCTIVITY			
Quick Layout for automatic forms, reports <u>and</u> labels	Yes	No	Yes
Application Generator for quick application development	Yes	Yes	No
Automatic code generation for all Design Tools	Yes	No	No
Automatic maintenance of <u>multiple</u> indexes for ordering data	Yes	No	No
Memo fields for notes, letters, descriptions	Yes	No	Yes
POWER & FLEXIBILITY			
Bold, underline, italic, subscript, superscript text for high impact reports and labels	Yes	No	No
User Defined Functions for extending programming language	Yes	No	Yes
Data input validity checking in forms	Yes	Yes	Yes
Multi-user transaction processing ensures data integrity	Yes	No	No
Number of file formats imported/exported	7	6	3
INDUSTRY STANDARDS			
#1 Selling, #1 Rated multiuser database; over 3 million users (1)(2)	Yes	No	No
Compatible with dBASE III PLUS data and applications	Yes	No	Yes
Compatible versions for DOS, VAX VMS, Macintosh, SunOS and other UNIX platforms (3)	Yes	No	Limited
Structured Query Language (SQL) integrated with programming language	Yes	No	No

(1) dBASE III PLUS and dBASE IV comprise approximately 35% of PC database systems sold (3 times nearest competitor) according to the most recent report by the market research firm Audits & Surveys (Oct. 1990) (2) Software Digest rated dBASE IV #1 among multiuser databases, October 1990 (3) Versions of dBASE IV are shipping for DOS, VAX, and SunOS. Macintosh and other UNIX Platforms are announced.

Based on what our customers tell us, we made a list of some of the most important features to look for in data management software.

Then we compared the new dBASE IV® version 1.1 with two other database products.

As you can see, dBASE IV offers exclusive advantages in

many categories.

For instance, only dBASE IV lets you access all its functions from a single screen. Called the Control Center, this screen lets you manage existing data, and create new tables, queries, reports, forms and labels totally without programming.

When all the facts are on the table, it's easy to see which database software is best.

Of course we aren't the only ones who have come to this particular conclusion.

Software Digest rates dBASE IV version 1.1 the #1 Multiuser Database (Vol. 7, No. 13, Oct. '90).

dTruth Comes Out.

Perhaps the most independent publication in the industry, *Software Digest* accepts no advertising whatsoever. Corporations pay hundreds of dollars a year to receive their monthly reviews—which are considered highly unbiased and objective. Their exhaustive, 75-page report concludes:

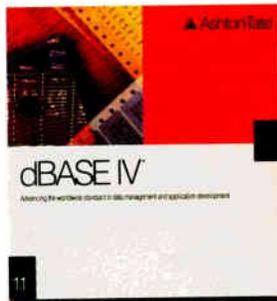
“Among the top ranking programs, dBASE IV (version 1.1) is the most well-rounded, with solid performance, versatility, and usability.” Commenting on speed, *Software Digest* points out that “dBASE IV produces all three test reports as fast as or faster than FoxPro/LAN.” As for Ease of Use and Ease of Learning, dBASE IV scored in the Excellent Range as many times as any other multiuser database product tested.

For a free evaluation kit, including competitive details and a free demo disk, call toll-free:

1-800-437-4329 ext. 1416.

Better yet, call 1-800-2ASHTON to upgrade to the new dBASE IV now.

The truth is, no other database can do so much to improve productivity.



 Ashton-Tate®

Software Digest RATINGS REPORT
 The Independent Comparative Ratings Report for Selecting IBM PC Business Software

Volume 7 Number 13

MULTIUSER DATABASE PROGRAMS

Ratings Key: ■ 70-100 ■ 50-69 ■ under 50

Software Digest Rating	Overall Evaluation	Overall Power	Program Name	Version Tested	Performance	Versatility	Error Handling	Ease of Learning	Ease of Use	Memory Requirement	Price	Volume Purchase Agreements	Page
***	7.0	6.7	dBase IV	1.1	■	■	■	■	■	450KB	\$795	✓	28
**	6.8	5.1	Paradox	3.5	■	■	■	■	■	640KB	\$995	✓	32
**	6.8	7.1	FoxPro/LAN	1.02	■	■	■	■	■	512KB	\$1,095	✓	30
**	6.4	5.1	DataEase	4.2	■	■	■	■	■	640KB	\$750	✓	26
*	5.8	3.6	R:Base	3.0	■	■	■	■	■	520KB	\$995	✓	34
*	5.7	6.0	Clarion Professional Developer	2.1	■	■	■	■	■	512KB	\$845	✓	24
*	5.7	6.6	Advanced Revelation	2.01	■	■	■	■	■	640KB	\$995	✓	22

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Realize New Windows Programs

Realizer combines a structured superset of BASIC, prefabricated Windows objects, Programmable Application Tools, and a visual form designer. Within Technologies created the environment to let you develop Windows applications without struggling with arcane scripting languages or the Microsoft Software Development Kit and a C compiler.

Prefabricated Windows objects include buttons, pull-down menus, and scroll bars. The visual form designer lets you quickly create an interface to an application by resizing and moving frames, edit fields, and list boxes.

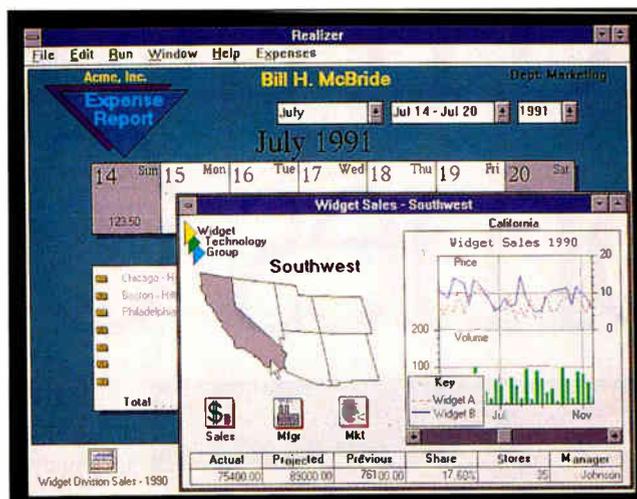
Advanced functions include a scheduler for timed events; triggers or links among tools to create associations and interactions throughout applications; a serial communications library; Dynamic Data Exchange support for building real-time systems or hot-linking data between applications; and access to any Windows application programming interface functions, as well as third-party Windows engines and functions written in C or Pascal.

A debugger included with the Realizer lets you test and fix programs using controls like single stepping, trace, variable display, and call tree.

Price: \$395.

Contact: Within Technologies, Inc., Laurel Corporate Center, Suite 201 South, 8000 Midlantic Dr., Mount Laurel, NJ 08054, (609) 273-8881; fax (609) 231-8991.

Circle 1299 on Inquiry Card.



Realizer's Programmable Application Tools let you add the standard elements of Windows programs, such as spreadsheet, chart, and editing functionality.

FORTTRAN Compiler for Next

Version 3.1 of the VAX/VMS-compatible Object-Oriented FORTRAN 77 compiler is compatible with Next's Interface Builder software toolkit, letting you add a Next-style GUI to a compiled FORTRAN program. Absoft says that the compiler, designed to port code from the VAX/VMS environment, takes full advantage of the 68040 and supports the 68030.

The compiler includes most VAX/VMS extensions and several from Sun Microsystems, Hewlett-Packard, IBM, FORTRAN 90, and FORTRAN 66. You can compile to ensure compatibility with popular mainframes and workstations or to optimize your code.

Price: \$995.
Contact: Absoft Corp.,

2781 Bond St., Rochester Hills, MI 48309, (313) 853-0050; fax (313) 853-0108.

Circle 1300 on Inquiry Card.

32-bit BASIC for Windows

ZBASIC/Windows, based on 32 Bit Software's ZBASIC-PC, lets you work in three levels of complexity, depending on your expertise and needs. You can use the package to write programs that will co-exist with other applications in the Windows environment.

ZBASIC-PC lets you write both 386 and 486 software programs on any PC. You can write programs on a non-386 machine and re-compile in the 32-bit version for the 386 and 486 hardware.

Price: \$199.95; ZBASIC-PC and ZBASIC/Windows, \$229.95.

Contact: 32 Bit Software, Inc., 3232 McKinney Ave., LB 14, Dallas, TX 75204, (800) 322-4879 or (214) 720-2051; fax (214) 855-0677.
Circle 1301 on Inquiry Card.

Cyma Revives Cause

Cause, the application generator formerly distributed by Maxem, has been rereleased by Cyma. Cause, which generates applications on the Mac and PC, lets you create cross-compatible programs without worrying about syntax and coding, Cyma reports.

Version 2.0's external call feature lets you access programs written in other languages and pass data back from within one Cause application to another.

Price: \$495 per platform; \$795 for both.

Contact: Cyma, 1400 East Southern Ave., Tempe, AZ 85282, (800) 292-2962 or (602) 831-2607; fax (602) 345-5703.

Circle 1302 on Inquiry Card.

A FORTRAN Checker for Correctness

Dimensional Reasoner is a programming tool for checking calculations in science, financial, engineering, and simulation applications written in FORTRAN and BASIC. The program provides an automated method for testing programs, useful for applications with extensive code or those developed by programming teams. The program checks for typos, incorrect equations, inconsistent use of variables, and incorrect documentation, its developer reports.

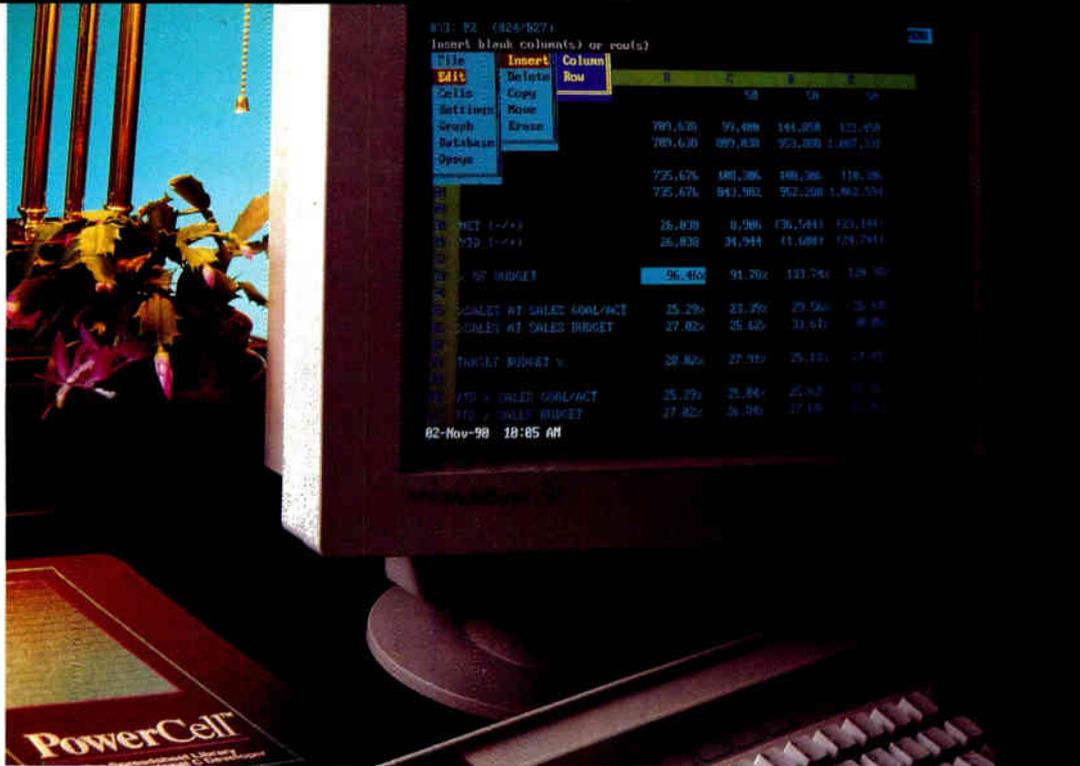
The program runs on the PC. Versions are being developed for the Mac, Pascal, and C.

Price: \$65.

Contact: Dimensional Reasoner, Inc., 205 Longleaf Court, Aiken, SC 29803, (803) 649-7887.

Circle 1303 on Inquiry Card.

PowerCell: Custom Spreadsheets For C



Easier Than 1.2.3

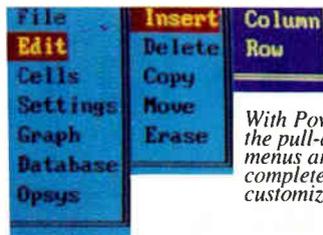
With PowerCell, Developing C Applications Just Got Easier.

PowerCell is the spreadsheet engine that goes beyond so-called "spreadsheet compilers" because it offers all the features of a complete spreadsheet program to your end users. Now you can create stand alone spreadsheet programs or integrate spreadsheet capabilities into C applications. You can also use PowerCell with your db_VISTA Database Management System and give your end users an application with incredible performance and a spreadsheet interface.

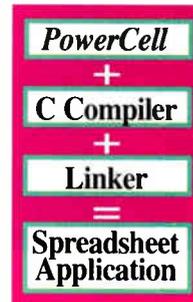
PowerCell™
The Spreadsheet Library for Professional C Developers

The PowerCell Advantage:

With PowerCell, you can modify the table-driven menu system to provide keystroke compatibility with products like Lotus 1-2-3, Quattro, and Excel. And with source code, PowerCell is infinitely customizable - you can add features to expand your application and remove features to save space or restrict your end users. PowerCell supports Pharlap's DOS extender, so you can build even bigger applications.



With PowerCell, the pull-down menus are completely customizable.



How The C And PowerCell Combination Adds Up to Great Spreadsheet Applications.

With PowerCell, it's easy to link spreadsheet functionality into your C applications.

Now Have It All With PowerCell
Fast development time for you and fast training for your end users—plus the flexibility to customize your applications. It's easy with PowerCell.

See us at
COMDEX/Fall '91
October 21-25, 1991
Las Vegas, Nevada

Call: 1-800-275-4724



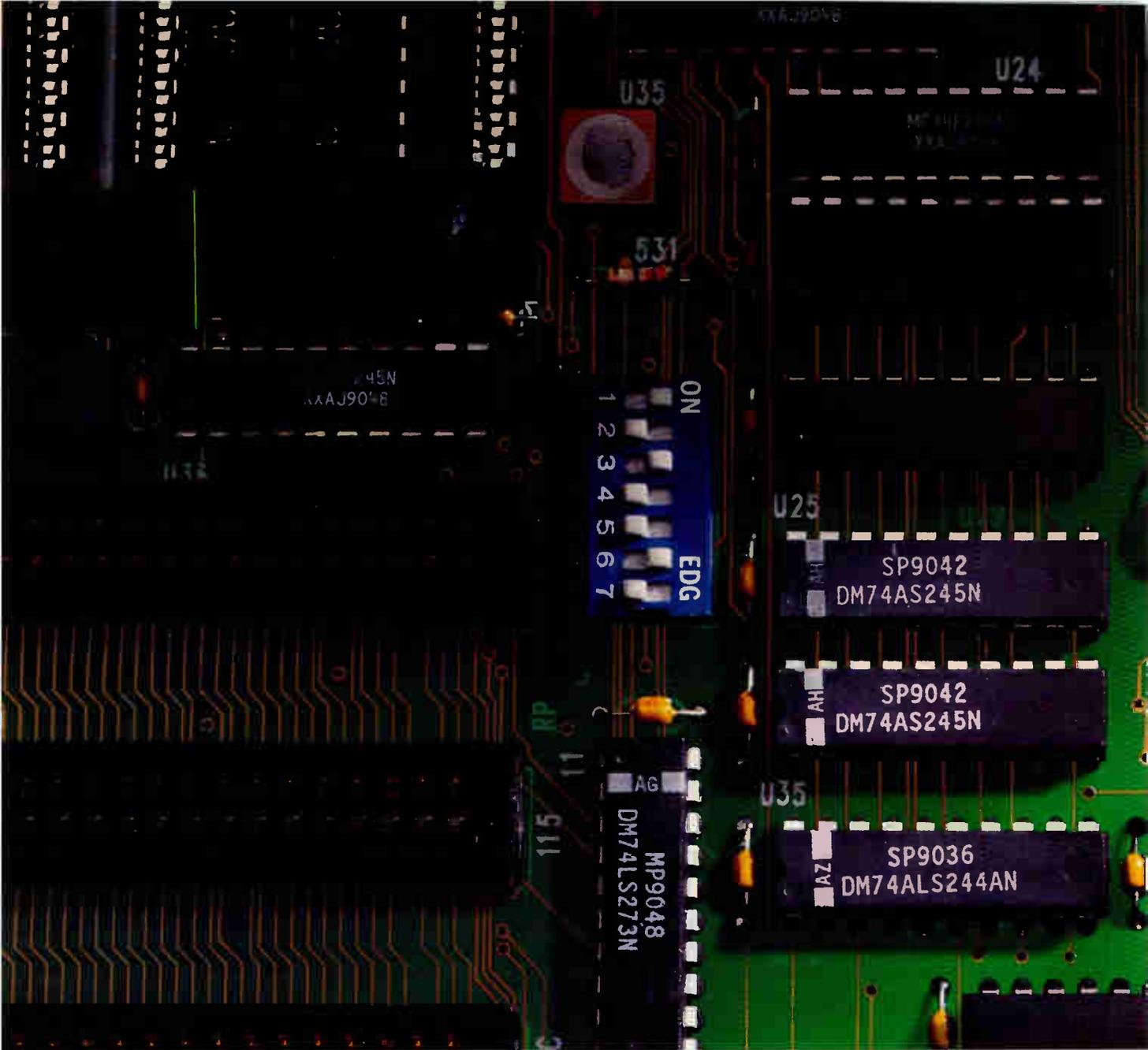
PowerCell Features: Support for all standard spreadsheet menu selections except graphics. Full complement of spreadsheet functions, including financial and statistical functions. Keystroke compatible with most popular spreadsheets: WKS WK1, DBF, ASCII file formats supported. Microsoft C and Borland C compilers. C source code is available. No royalties. Supports: MS-DOS.

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Switzerland: 41 64 517475 Taiwan: 886 2 552 3277 Turkey: 90 1 152 05 16 United Kingdom: 44 992 500919 Uruguay: 598 292 0959 USSR: 01 22 35 99 07; 812 292 7210

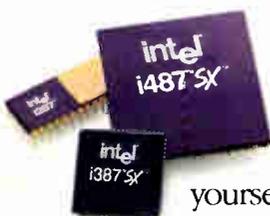
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World Radio History

Circle 265 on Inquiry Card.



Ask for genuine Intel or who knows what you



If you need a math coprocessor to speed your power applications, ask yourself this question: Which would you rather have sitting next to your Intel microprocessor — an Intel Math CoProcessor

or something you may know nothing about?

Because if you don't specify Intel, that's basically what you're getting — a big question mark. With Intel, however, there's simply no question. You're getting quality.

That's because Intel has the longest track



Math CoProcessors, I'll have to count on.

record with math coprocessors. In fact, we've manufactured and sold millions more than all the others combined. And we've tested every one of them with the most exhaustive battery of tests in the industry. All to assure you absolute reliability.

So ask for Intel Math CoProcessors. Or

there's no calculating what you'll end up with. For a free information packet, call (800)538-3373.

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The Computer Inside.™

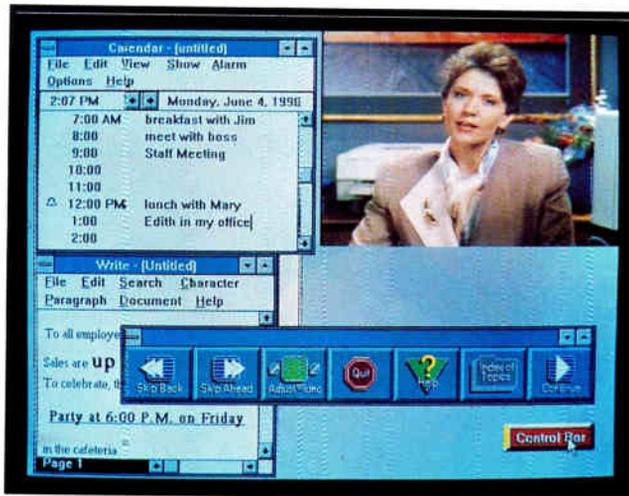
Circle 149 on Inquiry Card (RESELLERS: 150).

World Radio History

Learn Windows Using Multimedia

Companies with PCs looking to standardize on Windows 3.0 can use a new multimedia program from Comsell to teach the skills and fundamentals necessary to run Windows applications. The interactive Windows Basics program uses motion-video sequences and a talking on-screen instructor to teach you how to move data between documents and applications, how to open several programs at once, and how to perform other Windows operations. The program lets you learn at your own pace: You are able to back up, review, pause, or repeat any lesson sequence you want to.

To run Windows Basics, you need Windows 3.0, a videodisk player, and an IBM M-Motion Video Adapter/A Card or a similar full-motion video board. **Price:** \$1195. **Contact:** Comsell, Inc., 500 Tech Pkwy., Atlanta, GA 30313, (404) 872-2500; fax (404) 874-0451. **Circle 1304 on Inquiry Card.**



Through motion-video sequences, Windows Basics lets you work with an on-screen instructor who uses simple explanations and on-screen demonstrations to guide you through Windows operations.

1-2-3 for Windows and the Mac

Two long-awaited programs from Lotus Development are finally a reality with the release of Lotus 1-2-3 for Windows and the Mac. Both programs include the 1-2-3 Classic feature, which provides complete compatibility with

earlier versions of 1-2-3, and both let you access the familiar 1-2-3 menu by pressing the “/” key.

The Windows version includes SmartIcons, for push-button access to spreadsheet functionality, giving you single-click access to file access and saving, printing, charting, and other functions. In addition to supporting Windows conventions such as memory management, pull-down menus, and sizable windows, the program includes Adobe Type Manager for accurate on-screen representation. The Solver and BackSolver goal-seeking tools and 3-D functionality are also included.

The Mac version's unified work environment lets all data, graphs, macros, and drawn objects reside in the same file. The program fully supports Apple's System 7.0 operating system and can directly read and write Microsoft Excel 2.2

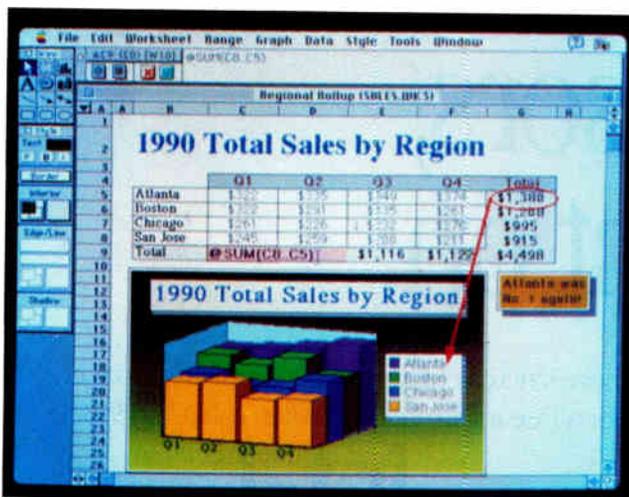
and 3.0 worksheet files. Using the 1-2-3 Classic menu, you can execute 1-2-3 macros without translating, the company says. **Price:** 1-2-3 for Macintosh, \$495; Standard Edition of 1-2-3 for Windows, \$595. **Contact:** Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142, (617) 577-8500. **Circle 1305 on Inquiry Card.**

Claris Launches into System 7.0 with Resolve

In addition to complete System 7.0 compatibility, supporting virtual memory, Balloon Help, TrueType, Publish and Subscribe, and AppleEvents, the Resolve spreadsheet sports an interface identical to that of other Claris applications. The common interface makes it immediately familiar to users of MacWrite, FileMaker Pro, SmartForm Designer, and other applications, the company says.

Along with offering a tight integration of its applications, Claris says, Resolve can meld Publish & Subscribe with XTND file translation so that workgroup publishing can include work created on non-Mac platforms.

The company has also released versions of MacWrite Pro, the company's flagship word processor, and MacProject II, the project management program, which support System 7.0. **Price:** Resolve, \$399; MacWrite Pro, \$249; MacProject II 2.5, \$499. **Contact:** Claris Corp., 5201 Patrick Henry Dr., Box 58168, Santa Clara, CA 95052, (408) 987-7000. **Circle 1306 on Inquiry Card.**



Lotus 1-2-3 for Macintosh lets you enhance and customize 3-D graphs with text boxes for annotation, lines, arrows, circles, rectangles, and logos.

PROTEUS

...CAUSING A SEA CHANGE IN AFFORDABLE INSTRUMENTATION

As the Greek God Protéus could assume many forms, so can our Protéus. With various software modules and corresponding adapters, Protéus can transform itself into a Universal Device Programmer, Data Logger, Universal Controller, Programmable Power Supply, Universal Device Tester and PCB Tester.

The New Wave in Instrumentation Begins with Bold Features:

- Standard IBM-PC parallel printer port; Optional detachable IBM-PC compatible computer for stand-alone operation; Built-in Power Supply.
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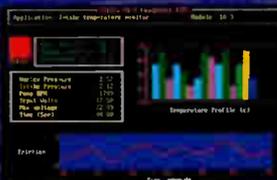
PROGRAMMER



ALGORITHM DEVELOPMENT



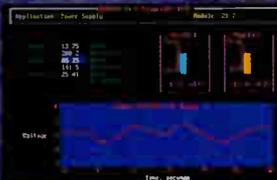
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from \$995

[Basic Unit with Programming Adapter supporting up to 40 pin devices; Detachable computer shown in photo not included.]

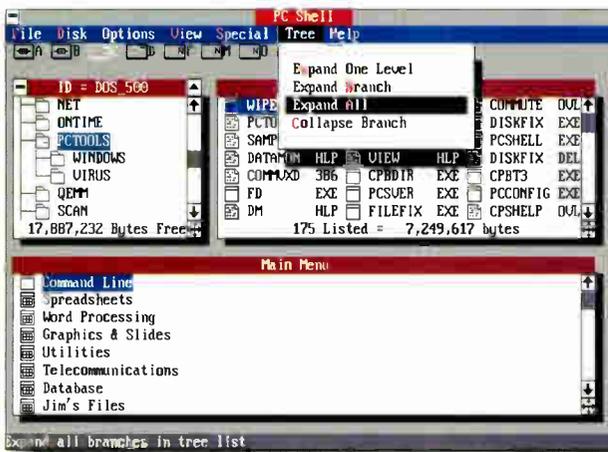


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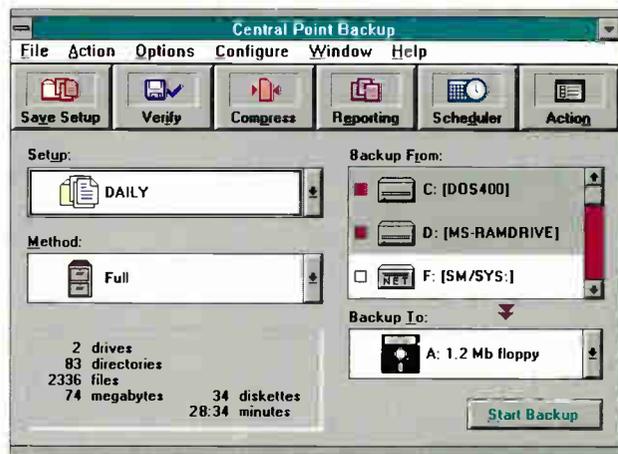
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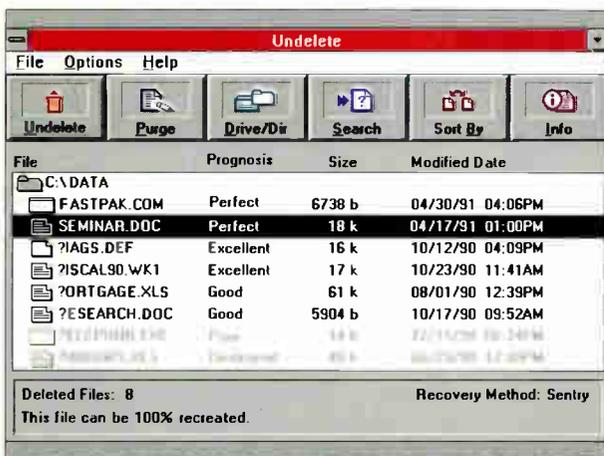
“We Chose PC Tools The Best Technology



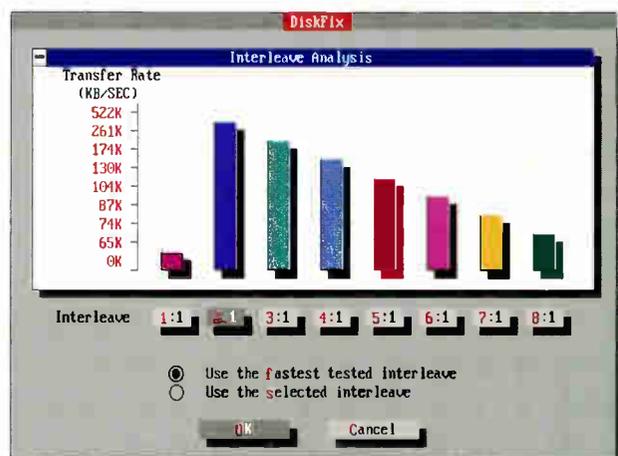
DOS 5.0 Compatible Shell & File Manager. Designed for DOS 5.0 keystroke and menu compatibility, PC Tools 7.0 gives you a powerful system for launching applications and managing your hard disk. Includes viewers for 37 popular programs.



DOS and Windows Backup. Only PC Tools gives you award-winning backup for DOS and Windows in one box. Both programs use the same keystrokes and file formats so you can move to Windows without a hitch.



DOS and Windows Undelete. Our new Undelete moves erased files to a "safety zone" on your disk – local or network. It's compatible with the technology we licensed to Microsoft for DOS 5, but provides even better protection.



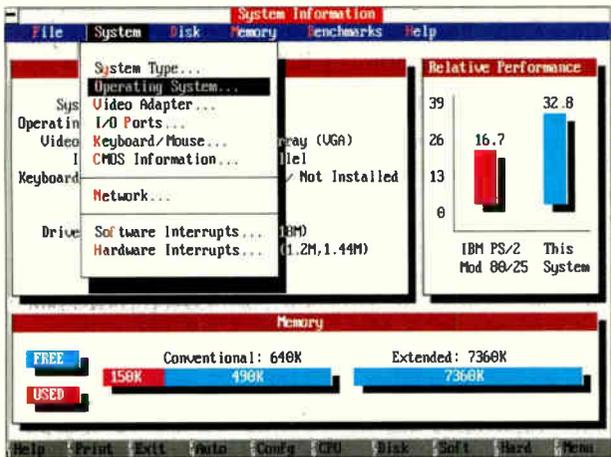
Disk Maintenance and Repair. To help avoid disk crashes and optimize data transfer, our DiskFix™ now does non-destructive, low-level reformatting. DiskFix solves dozens of other disk problems as well.

Tools Because It Is The Best On The Market."

Brad Silverberg, VP for DOS & Windows, Microsoft (Oct. 1990)



Remote Computing. PC Tools Commute™ lets you take control of another PC, whether you're across town or across the country. Use it over a modem or LAN. You even get remote mouse support for Windows.



System & Network Information. Reports on over 160 attributes, including video, I/O, memory, mass storage, and four performance benchmarks. On NetWare, SI displays all servers, usage, users, and Novell groups.

Introducing PC Tools™ 7.0.

Whether you're running DOS or Windows, on a network or stand-alone, nothing can protect and manage your data as completely as PC Tools™ 7.0.

New PC Tools gives you the most advanced utilities you can buy in one integrated package. Like real Windows applications, new remote computing, and the only DOS shell with a Microsoft-licensed visual display.

Nothing tops PC Tools 7.0 for data recovery. Our new Delete Sentry manages and protects your deleted files to ensure 100% recovery. And gives you file-preview capability as well. It's the perfect companion to the undelete technology we wrote for DOS 5.

For the best technology available, get new PC Tools. Call us at **1-800-445-4202** for the name of the dealer nearest you.



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Making Computing Safer, Simpler, Faster.

Circle 63 on Inquiry Card.

Let's Dance (with the Planets)

The new version of Dance of the Planets, a solar system simulation program for the PC, adds additional detail to solar eclipses, including the solar corona and stars appearing during a state of total eclipse. Version 2.3 lets you view local horizons, and the viewing of ancient skies is enhanced to account for the Earth's slowing rotation. You can view skies as they would have appeared as early as 4680 B.C., according to A.R.C. Software.

The program provides a general model of the dynamic sky with 10,500 stars and deep-sky objects. Simulations include detailed solar and lunar eclipses, lunar and planetary occultations, and rotating planets with accurate surface features and lighting effects.

Price: \$195.

Contact: A.R.C. Software, P.O. Box 1955, Loveland, CO 80539, (800) 759-1642 or (303) 667-1168; fax (303) 667-1105.

Circle 1307 on Inquiry Card.



A space view of Saturn as shown by Dance of the Planets.

Circuit Capture, Simulation, and Analysis

With the release of Genesis, Circuit Analysis, and Circuit Synthesis, MicroSim provides an integrated environment for electrical and electronic circuit design, simulation, and analysis.

Genesis, which includes MicroSim's schematic capture program called Schematics, provides an integrated environment for graphical definition, simula-

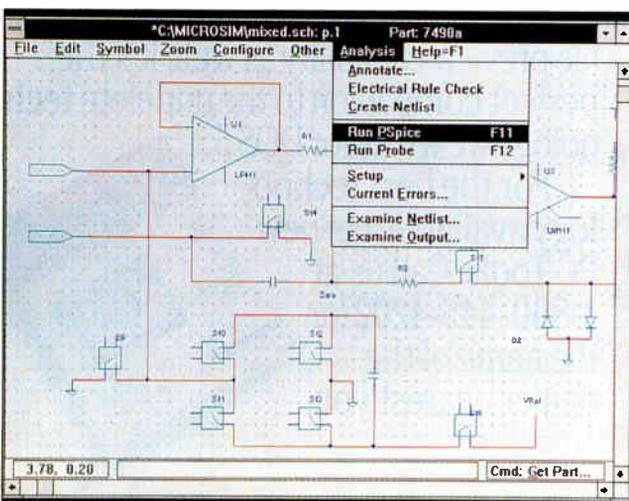
tion, and circuit analysis through its direct interface to PSpice and Probe. Schematics is available under Windows 3.0 and Open Windows on Sun workstations.

PSpice 5.0, part of the Circuit Analysis package, is for analog and mixed A/D circuit analysis. The Probe option can display analog and digital waveforms simultaneously for mixed-mode circuit analyses supported by the Digital Simulation option.

The Circuit Synthesis package includes the Filter Design 5.0 program for the synthesis of frequency-selective filters. The Circuit Analysis program supports DOS systems, Sun workstations, the Mac, and the VAX. **Price:** Genesis: Windows Mac, \$695; dV/dt Plus (for extended memory), \$795; dV/dt Timing Diagram Accelerator with Test Vector Generator, \$995.

Contact: Doctor Design, Inc., 5415 Oberlin Dr., San Diego, CA 92121, (619) 457-4545; fax (619) 457-1168.

Circle 1309 on Inquiry Card.



Schematics provides an integrated environment for graphical definition, simulation, and circuit analysis through its direct interface to PSpice and Probe.

Design and Verify PLD Designs

The new version of dV/dt Timing Diagram Accelerator, Doctor Design's program that automates the tedious task of drawing timing diagrams, adds support for the company's new Test Vector Generator program, thus linking dV/dt to leading programmable-logic-device (PLD) simulators. Timing Diagram Accelerator 3.0 also supports printers.

Available on the Mac and PC, dV/dt supports timing verification during the pre-schematic capture design stage. The program lets you sketch and analyze what-if conditions and instantly see the effects of changes in circuit timing. When you modify your parameters (e.g., change the clock speed), the effects ripple throughout the diagram.

The Test Vector Generator links dV/dt to PLD simulators like ABEL, CUPL, OrCAD/PLD, Schema, and Palasm. The combination of the two programs lets you design and test PLD designs without having to build a prototype, Doctor Design says.

Price: dV/dt Test Vector Generator, \$495; dV/dt Standard DOS, \$695; dV/dt Mac, \$695; dV/dt Plus (for extended memory), \$795; dV/dt Timing Diagram Accelerator with Test Vector Generator, \$995.

Contact: Doctor Design, Inc., 5415 Oberlin Dr., San Diego, CA 92121, (619) 457-4545; fax (619) 457-1168.

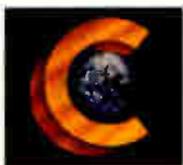
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WATCOM C8.0/386
Optimizing C Compiler and Tools
for 386 Extended DOS

WATCOM C/386
for Windows

Unleash 386 Power on Your Microsoft C Code.

- ❑ Interactive source-level debugger
- ❑ Generates high-performance code for 32-bit protected mode
- ❑ Microsoft source and library compatible
- ❑ Fast, tight code
- ❑ Profiler
- ❑ Protected-mode version of compiler
- ❑ Graphics library
- ❑ 100% ANSI C and SAA compatible
- ❑ Run-time compatible with WATCOM FORTRAN 77/386



Experts Agree on WATCOM C:

"When Novell went looking for a 32-bit compiler for use with the NetWare 386 developer's kit, the company selected WATCOM's... It's clear that Novell chose wisely; this product is a winner."
Fred Hommel, BYTE, December 1989

"WATCOM C/386 is a fantastic new ANSI C compatible compiler for 386-based PC's... If you have written your application in Microsoft C, you will love this compiler."
J. Richard Hines, Electronic Test, December 1989

"Microsoft library- and source-compatibility makes WATCOM C7.0/386 ideal for porting DOS applications to 32-bit native mode. This compiler enables full 386 performance without 640K limitations."

Richard M. Smith, President, Phar Lap Software, Inc.

"WATCOM is definitely the leader in object-level optimizations... For flat-out execution speed, WATCOM C showed shining performance."

Computer Language, February 1989

WATCOM C8.0/386 Professional

• 100% ANSI C optimizing compiler • Protected-mode version of compiler • 386 run-time library object code • Windowed source level debugger • Profiler • Editor • 386 graphics library • MAKE • Linker • Object-code librarian • Object-code disassembler • Supports Phar Lap and ERGO DOS extenders

1-800-265-4555

WATCOM

415 Phillip Street, Waterloo, Ontario, Canada N2L 3X2
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WATCOM C is a trademark of WATCOM Systems Inc.
Trademarked names are the properties of their respective owners.
© Copyright 1990 WATCOM Products Inc.

WATCOM C/386 for Windows

- ❑ Enables 32-bit Windows 3.0 GUI applications
- ❑ Interactive debugger for 32-bit Windows GUI applications
- ❑ Ideal for porting 32-bit Unix applications to Windows
- ❑ 32-bit flat model simplifies Windows memory management
- ❑ Royalty-free run-time license
- ❑ Requires Windows 3.0 SDK, does not require DOS extender

Show Your Hard Disk Who's Boss

Finding a particular file on your hard disk can be a frustrating job, but Imsi has something to help you. Its menuing and hard disk manager, MenuDirect Gold, now simulates a Windows-type interface that lets you move, size, and open multiple windows. You can build unlimited menus and submenus that let you access files and programs with a single keystroke.

Finding lost information is now easier with MenuDirect's tree display and hard disk search capabilities. Other features include password protection and usage reporting for programs, as well as file undelete, pop-up calculator and calendar, and mouse support.

MenuDirect Gold runs on IBM and compatible systems.

Price: \$79.95; \$495 for network version.

Contact Imsi, Inc., 1938 Fourth St., San Rafael, CA 94901, (800) 833-4674 or (415) 454-7101; fax (415) 454-8901.

Circle 1310 on Inquiry Card.

Windows-Like Interface Added to Fastback Plus

A graphical interface that lets you initiate a backup session with a single mouse-click and an improved macro language are two of the new features of Fastback Plus 3.0, Fifth Generation's DOS backup utility.

The built-in English-language macro editor supports nesting to run other macros, single-stepping and



Finding lost information is now easier with MenuDirect's tree display and hard disk drive search capabilities.

other debugging aids, suspend and resume, and a Record Command Timing feature that replays a macro at the same speed at which it was recorded. The macro language's built-in scheduler lets you automate unattended backups.

Version 3.0 backs up multiple volumes, such as the C, D, or E drives, in a single session. It also provides bindery and trustee rights on NetWare 286/386. The NetWare bindery, which contains information on network clients, is the foundation of client security, password system, and accounting on the network.

The program also supports data compression and deletion during backup.

Price: \$189.

Contact: Fifth Generation Systems, Inc., 10049 North Reiger Rd., Baton Rouge, LA 70809, (800) 873-4384 or (504) 291-7221; fax (504) 291-5453. Upgrade information, (800) 933-0108.

Circle 1311 on Inquiry Card.

SPREAD THE WORD

Please address new product information to New Products Editors, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Better yet, use your modem and mail new product information to the microbytes.hw or microbytes.sw conferences on BIX. Please send the product description, price, ship date, and an address and telephone number where readers can get more information.

IconAuthor Supports CD-Audio

IconAuthor, an authoring tool for developing interactive multimedia presentations, now offers enhanced audio support through its support for Multimedia Extensions to Windows 3.0. Even if you're not a programmer, IconAuthor 4.0 lets you develop interactive multimedia applications that combine text, graphics, animation, full-motion video, and audio for computer-based training, self-service terminals, and interactive desktop presentations, AimTech says.

The new version adds support for CD-audio, waveform, and MIDI sound, plus support for the MediaVision Pro Audio Spectrum and Creative Labs' Soundblaster boards. A new interface to the program decreases time spent in application development and debugging, the company says.

Support for the Windows multiple-document interface lets you open more than one application, or duplicates of an application, and copy and paste among them. A zoom capability has been added, along with a ribbon bar for access to frequently used commands. A status bar provides the icon description without opening the icon's content editor.

Applications can run in a window. Support for BMP and RLE file formats is said to increase the graphics display speed by up to 10 times.

Price: \$4995.

Contact: AimTech Corp., 20 Trafalgar Sq., Nashua, NH 03063, (800) 289-2884 or (603) 883-0220; fax (603) 883-5582.

Circle 1313 on Inquiry Card.

Predict the Tides on the Mac

A program for newspaper editors, marine pilots, sailors, surfers, and anyone else who needs to predict ocean tides and tidal currents is now available for the Mac. Harbor Master, an ocean-tide prediction program, has tidal-current information for 2300 locations in the continental U.S., Alaska, and Hawaii and a total of 2900 tide locations. You can use it to generate calendars that track a location's high and low tides.

The program can also generate tidal-current calendars with information such as sunrise and sunset times; flood, ebb, and slack; current speed and direction; and moon phase.

Price: \$149.

Contact: Zihua-Software, P.O. Box 51601, Pacific Grove, CA 93950, (800) 659-0155 or (408) 372-0155.

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- 1 Parallel/2 Serial Ports
- 124 Key AnyKey™ Keyboard
- Microsoft Mouse
- New MS DOS 5.0
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True-Color Imaging in Windows 3.0

Windows users looking for an image-creating and -editing program that breaks out from the restraint of the 256-color palette and costs less than \$500 have an option in WinRix. The program supports Object Linking and Embedding in Windows 3.1. In WinRix, OLE provides a direct editing link between images and the documents in which they are placed. Depending on your video display adapter, WinRix lets you create and edit images in 15- or 24-bit resolution. The program also supports standard VGA displays.

In addition to adding a variety of image-editing features (e.g., process filters, global and spot adjustment, and brightness and contrast control), WinRix includes antialiased fonts and a collection of built-in clip art.

The program supports color scanners from within the application.

Price: \$495.

Contact: Rix SoftWorks, Inc., 18552 MacArthur



The 24-bit WinRix image creation and editing program can import and export files in TIF, Targa, PCX, and GIF format. It also supports Object Linking and Embedding in Windows 3.2.

Blvd., Suite 200, Irvine, CA 92715, (800) 345-9059 or (714) 476-8266; fax (714) 476-8486.

Circle 1000 on Inquiry Card.

Powerful Image Editing in DOS

Tempra Pro, Mathematica's powerful program for capturing, manipulating, and editing images, works with 24-bit images and can be used to edit

images of up to 8000 by 8000 pixels in 24-bit color. The program uses its own GUI but can operate as a DOS application under Microsoft Windows. You edit images in scrollable, resizable windows. The program is a full 32-bit application, which is why it can handle such large images easily.

The program has a wide range of powerful editing tools, including freehand drawing, spline-based curves, polygons, antialiasing, tints, washes, and advanced masking.

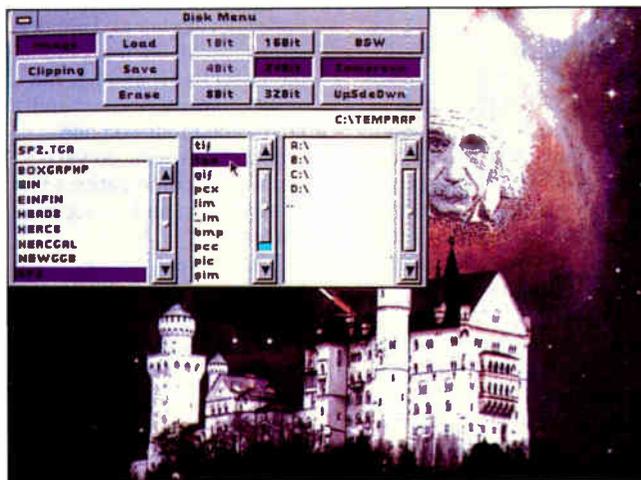
Tempra Pro 1.0 works directly with a variety of scanners and can be used to scan images in up to 24-bit color. It can automatically dither these so that they can be displayed clearly.

To edit 24-bit, 8000- by 8000-pixel images, you need a 200-MB hard disk drive or higher.

Price: \$495.

Contact: Mathematica, Inc., 402 South Kentucky Ave., Lakeland, FL 33801, (800) 852-6284 or (813) 682-1128; fax (813) 686-5969.

Circle 1001 on Inquiry Card.



Tempra Pro 1.0's interface resembles Windows and Motif. When Microsoft improves Windows' memory management and I/O functionality, Mathematica says it will then offer a native GUI version of Tempra Pro.

System 7.0 Adorns Canvas 3.0

The System 7.0-savvy version of the Canvas drawing package uses the new Mac operating system to connect documents to other applications and share text blocks, charts, and graphics across networks. The program lets you adorn subscribed items by modifying fonts and stretching text and graphics that originate from a word processor.

According to Deneba, when Canvas subscribes to a document published from a word processor, you can change the size of the document's text, perform kerning, or customize its colors from within Canvas.

You can also change the orientation of graphs and other objects. For example, if you publish a graph from Excel to Canvas, then once you're in the draw program, you can modify the shape of the graph. When you modify the data in Excel, the modified data appears in the Canvas document, but the graph retains its modified shape and doesn't revert to its original shape.

The program supports interactive TrueType manipulation and character-by-character colorization. Technical illustration features include definable hatch patterns and automatic dimensioning.

Canvas 3.0's file translators include EPSF, Illustrator 1.1 and 88, CGM, .DXF, IGES, PICT, TIF, MacPaint, StartUpScreen, and MacDraw I and II (read only) formats.

Price: \$399.

Contact: Deneba Software, 3305 Northwest 74th Ave., Miami, FL 33122, (305) 594-6965; fax (305) 477-5794.

Circle 1002 on Inquiry Card.

Compress Windows Video Using Fractals

Iterated Systems, a company that early this year released a hardware/software combination that uses fractal transforms for compressing and playing full-motion images on PCs with a VGA screen, now offers a similar kit for Windows.

The company also offers Windows support for compressing still-color images.

The P.OEM Windows Developer's Kit for gray-scale, full-motion video is an add-on to the P.OEM Grayscale Video Developer's Kit. The Windows kit, a library for C compilers, lets you develop applications that incorporate software-based video without Microsoft's Multi-Media Extension, Iterated Systems says.

While the gray-scale video and still-color kits require special hardware to compress the video images, the end user isn't required to buy special hardware to run the application. Video software decompression occurs in real time. Quarter-screen, gray-scale video can be played at speeds of up to 30 frames per second on a 33-MHz 386.

The Windows kit supports the playback of gray-scale video in a quarter-screen window at 160- by 100-pixel or 160- by 120-pixel resolution. Compression, done on a P.OEM



Iterated's P.OEM compression technology uses fractal transforms to compress images. The uncompressed image at left consumes 768K bytes. The compressed image at right consumes 10K bytes.

Fractal Transform Image Compression Board with compression software, takes about 1 second per frame. Or you can use the company's Fractal Factory Compression Service. The size of the compressed file varies from 250 to 500 bytes per frame.

The Windows Developer's Kit requires either the P.OEM Color Stillframe Developer's Kit (\$2995) or the Grayscale Video Developer's Kit (\$3395). The compression board (a full-slot ISA bus board based on an Intel 960 RISC processor and eight custom application-specific ICs) with software costs \$9850. You can incorporate sound via Digi-speech, a PC sound system from Digispeech, Inc. **Price:** Windows Developer's Kit for gray-scale video, \$995; Windows Developer's Kit for color still-frame

Stork lets you create a professional installation procedure in WYSIWYG mode without requiring the use of programming or a script language.

From the add menu, you can specify checkbox menus and radio buttons that will appear in the installation menu.

images, \$995.

Contact: Iterated Systems, Inc., 5550A Peachtree Pkwy., Norcross, GA 30092, (404) 840-0310; fax (404) 840-0029.

Circle 1004 on Inquiry Card.

The Stork Delivers Easy Installation

So you've written and debugged your program. But wait—you're not done yet. You still have to write the installation procedure. That's where the Stork comes in.

The Stork, for DOS-based programs, automates the process of creating a user-friendly installation procedure. It has tools for configuring the disk organization, creating the interface that the end user sees, specifying system checks, and building the media set. The Stork's Make Menu tool lets you create a professional interface for the end user of your application to indicate which product options will be required during installation.

The Disk Manager tool lets you organize all the program's files on your media. When you revise the applica-

tion, you load new files into the product directory, and the Disk Manager tool indicates which files need to be added to the disk set. It also tells you if any files have outgrown their disk. The Stork can automatically create the installation procedure.

Price: \$175.

Contact: Island Systems, 7 Mountain Rd., Burlington, MA 01803, (617) 273-0421; fax (617) 270-4437.

Circle 1005 on Inquiry Card.

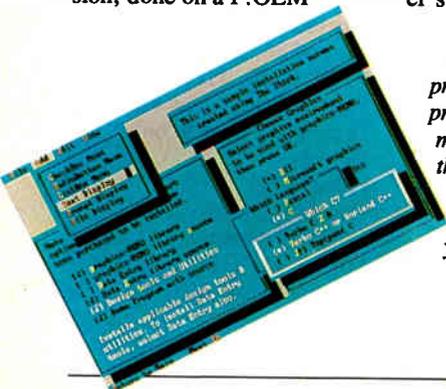
No More PCL Coding

Design-a-Form lets you integrate forms into applications programmed in dBase, Paradox, R:Base, Clipper, and other languages. Bytech Business Systems says the tool lets you create a complex form by positioning type, rules, copy blocks, and graphics characters where you want. Design-a-Form then creates a file containing the Printer Control Language codes that you copy into your application. You send the form to the printer and then the data. Form and data print in one pass.

Version 2.0, currently under development, supports internal scalable fonts of the LaserJet III and has the ability to print portrait and landscape modes on one sheet, center text, do various weight combinations for border lines, and perform other tasks.

Price: Current version, \$185; version 2.0, \$239. **Contact:** Bytech Business Systems, 5C Medical Park Dr., Pomona, NY 10970, (914) 354-8666; fax (914) 354-5433.

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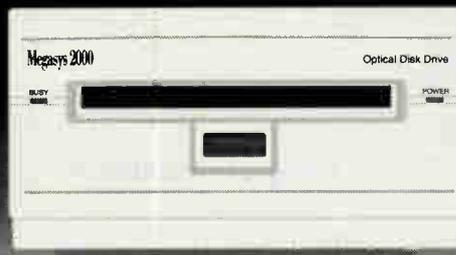


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PC Sources, Feb 1991

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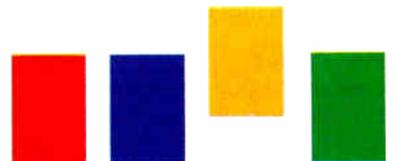
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World Radio History

Industrial-Strength Project Management

A project management program currently in use in European automotive, power, banking, and construction firms is now available in the U.S. with an enhanced GUI and more detailed resource management. Texim Project for the PC combines task, resource, and cost information for comprehensive project overview and management reports.

The program lets you create reports for any level of management so that the recipient receives only relevant information. Password protection lets you protect files, and when it is operated on a LAN, the program supports file locking. A merge function lets you update sub-projects and roll them into the total plan.

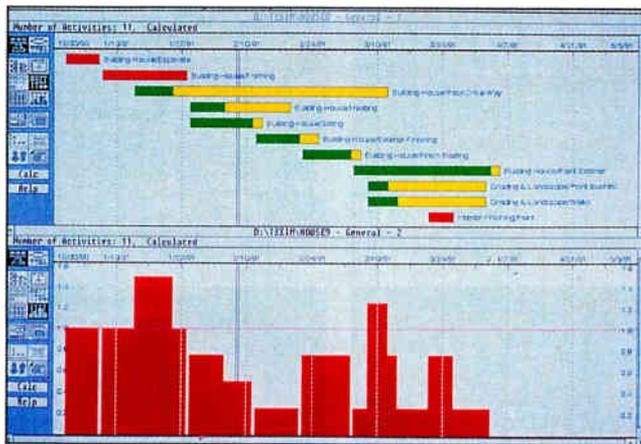
The program's interface provides WYSIWYG reports. It also supports PostScript and color PostScript devices.

For large and small projects, the program handles project management needs through multilevel work breakdown structuring. Texim Project's organizational breakdown structure capabilities match the organization of a company and let you track resource schedules and costs. Overloading is detected through options such as leveling and limited resource scheduling. The program's OBS concept of pool hierarchies mirrors the WBS.

Price: \$1295.

Contact: Texim, Inc., 833 Portland Ave., St. Paul, MN 55104, (612) 290-9627; fax (612) 290-9631.

Circle 1008 on Inquiry Card.



Texim Project's split-screen view displays a resource bar chart and a load profile for the same resource. The program supports up to four windows, each with its own screen of a file.

Protect Your Legal Interests

It's Legal, Parsons Technology's program that lets you protect your legal interests, adds 13 new documents and extensive legal assistance in version 2.0, the company says. The program walks you step-by-step through the preparation of 24 binding legal documents in all.

New to version 2.0 is the durable health-care power-of-attorney document that lets you determine who should decide the extent of life-sustaining measures in the event of a debilitating illness or accident. Other new documents concentrate on consumer affairs and business contracts, including credit and consumer letters, employee documents, consulting/independent contractor agreements, equipment leases, and bills of sale. It also offers a form for board of directors minutes.

The new on-line legal-support system consists of a legal guide and a glossary of terminology to help you understand the law.

Price: \$69.

Contact: Parsons Technol-

ogy, 375 Collins Rd. NE, P.O. Box 3120, Cedar Rapids, IA 52406, (319) 395-9626; fax (319) 395-0217.

Circle 1012 on Inquiry Card.

Save Money on Your Credit Card Bill

Most credit cards make you pay interest on your outstanding balance. You probably realize that the more you pay each month on the balance, the less interest you have to pay. But how do you tell how much money you save by doing this?

The Banker's Secret Credit Card Software is designed to solve this problem. It lets you quickly calculate how much money you can save through the use of a variety of prepayment schedules on all your credit cards.

Price: \$25.

Contact: Good Advice Press, P.O. Box 78, Elizaville, NY 12523, (800) 255-0899 or (914) 758-1400; fax (914) 758-1475.

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Ten Pop-up Financial Calculators

Finance10 2.1 offers 10 financial calculators that you can run as a stand-alone or RAM-resident program.

The 10 calculators are bond yield to maturity, depreciation, financial manager's rate of return, internal rate of return, individual retirement account, lease versus purchase analysis, loan amortization schedule, personal financial statement, present value/future value, and statistics.

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Contact: The Financial Software Company, P.O. Box 481290, Los Angeles, CA 90048, (800) 332-2983 or (213) 931-1527.

Circle 1009 on Inquiry Card.

Throw Out Your Checkbook

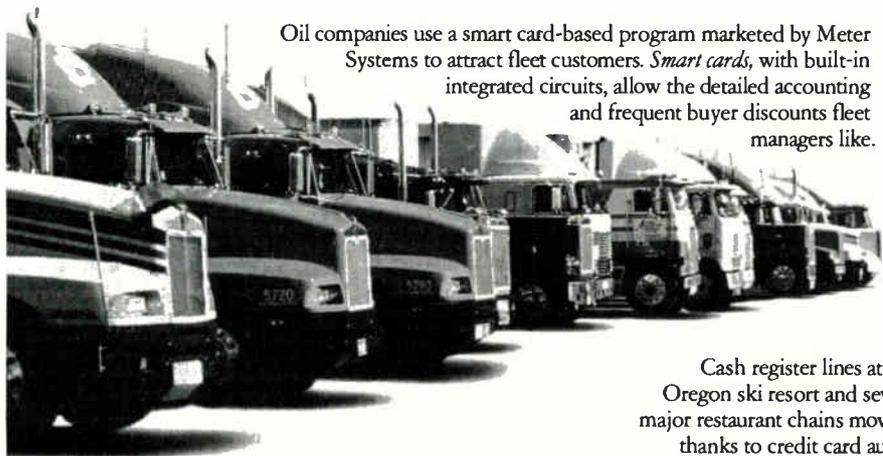
Although computerizing your business has many advantages, it can also have disadvantages. One of the more mundane disadvantages is that when you buy an accounting program you're often required to buy pre-printed blank checks.

Bottomline Technologies' solution to this problem is LaserCheck. Together with a special dry ink called magnetic-ink character-recognition toner, the program lets you issue checks from blank paper. The initial version of the program supports the LaserJet II, IID, III, and IIID.

Price: \$795; toner cartridge, \$159. **Contact:** Bottomline Technologies, Inc., 1 Court St., Exeter, NH 03833, (800) 243-2528 or (603) 778-1924; fax (603) 778-3975.

Circle 1010 on Inquiry Card.

THEY TOOK OUR IDEAS AND RAN WITH THEM.

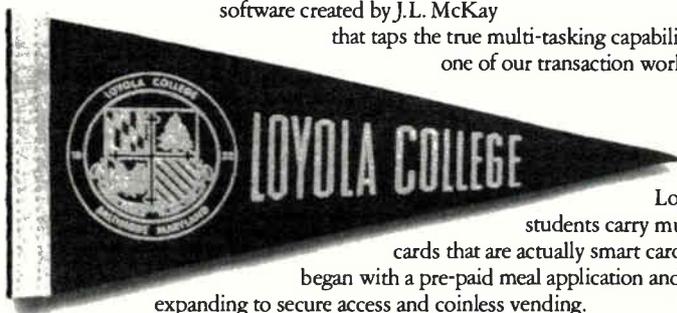


Oil companies use a smart card-based program marketed by Meter Systems to attract fleet customers. *Smart cards*, with built-in integrated circuits, allow the detailed accounting and frequent buyer discounts fleet managers like.



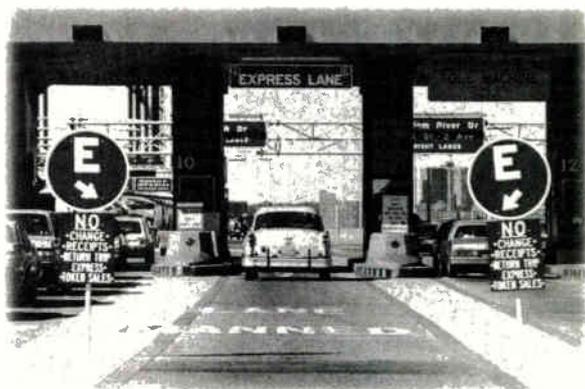
Cash register lines at an Oregon ski resort and several major restaurant chains move faster thanks to credit card authorization software created by J.L. McKay that taps the true multi-tasking capability built into one of our transaction workstations.

Supermarket check-out clerks swipe shoppers' cards through a reader to electronically gather purchase amount and frequency data. This system lets retailers reward customer loyalty without using stamps or coupons.



Baltimore's Loyola College students carry multi-purpose I.D. cards that are actually smart cards. The VAR began with a pre-paid meal application and is now expanding to secure access and coinless vending.

Traffic rolls faster on toll bridges spanning The Bosphorus in Istanbul because DataCard terminals and software developed by AYBIM Ltd. allow drivers to pay tolls with bank-issued debit cards.



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The Cellular Data System 120 provides a lightweight communications platform that integrates cellular, modem, and interface technologies for wireless communications using the existing voice cellular phone network. When combined with a laptop or notebook computer, the CDS 120 adds wireless communications to field computing.

You can hook up such telephone devices as fax machines, credit card verifiers, or internal fax modems to the CDS 120 and operate them in wireless mode. The CDS delivers up to 15,000 bps throughput.

I/O interfaces include an RS-232 serial port; two RJ-11 ports; an RJ-45 port for connecting modems, telephones, and the handsets; and a terminal-card controller antenna connector. The CDS 120 includes a 3-W transceiver.

An internal battery provides about 2 hours of communications. It includes Microcom's Carbon Copy Plus communications software, a portable knuckle antenna, a vehicle adapter, a cigarette lighter adapter, and a cellular handset.

Price: \$3299.

Contact: Vital Communications, 3366 Hillside Ave., New Hyde Park, NY 11040, (516) 294-5424; fax (516) 294-5423.

Circle 1013 on Inquiry Card.

Carbon Copy Takes Over Windows

The new release of Carbon Copy Plus combines remote control across asynchronous connections and



The external status indicators of the Cellular Data System 120 keep you abreast of important information, such as low battery power, roam, lock, no service, and test.

LANs with support for remote Windows applications across a LAN.

Carbon Copy Plus 6.0 has two components, one for communications between modems and the other for communications over a LAN. You can use both components at the same time to communicate from any PC on a LAN to PCs off the LAN. This means you can call into a LAN from a remote site and take over any system on the network.

Another highlight of the program is that you can take over another networked system that is running Windows from any PC on the LAN, even one not running Windows. This function is almost impossible to carry out across modems, however, because of the large amount of data passed back and forth.

Carbon Copy Plus 6.0 supports Novell NetWare LANs (version 2.15 and higher) and NetBIOS LANs, including 3Com 3+Share, IBM PC LAN, and AT&T StarLAN.

Price: Unlimited license for one LAN plus support for

one asynchronous host and one remote, \$199; additional host or remote licenses, \$119 each.

Contact: Microcom, 500 River Ridge Dr., Norwood, MA 02062, (800) 822-8224 or (617) 551-1000; fax (617) 551-1007.

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Network Management Does Windows

The new version of Horizons Technology's LAN Auditor sports an easier-to-use Microsoft Windows interface and lets you create a database of inventory and configuration information for PCs on a LAN running Novell's NetWare, Microsoft's LAN Manager, or Banyan's Vines network operating systems.

Rather than requiring the network administrator to enter the data, the software automatically goes out onto the LAN, audits the devices, and captures their configuration data, the company reports.

Price: 50-user license, \$495.

Contact: Horizons Technology, Inc., 3990 Ruffin Rd., San Diego, CA 92123, (619) 292-8320; fax (619) 292-7321.

Circle 1015 on Inquiry Card.

Notework Adds Windows to E-Mail

The Notework for Windows interface works in tandem with the Notework E-mail program for DOS, letting you send and receive mail in both environments. Notework supports the Message Handling Service protocol for store-and-forward message distribution over networks. With the new Windows package, you can manage your E-mail in a GUI, but if you're in DOS, you can handle your mail through the Notework DOS TSR program.

The add-on lets DOS and Windows users on the same network exchange mail and telephone messages without worrying about which environment their correspondents are operating in, the company says. The company preserved in the GUI version the menu structures and pop-up notepads found in the DOS version.

Price: Standard Notework E-Mail package: installation kit, \$99; for two users, \$99; for 10 users, \$399; for 50 users, \$1499. Notework for Windows interface: for two users, \$49; for 10 users, \$199; for 50 users, \$749. Novell NetWare owners qualify for a free 30-day trial program.

Contact: Notework Corp., 72 Kent St., Brookline, MA 02146, (800) 767-6683 or (617) 734-4317; fax (617) 734-4160.

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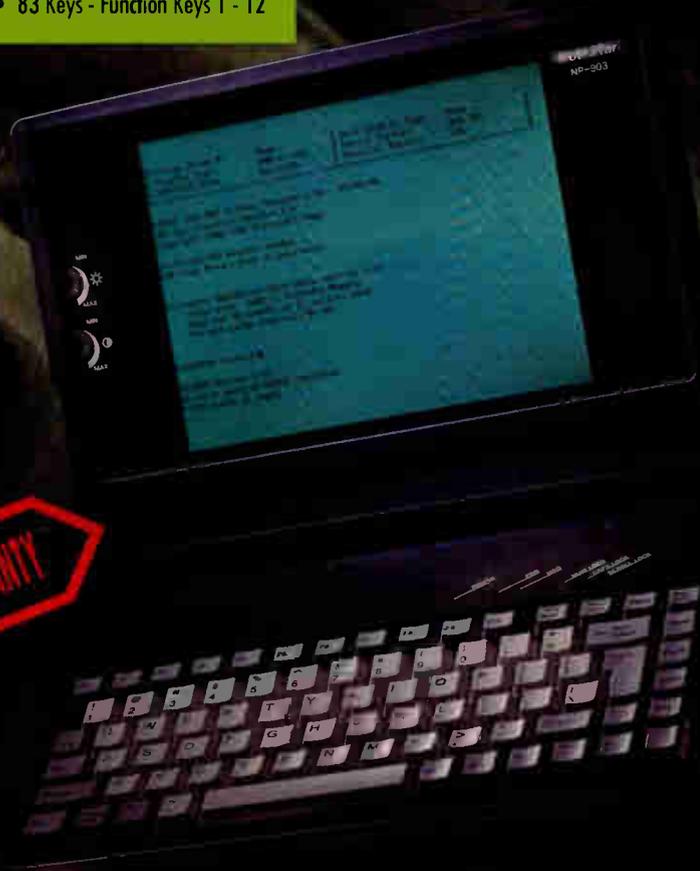
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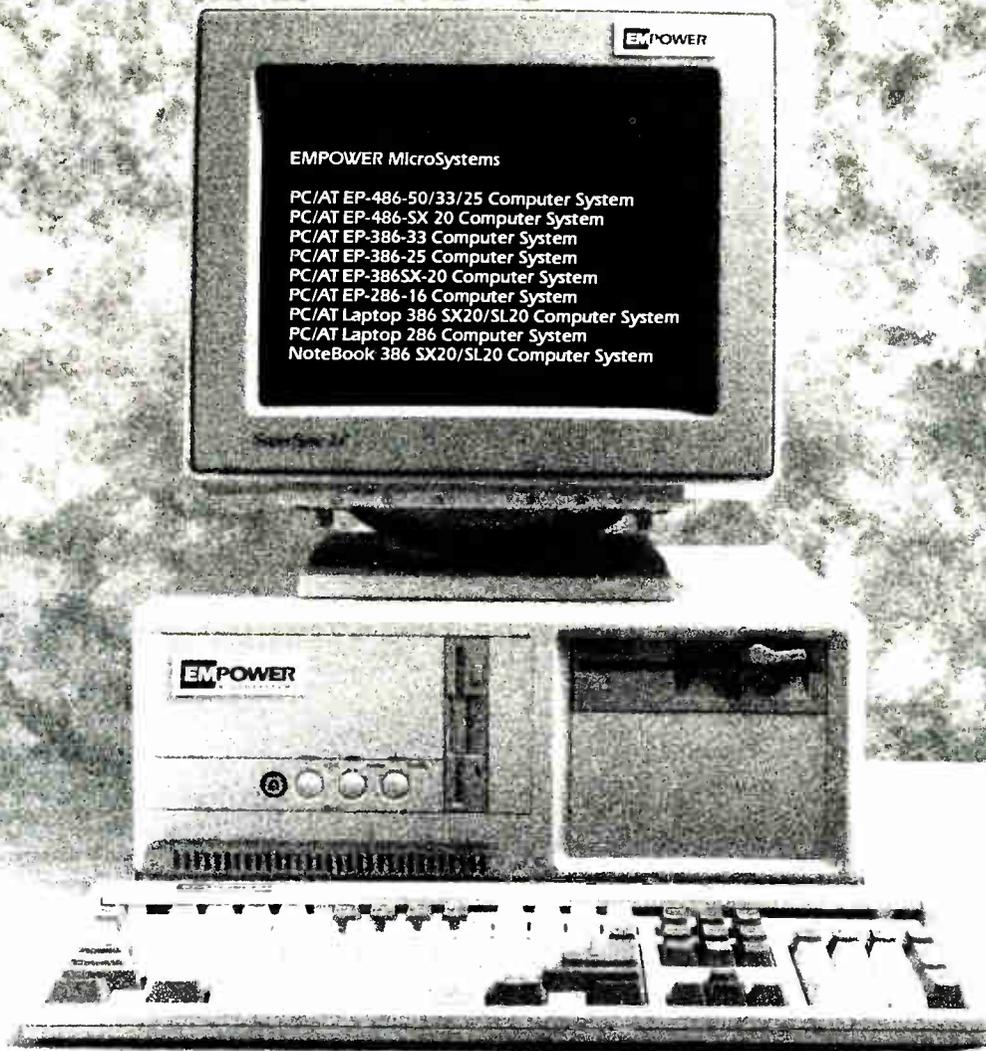
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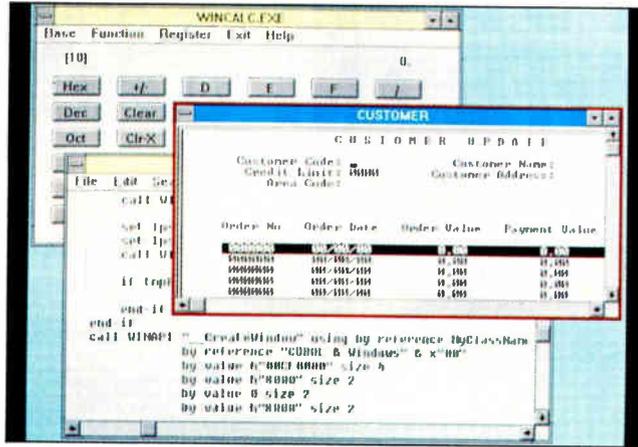
Micro Focus Does Windows, Mainframes

Version 2.5 of Micro Focus COBOL/2 supports the ANSI 1985 COBOL specification for intrinsic functions for coding calendar, business, mathematical/statistical, trigonometric, and character/string handling activities for DOS or OS/2. The compiler lets you write applications that run under Windows 3.0 through its extensions for screen handling and direct access to the Windows application programming interface, Micro Focus says.

A new common communications interface supports cooperative processing capabilities. The CCI is the same for all programs regardless of the underlying communications protocol being used, according to the company. Version 2.5 supports NetBIOS on DOS and OS/2, OS/2 named pipes, APPC on OS/2, and Novell IPX on DOS. Plans also call for support for TCP/IP on DOS, OS/2, and Unix, and APPC on MVS. Version 2.5 adds COMP-1 (32-bit real) and COMP-2 (64-bit real) floating-point data types.

The company's new COBOL/2 Toolset provides utilities that improve report-writing capabilities; reduce memory constraints; and provide for low-level debugging, advanced screen handling, and advanced file handling. XM, the Toolset's memory extender, supports the DOS Protected Mode Interface standard, increasing available memory from 640 KB to 16 MB.

The COBOL/2 Workbench provides the capabilities of the compiler and Toolset plus more COBOL programming utilities. The improved COBOL Source In-



A Micro Focus COBOL/2 application running in Windows.

telligence facility provides real-time analysis tools. **Price:** COBOL/2, \$750; Toolset, \$750; Workbench, \$2500.

Contact: Micro Focus, 2465 East Bayshore Rd., Suite 400, Palo Alto, CA 94303, (800) 872-6265 or (415) 856-4161; fax (415) 856-6134.

Circle 1017 on Inquiry Card.

Develop Ada Programs Under Motif

RISCAda/SPARC, an Ada development environment for RISC workstations running the Motif GUI, includes an optimizing compiler that uses the TeleGen2 Ada Optimizing Compiler Technology while offering a set of Ada bindings to industry standards. The initial version of the program runs on SPARC-based workstations and servers from Sun Microsystems.

TeleSoft says RISCAda/SPARC compiles typical applications to unoptimized code at over 2450 lines per minute and generates optimized code at over 1650 lines per minute on a Sparcstation 1. The company says

generated code executes quickly due to the package's global optimization techniques for analyzing all of an Ada application and optimizing across package boundaries, including the run-time system.

Included with the program is a new source-level debugger and a profiler with graphical capabilities. The profiler lets you pinpoint performance bottlenecks in applications as they are executed.

RISCAda/SPARC's bindings include XView and Posix.

Price: \$6000 to \$12,000 per workstation or server.

Contact: TeleSoft, 5959 Cornerstone Court W, San Diego, CA 92121, (619) 457-2700.

Circle 1018 on Inquiry Card.

A Modern Dialect of Lisp

EdScheme is an interpreter for the Scheme programming language that runs on the PC, Atari ST/Mega, and Mac. The program, which Schemers calls a "modern Lisp," offers a dedicated Lisp editor with automatic indentation and parenthesis matching. It also has color-coded ex-

pression categories for distinguishing between system messages, evaluated messages, and unevaluated messages.

The program, aimed at educational users, also supports incremental compilation. Version 3.4 supports a standard Scheme mode that more closely matches the IEEE standard, along with the educational mode that corresponds to the company's textbook, *The Schemers' Guide*.

Price: \$49.95.

Contact: Schemers, Inc., 4250 Galt Ocean Mile, Suite 7-U, Fort Lauderdale, FL 33308, (305) 776-7376.

Circle 1020 on Inquiry Card.

The Force dBase Compiler Gets SuperMake

Force, the dBase compiler that doesn't require a run-time interpreter, now includes a SuperMake utility for network environments. SuperMake, designed for the distributed processing of applications on a network, lets you use individual network nodes to make different parts of an application.

According to Sophco, you use SuperMake to create make files that contain specific instructions about which files within an application must be relinked or recompiled. Any network node can read the make files, the company reports.

Force eliminates the need for the run-time interpreter by producing native machine code from your source code.

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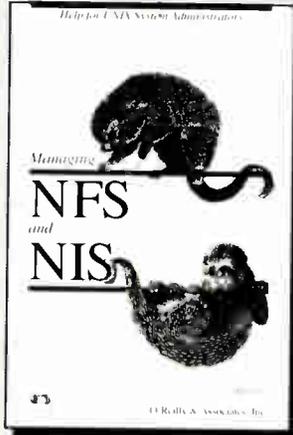
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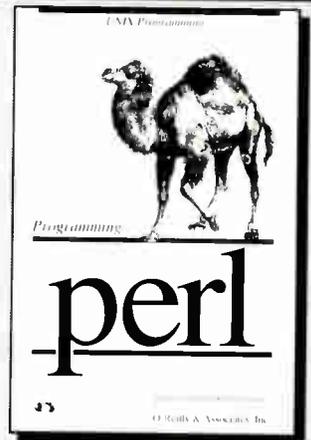
Programming Perl

By Larry Wall & Randal Schwartz
482 pages, ISBN 0-937175-64-1.
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This is the authoritative guide to the hottest new UNIX utility in years, co-authored by the creator of that utility.

Perl is a language for easily manipulating text, files and processes. Even though Perl is not yet a standard part of UNIX, it is likely to be available wherever you choose to work. And if it isn't, you can get it and install it easily and free of charge.

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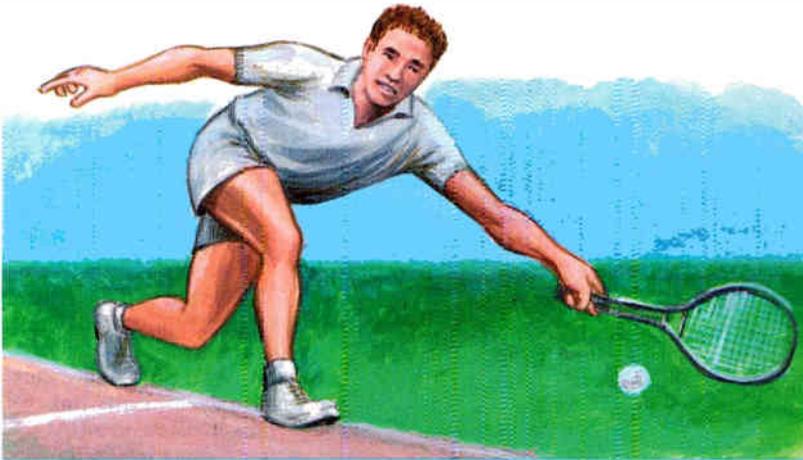
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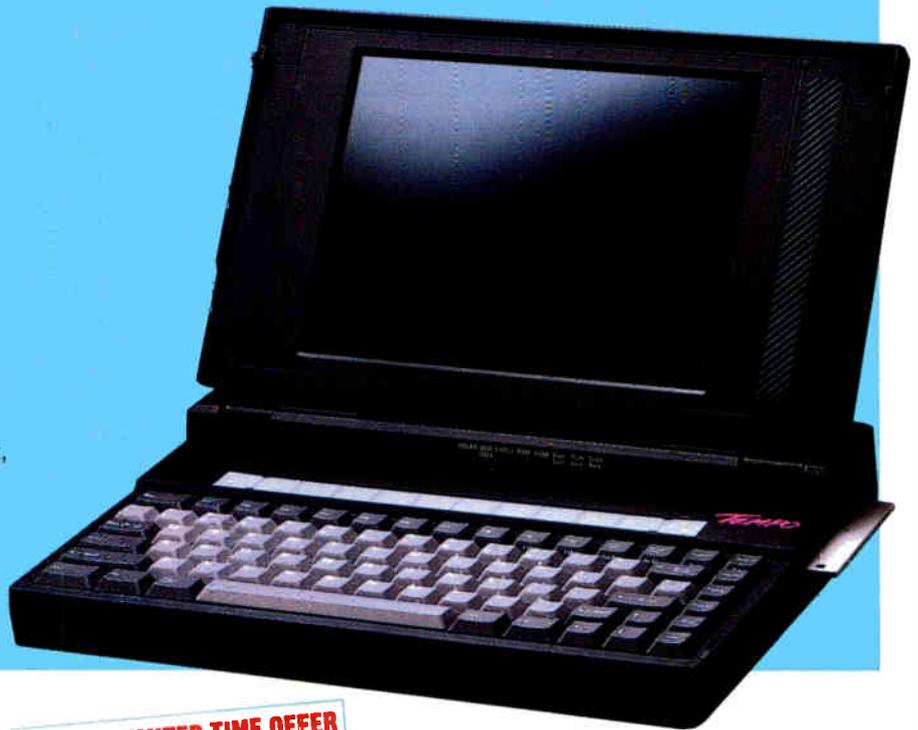
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Access AutoCAD Drawings and .DXF in X

The Drawing Librarian-Unix package lets you view and manage CAD drawings without the risk of altering or damaging the original drawing. The program provides a bridge to other applications with its .DWG to .DXF translator and .DXF view capabilities. SoftSource says the program lets you view AutoCAD drawings up to 10 times faster than you would with AutoCAD.

The program runs on DECstations under DECwindows or Motif with Ultrix. Versions are planned for Sparcstations and Data General Avion workstations, the company reports.



Drawing Librarian provides Unix and X Window System users with access to AutoCAD drawings and .DXF.

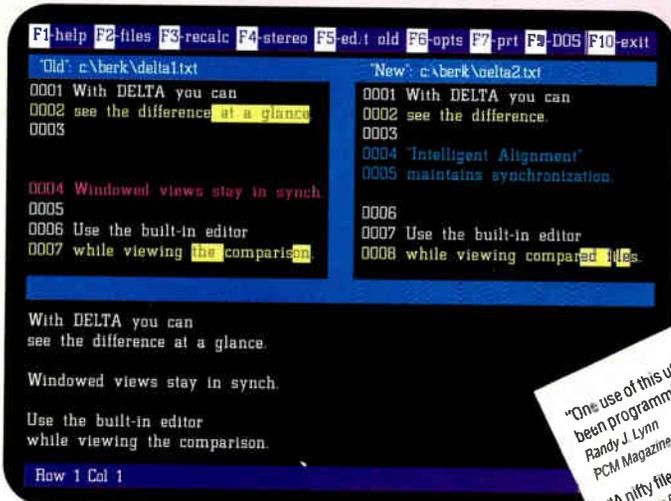
Price: \$500 per workstation.
Contact: SoftSource, 301 West Holly, Bellingham, WA

98225, (206) 676-0999; fax (206) 671-1131.
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A Look at AutoCAD Drawings

With SirlinView/Pop, you can view an AutoCAD drawing while you're in another application. The program is the latest from Sirlin. With SirlinView/Plus, you can dynamically link records in dBase to a CAD drawing. Data retrieval can be keyed off x,y locations, block attribute values, or entity handles. A posted-notes feature lets you send text redline corrections. **Price:** Pop, \$99; Plus, \$395; five-user network pack, \$1295.
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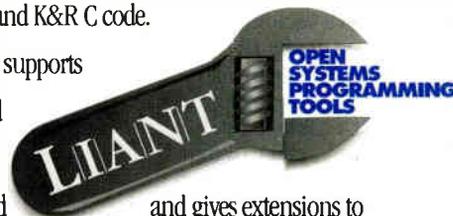
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World Radio History

NEWS

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With the network version of YourWay, a group contact management system for Windows 3.0, your workgroup can share daily calendars while maintaining a daily task scheduler. You can store contact history in a secured master file as you create files.

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The program supports Dynamic Data Exchange for linking YourWay to a Win-



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dows word processor.

Price: YourWay 2.0, \$199.

YourWay Network: three-node pack, \$595; five-node pack, \$695.

Price: Prisma Software

Corp., 2301 Clay St., Cedar Falls, IA 50613, (319) 266-7141; fax (319) 266-2522.

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Get It Together on Time

OnTime for Windows is now available in a network version that lets you overlay schedule grids for any number of individuals, find mutually available meeting times, and schedule meetings quickly. OnTime focuses on just one thing—managing your time. You can use the program to color-code and reschedule appointments and view existing time commitments on daily, weekly, and monthly grids. **Price:** \$129.95; LAN version starts at \$356 for three users.

Contact: Campbell Services, Inc., 21700 Northwestern Hwy., Suite 1070, Southfield, MI 48075, (313) 559-5955.

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PIM for System 7.0 Activates Networking

What was once a personal information manager aimed at the single user is now—through support of System 7.0—a program that groups of people can use to share ideas and projects. Active Memory 2.0, an organizer and event scheduler, lets you define activities with dates, deadlines, and participants, and it lets you determine how you want to be reminded of commitments. You can share files with others in a workgroup, and, with a transportable memory file, you can take work home or on the road and automatically update everyone on the network when you return to the office,

Translatum says.

While you're within Active Memory, you can use System 7.0's new Find command to access information in other databases.

Support for the Data Access Manager lets you easily access data on remote computers using a query document. The DAM establishes contact with the remote server, opens a query document, sends a query, and receives the returned data. The DAM supplies an interface for communicating in a format that's suitable for the remote database. This lets database-naive applications access databases.

Price: \$149.95.

Contact: Translatum International, Inc., P.O. Box 19418, Austin, TX 78760, (512) 443-8932; fax (512) 444-0691.

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On Technology's Mac Workgroup Solution

On Technology's Instant Update is a Mac-based workgroup program that lets a group of people work on a document—simultaneously if you wish. The company says the program, which bridges the gap between word processing and E-mail, keeps a copy of the master document on the server and tracks changes that have been made and who made them. It assists in resolving editing conflicts.

When you use the live document model, the program automatically notifies you of changes that someone else makes to a document and incorporates them into your copy when you press

the Update button. Instant Update stores text, pictures, and tables in an object-oriented database. You can click on any line in a document to find out who wrote it; the program displays the time and date for each entry. You can tag files to play a sound when someone modifies them.

Instant Update is fully compatible with System 7.0 and supports graphics, basic Apple Events, TrueType fonts, and the fast find capability. A Windows version is planned.

Price: Instant Update: two-user pack, \$495; five-user pack, \$995.

Price: On Technology, Inc., 155 Second St., Cambridge, MA 02141, (617) 876-0900; fax (617) 876-0391.

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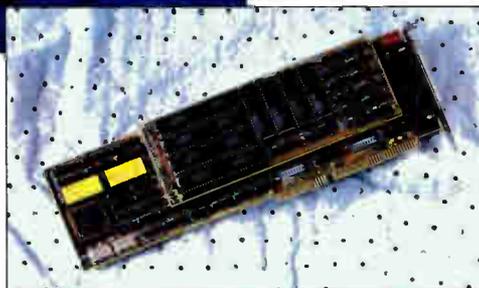


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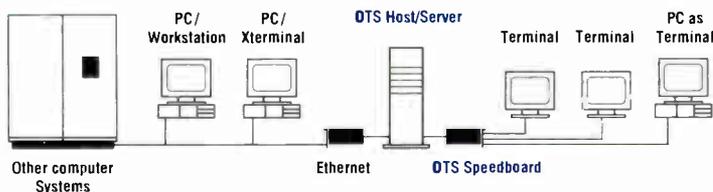
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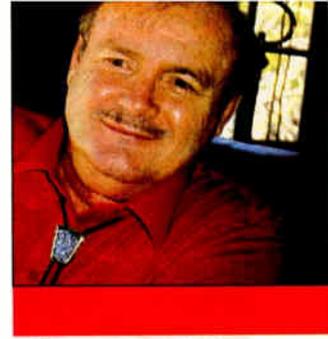
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World Radio History



JERRY
POURNELLE

IT'S ALL DIGITAL

This has been an exciting month. I've got what could be two lead stories: multimedia and Comdex. They can't both be first, so I'll start with the multimedia story. Jonathan Seybold has noticed that the digital audio, digital video, consumer electronics, and small computer multimedia people are all rushing toward the same place, but each is nearly unaware of the others. The stereo magazines, for instance, have not the slightest trace of technical information on how digital audio works, and most of their people don't understand the digital world at all. The same is true for digital video, while high-definition TV remains a phrase without much meaning.

Digital World

The result was Digital World, a Seybold conference that included people from all the above. If you haven't heard of it, neither had I (although in my case it was due to not reading my mail). I had no notion there was such a conference, much less that it was happening in my own city, until Coco and Peter Conn, who do animation and graphics—they have a sequence in the film *Total Recall*—held a party for the Digital World people and invited me. I met a number of interesting people who are doing fascinating things, and the next day I went down to the Beverly Hilton for a conference that generated some of the old excitement we used to get in the early days of the computer revolution.

The news is that the computer revolution isn't over. It hasn't even fairly begun.

Item: Beneficial Finance commissioned Adair and Armstrong (900 23rd St., San Francisco, CA 94107, (415) 826-6500) to do an educational videotape that would also make Beneficial look good. The notion was to teach young people something about credit and paying your bills. This could easily have resulted in the usual hokum, a tape that would be shown at Kiwanis meetings and forgotten as soon as it was over; but it didn't.

What Adair and Armstrong made was an interactive video game. It shows high-quality video of young people who just graduated from high school, landed a great job, and now have to furnish a condo and live in it. Because of the great job, they have great credit. Everyone wants to sell the player something: a car, a stereo, whatever. Sales pressure is high. There are bait-and-switch operations. Peer pressure. But every month the bills come in, and if they aren't paid, the consequences are grim. All in all, it's an example of what we have

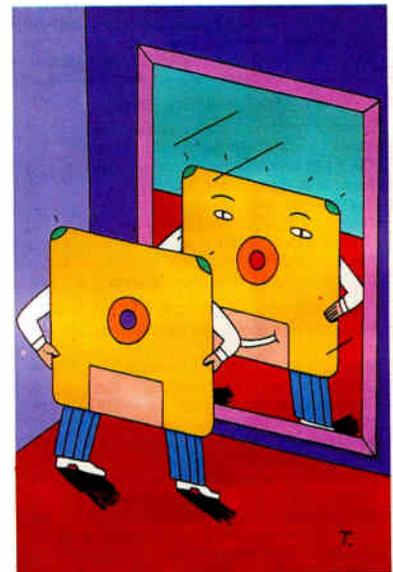
always wanted computer education to be like.

Item: Kinetic Effects (1319 Dexter Ave. N, Suite 310, Seattle, WA 98109, (206) 283-6961, fax (206) 283-1131) has a human animation program called Life Forms that is best described as awesome. The program knows a lot about how people move, and how a spine bends and twists, and so forth; and it can interpolate between poses. There are also canned sequences of running, walking, jumping, and the like. You can, in an hour, set up an animation sequence that would take days the old way. Anyone doing animations should look into this.

Item: Spaceship Warlock is a CD-ROM game for the Mac. The interface is rough in places, but when they call this an "interactive movie," they aren't far wrong; there are integrated sound and visuals, and both are good. It isn't really video, but some of the animation sequences are at least Saturday-morning-cartoon quality, and there's a lot of it. The game takes many hours to get through—I'm not even started good yet, and I've put in more time than I care to. The graphics are wonderful, but the game has an arcade feature I can't get past. You have to fight a pirate with your bare hands (well, by trying to follow his chin with the Mac mouse), and he's killed me nine times in a row. That ends the game. I doubt I'll bother with it anymore.

If I sound unhappy, I am: they put a lot of work into visuals that I'll never see, because I'm just not very good at arcade games with Mac mice. It's a pity they don't have some other way around the pirate. A secret password, ability to use a weapon, almost anything. If you like frustration or you're really good at arcade games, you'll love this, but I'd advise waiting for a new edition. Too bad.

The explosion of multimedia computing has recharged the computer revolution



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Item: Digital F/X (755 Ravendale Dr., Mountain View, CA 94043, (415) 961-2800) has a complete system for creating video and integrating artwork, audio, video clips, complex graphics, and the like using their box and a Mac. It's all very visual and Mac-like.

Item: C-Cube Microsystems (399-A West Trimble Rd., San Jose, CA 95131, (408) 944-6300, fax (408) 944-6314) has a new video digital compression chip that squeezes video down to where it begins to make sense to have digitized video on a hard disk.

Item: Interactive Media Technologies (7320 East Butherus, Suite 200, Scottsdale, AZ 85260, (800) 289-4689 or (602) 443-3093, fax (602) 443-3086) has a line of stuff, from software only to high-end hardware, for video and audio editing and integration of materials from different sources. Combine digital audio and digital video editing, that sort of thing. Incredible control.

And so forth. There weren't that many exhibits—30 or so at most—but they were impressive. Interestingly, there was only one PC-based exhibit: C-Cube had their compression/expansion chip working on a PC as well as a Mac. Everything else was for the Mac, Next, or some high-end machine.

My guess is that once the multimedia standard for DOS machines catches on, there will be more on the PC side of the house; but at the moment the Mac is riding high, with lots of third-party developers working on making better multimedia products for it. I think that attracting third-party developers, thus capturing the real ferment of creativity in this industry, is the key to success. DOS has a, you'll pardon the expression, window of opportunity, but it's not infinite. So does the Amiga. But right now for multimedia work, it's the Mac 10 to 1.

The real meat of the show was the conferences, which included discussions of legal problems, licensing, plagiarism, and intellectual property protection; marketing discussions; and suchlike.

I'm very glad I went to Digital World, and I'm pretty sure I'll be at next year's.

Mirror, Mirror

You may recall that last month I allowed Perceptive Solutions, Inc. (PSI) to install their new hard disk drive controller on the Cheetah 386/25 that is my main machine. The result was a marginal increase in disk speed at what appeared to be a cost of 8 percent of the disk space on my Priam 330-megabyte hard disk drive. I also had a few minor glitches when I ran communications in the background under Desqview while doing other work in the foreground.

Last week, PSI's Warren Lee came around to look into the situation. First, we installed an SDC Series 400 SCSI controller into the Cheetah 486 that Larry Niven uses when he's over here, and it works fine. I can see speed differences with benchmark programs, but they aren't very noticeable in the work we do with that machine. It still saves large text files so fast you're not sure it has saved them at all.

Then came the big task: replacing the older Priam hard disk drive in my main machine. The drive was beginning to get noisy. I have never lost any data with that drive, but it has been used a lot; and it's in my main machine, the one I'm working with right now. We replaced it with two Maxtor XT-8380EH 361-MB drives arranged so that one is a mirror of the other. I tend to back up my work religiously, copying onto either the Maximum Storage WORM (write once, read many times) drive or, more likely now, the Pioneer multipurpose optical drive with a WORM cartridge. Even so, the ultimate backup system is disk mirroring: a scheme whereby whatever is written to one hard disk is almost simultaneously written to another.

In addition to installing the mirroring, Warren Lee fixed the communications interference problem: there is a mode of operation in which the PSI controller disables some interrupts when it's working. That is supposed to make it faster, but it can interfere with Desqview and background tasks. Although this operation mode is a documented feature, I confess I didn't notice it. In any event, it was the work of a moment to change operating modes, and I am pleased to report that now I have a communications program running at 9600 bps even as I write this, and there's no glitch or hitch; indeed, as a test, I've run both communications and a large background XCOPY operation simultaneously with writing letters in Q&A Write in the foreground, and there were no problems at all.

Setting up mirroring was simple if tedious: both hard disks have to be low-

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level formatted, and it takes time to let the PSI program do an intensive media analysis as it formats. After that, it's boot with floppy disks and use FDISK to set up disk partitions—and when we did that, we found the probable cause of the 8 percent disk storage loss. It turns out that IBM PC-DOS 3.3 FDISK is inadequate: it doesn't properly handle more than 10 logical drives. The answer was to use the FDISK from MS-DOS 5.0 on the Maxtor drives. I've still got the Cheetah 386 running on DOS 3.3, mostly because it isn't broke. I expect I will change over to MS-DOS 5.0 fairly soon. With it, you can get 620 kilobytes of main system RAM and still have a mouse, the Corel SCSI driver, and other system assets. I have MS-DOS 5.0 on the 486 we use for Windows.

In any event, I have slightly more than 330 MB available, and the PSI/Maxtor system works splendidly. It's noticeably faster than the Priam drive was. It's also interesting to see it in operation. When I save something to "disk," what actually happens is that it's written to the disk memory cache on-board the controller. Immediately after, however, the cache writes to first one hard disk and then the

other. It all happens totally invisibly unless you're watching the three flashing lights (two on the disk drives themselves, plus the machine's "hard disk in use" light).

Low-Level Reformatting

Steve Gibson sells SpinRite II, a program that goes out to your hard disk, lifts off the data, does a low-level reformat of the track, and puts the data back down. I once saw an ad to the effect that SpinRite works on "anything that spins," but that is not true; in fact, I've yet to get it to work on any of the high-performance disk drives here at Chaos Manor. This isn't to knock the program. It worked wonderfully well on some of my older noncached controllers and drives. It's just that SpinRite wants absolute control of the disk, and if the system has caching on the controller itself, there's no way SpinRite can get what it wants. It's to Gibson's credit that the program tests and won't take chances.

It turns out that SpinRite is very useful on all the systems it will work with, and if you can get it to work, I'd recommend using it periodically. However, it's not

needed at all with the latest controllers. Some caching controllers (from PSI and other companies) are continually testing the disk media, doing low-level reformat, moving data around if there's any chance of a problem, marking weak sectors as bad, and generally fussing about like a mother hen. Indeed, if you do nothing at all on your system, you will still see the disk access light come on once in a while as the PSI controller quietly goes about its job. I confess I was a bit disconcerted the first time I saw that happening.

I'm assured that these disk accesses are harmless, and I suppose I believe it. In my case, I don't even have to worry about a power failure while the controller talks to the disk: both my system and the one Larry Niven uses are run off a Clary uninterruptible power supply.

The bottom line is that the Cheetah 386 with a PSI controller and twin Maxtor mirrored drives works better than it ever did before. I've deliberately tried to confuse the system by doing odd multi-tasking operations that require lots of complex disk accesses, and nary a glitch. Mirroring isn't cheap, and I can't say I

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really need it, but it's comforting to know I have it. Mostly, though, I'm very favorably impressed by the PSI/Maxtor combination. Highly recommended.

Spring Comdex

First it was the "Shelly Awards" for best new products at Comdex. They were very informal—partly serious, partly a joke—and presented by BYTE senior editors at the BYTE breakfast party. Then, by some magic, they were transformed into a whole series of awards in half a dozen categories, presented at a formal ceremony in a big theater complete with a band. All the BYTE editors at Comdex participated.

As a result, we were all running frantically around the Comdex exhibits looking for the best products making their first appearance at a major trade show, and I was heard loudly to complain about the monster that devoured Comdex. But when it was over, I found I rather liked the result.

For one thing, while I never worked so hard in my life, I saw a lot of things I would have missed, as one or another of my editorial colleagues pointed out prod-

ucts possibly worth nominating. For another, the long—about 5 hours—editorial meeting at which we chose the winners was the best Comdex discussion I've ever attended, and well worth the parties we missed. I don't know if the other editors learned much from it, but I sure did, as we talked about trends and what products would have the most effect on the industry. I began by hating the awards; now, I'm definitely looking forward to doing it again.

Spring Comdex this year had fewer exhibits than any I remember, but there wasn't any lack of good stuff; and the crowds were larger than last year. The industry isn't in bad shape at all.

I saw several major trends. As you'd expect, machines are getting cheaper, faster, and more powerful. They're able to handle larger files and more work. Laptop machines are smaller and better. About a quarter of the show was devoted to Windows 3.0, which looks to be catching on. It doesn't hurt that memory is now practically free. There were more CD-ROM products, and Tandy's new line of reasonably priced multimedia machines will help that trend along.

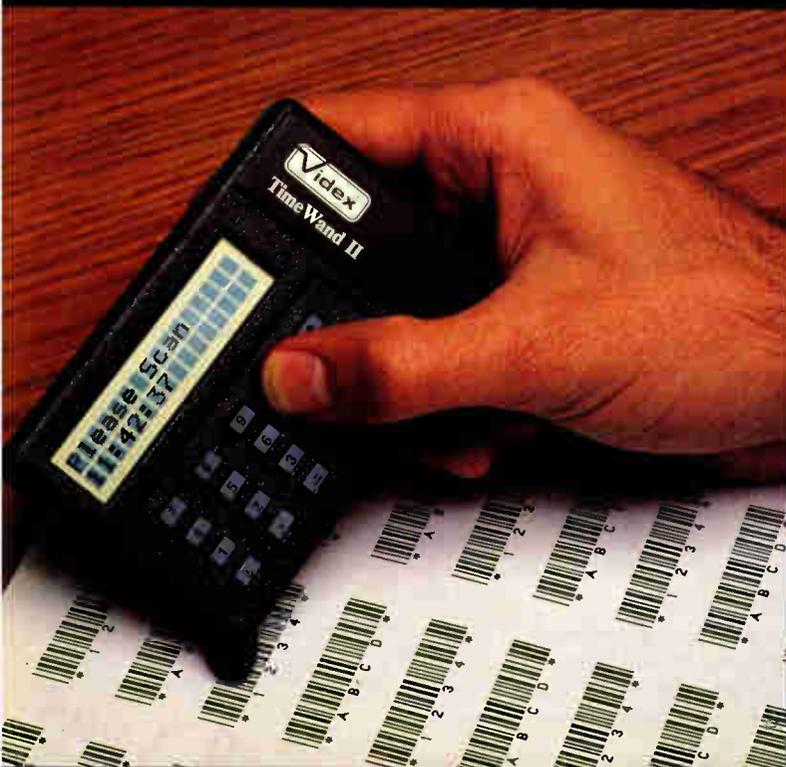
Realizer and Thunder

Years ago, I said that the most important trend in the computer revolution was steady progress toward taking the work out of programming: fixing things up so that it's more important to know what you want the machine to do than to know how to teach the machine to do it. Someday everyone will be able to program, just as nearly everyone can write.

First we need to develop the tools to make that possible. I admit things have not come as far that way as I thought they would. On the other hand, the trend is accelerating, in large part due to Windows. Not only do we have easy-to-use languages like Object-Oriented Pascal and Visual Basic, but we're getting programs like Realizer and ThinX. Visual Basic, which was long code-named Thunder by Microsoft, is best described as Quick-Basic for Windows.

Realizer might be described as Visual Basic for Windows with differences, but the differences are highly significant. Nonprogrammers will almost certainly find it easier to do complex jobs with Realizer than with Visual Basic. On the other hand, Visual Basic has strengths of

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Both TimeWands transfer their data through the host computer's serial port where the

its own. On the gripping hand, I haven't had enough time to work with either, so I haven't come to any definitive conclusions. This is partly because I haven't converted over to Windows; I have Windows on two machines here, but my primary system is still the Cheetah 386 running Desqview. Programs like Realizer and Visual Basic may cause me to change fairly soon.

Realizer won the BYTE/Interface Group "Rookie of the Year" award at Spring Comdex. More interestingly, it was one of three finalists in the Best of Show competition—which it lost to Visual Basic. There was heated discussion over the Best of Show award: a number of editors, including me, argued that Realizer looked to be a better program—certainly easier to use—than Visual Basic. On the other hand, one of the award criteria was impact on the industry, and Microsoft's marketing clout—not to mention the company's development team that even now is working to improve the product—makes it pretty certain that Visual Basic will be a major force.

My advice is to get both. If you're seriously contemplating the development of

Windows software products, you'll need them. Either is much easier to use than C, and potentially just as powerful. Realizer has far the better debugging tools; Visual Basic seems more natural to me (but I do a fair amount of programming in QuickBasic for DOS). I'm glad I don't have to choose. Both are recommended.

When Windows 3.0 first came out, I asked Microsoft when they'd have a good Windows BASIC. "We're not sure there will be one," a languages product manager told me. "ToolBook does most of what people use BASIC for. We wonder if there will be a market for Windows BASIC."

I didn't believe it at the time. Bill Gates got his start with Altair BASIC, and he retains a fondness for the language—and unlike some other language enthusiasts, he has the resources to indulge his whims. Besides, BASIC is potentially a lot more popular (as well as more useful) than C. The day has not come when Bill Gates abandons BASIC. Moreover, ToolBook, while a great idea, is s-l-o-w, and it doesn't give you all the control that BASIC does.

Philippe Kahn has been sending E-

mail denouncing Visual Basic as the programming equivalent of cocaine. I'm afraid I can't agree. While Object-Oriented Pascal is a fine program, and people who know Pascal should be able to make good use of it, Realizer and Visual Basic are going to have an impact far beyond the more traditional languages. Between them, they open, just a crack, the door to programming for everyone.

Thinx

Thinx is wonderful. I've always said that what it will take to make Windows take off is a series of indispensable applications that run only on Windows. Thinx may be one of those; it's certainly another of those programs that push me toward Windows.

You could describe Thinx as a visual database combined with a spreadsheet: in other words, much like Mind's Eye, the DOS application I described in July. Only this is for Windows, and it's very easy to set up and use. The manuals are complete, and the tutorial is superb.

Thinx merges objects—such as maps, floor-plan furniture, symbolic objects like TV sets, organization charts, and

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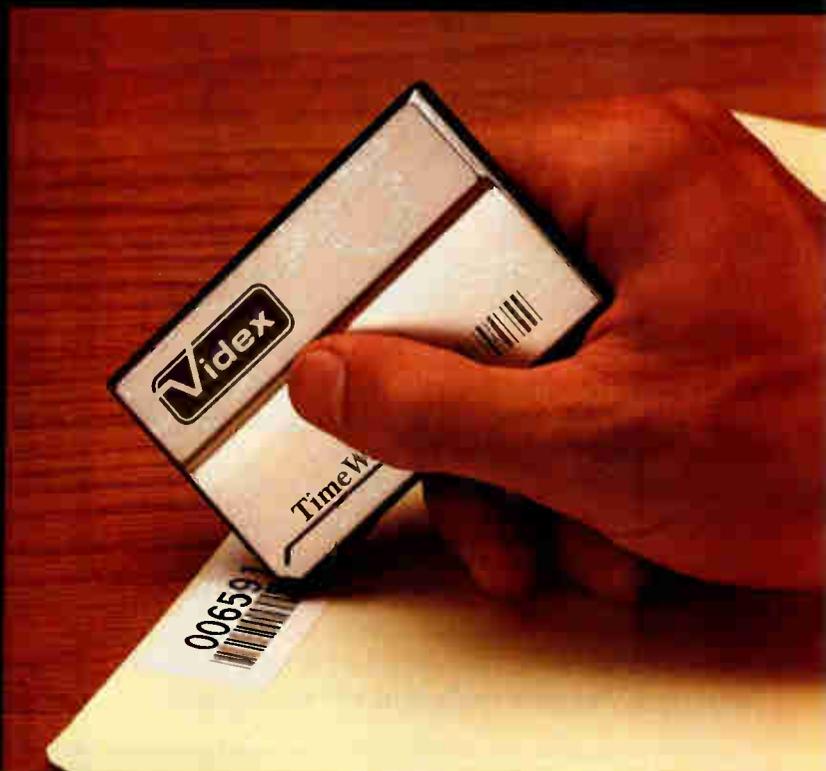
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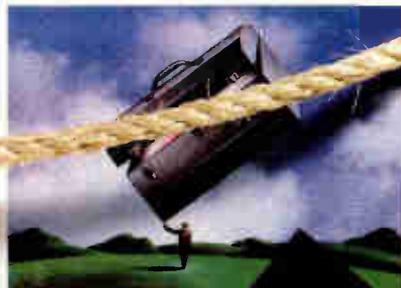
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dynamic models with formulas—with data. Complex structures are built by clicking and linking; there's a very Mac-like feel to using this program. As with Mind's Eye, there are a lot of features, but you don't have to learn them all to begin using the program. Just follow instructions, open the tutorial, and have at it.

I intend to use Thinx to build a dynamic model of the world of the CoDominium, the fictional future history featured in my novels of Falkenberg's Legion. Keeping all the details—characters and their ages; families; the tables of organization and equipment for Falkenberg's Mercenary Legion; TO&E for other military groups; maps, both planetary and interstellar—self-consistent has become a considerable chore, and my preliminary experiments with Thinx indicate that it will help a lot.

Also, Thinx is just plain fun to play around with. Recommended.

Short Shift

Once again, the stuff is piling up: there's just a lot of really good software out there, far more than I could possibly cover in the detail that it deserves. Thus, it's short-shift time once again at Chaos Manor. Do understand, if I mention something at all, it's because I would like to have written more about it.

Crescent and Clip Art

Although Mrs. Pournelle's Reading Program works quite well, I have to admit the graphics are hokey: they're all monochrome line drawings, and primitive even by CGA standards. Of course, there's no real need for them to be better: the program does what it's supposed to do, which is to let one person who can read teach another who needs to learn how. Still, it would do no harm to upgrade the graphics.

I've finally got the tools to do that: PCX files of artwork from T/Maker. T/Maker advertises itself as the leading supplier of PC and Mac computer art, and I've no reason to disagree. There are business drawings, funny drawings, all kinds of drawings, all good stuff, plenty enough to jazz up the Reading Program.

Unfortunately, Roberta's program is written in QuickBasic, which has no way to bring in and display outside files like T/Maker clip art. That turns out not to be a problem: Crescent Software's Graphics Workshop Tool Kit has routines that will open a PCX file and display it on-screen. That's more or less what I've been doing already using BSAVE and BLOAD, so this should do the job. I may have some fiddling to do to speed things up and hold

down file sizes, but preliminary tests are encouraging.

Once again, Crescent comes through: if you program in QuickBasic, you simply must have the Crescent BASIC programming tools. I can't wait for Crescent to put out a library for Visual Basic.

Writing Chinese

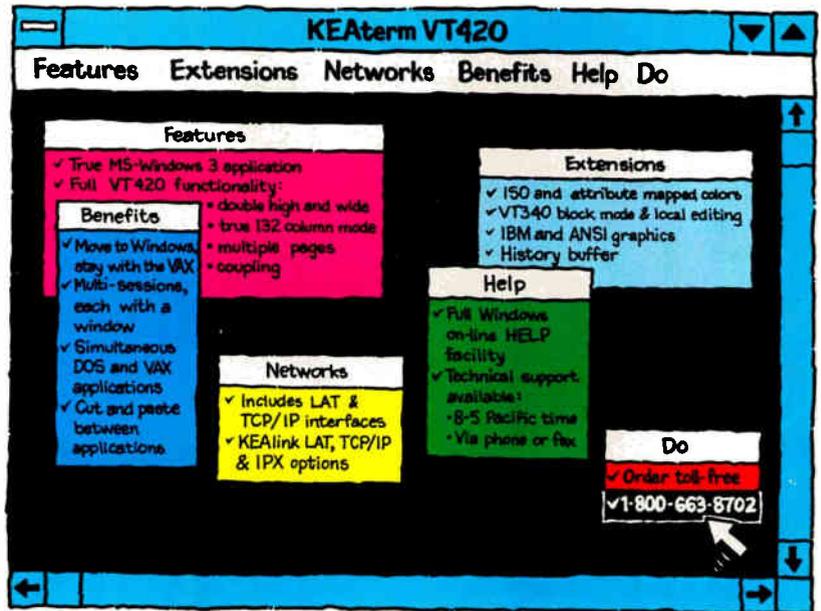
A few years ago, I recommended Dr. Peter Leimbigler's system for writing in Chinese on a PCompatible. At that time,

he had no choice but to sell graphics boards capable of handling Chinese ideographs; the usual PC video board could not display Chinese. Now he can do it in software alone for VGA systems, and of course it prints on a laser printer.

If you have any need to write and/or print Chinese, you really must get Xian-TianMa. It allows data entry in a number of ways, including phonetic spelling. The characters are clear and crisp on-screen and in print. Understand, I don't read

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Chinese, so I have to rely on those who can; but everyone I know who has seen this system praises it. If you need it, you need it bad. Recommended.

Optical Disk Drives

As most of you know, I've been a bit of a WORM drive fanatic. With a WORM drive, you get what amounts to an eternal record, a file not easily erased short of the physical destruction of the cartridge.

For the past six months, I've been

using the Pioneer DE-S7001 dual-purpose optical disk drive. This is either a WORM or a read/write optical drive, depending on which cartridge you put in. I have been torture-testing this drive; I have had it XCOPY enormous blocks of data to a large hard disk and copy it back again, and keep that going for days. I have copied to the DE-S7001 using Lap-Link III (using Turbo parallel mode). I have had Dr. Solomon's virus-checking software access the Pioneer data car-

tridge continuously over a 24-hour period. And I've accessed the disk through LANtastic.

I am pleased to report that I'm sold. The Pioneer optical drive, with Corel SCSI card and access software, is as solid as a rock.

Thus, I'm discontinuing testing. Now I'll just use the drive. I still archive finished novels onto a WORM cartridge, but I now rely on the Pioneer erasable optical disks for backup, for primary storage of really big files, and for archive copies of software. If you're in the software development business, you really need something so easy to use that you'll routinely use it for backup. The best backup device is still a Palindrome system with a big Exabyte tape drive, but that's quite expensive. Failing that, the Pioneer DE-S7001 will do the job very well indeed. Recommended.

Winding Down

The book of the month is by Orr Kelly, *King of the Killing Zone* (Berkeley Paperbacks, 1991), a really excellent history of the design and development of the Abrams tank. It's a good picture of how the Pentagon works and what it's like to be a dedicated Army officer in a bureaucracy; and how the system, flawed as it is, managed to produce a winner.

The first computer book of the month is Michael Hyman's *Windows 3.0 for BASIC Programmers* (Addison-Wesley, 1991). This one covers Realizer (but not Visual Basic) and goes into the proper level of detail about how Windows does things, what objects are, and so forth. It contains a limited version of Realizer. Hyman is the author of *Microsoft Windows Program Development* and knows a lot about Windows. This book is recommended.

Another computer book worth mentioning is by Wayne Rash Jr. and Peter Stephenson, *Executive Guide to Local Area Networks* (Compute! Books, 1991). It's written in the style you've come to expect from BYTE columnist Rash. The book is precisely what it says it is: an introduction to the subject written for the executive who has to supervise people installing a LAN. It won't make you an expert, but at least it will make it easier to talk to the experts.

The game of the month is Harpoon from Three-Sixty. They now have a scenario editor that lets you add ships and planes to existing battle scenarios. Using it is not intuitive: to load a scenario, you have to edit it using one program, and then load the main game program; tell the game program to start a new game in

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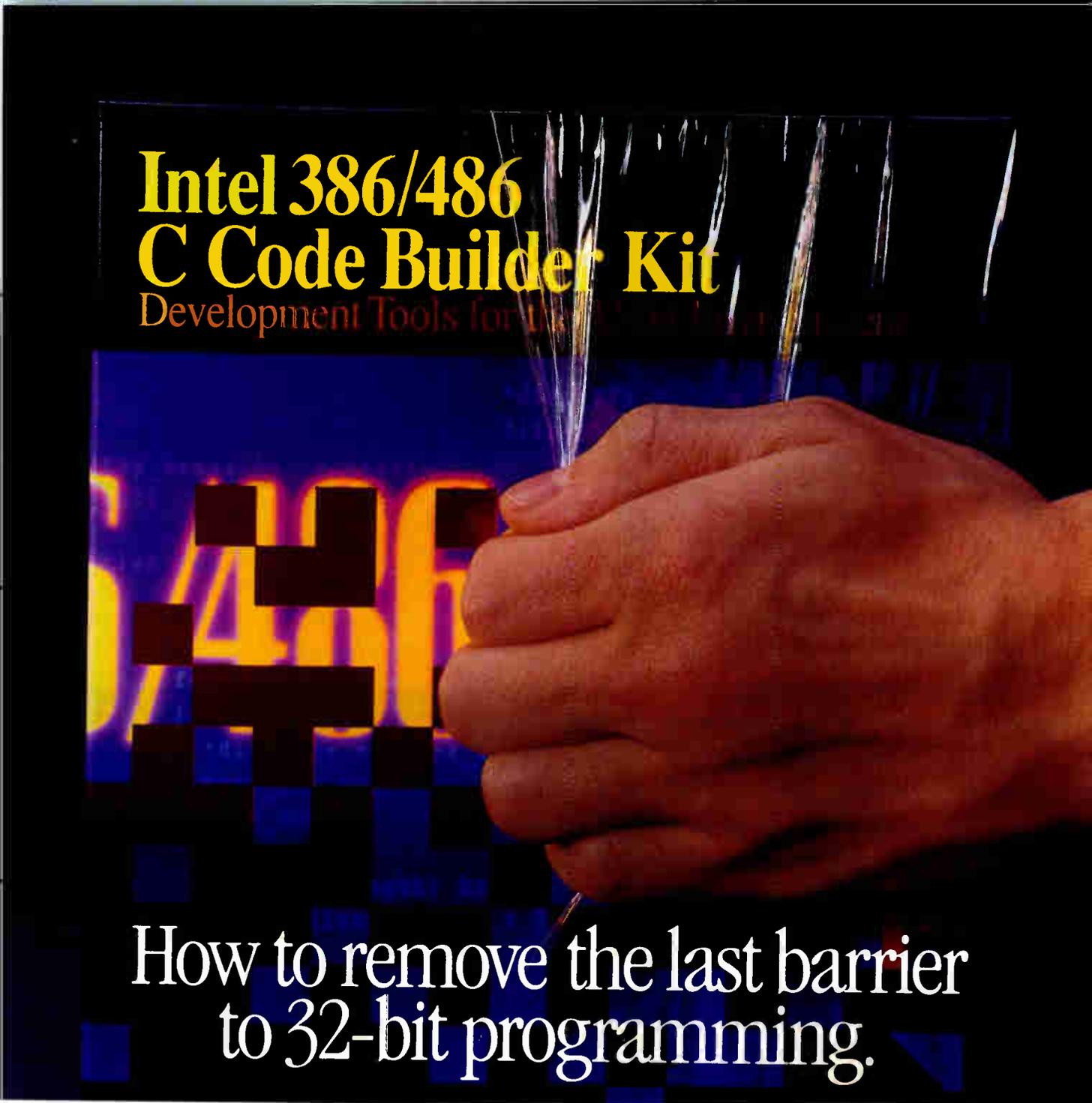
the generic battle scenario area you've chosen; press Alt-F1, an action documented in precisely one sentence buried in the back of the scenario editor manual; and load your edited scenario. Any other action will fail frustratingly.

My son Phillip is getting his commission in the Navy in a few days, and he's been assigned to a helicopter carrier, so we were anxious to put his ship into one of the battles. When we did, we found to our horror that it didn't have any helicopters aboard. It turns out that you must first add a new battle group, and in a sep-

arate action *edit* that battle group if you want to add aircraft. Once we figured out that secret, the rest was easy, and Harpoon is far and away the most realistic naval war game around.

Thanks to everyone who bought *Fallen Angels* and *Go Tell the Spartans*, both books hit the best-seller list just after they came out. Now I'm off to the beach house with Larry Niven, where we hope to finish *The Moat Around Murcheson's Eye*. I'd like to think that while I'm gone some of this sea of software will vanish, but I know better. ■

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. Jerry welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on BIX as "jerryyp."



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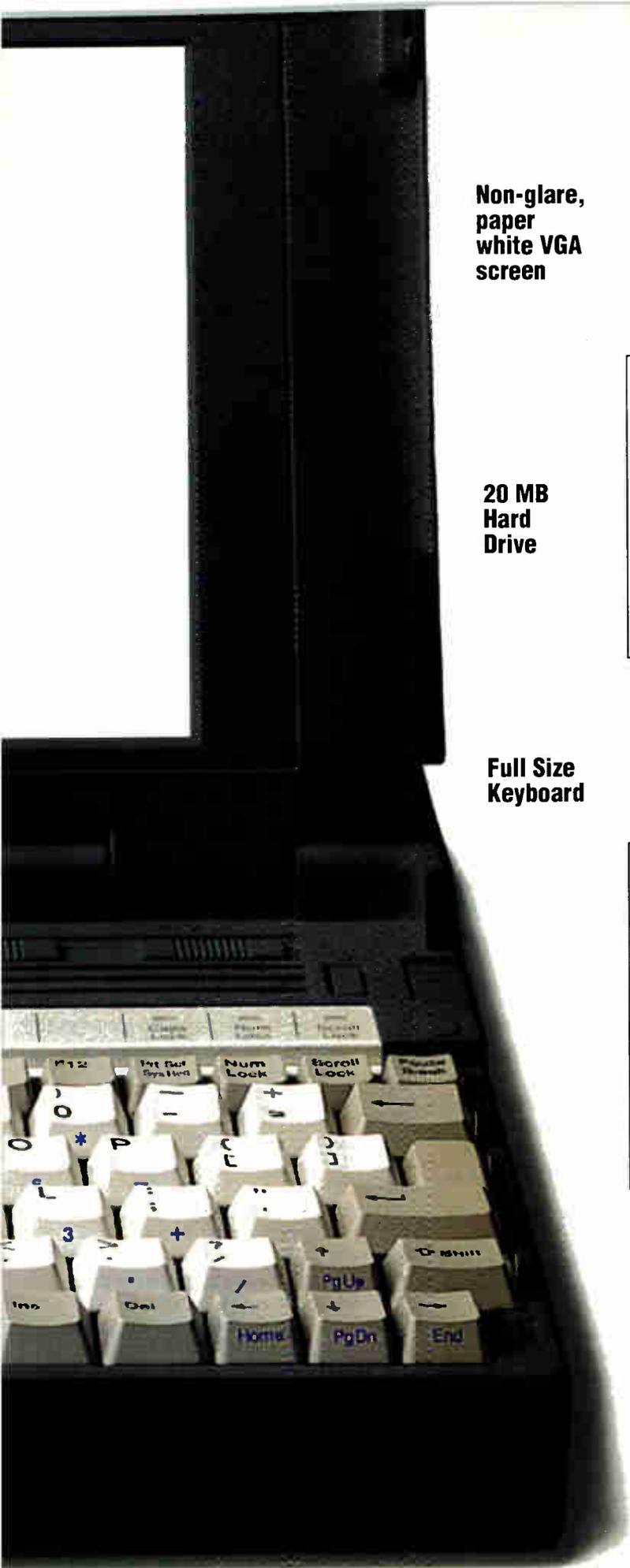
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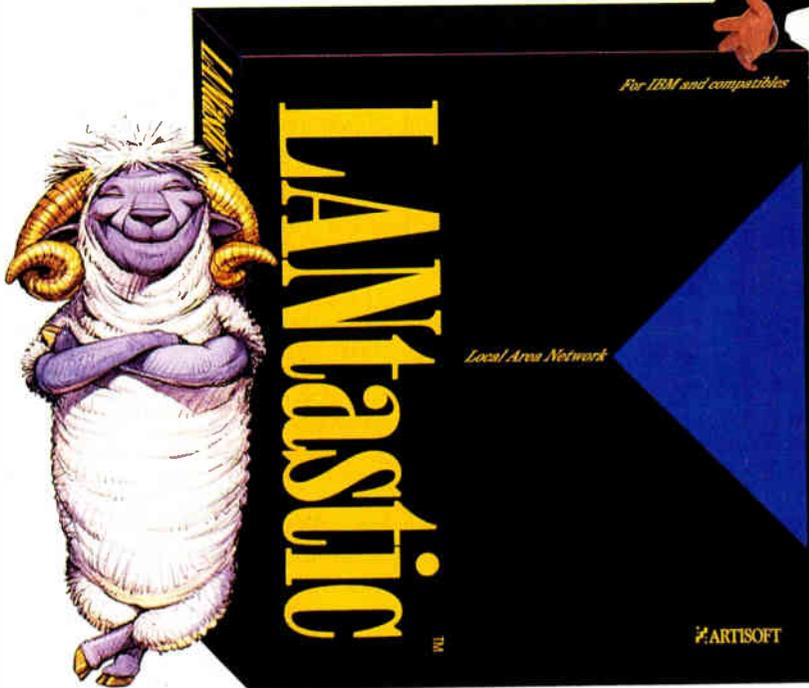
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LANtastic shatters the myth that networks have to be an employment program for on-site computer technicians.

Out in Indiana farm country in 1988, Dennis Reese indulged his passion for computers by adding a room to his dad's farm equipment company. Last July, he started connecting his customers on LANtastic networks. Today that sideline is turning a million dollars a year.

His biggest client was running a 25-node network on one Novell system and preparing to upgrade to another. That's when Dennis installed Artisoft's LANtastic. "I told them if they didn't like it, I'd pull it out. No charge. Now they're the happiest customer I have. They really like having multiple servers with drives formatted for DOS. They thanked me for giving them back their computers."

LANtastic is so easy to use that Dennis's customers enjoy networking. The flexible peer-to-peer structure was another plus. "We have had many applications that bogged down on a client-server network. Now with LANtastic we can redistribute the processing to multiple servers."

Dennis' clientele are people more interested in being experts in their own fields rather than having to become—or hire—experts in an overcomplicated network. They are doctors, lawyers and industrial specialists like a large communications tower producer, a bearing manufacturer and a plastics firm that makes showers and tubs.

There's a myth that networks have to be an employment program for on-site computer technicians. Artisoft's LANtastic shatters the myth with a network that everyday people can install and understand and use with confidence.

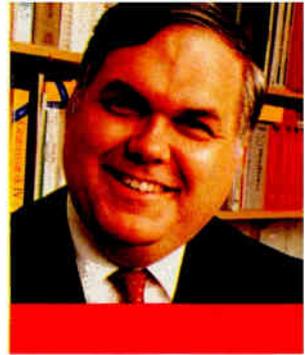
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YOUR FIRST LAN: DO IT YOURSELF?

One of the mistaken impressions that business computer users have is that LANs are only for large businesses. Many business users think that something as complex as a LAN can be designed and installed only by a company that specializes in such things. While this may be true in the case of large corporate LANs, the fact remains that, in many cases, it's entirely possible for a small company to design and install its own LAN.

A great deal depends on your ability to work with computers and your willingness to spend time on LAN installation rather than (or perhaps in addition to) your normal line of work. Not everyone is a candidate for a do-it-yourself network. In some cases, you can do part of the work, though, and still have a role in the installation.

A good example of a business that succeeded with a do-it-yourself LAN is Metropolitan Helicopters in Manassas, Virginia. The president of Metropolitan is Dave Carter, a knowledgeable computer user. Dave runs one of the largest flying services in the Washington, D.C., area and performs much of the work with a trio of PC clones from Tandy. These computers do everything from keeping the books to downloading aviation weather from the Federal Aviation Administration. Unfortunately, they're also widely separated from each other.

While he could have used the computers the way they were, life would have been easier if the accounting functions were available from the back office as well as at the front counter. Swapping disks would never do, since there was no way to be sure that the accounts would stay the same while they were being used in two different locations.

Dave started off with a LANtastic starter kit and ran the cable himself. The design was limited to figuring out where the cable runs would be, and in a couple of hours, Dave and Metropolitan were networked.

The resulting benefits were immediate. The accounting work was significantly more productive, and the load on the staff was reduced. The LAN clearly made a difference.

Not every business is as easy to network as Metropolitan Helicopters, and not every business has someone who knows as much about computers as Dave Carter does, so not every business is a candidate for a do-it-yourself LAN. Likewise, not every business owner is as willing to work nights, as was the case here. So, how can you tell if you should do all of the job, part of the job, or none of the job? The answer is that you must

evaluate the capabilities of your business, just as you evaluated your requirements last month.

Making the Decision

The following points will help you decide if designing and installing your own LAN is for you. Remember that these are just guidelines and that there may well be additional factors that will sway you one way or the other. Remember also that while the cost of LAN installation is usually one factor in looking at do-it-yourself LANs, a lot of factors constitute costs over the life cycle of a network. If you don't know what you're doing, the money you save on installation will be extracted from you many times in the future as you try to recover from the results.

- *How much do you know about your computers?* While a simple LAN installation doesn't require formal education in computer science, you should be comfortable opening up your machines and adding or removing expansion boards. You should also be familiar with computer documentation and be willing to try a process several times before you get it right.
- *How much downtime can you tolerate?* When you're installing your computers, you may be without them for as much as a day or so. A lot depends on how well the installation proceeds, and that depends on your experience. Professional installers can have your machines out of operation for only a few minutes apiece. If you can't live without your computers for a while, you might want to avoid doing it yourself.
- *How are you at construction techniques?* Installing a LAN involves running cable to several offices and may require you to install junction boxes in walls, install conduit, and maybe install electrical power. If you aren't familiar with these skills, and if you don't have a

**You might already
have the resources to
install your own LAN**

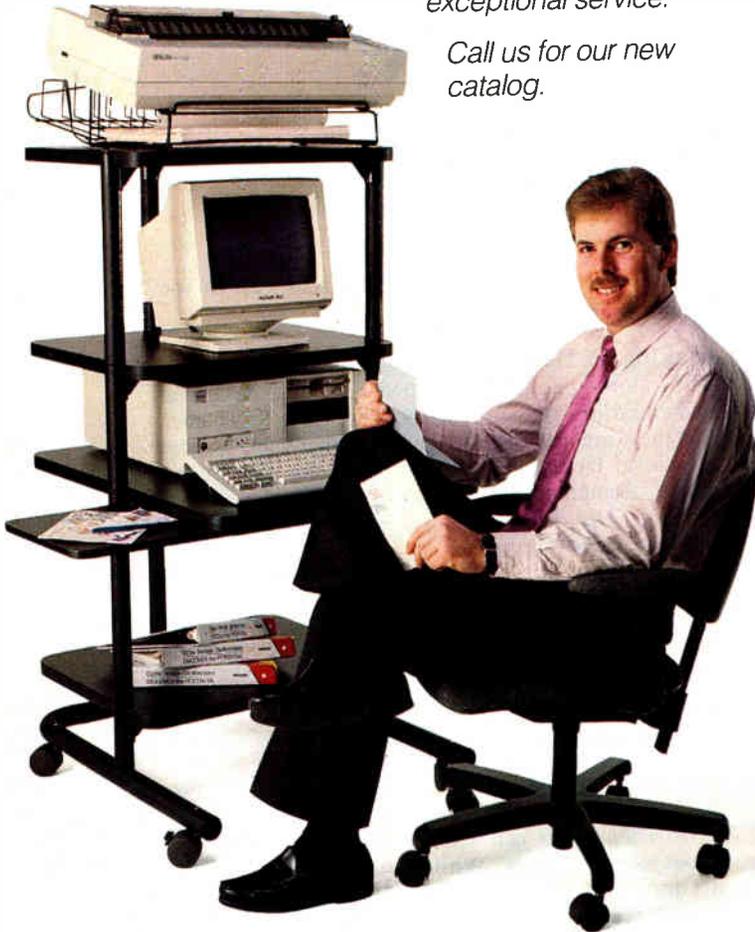


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license in areas where one is required, you will need to hire someone for this part, at least.

• *How much free time do you have?* You need to have the time to do the installation properly, including the part about reading the manuals. If you're already perpetually minus on minutes, you might want to reevaluate installing a LAN yourself. How did Dave Carter manage? Things can get pretty quiet at a flying service when the airport is socked in.

• *How big is the project?* Success with do-it-yourself LANs drops as the complexity increases. Most users without an MIS staff should contract out even a 10-user LAN. Doing a 100-user LAN yourself without a trained staff is folly.

• *Are you connecting anything besides personal computers?* Unless you have the right training or experience, adding gateways, bridges, routers, and multiple servers is the province of skilled contractors. Many large companies, even those with skilled staffs, farm out this work because it costs too much to use a support staff for new installations.

Ultimately, the decision to install a LAN yourself is a business decision like any other. If the net cost (including all factors) is lower to do it yourself, then you should consider that option. Just remember to count things like downtime in the cost column of your comparison.

Doing Part of the Job

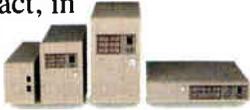
Let's say that you've looked at the options and it's now clear that you're not really in the market for a do-it-yourself LAN. If that's the case, you may be a candidate for doing part of the LAN yourself. Frequently, this is both less expensive and more effective than contracting the whole job. It's less expensive because you do part of the work, and more effective because you have more involvement in the process, so the resulting installation closely reflects your needs.

In the case of doing part of the LAN for yourself, you have to decide what skills you can provide and whether you can provide them more cheaply or more effectively than the LAN installer. You might have your company maintenance staff (if you have one) do the basic cable installation, for example. You might produce the initial drawings of the LAN, showing the locations of workstations, cable connection boxes, and LAN support equipment. You might even install some of the simpler hardware, such as the network interface cards. Even doing something simple, such as attaching 3M Post-it notes to the walls to indicate

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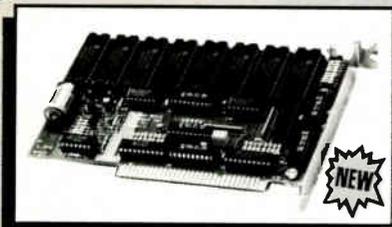
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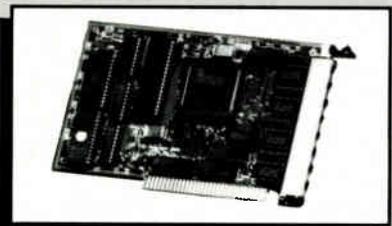
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The best way to decide how you can help install your LAN, and maybe save some money in the process, is to make an inventory of your capabilities.

connection box locations, can save money and reduce installation time.

The best way to decide how you can help install your own LAN, and maybe save some money in the process, is to make an inventory of your own capabilities. Of course, it helps a lot to know what capabilities are required:

• *Are you good with graphics software?* If so, you can save a lot by using a program like AutoSketch from Generic Software to create the drawings for the LAN. This company is a subsidiary of Autodesk, which makes AutoCAD, the leading CAD package. AutoSketch is easy to use, and there's an optional Symbols Library for LAN design. This means you can create your own physical LAN layout.

• *Do you have a staff electrician?* If your electrician (or some other qualified person) can do your data cable installation, you'll speed up the LAN installer's job. You may find that you'll have to make arrangements for additional power in any case, so you can do both jobs at once.

• *Can you plan where the equipment should go?* Making a survey of your office spaces and deciding where you would like to have the wall boxes placed for the LAN connections, and deciding where to place equipment such as file servers, power supplies, and the like will ease installation and lower prices.

• *Do you have a skilled staffer who can help with the installation?* Many LAN installers will let you supply some of the labor for things like installing network interface cards. This means you'll pay the installer less and at the same time will learn more about your own LAN than you would if your staff didn't help.

Keep in mind that a great deal of the process of helping the LAN installation along can be negotiated with the company doing your installation. In fact, this is a good way to help select a LAN contractor if you're interested in keeping prices down and in getting the process done as quickly as possible. You should remember, however, that you'll be responsible for any work you do yourself. This means that if your cable was installed incorrectly, you'll have to fix it or pay to have it fixed. Likewise, if your staff installed the network interface cards, and they are not set up properly, your staff will be responsible for making them work. This is why you have to make sure you have skilled people doing the work in the first place.

The Lay of the LAN

One area that nearly every LAN customer can help with is the physical layout of the network. As mentioned in the checklist above, this can be done with existing blueprints or with software that lets you create your own. In a way, designing the physical layout is the next step beyond the requirements definition that I discussed in last month's column.

First, get a set of blueprints of your office spaces. In some cases, finding an existing set is impossible and you'll have to create your own drawings. In new buildings, a set of blueprints is usually available from the building manager or the owner, or maybe from the company that built the structure. If you have a choice, you'll want to ask for the drawings that have the electrical and HVAC components illustrated.

If you don't have and can't get drawings of your offices, it's time to get a copy of AutoSketch and do your own. Make a rough sketch on graph paper, making sure to draw to scale using actual measurements. You might have to pick up a 100-foot tape measure at the local building supply store to get accurate measurements of large spaces. You'll also need to measure ceiling height and note what kind of ceilings you have.

Once you have drawings in hand, you need to indicate the proper placement of the LAN hardware, as far as your requirements are concerned. To do this, you should visit every office and note where the LAN connection box should be located. This is an electrical junction box about the size of similar boxes that already contain phone connectors and electrical convenience outlets. Generally, it's a good idea to put the LAN connection in the general vicinity of the other boxes so that the occupant of the office

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knows where to find things.

You will also need to decide where the LAN equipment should be placed in your office. Normally, this equipment will include a file server, an uninterruptible power supply, and perhaps one or more hubs to which you will attach the workstation cables.

The LAN equipment should be placed out of a traffic area, but in a location that has good climate control. You will need to be sure that you have a room that can be locked if your office isn't very secure or if you have employees who like to fiddle with computers when they're not supposed to.

If you're helping with the layout for a larger LAN, you will need to be concerned about the location of telephone equipment closets, building backbones, and cable raceways. In this case, the installation will work better if you perform a preliminary study so that you can get a meaningful bid from a LAN contractor and then work with the contractor that you select to perform the more detailed work. In complex LANs, there are a number of acceptable ways to meet your requirements, and you will need to find out how the contractor plans to meet them so that you can work together to that end.

To Do or Not to Do?

Now that you've seen some of the ways that you can do all or part of your own LAN installation, it's up to you to decide what role to play. In some cases, such as the installation that Dave Carter performed himself, the choice is simple. LANtastic is easy for a user to install, and it works fine. The question is more difficult in more complex installations, however.

When an installation becomes more complicated than a few workstations, such as when it moves into the world of file servers, mainframe gateways, and communications servers, you need to call in people who have the required training. It may be that those people al-

ready work for you in the form of your MIS department. Approaching a complex LAN installation with untrained installers is an effective way to extract money from your business, so it's better to do it right the first time.

Finally, there's also the question of whether you want your staff to be spending its time installing LAN hardware and software. Depending on how lean your organization is, you might not want to shut down other operations just so your own staffers can load the NetWare shell onto everyone's workstation. Again, this might be a situation in which an outside contractor can do the job more efficiently, despite the fact that you have the skills you need on your staff.

Installing your own LAN or helping with the installation has some distinct benefits beyond the financial savings. When you participate in the installation, it means that you become vastly more familiar with the network than you would have been otherwise. This, in turn, means that you will have fewer problems that you can't handle and that you'll know what your LAN can do when you have to expand it later.

Ultimately, the question is more than just whether you can do it yourself. The question is also how much of a role you can play, for you should always plan to play some role. After all, it is your LAN, and it'll work better if you know what you've got. ■

Wayne Rash Jr. is a contributing editor for BYTE and a principal and technical director of the Network Integration Group of American Management Systems, Inc. (Arlington, VA). He is coauthor of two books for business network users: The Executive Guide to Local Area Networks and The Novell Connection. You can contact him on BIX as "waynerash," or in the to.wayne conference.

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

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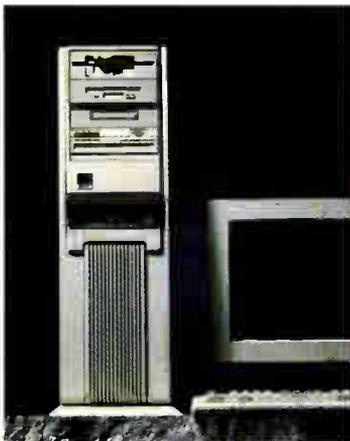
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BYT1991

ROUNDTABLE



BYTE columnists, staff, and contributors debate the issues

COMPUTING'S NEW WORLD ORDER

Roundtable is a forum in which BYTE editors, columnists, and contributors debate key issues that affect how you purchase and use hardware and software. The “conversations” take place on BIX, where you can participate in the round table conference.

MICHAEL NADEAU: The personal computer market seems to be in turmoil. IBM, Compaq, DEC, and other usually stalwart vendors are faltering. Clearly, economic and competitive factors are changing the computer buying habits of businesses. To counter this, the major vendors are slashing prices and streamlining operations. But the die is cast—there is a “new world order” coming in the personal computer industry.

Looking at 1992, what exactly will that new world order look like? Will vendors such as Dell and AST take the place of Compaq and IBM? Will more opportunities open up for Apple and RISC system vendors? Will IBM et al. regain the upper hand?

BARRY NANCE: The picture may not be quite so bleak for IBM. We're reaching the time when the 286 PCs purchased in the mid to late 1980s are fully depreciated. There will shortly be another buying spree, I predict. The catchphrase will be downsizing; companies will embark on huge projects to replace stand-alone older PCs with networked desktop machines. And, as usual, most of these new machines will carry an IBM label. The software they run will be developed mostly in-house, using IBM language products and IBM OS/2.

IBM has a tremendous sales force. The IBM salespeople will do whatever it takes to sell hardware, software, and services to corporations. I don't think Dell, AST, or the Kowloon Komputer Company can compete with IBM's sales force. Last year, this sales force sold 43 billion dollars' worth of computer technology to other corporations.

I do think IBM has abandoned the “retail” market to Microsoft so it can concentrate on the Fortune 500 market. IBM and Microsoft are not angry with each other at all. I suspect they've formed long-range business plans that allocate the retail market to Microsoft and the corporate market to IBM. When IBM sells

OS/2 to Exxon, IBM sends part of the money to Microsoft. When Microsoft sells DOS to Egghead and thence to an individual or to a small company, Microsoft sends part of the money to IBM. It's a win-win situation.

JERRY POURNELLE: I never met a capitalist who was for capitalism after he got his: Once you're in, you talk about “stability of the market” and “market maturity.” I look for the Big Boys to get the government to save their high-priced bacon by making FCC certification even more difficult, possibly getting some kind of “safety test,” like crash tests of cars.

Note that Bill Gates can't import his Porsche (which is in a bonded warehouse in Seattle) because no one has ever crash-tested one of those half-million-dollar cars, and no one will, and the authorities won't let him import a car that isn't “safe.”

Something of that sort will be invoked to stop small companies from getting into the computer business. It is likely that a deal will be cut among the larger ones, cutting in some of the small guys for a guaranteed share in exchange for their support of the cartel.

It won't be called a cartel, of course, and it won't look from the outside like one, just as the artificially high memory prices didn't look like a device to keep IBM going at high prices and keep the small clones out; but it will operate that way.

KEN SHELDON: It saddens me to have to agree with you, Jerry. On the “we got ours” front, there's ACE (the Advanced Computing Environment consortium). Whether ACE will turn out to be a cartel remains to be seen, but it can be reasonably argued that the point of it is to promote a standard that clone makers will not be able to compete against. Given that one of the major players in ACE (Compaq) started out as a clone maker,

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this seems especially egregious.

Of course, you mustn't ever underestimate the ability of the tiny mammals to eat the eggs of the dinosaurs, regardless of how many consortia the dinosaurs form. So far, EISA hasn't driven any clone makers out of business.

LARRY LOEB: The new world order, like the political one, will probably be more of the same, but repackaged for easier consumer acceptance. The marketing focus is changing from gaining desk space for a machine to upgrading the performance of the one that is there—or changing the one that is there.

Apple and IBM will eventually find some common ground to agree upon, and this may be the story of what's coming: the end of the Microsoft oligopoly as we know it. Let's assume Apple has a RISC operating system pretty much ready to go this year. They have to glue it to a processor (preferably a non-Intel one) at a time when they are laying off people and don't have a lot of current revenue to spend on R&D. It's cheaper to buy it than invent it—on both sides. With known outcomes from the research, you can figure a time to market for a product. And I think Apple wants to pull off a RISC machine in 1992—one that Billy has no hold over. They want Claris to sell all those spreadsheets, not Microsoft.

OWEN LINDERHOLM: I seriously think that at last the software world is starting to direct the hardware world. Microsoft now has enough fingers in enough pies and enough control over operating systems that it can direct to a great extent the software future for many hardware platforms, Apple being the exception. Although this may sound odd, there is no good reason why software companies shouldn't be leading the hardware companies. Software is what the user sees and runs and uses—hardware is just a box of tricks to make it all happen. It makes sense that hardware should be designed to make the software work better. However, there is a danger of a stranglehold monopoly developing.

WAYNE RASH JR.: It's far too early to count IBM out of the picture. I'm less sure about Compaq, but they've stashed a lot of resources in the bank, and they have the time to learn to be competitive again. Currently, the situation is that a couple of the major manufacturers have been able to maintain prices that are artificially high, partly due to their ability to market, and partly due to the lack of familiarity of business buyers with the PC

marketplace. Since buyers weren't really familiar with what they were purchasing, they just looked for names they recognized, such as IBM, Apple, and Compaq. Several factors have contributed to changing this, the first being the current recession (which may have ended by now), and the other being a move to companies that are trying to be more competitive so that they can compete in the world marketplace.

As a result of the current market forces, companies that once bought only

position. Both companies are addicted to the easy money of the late 1980s, and they'd rather not have to fight for market share. Apple, forced by corporate users, finally lowered prices, but I suspect the company's heart isn't in it. I'm not convinced that Compaq has the ability to become lean and competitive anymore.

What will the outcome be? IBM will be a dominant force in the market, but it will share the market with the second tier. The third tier will be there to keep them honest and the prices low.

A pple and IBM will find some common ground to agree upon.

IBM have had to risk trying other brands, such as AST or Dell. In the process, they found out that these machines were every bit as good as the higher-priced machines they were buying in the past. The managers are also hearing about other companies that have abandoned the high end in favor of a moderate-priced machine that was just as capable. The result is a much larger role for second- and third-tier companies, and tight times for IBM and Apple.

Now that the second- and third-tier companies are entering the mainstream, IBM is finding out that it must compete more than in the past. Likewise, Compaq and Apple have found out that the buyers will pass them by unless they provide more value.

IBM is ultimately a marketing company that is driven by technology. One way or the other, it will meet the needs of the marketplace eventually. In addition, IBM has the resources to be a fierce competitor indeed. If the company wishes to make a major push in market share, it has the resources to do so. After all, IBM controls nearly all its manufacturing, right down to the chip level. If the company sees that such a strategy will benefit it, then it can control the market, provided the FTC will let it, which it probably won't. In any case, it would still be a significant force.

Apple and Compaq are in a tougher

DON CRABB: I think all the concern over the new world order in computing is horsepuckey. Trying to speculate on it is like trying to nail Jell-O to a wall—you can certainly try it, but the results are anything but satisfactory. Since no one has yet made a convincing analysis of how computing got to where it is today in 1991 (and pundits have been trying for the last 20 years), it seems to me that trying to discern the future and all its market vagaries is a monumental waste of time.

Frankly, I don't care what the new world order turns out to be, or even if one can be explicated. As someone who uses computers and manages others who use them, I know that no matter what I see happening, or what I'd like to happen, the reality of it will end up so twisted as to make the exercise one of dumping energy down the proverbial rat hole.

Instead, I'd like to propose that we've had a chaotic and often nonsensical computing market for some time now, and that every vendor who has tried to define some kind of new future (to which they, presumably, have the answers) has failed utterly. Rather than trying to discern how the new world order of computing will shake out, we should demand of our computer companies that they honestly evaluate where they are today and how they, as individual companies, intend to invent the future of computing. This concern for the rationale and goals behind technology might actually result in socially responsible computing solutions that will make it easier for computer users to get their work done. . . .

Wait a minute, what am I thinking about? Computer companies actually worrying about sociotechnological issues instead of next quarter's bottom line? I must be nuts. Forget it, you guys are right, all the companies will fight it out tooth and nail over each little marketing tidbit, and all kinds of scenarios are possible with that happening, including just about every permutation of what has already been speculated here. ■

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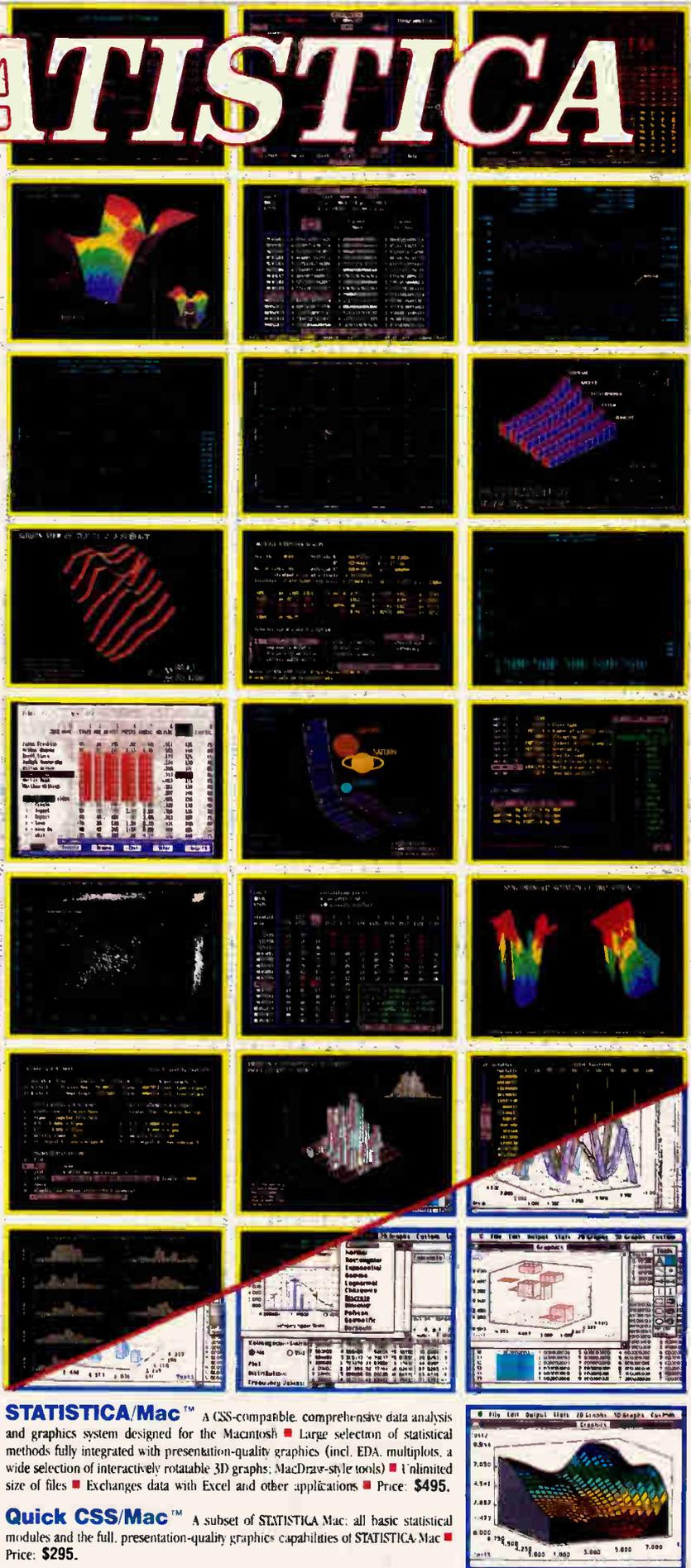


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World Radio History

True Data

A technology called authentication ensures that
what you send is what they get

PETER WAYNER

Computers have the reputation of always telling the truth. Unfortunately, humans tell computers their own versions of the truth. Millions of businesses keep their records in spreadsheets, but embezzlers easily cover their tracks by switching just a few entries. Computer viruses can attach themselves to programs, and you can't tell whether the current version is really the same as the original. Paper documents must obey physical laws, but magnetic bits know no masters.

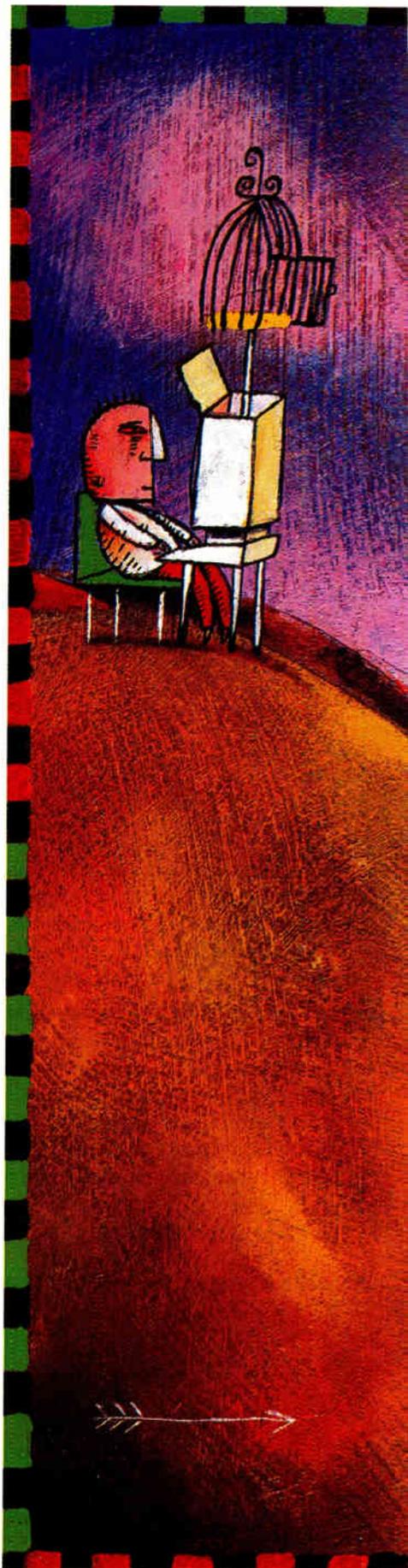
Recent cases from the crime files show how dishonest data is beginning to spread. In one incident, the outcome of a murder case hinged on the list of phone calls made by the defendant. MCI's internal records showed she made a phone call to a gun store, but the defendant produced her phone bill, which showed she was talking to her mother at the exact time the call to the gun store allegedly took place. Who do you believe when there are two sets of computer records that contradict each other?

Another example: Investigators in the Iran Contra scandal discovered a file filled with incriminating E-mail messages from Oliver North. If you were on the jury, could you be sure that they weren't forged or modified by one side or the other? E-mail is used throughout the business world, but a forged E-mail message is easy to create. Can you trust electronic records?

Cryptographers have come up with a number of systems that allow people to verify the authenticity of a document; this article will discuss three of them. The first is similar to the familiar checksum, but it is much more impervious to tampering—in fact, it can be used to detect tampering. The second is based on public-key cryptographic codes, which you can use to add electronic “signatures” to documents or letters. The third is a technique for making sure that computers on a network are honest about their identities and deserve access to files. [Editor's note: *For more on data security and encryption, see “How Safe Is It?” and “Secret Codes,” June 1989 BYTE. For a look at software packages that provide encryption, see “R_x for Safer Data,” August BYTE.*]

Check Out These Sums

The standard checksum is a well-known feature of any sort of data management. Snefru and MD5 are two examples of cryptographically secure checksums. These are difficult to invert. (For an explanation of checksums, see the text box





“Checks in the Mail” on page 128.) Ralph Merkle, a scientist at Xerox’s Palo Alto Research Center, invented Snefru—named after an Egyptian pharaoh who is now “in crypt.” MD5 was developed by Ron Rivest, a professor at MIT and one of the creators of the Rivest-Shamir-Adelman (RSA) public-key encryption system.

Snefru begins by loading 16 32-bit words, $w(0) \dots w(15)$, from the message into registers. These words fit conveniently in the register file of many RISC processors. Once the data is loaded, the function can be calculated faster than if the data is kept in memory. In addition, Snefru uses several 256- by 32-bit word tables called S-boxes that provide the randomizing, nonlinear features of the function. The term *S-box* comes from the Data Encryption Standard (DES), which is structurally similar to Snefru. The hope is that by mashing the bits through this nonlinear function a number of times, Snefru cannot be inverted.

The basic operation of Snefru takes one of the 16 words in the register files $w(i)$ and uses the last byte of $w(i)$ to choose one of the 256 values from the S-box. An exclusive-or is then performed on this value with $w((i-1) \bmod 16)$ and $w((i+1) \bmod 16)$, and the new results are stored in the same place. Symbolically, it looks like this:

$$w((i-1) \bmod 16) := w((i-1) \bmod 16) \text{ XOR } S[w(i) \text{ AND } 255]$$

$$w((i+1) \bmod 16) := w((i+1) \bmod 16) \text{ XOR } S[w(i) \text{ AND } 255]$$

The pseudocode in listing 1 shows how this basic operation is repeated. [Editor’s note: *The complete source code for Snefru and MD5 is available on BIX and free of charge on Demolink. See page 5 for details.*] Snefru’s security rests on the expectation that the S-box is sufficiently nonlinear that an attacker will not be able to easily invert the function. The value of the constant `SecurityLevel` controls the number of times the basic operations are repeated. The constant is sort of a security dial, and the larger settings are probably more secure.

A programmer constructs the S-boxes carefully. Initially, each of the 4 bytes in the 32 bits of $S[i]$ is set to i for all i s from 0 to 255. Then two random numbers i and j , between 0 and 255, and one random number b , between 0 and 3, are chosen. The b th bytes of $S[i]$ and $S[j]$ are swapped. This swapping must be repeated many times—often more than 25,000.

This technique ensures that you will not find any duplicates among the set of first bytes of the 256 entries of the S-boxes. You also will not find duplicates in the set of second, third, or fourth bytes. You may want to experiment with this procedure and look for the security hole caused by allowing duplicates.

Further discussion about the design of the function and the actual construction of the S-boxes is too detailed for this article.

Unfortunately, the mathematical tools for analyzing these functions are not particularly powerful, and it is difficult to be certain about the absolute strength of the systems. Merkle realized this when he was testing his Snefru system, so he

took a pragmatic approach and offered a monetary reward for breaking the system. The early version, with `SecurityLevel` set to 2, was broken by Eli Biham and described in a paper by Biham and Adi Shamir (both of the Weizman Institute, a university in Israel). Merkle recommends setting `SecurityLevel` to either 4 or 8; as of this writing, these settings have remained unbroken despite the incentive of a \$1000 reward.

The basic operation of MD5 is different. Snefru relies on an S-box to provide noninvertability, but MD5 uses a complicated set of Boolean operations. The advantage of this method is that the program does not need to repeatedly look up a value in a table; it can complete all the operations in registers. There is, however, no solid theoretical justification for either method being more secure than the other. So far, no one has publicly claimed to have broken the MD5 system, but then, no reward has been offered to encourage the attempt.

At the core of MD5 are three functions of three bits X , Y , and Z . The first function, f , is a conditional function: If X is 1, then return Y , else return Z . The second function, g , is a majority function that returns 1 if at least two of X , Y , or Z are 1. The last function, h , is a Boolean sum: $X \text{ XOR } Y \text{ XOR } Z$. All three functions can be computed by using simple AND, OR, and XOR on 32-bit words.

The way that MD5 combines these basic functions into a hash function is too difficult to describe completely in pseudocode. The basic functions f , g , and h are repeated in a nonobvious pattern that Rivest says he found mixed the results well. You can obtain a copy of the initial document defining the function on BIX.

Public Keys and Authentication

Another type of authentication involves the use of public-key encryption. These encryption systems have the unique feature of requiring two keys. If a message is encrypted with one key, it can only be decrypted by the other key. One key is broadcast to the world as the public key, and the other is kept secret by the owner. If you want to send mail, you encrypt it using the receiver’s public key. Then, only the receiver’s private key can decrypt it.

You can perform authentication by running the system in reverse. A person can “sign” a document by encrypting some identifying block of information using the private key. This data can be a name or a cryptographically secure checksum of the document. Everyone has access to the public key and can use it to decode the block. They know that only the secret key could have encrypted this block, because they were able to decrypt it. Unfortunately, the use of public-key systems is one of the most disputed areas of patent law. Some of the best-known systems, like those developed by Rivest, Shamir, and Adelman, are protected by several patents. The company that owns the patents, PK Partners, actively defends them against infringement.

The area of software patents has not been carefully tested in court, so use may constitute infringement. So far, however, no one has had enough determination to fight the patents in court. Reading about the systems, though, is not illegal, and a description of the RSA algorithm can be found in “Cloak and Data,” June 1990 BYTE.

How to Use Checksums

If you want to use cryptographically secure checksums to keep track of your files, you need to take some precautions. Anyone who modifies a file can also recompute the checksum. You need to ensure that the list of checksums is physically secure.

If you are using the system to watch for viruses, you must

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World Radio History

keep your list of checksum values on a separate disk. That way, the virus can't infect a file and then change the file's checksum, because that is stored on a separate disk. Many antivirus programs have this feature built in, but as you might imagine, it is of limited use. A virus could be able to detect the antivirus and patch the checksum routine.

If you want to use the checksums in an office, it may be prudent to print out the lists of the values and sign and date them. This procedure is less prone to tampering and may have some legal merit. The U.S. Rules of Evidence allows business records to be admitted under what is often referred to as the *shopbook rule*. Ordinarily, testimony from the two parties in

litigation is excluded as hearsay. An exception to the exclusion of hearsay developed from a case where the shopkeeper wanted to introduce his shopbook, which contained a record of every deal he had made. The court ruled that if records are regularly kept in the course of ordinary business, then the owner would try to avoid mistakes. Any tampering with the shopbook would be obvious.

In recent years, the courts have often accepted computerized business records under the assumption that computers never make mistakes. This assumption is almost certain to be challenged. Many businesses microfilm important records. Physically recording the cryptographic checksum may be a good alternative. There is no reason to keep physical records of terabytes of data, and the electronic checksum can verify the authenticity easily.

You can also use the public-key system to encrypt checksums with a private key. The corresponding public key can decrypt a checksum and verify an enormous block of data with it. Using the cryptographic checksum and the public-key encryption system together saves having to encrypt an entire file.

Authentication over a Network

A different type of authentication is often necessary when computers are linked over a network. A central file server must decide whether or not to honor a request for data. Currently, many systems, like the Network File System, do not bother to check who sent a request for a file; they just honor the request. If the appropriate bits say, "I'm George Bush; send me the nuclear access codes," most file servers won't query, "How do I know you're who you say you are?" They just send out the information.

As part of MIT's Athena project, its personnel developed a system called Kerberos to provide security for MIT's university-wide distributed computer system, which consists of hundreds of PCs and workstations and a large number of file servers. One objective for Kerberos is to permit users on any workstation to obtain files from any server whenever they are appropriately authorized. Another objective for Kerberos is to prevent smart students from fooling file servers with messages like, "Hi, I'm Professor Sussman. Could you send me a copy of the exam?"

Kerberos uses passwords for security. If you know the correct password, Kerberos will produce the files. The trick is making sure that passwords don't travel over the network to unauthorized users. Kerberos performs this process by encrypting the messages that travel over the network. If a user and a server know the right key, then they can decrypt each other's messages, but others on the network have no access to this information.

The system consists of file servers, workstations, and the physically secure Kerberos Ticket Granting Server. When someone logs in, the workstation sends a message to the KTGS announcing the new user. The KTGS returns a data packet encrypted with the user's password. Only the user's workstation can decrypt this packet, because only it knows the user's password. Knowledge of the password is equivalent to proof of identity.

The packet, known as a "ticket" in Kerberos parlance, contains a new key (K_{user} , which is known only by the KTGS and the user), an expiration time for the key, and the address on the network of the current workstation. With this key, communication between the KTGS and the workstation can be performed securely. The workstation must obtain a new key when the old one expires, thus preventing old keys from inadvertently leaving security holes in the system.

Listing 1: *Snefru takes one of the words in the register files $w(i)$ and uses the last byte of $w(i)$ to choose a value from the S-box. An exclusive-or is performed on this value with $w((i-1) \bmod 16)$ and $w((i+1) \bmod 16)$, and the results are stored in the same place.*

SecurityLevel: The number of rounds of hashing done to each block of data. Merkle recommends setting this to either 4 or 8.

Round: The current round of hashing being done.

S-box: A 256-entry table of 32-bit numbers. Two are used for each round for a $2 \times \text{SecurityLevel}$ overall.

Block: An array of 16 32-bit numbers.

RotateAmount: An array of four numbers that controls how much each block is rotated after each pass through the S-box. This encourages mixing between blocks of data. Set to be 16, 8, 16, 24.

Key: The final value returned. It is also the four blocks of 32 bits that are passed between each iteration.

Repeat this loop until no more data remains:

```

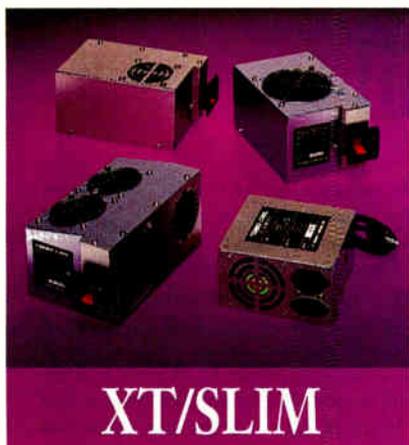
Begin with Block[0] through Block[3] filled with
  Key[0] through Key[3]. At the beginning, Key[0]
  through Key[3] are set to be 0.

Load the next 12 32-bit words of the file into
  Block[4] through Block[15]. Pad the extras with
  zeros.

For Round = 1 to SecurityLevel do
  begin
    For CurrentByte = 0 to 3 do
      begin
        For i = 0 to 15 do
          begin
            Find S-box[Block[i] and 255] in the
              S-box numbered  $2 * \text{SecurityLevel} +$ 
               $(i \bmod 2)$ .
            Replace Block[(i-1) mod 16] with
              Block[(i-1) mod 16] XOR
              S-box[Block[i] and 255]
            Replace Block[(i+1) mod 16] with
              Block[(i+1) mod 16] XOR
              S-box[Block[i] and 255]
          end
        For i = 0 to 15 do
          Rotate Block[i] by RotateAmount[Round]
        end
      end
    end
  For i = 0 to 3 do
    Key[i] = Key[i] or Block[16-i]
  loopend...

```

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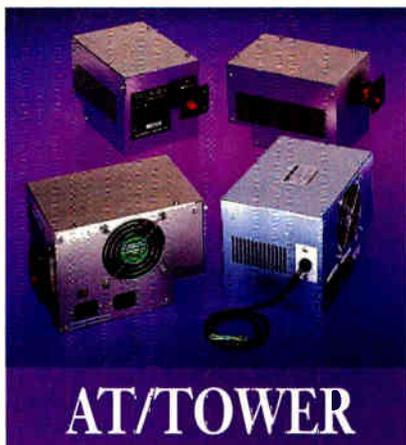
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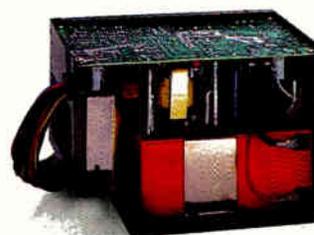
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Checks in the Mail

The use of checksums is a common technique for testing if information has been changed—either purposely or accidentally. When a program creates a checksum, it adds together all the bytes of a block of data (e.g., an E-mail message), and then it keeps this sum as a “proof” of correctness. If you want to know if data was somehow changed, you only need to add all the bytes again and see if the sums match.

Often, the addition is performed modulo n . (Modulo arithmetic is a system in which you divide the results of arithmetic operations by n and keep the remainder.) Usually, n is 2^8 , 2^{16} , or 2^{32} —or 1, 2, or 4 bytes of data, respectively. The chance is only $1/n$ that randomly changed data will have the same checksum as the original.

The small size of $1/2^{32}$ might give you the impression that a 4-byte check-

sum is a good guarantee of unchanging data. After all, these are safe odds on any racetrack. The weak point in this analysis, though, is the assumption that changes in your data are random. What if the differences in the data are caused by a malicious human or virus?

Consider this block of data: 5 7 9. The checksum is 21. What if I maliciously wanted to change the first number to, say, 4? I could also change the second number to 8, the third number to 10, or add a fourth number, 1, anyplace in the data. The checksum would remain 21, and the changes would be transparent.

The standard additive checksum is not foolproof because, for any pair of numbers a and b , any human or machine can find another pair of numbers c and d , such that $a + b = c + d$. Addition is easy to invert. If you have a function f of two variables x and y , and you know

the value $f(x - y)$ and either x or y , then you invert the function f by calculating the unknown value.

Cryptographically secure checksums are similar to regular checksums, but they use a difficult-to-invert function in place of addition. Let $a_1 \dots a_n$ be blocks of a file and $f(\text{data block}, \text{key})$ a difficult-to-invert function taking a key and a block of data. (A key is a set of bits mixed with data to come up with a checksum.) Let the key and the result of f be the same number of bits. Then $f(a_1, f(a_2, f(a_3, \dots f(a_n, \text{initial key}) \dots)))$ is a cryptographically secure checksum. The initial key is just some agreed-upon constant.

The difficult engineering problem is designing the function f and the sizes of its blocks and key. The goal is to make a checksum easy and fast to compute, but sufficiently difficult to invert to be impervious to attack.

When a user wants to access a file server, the workstation calls up the KTGS and asks for access. The KTGS already knows that this workstation knows the right password, so it bundles up a new ticket that contains a key shared by the file server and the workstation ($K_{\text{user,server}}$), an expiration time, and the address of the workstation on the network. This entire ticket is encrypted in the server's secret key, K_{server} , which is known only to the server and the KTGS. This message is sent off to the server, which now knows that the workstation is OK.

The workstation will get its own ticket with $K_{\text{user,server}}$ encrypted using $K_{\text{KTGS,user}}$. Both the workstation and the server will decrypt their tickets, thereby opening the channel for communication. The workstation and the file server can communicate securely using $K_{\text{user,server}}$.

In some cases, the workstation and the file server will encrypt all data using this key. In many cases, the workstation will encrypt only the requests for data. The actual data will be shipped unencrypted to save computation time. This compromise prevents people from randomly snooping through files by forging requests to the file server, but it does not deter a snooper on the network who just happens to be listening when the data goes by.

Maintaining authenticity on a network is quite possible using Kerberos and any standard encryption system like DES. You may find that you want to apply the principles in slightly different ways to fit your particular situation. Kerberos is interesting because it duplicates many features of public-key encryption systems by using normal encryption systems (like DES), which are usually faster than public-key systems. DES was designed to be implemented in hardware, and these silicon versions are blazingly fast.

Putting It All Together

As time goes on, knowing which messages are authentic and which messages are forgeries will become a more serious problem for all computer users. One good method to distribute large, unencrypted files and to ensure that they remain unchanged is by using cryptographically secure checksums. They are ideally suited to the task of checking for viruses and record tampering.

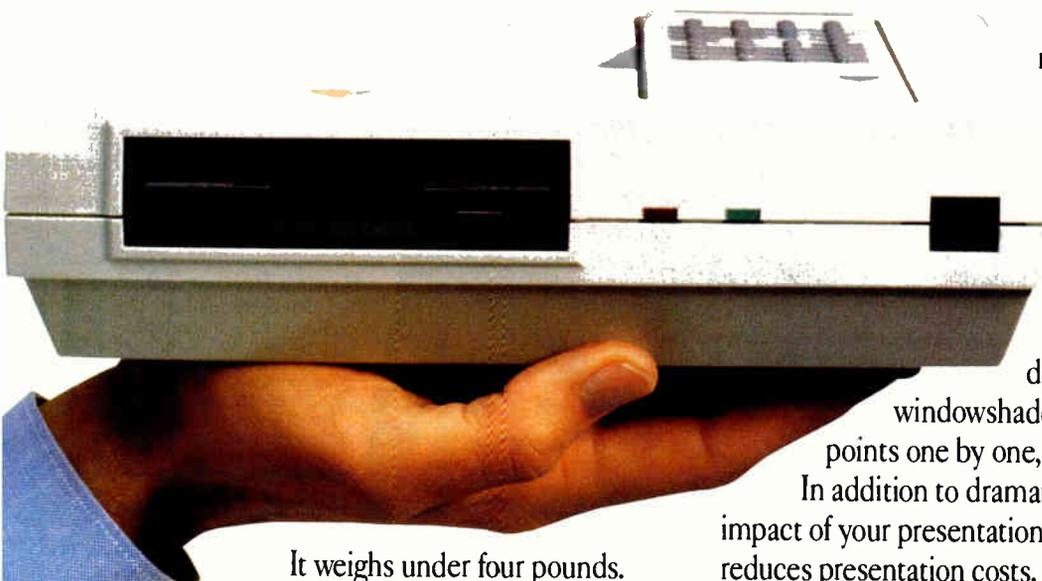
The public-key cryptosystems would be an ideal way to allow people to check the authenticity of a file except for two problems: The systems are relatively slow, and their use must be cleared by attorneys. If you want to make sure a file remains unchanged but you're not particularly concerned with secrecy, then a one-way cryptographically secure checksum is a simpler and faster way to go.

The Kerberos system is a good example of how secret keys can be used to maintain identity on a network. It works with any standard encryption system, but it can be only as secure as the encryption system itself. Kerberos could also be used in a system that required computer users to prove their identity on a network.

These three techniques illustrate some of the ways of addressing data integrity electronically. They can be used separately or in combination to solve many security problems. Be careful, though, to analyze the solutions carefully and make sure that you are using the software correctly. Security holes are hard to plug. ■

Peter Wayner is a consulting editor for BYTE. He is also working toward a Ph.D. in computer science at Cornell University. You can contact him on BIX as "pwayner."

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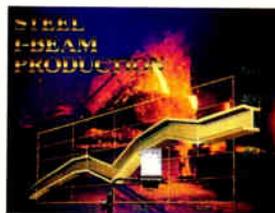
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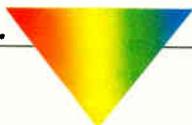


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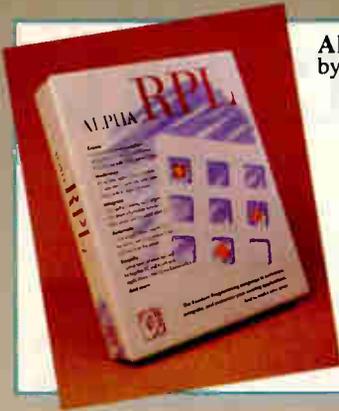


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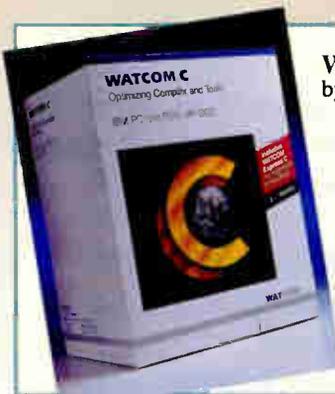
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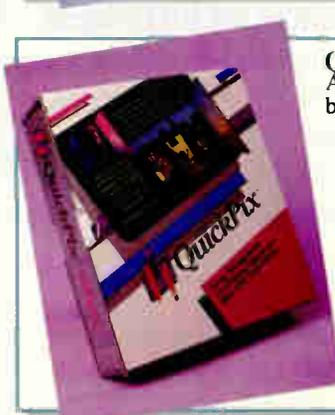
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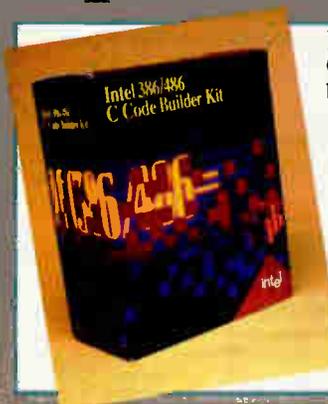


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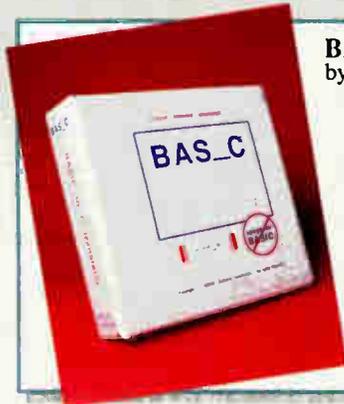


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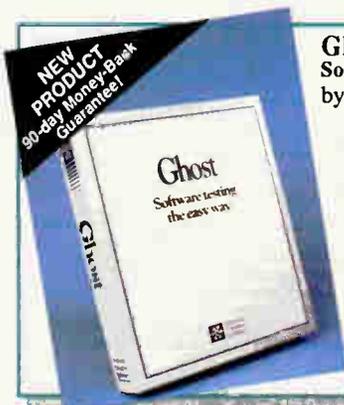
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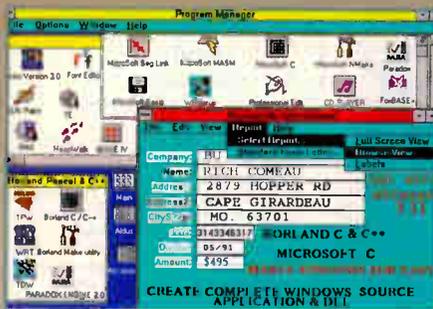
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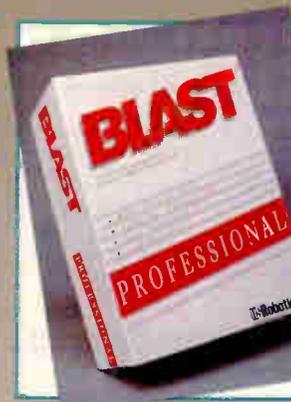


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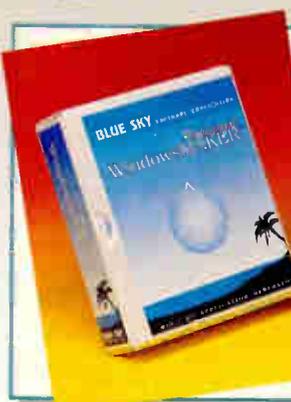
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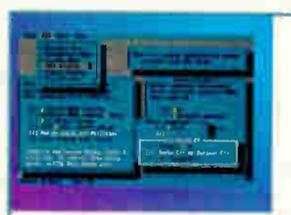
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The Stork by Island Systems

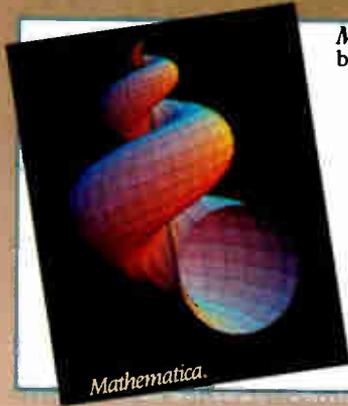
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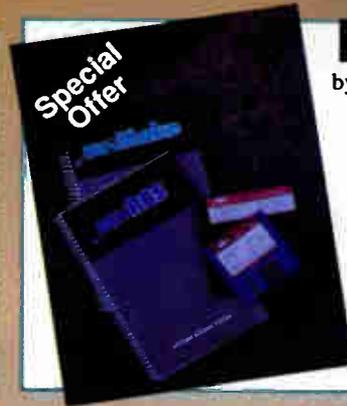


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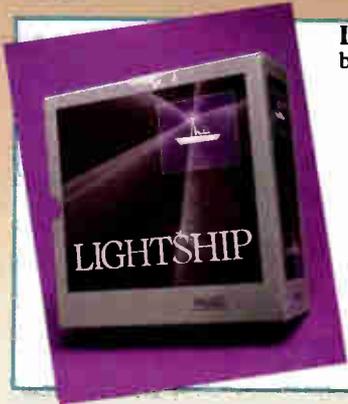
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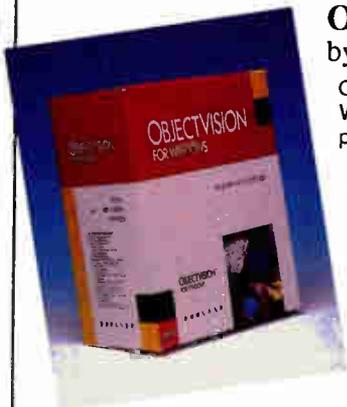


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Prevent Screen Burn In! After Dark for Windows has over 35 different displays, password protection and sound. You can hear ticking clocks, bouncing balls, and screen-munching worms. Use your company logo, Flying Toasters or other graphics as screen saving art, type in messages, or set up Slide Show style presentations.

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Screen	VGA, 32 shades of gray	VGA, 16 shades of gray
Dimensions	2" H x 11.2" L x 9.2" W	2.2" H x 11" L x 8.5" W
Weight	5.8 lbs	7.5 lbs
Support	One year, parts & labor	One year, parts & labor
Price	\$2,795	\$4,399*

*List prices published by IDC and Hard Facts, April 1991.

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64-bit Computing

What is a 64-bit microprocessor?
Why would you want one, especially in a personal system?

JOHN R. MASHEY

Today's most popular computers are built around 32-bit microprocessors. The next generation of chips—64-bit microprocessors—will bring even more power to the desktop.

But what does it mean to call a chip *64-bit*? It's easy to get confused, because different numbers of bits are used in different parts of a microprocessor (see the text box "What's in a Chip?" on page 138). Although the Mips R4000 is currently the only 64-bit microprocessor, 64 bits is almost certainly a coming trend. At microprocessor conferences, sessions on the future of chip technology routinely predict widespread use of true 64-bit microprocessors by 1995 or earlier.

You may be thinking, "My PC software still runs in 16-bit mode, and it will be years before the software catches up with 32 bits. But 64 bits? People who predict widespread use of true 64-bit microprocessors by 1995 must be raving lunatics!"

There are two reasons for the prediction: 64-bit integer processing and convenient use of more than 32 bits of address space. The first reason is a straightforward performance issue; the second has more widespread implications. As you'll see, applications for 64-bit microprocessors exist for both servers and desktops.

CPU Architectures

When it comes to CPU architectures, it helps to distinguish between Instruction Set Architecture, which presents an assembly language programmer's view of a processor, and hardware implementations of that ISA. Successful ISAs persist unchanged or evolve in an upward-compatible direction for years. Distinct implementations are often built to yield different cost/performance points. At times people get confused about the difference between ISA and imple-

mentation sizes. Table 1 may help clear up the confusion.

In figure 1, the CPU's integer registers are R bits wide. Address arithmetic starts with R bits, either producing a virtual address size of V bits (V is the generated user address, $V \leq R$) or using a segment register to expand R bits to V bits. The memory management unit translates V bits of virtual address to A bits of physical address that are actually used to access memory. For each access, up to D bits are transferred (i.e., the data bus is D bits wide). For user-level programs, R and V are programmer-visible properties of the ISA; A and D are usually less-visible implementation-specific characteristics. (Floating-point register size is almost always 64 or 80, and so is not included.)

continued



CPU CHARACTERISTICS

Table 1: The size that a microprocessor is called is generally the integer register size.

CPU	Year released	Size called	ISA characteristics		Hardware Implementation	
			Integer register size (R)	Generated user address size (V)	Physical address size (A)	Data bus size (D)
DEC PDP-11/45	1973	16	16	16*	18	32
DEC PDP-11/70	1976	16	16	16*	22	32
DEC VAX-11/780	1978	32	32	31	32	64
IBM S/360	1964	32	32	24	24	8-128
IBM S/370XA	1983	32	32	31	32	128
IBM ESA/370	1988	32	32	31*	32	128
IBM RISC System/6000	1990	32	32	32*	32	64-128
HP Precision	1986	32	32	32*	32	32-64
Intel 386DX	1985	32	32	32*	32	32
Intel 386SX	1987	32	32	32*	24	16
Intel 860	1989	64	32	32	32	64
Intel 486DX	1989	32	32	32*	32	32
Intel 486SX	1991	32	32	32*	32	32
Mips R2000	1986	32	32	31	32	32
Mips R4000	1990	64	64	40-62	36	64
Motorola 68000	1980	32	32	24	24	16
Motorola 68020	1985	32	32	32	32	32
Motorola 68030	1987	32	32	32	32	32
Motorola 68040	1990	32	32	32	32	32
Sun SPARC	1987	32	32	32	36	32-64

* These processors use some form of segmentation to obtain more bits of user address space when necessary.

Table 1 lists numbers for well-known computer families. For simplicity, V is given only for user-level programs. The table shows that physical address size (A) and data bus size (D) can vary within a processor family. The IBM S/360 family included five data bus sizes (8 to 128 bits); the 32-bit Intel 386 is sold in two sizes—32 and 16.

Better Performance with Bigger Integers

For years, PDP-11 Unix systems have used 16-bit integers for most applications, as do many PCs. Sometimes performance can improve merely by switching to larger integers. Integer code has proved resistant to recent speedup techniques that have greatly helped floating-point performance, so any integer improvement is welcome. Some applications for 64-bit integers are the following:

- *Long strings of bits and bytes.* By using 64-bit instead of 32-bit integers, some programs may run up to twice as fast. First, operating systems often spend 10 percent to 20 percent of their time zeroing memory or copying

blocks of memory; often, doubling the integer size can help these operations. Second, modern global-optimizing compilers spend a great deal of time performing logical operations on long bit vectors, where 64-bit integers nearly double the speed. Third, the increasing disparity between CPU and I/O device speed is increasing the use of compression/decompression methods, some of which rely on the main CPU, where 64 bits may be helpful.

- *Graphics.* Graphics applications are a special, but important, case of the long bit-and-byte-string problem. Using 64-bit integer operations can speed the work required by raster graphics. The increase in performance is especially true for large-area operations like scrolling and area-fill, where performance may approach a full two times that of a 32-bit CPU. This approach helps raise the graphics performance of a minimal-cost design—a CPU plus a frame buffer but without graphics-support chips.

- *Integer arithmetic.* Most chips make addition and subtraction of multiprecision integers (i.e., 64-bit, 96-bit, 128-bit, etc.) reasonably fast, but multiplication and division are often quite slow. Cryptography is a heavy user of multiple-precision multiplies and divides. Financial calculations could use integer arithmetic; 32-bit integers are far too small, but 64-bit integers are easily big enough to represent objects like the U.S. national debt or Microsoft's annual revenue to the penny.

Big-Time Addressing

Perhaps more important than using 64-bit integers for performance is the extension of memory addressing above 32 bits, enabling applications that are otherwise difficult to program. It is especially important to distinguish between virtual addressing and physical addressing.

BYTE ACTION SUMMARY

As 64-bit microprocessors become widely available, the need for what they provide—faster, large-integer math and larger virtual memory addressing—will become more obvious. The operating systems and application programs that will profit exist even today.

The virtual addressing scheme often can exceed the limits of possible physical addresses. A 64-bit address can handle literally a mountain of memory: Assuming that 1 megabyte of RAM requires 1 cubic inch of space (using 4-megabit DRAM chips), 2^{64} bytes would require a square mile of DRAM piled more than 300 feet high! For now, no one expects to address this much DRAM, even with next-generation 16-Mb DRAM chips, but increasing physical memory addressing slightly beyond 32 bits is definitely a goal. With 16-Mb DRAM chips, 2^{33} bytes fits into just over 1 cubic foot (not including cooling)—feasible for desk-side systems.

An even more important goal is the increase of virtual addresses substantially beyond 32 bits, so you can “waste” it to make programming easier—or even just possible. Although this goal is somewhat independent of the physical memory goal, the two are related.

Database systems often spread a single file across several disks. Current SCSI disks hold up to 2 gigabytes (i.e., they use 31-bit addresses). Calculating file locations as virtual memory addresses requires integer arithmetic. Operating systems are accustomed to working around such problems, but it becomes unpleasant to make workarounds; rather than making things work well, programmers are struggling just to make something work.

The physical address limit is an implementation choice that is often easier to change than the virtual address limit. For most computers, virtual memory limits often exceed physical limits, because the simplest, cheapest way to solve many performance problems is to add physical memory. If the virtual limit is much smaller than the physical limit, adding memory doesn't help, because software cannot take advantage of it. Of course, some processors use segmentation schemes to extend the natural size of the integer registers until they are equal to or greater than the physical address limit.

The Mainframe, Minicomputer, and Microprocessor

Reflect on this aphorism: *Every design mistake gets made at least three times: once by mainframe people, once by minicomputer people, and then at least once by microprocessor people.*

An illustrative sequence is found among IBM mainframes, DEC superminicomputers, and various microprocessors.

IBM S/360 mainframes used 32-bit integers and pointers but computed addresses only to 24 bits, thus limiting virtual (and physical) memory to 16 MB (see reference 1). This seemed reasonable at the time, as systems used core memory, not DRAM chips. A “large” mainframe (such as a 360/75) provided at most 1 MB of memory, although truly huge mainframes (360/91) might offer 6 MB. In addition, most S/360s did not support virtual memory, so user programs generated physical addresses directly. There was little need to consider addresses larger than the physical address size. Although it was unfortunate that only 16 MB was addressable, it was even worse to ignore the high-order 8 bits rather than trap on non-zero bits. Assembly language programmers “cleverly” took advantage of this quirk to pack 8 bits of flags with a 24-bit address pointer.

As memory became cheaper, the “adequate” 16-MB limit clearly became inadequate, especially as virtual addressing S/370s made it possible to run programs larger than physical memory. By 1983, 370-XA microprocessors added a 31-bit addressing mode for user programs but were required to retain a 24-bit mode for upward compatibility. Much software had to be rewritten to work in the 31-bit mode. I admit that I was one of those “clever” programmers and was somewhat surprised to discover that a large program I wrote in 1970 is still running on many mainframes—in 24-bit compatibility mode, because it

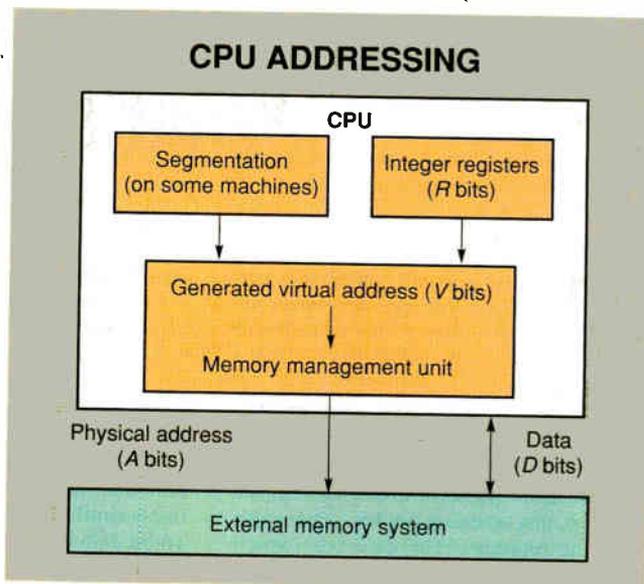


Figure 1: Efficient address arithmetic is limited by the integer register width (R). Actual memory access is limited by the virtual address size (V) and address bus width (A). Efficient memory I/O is limited by the data bus width (D).

won't run any other way. “The evil that men do lives after them, the good is oft interred with their bones.”

By the mid-1980s, 31-bit addressing was also viewed as insufficient for certain applications, especially databases. ESA/370 was designed with a form of segmentation to allow code to access multiple 2-gigabyte regions of memory, although it took tricky programming to do so.

In the minicomputer phase of this error, the DEC PDP-11 was a 16-bit minicomputer. Unfortunately, a single task addressed only 64 kilobytes of data and perhaps 64 KB of instructions. Gordon Bell and Craig Mudge wrote, “The biggest and most common mistake that can be made in computer design is that of not providing enough address bits for memory addressing and management. The PDP-11 followed this hallowed tradition of skimping on address bits, but it was saved on the principle that a good design can evolve through at least one major change. For the PDP-11, the limited address space problem was solved for the short run, but not with enough finesse to support a large family of minicomputers. This was indeed a costly oversight.” (See reference 2.)

Some PDP-11/70 database applications rapidly grew awkward on machines with 4 MB of memory that could only be addressed in 64-KB pieces, requiring unnatural acts to break up simple programs into pieces that would fit. Although the VAX-11/780 was not much faster than the PDP-11/70, the increased address space was such a major improvement that it essentially ended the evolution of high-end PDP-11s. In discussing the VAX-11/780, William Strecker wrote, “For many purposes, the 65-Kbyte virtual address space typically provided on minicomputers such as the PDP-11 has not been and probably will not continue to be a severe limitation. However, there are some applications whose programming is impractical in a 65-Kbyte virtual address space, and perhaps more importantly, others whose programming is appreciably simplified by having a large address space.” (See reference 3.)

Finally, we come to microprocessors. The Intel 8086 was a 16-bit architecture and, thus, likely to fall prey to the same

What's in a Chip?

Kenneth M. Sheldon

The first personal computers were built using microprocessors with integer registers that were 8 bits wide, so they were called 8-bit chips and 8-bit systems. Microprocessors with 16-bit registers went into 16-bit systems, and so on. Life was simple.

The problem is, data flows to and from those registers over pathways, or *buses*, that often are not the same width as the registers. The data bus (which carries *data* to and from external locations, such as memory chips) and the address bus (which carries the *location* of the data) may be smaller or larger than the registers, depending on design considerations. This makes it somewhat

confusing to decide what to call a chip.

For example, the original IBM PC had an 8088 chip with 16-bit registers, but it had an 8-bit data bus and a 20-bit address bus. Its fraternal twin—the 8086—was the same but with a 16-bit data bus. (If the 8088 were released today, Intel would probably call it the 8086SX; the 386SX is a 32-bit chip that's similar to the 386DX, but it has a 16-bit data bus and a 24-bit address bus rather than full 32-bit buses.

Similarly, all the members of the Motorola 680x0 family have 32-bit registers. However, while the 68020, 68030, and 68040 have full 32-bit data and address buses, the original 68000

has a 16-bit data bus and a 24-bit address bus.

Currently, the only microprocessor that uses 64-bit registers is the Mips R4000. The R4000 has a 36-bit address bus, which allows it to address up to 64 gigabytes of data.

For the sake of accuracy and consistency, the main article refers to microprocessor size based on the width of the microprocessors' respective internal registers, without regard to the width of their data or address buses.

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issues as the PDP-11. Fortunately, unlike the PDP-11, it at least provided a mechanism for explicit segment manipulation by the program. This made it possible for a single program to access more than 64 KB of data, although it took explicit action to do so. Personal computer programmers are familiar with the multiplicity of memory models, libraries, compiler flags, extenders, and other artifacts needed to deal with the issues.

The Motorola MC68000 started with a more straightforward programming model, since it offered 32-bit integers and no segmentation. However, by ignoring the high 8 bits of a 32-bit address computation, it repeated the same mistake made 15 years earlier by the IBM S/360. Once again, "clever" programmers found uses for those 8 bits, and when the MC68020 interpreted all 32 bits, programs broke. BYTE readers may recall problems with some applications when moving from the original Macintosh to the Mac II.

The Need for Big Computers

Two common rules of thumb are that DRAM chips get four times bigger every three years and that virtual memory usage grows by a factor of 1.5 to 2 per year (see reference 4). Additional memory is often the cheapest and easiest solution to performance problems, but only if software can easily take advantage of it.

As the natural size of code and data reaches and then exceeds some virtual address limit, the level of programming pain increases rapidly, because programmers must use more and more unnatural restructuring. If the virtual address limit is significantly lower than the physical limit, it is especially irritating, since buying more DRAM won't do you any good. Fortunately, the virtual address limit is typically larger than the physical limit, so programs may work but perhaps run slowly. In this case, you can at least add physical memory until performance becomes adequate.

There is no definite ratio between maximum task virtual-ad-

dress limit and physical address limit. Conversations with many people have convinced me that a 4-to-1 ratio is reasonable (i.e., you will actually see practical programs four times bigger than physical memory) if the operating system can support them. Some people claim that a ratio of 4 to 1 is terribly conservative and that advanced file-mapping techniques (as in Multics or Mach) use up virtual memory much faster than physical memory. Certainly, in the process of chip design and simulation at Mips Computer Systems, some of our 256-MB servers routinely run programs with virtual images that are four to eight times larger (1 to 2 gigabytes). Several companies (including Mips) already sell desktops with 128 MB of memory. With 16-Mb DRAM chips, similar designs will soon hit 512 MB—enough to have programs that could use at least 4 gigabytes of virtual memory.

32-bit Crisis in 1993

Consider the history of microprocessor-based servers from Mips Computer Systems and Sun Microsystems. Figure 2 shows that the 32-bit limit will become an issue even for physical memory around 1993 or 1994.

As soon as 16-Mb DRAM chips are available, some microprocessors will be sold with 2 to 4 gigabytes of main memory—in fact, just by replacing memory boards in existing cabinets. You may now be convinced that Sun and Mips designers must be crazy to think of such things; but if so, they have plenty of company from others, like those at Silicon Graphics, Hewlett-Packard, and IBM. Keeping pace with DRAM growth requires appropriate CPU chips in 1991 so that tools can be debugged in 1992 and applications debugged by 1993 or 1994—barely in time.

Why So Much Memory?

Finally, look at the applications that put pressure on the size of virtual memory addressing. To handle virtual memory greater

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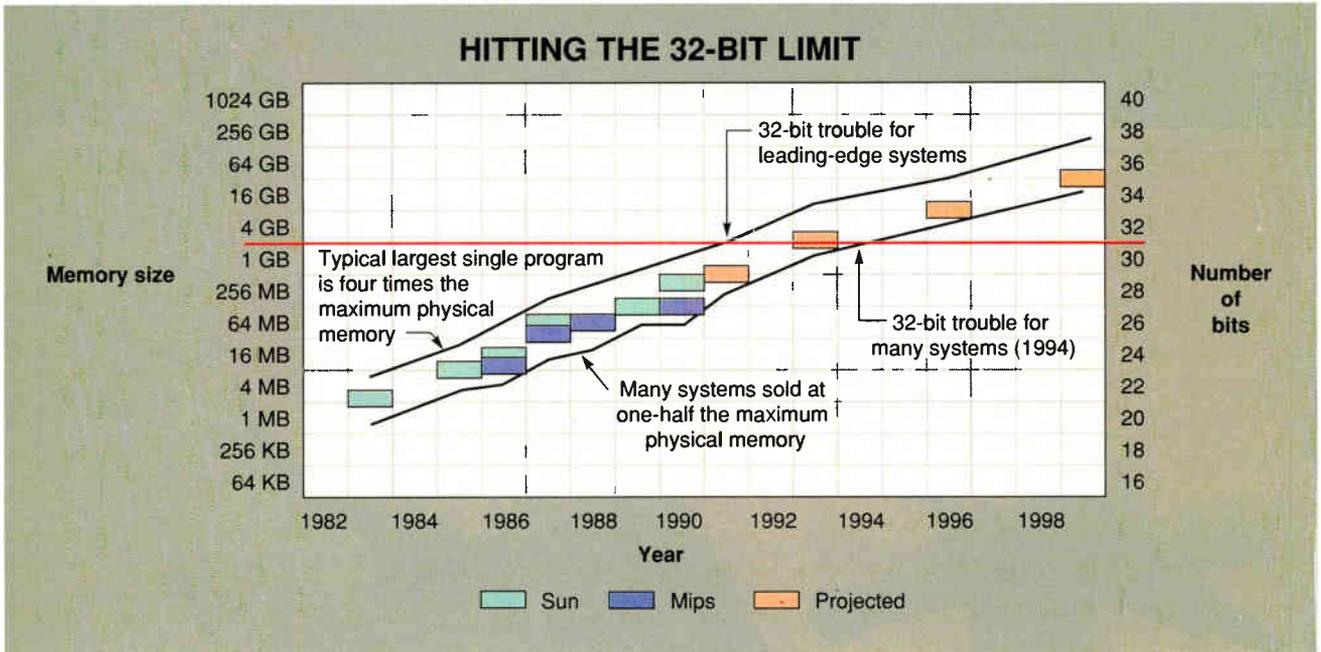


Figure 2: The memory sizes of a Mips and a Sun machine, year by year, using a logarithmic scale. The data points fall in a straight line, gaining 2 bits every three years, as they naturally follow DRAM curves. The top line shows virtual memory size at four times the maximum physical memory, hinting that large leading-edge applications may already be pushing 32-bit limits in 1991 (and they are). The line below the data shows physical memory size at 50 percent of maximum size. Vendors actually sell a substantial number of such machines.

than 32 bits, you need either segmentation or 64-bit integer registers.

Why 64 and not something smaller, like 48? It is difficult to introduce a new architecture that runs the C language poorly. C prefers byte-addressed machines whose number of 8-bit bytes per word is a power of 2. The use of 6 bytes per word requires slow addressing hardware and breaks many C programs, so 64 is the next step after 32.

Segmentation may or may not be an acceptable solution, but there is insufficient space here to debate the relative merits. Suffice it to say that many software people with segmentation experience consider it a close encounter of a strange kind.

The following applications tend to consume virtual memory space quickly and generally prefer convenient addressing of large memory space, whether it's contiguous or sparse:

- **Databases.** Modern operating systems increasingly use file mapping, in which an entire file is directly mapped into a task's virtual memory. Since you can leave empty space for the file to grow, virtual memory is consumed much faster than physical memory. As CPUs rapidly increase their performance relative to their disk-access speeds, disk accesses are often avoided by keeping the disk blocks in large DRAM cache memories. Database managers on mainframes have long felt the pressure here, as many installations are already above 2^{40} bytes. Distributed systems designs often use some bits of the address as a system node address, with others as a per-node data address.
- **Video.** For uncompressed video, a 24-bit-color, 1280- by 1024-pixel screen needs 3.75 MB of memory. At 24 frames per second, 4 gigabytes of memory is consumed by only 45 seconds of video.
- **Images.** At 300 dots per inch, a 24-bit-color, 8½- by 11-inch page uses 25 MB, so 4 gigabytes is filled by 160 of these pages.

Databases of such objects get large very quickly.

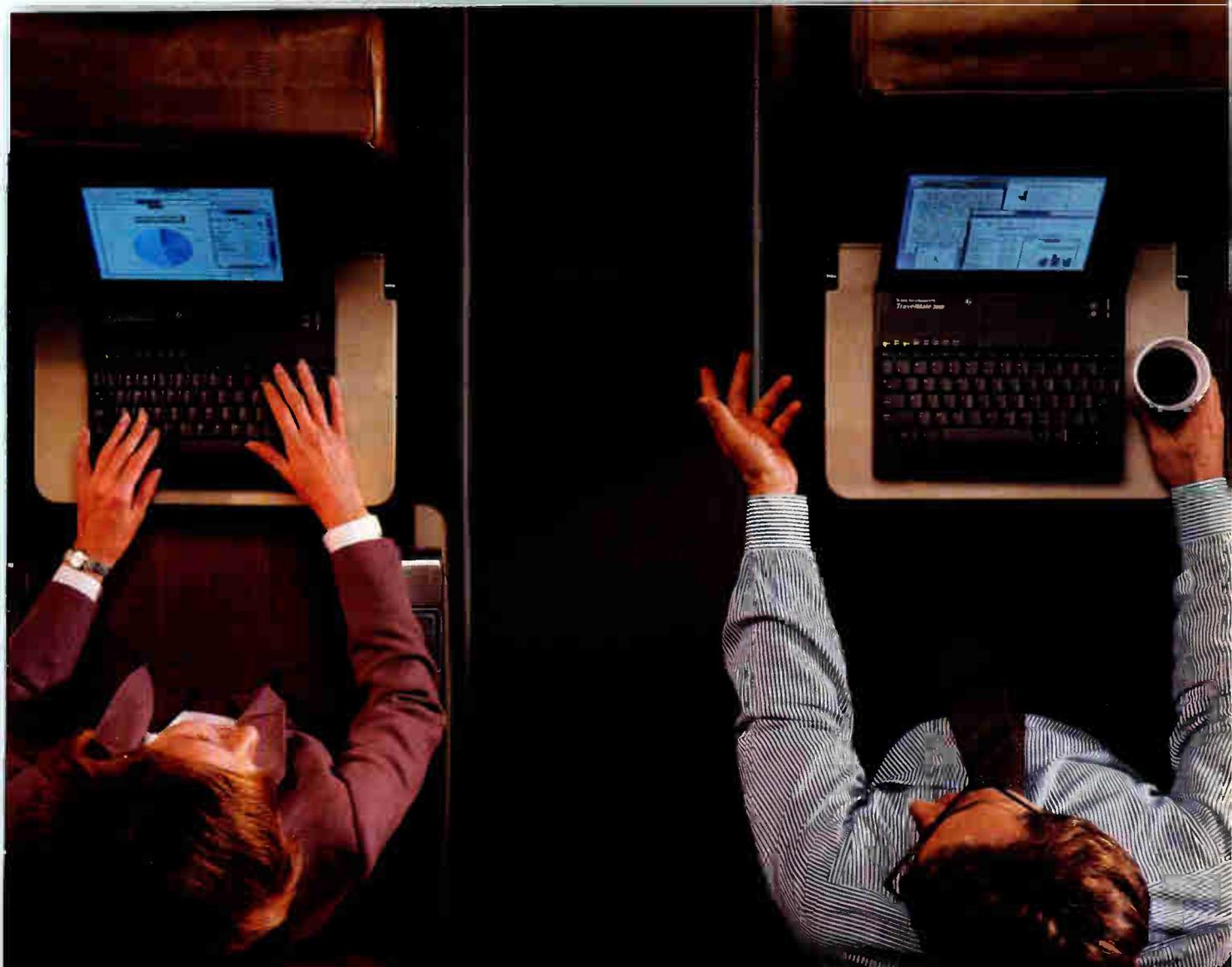
- **CAD.** CAD applications often include large networks of servers and desktops, in which the servers manage the databases and run large simulations. They naturally can make use of 64-bit software. Desktops navigate through the huge databases, and although they are not likely to map in as much data at one time as the servers, software compatibility is often desirable.
- **Geographic information systems.** These systems combine maps, images, and other data and have most of the stressful characteristics of video, CAD, and GIS.
- **Traditional number crunching.** Of course, technical number-crunching applications developers have never been satisfied with any memory limits on any machine that exists.

On the Desktop?

Perhaps you now believe that 64-bit servers may be reasonable, but you still wonder about the desktop. Table 2 lists the applications areas discussed, showing whether the primary use of 64-bit systems is for speed (either in desktop or server); for addressing large amounts of data simultaneously; or for using software in a desktop system identically to its use in a server but with less actual data. Such compatibility is likely to be crucial for CAD applications but is also important for others, if only to get software development done.

For most readers, 64 bits is likely to be most important as an enabling technology to help bring powerful new applications to the desktop. The history of the computing industry, especially of personal computers, shows there is some merit to thinking ahead. Some of us remember when a 640-KB limit was considered huge.

As 64-bit systems become available, some of the number-crunching people will recompile their FORTRAN programs



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64-BIT COMPUTING

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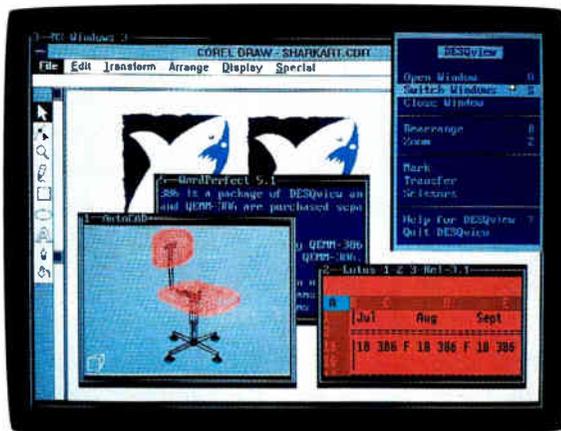
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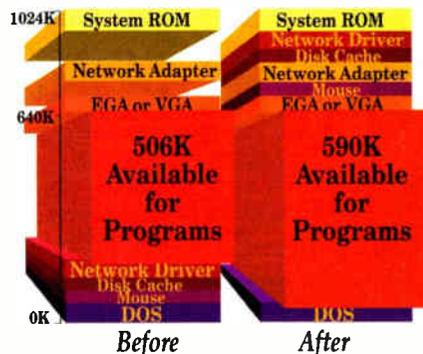
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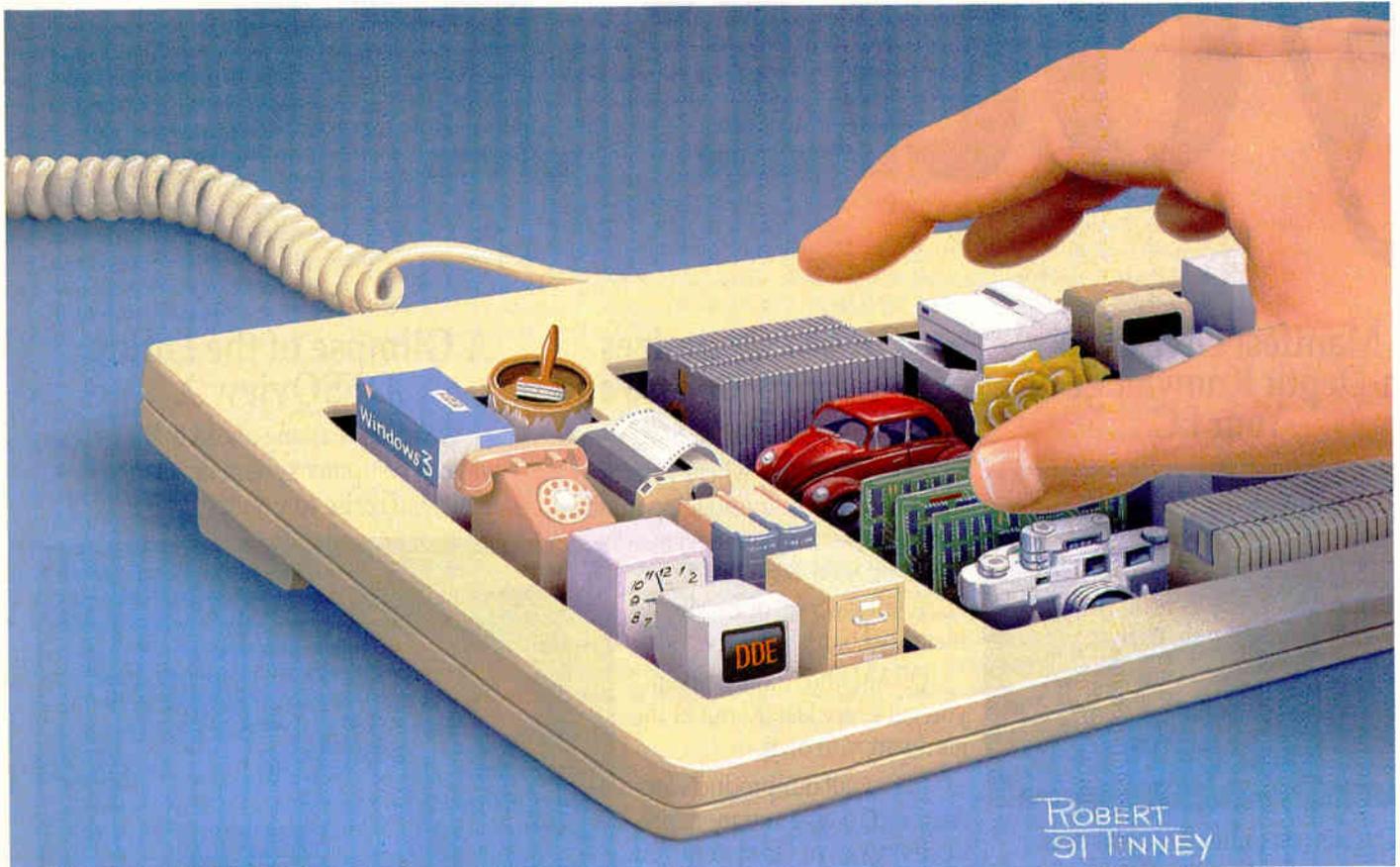
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FORTRAN

First in a six-part series
on languages that have stood the test of time

Doris Appleby

It's been nearly 38 years since the acceptance of John Backus's idea for the first high-level programming language—called *FORTRAN* (for formula translation). It was December 1953. Before that, no one had conceived of communicating with a computer at any level higher than that of an assembler. There were well over a dozen languages in use by 1967, but only 13 survived and were still being used in 1977. Of these, only six are widely used today: FORTRAN, COBOL, Lisp, APL, Snobol, and BASIC. In the next several issues of *BYTE*, I will look at these survivors and explore the reasons for their longevity.

Survival by Acceptance

FORTRAN has survived. Survival in the computing industry is often connected to standards, and standards are connected to acceptance and politics.

Jeanne Martin, of the ANSI FORTRAN committee X3J3, explains why FORTRAN has not been subsumed by another, more general language: PL/I is no longer viable as a portable language, since its standards committee has been disbanded; Ada has never been accepted by the scientific community; and although currently popular, C is, according to Martin, "sort of a hacker's language," with code sometimes readable only by its author. FORTRAN code looks more like the application being programmed and has superior array facilities. So much is invested in already-written and optimized FORTRAN code that it will necessarily continue to be used. It is the blue-collar language of the scientific, number-crunching community.

In the Beginning

The first standards document for the language was FORTRAN 66 (ANSI X3.9-1966). This document described the existing FORTRAN IV and eliminated FORTRAN II.

FORTRAN IV provided for programs that call subroutines through a return-jump mechanism (i.e., process control jumps to the subroutine and returns to the line after the subroutine call). Return-jump eliminates recursion, since a

recursive call returns to the first line of a recursive subroutine, rather than to the line after the call.

With FORTRAN IV, you could compile subroutines separately, facilitating the development of large, well-designed libraries—one of FORTRAN's most useful features. The language was intended to solve problems involving repetitive numerical calculations, especially those that used matrices of a fixed size. Because of FORTRAN's numerical strength, many statistical packages, including the BMDP and SPSS series, are composed of FORTRAN procedures.

There were many restrictions to FORTRAN IV: at most, 63 parameters per subroutine, six characters per identifier, DO loops nested no more than 50 deep, arrays of three or fewer dimensions, and 10 characters per integer. The only control mechanisms besides the SUBPROGRAM statement were a DO loop, a logical IF statement, arithmetic statements, a GO TO statement, and the COMMON block, which provided for global variables. FORTRAN IV's formatted I/O was slow, but it was the only language that provided full access to an operating system's record manager.

It took the X3J3 and X3 committees four years to complete the FORTRAN 66 standardization process. The document was 26 pages long—huge compared to the one-page standard of the time.

A Decade Later

FORTRAN 77, which took seven years to standardize, is about 150 pages long. It replaced FORTRAN 66 and represents work on hundreds of technical proposals from around the world. Among other things, it added the following to FORTRAN IV:

BYTE ACTION SUMMARY

Don't throw out that old code! New FORTRAN standards have kept the language alive and current with the growing needs of modern programming.

Make Your Best Work Look Its Best!

Name	Definition
Gamma	$\Gamma(z) = \int_0^{\infty} t^{z-1} e^{-t} dt$
Sine	$\sin(x) = \frac{1}{2i}(e^{ix} - e^{-ix})$
Error	$\operatorname{erf}(z) = \frac{2}{\sqrt{\pi}} \int_0^z e^{-z^2} dz$
Bessel	$J_0(z) = \frac{1}{\pi} \int_0^{\pi} \cos(z \sin \theta) d\theta$
Zeta	$\zeta(s) = \sum_{k=1}^{\infty} k^{-s} \quad (\Re s > 1)$

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- a character type that replaced the Hollerith type (which was integers representing ASCII codes for characters)
- an extension of array dimensions to seven
- extended use of expressions: $A(X*3+1)$ is now acceptable
- the addition of the IF... THEN... ELSE construct and the extension of the DO loop
- improved standard I/O
- the addition of general parameters and generic subroutines, which accept and return values for various data types. One example is the SQRT function, which accepts and returns integers, single- or double-precision reals, and complex values.

Now, It's FORTRAN 90

The development of FORTRAN 90 was not straightforward. In 1979, Walt Brainerd of the Burroughs Company (and also a member of X3J3) described the early situation as follows:

"There has been a significant shift in attitudes concerning the objectives of FORTRAN standardization. One reason for this has been the realization that the language is becoming too large by adding new [nonstandard] features and almost never removing any old ones. X3J3 has responded to these challenges by proposing a language architecture consisting of a 'core' language and 'modules.' The core is to be a complete general-purpose programming language but will not contain features that are redundant or obsolete just because they are FORTRAN 77. One of these modules will contain all the features in FORTRAN 77 that are not in the core. This is important in order to support the huge investment in FORTRAN programs written using these features."

But by 1983, the idea was dead. Brainerd was disappointed to note that "a committee simply cannot design something small and elegant; one person's frill is another's essential feature."

Then, in the spring of 1984, a move to publish a draft standard to elicit comments was accepted by 40 voters at an X3J3 meeting—but voted down by only two. The two votes represented DEC and IBM, and the draft was not published. (Some votes were more "equal" than others.) Additional players were professional organizations, institutions, and individuals.

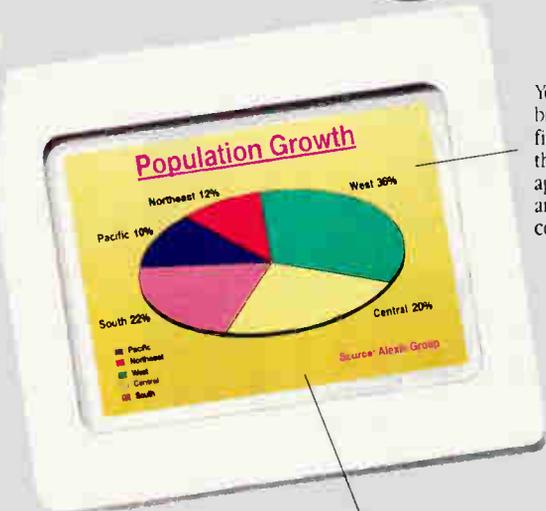
It still took until April of this year to get FORTRAN 90 through both of the committees. Industry involvement was intense, with some accused of merely trying to protect their investment while having their interests elsewhere (e.g., in C or Ada). After 13 years of often-bitter negotiations, the new standard—FORTRAN 90—has now been approved by technical committees of both U.S. and international standardization organizations. The final approval depends on the parent committees and should be completed by the time you read this article. The FORTRAN 90 standard includes FORTRAN 77 and adds the following:

- longer identifiers
- in-line comments and multistatement lines
- symbolic relational operators (e.g., < instead of .LT.)
- use of the INCLUDE statement
- optional free form (blanks are now meaningful)
- nested scoping of procedures (a procedure can include one internal procedure)
- recursive procedures
- optional IN and OUT procedure parameters, as in Ada
- modules containing both data types and procedures, with both PUBLIC and PRIVATE levels of access
- bit operations similar to those in C
- a variety of array operations
- utilities such as DATE and TIME

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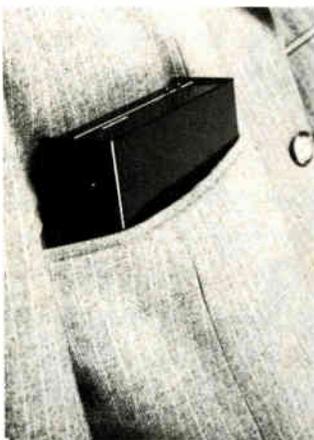
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CLASSIC LANGUAGES: FORTRAN

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- new data types—including pointers, character strings, and those derived from others, as in Pascal

Survival by Standardization

The continuing saga of the FORTRAN 90 standard is as baroque a tale as any. It involves corporate raiders, dollars versus design, and big industry against the bureaucracy. The tale reads like a mystery, with good guys, bad guys, and ordinary foot soldiers. April was a historic month for FORTRAN, as the X3J3 committee gave final approval to FORTRAN 90.

Standardization is serious. Its main purpose is to ensure program portability—that is, that a program conforming to standard syntax can be compiled and run with the same results on any machine that supports a standard compiler. But once a language description has been accepted by ANSI, you can't market a compiler in the U.S. under the approved name unless it faithfully implements the standard. If it has also been approved by the ISO, you can't sell it unless it measures up. Compilers can, however, be marketed with added features (or *extensions*) to the standard core.

Actually, the ISO supersedes ANSI and its counterpart, the British Standards Institute, but this is not the whole story. There are powerful industries interested in standardization, most of which have headquarters in the U.S.

Holding Its Own

FORTRAN has definitely grown. Its reputation for efficiency in computational speed as well as in memory usage, its large body of existing optimized code, and its large and dedicated group of users suggest that it will be around for a long time.

But what about the Department of Defense's insistence on the use of Ada and the growing interest in C running under Unix? Unix has a reputation for being cryptic and difficult to use. Thus, CASE interface tools allow FORTRAN programmers to use Unix in a friendlier operating environment. There are also translators from FORTRAN to C and from C to FORTRAN. FORTRAN-compiled code was found to run faster on VAX systems than similar C code; thus, the ability to program in the language of your choice while compiling and running on the fastest compiler has been fostered. FORTRAN also appears to be the language of choice for some supercomputers, where array operations can be sent to CPUs running in parallel.

What's more, FORTRAN is becoming increasingly available on personal computers. Engineers have begun to see the advantages of working away from the mainframe and are demanding software that compiles code that is portable between personal computers and larger systems. Microsoft's FORTRAN Optimizing Compiler provides for portable code, while Lahey Computer Systems' compiler is targeted to 386 systems, and Microway's is for the 486.

FORTRAN 90 fits comfortably into the worlds of supercomputers, minicomputers, microcomputers, Unix, and DOS. Some claim it includes most of the machinery for object-oriented programming as well. Just how it meshes with Ada remains to be seen. ■

Doris Appleby writes about mathematics, computer science, and pedagogy. She is also the chairperson of mathematics/computer science/information systems at Marymount College in Tarrytown, New York, and the author of Programming Languages—Paradigm and Practice (McGraw-Hill, 1991). You can reach her on BIX c/o "editors."



v 4.1



Software Digest

RATINGS REPORT

The International Computer Software Ratings Report for Selecting IBM PC Business Software

Volume 8, Number 5

STATISTICS PROGRAMS

Statistical programs present a high degree of complexity that limits their use. Most of the best programs have been modified to minimize that complexity, but to a large extent they remain cumbersome. Programs designed to run in mainframe environments make few concessions in the PC environment and PC users.

- Syntex boasts power and usability. SAS proves great power to users who master it and find it to be the easiest to learn and use. BMDP does not recommend the other programs for PC use except in business already running the mainframe version.
- Four of the statistics packages are sold as modules, and prices range from \$200 to over \$4,000 for a complete set. Refer to the Program Module Cost on page 18.

Contrary to the common belief among statisticians, great attention in development must be given to the programs. Calculation speed can be very important to users who run frequent analysis of large data sets. **See Results, page 122.**

Place this report in your binder behind the Miscellaneous Software tab divider.

Digest Rating	Quality	Price	Program	Version	Platform	Memory	Price	Notes
***	7.5	\$110	SAS	5	PC	60KB	\$3,270 modular	28
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***	7.2	\$110	Statgraphics	4.0	PC	512KB	\$995 modular	26
**	6.5	\$110	SPSS/PC+	1990	PC	512KB	\$195 modular	22

Ratings Key
(On a scale of 0 to 10)
Overall Evaluation
★★★★ 9.0 or higher
★★★ 8.0-8.9
★★ 7.0-7.9
★ 6.0-6.9
☆ 5.0-5.9
ALL OTHERS SURVIVED
★ 4.0-4.9
☆ 3.0-3.9
★ Lower 3.0

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Program Reports	20-31
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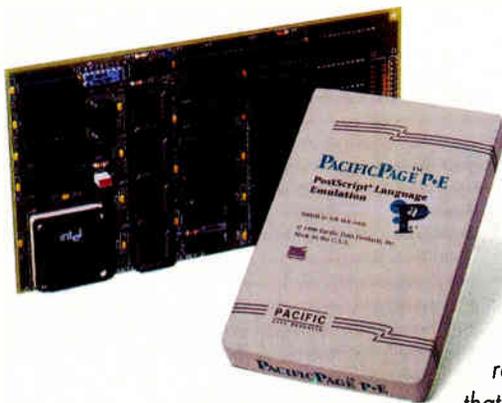
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Edward Mendelson
PC Magazine, (June 25, 1991)

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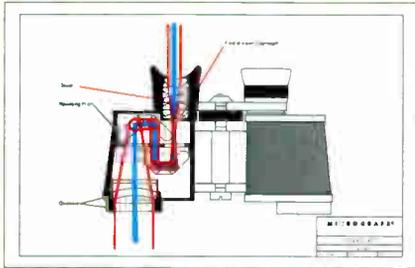
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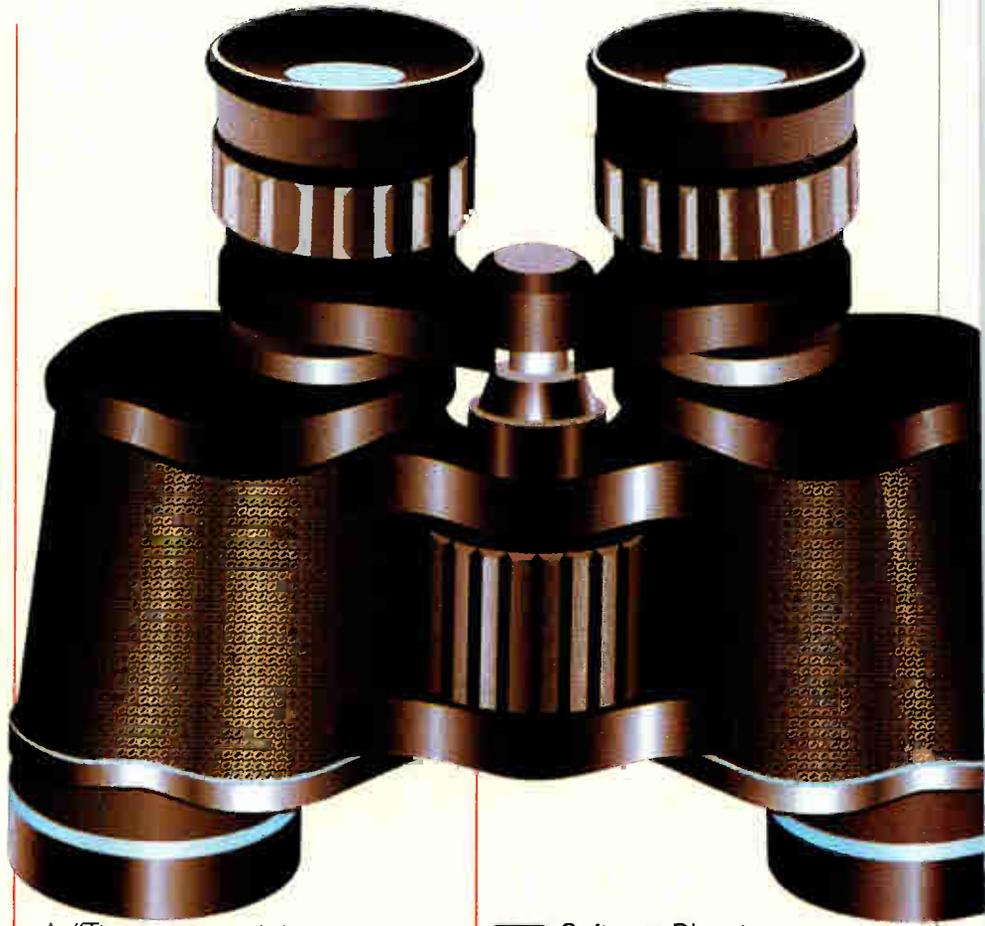


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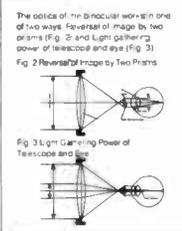


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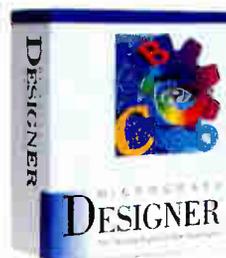


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WINDOWS 3.0 APPLICATIONS THE STATE OF THE MARKET

A view of six popular Windows applications categories

DOUG DAYTON AND LAMONT WOOD

Whether you are a true believer, undecided, or wouldn't use it on a bet, no one can deny the tremendous impact Windows 3.0 has had on PC-based applications. Last July, BYTE surveyed the Windows application market and found relatively few available products (though many were promised). Now, there are hundreds that you can purchase today.

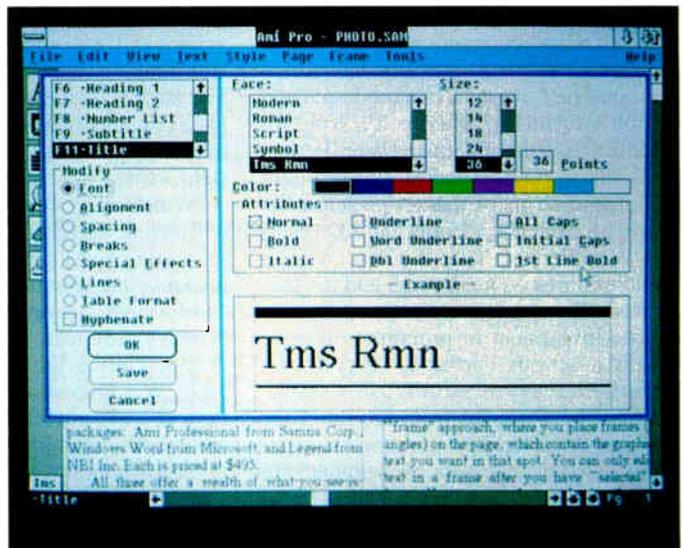
This supplement provides a view of the Windows applications market in six categories: word processing, database management, spreadsheets, utilities, graphics, and communications. We found nearly 60 products for this report. In fact, in several categories, we found so many products that we couldn't possibly cover them all in the allotted space. Consequently, we limited the graphics, utilities, and communications topics to the most popular subcategories.

Authors Lamont Wood and Doug Dayton are well known in the Windows community. Lamont has written numerous articles on Windows and reports here on word processing, database management, and spreadsheets. Doug is a reviewer, writer, and consultant specializing in Windows. Doug wrote the sections on graphics, communications, and utilities.

A Window on Word Processors

Windows 3.0 has proven the salvation of Windows word processors. While Microsoft, Samna, and NBI came out with ambitious word processing packages for earlier versions of Windows, the absence of effective memory management caused horrific performance problems. It sometimes took 20 minutes for a complex docu-

Ami Pro, recently acquired by Lotus Development Corp., was one of the early Windows 3.0 word processors.



ment to roll off a laser printer. If the page was laden with graphics, just waiting for it to reformat on screen gave you time to get up, stretch your legs, and perhaps have a cup of coffee.

The removal of the 640-kilobyte memory barrier (plus the revamping of Windows' printer drivers) has eliminated these impediments, making Windows an attractive environment. So attractive, in fact, that at this point it's hard to name a major word processing vendor that has not at least leaked word that it is tinkering with a Windows version of its product.

Of course, Windows 3.0 has enjoyed spectacular acceptance in its first year on the market. In part, the rush to get out Windows versions is motivated by developers' fear of being left behind when the

dust settles. But there is more to it than that.

After all, if the object of word processing is to deposit spots of ink on paper, Windows' graphical environment gives you potentially more precise control over the deposition of those spots. But more than that, you get an intuitive interface that offers immediate feedback and consequently is easy to use.

"Because you can see everything on the screen and directly manipulate things, it alleviates the need for a whole bunch of commands," explains Said Mohammadioun, vice president of Lotus's word processing division in Atlanta, which now markets Ami Pro. "If you want to create a header or footer, you just go to the top or bottom margin, put your cursor there, and start typing; you don't require a command

to create [a header or footer] or edit one. Windows gives you a real boost in productivity once you get over the first week of playing with it."

Among users, the consistent Windows interface across applications is widely cited as making training easier. Not only does this enhance productivity, it also makes new software easier to introduce.

But there's another reason for adopting Windows that has nothing to do with its graphical interface. "It's a new platform, and with any new platform you have a chance to shake up the world order. People have to make a decision when they turn to Windows, and they might decide to switch from their current word processor to a new one," notes Jon Reingold, Microsoft's word processing product manager.

That prospect raises the hopes of software developers trying to get in on the ground floor of a new market. Vendors that were small fish in the character-based DOS pond can dream of ascending to greatness in the new Windows market.

Mohammadioun cautions, however, that the market probably already has sorted itself out; he foresees a market dominated by Lotus's Ami Pro, Microsoft's Word for Windows, and the anticipated WordPerfect for Windows. Other vendors' products will be noise in terms of market presence because, he contends, "Lotus and Microsoft and WordPerfect have the resources to spend millions on marketing, and the others don't."

The investment in programming time also is a serious barrier to entry in the market, since a successful Windows product must be designed from the onset for Windows; conversions don't work, especially for word processors, Mohammadioun continues. "When you add different fonts, word processing becomes a two-dimensional composition problem, rather than just lines of text," he says.

Others see the market as sorting itself into high-end and low-end tiers based on price. Reingold at Microsoft isn't so sure it will work that way, at least for a while. "If you've spent all this money on a VGA card, 4 megabytes of memory, a 60-MB hard disk drive, and a 386 processor, who's going to stop from spending another \$100 on a word processor? But I think as the market matures, the low end may become a viable market."

Time will tell who is right, but already Windows 3.0 promises a varied menu of word processors. We'll look at the current state of affairs in this budding market, examining a representative selection of vendors and offerings.

In the Wings

As this issue goes to press, WordPerfect

has not introduced a Windows version of its word processor, but because it is the dominant vendor in the DOS character-based word processing market, the fact that it is known to be working on a Windows version casts a long shadow. Vendors of other Windows word processors speak of numerous customers waiting for WordPerfect for Windows to come out and express hope that they can win some of those customers over in the meantime.

Representatives at WordPerfect, on the other hand, maintain that their product is worth waiting for. "We have felt pretty good about the success of WordPerfect 5.1, and we want to take its power and incorporate it into a graphical environment," says product marketing manager Devin Durrant of the nascent Windows WordPerfect, expected to cost \$495, the same price as WordPerfect 5.1. It will have most of the features of 5.1, except long filenames, he says, and will be able to read version 5.1's text files. It also will have a macro language, but it won't be compatible with version 5.1's macro language; a conversion function will be provided, however. The macro language will support Dynamic Data Exchange (DDE), as well as access to other applications' dynamic link library (DLL) files.

WordPerfect for Windows reportedly will include a layout mode with WYSIWYG formatting, fonts, plus graphics and a screen response that, in some cases, is too slow for comfortable typing. Draft mode, which displays only text, shows no appreciable delays. Unlike the draft mode in many other Windows word processors, WordPerfect's will not rely on Windows' native Notebook screen font. Instead, it will supply its own monospaced screen font. Also slated for inclusion is an on-screen "button

bar" that will let you easily create tables and change margins, fonts, justification, styles, and line spacing.

It will not, however, provide drawing tools (the company is readying DrawPerfect for Windows to fill that niche), but you can expect a figure editor, similar to version 5.1's, that lets you rotate, size, and scale vector graphics.

"The world has embraced Windows with open arms, and there is a pretty good offering of Windows word processors out there now, except there is a shortage of one—ours," Durrant says. "But we are not saying that Windows is a must, or that character-based is the way to go. We want to be the top choice either way."

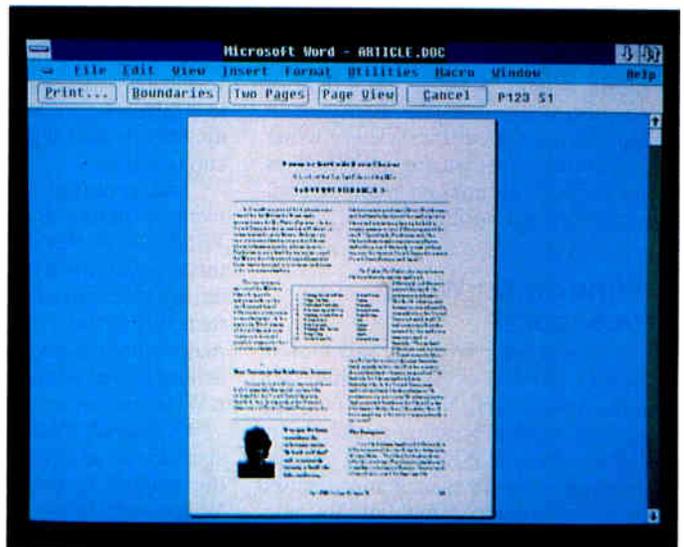
Casting an almost invisible shadow, meanwhile, is IBM, which has announced it will move from its character-based DisplayWrite word processor to a Windows-based package called Signature. Under joint development with XyQuest, maker of the XyWrite word processing package, Signature is to have a file format compatible with DisplayWrite's.

"The decision to develop a new word processor family was based on requests from our customers for a feature-rich product that would deliver the benefits of graphical word processing across the leading personal computer platforms," states Fernand Sarrat, vice president of IBM's Desktop Software Division. Representatives from IBM decline to discuss Signature further.

The Pioneers

Chief among those vendors with a tangible product on the market is Microsoft itself, whose \$495 Word for Windows came out in November 1989—about a year after it was first announced. "It's hard when you're doing a Windows application for the first

Microsoft's Word for Windows has its roots in the earlier character-based version. Nonetheless, it is currently the top-selling word processor for Windows 3.0.



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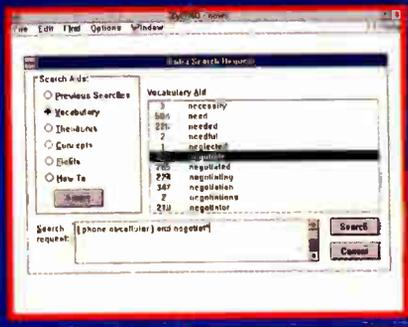
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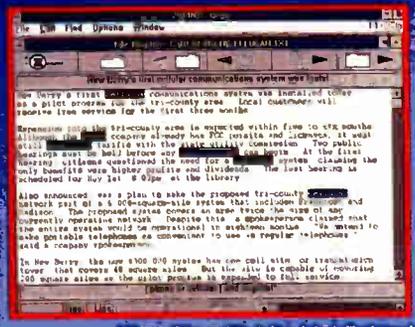
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ZyINDEX finds every occurrence of your search request and highlights words, phrases and dates you're looking for. Once found, you can copy, paste and print.

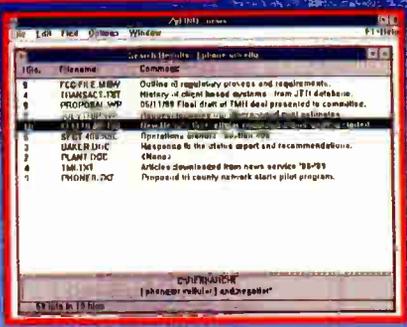
Available for DOS, Windows and UNIX.



Type a search request.



View file with hits highlighted.



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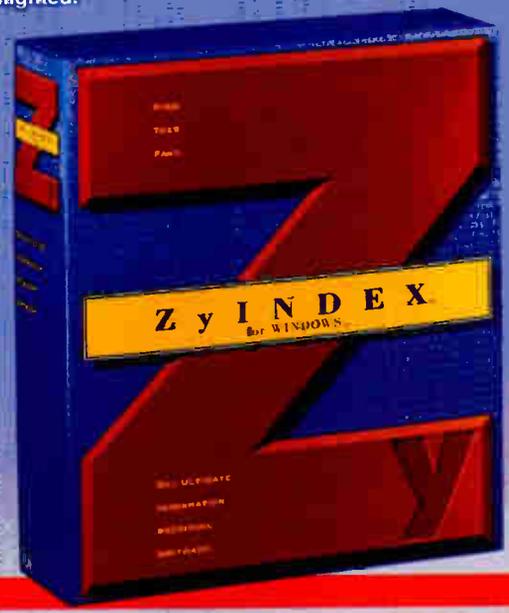
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Windows Word Processing Programs: Features Summary

Product*	Price	System Requirements					Popular File Formats Supported
		Min. RAM	Hard Disk Space Required	Min. CPU	Mouse Req.?	Other Versions	
DeScribe Word Processor	\$495	2 MB	2 MB; 8 MB recommended	386SX	No	PM	ASCII, DCA, DisplayWrite, Excel, Framework 3, WK1, Word, MultiMate, WordPerfect, XyWrite, PFS: First Choice and First Write, WordStar, Professional Write, GEM, PCL, PIX, PIC, CGM, PCX, WMF, TIFF
Lotus Ami Pro	\$495	1 MB	5.5 MB	286	No	NewWave	ASCII, DCA, WordPerfect, DisplayWrite, WordStar, MultiMate, Word and Word for Windows, RTF, WKS, WK1, WK3, Excel, DBF, SuperCalc, DIF, EPS, PIC, PCX, CGM, HPGL, WMF, TIFF
Microsoft Word for Windows	\$495	640 KB	3.2 MB	286	No	Mac	WordPerfect, MultiMate, DisplayWrite, WordStar, Works, ASCII, WKS, WK1, WK3, HPGL, PCX, TIFF, PIC
NBI Legacy	\$495	640 KB	3.8 MB	286	Yes	None	ASCII, WordPerfect, Word, DisplayWrite, MultiMate, RTF, DIF, PIC, DRW, HPGL, CGM, EPS, TIFF, PCX, WMF, WKS, WK1
Software Publishing ProWrite Plus	\$249	1 MB; 2 MB with grammar checker	4 MB	286	No	DOS	CGM, PCX, PIC, Word, DCA, Professional Write Plus, MultiMate, WordPerfect, Professional Write DOS, OfficeWriter, WordStar, WordStar 2000, ASCII, RFT, EPS, TIFF, WMF, Excel, SuperCalc
WordStar Legacy	\$495	1 MB; 2 MB recommended	4.3 MB	286	No	None	WordStar, WordStar 2000, WordPerfect, ASCII, DIF, RFT, MultiMate, Professional Write, PFS: First Choice, PIC, DRW, HPGL, CGM, EPS, WMF, TIFF, PCX, BMP, DCA, RFT

*IBM Signature and WordPerfect for Windows are still under development; no pricing or system requirements are available for the products.

Company Information

IBM Corp.
(Signature)
Old Orchard Rd.
Armonk, NY 10504
(800) 426-2468
Circle 1430 on Inquiry Card.

DeScribe Inc.
(DeScribe for Windows)
4047 North Freeway Blvd.
Sacramento, CA 95834
(916) 646-1111
Circle 1431 on Inquiry Card.

Lotus Development Corp.
(Ami Pro)
55 Cambridge Pkwy.
Cambridge, MA 02142
(617) 577-8500
Circle 1432 on Inquiry Card.

Microsoft Corp.
(Word for Windows)
1 Microsoft Way
Redmond, WA 98052
(800) 426-9400
Circle 1433 on Inquiry Card.

NBI, Inc.
(Legacy)
P.O. Box 9001
Boulder, CO 80301
(800) 624-1111
Circle 1434 on Inquiry Card.

Software Publishing Corp.
(ProWrite Plus)
P.O. Box 7210
Mountain View, CA 94039
(415) 962-8910
Circle 1435 on Inquiry Card.

WordPerfect Corp.
(WordPerfect)
1555 North Technology Way
Orem, UT 84057
(800) 321-4566
Circle 1436 on Inquiry Card.

WordStar International, Inc.
(WordStar Legacy)
201 Alameda del Prado
Novato, CA 94949
(800) 227-5609
Circle 1437 on Inquiry Card.

time," says Microsoft's Reingold—an observation echoed by other vendors.

Word for Windows has annoyed some by being all-too reminiscent of its character-based predecessor, Microsoft Word, which features a preview mode instead of a WYSIWYG layout mode. In preview mode, you get a graphical full-page view of the document, and you can position and move graphics on the page. Unlike most other Windows word processors, Word doesn't let you do text editing or formatting in this mode; you have to go back to draft mode.

But Reingold says this doesn't matter, since Word for Windows is aimed at mainstream users uninterested in desktop-publishing features. Editing and creating tables is popular, but few users need to position tables on screen. Although future versions, Reingold indicates, might well move closer to desktop publishing, he doesn't think sales have been hurt because of this omission. Reingold figures Word for Windows outsells Ami Pro, the nearest competitor, by 10 to 1.

Certainly Word is flexible enough in

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other ways. You can open nine documents on screen at one time, and all standard page formatting can be done with single mouse clicks from the on-screen "ribbon ruler."

Beyond that, Word for Windows' powerful macro language has led to its adoption by custom software developers who use DDE to splice in functions from other off-the-shelf programs, such as spreadsheets, telecommunications packages, network file finders, and databases. Going on line to check something while still in their word processors, the users think they're using a very powerful version of Word for Windows. And, basically, they are.

Meanwhile, Word's rival, Ami Pro (also priced at \$495), has come under the management of Lotus Development. Ami's approach pretty much follows the standard drill for Windows word processors: a draft mode that shows only text and a layout mode offering a WYSIWYG document view at various magnifications. In layout mode, you can place, move, and size on-screen frames containing text or graphics. A frame can be tied to a spot on a page or to an adjoining paragraph of text so that the frame moves if pagination changes. Like Word for Windows, Ami Pro sports a Basic-like macro language, although its macro

capabilities are not considered as sophisticated as Word's. The package also comes with its own drawing and charting tools. For bit-mapped graphics, there is a graphics-scaling and image-processing feature.

"We think drawing and charting and image enhancement are the kind of functionality people should expect in their word processors," says Mohammadioun, "since they are useful in doing the full job of creating and editing a document. Even if you are importing graphics that were done somewhere else, it's nice to have tools to do minor editing."

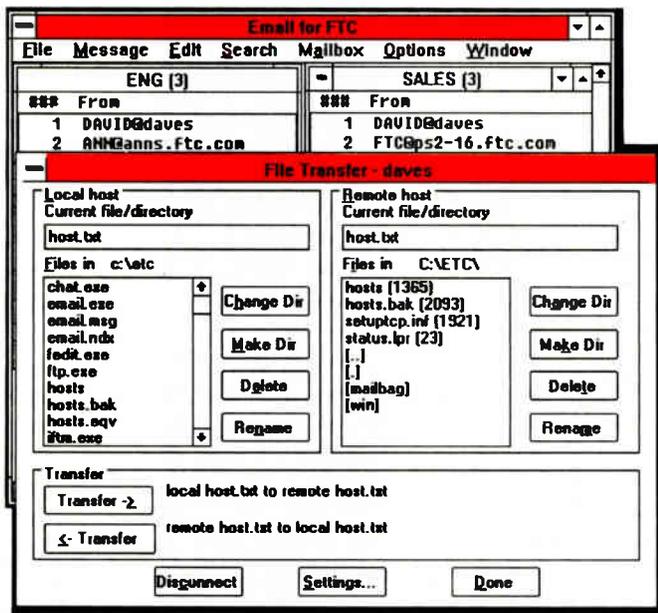
NBI—another ambitious pioneer in the field of Windows word processing—originally sold dedicated word processing systems in the law-office and networking markets. NBI left that hardware business behind in November 1989 to become a systems integrator and vendor of word processing software. Like Ami Pro's creators, NBI introduced a word processor that offered many features of a desktop publisher: separate draft and WYSIWYG modes, and frames (called objects) that could be placed on a page. NBI's aim was to deliver high-impact documents. The first attempt, called Legend, suffered from all the speed problems inherent in previous versions of Win-

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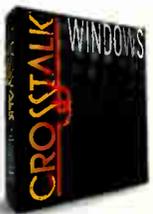
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"We don't see the big slowdown in OS/2 demand that everyone else sees," White says. On the other hand, "Nearly all our OS/2 users have asked about a Windows version."

So far, the offerings in the Windows word processing market can be described as nice but predictable: full-featured word processors in a graphics environment, but otherwise not breaking much new ground. Many vendors think a couple of developments on the horizon might prove interesting. The rumored upgrade to Windows 3.0, version 3.1, is supposed to offer truer WYSIWYG capabilities through scalable screen fonts. Currently, Windows offers you more of a map of the text flow of your document than a picture of it. The lines break at the same places they will on the printed page, and are spaced the same distance, but the appearance, size, and spacing of the text may bear no resemblance to the printout you'll get.

And then there's Object Linking and Embedding, Microsoft's new protocol, which takes the concept of DDE a step further. With OLE, an object can contain references to both logic and data. You can, for instance, click on a chart and call up the original charting software and have the

chart redrawn with updated numbers. (Hewlett-Packard's NewWave interface does something like this, incidentally.)

But for the moment, "Everybody is just trying to get a foot in the door," explains Watanabe at WordStar. "After that's done, we'll start to see more features in their products."

Building a Better Database

Vendors offer so many differing opinions on the market for Windows databases that, at first, you might wonder whether they use their own software.

"I see a lot of activity," says Bill McEwen, sales manager at GenSoft Development, maker of dBFast for Windows. "The market is becoming more refined, and we are seeing more entrants."

On the other hand, Gary Rush, president of MDBS, maker of the M/4 Windows database package, states, "We have gotten considerable response running an ad saying that if you can find a more powerful Windows database engine than ours, we'll buy it for you. But many can't find another one in any event; people are craving one."

"At the moment, there is not a terrific amount of life in the field, agrees Bob

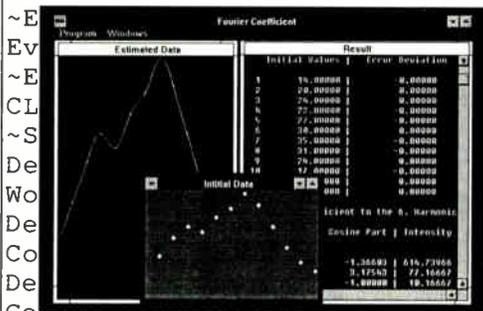
Besaha, president of Malachite, maker of Dossier for Windows. "The market is wide open for a well-marketed, well-conceived graphical database."

The problem boils down to defining what constitutes Windows database software. Authoring tools, such as Asymetrix ToolBook and Microsoft Visual Basic, can be used to cook up systems that will store data and produce reports based on it. But that's not the purpose for which they are marketed. A plethora of Structured Query Language front ends also exists—Windows software intended to make SQL calls to a database server over a network. But since these front ends don't store data, they really don't fit the category, either.

Counting only those packages with native data storage narrows the field considerably, to a point where few products and no big-name vendors remain. It also reduces the field to two varieties of software: workstation databases, with which a user could accomplish something pretty much out of the box; and programming tools, so-called engines, of varying complexity. And if the field is rather narrow, it's not for lack of interest in Windows or for a lack of advantages offered by the interface.

"The advantage of Windows?" asks

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```

~E
Ev
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~S
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De
Co
De
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Initial Values ( )
IF GRAPH!
ChildCreate (1)
PresentInitialValues ( )
IF FFT!
DoFFT ( )
ELSE IF POLY!
DoPolynomPhi (NV&, Q&, TIME ( ), PHI ( ))
DoPolynomKoeff (NV&, Q&, KO ( ), PHI ( ))
ENDIF
ChildCreate (2)
PresentEstimates ( )
ENDIF
    
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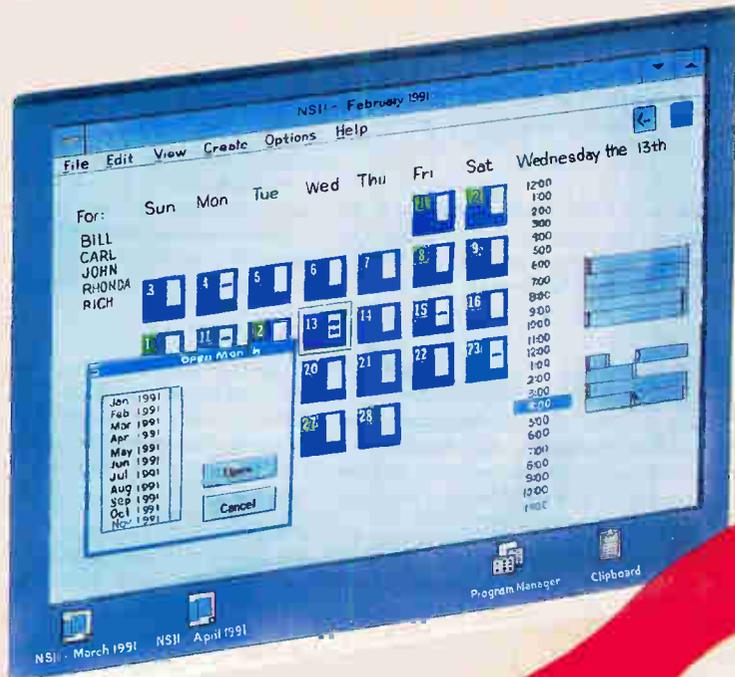


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Duke Lane of Software Publishing Corp. and board member of the Windows Presentation Manager Association. "Well, look in the DOS arena. If you have data in dBase, you have to export it to a file, then go to Lotus to import it and graph it, and then export it, quit Lotus, load WordPerfect, and import the Lotus graph. With Windows, you can tap from one environment to the next and have links between products. It's an integrated environment. There's a shortage of Windows databases because no one planned on Windows being as popular as it got." Those vendors who initially launched OS/2 programming efforts had to stop and rethink what they were doing.

"Windows makes a database a lot friendlier to the user, and since the applications do things with a common interface, it's relatively easy to tackle something new," adds Penny Misrahy, product manager for WindowBase, a Windows database from Software Products International. "And with Windows interoperability, an application is not an island any more."

As for the absence of big-name players, "The little guys can move a lot faster. Microsoft and Borland have existing languages that they have to carry forward; they have to protect their installed base

while doing something in Windows. And that's hard. And if it's not done well, it will alienate the user base," notes Rush of MDBS.

The Dominant Players

The user-oriented databases most widely cited as dominating what there is of the market so far are SuperBase 2 and SuperBase 4, from Software Publishing. Lane explains that the \$345 SuperBase 2 is an executive flat-file manager that can run applications written in SuperBase 4, which costs \$695.

A raw newcomer to the field is WindowBase from Software Products International. Misrahy says the \$495 package is a "high-performance, relational database completely designed for Windows; it's not a port from a character-based flat file [as] some others [are]."

"One of the real strengths of the products is that they hit both the novice and the power-user level. The novice can build SQL or DDE commands, and power users can take advantage of the relational aspects of the package, using C libraries [to] turn an application into a DLL."

She adds that, "Another reason you haven't seen many databases in Windows

is that Windows is slow, and when you have a database, you want to get at it quickly—so you need a powerful engine, and that takes a lot of development. We were able to do it."

Halfway between user-oriented software and pure programmer tools are packages such as Malachite's \$495 Dossier for Windows. "We feel we are a niche product for users with dBase and Clipper data who are in transition from DOS to Windows," says Besaha. "Like dBase, we allow the user to browse and create forms, data-entry validation, and menu-interface screens. But for anything more sophisticated, you have to go to the programming language." Written applications can be distributed royalty-free using the package's run-time module.

"We feel the largest installed base will belong to something that lets people create and maintain a database graphically—by, say, drawing lines between boxes. We'll be moving in that direction. But in the meantime, we are trying to let dBase and Clipper users feel comfortable," Besaha adds.

Omnis 5 from Blyth Software often is mentioned as a user-oriented competitor to SuperBase. But Jim Willis, senior vice president at Blyth, says Omnis 5 actually is "a professional developer's environment

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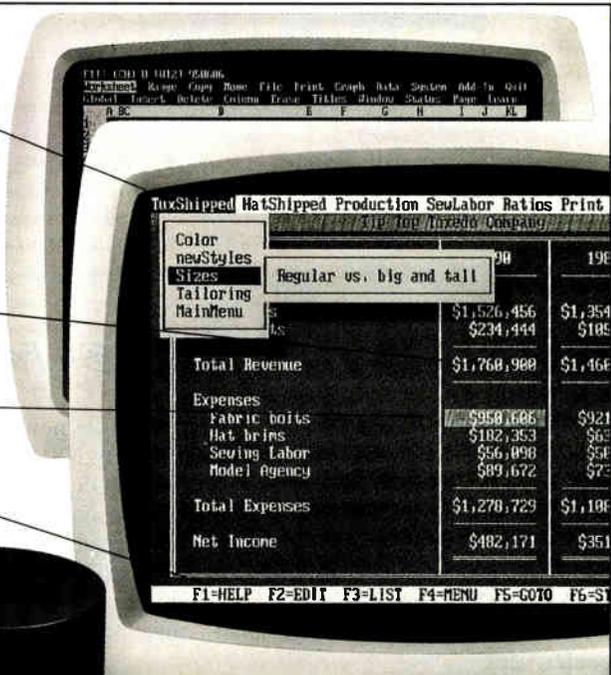
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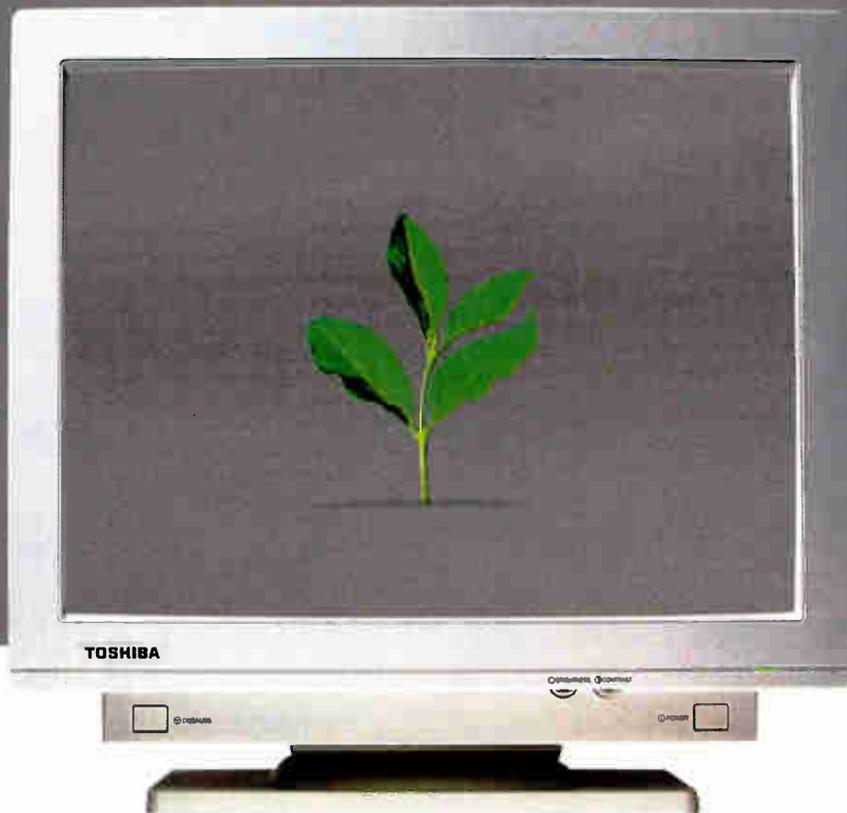


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Windows Database Programs: Features Summary

Product	Price	System Requirements						
		Min. RAM	Hard Disk Space Required	Min. CPU	Mouse Required?	Other Versions	Popular File Formats Supported	SQL Support?
Blyth Omnis 5	\$1000	1 MB	1 MB	286	Yes	Mac	DIF, SYLK, DBF, WKS	Yes
Coromandel ObjectTrieve	\$495*	200 KB	1 MB	286	No	DOS, Unix	ASCII	Yes
GenSoft dBFast for Windows	\$495	1 MB	1 MB	286	No	DOS, Mac	DBF	No**
MDBS M/4 Windows	\$995	50 KB	300 KB	286	No	DOS, Unix, VMS, OS/2	None	Yes
Software Publishing SuperBase 2	\$345 with example files	640 KB	2.4 MB	386SX	No	None	ASCII, WKS, WK1, Excel, DIF, PCX, EPS, TIFF	No***
Software Publishing SuperBase 4	\$695	640 KB	1.2 MB	386SX	No	None	ASCII, WKS, WK1, Excel, DIF, PCX, EPS, TIFF	No***
Raima DB_Vista III	\$695	640 KB	80 KB****	286	No	DOS, Unix, VMS, OS/2, Mac	ASCII	Yes
Software Products WindowsBase	\$495	2 MB	640 KB; 2 MB recommended	286	Yes	None	DBF	Yes

*Price is for version that supports binary large objects.

**SQL support available only through DDE.

***Product lets you embed SQL commands, but to use them you must purchase SuperBase SQL Library (\$495).

****Figure is for user environment; developer environment requires 2 MB.

Company Information

Blyth Software, Inc.
(Omnis 5)
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Foster City, CA 94494
(800) 843-8615
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Coromandel Industries, Inc.
(ObjectTrieve)
70-15 Austin St., 3rd Floor
Forest Hills, NY 11375
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GenSoft Development Corp.
(dBFast for Windows)
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Bellevue, WA 98006
(206) 562-0690
Circle 1440 on Inquiry Card.

MDBS, Inc.
(M/4 Windows)
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Lafayette, IN 47903
(800) 344-5832
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Raima Corp.
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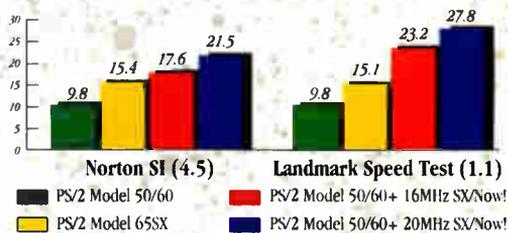
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Windows Spreadsheet Programs: Features Summary

Product*	Price	System Requirements					
		Min. RAM	Hard Disk Space Required	Min. CPU	Mouse Required?	Other Versions	Popular File Formats Supported
Bell Atlantic Thinx	\$495	1 MB	2 MB	286	Yes	None	WK1, DBF, XLS, DRW
Informix Wingz	\$499	2 MB	1.5 MB	286	Yes	Ultrix, OS/2 OS/2, SunOS, Excel, Mac	WKS, WK1, WK3
Lotus 1-2-3 for Windows	\$595	2 MB	5 MB	286	No	DOS, Mac Unix, PM	WK1, WK3, WKS, WKR, ALL, FMT, VMS, SunOS, FM3 VM, MVS
Microsoft Excel	\$495	1 MB	3 MB	286	No	OS/2, Mac	ASCII, WKS, WK1, DBF, SYLK, DIF, DBF2, DBF3, DBF4

*Quattro Pro for Windows is still under development; Borland has not released pricing or system requirements for the product.

Company Information

Bell Atlantic Software Systems, Inc.
(Thinx)
P.O. Box 3528
Princeton, NJ 08543
(800) 688-4469
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Borland International, Inc.
(Quattro Pro for Windows)
P.O. Box 660001
Scotts Valley, CA 95066
(408) 438-8400
Circle 1447 on Inquiry Card.

Informix Software, Inc.
(Wingz)
4100 Bohannon Dr.
Menlo Park, CA 94025
(800) 438-7627
Circle 1448 on Inquiry Card.

Lotus Development Corp.
(Lotus 1-2-3 for Windows)
55 Cambridge Pkwy.
Cambridge, MA 02142
(617) 577-8500
Circle 1449 on Inquiry Card.

Microsoft Corp.
(Microsoft Excel)
1 Microsoft Way
Redmond, WA 98052
(800) 426-9400
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data sources, and the Solver and Baksolver from 1-2-3/G. Our Solver is simpler than Excel's. It will be completely compatible with Lotus files, styles, keystrokes, and macros. All macros from any previous version will run unmodified. Performance will be comparable to, if not better than, 3.1's."

Lotus for Windows also will introduce "smart icons," he indicates. "Users will be able to [use] either a supplied function or a user macro and put it behind an icon and make it available to the Lotus for Windows desktop. For things like sorting a column, you could click on the icon after clicking on the column."

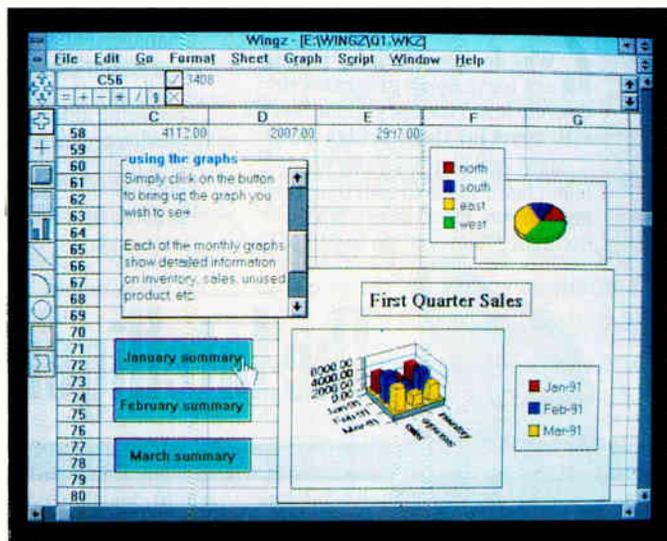
Informix has decided to take the high road with Wingz, emphasizing graphics for presentation.

And the company, having gotten its feet in the Windows door this year, has a lot of innovation on tap for next year, Beir promises.

Borland, for its part, acknowledges that a Windows version of Quattro Pro is under development, but it will not release further details.

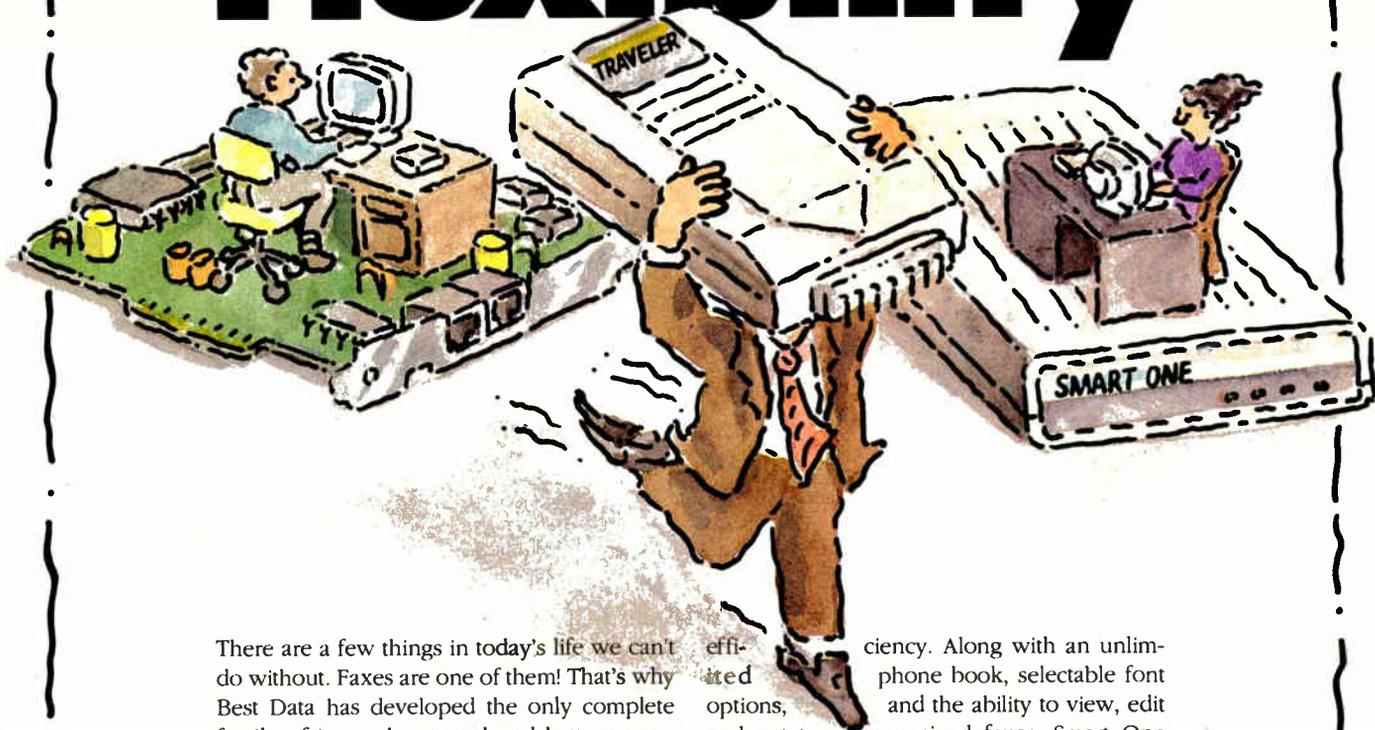
And All the Others

The chief alternative to the recognized leaders seems to be Wingz, a \$499 package from Informix Software. "Our position for Wingz is not to compete head-on in terms of things like recalculation speeds, but to



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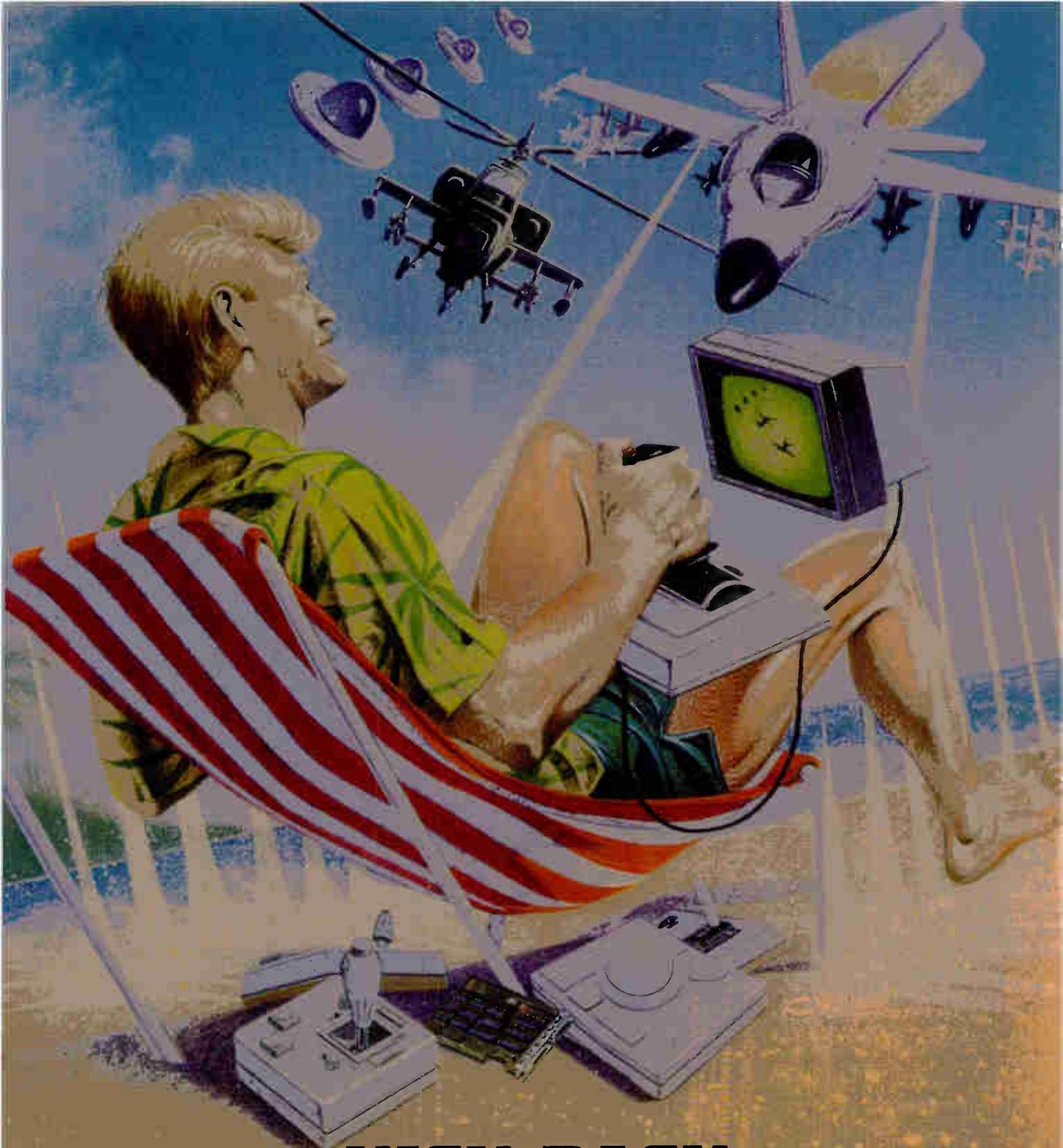
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Windows Graphics Programs: Features Summary

Product	Price	System Requirements					
		DOS Version	Minimum RAM	Min. Hard Disk Space	Mouse	Video	Other
3-D Charts To Go	\$99.95	3.1 or higher	640 KB	640 KB; 1 MB with clip art	Recommended	EGA or higher	None
Adobe Streamline	\$195	3.1 or higher	640 KB; 1 MB per page recommended	700 KB	Required	EGA, VGA, or Hercules supporting TIFF or black-and-white images recommended	PostScript printer recommended
Aldus Persuasion 2.0	\$495	3.1 or higher	1 MB	2 MB	Required	EGA or higher	None
ArtMaster 2.4	\$495	3.1 or higher	640 KB	250 KB	Recommended	EGA or higher	None
Arts & Letters Graphics Editor 3.1	\$695	3.0 or higher	640 KB	8 MB with clip art	Recommended	EGA or higher	None
CA-Cricket Graph for Microsoft Windows	\$129	3.1 or higher	640 KB; 1 MB recommended	3.5 MB	Recommended	EGA or higher	None
CA-Cricket Presents 1.31 for Microsoft Windows	\$199	3.1 or higher	2 MB	3.5 MB	Required	EGA or higher; VGA recommended	None
Charisma 2.1	\$495	3.1 or higher	1 MB; 2 MB recommended	12 MB with clip art	Mouse or digitizing pad	EGA or higher	None
CorelDraw 2.0	\$695	3.1 or higher	1 MB; 2 MB recommended	9 MB with clip art	Mouse or digitizing pad required	EGA or higher	None
Hollywood	\$495	3.3 or higher	1.6 MB; 2 MB recommended	8 MB with clip art	Mouse or Windows-compatible input device required	EGA or higher	None
Micrografx Designer 3.1	\$695	3.1 or higher	1 MB	4 MB	Mouse or digitizing pad recommended	EGA or higher	None
PowerPoint 2.0	\$495	3.1 or higher	1 MB; 2 MB recommended	8 MB with clip art	Required	EGA or higher	None
Publisher's Paintbrush 2.0 for Windows	\$495	3.1 or higher	640 KB	7 MB to install; 1 MB once installed	Mouse or Windows-compatible input device required	VGA or higher	None



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World Radio History

Windows Graphics Programs: Features Summary (continued)

Product	Price	System Requirements					
		DOS Version	Minimum RAM	Min. Hard Disk Space	Mouse	Video	Other
VentanaDraw 1.2	\$149	3.1 or higher	640 KB	640 KB	Required	VGA or higher with Windows 3.x driver recommended	Text rotation feature requires Adobe Type Manager
WinRIX 1.0	\$495	3.1 or higher	2 MB	600 KB; 8 MB recommended	Recommended	VGA or higher with Windows 3.x driver recommended	None

Company Information

BLOC Publishing Corp.
(3-D Charts To Go)
800 Southwest 37th Ave., Suite 765
Coral Gables, FL 33134
(800) 955-1888
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Adobe Systems, Inc.
(Adobe Streamline)
P.O. Box 7900
Mountain View, CA 94039
(800) 922-3623
Circle 1452 on Inquiry Card.

Aldus Corp.
(Aldus Persuasion 2.0)
411 First Ave. S
Seattle, WA 98104
(800) 333-2538
Circle 1453 on Inquiry Card.

Micro Synergy International, Inc.
(ArtMaster 2.0)
4400 MacArthur Blvd., Suite 860
Newport Beach, CA 92660
(800) 762-5622
Circle 1454 on Inquiry Card.

Graphics Editor 3.1
(Arts & Letters)
Computer Support Corp.
15926 Midway Rd.
Dallas, TX 75244
(214) 661-8960
Circle 1455 on Inquiry Card.

Computer Associates International, Inc.
(CA-Cricket Graph for Microsoft Windows)
711 Stewart Ave.
Garden City, NY 11530
(800) 645-3003
Circle 1456 on Inquiry Card.

Computer Associates International, Inc.
(CA-Cricket Presents 1.31 for Microsoft Windows)
711 Stewart Ave.
Garden City, NY 11530
(800) 645-3003
Circle 1457 on Inquiry Card.

Micrografx, Inc.
(Charisma 2.1)
1303 Arapaho
Richardson, TX 75801
(800) 272-3729
Circle 1458 on Inquiry Card.

Corel Systems Corp.
(CorelDraw)
1600 Carling Ave., Suite 190
Ottawa, Ontario K1Z 8R7
Canada
(613) 728-8200
Circle 1459 on Inquiry Card.

IBM Corp.
(Hollywood)
IBM Product Information Center
P.O. Box 2150
Atlanta, GA 30301
(800) 426-7699
Circle 1460 on Inquiry Card.

Micrografx
(Micrografx Designer 3.1)
1303 Arapaho
Richardson, TX 75801
(800) 272-3729
Circle 1461 on Inquiry Card.

Microsoft Corp.
(PowerPoint 2.0)
1 Microsoft Way
Redmond, WA 98052
(800) 426-9400
Circle 1462 on Inquiry Card.

ZSoft Corp.
(Publisher's Paintbrush 2.0 for Windows)
450 Franklin Rd., Suite 100
Marietta, GA 30067
(404) 427-1150
Circle 1463 on Inquiry Card.

VentanaWorks
(VentanaDraw 1.2)
2111 South Industrial Blvd., Suite 108
Tempe, AZ 85282
(602) 968-9874
Circle 1464 on Inquiry Card.

RIX SoftWorks, Inc.
(WinRIX)
18552 MacArthur Blvd., Suite 200
Irvine, CA 92715
(800) 345-9059
Circle 1465 on Inquiry Card.



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differentiate Wingz as a tool to create graphical decision-support systems, particularly for viewing spreadsheet information" says Ron Bower, Informix's director of product marketing. "People have begun using Wingz as a presentation tool, [rather than for] number crunching."

Wingz comes with an event-driven graphical language called HyperScript. Bower believes many customers have purchased Wingz solely for this language.

Another alternative, one that may push the definition of a spreadsheet to the breaking point, is Thinx from Bell Atlantic. Jack Copley, product manager for Thinx, says you can use the \$495 program for doing spreadsheet-like things that ordinarily you don't do in spreadsheets.

"If you are balancing an organization's budget, in a spreadsheet you would have several columns for each department. In Thinx, each person would be a block on an organization chart," he explains. Graphical attributes of an object can change as the data assigned to it changes—you might change to red, for instance, if expenditures exceed the budget. The package comes with a set of clip art and drawing tools.

Overall, the Windows spreadsheet market exhibits a concentration of products that parallel offerings in the character-based DOS world. Observers see it as ripe for "garage shop" entrants. And it is from any such newcomers that they expect to see any serious innovation.

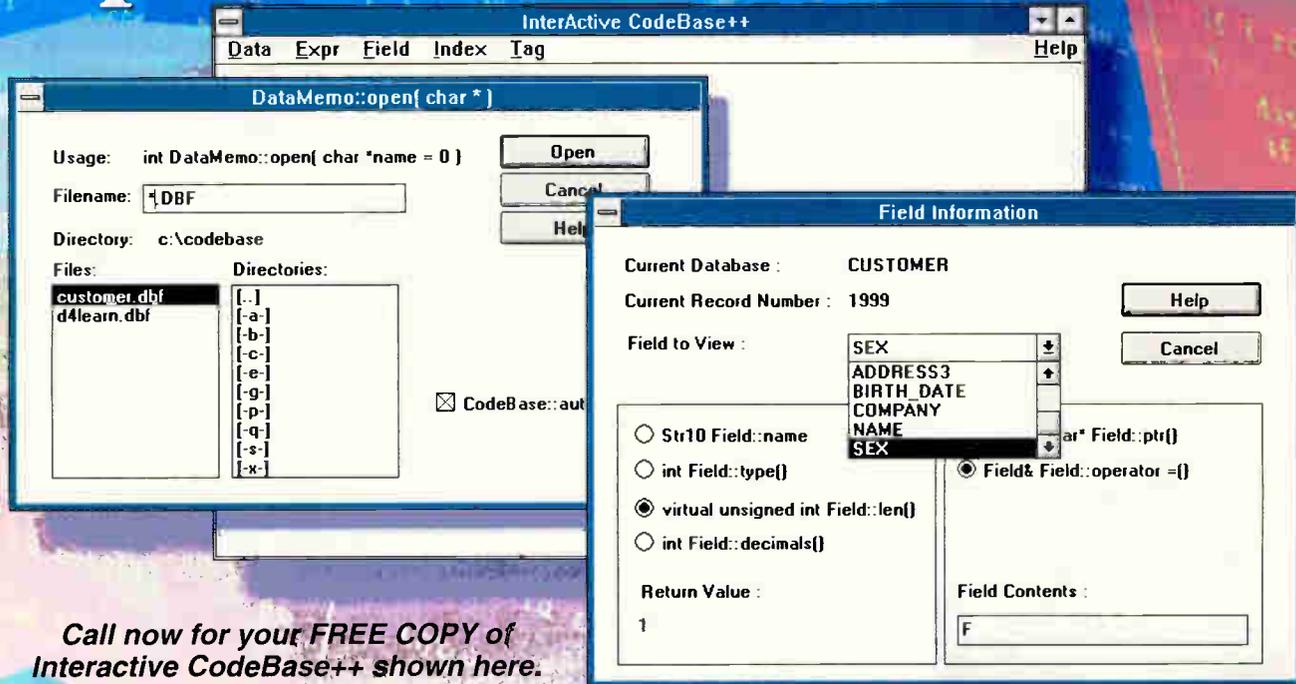
Graphics Unbound

Early versions of Microsoft Windows did not provide the performance, memory management, or data sharing technology necessary to support powerful desktop graphics applications. But Windows 3.0 has unleashed the power of Windows by providing better memory management and by implementing DDE and OLE. Users now can change tasks and move images between different Windows applications with almost reckless abandon.

Windows 3.0 drawing and painting tools—such as Computer Support's Arts & Letters Graphics Editor, Corel's CorelDraw, Micrografx's Designer and Draw Plus, Micro Synergy International's ArtMaster, RIX Softworks' WinRIX, VentanaWorks' VentanaDraw, and ZSoft Publisher's Paintbrush—let you select, edit, and modify graphics objects with the click of a mouse. And, using DDE, OLE, or Windows' own Clipboard, you can paste images into desktop presentations created with Computer Associates' Cricket Presents, Aldus' Persuasion 2.0, Micrografx's Charisma, Microsoft's PowerPoint 2.0, or IBM's Hollywood.

As more products enter the desktop graphics market, competition is forcing

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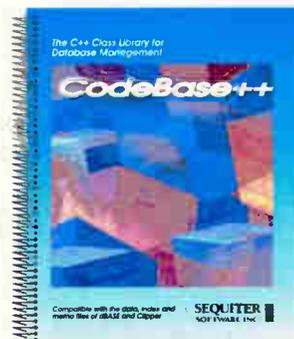
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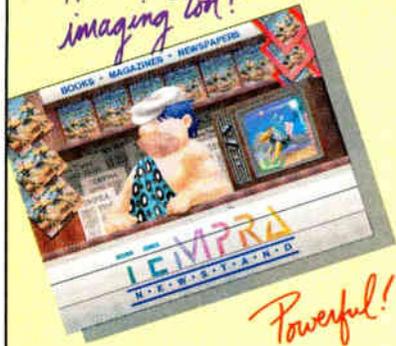


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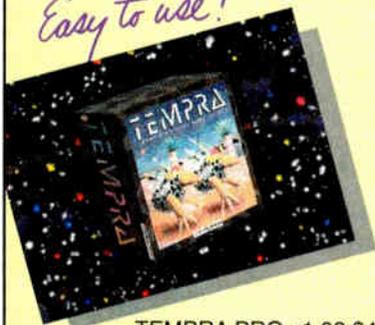
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developers to add value to their products by bundling additional graphics tools, clip art, and fonts, and by lowering prices to build market share. This competition is a windfall for users.

Windows-friendly PCs are still more expensive than comparable DOS-based systems, but Windows-based graphics applications continue to build market momentum because they are easy to learn and to use.

Windows' WYSIWYG interface—along with its point-and-click tool boxes and palettes—are literally redefining how corporate users create graphics images and presentations.

Nonetheless, developers of graphics software face the challenge of making their products as easy to use as possible without engineering the creativity out of them. Following are descriptions of the major Windows graphics applications.

3-D Charts To Go

3-D Charts To Go produces 3-D bar, line (ribbon), area, and pie charts that can be displayed in perspective or in isometric or oblique projection.

You can control chart size, viewing distance, all rotation angles, and the offset and thickness of pie charts. Up to 15 data sets and 2550 points may be charted using 17 different chart-drawing patterns. You may link charts together to create an animated demo, or print them using any Windows-compatible output device.

Eight foreground colors and eight background colors are available for text and images, and images can be imported and combined from Windows drawing and painting programs using files in PCX, BMP, and WMF formats.

Adobe Streamline

Adobe Streamline simplifies the art production process by automatically tracing bit-mapped images from scanned black-and-white line art or existing TIFF, PCX, or MacPaint files and converting them into PostScript files. Converted PostScript files can be edited using a drawing program, or you can export them to a layout program. Streamline can work with Encapsulated PostScript (EPS) files from the Windows version of Adobe Illustrator-Windows, CorelDraw (using Adobe Interface, which is included), and Micrografx Designer 2.0's DRW files.

Adobe Streamline requires only 640 KB to convert 4- by 5-inch images at 300 dots per inch, but it takes 1 MB of RAM to convert an 8 1/2- by 11-inch 300-dpi image and 4 MB of RAM for 8 1/2- by 11-inch 600-dpi images. Once converted to PostScript files, images may be displayed or printed at resolutions as high as 2450 dpi.

Aldus Persuasion 2.0

Persuasion 2.0 enables presenters to create overhead transparencies, slides, on-screen presentations, and printed materials. It includes a basic set of drawing tools and features PageMaker-like layout features, such as a pasteboard, ruler, and ruler guides.

To create a presentation, you can simply choose a template and enter your text and data into an outliner. Persuasion's collection of 55 auto-templates lets you automatically format a presentation and generate image files and printed presentation materials.

Persuasion can import text and graphics in most common file formats and can create on-screen presentations that include special effects such as fades, wipes, and dissolves. Adobe Type Manager is included.

ArtMaster 2.0

ArtMaster is a graphics integrator and editor for editing, merging, annotating, resizing, and enhancing standard Hewlett-Packard Graphics Language or HPGL/2 plot files generated by graphics applications for PCs, minicomputers, mainframes.

ArtMaster permits up to eight graphic-editing windows and has a fit-to-page feature that displays an entire multipage drawing on a single page. You can move objects between windows to merge files, add text, create new drawings using ArtMaster's basic graphics tool set, and print presentation materials on any Windows-compatible laser printer, ink jet printer, or film recorder.

Arts & Letters Graphics Editor 3.1

Arts & Letters lets you combine original artwork, clip art, stock photography, charts, and type to create business presentations and graphics for desktop publishing.

Arts & Letters' Bézier-based drawing tools will create color or wire-frame illustrations without splitting the screen and forcing you to jump back and forth. A unique Warp/Perspective drawing tool reshapes text and artwork and creates 1- and 2-point drop shadows.

The program also supports interactive and numeric sizing, positioning, rotation and slant, polymorphic tweening, auto-trace, end caps, and joins. A special tool box is supplied for precise technical drawings.

Also, the program supplies 5000 clip-art images, or you can import additional clip art images in EPS format. Arts & Letters includes 60 typefaces and supports Adobe Type Manager's PostScript Type 1 fonts.

CA-Cricket Presents 1.3

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FACT: Computer Shopper compared 3 systems in its July cover feature. **TOUCHE** beat NORTHGATE and DELL in the overall total speed test for performance! Shopper also said, "**TOUCHE**'s system operated quietest... **TOUCHE** obviously offers the fullest expansion of the three systems... **TOUCHE**'s ESD1 edged out NORTHGATE'S IDE drive and DELL'S slower IDE" Of all three systems **TOUCHE** was the least expensive. Shopper also said, "In fit and finish **TOUCHE** offers among the best we've seen."

FACT: Our AMI partnership enabled us to begin shipping 386 to 486 upgradable systems in 1989... 2 years before NORTHGATE even announced theirs! Northgate President Art Lazere is quoted in PC WEEK 06/03/91, "Upgradable is the wave of the future..." Unfortunately anyone riding the NORTHGATE wave is sunk when it comes to upgrading their 386 systems. Now that everyone wants a 486 anyway, what good is that to customers that bought Northgate systems for the past 2 years? Only GATEWAY knows when their upgradable system will ever become available.

FACT: **TOUCHE** was first to offer a 386 caching motherboard because AMI was the first to design a caching 386 motherboard.

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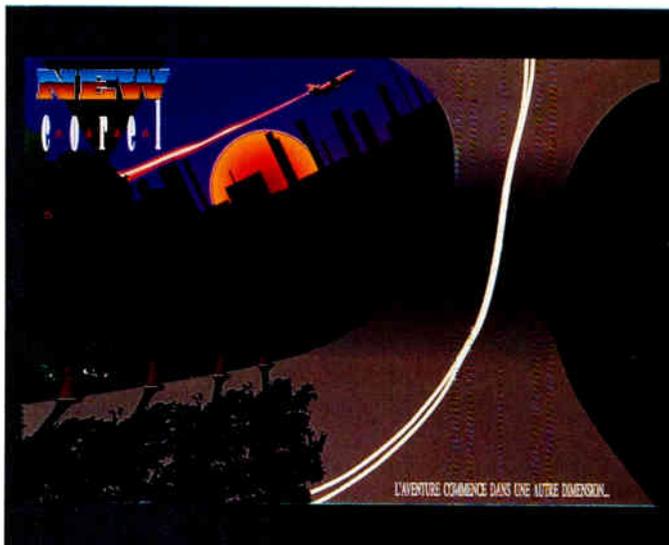
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BYTE SOFTWARE RESOURCE SERIES

CorelDraw, along with Micrografix's Designer 3.1, are by far the most popular Windows drawing programs. The screen shown here was an entrant in Corel's annual International Design Contest, submitted by Eric Hurtrez.



outs, graphs, and tables, you can create overhead transparencies, slides, speaker's notes, and handouts. The program features an outline processor and includes 12 of Nimbus Q's device-independent vector-based fonts. Sixty clip-art images and eight chart types with basic editing capabilities are included. CA-Cricket Graphcharts may be imported via the Windows Clipboard.

You can create on-screen presentations with 13 different special effects, and electronically transmit graphics files to Autographix's Overnight Slide Service.

CA-Cricket Graph for Windows

CA-Cricket Graph enables you to convert into graphs data in ASCII; Data Interchange Format (DIF); Lotus WK1, WK2 and WKS; and Microsoft SYLK formats. The product supports 12 types of graphs and includes basic drawing tools, such as a 256-color palette that may be customized using an RGB, hue-saturation-luminance (HSL), or cyan-magenta-yellow-black (CMYK) color-mixing model.

A Page Layout command lets you change layouts and add graphs to the page you will be printing. An Autographix driver is included for sending graphs in file-ready format to an Autographix service center.

Charisma 2.1

Charisma is a complete presentation graphics, charting, and free-form drawing package that features straightforward worksheet data entry. It includes advanced drawing tools such as Bézier curve editing and supplies 44 types of charts and graphs.

CMYK, RGB, and HSL color models and the Pantone Matching System (PMS) palette are supported, and over 2200 clip-art images are included.

Charisma can simultaneously import data and graphics from Lotus 1-2-3, Excel, and Harvard Graphics; it also can import and export graphics files in DRW, DXF, PICT, CGM, GEM, WMF, EPS (export only), PCX, and TIFF 5.0 formats.

CorelDraw

CorelDraw is a complete desktop graphics program that features special effects such as wraparound text and graphics, bent (warped) text and graphics, extrude capability (to simulate 3-D), perspective (to add depth to text and graphics), blend (for shapes and colors), and support for multiple columns of text.

The package includes over 3000 symbols organized into 36 libraries; 9 MB of clip-art images; a batch auto-trace utility for converting color or gray-scale bit-mapped images into vector graphics; and a visual file manager called Mosaic, which handles batch printing and file export. It lets you select files from an image gallery and use them to create a basic slide show.

CorelDraw also comes with 153 scalable outline fonts and a typeface converter that supports Adobe Type Manager's Type 1 PostScript format.

Hollywood

Hollywood's rich feature set makes it easy to create powerful presentation graphics and charts. The program includes outlining capabilities for slide creation, a good selection of presentation templates, graphing capability, support for Bitstream fonts, and compatibility with most popular graphics file formats.

And Hollywood has upped the ante for on-screen animated slide presentations. You can emphasize your points by highlighting bullets as they are mentioned or by making

I LOVE IT.

Fifteen minutes after installing Arts & Letters I was able to produce an exact reproduction of a client's business card including a graphic of hands shaking across a stylized globe, text curved over the top of the globe, and a blue bar through the whole design. The only thing I used the manual for was to look up the graphics.

I admit that I'm pretty good at figuring out computer programs but even so, the whole job was EASY. And exciting! And fun! And you can quote me on that.

By the way, I had almost decided to get CorelDRAW but your timely and informative FAX response pushed me firmly into the Arts & Letters camp instead. I'm sure glad it did. Arts & Letters is perfect. I love it.

Mark Selman
Trans Print Graphic Arts
Santa Cruz, CA

Arts & Letters was selected Editor's Choice by PC Magazine for 1991 and has won Publish magazine's Reader's Choice Award two years in a row. Computer Support Corporation, Dallas, TX.

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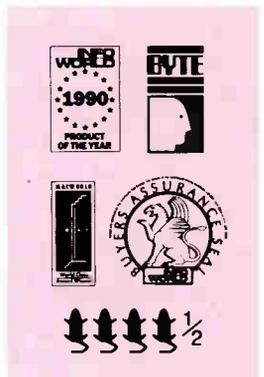
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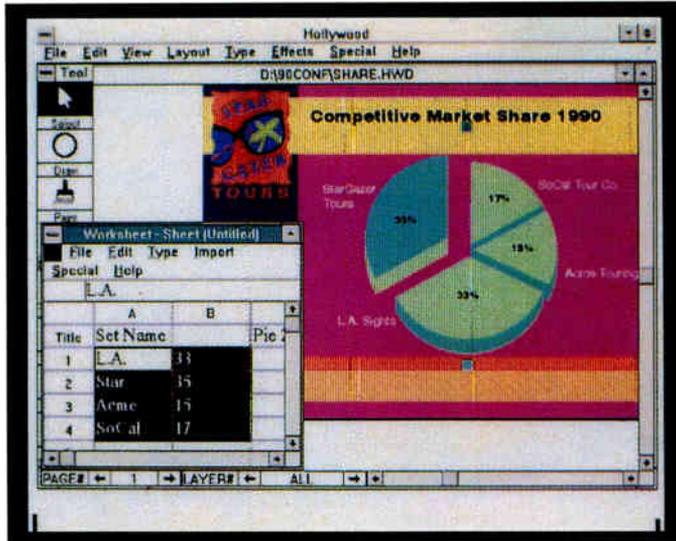
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Circle 154 on Inquiry Card (RESSELLERS: 155).

Hollywood marks IBM's entry into the Windows presentation graphics market. It offers a rich feature set and unique special effects.



elements of a slide appear one at a time. Special effects such as making a slice pop out of a pie chart or having a chart explode gives you control while maximizing visual impact.

Micrografx Designer 3.1
Designer 3.1 is a powerful drawing pro-

gram with advanced CAD features that include Bézier-curve editing, color auto-trace to convert bit maps into line art, fill patterns for clip-art images, and a customizable tool box. Users can create custom color palettes using CMYK, RGB and HSL color mixing, or specify Pantone colors.

Designer's print options simplify the procedures for obtaining process and spot color separations, allow printing mirror and negative images, and support vector clipping on plotters. Its import/export features allow file sharing between programs that support DRW, EPS color, GEM, CGM, DXF, color TIFF 5.0, PICT, PCX, and WMF file formats. Micrografx provides a Telegrafx utility for telecommunicating to Micrografx-supported imaging centers.

PowerPoint 2.0
PowerPoint 2.0 closes the gap between PC and Macintosh desktop presentation tools by taking advantage of Windows 3.0's robust interface and OLE technology.

Creating slides with PowerPoint is an intuitive two-step process. First, you create a slide master that contains logos and the presentation borders, or you may select one from the program's templates. Then, you design each visual using text and images created with PowerPoint's basic drawing tools or imported from other programs. PowerPoint includes a separate charting program that lets you import charts directly into PowerPoint slides using OLE.

The program automatically formats slides, transparencies, speaker notes, and

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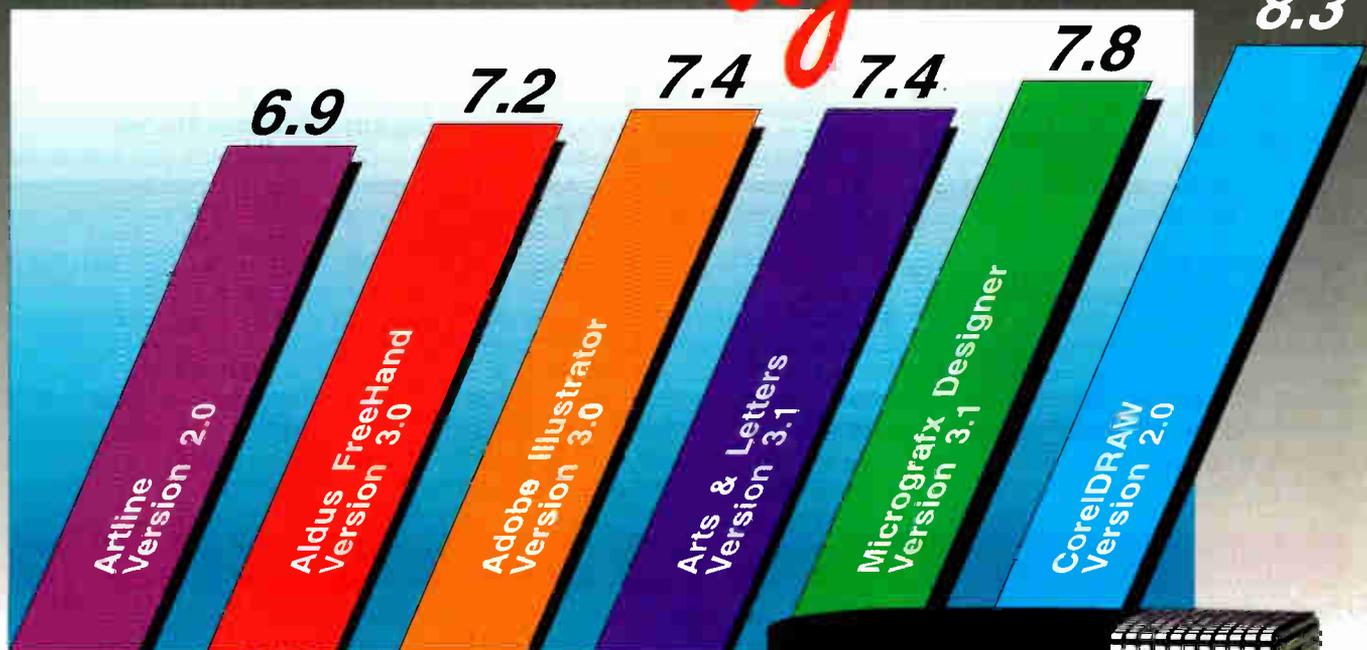
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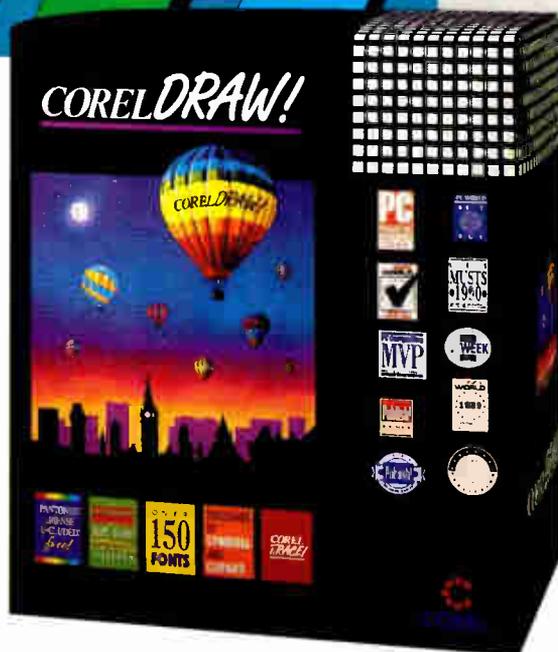
InfoWorld Product Comparison June 17, 1991

CorelDRAW wins InfoWorld Evaluation

Yes, CorelDRAW has done it again! In a pivotal InfoWorld product comparison, CorelDRAW, running under Windows 3.0, beat all leading illustration packages — Macs included!

InfoWorld states: "CorelDRAW combines strong ease of use with a top-notch selection of drawing and editing tools...The program has superior typehandling and tracing utilities...CorelDRAW is applicable to the widest range of drawing uses."* Without a doubt, CorelDRAW speaks for itself as the world's finest graphics software!

*Mike Heck, Doug and Denise Green,
InfoWorld June 17, 1991.



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Circle 79 on Inquiry Card (RESELLERS: 80).

World Radio History

handouts, but its on-screen presentations do not provide special effects.

Publisher's Paintbrush 2.0 for Windows
 Publisher's Paintbrush 2.0 provides tools for creating original artwork, controlling scanners, retouching and applying special effects to scanned images, and adding high-quality type to graphics images.

Paintbrush's interface is modular and customizable; you can move and hide all of the interface components and save and load workspaces with images in progress.

Gray-scale or color photographs and images can be retouched using automatic and manual filters for blending, equalizing, removing spots, and controlling brightness, contrast, mosaic, and sharpness. Along with support for 24-bit true color, the program permits the import and export of standard PCX, MSP, BMP, TIF, GIF, TGA, RAW, and EPS files.

VentanaDraw 1.2

A vector-based drawing package, VentanaDraw can handle Bézier curves, moving and shaping, resizing and scaling, grouping and ungrouping, and text and object rotation. The program provides access to unlimited fill patterns and pen sizes, five

Windows-based terminal emulators enable users to display multiple 3270 sessions in different, resizable windows.

pen types, nine drawing tools, and Windows fonts. Version 1.2 adds graduated color fills, masking, and node editing capabilities to the mix.

Other notable capabilities include dithering and undo, rotate, flip, scale, drag, group, and ungroup features. ASCII text files, Windows metafiles, and PostScript are supported.

WinRIX

In addition to supporting true-color, bit-mapped, and vector-image creation and editing on a VGA monitor, WinRIX provides compatibility with vendor-supplied drivers for up to 24-bit color and IBM XGA

and other high, true-color display adapters.

WinRIX can "antialias" vector text into raster images and provides image-editing process filters for enhancing images with sharpening, softening, darkening, lightening, smudging, blurring, and tinting. You can make global and spot adjustments for color correction, balancing, brightness, color tonal control, and gamma correction. The product also provides area selection and masking options.

WinRIX uses a multiple-document interface that lets you edit images at several levels simultaneously. It supports DDE under Windows 3.0 and will support OLE under Windows 3.1.

Making Connections

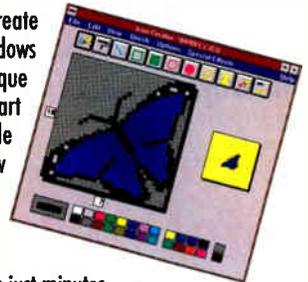
Microsoft Windows' basic communications program, written by Future Soft Engineering, supports XMODEM and Kermit protocols and provides DEC VT100, VT52, and ANSI emulation. But its COMM.DRV file uses nonstandard COM3 and COM4 addresses, does not support the first-in/first-out buffer in the standard 16550A universal asynchronous receiver transmitter, and limits transmission speed to 19.2 KB per second.

INTRODUCING



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Windows Communications Programs: Company Information

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Price: \$295
Circle 1466 on Inquiry Card.

Attachmate Corp.
(Extra For Windows 3.2)
13231 Southeast 36th St.
Bellevue, WA 98006
(800) 426-6283
Price: \$425
Circle 1467 on Inquiry Card.

Crosstalk Communications/DCA
(Crosstalk for Windows 1.2)
1000 Holcomb Woods Pkwy., Suite 440
Roswell, GA 30076
(800) 241-6393
Price: \$195
Circle 1468 on Inquiry Card.

Digital Communications Associates
(Windowlink for IRMA)
1000 Alderman Dr.
Alpharetta, GA 30201
(800) 348-3221
Price: \$495
Circle 1469 on Inquiry Card.

Digital Communications Associates
(IRMA Workstation for Windows)
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Price: \$495
Circle 1470 on Inquiry Card.

Software Ventures
(Microphone II for Windows version 2.0)
2907 Claremont Ave., Suite 220
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(415) 644-3232
Price: \$295
Circle 1471 on Inquiry Card.

Wall Data, Inc.
(Rumba 3.1)
17769 Northeast 78th Place
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Circle 1472 on Inquiry Card.

These limitations have encouraged third-party developers to create communications programs such as Crosstalk's Crosstalk for Windows, Future Soft Engineering's asynchronous edition of DynaComm, and Software Ventures' Microphone II for Windows. Each of these programs provides additional terminal emulations, as well as support for other common communications and network-communications protocols, script languages, and background operation.

Character-based communications tools typically provide interfaces that are functional, but austere. Running multiple sessions or toggling between mainframe and local applications usually requires a user to page through full-screen displays. This does not present a problem for running one communications session; in fact, some users leave the Windows environment to run their favorite character-based communications program. But many users must access multiple host connections to query corporate databases, send and receive E-mail, and perform other tasks while using local applications.

Windows-based terminal emulators such as IRMA Workstation for Windows from Digital Communications Associates, Extra for Windows from Attachmate, and

Rumba from Wall Data enable users to display multiple 3270 sessions in different, resizable windows. This makes it easy to monitor a number of remote sessions while running applications on a local computer. In addition, Windows-based 3270 emulators can use DDE and the Windows Clipboard to help move information between mainframe and local applications. These emulators also can use DLLs to help free up memory and disk space. The ability to display multiple 3270 sessions, share information between local and remote applications, and select command keys with a mouse (to overcome keyboard differences) are endearing Windows-based communications packages to corporate users.

General-Purpose Packages

DynaComm for Microsoft Windows
DynaComm, a superset of Windows' Terminal module, includes a high-level script language, a reconfigurable user interface, tabular data-manipulation capability, script-building utilities, and full keyboard remapping capabilities.

The program runs at up to 19,200 bits per second and can access modem pools and remote information services across a LAN through ComBIOS via INT 14H,

NetBIOS, and UBNNetCI. Its complement of binary file-transfer protocols include XMODEM, YMODEM, ZMODEM, Kermit, and CompuServe B+. Terminal emulations include TTY, DEC VT220, VT100, VT102, VT52, ADDS VP/60, HP 700/94, IBM 3101, Televideo 925/950, and CompuServe VIDTEX terminals.

Crosstalk for Windows 1.2

Crosstalk for Windows includes a robust command language based on Crosstalk Mk. 4's CASL language. It offers a range of file transfer protocols, including XMODEM, YMODEM, YMODEM-G, ZMODEM, Kermit, CompuServe B+, Crosstalk and DART protocols, and ASCII upload and capture. Its list of terminal emulations encompasses DEC VT52, VT102, VT220 and VT320, IBM 3101, IBMPC ANSI, and CompuServe VIDTEX.

Crosstalk runs in the background at up to 115,200 bps, supports COM1 through COM4 (letting you communicate with multiple hosts), can use DDE to share data with other Windows applications, and supports network modem sharing via INT14 and Novell's Asynchronous Server Interface.

Microphone II for Windows 2.0

Microphone II for Windows supports background file transfers and batch transfers using XMODEM, YMODEM, YMODEM-G, and ASCII protocols. TTY, VT52, VT100, and VT102 terminal emulations are provided.

The program includes a powerful script language with flow-control variables and the ability to call subroutines. Its learn mode lets you record a log-on sequence or other procedures, and a script feature called Watch Me prompts you through setup. Scripts can be assigned to function keys, radio buttons, or pull-down menus and can be traced through each step of operation.

Included are a personal BBS and matching user interface, which are implemented with Microphone II's scripting language.

Terminal Emulators

DCA Windowlink for IRMA

DCA Windowlink for IRMA provides 3278/79 Models 2, 3, 4 and 5 terminal emulation and TSO, CMS, and CICS file-transfer software. Windowlink also supports IBM's 3270PC File Transfer Program. Windowlink's Multiple Logical Terminal can support up to five nonconcurrent host sessions from the PC.

File transfers are initiated from a pull-down menu and can run in background mode. Windowlink's Edit menu provides access to the Windows Clipboard.

Windowlink's DCA API Executable

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Module permits third-party or custom applications using IBM's EEHLLAPI 1.2.0, SRPI, or PS API to communicate with the host through the IRMA adapter. The hardware interface is a Type A coaxial connection to an IBM 3X74 cluster controller.

DCA IRMA Workstation for Windows
DCA IRMA Workstation for Windows supports CUT, DFT, SDLC, and Token Ring connections with an IBM host. The program fully emulates IBM 3270 monochrome or color display terminals and enables a PC printer to emulate a 3270 printer. It can accommodate up to five concurrent 3270 sessions.

IRMA Workstation supports file-transfer spooling for multiple concurrent file transfers using DCA's IRMAlink or IBM's IND\$FILE. Both DCA and IBM 3270 communications adapters are supported, allowing you to communicate with both 3270 host and asynchronous hosts. ANSI/ASCII terminal emulation is provided for asynchronous connections using Kermit, XMODEM, or YMODEM.

The program supports Windows' DDE, IBM's HLLAPI, APPC conversations via LU 6.2, and note type 2.1.

IRMA Workstation for Windows can accommodate up to five concurrent 3270 sessions.

Extra for Windows 3.2

Extra for Windows lets you run up to 26 simultaneous host sessions in separate windows. Sessions can display 3270 Models 2, 3, 4, and 5 and also support Extended Attribute Bytes. File transfers use IBM's Send/Receive IND\$FILE, a de facto standard for PC-to-mainframe connectivity.

Because Extra for Windows supports the Windows Clipboard and "host aware" DDE, you can establish links among data displayed on several different screens. The program's ability to handle both EHLLAPI and WHLLAPI allows multiple Windows programs to access multiple mainframe

sessions simultaneously, and permits both coaxial and LAN connections with IBM's Token Ring Coupler.

Rumba 3.1

Rumba allows a PC to act as a distributed function terminal supporting multiple data streams. Rumba can handle multiple 3270 mainframe sessions while maintaining other applications in other windows, and it supports IND\$FILE, which allows file transfers, macro customization, "hot links" to update data downloaded from a host into a Windows application, "hot spots" to enable users of local Windows programs to execute mainframe functions or previously created macros by clicking on the appropriate menu items, and an on-screen keyboard mapper. Rumba can use Windows' scalable fonts, supports HLLAPI and DDE through an optional software design kit, and comes with on-disk documentation.

Filling in the Gaps

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file manager or believe they are more productive entering commands at the DOS prompt. Others think that Windows' interface is not object-oriented enough; they want a more visual interface that makes them less reliant on their keyboards.

Third-party developers have responded to these concerns by creating shell programs that augment or replace Windows' Program Manager and File Manager. Users who are looking for an icon-based "folder and document" program interface will appreciate hDC Computer's Windows Express. Users who prefer to work with user-defined drop-down menus should consider Abacus Software's BeckerTools 2.0 Plus, Access Softek's Prompt, Metz Software's Metz File F/X, or Wilson WindowWare's Command Post. Each of these programs provides a file manager along the lines of X-Tree Pro's interface.

You also can enhance Windows 3.0's performance with multipurpose file-management tools. Metz Software's File F/X Task Manager replaces Windows' Task List and provides utilities for managing files and performing rapid text searches. BeckerTools 2.0 Plus and hDC Computer's hDC First Apps and hDC File Apps provide file- and system-management features

All of the programs profiled work as advertised, but some programs will fit your work requirements and style better than others.

that can be mixed and matched to improve productivity.

Specialized utilities let you password-protect your system using Metz Software's Lock 3.0; create custom icons using hDC Computer's hDC Icon Draw; schedule tasks, such as automatic tape backup with Aldia Systems' Time After Time or Merasoft's E'vent Manager; and transfer files between laptop and desktop systems without leaving the Windows environment with GetC Software's File Shuttle Express or Traveling Software's WinConnect.

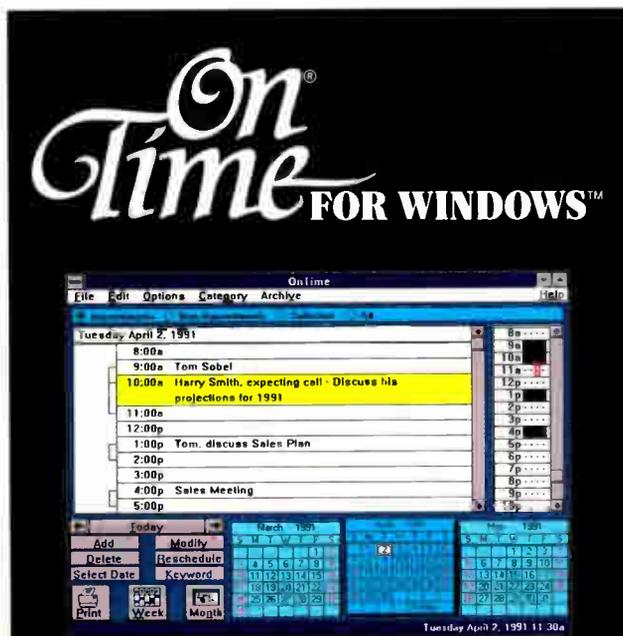
DOS-based application developers are

beginning to port their productivity tools to the Windows-environment to take advantage of Windows' rapidly growing installed base. Symantec, for instance, has announced that a version of Norton Backup for Windows will be available this fall, and Central Point Software already has enhanced PC Tools for the Windows' environment by providing disk-backup and file-undeletion utilities.

All of the programs profiled work as advertised, but some programs will fit your work requirements and style better than others. Fortunately, many of these programs cost less than \$100 through mail-order and software discounters that offer unconditional money-back guarantees.

Shells and Management Tools BeckerTools 2.0 Plus

BeckerTools 2.0 Plus contains BeckerTools plus three new utilities for compressing, recovering, and backing up files. It replaces Windows' Program Manager and File Manager with a complex interface containing 50 push buttons and associated "quick menu" dialog boxes. Directories are displayed for two different disk drives. BeckerTools Backup permits you to select files for backup by drive, directory, file



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date, or by the date of the file's last backup. Backup files may be compressed, encrypted, and password-protected. BeckerTools' Recover checks and repairs common file and disk problems, such as corrupted file-allocation tables, improperly chained clusters, bad files. The program's compression module helps optimize performance by defragmenting disk files.

Command Post

Command Post's default menus provide basic file- and directory-management functions, as well as a file browser for displaying ASCII text or hexadecimal dumps. But the real power of Command Post lies in its ability to create customizable menus with the powerful Command Program Menu Language. CPML controls how each menu selection executes a program or completes a task and defines the choices that appear in each dialog box.

Command Post can launch programs as icons or in normal or zoomed windows, and can automatically arrange window size and position. The program includes an automatic screen blanker, as well.

hDC File Apps

hDC File Apps contains five MicroApps. File Enhancer Plus lets you undelete, copy, move, and delete files; change file attributes; create directories; and enter DOS commands from the system menu. File Secure encrypts files using either the Data Encryption Standard or the Quick Encryption option. Disk Viewer provides a graphical view of disk usage and lets you delete unnecessary files. File Search accepts standard group search parameters and can search on a file's name, contents, and date and time. Disk Share, codeveloped with Traveling Software (which markets the utility as WinConnect), helps you transfer files between a laptop and a desktop computer.

hDC FirstApps

hDC First Apps includes nine pop-up MicroApps utilities that can be launched from any Windows application. The program's Memory Viewer displays system memory; Font Viewer displays available screen and printer fonts; Desktop lets you create a custom start-up screen, screen background, and screen saver; Work Sets groups files and applications together so that they can be loaded together; Art Gallery imports and saves clip-art files; Auto Save saves files at preset intervals; Character Set provides access to special typographic symbols; Alarm Clock reads Windows Calendar files and sets alarms; and System Enhancer provides Windows shortcuts, such as closing all open windows.

Windows Utilities Programs: Company Information
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 (hDC File Apps)
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Aldia Systems, Inc.
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hDC Computer Corp.
 (hDC Icon Designer)
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GetC Software, Inc.
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Metz Software
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 Price: \$129.95
Circle 1479 on Inquiry Card.

Wilson WindowWare
 (Command Post)
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 Seattle, WA 98116
 (800) 762-8383
 Price: \$49.95
Circle 1068 on Inquiry Card.

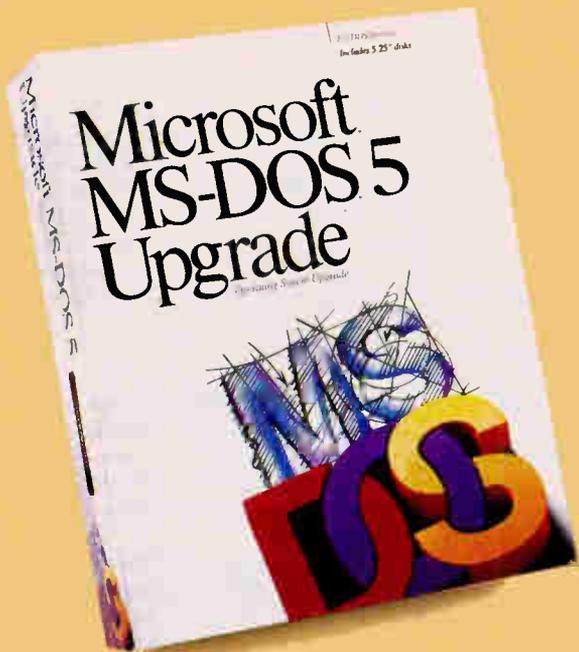
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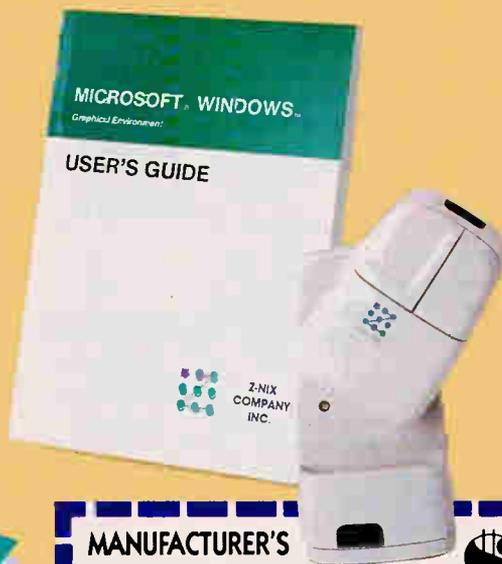
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World Radio History

hDC Windows Express

The hDC Windows Express menu system provides a means of regrouping applications and documents in "file folder" menus, from which you can launch them using Quick Keys. Many corporations have moved to Windows Express to standardize their "corporate desktop."

Windows Express menus support extended file descriptions and can be customized with over 200 different icons. The program's editor lets you define standard menus, defeat file operations such as the Delete command, and add password protection for files, folders, and menus. The program includes a user-definable help system and a screen saver.

PC Tools 7.0

Following the trend in Windows-based software, the latest incarnation of PC Tools includes three new Windows utilities. Windows Backup, similar in function to PC Tools' stand-alone backup program, maintains complete data and keystroke compatibility with the DOS product. Windows Undelete is useful for recovering deleted files, and Windows Launcher can initiate any Windows or DOS application directly from the Windows 3.0 system menu. PC Tools 7.0 is well positioned to stay at the leading edge of usefulness and value in the competitive PC utilities market.

Prompt

Prompt may get its name from its ability to copy, move, rename, delete, or compress any or all files in one operation. Users can log up to 26 disk drives, display two disk drives at once, and view multiple directories for each file.

Prompt includes file viewers for HPGL, CGM, PCX, DBF, TIF, WKS files and WordPerfect, Write, Microsoft Word, Excel, and other programs. The package supplies a DDE link with Dragnet, Access Softek's text-retrieval utility for locating files by scanning their contents.

File F/X

File F/X's file- and task-management tools can be used together or singly. The file manager lets you change file attributes and copy, delete, move, and rename files and directories—without resorting to DOS commands or Windows 3.0's File Manager.

File F/X's Task Manager, a replacement for Windows' Program Manager, is a pop-up utility that can launch applications, arrange windows, and switch between open applications. Frequently used applications can be added to F/X Task Manager's Tools menu.

F/X File includes three utilities—F/X File Find, F/X Text Search, and F/X File

Undelete—along with a customizable screen saver capable of displaying any bit-mapped or metafile graphics file as a moving on-screen image.

Lock 3.0

Lock 3.0 protects against unauthorized system access by requiring users to type a verifiable password before access is granted to use the system's keyboard, mouse, or pen. Lock features both manual and automatic lock-setting options, a customizable screen saver, and an option to disable the Ctrl-Alt-Del function.

Lock can be configured to lock up unattended systems or restrict mouse movement and blank the screen when the system is locked. The program's screen saver can display a Windows bit map as a moving image when the system is locked.

PC Tools 7.0 is well positioned to stay at the leading edge of usefulness and value in the competitive PC utilities market.

Specialized Utilities

E'vent Manager

E'vent Manager is designed to monitor time and system events and execute commands based on events that occur. It uses Dynamic Event Management to monitor over 180 events, including keystrokes, error messages, and the time at which an application is opened and closed.

The program's list-based interface permits point-and-click programming; each task is created one step at a time by recording and editing keystrokes, mouse movements, and commands. You can execute these commands globally or singly to run specified applications and program message boxes to tell the user what the E'vent Manager is doing.

Time After Time

Time After Time can schedule repetitive operations, provide automatic operation of Windows 3.0 applications, schedule one-time events in Windows' Calendar Program, and schedule DOS programs and batch files to execute at predetermined times. Complex applications can be re-

corded using Windows' Macro Recorder.

Time After Time stores your schedule in an event file that can contain up to 256 events. If you are running a Windows application when an event is scheduled to occur, the scheduled program can run in the background without disturbing you or your application.

hDC Icon Designer

With hDC Icon Designer, you can create or modify icons for use with Windows' Program Manager or hDC Windows Express. Icon Designer features a 16-color palette with special background colors for creating true icons.

The program includes over 125 color icons that are stored and managed in a graphics library. Because Icon Designer is an hDC MicroApp, it is accessible from within any Windows application.

File Transfer Utilities

WinConnect

WinConnect lets you use a laptop computer's disk drives as if they were extra drives on your desktop computer, giving you access to laptop files from a desktop computer without transferring them. It works in the background and can be launched as an hDC MicroApp from any Windows program. WinConnect includes hDC's File Enhancer utility for copying, moving, and deleting files and directories, a 25-foot four-headed (9-pin and 25-pin) serial cable, and an 8-foot parallel cable for connecting computers.

File Shuttle Express

File Shuttle Express is a high-speed file-transfer program for moving files from one PC or laptop to another. The program includes a file manager for changing one or more file attributes and copying, moving, deleting, renaming, viewing, and finding files. You can create, rename, delete, and copy directories. A special Graft option lets you graft transferred directory structures below a selected directory on the receiving PC.

Two versions of the program are included to support both DOS and Windows-based PCs. The Rocket Socket plugs into a PC's parallel printer port, permitting you to transfer files using a standard parallel printer cable. ■

Doug Dayton is the founder of Dayton Associates, a computer-industry marketing and consulting firm in Bellevue, Washington. He can be reached on BIX c/o "editors."

Lamont Wood is a computer consultant and freelance writer specializing in high technology. He lives in San Antonio, Texas. He can be reached on BIX as "lwood."

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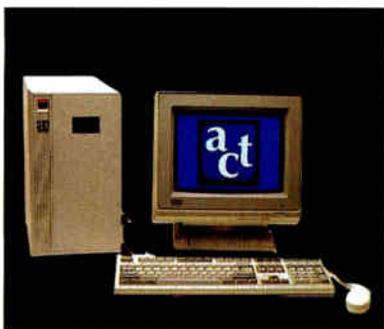


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World Radio History



THE OFFICE OF THE FUTURE

How different is the office of today from the office of the past? Dingy, tan walls have given way to off-white walls or modular cubicles. Typewriters and ledgers have been replaced by personal computers using spreadsheet and word processing software. Offices once isolated but for the telephone are now linked electronically, to a greater or lesser degree, to almost any desired location.

As diametrically opposed as these two pictures may seem, the office of the future will be just as different from the office of today. Many of the elements that seem so necessary for normal day-to-day functioning will be replaced by more efficient and more aesthetic components. And the overall operating concepts on which today's office is based are also likely to change, to find solutions to problems that arose as the past grew into the present.

What will the office of the future be like? It's a good bet that some of what research scientists are working on today will be ready for market tomorrow. The questions remain: Which ones? In what kind of incarnation? In "Visions of Tomorrow," I look at one possible scenario for the office of the future and the current state of the technologies that would make it possible. Perhaps the future is not so far away as it seems.

Without a doubt, the foundation of the office of the future is networking technology. Networks give business an enormous amount of latitude in how they structure departments and workgroups. In "Corporate Connections," Wayne Rash Jr. describes how enterprise networks will change the way we work in the 1990s. And in a related text box, "Enterprising Storage," Gregory G. Kenley discusses the emerging standards for mass storage on networks.

One aspect of the office of the future that you can bank on is that the computers that drive it will be smaller and more powerful than today's machines. Despite the fears of MIS departments, downsizing, or *rightsizing*, is an idea whose time has come. In "Downsizing: Bane or Boon?" Bob Ryan shows how rightsizing will let you save money, increase efficiency, and tap into the unused power of personal computer networks while changing—rather than eliminating—the role of MIS.

The most significant element shaping the office of the fu-

ture would appear to be research, and the current state of research in America is a matter of some concern. The success of Japanese and European products shows the results of proper funding for R&D. With the appropriate research, the U.S. can cultivate and explore the ideas that will become the technologies of tomorrow. Without it, many of today's promising technologies will simply die on the vine. In "Is America Losing Its Edge?"

Alan Joch examines the crises in R&D in the U.S. and discusses how our top researchers are being lured away by better funding.

The office of the future—I am certain each one of us has a slightly different fantasy of what it should be like. For some, the ideal office of the future will be in their homes; others envision a totally automated workplace. Still others look to developments in multimedia, speech recognition, or pen-based computing for clues to the office of the future. With the power you'll see in desktop systems and the bandwidth in new communications technologies, any of these could play a part in the office of the future. What visions and technologies will win out? If we are in luck, current trends toward customized workstations will allow each of us to create our own ideal work environment. And then everyone can be right. We all win!

—Jane Morrill Tazelaar
Senior Editor,
State of the Art

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World Radio History

VISIONS OF TOMORROW

The technological seeds for the office of the future are already planted

JANE MORRILL TAZELAAR

What will the office of the future be like? Will we have robotic assistants doing all the mundane tasks? Will we have intelligent agents planning the most efficient ways to organize our time? Will we work at home or in modular cells?

We could look to the works of Arthur C. Clarke, Immanuel Velikovsky, Jerry Pournelle, and Isaac Asimov to find out. Science fiction has long been the forerunner of science fact (although time frames may be less than exact), and these writers are some of the best.

My vision is a little different, however. It's based on several years of researching and covering state-of-the-art technologies for *BYTE*. And I'll let you determine its validity for yourself.

The Promise for the Future

Imagine entering the office of the future. It is ergonomically designed for the health and safety of its workers. Furniture and equipment are not fatiguing or stressful to your body. You are protected from any danger of radiation.

Paper is nearly nonexistent. You receive all mail electronically, and you sign documents with a stylus. The few remnants of paper are mainly on the desks of veteran workers not yet fully adjusted to the idea of a paperless office.

In meetings, you take notes on pen-based computing pads and feed them directly into your computer where they are read—with or without your doodles. Presentations are multimedia-based: Pulling them together is simply a matter of “mousing” around and combining various objects. All linkage between them is automatic.



continued

Training uses multimedia techniques and hypertext linkages to provide individually customized information on an as-needed basis. And actual computing tasks are "rightsized," assigned to the type and size of computer that they need.

Computers are much smaller, as are their peripherals, and they have fewer adjuncts; thus, fax and phone capabilities are built in. You can talk to your computer in a normal voice with continuous speech. It understands the natural language it hears and then either speaks in human tones or displays its response on a large screen in nonfatiguing colors.

If you prefer to use key entry, the keyboards available are appropriately shaped to alleviate stress on your wrists, hands, and arms. Various other input options are also available: from trackballs to styli to touchscreens and left- and right-handed mice (see "Touch-and-Feel Interfaces," February BYTE).

An intelligent agent within the computer performs organizational and preliminary research tasks for you, gleaning information from any number of sources available on your enterprise network or elsewhere in the world. All nonproprietary networks are linked to form the ultimate information repository, with private information protected from compromise by biological imprinting.

Does all this sound a bit farfetched? It shouldn't. Everything I've mentioned so far is available today, although in a more primitive form.

The Reality of the Present

Ergonomically correct furniture is already being designed and manufactured

and is available today from a variety of sources. There are desks with adjustable work surfaces to reduce the stress of repeating the same motions in the same position hour after hour, and chairs that support your posture in a way that doesn't stress your joints or muscles.

The main barrier to the furniture's widespread acceptance is the amount of nonergonomic furniture that exists in today's offices. Replacing a large number of old desks and chairs when they are perfectly serviceable, if not conducive to minimum stress, is seen as an unnecessary expense, especially in economically uncertain times.

Radiation screens are also available and have been for some years. Most of them place an emissions barrier between you and the front of your display, while others encase the entire monitor, protecting you from side and rear emissions as well. Many offices have these screens available for their workers.

The paperless office is still a dream—a pipe dream, many would say—but the basic tools are in place. We receive mail in two basic forms: on paper in an envelope or electronically on our computers. Most of us have access to E-mail in one form or another. That's half the battle.

The other half is a bit more cumbersome, but it can be, and is being, done. All mail can be opened in the mail room and scanned into the computer using optical character recognition. Then a document-image-processing program takes over and lets you accomplish electronically what you would normally do with paper. Various personal computer products are available for this purpose (see "The Paperless Office," April BYTE).

Pen-based computing is just coming into its own. Right now, the promise is still considerably better than the delivery, but it is a real promise. Pen-input capabilities are beginning to show up in hardware, applications, and operating systems (see "The Point of the Pen," February BYTE). You can't take notes that will go directly into your computer, and the technology wouldn't know what to do with your doodles, but it would know that a doodle isn't a valid word. And that's a start—a good one.

Multimedia really needs no explanation. Packages that help you create multimedia presentations abound, and the tools to create customized multimedia training programs are plentiful. CD-ROM disks such as Ziff-Davis's Computer Select and Microsoft's Bookshelf let you access mountains of information with ease.

Downsizing, or rightsizing, is the

stuff of today's MIS nightmares, whether or not it needs to be. But it is definitely under way. The concept of running applications on the size and make of machine that they're most suited to is a popular one, and it is also a primary tenet of today's distributed processing systems.

Computers are already much smaller than they used to be, and you can't go to an industry show these days without finding something touting its "small footprint." When you start talking about laptops, notebooks, and palmtops, the question becomes, "How small is too small?" Fax capabilities are already available on boards that you can plug into your computer. When you combine the technologies present in internal modems with voice recognition, the basics for having your computer replace your phone voice line are in place.

Input and Output

Voice recognition is another technology that may appear limited in its present form while showing great promise for the future. Current voice-recognition systems can handle speaker-dependent continuous speech or speaker-independent discrete speech. You can have one or the other, but you can't have both (see "The Spoken Word," July 1990 BYTE). Well, that's changing, too.

Speaking to your computer will be a major factor in the office of the future. In some locations, it is already a major factor in the office of today. Stock is traded in some brokerage houses by verbal command from the broker to the computer. And personal computer giant Apple has invested R&D dollars into voice-recognition technology for the Mac.

So, you ask your computer a question, and it answers you—verbally. We have all heard these droning, metallic computerized voices, and it takes about 5 or 10 seconds to get sick of them—a little longer if they're saying something that you really want to hear. A few of those around the office could reverse all the progress made against stress by ergonomic designs.

We can do better. In fact, we are beginning to do a whole lot better. Depending on the rate of speech sampling used and the resolution the A/D converter uses for each sample, we can already create a credible approximation of human speech with digitized sound.

Large display screens? You can get screens of up to 35 inches now, and between Barco and Mitsubishi jousting for largest monitor honors, the wall's the limit. As for color, some companies offer upwards of 16 million. Somewhere in

BYTE ACTION SUMMARY

Technologically, all the seeds for the office of the future are here today, but in more primitive forms: ergonomic designs, voice recognition, massive networks, and pen-based input. All you need is time and money—and the will to invest them in the research necessary to bring the visions for the future to life.



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that number must lie the perfect color for reducing eyestrain.

The real ergonomic disaster that most of us still have to deal with is the traditional keyboard, which is the cause of much pain and suffering in the form of carpal tunnel syndrome and other repetitive-strain injuries. Wrist rests are available to alleviate the problem, and new designs for strange-looking keyboards, *Star Trek*-style, are moving from the drawing board to the factory.

Agents and Networks

I must admit, the intelligent agent capability still sounds like science fiction. And, in its ultimate form, it is. But even the intelligent agent has already begun to take shape; for example, Ramus from Beyond (Cambridge, MA) in a full-blown implementation provides some fairly sophisticated organizational and research capabilities.

Lest you think that this is a new and rather farfetched concept, let me quote

Alan Kay, Apple Fellow and definer of the Dynabook concept, who helped to found Xerox Palo Alto Research Center. Speaking of intelligent agents, Kay says, "I did one 10 years ago. Overnight [it] dialed into 12 different news sources, like AP and Reuters, and the *New York Times* and stuff in the morning. [Then the agent] put together a custom newspaper of the articles that it thought you would most like to read. If you ever did it for yourself, you'd only do it once. It took the agent 8 or 9 hours to do [all this]. It's a perfect task for an agent." And that was 10 years ago.

I doubt if the networking capabilities in my future-office fantasy are a surprise to anyone. Enterprise networks are proliferating almost as fast as LANs did just a year or two ago. Public data networks are ripe for the dialing up and signing on (see "Select a PDN," July BYTE, page 176). And the Internet already exists, with several of the research and educational facilities on its membership rolls (see "Feeding the Internet," July BYTE). The National Research and Education Network, championed by U.S. Senator Al Gore of Tennessee, is on the drawing board (see "Whither NREN?," July BYTE).

Worldwide connectivity is already available in the enterprise networks of some major corporations (e.g., DEC's DECnet and IBM's Systems Network Architecture). Admittedly, these are proprietary networks, but they are living proof that the concept can and does work.

Reaping the Harvest

The technological seeds for the office of the future are already planted, and most have sprouted. But from sprouting seeds to a well-planned, fully blooming garden is a long way. And as any gardener will tell you, shortcuts usually don't work.

Each of these technologies will need to be watered generously with money and tended carefully with research. They must then be brought together, a few at a time at first, to see if they work in concert. Given the funding, my vision of the office of the future can become a commonplace reality—but will it?

Research is a must. Without it, my vision and the far more ambitious ones of Clarke, Velikovsky, Pournelle, and Asimov will all die of neglect. Planning for the future and putting our money into those plans is the only way to bring them to fruition. ■

Jane Morrill Tazelaar is senior editor for BYTE's State of the Art section. You can reach her on BIX as "janetaz."

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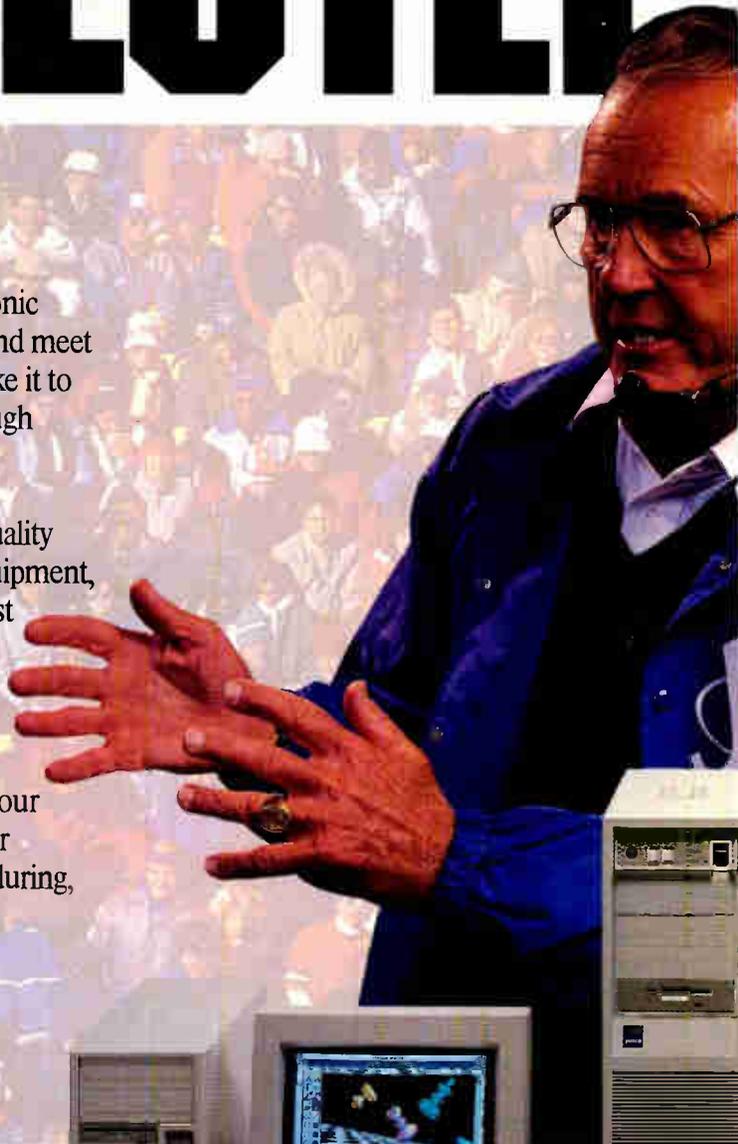
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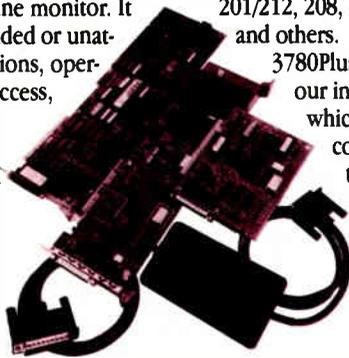
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CORPORATE CONNECTIONS

Linking LANs—those “islands of connectivity” that sprang up in the 1980s—will be the primary focus of networking in the 1990s

WAYNE RASH JR.

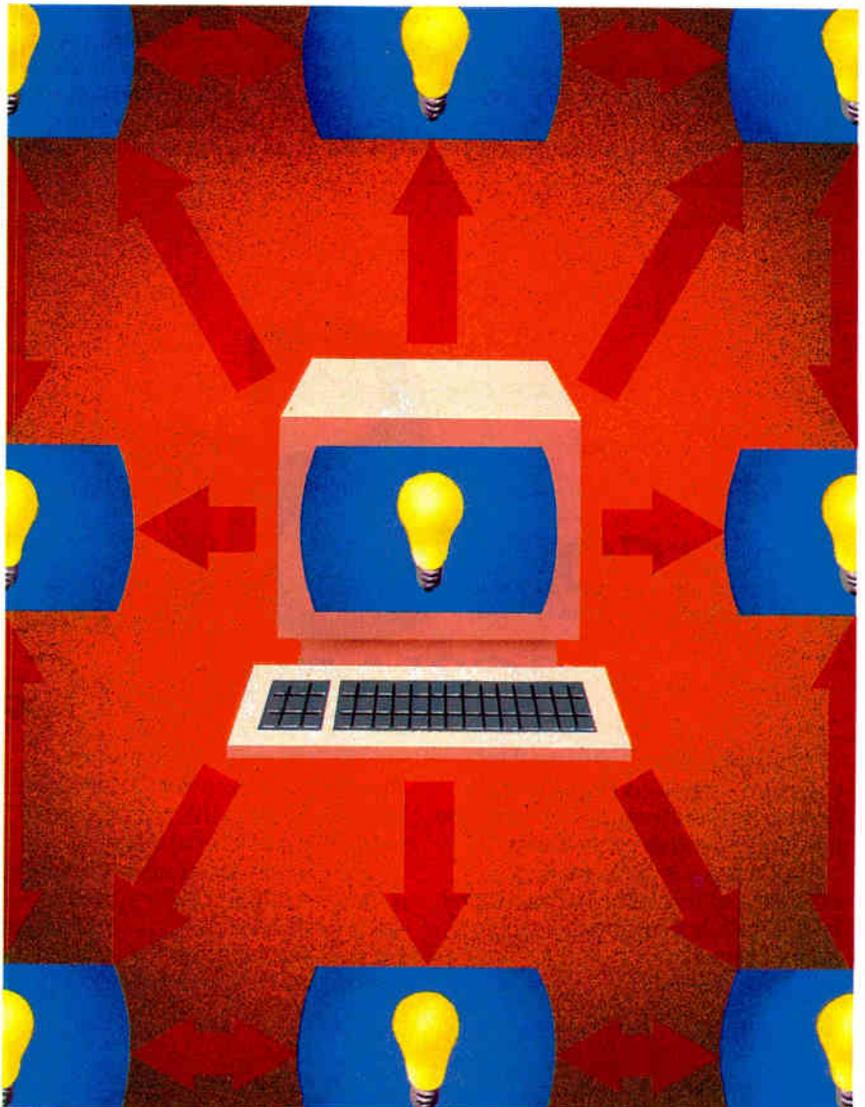
For as long as computers have been used in business, data-processing managers have dreamed of ways to integrate them into a seamless, companywide system. Originally, the vision was that such a system would consist of a gigantic mainframe swapping data with other mainframes elsewhere in the company. As it turns out, mainframe enterprise computing died an early death. It was the victim of a hardware technology—personal computing—that outstripped the ability of planners and managers (and even computer manufacturers) to keep up.

Before corporations were prepared to implement mainframe-based enterprise computing, people began abandoning centralized computing in droves. Tired of waiting years for software changes and sick of the cost of supporting huge mainframes with little return, they turned to personal computers. This movement finished any chance for mainframes to control all the computing resources in their companies. Today, however, enterprise computing is back, in the form of companywide networks.

The Personal Computer Effect

Although the introduction of personal computers was hailed by individuals, the results were mixed from the corporate viewpoint. Personal computers improved productivity just about everywhere they were installed, but it was not always clear that the improvement was worth the loss of control.

In the early days, some people who were tired of waiting for the software they needed wrote their own programs. Many of these amateurs lacked even



BYTE ACTION SUMMARY

Enterprise networks create a platform for the centralization and control of vital corporate data while providing access for people throughout an organization. Advances in networking hardware and software, database servers, and network management have made enterprise networks the perfect vehicle for workgroup computing.

changed data in ways other than expected or intended.

In addition, individuals started creating their own data and storing it on local hard disks. But most of this data was never backed up, once again placing the company at risk if the local disk should fail. This combination of unreliable programming and nonexistent data security caused managers many sleepless nights. Eventually, they turned to LANs.

To a corporation, a LAN has two attractive features beyond its obvious abilities in communications and file sharing. LANs allow some control over the company's information, because the information is stored at a central site: the file server. And LANs give managers a degree of control over what software is available to whom. As a result of these advantages, networks started springing up all over large companies.

Islands of Connectivity

As departments started to adopt LANs, they did so with their own needs in mind. Rarely were LANs adopted with any sort of strategic plan. As a result, many companies found themselves with lots of de-

partmental LANs that did not communicate with each other.

IBM describes these networks as "islands of connectivity." As useful as they are to the departments that have them, these islands are of limited value to the company as a whole. They protect the department's information, but they don't do much for organizing or protecting information on a companywide basis.

This need for companywide connectivity created enterprise networking, which has in turn helped to fuel the growth in LAN installations. Organizations of almost every size have found that they can benefit from the ability to share information across the company. They communicate more effectively, plan more consistently (because the information is more consistent), and worry less about incorrect or missing information.

What Is Enterprise Networking?

Enterprise networking is a system of organization-wide data communications that supports you and your computers wherever you may be in a company. This definition implies some important capabilities: that an enterprise network must

elementary training in programming; thus, some of the programs they wrote were terrible. A lot of the programs placed the company at risk because they



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serve all levels in an organization and that it must not be sensitive to location.

For example, if only senior management is on a network, then it's a senior management network. If only the headquarters building is on a network, then it's a headquarters network. Enterprise networking covers the entire organization or enterprise.

Because of their scope, enterprise networks have a few common characteristics, most notably their tendency to concentrate data in some form of central storage. They hold important corporate data in a common location where the data can be protected and archived so that the loss of the central storage facility will not destroy that data.

In addition, enterprise networks are ordinarily made up of groups of LANs linked by a communications medium. The exact nature of this medium depends on the company.

Note that enterprise networks need not have large numbers of users, nor do they have to span continents or oceans. Although many such networks do support a large user base and cover great distances, there are also enterprise networks that

connect relatively few users over short distances. The determining factor is the size and breadth of the company.

I know of a Mexican restaurant chain in the Washington, D.C., area that has a small LAN at each of its two locations. The LANs are linked by a dial-up line so that they appear to be a single LAN. This allows accounting reports, requests, and even recipes to be moved between the two locations. Small? Sure, but it is as much an enterprise network as Microsoft's 18,000-node network, which almost stretches around the world.

In fact, there's nothing in its definition that requires an enterprise network to exist in more than one building. It's even true that you can reach a point at which an enterprise network becomes so small that it is indistinguishable from any other small LAN. It all depends on the size of your business.

Centralized archival storage is a top selling point for an enterprise network. Nothing strikes fear into the heart of a manager more than the thought of losing valuable information or having that information compromised by allowing an unauthorized person to gain access to it.

Because enterprise networks allow you to manage corporate data centrally, they enable you to deal with these problems.

The most important element of centralized data management for most businesses is the ability to back up all the company's file servers from a central point. With individual hard disk drives, you can't ensure that backups are run, and for the most part, they aren't. It's not unusual in a decentralized scheme to find the financial information necessary to run a \$100,000,000 business scattered across a variety of \$300 hard disk drives.

Most companies use the same techniques to back up their enterprise networks that they once used to back up their mainframes: They take incremental daily and full weekly backups of all information on the network. The process can be labor-intensive, but it ensures that the data is protected. Likewise, corporate networks let you implement some means of access security, lessening the chance that the competition will walk off with company secrets.

An enterprise network, then, is a network that provides connectivity to an entire organization. It is available at all

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Enterprising Storage

Gregory G. Kenley

Ten years ago, the ISO seven-layer Open Systems Interconnection model helped standardize the logic of communications by providing a common groundwork for communications protocols. Currently, the IEEE is working to define a comparable logic for network-storage interchange. The two-year project is supposed to generate a five-layer model that will provide a structure for solving the data management problems introduced by network computing and rapid growth of on-line information.

Who Needs It?

The shift from centralized time-sharing computing to network computing is in full force. Known by various terms (e.g., client/server, workgroup, downsizing, or rightsizing), network computing provides quick response times and easy-to-use visual interfaces. That's the good news. The bad news is that the transition has introduced greater complexity into the data management process.

In many companies, individual sites now include computers from many different vendors. These sites need a centralized, integrated service for managing distributed data that permits the same degree of control that centralized computing offers.

Two economic factors are having a great impact on the management of distributed data. First, the cost of small hard disks has fallen so dramatically that providing all the local storage you

need is not a very expensive proposition. In the past, desktops, as much as workstations, were diskless for economic reasons—hard disk drives cost a lot of money. Today, diskless workstations are still around, due primarily to the lack of acceptable storage management standards.

Second, mass storage in the form of optical or tape robotic devices is most economical when you buy it with large capacities. When you replace a mainframe with a mass-storage device on a network, you need a common network service to distribute and share the low-cost storage throughout the network.

Defining the Model

The IEEE Mass Storage System Reference Model, which is currently being developed by the IEEE Technical Committee on Mass Storage Systems and Technology, provides a framework for describing the functionality required by mass-storage systems. By providing a consistent set of concepts and terminology, the reference model lays the foundation for the development of standard mass-storage architectures and interfaces. It does not dictate a specific implementation architecture.

The reference model divides a mass-storage environment into the following logical entities:

- The *Bitfile Client* presents an application-oriented storage abstraction, defining such concepts as files, images, directories, and file attributes, as well

as access control.

- The *Bitfile Server* provides the storage needed to implement the Bitfile Client's abstract view. The Bitfile Server manages objects called *bitfiles*, which hold uninterpreted data and attributes and are identified by globally unique identifiers called *bitfile IDs*. The bitfile is the core component of the reference model.

- The *Name (Attribute) Server* provides a mapping between application-oriented names and the IDs of the bitfiles used to hold the storage service's data.

- The *Storage Server* provides a set of perfect (defect-free) logical volumes that the Bitfile Server uses to hold bitfiles. These logical volumes may have associated properties, such as size and location.

- The *Bitfile Mover* is a data-movement service that the Bitfile Client and Bitfile Server use to transfer large quantities of data between logical volumes and applications. It's currently the most disputed component of the model.

- The *Physical Volume Repository* manages the physical media used to implement logical volumes. Its tasks include physical volume identification, access control, jukebox control, and physical device access.

- The *Site Manager* provides tools for monitoring and controlling the actions of the other services.

Epoch Systems (Westborough, MA) has developed the Infinite Storage Architecture based on the emerging IEEE

levels within the company, and in most cases, it provides connectivity beyond the limits of individual LANs. The enterprise network provides connectivity between departmental LANs as well as a means to access corporate resources, such as a centralized archival facility. It can also provide access to other central resources, such as a mainframe.

What's the Big Deal?

Why is enterprise networking suddenly so important? Because, although most of

the technology necessary for enterprise networking has been around for a while, it's only in the last two or three years that the technology has become an important factor in the growth of the use of personal computers and LANs in corporations. As you might expect, there is no single reason for this sudden emergence.

The most pervasive factors in the sudden growth of enterprise networking are the current economic environment and the related rising cost of labor. These elements have changed the way many busi-

nesses are organized, which affects the way you work.

In addition, after over a decade of growth, personal computers and LANs have reached a critical mass sufficient to support enterprise networking using existing equipment. And although the technological support for enterprise networking has been available for a while, some critical technologies have matured only just recently to the point where enterprise networking is now practical rather than simply possible.

mass-storage model. ISA was developed to provide reliable, transparent access to on-line storage. It was designed to provide automatic data management that requires little human intervention to permit all data to be on-line at all times and to let distributed systems enjoy the same reliability and ease of use that centralized data management systems do.

Bitfile Basics

The bitfile is the lowest common denominator in the ISA. Each bitfile is named and accessed with unique 128-bit networkwide identifiers. A name-generation service lets different storage servers create bitfiles, and it guarantees their uniqueness. Bitfiles are managed by the Renaissance InfiniteStorage protocol, which is implemented with remote procedure calls.

Higher-level network-storage services (e.g., hierarchical storage and backup) can also be implemented using the bitfile service. You can think of the bitfile service as a networkwide, logical-storage name space. And the machines that support the bitfile service are called storage servers, as opposed to file servers.

Most important, ISA provides bitfile service to all file system and database servers and services on the network, thereby creating a common storage service. One mass-storage device can provide storage for a database and a file server.

Epoch Systems has already applied this technique to very large Unix networks. Each workstation and file server runs a copy of a migration service and a bitfile client. Together, these services seamlessly integrate with existing storage services (Network File System and Unix File Systems) to provide networkwide hierarchical storage.

Mass Storage and Archiving

Volume Management and Automated Library Management services are Epoch Systems' implementation of the IEEE Physical Volume Repository. Although mass-storage robotics are very similar in most implementations, the lack of robotics standards makes integration time-consuming as well as proprietary.

A standard abstract interface for robotics integration can lower costs, reduce engineering burdens, and free you from proprietary solutions. The effects of such standards have been shown in Epoch's labs, where SCSI-2-based robotics for disk and tape products have been integrated in two weeks.

When data is archived, it is removed from your immediate reach. With the inexpensive storage that's available, it's now possible to keep all your information on-line. Keeping information accessible at all times requires new solutions to old problems—most notably, how to perform a backup and how to locate the data.

In traditional systems, the time required to complete a backup is a function of how much data is involved. Because old data is usually removed or deleted from the system, the accumulation of new data dominates backup.

ISA-based systems are just the opposite. Because information is never logically removed from the system, less-used but nonetheless valuable data soon dominates the bulk of on-line storage. The time needed to complete a consistent backup needs to be a function of the data that has changed, not of the data that must be kept on-line.

Epoch Systems developed patented baseline-backup technology to meet the objectives of a system where all information is on-line all the time. For example, baseline backup will perform con-

sistently whether the 30 gigabytes of changed information resides on a 100-gigabyte or 2-terabyte storage server.

As the amount of on-line information reaches immense capacities, it becomes more effective to constantly keep track of what information has changed rather than to periodically search the entire storage space.

The Office Is the Enterprise

The office of the future will feature human-oriented, data-intensive multimedia applications. Information created at the desktop will flow throughout the networked office. Even novice users will be creating and using computer-based information.

In such a system, you can't expect individuals to be responsible for the preservation and maintenance of office information. Offices of the future will plug into an integrated network that provides transparent access to storage services. Individual desktops will access this storage on demand, and backup and archive tasks will be automated. You will access information through your applications. It will be up to the storage services to ensure that information is reliably managed and moved on demand to the appropriate storage level.

As the workgroup concept spreads and more immediate problems (e.g., network management) recede, you will come face-to-face with the problems of storage management over a network. The IEEE model—and architectures based on it—promises to do for network storage what the ISO reference model has done for network communications.

Gregory G. Kenley is vice president of strategic planning for Epoch Systems in Westborough, Massachusetts. You can reach him on BIX c/o "editors."

The combination of economic factors and changes in the way you work is the key element in the acceptance of enterprise networking as an attractive answer to the challenges faced by corporations. The rising cost of labor affects this acceptance in two ways: First, companies must pay more for the time you work; and second, most companies are under increasing pressure to accomplish more work with fewer people. You must be both productive and flexible.

As a result, companies are finding that

they must adopt something resembling a matrix organization, where you may find your work assignments changed often. One way to make these changes easily is to form workgroups that don't require the participants to be in each other's physical presence. The corporate network's ability to support such workgroups makes matrix management possible in many companies.

In addition to changing how you work, economic forces have also drastically lowered the price of computer hardware.

Today, you can have a computer that is more powerful than the mainframes of yesteryear for less money than an electric typewriter used to cost. This revolution in inexpensive computing power is the second key factor in the sudden growth of enterprise computing.

The growth of personal computing began a decade ago, and although it started slowly, many of the microcomputers purchased by companies in the early 1980s are still in use. Coupled with the more powerful machines of today, these older

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microcomputers create an enormous base of individual-computing resources.

While this personal computer base improves individual productivity a lot, it is also a key factor in the network: It is the foundation for a corporate enterprise network. Personal computers, whether they are early models or more recent ones, all have a role to play in the enterprise network. The fact that they are already in place means that you can build the network around them.

The last key factor is a series of critical enabling technologies that make enterprise networking economically justifiable. These technologies include new bridge technologies, reasonably priced high-speed data networks, high-speed modems for dial-up use, new transmission media, practical methods of centralized data storage, and new ways to manage huge networks. Although enterprise networking is possible without some of these technologies, the arrival of each of them has made the concept more attractive.

Taken together, these factors transformed enterprise networking from an interesting theory to a process that could be achieved within a few months. Suddenly, companies had to have networks, and they had to network their entire business. Nothing less than an enterprise network would do.

New Technologies

Ultimately, the success of a technology in the computer business is dependent on two elements: First, the technology must fill an identifiable need; and second, it must be practical. The technology must be easy for companies to obtain; in other words, it must be both possible and affordable. A company also needs some assurance that it will be successful in implementing the new technology. This is why companies don't usually purchase their own communications satellites—it is certainly a possibility, but it's expensive, and success isn't assured.

The need for enterprise networking is based on the belief that it will fulfill a requirement that exists in a particular corporation. A series of technologies became available within a few months' time and in such a way that they helped to create a ground swell of acceptance of enterprise networking. Interestingly, most of the technologies involved were versions of earlier technologies that became easier to use and/or much less expensive to buy. In some cases, they expanded the use of current technology into new areas. For example, network-bridge technology changed so that the products became

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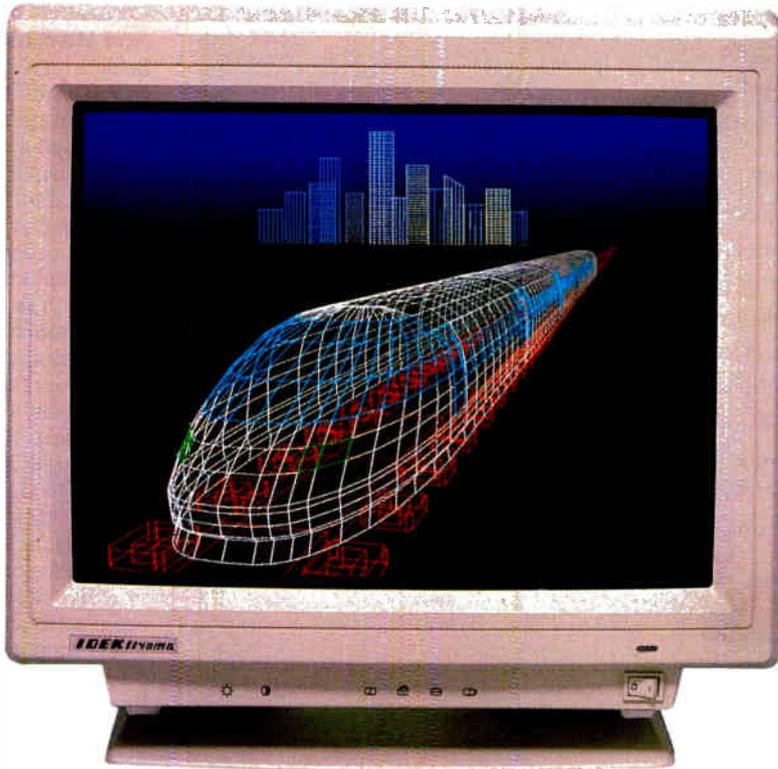


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less of an issue because most companies only need a few of them.

New Ways to Move Data

Bridges and gateways benefit from access to high-speed data communications. This is an area that has recently exploded. Once, high-speed remote data communications usually meant a Hayes 2400-bps modem; now you can achieve effective throughput at speeds of up to 38.4 kilobits per second with V.42bis modems.

Communications throughput on dial-up lines now rivals that of leased data lines. Branch offices can now establish communications with each other at costs much lower than previously. The speed is slower than a 56-Kbps data line, but in many cases, it's plenty fast enough.

Packet-switched public data networks also play a significant role in making enterprise networking function over long distances. Although it has always been possible to connect two LANs over a service like Tymnet, the results have not been satisfactory in most cases. Now PDNs support a variety of services (e.g., 56-Kbps, frame-relay, and fractional-T1 lines). So you can establish a link between two offices at a speed that provides useful throughput.

Other types of data communications are growing as well, and the growth of enterprise networking is creating a niche for them. Several companies are selling infrared lasers designed to send LAN transmissions between buildings in the same metropolitan area.

Likewise, there are several sources for microwave transmission equipment designed to be used with networks. Like lasers, a microwave connection is only useful for line-of-sight operations.

Other solutions include central-office LANs, offered by Bell Atlantic, among others. This technology lets a Centrex switch handle LAN data as well as voice telephone traffic. If that's not what you want, the telephone company will install fiber-optic cable in its phone conduits—as long as you're willing to pay the price.

Centralized Data

Changes in how data is handled have paralleled the changes in communications technology. The most significant is the growth in LAN-based database servers. Coupled with the quick acceptance of Structured Query Language (SQL) as a universal database language, these servers give companies a valid reason to use LANs for something besides E-mail and backup. In fact, database servers give a corporation much of what it had in mainframe days—control over its data—while

both less expensive and better suited to corporate use.

A bridge is a device that lets you connect two networks and operate them as if they were one. One common type of bridge lets you connect two Ethernet LANs via a T1 line so that the LANs seem to be directly connected. Other bridges let you link LANs through microwave links, lasers, or dial-up telephone lines.

Originally, bridges were expensive and/or highly proprietary. If you bought an Ethernet-to-T1 bridge, you'd pay tens of thousands of dollars and might find that it passed Ethernet packets from only one manufacturer's equipment.

Now, with bridges like the MLB/6000 series from Microcom, the bridge is an expansion card that mounts on any IBM AT compatible. This bridge passes anything that comes across the Ethernet or the Token Ring and does so over a variety of transmission media, including T1, fractional T1, or dial-up lines. You can even create a temporary bridge when you need one.

Previously, gateway technology that let your LAN access an external computer was little different from bridge technology. The gateways that were available to businesses were very limited. Cost was not so much of a factor—when you're paying \$500,000 for a

mainframe, a couple thousand dollars one way or the other for a gateway isn't much of an issue.

The problem was that mainframe manufacturers had little incentive to produce LAN gateways, so they left it to the LAN companies to develop them. Important items, such as Systems Network Architecture gateways, have been around for a while, but less popular items, such as gateways to the Honeywell DPS-6, were a lot longer in coming. Because companies wanted to make the most of their investment, they wanted the company network to provide access to their mainframes and to the personal computers. Where such connectivity was difficult, corporate acceptance of LANs slowed.

In addition, the leading LAN developers were sometimes slow in providing a wide range of connectivity. Novell, for example, is only now providing full TCP/IP connectivity. Connectivity to VAX computers through LANs is fairly recent for everyone except DEC. IBM, meanwhile, was so busy with new connectivity solutions that everyone else was caught off balance for a while.

The gateway technology has improved as well. Current technology now provides gateways that are software running on a computer on the LAN. Others are limited to one expansion card for a PC. Gateways remain expensive, but cost is

giving you the freedom you have come to expect with personal computers.

Database servers are moving beyond simply handling databases; they are becoming applications servers. Although they still store data, the queries and commands they satisfy are coming from non-database programs. These programs can be anything from image processors to spreadsheets.

Information is easier to track when it's on one database server than when it's spread over many hard disk drives on individual computers. So the company is more likely to pool information in a place where it can be accessed over a LAN, making the same information available to everyone.

Another factor in the growing popularity of the centralized data server is that it gives continued life to mainframe computers. With an enterprise network, you can access data from a DB2 database running on a mainframe as easily as you can access data from a SQL Server database running on a Compaq Systempro. The mainframe can continue to do the things it does best while the data it stores becomes available over the network.

Managing the Network

Once the network is functioning, it must be kept running. The problems encountered in operating a network are legion. They include cable faults, traffic congestion, software version control, and component failures. Until recently, managing a network meant hiring many people to baby-sit the network, offsetting much of the cost advantage of enterprise networking. Now technology can overcome this problem.

Several companies, including Cabletron and Synoptics, that make hardware have developed comprehensive network management software that works with their own hardware. A single workstation can manage Cabletron's or Synoptics' hubs, bridges, routers, or network interface cards. In most cases, these packages run under Windows or OS/2 and take full advantage of the graphical environment to make the software easy to use and the network easy to control.

In addition to supporting proprietary systems from adapter and hub makers, many manufacturers also support management systems like IBM's NetView (a mainframe-oriented network management system) and Simple Network Management Protocol. SNMP started out in Unix networking and is becoming widely accepted in the networking world. In fact, as more networking devices add support for SNMP, and as companies

that used to rely on proprietary network management add SNMP support, the industry is getting closer to supporting SNMP as the single standard for enterprise network management support.

A Bright Future

There is no question that corporations will embrace enterprise networking. As the millennium approaches, the trend toward enterprise networking will become a rush, and the rush a flood. The driving force will be the desire of companies to control their information while promoting communication among their people and making them more productive. The pace will quicken as companies discover that the return on their investment is better when they add computer capacity through networking instead of by buying more mainframe computers.

The road to enterprise networking is not open and clear, however. There is a sad lack of standards in some critical areas. (For a look at an evolving standard for network storage, see the text box "Enterprising Storage" on page 218.)

Where standards exist, many vendors insist on providing proprietary products. For example, the bridges at both ends of a communications line must be from the same vendor. You must pick one vendor for each line you use. Fortunately, the bridges that connect LANs are moving

away from these requirements.

Network management is closer to standardization. As enterprise networks expand, management becomes critical, and companies are demanding standards. By the end of the decade, all enterprise-network management solutions will probably support SNMP, perhaps side by side with a vendor's proprietary solution.

Overall, the future is bright for enterprise networking and the industries related to it. Businesses need networks that connect all their operations. These networks provide a means for using database servers, E-mail, group-productivity software, bridges to other systems, and gateways to the company mainframes.

The industry has reached critical mass in enterprise networking. The concept will spread and drive growth throughout the small computer industry. All that remains is to see how fast the growth will be and where it will take us. ■

Wayne Rash Jr. is a contributing editor for BYTE and a principal and technical director of the Network Integration Group of American Management Systems, Inc. (Arlington, VA). He is coauthor of two books for business network users: The Executive Guide to Local Area Networks and The Novell Connection. You can contact him on BIX as "waynerash," or in the to.wayne conference.

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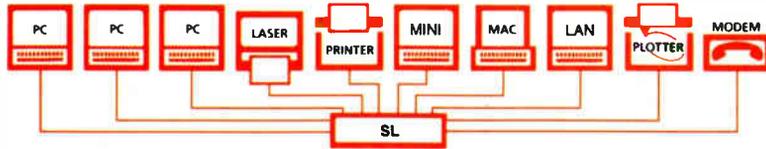
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DOWNSIZING: BANE OR BOON?

Downsizing can save money, increase efficiency, and take advantage of the unused power in personal computer networks

BOB RYAN

Want to start a fight? You could ride into the Democratic National Convention on the back of an elephant or wear a Microsoft T-shirt to the IBM company picnic. Or you could simply stick your head inside your company's MIS department and say, "Downsizing!"

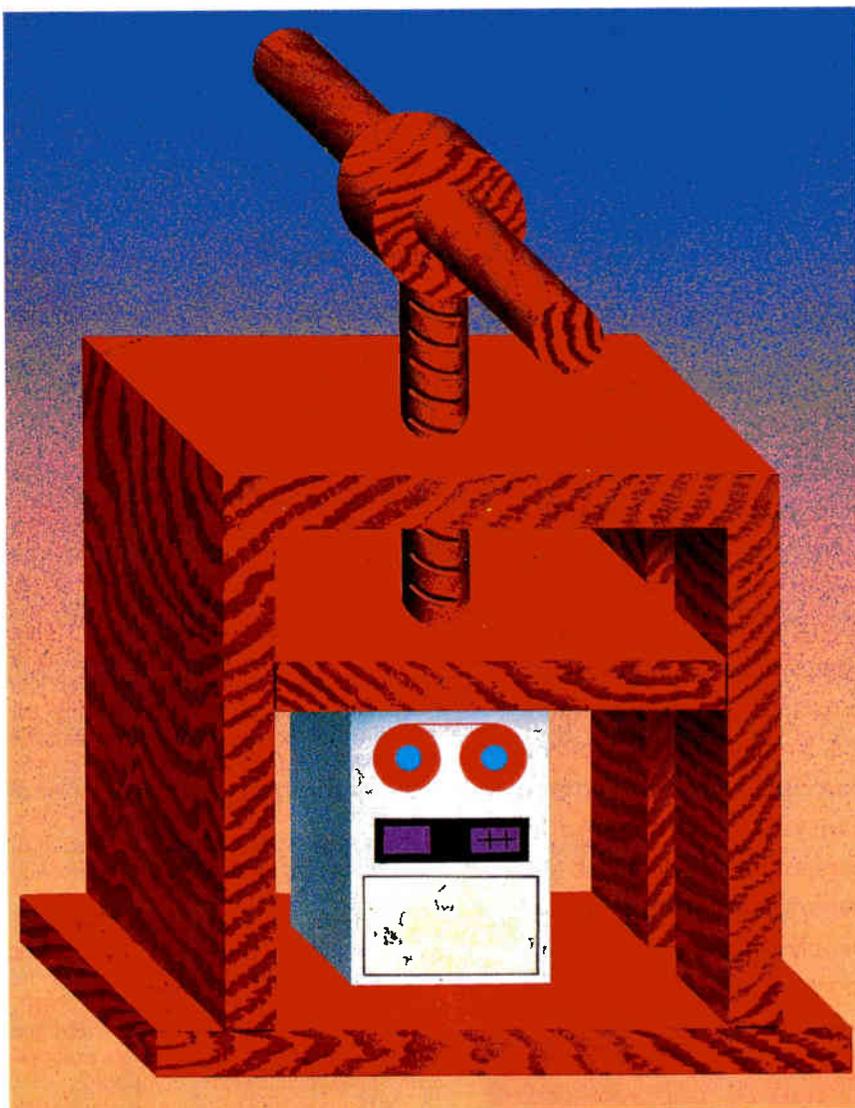
Like *multimedia* and *object-oriented*, *downsizing* has quickly established itself as a buzzword of the 1990s. It also shares with these terms the property of being pregnant with meaning and almost meaningless at the same time. Nevertheless, many people think that it is the most important trend in computing today and that it will shape the future of business computing tomorrow. So, what is it?

Defining Downsizing

Different people mean different things when they talk about downsizing. To the most dyed-in-the-wool personal computer enthusiast, it means scrapping every computer that can't fit on a desktop in favor of personal computer-based LANs. It also means scrapping the staffs that support such machines. Naturally, people in MIS are not terribly thrilled with these attitudes. In fact, many associate the term *downsizing* with these attitudes and disparage the term.

For my purposes, I will define downsizing as the migration of mainframe-and/or minicomputer-based applications to a platform that consists primarily of a network of personal computers. This definition does not imply that all applications migrate off the larger machines or that personal computers supplant any larger machines.

Most people in the industry prefer the



term *rightsizing* (moving applications to the most appropriate platform) to the term *downsizing*. But *downsizing* is by far the more flamboyant term. Consequently, it is the one that has caught on.

Companies downsize for many reasons. Some are trying to save money. Others are trying to increase operational efficiency. And still others are trying to take full advantage of their personal computers. Whatever the reason, downsizing wouldn't be practical without the convergence of a number of factors.

Building Blocks of Downsizing

The concept of downsizing is founded on three pillars: capable technology, attractive economics, and changes in the role of MIS in business. The technologies that make downsizing viable begin with processor technology. Powerful processors—such as the ones in the Intel 386/486 line, Motorola's 68030 and 68040, and the many flavors of RISC—make desktop computers today as powerful as the mainframes of 10 or 15 years ago.

Likewise, the inexorable advances in memory-chip integration and storage speed and capacity have given rise to \$5000 systems that match the capacity of the \$500,000 systems of five years ago. Clearly, the hardware available on the desktop is more than up to the task of

crunching the largest applications.

Although hardware is vital, it has been the advances in other technologies that have MIS directors thinking about downsizing. In the past few years, local- and wide-area networking have developed to the point where it is conceivable to use them as platforms for mission-critical applications.

Improvements in routing and bridging technologies and effective network management have made it simpler to connect LANs, and technologies such as frame relay and switched megabit data services make it possible to interconnect geographically dispersed LANs.

In addition to networking, the explosion in microcomputer-to-minicomputer and microcomputer-to-mainframe links makes it relatively painless to integrate desktop computers with the so-called big iron. This provides you with a way to tap into information that resides on larger machines.

Clients and Servers

A desktop machine can't tap into a mainframe database unless the machines are speaking the same language. Microcomputer-to-mainframe links and networking are only part of the solution. They provide the communications circuits, but the systems still need to speak the same language. Increasingly, this language is Structured Query Language (SQL), the lingua franca of the downsizing world.

SQL is the most popular way to construct and query databases in minicomputers and mainframes. DB2 from IBM (Armonk, NY) supports it, and so does RDB from DEC (Maynard, MA). It is also the foundation of all versions of Oracle from Oracle Corp. (Redwood Shores, CA). Therefore, SQL provides a standard method of accessing most of the large corporate databases in the world.

In addition to wide support, SQL has one other characteristic that makes it ideal in a downsizing situation: It lets you separate the application requesting the data from the application that handles data storage and retrieval. SQL lets you query a database *engine* from any type of application. All the querying application needs to do is to construct a valid SQL query; the engine handles the request and returns the proper data.

With this division of labor, the database engine is called the *back end* or server; the application that accesses the database is called the *front end* or client. Taken together, these terms describe one of the hottest paradigms in data processing today: client/server computing.

MIS takes its position as the guardian

of the corporation's data quite seriously, and for good reason. Without the controls that guarantee the coherency and validity of its data, a business would very quickly find itself operating blind, without the information its needs to make correct decisions.

The key aspect of client/server computing is that it keeps all your data in a central, controllable location (or locations) while providing access to this data to anyone who requires or merits it. Client/server computing keeps MIS as the guardian of corporate data, yet relieves it from having to be the sole provider of applications that access that data. Now applications development can devolve to the department, the workgroup, or even the individual. In fact, with many commercial applications now sporting SQL, access to corporate data can be more widespread than ever before.

Recognizing the significance of client/server computing, a host of companies are providing the hardware and software that support it. Most of the software support comes from database vendors, such as Gupta Technologies (Menlo Park, CA), Oracle, and Revelation Technologies (New York). In addition to providing SQL databases, these companies also provide connectivity to minicomputer and mainframe databases.

On the hardware side, the most perceptible evidence of the significance of client/server technology are the so-called superservers. These machines are designed to act as fast, high-capacity database servers on a LAN. Companies pursuing this strategy include NetFrame Systems (Milpitas, CA), Compaq Computer (Houston, TX), Dell Computer (Austin, TX), AT&T Computer Systems (Morristown, NJ), DEC, Parallax Computer (Mountain View, CA), and Tricord Systems (Plymouth, MN). Superservers are important in downsizing, because in many cases they can replace departmental minicomputers. It is estimated, for example, that 20 percent of Tricord's sales are related to downsizing.

While client/server databases usually present data that appears logically to reside at one location, the reality can be quite different. Advances in distributed database technology now make it possible to store the pieces of a logically coherent database in different physical locations. Thus, you can store the data used most often by dispersed departments at the local sites without losing the view of the database as a logical whole. As it turns out, the language most often used to define a distributed database is—you guessed it—SQL.

BYTE ACTION SUMMARY

Whether you call it downsizing or rightsizing, it is the cause of many nightmares among MIS people. Justified or not, they fear losing control of company data. Downsizing's purpose is to move applications to the most appropriate platform, whether it's a mainframe or a microcomputer, not to replace everything with personal computers and demolish MIS departments. Better use of people, machines, time, and money is the intent, if not always the result.

Money Matters

Even with all the technology in place, downsizing wouldn't be attractive if it couldn't save an organization a lot of money. Personal computers on a price/performance basis have always been far cheaper than larger systems, with the gap widening every year. It's only been in the past few years, however, that personal computer networking technology has evolved to where it's possible to take advantage of the cost savings inherent in downsizing. Given that the saving exists, there are still many reasons why companies prefer not to downsize.

The most important reason for this is that companies do not want to lose their enormous investments in mainframe and minicomputer technology. As a result, many companies defer any decisions on downsizing until they reach the point where they have to upgrade or change their current environment. Then downsizing becomes a viable alternative to continued investment in mainframes and minicomputers.

The New MIS

The final pillar of the downsizing concept is the changing definition of MIS in the corporate world. For 30 years, the job of MIS has been to centralize and direct the use of computer assets in the corporation. Corporate computing decisions were driven by MIS; if an application or platform didn't fit the needs of MIS, it wasn't implemented.

When the IBM PC arrived on the scene in 1981, it did not greatly upset the order of things. For the most part, the tasks it performed fell outside the purview of MIS, so it was tolerated, if not welcomed. That view changed as personal computers and personal computer software became more powerful. The great advantage of combining sophisticated spreadsheet models with data from the corporate database became obvious.

Naturally, MIS departments were reluctant to permit widespread data access by programs they had not developed, fearing for the integrity of the data the corporation needed to function. The result was an impasse that still exists today in many organizations.

However, some MIS organizations began investigating how they could provide wider access to corporate data without compromising its integrity. A few years ago, such a search might have been fruitless, but today it is hard to miss the technologies that permit such access.

Downsizing is often initiated outside of MIS—whether by individuals desperate for access to corporate resources or

by chief financial officers desperate to save on capital expenditures. But a new kind of MIS department is needed to make downsizing work, one that embraces the concept that the data it guards does the most good when it is made accessible to as many people (with a legitimate need) as possible.

The Case for Downsizing

Fred Meier *knows* downsizing. As manager of system architecture at Gates Rub-

ber, he is instrumental in moving much of the processing performed by the Denver-based manufacturer from large systems to Novell-based LANs. "We have an IBM mainframe and a fleet of IBM 8100 distributed processors," says Meier. "The fact that the 8100 is being discontinued was the catalyst [for the downsizing efforts]. We had to select another platform. As it happened, LANs and micros came together at the same time, so we jumped on the LAN bandwagon."

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According to Meier, Gates hopes to replace its 8100s with LANs from Novell by 1995. But the company's downsizing strategy does not include eliminating the mainframe. "Many people believe downsizing means the elimination of the mainframe, and we don't agree with that definition," says Meier. "We have way too much money invested to eliminate the mainframe. Our mainframe will be another server. We thus preserve our investment in the mainframe."

Meier is more comfortable with the term *rightsizing* than with the term *downsizing*. "We'll let processing evolve to the right size," he states. "I don't want to imply that we want to get rid of the mainframe; it's a beautiful thing [when] used properly."

"We'll always have some things that we will run on a central processor," Meier says. "I don't necessarily mean a mainframe, but we have a lot of things we want to run centrally. Our company is centrally controlled and centrally planned, so we want to do all of our planning and invoicing and accounting centrally. Today, and maybe for a long time, the mainframe seems to be the proper

platform to do that central stuff on."

John Cummings of Turner Construction is also building a system that reflects how his company works. Based in New York, Turner is the nation's largest general contractor. Much of its work takes place in field offices, which track the progress and costs of projects.

In 1985, to reflect the distributed nature of its business, Turner made the strategic decision to depart from an unresponsive and difficult network of 25 IBM Series/1 minicomputers connected to an IBM 4341 mainframe and implement a series of networks using Vines from Banyan Systems (Westborough, MA). The networks are connected via a Banyan Wide Area Network. Turner uses Advanced Revelation from Revelation Technologies to implement applications once handled by the larger systems.

According to Cummings, the mainframe at Turner will soon be expendable. "We're currently in the process of bringing the final applications off the mainframe... payroll and HR [human resources]," says Cummings. "The hardest part [of downsizing] is getting the final large applications onto the net."

The Old and the New

While Gates and Turner are actively migrating applications from large systems to personal computer-based networks, Joe DeRiggi takes another angle on downsizing. As director of systems development at the accounting firm of Peat Marwick, DeRiggi isn't migrating existing applications to personal computers and networks.

"Downsizing is probably not the correct term for what we're doing," says DeRiggi. "We are developing on networks and PCs what we would normally have developed on the mainframe." According to DeRiggi, 50 percent of new development at the company is targeted at personal computers and networks. These applications are traditional data-processing systems (e.g., accounts receivable and payroll).

Like Turner, Peat Marwick is implementing a distributed-processing strategy. "A great many people mistake distributed processing for decentralization," says DeRiggi, "but you can really have a highly centralized organization with a distributed system. It is just a question of maintaining control over the

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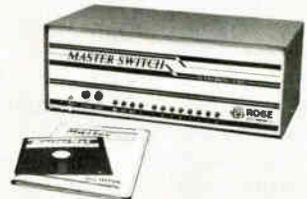
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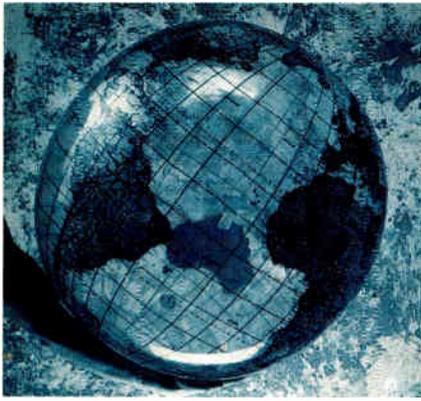
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DOWNSIZING: BANE OR BOON?

systems and standards."

"We still have the mainframe here, and, basically, everything gets consolidated here," DeRiggi continues. "Much of what we do is still done here, and these other things [personal computer-based networks] are subsystems of that. We'll always have a consolidation ability here; we'll always maintain control over the whole procedure—we develop all the network software here; we retain the code; we distribute executable modules. It's not as if we are totally decentralizing the organization. We're just distributing the processing."

The Effects of Downsizing

Depending on your point of view, downsizing is either a blessing, a curse, or something in between. According to Paul Zorfass, an analyst for IDC, "the effects of downsizing [on mainframe and mini-computer makers] have already shown up. IBM and DEC are not getting the growth they are used to in big systems. The user base can't absorb products as rapidly as before."

Zorfass thinks that this change is a consequence of a desire "not to add to mainframe capacity." Meier concurs: "We told our management that we were going to try hard not to increase the capacity of our mainframe." Such strategies will directly affect the companies that supply large computer systems.

The effects on companies that adopt downsizing can be far-reaching. It can mean an end to the long wait for applications from MIS. More important, according to Zorfass, is the fact that "users want control of the organization responsible for the operating systems they rely on for access to data, future growth, and application programs."

Meier says downsizing will "radically affect the end user" at Gates. "Not only are we changing the hardware, but we're changing our philosophy of what DP is. Our strategy is to eliminate the central [MIS] staff as we know it today. There will probably be more programmers than ever, but they will be working in the end-user departments or at the divisional level, not at the corporate level."

One of the big effects of downsizing is to expand the role of MIS in directly supporting individuals. As more companies see the strategic value in giving more and more people access to information, MIS will have to figure out how to support all of them while maintaining the integrity of the corporate database.

Zorfass sees downsizing as one way to "partition MIS into more manageable and cost-effective units." He further

states that much of traditional MIS is "not anxious to have that happen."

One reason may be that MIS is reluctant to part with the type of service that comes with big iron. As Meier says, "[Downsizing] is a brown-bag, roll-your-own operation. If you go into it with the mentality that, 'OK, I've got a problem, I'm going to call the supplier, and he'll send three people to fix this,' that won't do. You have to do it yourself."

Not all MIS organizations oppose downsizing. In many companies, it is the MIS department that is actively pursuing it. According to DeRiggi, at Peat Marwick, "the drive came from the MIS department." Of course, he adds, "I realize that that is atypical." If desktop technology continues to expand the range of solutions it makes available, Peat Marwick might not be atypical for very long.

One effect that everyone concerned with downsizing agrees on is that it saves money. "In constant dollars, it will save money," says Meier. DeRiggi is more specific: "We spent about a million and a half dollars over two fiscal years to equip up for five years. Any one of these [software] systems would have cost many millions more to do in the traditional way."

Scope and Future

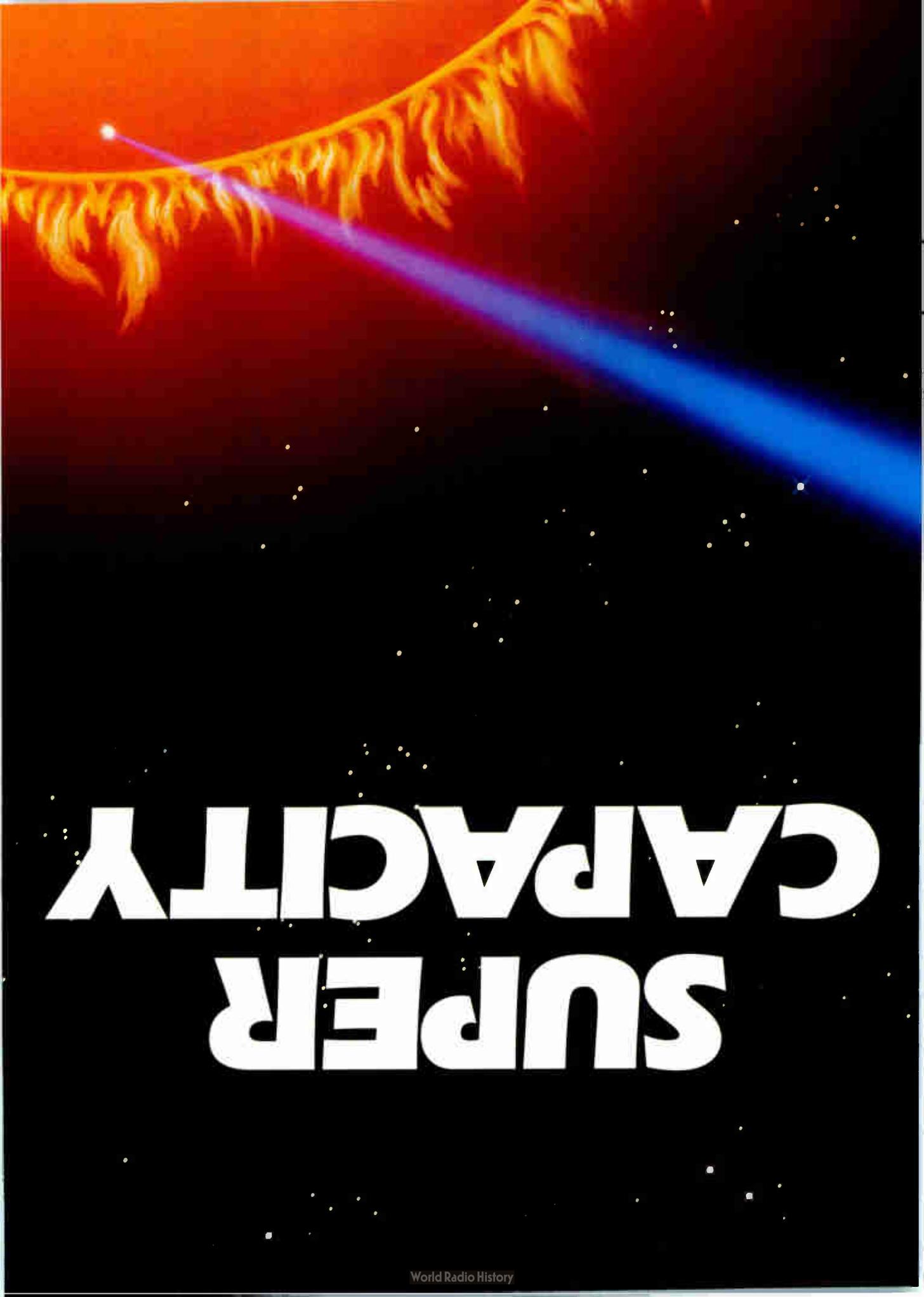
Putting a number on the downsizing phenomenon is impossible at this date. As Zorfass puts it, "there are no good numbers." DeRiggi thinks that companies actively downsizing are "still a very small minority, primarily because the world tends to resist change."

Although DeRiggi sees many MIS organizations adopting personal computers and networks as a development platform, he does not see many using them as a production platform. However, while it may be a minority, the number of companies pursuing downsizing will undoubtedly increase. As Zorfass says, "A lot of companies don't want to admit that they are thinking about it, but I'm sure it comes up in every meeting where users talk to the mainframe shop."

Will downsizing eventually lead to a world without mainframes? Perhaps, but that's not the point. Downsizing is about having your applications run on the appropriate platforms, be they mainframes or microcomputers. When that happens, everyone in the organization—management, users, and MIS alike—will get the maximum benefits from their computer systems. ■

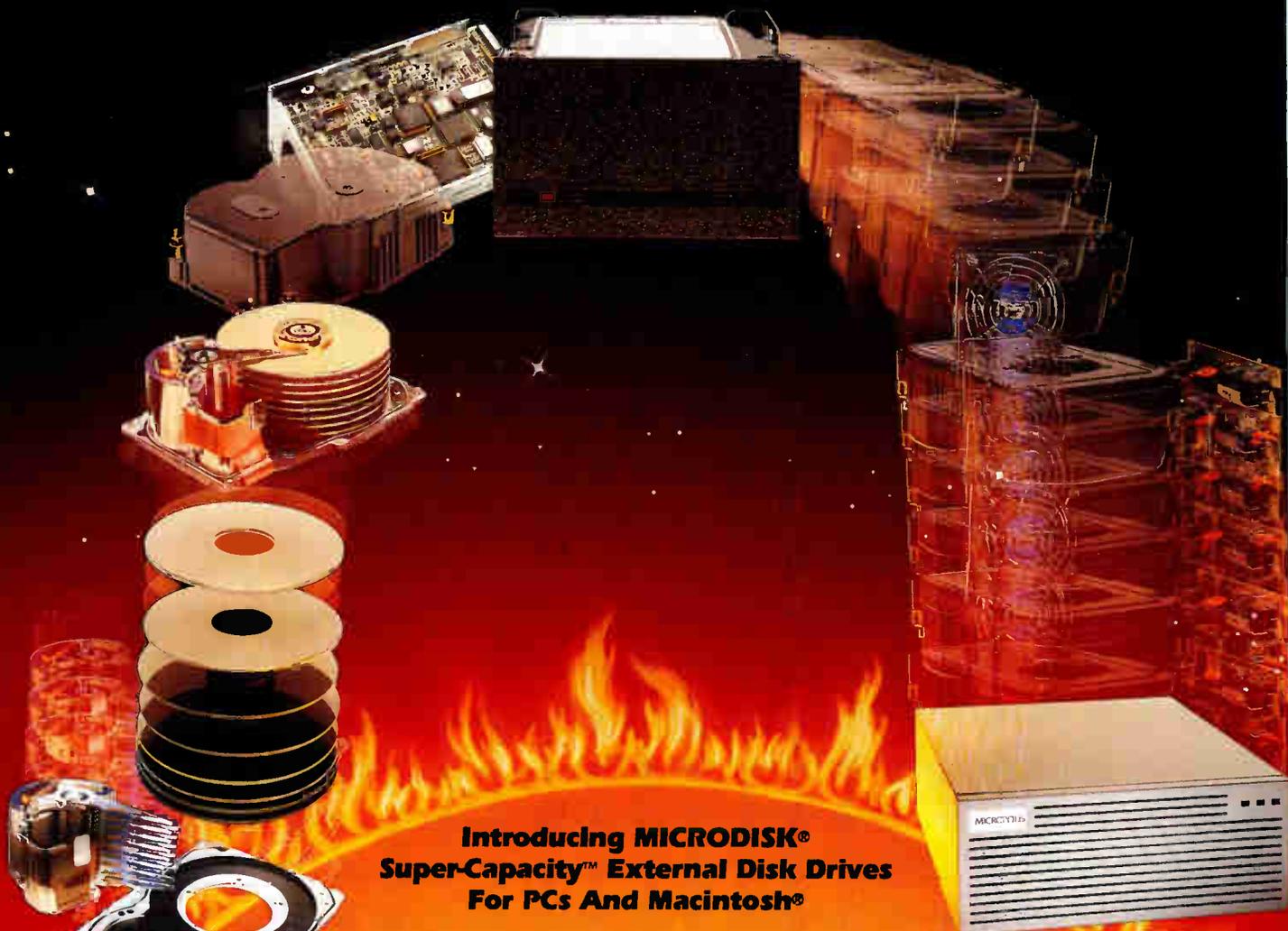
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IS AMERICA LOSING ITS EDGE?

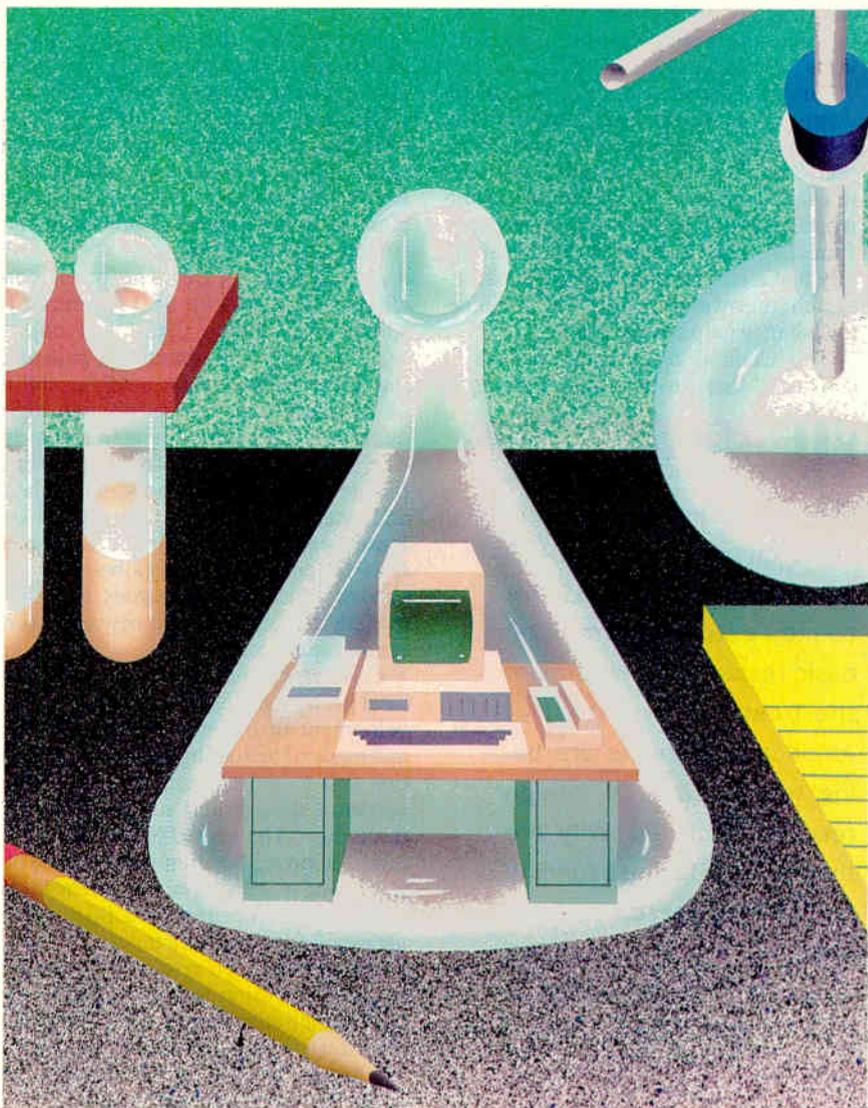
Basic-research labs, long a strong suit for the U.S., are becoming scenes for international competition

ALAN JOCH

On a 21-acre site near the campus of Princeton University, Japan-based NEC is quietly hiring senior-level scientists from U.S. research centers to produce the next breakthroughs in parallel computing, advanced software, and AI. The current staff of 35 scientists is small in comparison to the storied American research centers, like IBM's Yorktown Heights facility, Xerox's Palo Alto Research Center (PARC), and AT&T's Bell Laboratories. But Dawon Kahng, president of the NEC Research Institute, envisions that his staff will soon grow to 60 scientists and will include some of "the brightest young researchers in America." Kahng declines to reveal the institute's research budget or salaries for scientists, but there are some reports that put the latter at 30 percent above comparable university figures.

Even as the U.S. has forfeited market leadership in commercial sectors like ICs and display technologies, its strong suit has continued to be the quality of its research centers and the scientists who staff them. So, for some, recruitment of America's brightest by NEC, Matsushita, and others symbolizes a threat to U.S. dominance in the offices of the future. But for others, like Dr. Michael Harrison, professor of computer science at the University of California at Berkeley, the Japanese centers represent a challenge for U.S. companies to better support homegrown technologies. "For the most part, the Japanese centers are good. They mean new money is coming in to fund research," says Harrison, who has helped to recruit scientists for Matsushita.

continued



Research Erosion

Threatening or not, the Japanese and the Europeans are showing an increased appreciation—and funding support—for basic research in computer hardware and software, while at the same time U.S. computer scientists, White House advisers, and lawmakers warn of an erosion of American research leadership.

“The amount of fundamental research in this country is way beyond what’s going on in Japan, but in the last couple of years, a lot of big Japanese companies have started experimental-research centers,” concedes John Seely Brown, director of Xerox PARC. “This is significant because fundamental research is the competitive asset of the United States.”

“The trends are running against us,” adds Daniel Burton, executive vice president of the Council on Competitiveness. “Having established themselves as players in a lot of the components markets, our [foreign] competitors are now moving up to the large systems and into software,” Burton adds.

The next decade could bring stronger competition. European economic consolidation next year will mean consolidation of R&D funds, and Japan continues to challenge the U.S., thanks to its ability to marshal private and government funds. Although Japan hasn’t traditionally had a strong reputation for basic research, recent efforts like NEC’s Princeton lab may help change that.

The Council on Competitiveness is convinced that America is still strong in

technologies that don’t require large capital investments after the research stage. For example, the U.S. has recently lost ground in display technologies, because of insufficient investments in underlying technologies, and in optical-storage products, which have high capital needs over a long period of time, according to Burton. “Had we acted differently 10 years ago, we’d be strong or competitive in these technologies today,” he adds.

Earlier this year, the National Critical Technologies Panel, composed of scientists and businesspeople appointed by the White House, issued the first of what will become biennial reports on strategic technologies. It concluded that American leadership has been lost or will be severely challenged in seven critical computer technologies that could determine the economic and military viability of the U.S. in the years ahead. The NCTP report identified the following areas:

- *Massively parallel processing.* Saying that today’s supercomputer is tomorrow’s desktop system, the NCTP concludes that the U.S. no longer “has a clear lead in nondefense supercomputing applications.” It notes that Japan’s Ministry of International Trade and Industry plans to launch a parallel-processing development project next year.
- *Advanced software.* The panel concludes that writing the next generation of software (including CASE and object-oriented programs) remains a painstaking, labor-intensive task, and the ability of American industry to provide high-quality, reliable software is in jeopardy. The NCTP points to software problems that resulted in cost overruns, delays, and operational failures in critical defense systems. Although the U.S. controls 60 percent of the global software market, Japanese companies are challenging that position with new code-generating operations.
- *Computer simulation and modeling.* This area is becoming integral to the development of defense, manufacturing, and medical technologies. Better simulation and modeling techniques hinge on software design and hardware breakthroughs. “The United States has maintained a strong position in software, but it is losing its edge in certain areas to the Japanese, Europeans, and third-world nations,” the panel concludes.
- *Data storage.* To retain its leadership in the \$50 billion storage industry, the U.S. should step up research in thin-film recording-head transducers and recording media, as well as holographic elements for optical-storage systems.

The economic stakes are high. Computer hardware and software represented 10 percent of the entire U.S. GNP in 1988. The NCTP notes that growth or contraction in computer technologies has a ripple effect throughout the American economy. Many current computer jobs represent the fruition of basic-research projects that began decades ago, so deficits in today’s research may not have their full impact until the next century.

Hybrid Research

Tomorrow’s products will spring from a variety of research projects. Some breakthroughs will come as a result of university and corporate theoretical work performed without thought of commercialization. Other technologies will result from applied research carried out entirely for commercial advantage.

As public and private research funding becomes tighter, hybrid approaches are increasingly common, such as Stanford University and Silicon Graphics’ joint work on large-scale multiprocessors or the University of California at Berkeley and DEC’s Sequoia 2000 project.

Scientists at Berkeley, Stanford University, and Xerox PARC agree with the White House report’s assertion that massively parallel processing is one of the most critical areas for the 1990s. “From a research perspective, it’s far and away the hardest problem we’ve had to tackle in the last 10 or 20 years in computer science,” says John L. Hennessy, a Stanford University computer science professor who carried out pioneering research in RISC and later founded Mips Computer Systems. “The flip side of this is that the performance gains could be of a comparable magnitude.” He adds that parallel processing is a perfect candidate for research centers because it requires long-term efforts and crosses many computer science disciplines.

Hennessy’s list of critical technologies would also include more research emphasis on portable computing, advanced user interfaces, and “all the things that make the Dynabook vision” a reality. “This will be absolutely critical to deciding what computing will be like in the next decade.” His current work involves building a large-scale multiprocessor that’s flexible, easy to use, and uses shared-memory programming. “We are attempting to say you can build a machine that uses a shared-memory communication mechanism at a scale beyond what people have anticipated could be built,” Hennessy explains.

At Berkeley, Harrison’s research is now focusing on programming-language

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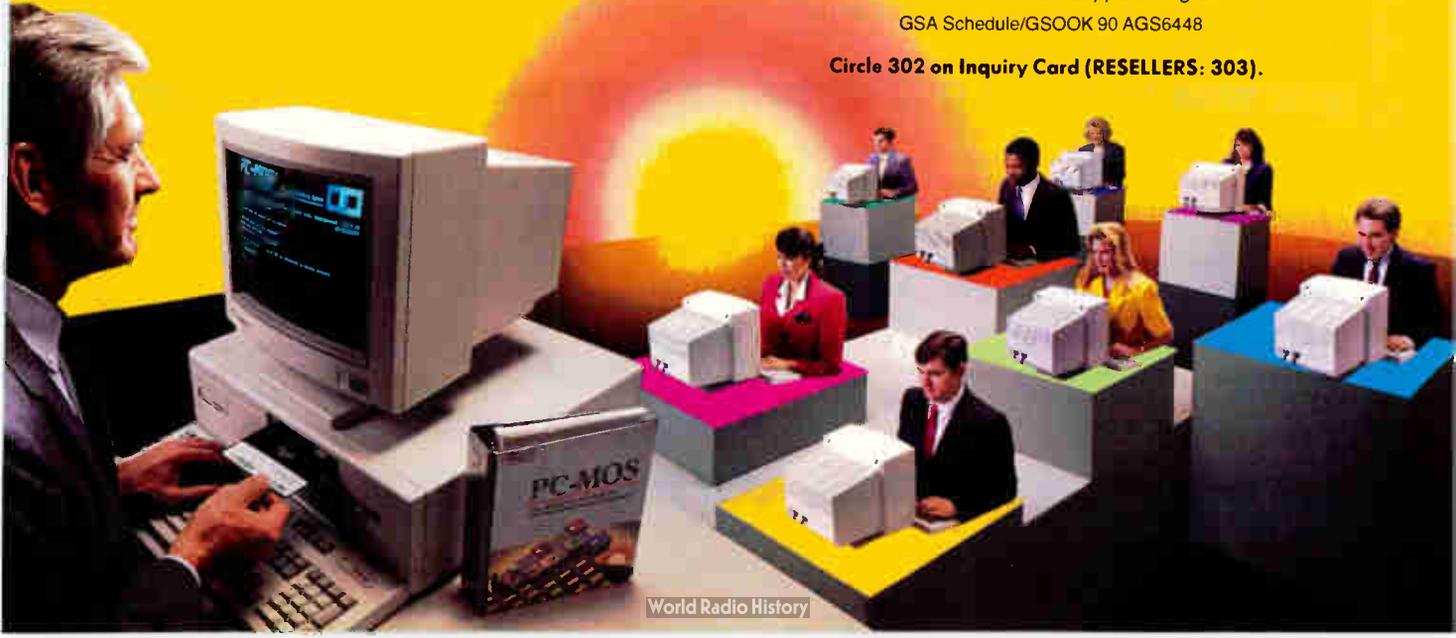
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environments that create composite multimedia documents built on top of object bases. "We think that in one to three years we'll have something that can be used by the CASE industry or for next-generation document systems."

Funding Vagaries

Projects now being funded or considered for support by the federal government address some of these strategic areas. The U.S. spends \$500 million annually for high-performance computing R&D.

The High-Performance Computing Act now pending in Congress calls for a nationwide network of supercomputers and digital libraries. The Bush administration favors spending \$92 million in the next fiscal year for such a project. The White House has also called for \$36 million to fund a Department of Commerce program for advanced, "precompetitive" technologies, which includes some computer-related segments.

But as of 1988, only 0.2 percent of the U.S.'s R&D budget went to industrial, nondefense-related projects. Japan and West Germany allocated 4.8 percent and 14.5 percent, respectively, of their R&D

budgets for the same type of projects.

The federal government disburses significant portions of its research budget through the Defense Advanced Research Projects Agency (DARPA) and the National Science Foundation. But researchers say acquiring funding through these programs can be a complicated process.

In the case of NSF, proposals undergo peer review, which often works against truly innovative projects. "The really far-out idea doesn't necessarily get through the review process," says Berkeley's Harrison, who is also a principal in Cayenne Systems.

Harrison believes that DARPA funds more innovative work. But the agency is understaffed, and its own budget is often late. "Even if you do get money from DARPA, you often have to raise additional funds from other sources to cover you during gaps when DARPA is too busy to respond to you," he says.

These funding vagaries discourage some scientists. C. William Gear, formerly of the University of Illinois, says that the prospect of having consistent research money helped motivate him to become vice president for computer re-

search at the NEC Research Institute. He observes that Japanese firms have a history of long-term vision and stamina in research.

But sparse funds aren't the only problem. Scientists say support by American corporations is on the decline because of too much emphasis on short-term profits and a lack of vision. "In some cases, there's an inability in corporations to see how the mission of the research lab ties into the long-term success of the corporation," says Hennessy.

"Maybe the technology transfer job [of moving from a research development to a commercial product] hasn't been done adequately. Sometimes it's hard for a company to transfer technology from its research lab to a [commercial] division. Technology can sometimes be spun out to a start-up company more easily than to another division of a company," Hennessy believes.

Others blame undue conservatism at the university level, which draws support to ongoing research at the expense of innovative projects. "A fair amount of university research is stuck within a rut," says PARC's Brown.

continued

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Japanese Efforts

By contrast, Japan's scientists are becoming better trained, and their government and corporations fund more basic-research programs. Gear says that Japan's reputation for tightly controlling dissemination of its technology developments is not because of strategic concerns. For years, "they had little worthwhile to report," he says.

A commitment to basic research is the main element of the NEC Research Institute's charter. NEC's Central Research Laboratories in Tsukuba, Japan, focus broadly on a wide range of basic and applied industrial research. The Princeton facility focuses on fundamental knowl-

edge basic to future computer technologies, according to NEC's Kahng.

The results of efforts like these are beginning to pay off for Japan. "Over the last six to eight years, Japan has gone from being a follower to becoming a leader," says Harrison. "It has spent money on ambitious projects, and they're definitely starting to take a leadership role. They've certainly made important contributions in logic programming and chip technology. They're still way behind in software, but they're starting to tackle the big projects."

Nevertheless, most of these Japanese efforts are small by American standards. Researchers see the Japanese centers as symbols of an increasingly competitive world market for ideas rather than a direct threat to the U.S.'s strategic position. "How can companies face this challenge? Finding better ways to work with universities is one way," says Hennessy.

Harrison, who participated in setting the charter for a Princeton-based Matsushita research center, says that company plans to have an open lab, where individuals can freely publish their results. "Naturally, if a [competitive] advantage

can be obtained, the sponsor will first try to lock that up [with a patent]. But that's nothing different than what IBM or Bell Labs would do."

Harrison adds that he is not worried that innovative ideas from American scientists will enhance Japan's position. "The universities have been where the breakthrough ideas in computer science have come, but we find that many American companies are somewhat indifferent to the work that's going on there."

"The Japanese companies are benefiting from this work. If any fault is to be found, it's with the American companies that aren't looking at what's being done with our tax dollars in our own backyards. It takes a real effort for the Japanese to go through the language barrier, take the ideas back to their companies, assimilate the ideas, and then use them. The Japanese are making an effort to do that; many U.S. companies are not," states Harrison.

Marinating Research

As to the future, the implementation of the High-Performance Computing Act gets high marks from researchers. "It's

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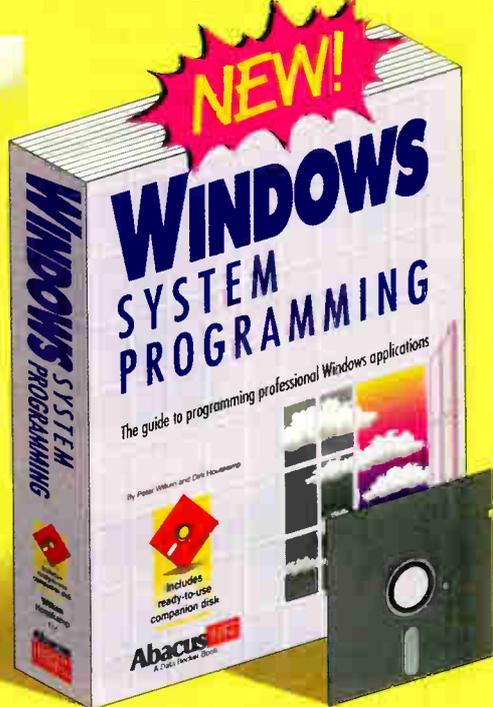
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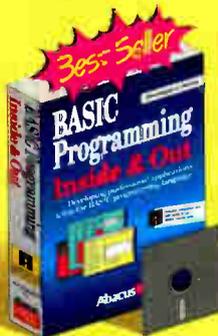
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IS AMERICA LOSING ITS EDGE?

one of the most important things going on in Washington, from my perspective," says Harrison.

Brown believes that more "marinating" of theoretical research with real-world business concerns is important to future developments. If it does not relate to the real world, "there's no point in doing radical research," he says. Brown advocates close ties between theoretical researchers and corporate managers who jointly decide on projects, goals, and development processes.

"The responsibility is ours to show that our research will have an impact. If researchers traffic in real problems, they will understand how to go to the jugular of the problem. Then they should be able to think radical thoughts on their own terms. Innovation comes from tackling real problems, like physics did at the turn of the century. I'm not backing away from theoretical research—I'm just saying that the work has to be informed by real problems."

Brown says that 10 years ago some researchers at PARC only gave lip service to real-world problems. "When we investigated AI, we didn't marinate problems into the real blood of our examples. The trend now is to take the world more seriously." He believes this kind of approach can be more beneficial to research than having a federal policy that prioritizes technology developments.

"We don't need the federal government to tell us what's important. We need honest reflection about what problems really matter. I personally favor having each research group take a hard-headed analysis and decide if its work really matters. This requires some soul-searching and soul-wrenching analysis. You might realize that you have spent the last five years pursuing a problem that no longer may be a significant problem. Not that the problem has been resolved, but the world may have shifted."

But at What Price?

Increased competition or not, the U.S. remains the leader in research. "Pockets of research excellence exist, and given the appropriate support, they will continue to do so," says Hennessy. He adds that support for science education is crucial for future competitiveness.

But more and more technology will come from abroad, no matter how strong the U.S. is. As Burton says, "It's not all Route 128 or Silicon Valley anymore." ■

Alan Joch is a technical editor for the BYTE Lab. You can contact him on BIX as "ajoch."

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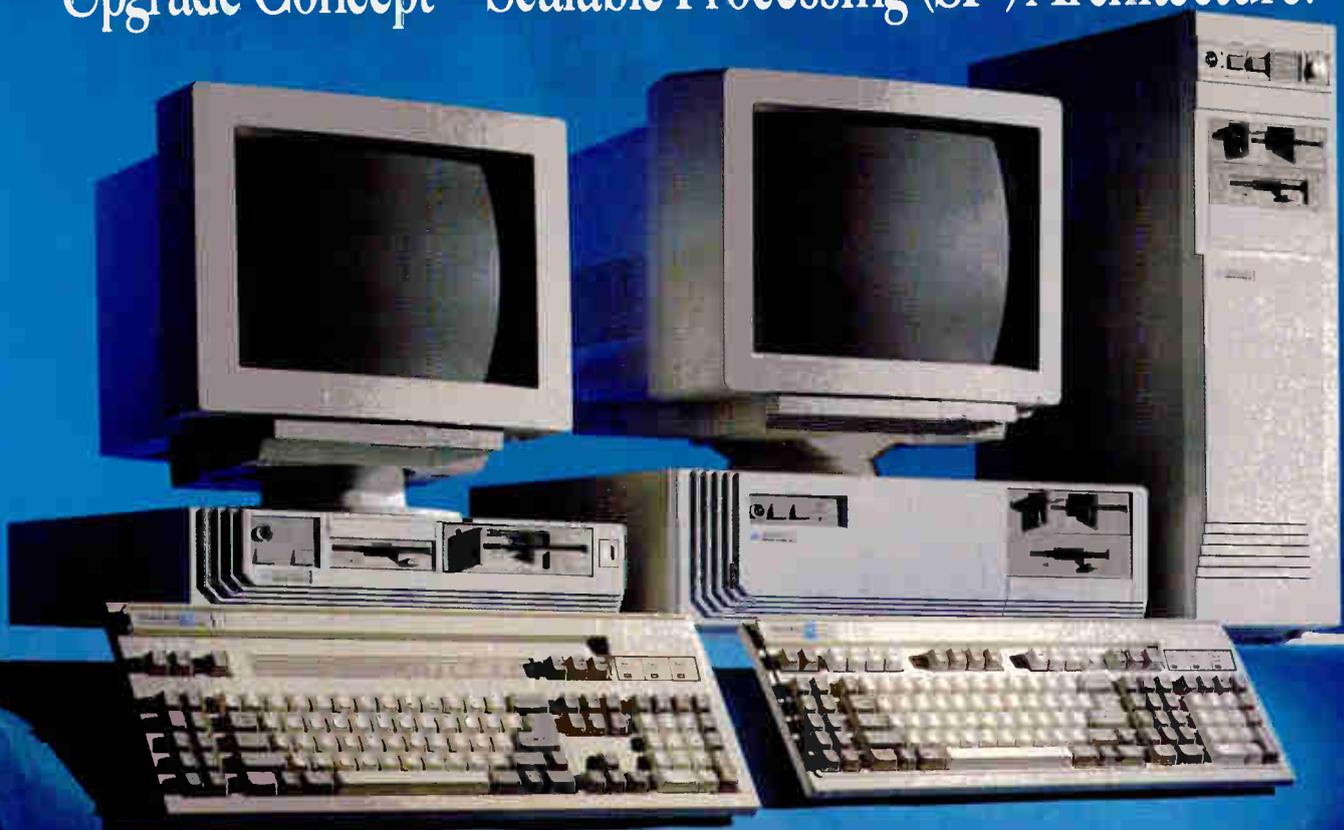
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Suppose you started out with a 386/25 MHz system. This module delivers that power and performance in your choice of SlimLine™, Elegance™ Desktop or Elegance Vertical Power Platforms. Want to Upgrade in the future? We'll buy your 25 MHz module back and send you the more powerful upgrade module. Every power module has 64K RAM cache included ... all for an unbeatable price!



Upgrade to 386/33:
send us your 386/25
module and ONLY \$349⁰⁰



Upgrade to 386/40:
send us your 386/25
module and ONLY \$649⁰⁰

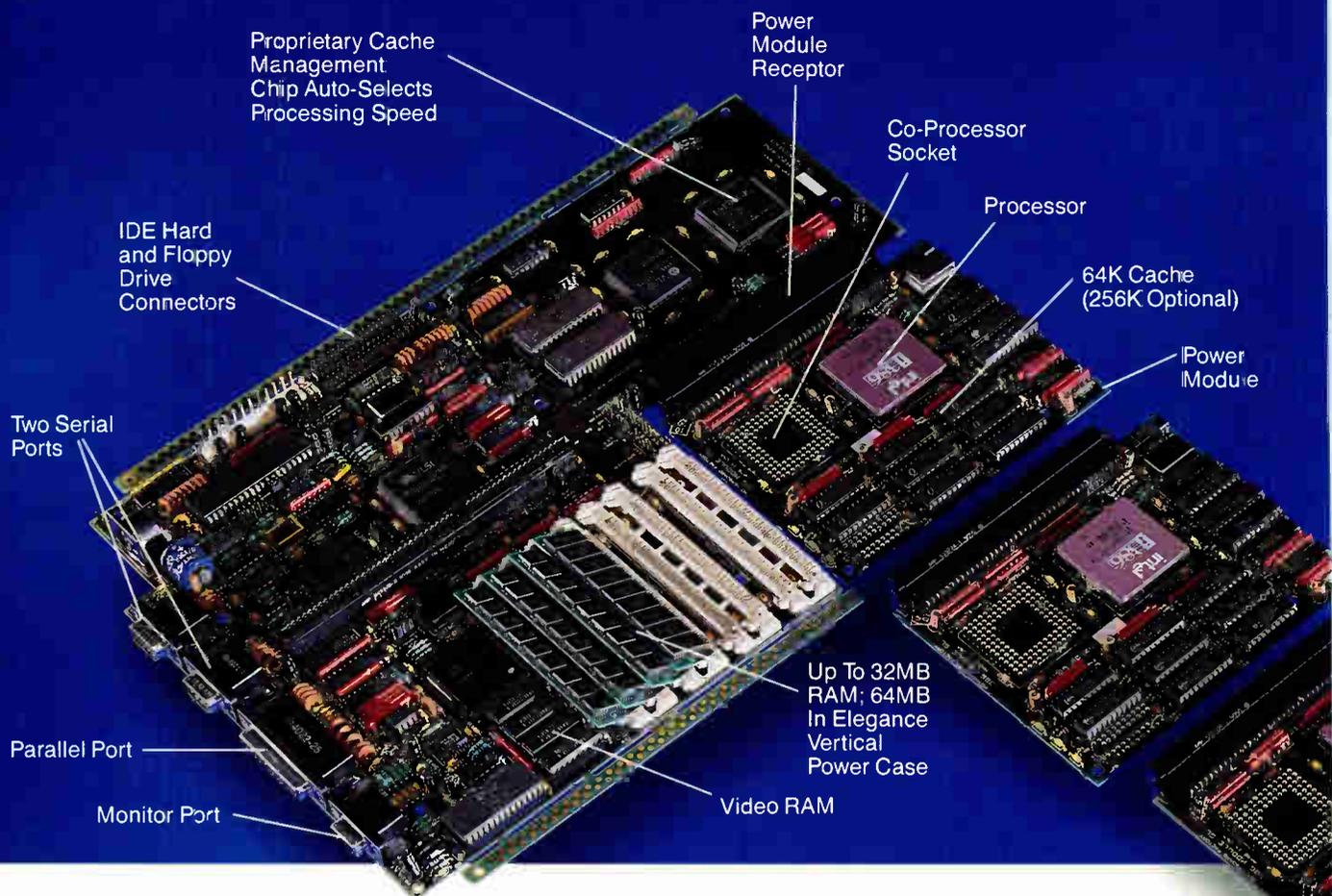


Upgrade to 486SX/20:
send us your 386/25
module and ONLY \$749⁰⁰



Upgrade to 486/33:
send us your 386/33
module and ONLY \$999⁰⁰

Now! Northgate Smashes The Upgrade Cost Barrier!



Here's How Scalable Processing (SP) Architecture Works!

The challenge facing our R&D department was: Create a total system concept that makes on-site upgrading fast and affordable while maintaining award-winning Northgate performance.

Northgate did it! Our engineers designed the SP Main System Board (see photo) with a slot where one of five power modules — including cache and coprocessor socket — easily plugs in. 64K cache standard (256K optional).

A proprietary Cache Management Chip on the Main System Board senses what processor is on the module and automatically lets all the other parts know who's in control. Plug in the power module, "fire it up" and thrill to the new performance. Your data remains intact. Incredible? You bet it is!

Never before has the computer world been presented with the options, flexibility and economies of Scalable Processing (SP) architecture. It's a Northgate original, developed to meet the wants and needs of computer users like you.

SP eliminates your future equipment concerns. And secures the value of your investment. Want to equip your department with lower cost 386 systems with an eye toward moving into 486 processing in a year or so? SP is your only low cost, high performance answer.

Three Platforms, five Power Modules ... fifteen systems in all! Northgate has an SP system to meet every application. Start by selecting the platform you need. Space-saving SlimLine, full size

Elegance Desktop, or for use as a file server choose the Elegance Vertical Power platform. All three accept any of the five power modules: 386/25, 33, 40, 486SX/20 and 486/33 MHz.

100% field upgradable ... dollars back, too! Some others make you send your system back for upgrading. What a time waster! Northgate SP systems can be upgraded right in your office or home. You can even do it yourself with just a screwdriver (detailed instructions provided). Want a coach? Call Northgate Tech Support any time day or night. (We're here 24 hours a day, 7 days a week.) One of our experts will guide you through it. Phone call and service are free! *And anytime you upgrade, we'll pay you real dollars for your old module!*

You Can't Make A Mistake With A Northgate!

Northgate is here to serve you all day, every day! You get industry-leading tech support, full parts/labor warranties — one year on systems, five years on *OmniKeys*. And our free overnight shipment of replacement parts policy. Now... 5000 technicians out of 400 locations nationwide are on call to service Northgate systems — **FREE for one year!**

Northgate takes the risk out of buying direct — 30 day No Risk Trial! We'll custom configure your SlimLine or Elegance SP. Use it for 30 days. If you have even a shadow of doubt about your purchase, we'll buy it back for every penny you paid. No questions asked!

Call today and we'll help you select the Northgate SP platform and processor option that best meets your needs: 386/25, 33 & 40 MHz, 486SX/20 or 486/33 MHz in SlimLine, Elegance Desktop or Elegance Vertical Power cases. Add hard drives — 40MB to 1.2GB. Monitor options include 14" VGA Mono or Color, 14" 16" and 19" SVGA. Get more RAM, extra floppies, a modem, a tape backup and more. And every system gives you an affordable upgrade path. You just can't make a mistake with Northgate!

Compare Northgate's 386/33 To 486/33 Upgrade Price With ALR, AST and Dell!

Northgate Upgrade Price: \$999.00! That's right. You can soar all the way from a 386/33 to a 486/33 for only \$999.00 with processor trade in.† Now lets take a look at what the other guys charge. Ready for an eye-opener?

AST Suggested Retail AFTER Processor Trade In \$3695.00! Sounds a little pricey doesn't it? But that's the figure AST tells their dealers they should charge to upgrade a 386/33 with 2MB of memory to a 486/33 with 4MB of RAM. Over **THREE AND A HALF TIMES** Northgate's price!

ALR Suggested Retail \$2495! Want to make an ALR 386/33 into a 486/33 Business VEISA? You can get a piggy-back module that will take you there, but it's not cheap. An ALR dealer will charge you up to \$2495.00 for the favor. **TWO AND A HALF TIMES** Northgate's price!

DELL \$1999.00! Their sales reps will tell you "there's a lot of value here at Dell." It doesn't show in their prices. You'll fork over \$1999.00 to upgrade a Dell 386/33 to a 486/33. If you paid the \$299.00 they charge for 32K cache in your Model 325P, kiss it goodbye! Dell's 486/33 has NO external cache memory capability and they won't buy back the module or the now worthless cache card! And these guys made a big to-do over Compaq's high prices!

SlimLine™ SP Platform Features:

- 2MB of RAM on motherboard; expandable to 32MB
- 64K SRAM read/write-back cache
- Edsun Continuous Edge Graphics (CEG)
- 1.44MB 3.5" floppy disk drive (1.2MB 5.25" optional)
- Small footprint (16.5" square x 4.25" high) SlimLine case with room for two exposed and one internal half-height devices
- Three full-length 16-bit and two half-length 8-bit slots
- Integrated IDE hard drive and floppy drive controllers
- Integrated 16-bit SVGA
- One parallel and two serial ports
- Intel and Weitek math coprocessor support
- 150 watt power supply
- *OmniKey* keyboard
- MS-DOS 3.3 or 4.01 and GW-BASIC or MS-DOS Version 5 and QUICKBasic installed
- QA Plus Diagnostic and utility software
- Microsoft® Windows™ and mouse
- FCC Class B certified

Elegance Desktop or Vertical Power SP Platform Features:

- 2MB of RAM on motherboard; expandable to 32MB in Desktop, 64MB in Vertical Power Case
- 64K SRAM read/write-back cache
- 1.44MB 3.5" floppy disk drive (1.2MB 5.25" optional)
- 16-bit SVGA adapter
- Desktop Case with 200 watt power supply and room for three exposed and two internal half-height devices; OR Vertical Power Case with 220 watt power supply and room for three exposed and four internal system half-height devices
- 7 expansion slots
- One parallel and two serial ports
- Intel and Weitek math coprocessor support
- *OmniKey* keyboard
- MS-DOS 3.3 or 4.01 and GW-BASIC or MS-DOS Version 5 and QUICKBasic installed
- QA Plus Diagnostic and utility software
- Microsoft® Windows™ and mouse
- FCC Class B certified

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Elegance Desktop SP Platform..... **\$2199.00**

Elegance Vertical Power SP Platform..... **\$2349.00**

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- * GERMANY, AUSTRIA: Microphar Gmbh (06223 - 73730)
- * HUNGARY, Polyware Kit (76-22-307)
- * ITALY, Siosistemi (030 24 21 074)
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- * SWITZERLAND, SAFE (024 21 53 86)
- * THE NETHERLANDS, Infotic (015 15 88 37)
- * UNITED KINGDOM, Clearsoft (091 378 91 91)

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fax: (908) 769-7403
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Applied Digital Data Systems, Inc.

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Applix, Inc.

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fax: (201) 644-9768
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Butler, NJ 07405
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Utica, NY 13501
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(602) 242-2929
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EEF

ELEX ELECTRONIC FILING - THE DOCUMENT IMAGING SYSTEM

The ELEX Electronic Filing System (EEF) is a hardware/software system designed to reduce the frightening volumes of documents that burden businesses on a daily basis. As paper is eliminated, transactions are made in a fraction of the time required by traditional means, costly storage facilities are reduced, data security and integrity is enhanced, and work quality and quantity is increased. These factors all give companies and individuals the competitive advantage they need to excel in the business environment of the 90's.

Filing vs. Archiving

Document image processing is a new technology which has just begun to evolve. The myriad of hardware devices on the market, and the lack of an industry standard protocol for communicating between them, make the integration of an electronic filing system a formidable task. And without an intelligent software to control all aspects of the storage, management, and retrieval of documents, the filing system will be nothing more than a micro-fiche machine in disguise.

With these considerations in mind, EEF was designed as a turn-key solution which relieves the clients of all the intricacies involved in integrating a truly functional electronic filing system. Its flexible design allows continuous and smooth upgrade as the users needs grow and change.

Open Architecture

EEF is designed as a totally open architecture system. Rather than being a closed package, EEF is composed of building blocks defined by their area of electronic filing functionality. These blocks are not bound to specific hardware/software limitations. As such, they can be combined in a variety of

forms on each of the following operating platforms, to achieve optimal satisfaction of an application's specific demands:

- A single user workstation under the DOS or the OS/2 operating system.
- A local area network - Novell NetWare 286 and higher or any MS DOS compatible network.
- A host computer under the UNIX, VAX/VMS or IBM AS/400 system with a PC connection.

EEF	
Input	
	Scanner, Fax, Word Processing, OCR, Host Computer, Etc.
Processing	
	Document Manager, Retrieval Engine, Hyper-Media, 5GL Image Database Application Generator
Output	
	Printer, Plotter, High Res. Display, Fax, Host Computer

EEF Applications

The EEF system opens a vast new world of opportunities for you. The possible applications are limitless, and to name a few:

- Automatic Fax Routing
- Work Flow Management
- Banking Signature Verification
- Medical Records Management
- Legal Case Management
- Personnel/Human Resource System
- Insurance Claims Management
- Mortgage/Loan Management
- Contract Management
- Engineering Department

EEF Entry System

For prospective clients wishing to step ahead with Document Imaging solution, we propose an Entry System, encompassing in one package the full range of functions necessary for implementing electronic filing.

The system components are:

Hardware

- Intel workstation with 386 CPU, 8 MB RAM, 500 MB Hard Disk with Disk Caching controller.
- Reflections 1GB Multi-function Optical drive.
- Fujitsu 3096E 400 DPI, 20 PPM scanner with 50 sheets ADF.
- HP Laser Jet III 300 DPI, 8 PPM printer.
- 19" High-resolution (1664x1200) CRT display.
- Hardware compression, image manipulation and video printing technologies.

Software

The EEF software license including:

- 5 GL Document Imaging Solution Generator for quick implementation of filing problems.
- Generic Work Flow Data and Image management system.
- 20 Hours of Prototyping and Application Support Services.

Total cost for the complete Entry system is US \$35,000.

EEF Implementation

Fax your specifications and we will prototype your application within weeks, to demonstrate the ease of development with EEF's 5GL Document Imaging Solution Generator.

ELEX INFORMATION SYSTEMS

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InfoWorld And *BYTE* Readers Go To The "Polls." Both Agree...

Northgate® Elegance™ 486/33 Voted "Desktop Computer Of The Year"!



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At The Sands

Who ever thought a direct marketing company could take away *InfoWorld*'s highest honor from IBM®, Compaq® or Apple®! They dominated the voting for a decade. But when the 1990 election was over, so was their dynasty! And a new champion was crowned: Northgate Elegance 486/33.



Then, *BYTE* Readers Voted Elegance "Desktop Computer of the Year"!

Shortly after *InfoWorld* readers spoke, *BYTE* readers went to the polls. They overwhelmingly voted for Northgate, saying they'd rather have Elegance 486/33 on their desktop than any other!



PC Magazine Adds To The Glory. Elegance Wins "Editors' Choice"!

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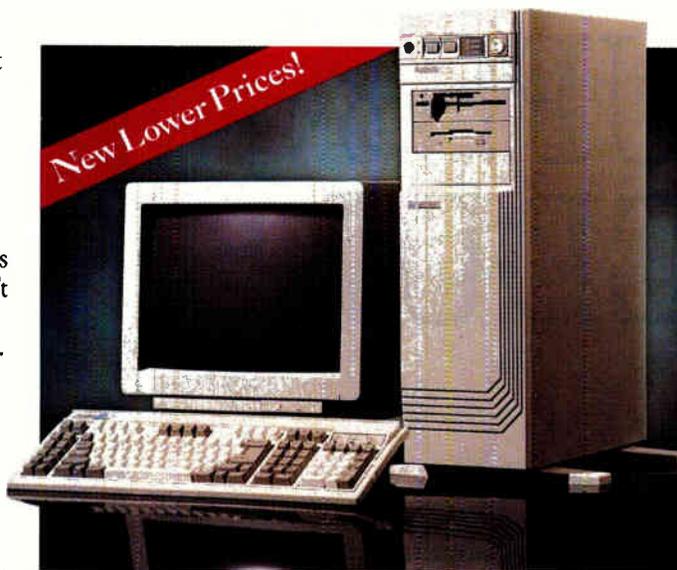
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GETTING GROUPS ON SCHEDULE

**The BYTE Lab tests
16 group schedulers
for Mac, PC,
and Unix clients**

**RICK GREHAN,
HOWARD EGLOWSTEIN,
TOM THOMPSON,
AND TOM YAGER**

You're undoubtedly all too familiar with telephone tag, the game of repeated return calls played by two colleagues whose work schedules are out of sync. A similar game gets going on a grand scale when you try to line up several staff members for meetings.

If your staff is already on a network—over 60 percent of BYTE's readers are—you can benefit from group-scheduling software. If your company doesn't have a LAN, perhaps it's time to consider one.

After all, at the heart of any network is a collection of shared data files. You may already be keeping your schedule and appointment book on your personal computer, so taking the step to a shared calendar on the network is logical and can resolve many scheduling headaches.

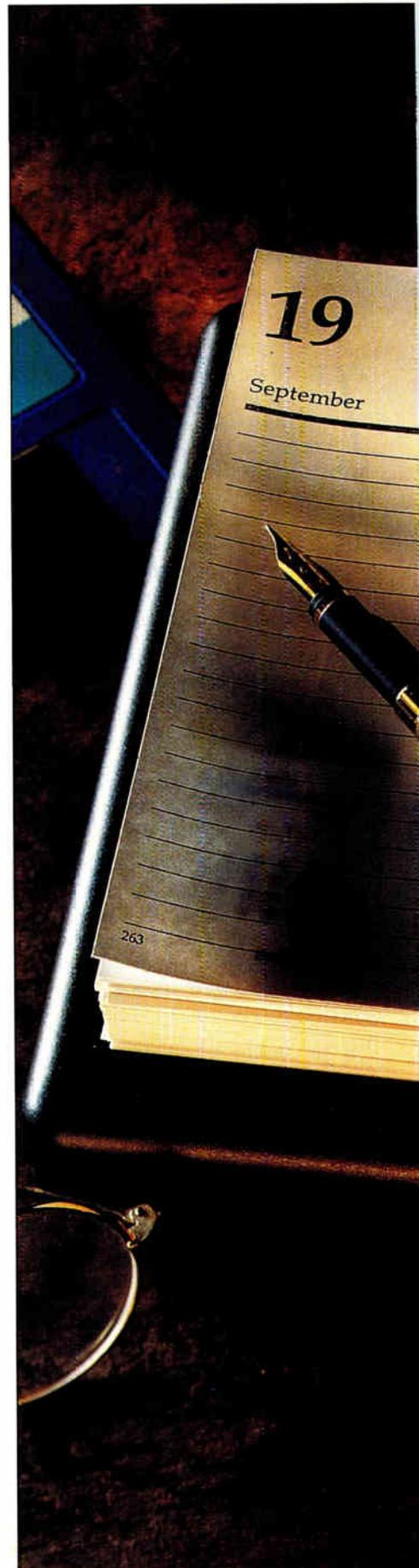
This month, the BYTE Lab examines group-meeting schedulers for Macintosh, PC, and Unix clients. These packages help resolve scheduling conflicts for both people and resources. (See the table for a list of key features.)

Group schedulers serve as BBSes: public locations where you post meeting announcements. They also provide on-line appointment calendars that interact with each other. When you want to call a meeting, you enter an appointment in your calendar and attach the names of the others involved. Most packages immediately notify all attendees of the planned meeting and give them a chance to accept or reject the proposed time on the spot.

The schedulers have different ways of handling meeting conflicts. Some examine the other participants' calendars and show you conflicts before you set a meeting time. Others find open times on everyone's schedule and propose a meeting time.

Many packages integrate E-mail to facilitate the negotiation of meeting times. In our experience, E-mail is essential in the process of scheduling, accepting, rejecting, and rescheduling meetings. It lets you tell participants *why* a meeting must take place, not simply when and where.

Most of these programs work by organizing participants into groups. When



■ WHAT GROUP SCHEDULERS ARE

Network-aware software that helps managers find common meeting times and resolve scheduling conflicts.

■ LIKES

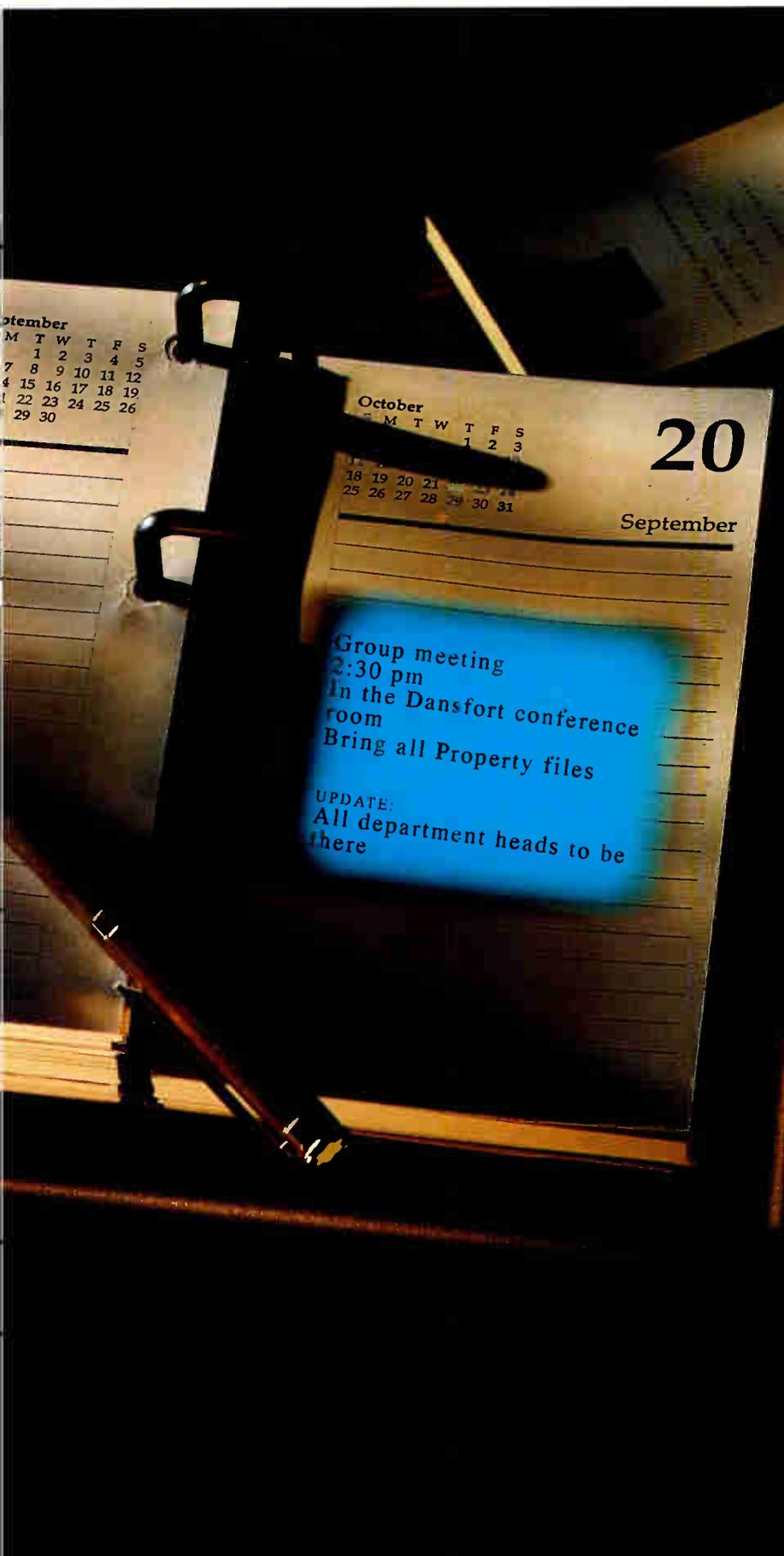
The better packages automatically find meeting times that fit into everyone's schedule. They immediately notify participants of proposed meetings and let each accept or reject the time. Some packages also include E-mail and project-tracking functions.

■ DISLIKES

Most packages support only one system platform. Planisoft supports Mac and PC clients.

■ RECOMMENDATIONS

Planisoft is the only choice if you have Mac and PC clients. For PC LANs, CaLANdar, Higgins, and Right Hand Man II are all good choices. We recommend Meeting Maker for Mac-only LANs.



you schedule a meeting, you can enter the workgroup's name as the attendee rather than list all the individuals; the scheduler will do the rest. Some group schedulers include project-tracking features as well; many let you attach explanatory notes to meeting notifications.

All packages provide some means of informing participants when a meeting or deadline is approaching. Nearly all the PC packages include a pop-up notification TSR program; some of the Mac applications include a notification INIT; and the Unix programs use standard Unix facilities to handle notification.

We found 16 products that support Mac, PC, or Unix clients, but none supports all three. Planisoft supports Mac and Windows clients only, leaving the Unix users in your group out in the cold. WordPerfect Corp. was working on Mac and Unix versions of its WordPerfect Office LAN at press time. Until such products arrive, users in heterogeneous computing environments have few choices (see the text box "Interoperability: Where Group Schedulers Fall Short" on page 257). Planisoft was the only product to support Windows at press time. Many other vendors should have Windows versions by the time you read this.

We tested these programs on three interconnected test-beds: a NetWare 386 LAN with Gateway 2000 386SX, Com-

GROUP SCHEDULERS

The better group schedulers let you assign resources to meetings, automatically search personal schedules for common meeting times, and immediately notify all participants of a proposed meeting so that they can accept or reject it. Ease of use is perhaps the most important criterion of all; see the main text for our impressions (● = yes; ○ = no; N/A = not applicable).

Product	Mac			PC			
	Meeting Maker 1.0	Planisoft 1.21	Schedule+ 1.00a	CaLANdar 1.29	The Coordinator II	Higgins 2.4	Network Scheduler II
Networks supported	AppleTalk	AppleTalk	AppleTalk	NetWare, any DOS 3.1-compatible LAN	NetWare 2.0a or higher	NetWare, NetBIOS	NetWare
System requirements	Minimum client: Mac Plus with 1 MB of RAM; minimum server: Mac Plus with 2 MB of RAM, hard disk, System 6.0.4 or higher	Peer: Mac Plus or better with 1 MB of RAM and System 6.0 or higher	Minimum client: Mac Plus with 1 MB of RAM and hard disk; minimum server: Mac Plus with 1 MB of RAM, hard disk, System 6.0.4 or higher, Microsoft Mail	350 KB of RAM, DOS 3.1 or higher	512 KB of RAM, DOS 3.1 or higher	512 KB of RAM, DOS 3.1 or higher	512 KB of RAM, DOS 3.1 or higher
Personal calendar							
To-do lists	●	●	●	●	●	●	●
Milestones/deadlines	●	●	●	●	●	●	○
Prioritize events	○	●	○	○	○	●	●
Attach notes to event	●	●	●	●	●	●	●
Assign resources to meetings	●	●	● ¹	●	●	●	●
Allow appointment overlap	●	○	○	●	●	●	●
Auto-schedule regular meetings	●	○	○	●	●	●	○
Event alarm	Visual, audio	Visual, audio	Visual, audio	Visual, audio	Visual, audio	Visual, audio	Visual, audio
Group scheduling							
Separate group schedule	●	●	●	○	●	●	●
Create workgroups	●	●	●	●	●	●	●
Schedule meetings with users on other servers	●	○	●	○*	●	●	●
Auto-search for common meeting time	●	○	○	●	○	●	○
Alert participants immediately to schedule changes	●	●	●	●	●	●	●
Appointment notification TSR/INIT (size)	44 KB	600 KB ²	12 KB	1.2 KB to 7.5 KB	None	7.4 KB	None
Participants can confirm/reject time	●	○	●	●	●	●	●
Reports							
Print personal calendar (daily/weekly/monthly)	D/W	D/W	D/W/M	D/W/M	D/W/M	D/W/M ⁴	D/W/M
Print group calendar	●	●	●	○	●	●	●
Export calendar as ASCII file	○	●	●	○*	●	●	●
Security							
Personal calendar password	●	●	●	●	●	●	●
Restrict view of personal calendar	●	●	●	●	●	●	●
Miscellaneous							
Integrated E-mail	○	○	Through Microsoft Mail	●	●	●	○ ⁵
Other bundled applications	Administration, server activity	Rebuild database utility	Administration	○	File manager	Notepad, contact directory, filing commands	○
Archive old appointments	● ⁶	●	●	○	●	●	○
Support remote access by modem	○	○	○	○*	○	○*	○
On-line help	○	●	●	●	●	●	●
Price (10 users)	\$895	\$1295	\$390 ⁸	\$395	\$1800	\$695 (8 users)	\$590 (25 users)

* Option

† A new version with this feature should be available by the time you read this.

¹ Must create users with resource name.

² Application must be running to handle immediate notification.

³ No notification TSR; alerted only when running OnTime application.

paq Deskpro, and Tangent 386 clients; an AppleShare/LocalTalk LAN with several Mac nodes; and the Unix Lab's thin-wire Ethernet LAN, which includes Sun, Altos, and Multimicro workstations. We created a hypothetical firm and simulated the process of initiating, moving, and rescheduling meetings that would occur during the life of a project.

Not All Smooth Sailing

BYTE's latest reader survey shows that 35 percent of BYTE readers who have access to a LAN use some type of groupware package, group schedulers being among the most common. That doesn't mean, however, that they had an easy time getting these products to work.

Intimidating installation procedures

common to the DOS-based group schedulers often had us reaching for our NetWare administrator manuals. The network administrator must install these programs and manage the resulting data files as old memos pile up. Fortunately, almost all the packages provide tools to archive or delete old schedules.

Not all group schedulers are easy to

GROUP SCHEDULERS

PC								Unix	
OfficeWorks 2.0a	OnTime 1.46	Planisoft 1.21	Right Hand Man II 1.01	Shoebox 2.3	SuperTime 1.0	Who-What-When Enterprise 1.0	WordPerfect Office LAN 3.01	ClockWise 1.3	Synchronize 1.1
NetWare, NetBIOS	Any DOS 3.1-compatible LAN	NetWare NetBIOS	NetWare NetBIOS	Any DOS 3.1-compatible LAN	NetWare, any DOS 3.3-compatible LAN	NetWare, any DOS 3.1-compatible LAN	NetWare, NetBIOS	All major Unix implementations	All major Unix implementations
640 KB of RAM, DOS 3.1 or higher	512 KB of RAM, DOS 3.1 or higher	2 MB of RAM, DOS 3.1 or higher	256 KB of RAM, DOS 3.1 or higher	256 KB of RAM, DOS 3.1 or higher	512 KB of RAM, DOS 3.3 or higher	384 KB of RAM, DOS 3.1 or higher	300 KB of RAM, DOS 3.0	Any Unix workstation	Any Unix workstation
●	●	●	●	●	●	●	●	●	●
○	○	●	●	○	●	●	○	●	○
○	●	●	○	●	●	●	●	●	○
●	●	●	●	○	●	●	●	●	●
○	○	●	○	○	●	●	●	●	●
●	●	○	●	●	●	○	●	●	●
○	●	○	●	●	●	●	●	●	●
Visual, audio	Visual, audio	Visual, audio	Visual, audio	Visual, audio	Visual, audio	Visual, audio	Visual, audio	E-mail, pop-up, bell	Pop-up, bell
○	○	●	●	○	●	●	●	●	●
●	○	●	●	●	●	●	●	●	●
●	○	○	○*	○	○	●	○*	N/A	N/A
●	○	○	●	○	●	○	●	○	○
None	None	None	4 KB	150 KB	30 KB	32 KB	7 KB	N/A	N/A
●	○	○	●	●	●	●	●	●	●
D/W/M	D/W/M	D/W	D/W/M	D/W/M	D/W/M	D/W/M	D/W/M	D/W/M, quarterly, yearly	D/W/M
○	●	●	●	●	○	●	●	●	○
●	○	●	●	●	●	●	○	●	●
●	●	●	●	●	●	●	●	○	○
●	●	●	○	●	●	●	●	●	●
●	○	○	●	○	●	○	●	●	○
Telephone messages, document control, name/address card file, task swapper, menu system	Backup & rebuild utilities	Rebuild database utility	Chat, database, card file, calculator, telecommunications, notepad	○	Contact database; conversion table; calculator; state/province abbreviation, time-zone, and area-code lookup library	Notepad, card file, phone list, auto-dialer, calculator	Editor, notebook, calculator, shell, TSR manager	Notepad, address book, task manager	○
○ ⁷	●	●	●	●	○	●	●	●	●
○ ⁷	○	○	○ [†]	○	○	○	○ [†]	●	●
●	●	●	●	●	●	●	●	●	●
\$495 (6 users)	\$690	\$1295	\$995	\$450	\$995 (8 users)	\$695 (6 users) 5-user upgrade: \$495	\$1495 (20 users) \$495 (5 users)	\$859	\$1040

⁴ Customizable.
⁵ Versions for cc:Mail, NetWork Courier/Microsoft Mail, and MHS available.
⁶ Administrator only.

⁷ E-mail only.
⁸ Requires Microsoft Mail (\$1185 for 10 users).

use, either. That's a problem, because group schedulers depend on everyone's participation. Even easy-to-use packages will have to overcome people's resistance to change. To avoid disruptions, you should keep using your current scheduling system as your staff comes up to speed with the group scheduler.

Group schedulers are a natural step for

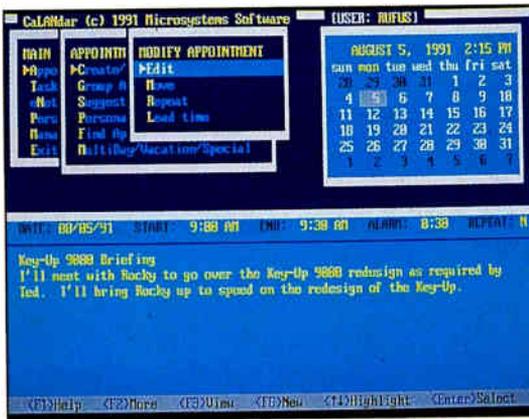
Unix systems, which already have some built-in multiuser applications, including E-mail and a calendar program that lets you send yourself E-mail reminders. Programs like the calendar manager included with Sun's Open Windows Desktop applications bundle carry forward this idea. For *true* group-scheduling capabilities, however, you still need to turn

to external applications.

The Mac incorporates AppleTalk network protocols, so the network administrator need only add the appropriate scheduling software, typically an INIT and a desk accessory (DA). As with DOS, the network administrator must take on the duties of adding groups and users and backing up the data.

continued

CALANDAR 1.29



Ease of use distinguishes CaLANdar from other DOS-based schedulers. Here a user is editing an appointment note.

CaLANdar was the easiest-to-use PC package we installed. You create users by simply giving CaLANdar the appropriate name, password, and telephone extension.

Microsystems Software has made CaLANdar's display refreshingly uncluttered. The format remains the same regardless of the operation that you are

performing, and it quickly becomes familiar. CaLANdar always displays a calendar on-screen—a convenience that other packages don't offer.

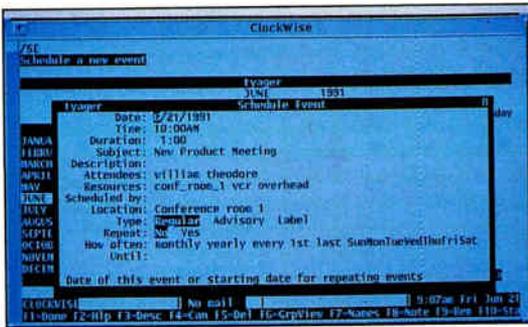
CaLANdar suggests times for group meetings. You choose the participants, resources, meeting length, and range of acceptable dates. CaLANdar then looks through everyone's schedule until it

finds a time that all the participants can meet. You can accept CaLANdar's first suggestion or hit PageDown for alternative dates. If you try to schedule a meeting that conflicts with a participant's schedule, CaLANdar alerts you by placing a C next to the name of that person.

Each user has two passwords. The master password lets you perform your day-to-day business by providing unlimited access to your data. The guest password allows others restricted access to your data. You can set systemwide security clearance on guest passwords to low, medium, or high. The low setting allows a guest to view only the top-level description of appointments and notes and accept or reject tasks and appointments.

CaLANdar's E-mail system, enotes, tells you when a receiver reads your note, whether he or she deleted it, and whether he or she attached a response. Whenever you compose an enote, you've got to make the first line count: It serves as the note's title. Unlike most other programs, CaLANdar does not let you archive old appointments.

CLOCKWISE 1.3



Clockwise's text-based interface is backed by a system of menus and pop-up dialog boxes, making it fast and easy to use.

capable of handling not only group scheduling but simple project management as well. Phase II plans to release a version of Clockwise for NetWare users later this fall.

A key difference between Clockwise and Synchronize (see page 262) is the licensing fee. Each user must have an entry in Synchronize's user database, and the license limits the number of entries: A five-user license supports exactly five users. Clockwise's floating license, on the other hand, limits only the number of simultaneous users. Since everybody doesn't need to use the calendar at the same time, Clockwise's scheme is much less expensive. A 50-person company, for example, could spend over \$20,000 for a 50-user Synchronize license but could get by with a 25-user floating license for Clockwise and spend just \$2129. Even the three-user Clockwise license lets as many different users manage their schedules as you like, provided that no more than three people use Clockwise at once.

The Unix group scheduler we recommend highly is Phase II Software's Clockwise. This is a text-only application, which means you can run it on serial terminals and on PCs running terminal-emulation software. We were initially impressed with Clockwise when we reviewed it in December 1990 (see "On Becoming a Clockwise Scheduler"), so we won't launch into much detail

here; the previous review and the features table tell most of the story.

Phase II Software sent us a small compendium of "technical notes" that give power users the information they need to create new calendar-printout style sheets, preview calendar printouts on DEC and Sun workstations, and perform many other functions. This latest release is gloriously easy to use and more than

THE COORDINATOR II

Action Technologies' The Coordinator II is an E-mail program with group scheduling and a unique project-tracking system. The Coordinator goes

out of its way to help new users; "getting started" mail appears in your mailbox the first time you log in.

The group-scheduling and project-

tracking applications sit on top of The Coordinator's E-mail engine, dividing the display horizontally into New Matters, Ongoing Matters, Completed Matters, I Am Copied, and Calendar Updates sections. The function of each of these becomes apparent as you use the

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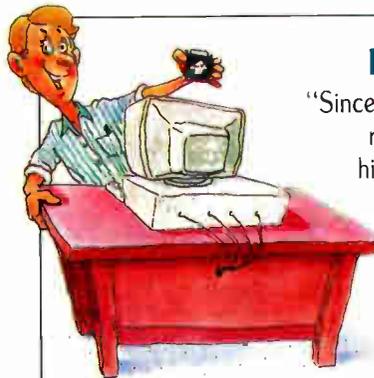


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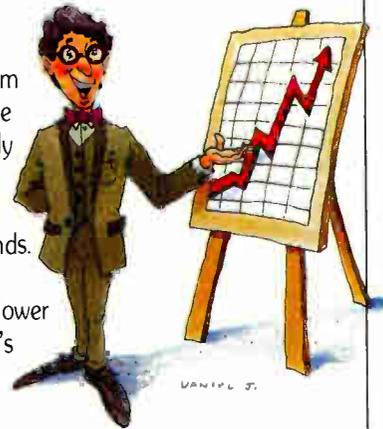


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package. For example, new mail arrives in New Matters; old mail moves to Completed Matters.

The Coordinator was surely named for its automation of electronic conversations. Sometimes, however, this automation goes too far. When you respond to a request, a pop-up menu asks you to label your response Agreement, Disagreement, or Delegation, among others. If you pick Agreement, you're given a note-entry screen that looks like any other except that the system has automatically inserted "I'll do it." as the first sentence.

This is functionality?

The Coordinator's group-scheduler module (actually a modified version of Network Scheduler II; see opposite) is less automated than some other packages. It does not automatically find common meeting times for you. And to properly acknowledge a group meeting request, we found ourselves confirming it in the personal calendar and then again in the group calendar. We discovered later that we didn't have to do this: We had neglected to do a *gather*, which pulls changes from the personal calendar into

the group calendar. According to Action Technologies, this is a side effect of The Coordinator's built-in wide-area-network capabilities, which permit multiple personal and group calendars to coexist on the same network.

Other aspects of the package left us feeling as though we were in a maze. Some pop-up windows have an "OK" selection that closes the window. Others don't; you have to hit the End key to get out of them. The Coordinator is certainly a powerful package, but it could use a user interface—lift.

HIGGINS 2.4



Higgins suggests group meeting times and lets participants vote for a preferred time. The appointment log on this screen shows meetings for the upcoming month.

Enable Software's Higgins handles the scheduling of meetings as a voting process. When you schedule a meeting, you present attendees with up to three time-slot choices—the program

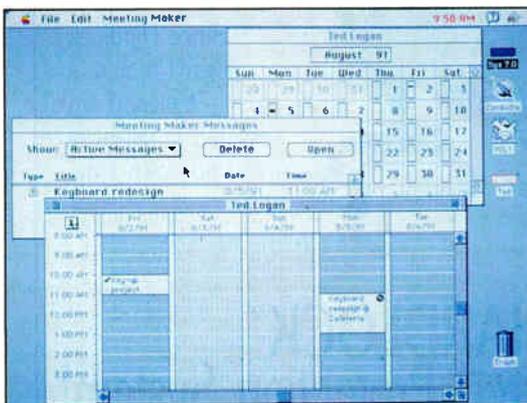
makes a best-effort guess at times that fulfill your criteria. If you don't like the times Higgins has picked, you can change them. Meeting attendees can then vote on which time they prefer. The

meeting organizer reviews the voting process. Alternatively, you can "force" a meeting to a specific time, regardless of what conflicts you might create. Meeting attendees can still refuse the meeting or they can use Higgins's integrated E-mail to discuss the situation with you.

Higgins is sensitive to the software interrupt you hook it to. The default value is 60 hexadecimal, which created a conflict in our Gateway 386SX test machine.

We didn't like the way Higgins handled the arrival order of E-mail messages. During testing we sent a mail message to Higgins users that described a new project. Later, we scheduled a meeting to go over the project. The memo we attached didn't describe the project—we assumed the participants had read our earlier mail message. However, Higgins delivers messages in a last-in first-out fashion, so users who hadn't already read the first memo saw the meeting request before the explanation message.

MEETING MAKER 1.0



Meeting Maker's weekly calendar concisely displays each meeting's time and purpose. The checkmark icon indicates that everyone can attend one meeting; the "no" icon indicates that some people can't attend another.

On Technology's Meeting Maker does the best job on the Mac. It uses a client/server arrangement on an AppleShare server to maintain information.

Meeting Maker supports participants attached to multiple servers—a feature many group schedulers lack. The client software uses an RDEV to select the

server Mac; a DA provides access to the information and displays a weekly calendar window, where you click and drag to schedule activities.

The menu lets you propose a meeting by suggesting when and where it is to take place and which individuals or groups should attend. A box appears in each participant's calendar window at the specified time and date. The description of the meeting shows within this box, so users can examine their week's schedule and pick out specific meetings at a glance.

Meeting Maker immediately alerts you to scheduling conflicts. Icons flag who can or can't attend, so you can see the scope of the problem. Meeting Maker notifies potential participants immediately.

Those users who reject a meeting proposal can provide a lengthy note of explanation and dicker over a more appro-

Interoperability: Where Group Schedulers Fall Short

Jim Lasiak is on a search for the Holy Grail. He's trying to find a group scheduler for some 7000 networked Mac, DOS, OS/2, and Windows users at Chevron. As system analyst at Chevron Information Technology, Lasiak researches products, makes recommendations, and supports users at Chevron's many divisions. "We have a 13-page list of requirements for calendaring software. We looked at 16 packages in 26 months and still haven't found a true multiplatform calendaring product," he says. "Planisoft comes close—it runs on Macs and PCs—but it's still not on all our platforms, and it's not [entirely] on the server, where we can manage it."

Other contenders included WordPerfect Office LAN, Meeting Maker, and Schedule+. WordPerfect has promised to support Unix and Mac clients, but its scheduler includes its own E-mail system. "That's a crucial application at Chevron. We already have All-in-One, PROFS, and Microsoft Mail, and we

don't want to invite another mail system into the network," Lasiak says.

Schedule+ runs only on Macs, but it works with Microsoft Mail to send meeting notification messages to people who aren't running Schedule+. Chevron's DEC All-in-One and IBM PROFS users would benefit, but the product still doesn't directly support DOS, OS/2, or Windows users.

The best package on the market, according to Lasiak, is Meeting Maker—a Mac-only package. "If it worked with Windows, I'd choose it over Planisoft," says Lasiak, who likes the product's ease of use and flexibility. Instead of printing out schedules on 8½- by 11-inch paper, for example, Meeting Maker prints Day-Timer and Franklin Planner forms that fit into your binder.

Right now, Planisoft is the closest to gaining his approval. "People want calendaring, but they want it to be simple. Planisoft meets our needs to a point. It imports and exports database information, does consolidated calendars, and

is reasonably fast." Unfortunately, Planisoft doesn't provide immediate notification of calendar changes or a way to reject or accept these changes on the fly (a new version, in beta as we went to press, offers immediate notification). And like most group schedulers, Planisoft lets you add new users to a group but doesn't update them with a list of meetings that the group manager has already scheduled.

Other wish-list items include OS/2 client support, server-to-server synchronization for scheduling users attached to other servers, and the ability to see meeting descriptions on the calendar screen. Right now, meetings appear as colored time blocks; you click on each block to see the description. Even if Planisoft offers a true OS/2 version, Lasiak still faces the hurdle of sending meeting messages to All-in-One and PROFS users. Right now, however, he just might settle for a package that will support all his Mac and DOS users.

appropriate time. You can reschedule a meeting by simply dragging the box representing the meeting interval to another day, and, again, the system detects any conflicts. Users get automatic notification of schedule changes, and those who had accepted the earlier meeting time get a cancellation notice and a proposal for the new meeting.

You are notified immediately of a new proposal, or you get an alert when you sign into Meeting Maker. Scheduling a recurring meeting is just a matter of selecting the meeting interval and hitting a button: No copy-and-paste process is necessary.

Meeting Maker makes scheduling a meeting with just one person or rescheduling meetings involving groups of people easy. It clearly shows conflicts. The package doesn't include an E-mail facility, but it should play with any package your company uses. We'd like to see a Windows version of this product.

NETWORK SCHEDULER II

PowerCore's Network Scheduler II is a full-featured group-scheduling program. A version of Network Scheduler II comes bundled with Action Technologies' The Coordinator II. Several other vendors also offer it as an option, or you can buy it from PowerCore.

Network Scheduler II keeps schedules for everyone in one database. The functions treat the entire group as a unit rather than as a series of individuals. The program's main screen shows both a monthly calendar and a breakdown of the current day's activities. Each day of the month has visual clues to alert you to upcoming events, and the daily calendar shows hourly events in a bar graph. After you select a specific day, the appointment book shows you the details of pending or scheduled meetings.

You can assign people to workgroups,

such as R&D and marketing. You can also assign shorthand codes to meeting rooms and include the room assignments in your schedule. Network Scheduler tells you when a room is booked.

Network Scheduler II's user interface and command set share the same faults we found in The Coordinator. It's easy to get lost in a sea of menu screens, and it's not always obvious what to do next. The abbreviated (18-page) manual shows the most important screens and a summary of the command keys.

About the only thing that keeps Network Scheduler II from being as useful as The Coordinator is a lack of built-in E-mail. Like The Coordinator, it won't automatically find a common group meeting time, and it doesn't include The Coordinator's unique project-negotiation and project-tracking functions.

continued

OFFICEWORKS 2.0a

Data Access's OfficeWorks consists of E-mail and a group scheduler. The installation process creates a super-user ID that you use to install OfficeWorks users. In our testing, the installation process created this user but assigned a password that differed from the one described in the installation guide. We called technical support for the correct password, and the rest of the installation went smoothly.

OfficeWorks lets you appoint *alternates*—users who have limited access to

your schedule and who can act on your behalf when you're away. That lets your secretary keep your E-mail and meeting schedule tidy. Alternates can't access calendar items that you mark as private.

OfficeWorks deals with meeting reschedulings cleanly. Some packages make you delete the old meeting and create a new one, leaving meeting attendees wondering what on earth happened. When you reschedule a meeting with OfficeWorks, attendees receive an E-mail message labeled "changed meeting" and

know instantly what has taken place. OfficeWorks can also link a program with an E-mail enclosure so that, for example, an attached graphic is automatically displayed when the recipient opens the enclosure.

You can't assign resources to meetings or automatically schedule regular meetings. Also, you must specify the disposition of an E-mail message—whether to file it as old mail or keep it as new—before you can reply. That amounts to only one extra keystroke, but the pop-up window that appears when you go to reply to a letter leaves you feeling like you've done something wrong.

ON TIME 1.46

Campbell Services' OnTime evolved from a stand-alone calendar program to support workgroups. Even though it is now network aware, OnTime still functions best as a stand-alone scheduling package.

The easy-to-use program includes the standard features, such as appointment alarms and to-do lists. The primary screen is a daily time schedule. A grid view shows you a week at a time. Both screens show the current and following months but don't show you on which days you have appointments scheduled. Use of

the program's few command keys is intuitive. Even the manual is accessible—a slim 60 pages, well organized and complete. If you like, OnTime will load as a TSR, making it instantly available in a mere 15 kilobytes of RAM.

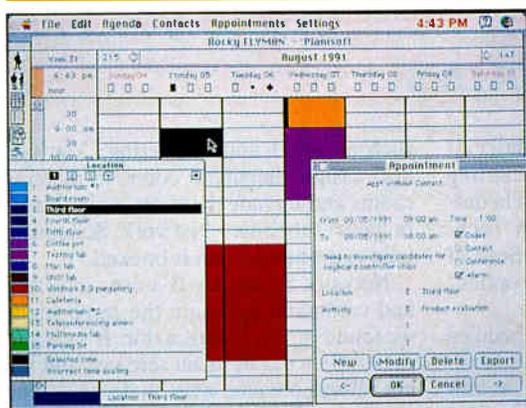
As a group scheduler, OnTime simply doesn't make the cut. Users can share their personal calendars with others in their group, but if someone adds an appointment to your calendar, OnTime does not tell you until the next time you run the package. It also doesn't let you book resources, such as a conference

room, for meetings.

Unlike the other packages, OnTime doesn't let you create workgroups. To schedule a group meeting, you choose the weekly view. OnTime shows you a list of the users who have granted you access to their calendars. You select one or more names from the list, and OnTime posts the appointment on each calendar.

OnTime lacks a way to confirm meetings. If someone schedules you for a meeting and you can't attend, you can delete it from your calendar. But if you do, the person who scheduled it won't know you canceled unless he or she looks at your calendar. OnTime should provide some kind of notification.

PLANISOFT 1.21



Planisoft in action. Clicking on a colored meeting block provides additional information about it.

rather than having to click on each block to see what's going on. Rescheduling a meeting requires extra mouse work as well: You must go to the group schedule to delete the meeting and set up a new time.

Planisoft detects conflicts but does not automatically locate available meeting times or schedule recurring meetings for you. Also, there's no easy way to schedule a meeting with a single person. Most other packages let you do this without creating a group. Planisoft requires that you create a temporary group consisting of just yourself and the other person. This is rather clumsy.

Version 1.21 provides no E-mail facility for conversations. The new Mac version 1.3 does have a note-passing feature that allows you to communicate with a single user and effectively eliminates this problem.

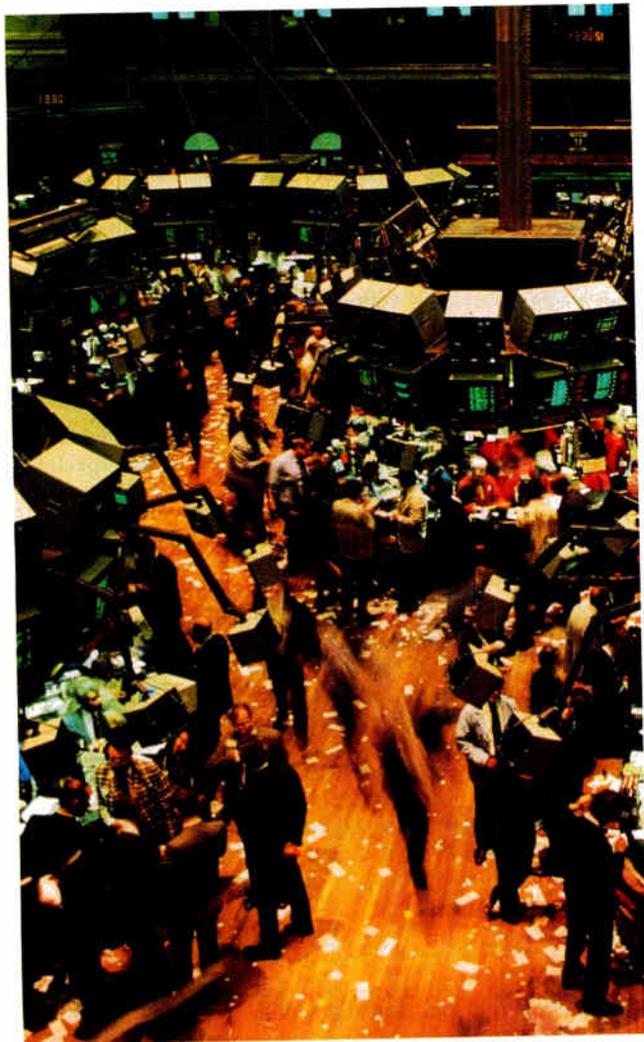
The Mac version handles meeting notification by running Planisoft in the background under MultiFinder or System 7.0. You get an alert when the information changes, and you also get audible alerts 15, 10, and 5 minutes before a

ASD Software's Planisoft runs on both Macs and Windows machines—something no other product will do. Planisoft manages its information as a shared data file that's accessible to all users. We installed the package on our NetWare 386 server and gave the Mac users access by way of NetWare for Macintosh.

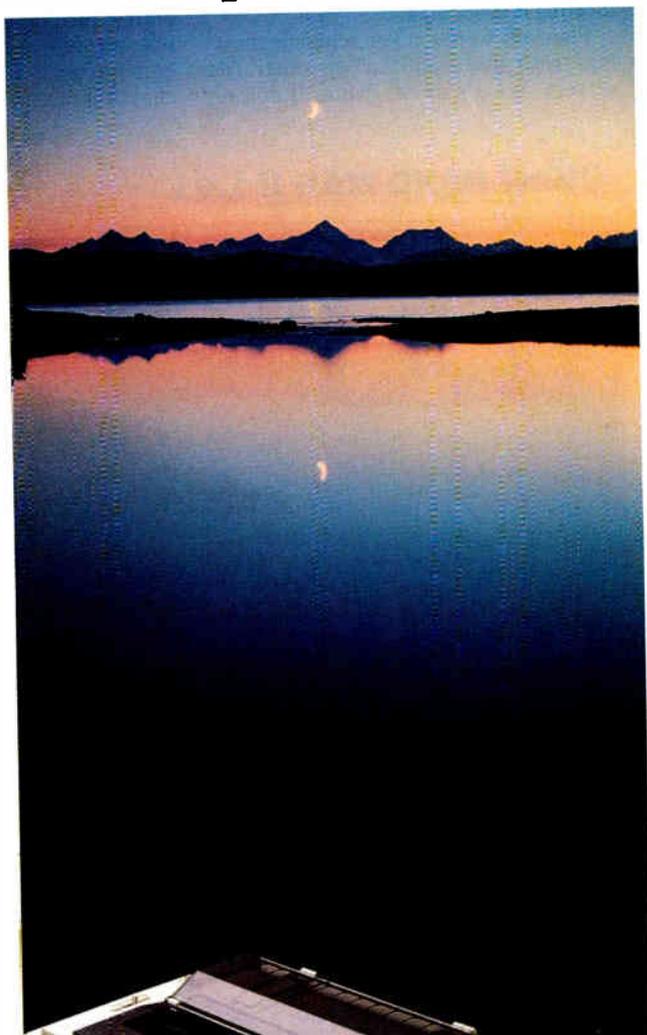
You can sign into Planisoft as a user or

a group. The schedule appears in a window that displays the current week. Meetings show as colored blocks; clicking on them shows either the meeting's time and members (if you're logged in as a group) or the meeting's place, function, and allocated resources (if you're logged in as a user). We'd prefer to have this information in the main calendar,

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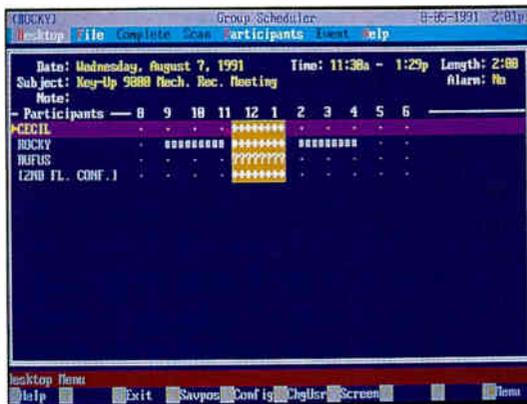
meeting is scheduled.

Planisoft won't let you schedule meetings with users attached to other file servers. What's more, Planisoft doesn't

notify meeting participants when you schedule new appointments; they discover them only when they run Planisoft and check their schedules.

ASD Software has demonstrated a new version of Planisoft that adds this capability. It should be available by the time you read this.

RIGHT HAND MAN II 1.01



Right Hand Man II is a full-featured scheduler that runs in just 4 KB of RAM. This screen shows a meeting proposal.

Most group schedulers for PCs have a watchdog TSR that alerts you when you have incoming mail or updated events. Right Hand Man II is a TSR that includes E-mail and other applications. Right Hand Man uses as little as 4 KB of conventional memory; you can allocate about 128 KB of additional memory as

workspace RAM.

The program modules include E-mail, personal and group calendars, a free-form database, a card-file-style database, a network-aware telecommunications package that supports interrupt 14h, a notepad editor, and a chat facility.

Right Hand Man supports group and

resource scheduling, but only the group manager can schedule meetings. Resource handling is bizarre: To manage a resource, you have to log into the system as that resource, so you might find yourself running as "Conference Room 2." And when you schedule a group meeting, you're given only a single comment line to describe the meeting. Any elaboration has to be done through E-mail.

Right Hand Man easily handles old mail by letting you file it into special mailbox categories. You might, for example, create one mailbox named Sales, in which you archive sales messages, and another named Advert, where you deposit your old advertising mail.

Right Hand Man delivers meeting requests via E-mail, but you can't respond to them with E-mail: You have to switch to the scheduler instead. This turns what could have been a one-step process into a two-step process.

Despite these flaws, we liked Right Hand Man II. Its many integrated applications and small program size should make it an ideal fit for many offices.

SCHEDULE + 1.00a

Schedule+ is a Microsoft add-on for Microsoft Mail. That limits its appeal, but if you don't have an E-mail package already, it makes Microsoft Mail that much more attractive. Schedule+ manages its information database on the file server and supports users across multiple servers. A DA lets you access this information, which shows the current day's activities, a small monthly calendar, user lists, and a notes section.

You can arrange meetings with both groups and individuals. For conflict res-

olution to work, all users must share their appointment data by checking the proper box in the Preferences menu selection. You set up a meeting by selecting the day, the meeting members, and the time slot by clicking and dragging over the desired time period. The program alerts you to conflicts, but finding out who can't make the meeting is unnecessarily cumbersome. Once you have determined the people with conflicts, however, you can negotiate with them easily using Microsoft Mail.

Schedule+ has a few prominent warts. To reschedule a meeting, you have to mail a cancellation notice to all parties and then reschedule. To set up a recurring meeting, you must copy and paste the meeting information into the appropriate slots in the coming weeks, which seems a tad clunky. Aren't computers supposed to handle this kind of drudge work for us?

Schedule+ assumes that you want to standardize on Microsoft Mail as your E-mail package. If you've already invested in another Mac E-mail package, buying this one just to obtain group-scheduling services won't be cost-effective.

SHOEBOX 2.3

Like OnTime, R+R Associates' Shoebox comes in both single and multiuser versions. The network version breaks your organization into groups, and you assign a coordinator to each. Only the group coordinator can add and remove users and schedule group meetings.

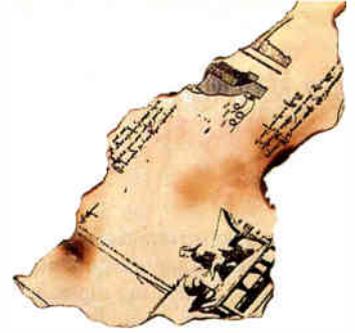
Shoebox runs as a 150-KB TSR and

alerts you to new appointments or upcoming meetings when you're not running Shoebox as your primary application. The user interface consists of an hour-by-hour daily schedule with a list of single-key functions displayed across the bottom.

When someone schedules you for a meeting, Shoebox puts a message in your

reminder list with the time, date, meeting description, and requester's name highlighted. You select the message with the cursor and press K to agree to the meeting or Control-K to decline. Your response appears in the requester's reminder list. Unfortunately, Shoebox lets you simply delete the message without acknowledging it. If you do, the meeting doesn't appear on your calendar, but the requesting party has no way of knowing that.

continued



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Shoobox also suffers from poor screen updates. When someone schedules you for a meeting, a flashing message alerts you to check your reminder list. After

you acknowledge the meeting, the flashing alert doesn't go away. To clear it, you have to change to a different day and then come back. The program also doesn't let

you assign resources or attach notes to meeting notices. While we didn't find any outright bugs, Shoobox had too many quirks for our taste.

SUPERTIME 1.0

The installation process for SuperTime had us tripping over our own shoelaces. As we created new users, we left several parameters on the user-definition screen empty, suspecting that they were either optional or would default to some systemwide value. Two in particular—the start-time default and the time-slot-length default—caused system errors until we backtracked, discovered our omission, and filled in the parameters.

The group appointment scheduler lets you suggest a time. It then automatically searches for conflicts and lets you either

override them or back out and try another time. We were disappointed to discover that we had to respond to a meeting request in the messaging portion of SuperTime, not in the calendar. Fortunately, SuperTime's messaging system initially presents you with a status screen. You can tell instantly which notes have come in, whether you've filed them, how many calendar appointments are waiting, and so on.

SuperTime has well-developed project management features. It's a simple matter to create tasks, attach deadlines and

milestones, assign resources and personnel, and track the progress of those tasks. SuperTime creates Gantt charts and cross-references displays that show which resources and personnel are assigned to which tasks.

SuperTime doesn't archive old appointments and projects and won't let you schedule meetings with users attached to other file servers.

When you send in your registration card, the company will ship you a library disk with a set of lookup dictionaries that consist of area codes, abbreviations for states and provinces, and a worldwide clock. The documentation promises more libraries in the future.

SYNCHRONIZE 1.1

CrossWind Technologies' Synchronize, with its stylish OSF/Motif graphical interface, is visually quite appealing. You can set it up to do most anything you'd want from a group scheduler, but we found the fancy interface more a hindrance than a help.

Creating an event, for instance, brings

up a complicated dialogue. If you fail to fill it out, a warning dialogue pops up telling you that the form is incomplete. It *doesn't*, however, tell you what you left out. Each action (e.g., adding an event) brings up a new dialogue, usually with the same pair of calendars and menu bar at the top of the screen. This wastes space

that most workstation users can't spare.

You can attach only a one-line description to an event; you file additional text under a "pop-up note." When other people read the event, they don't have any way of knowing whether a pop-up is attached. They must pull down a menu and see if an option with the pop-up's name exists. Overall, however, Synchronize measures up reasonably well in terms of features.

WHO-WHAT-WHEN ENTERPRISE

Installing this package taxed our patience. Some Enterprise directories and files need to be flagged as shareable, but the manual doesn't tell you this upfront. We stumbled across it in the troubleshooting appendix.

Creating groups is awkward. You have to switch between a screen showing current group members and a screen showing all users. Unfortunately, the second screen gives no indication of who is already in the group, so we had to keep switching between screens.

Enterprise has no integrated E-mail, but Chronos Software recognizes that

you probably will augment the package with an E-mail system and recommends using E-mail hot-key settings. Enterprise doesn't let you schedule overlapping meetings and doesn't help you find a common group meeting time.

You enter details about a meeting by attaching a memo to the meeting request. Most systems will automatically open a memo field to be attached to the note. Enterprise does not. The manual describes memos as items that you send to tasks, not people—a confusing scenario. Also, Enterprise lets you save the memo to any network drive—including those to

which other users may not have access. This requires even a neophyte to have knowledge of the network directory structure and access rights.

Enterprise's project management capabilities are well developed. You can create projects on the fly, and Enterprise will automatically create to-do list items for the project's start and conclusion times. There are a host of screen displays and reports for monitoring various tasks throughout a project's life cycle.

We liked Enterprise's trick of automatically leaving a notification TSR behind after you exit the package. The TSR signals you from within other applications when a meeting has been scheduled or an appointment is drawing near.

WORDPERFECT OFFICE LAN 3.01

The installation procedure for WordPerfect Office LAN could pass for a mortgage loan application. You are confronted with hordes of initialization

questions (most are optional), and you must have all the access privileges on WordPerfect Office LAN's subdirectories set just right before you can begin.

WordPerfect Office LAN separates group-calendar from local-calendar activities. You manipulate local-calendar activities—appointments and to-do list items—through the calendar selection off the main menu. The scheduler menu option takes you to the group schedule.

continued

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We prefer having one schedule that distinguishes between group and personal activities.

The scheduler's search option lets you instantly assess the availability of people and resources for a meeting. The program presents a grid, with names along one axis and time slots along another. Each user's calendar shades busy time blocks. You can't, however, see what they're doing. Also, you can't export personal-calendar information to an ASCII file.

WordPerfect Office LAN supports personal groups that any user can create, as well as the more typical global groups that only the system administrator can create. This makes WordPerfect Office LAN especially useful in environments where projects have short life cycles and groups rapidly form and dissolve. Word-

Perfect Corp. says that it should have Unix and Mac versions available by the time you read this.

Meeting Adjourned

None of the packages with project management capabilities will replace a full-featured project management package. But if you consider basic project tracking to be a crucial adjunct to your group scheduler, you'd do well to consider SuperTime or Who-What-When Enterprise—provided that your organization operates primarily on PC compatibles. If your office runs connected Macs and PCs, Planisoft is the only product that currently supports both.

For PC users, we preferred Higgins, CaLANdar, and Right Hand Man II. Higgins's tightly integrated functions and CaLANdar's uncluttered display

made these packages especially easy to use. Right Hand Man II won us over with its ease of installation and many integrated applications.

Meeting Maker wins hands-down for Mac users. It's the most full-featured, best-designed program in the group. Unix users should go with ClockWise, which combines an innovative licensing policy with the flexibility to work in many different Unix environments. ■

Rick Grehan is the director of the BYTE Lab. Howard Eglowstein is a BYTE Lab testing editor. Tom Thompson is a BYTE senior technical editor at large. Tom Yager is a technical editor for the BYTE Lab; he also manages the BYTE Unix Lab. You can reach them on BIX as "rick_g," "heglowstein," "tom_thompson," and "tyager," respectively.

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(The Coordinator II)
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Alameda, CA 94501
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ASD Software, Inc.
(Planisoft 1.21)
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fax: (714) 624-9574
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Chronos Software
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fax: (305) 238-0017
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(Right Hand Man II 1.01)
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(ClockWise 1.3)
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(Network Scheduler II)
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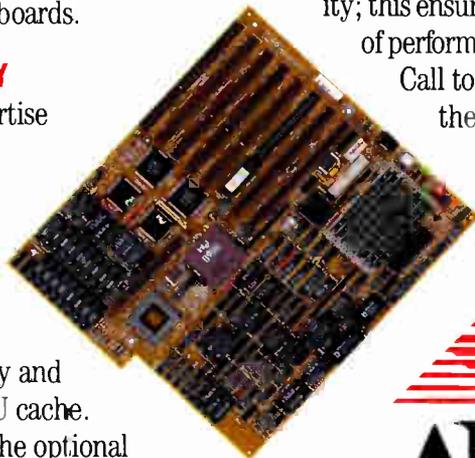
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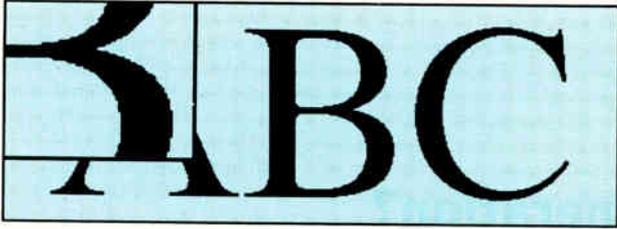
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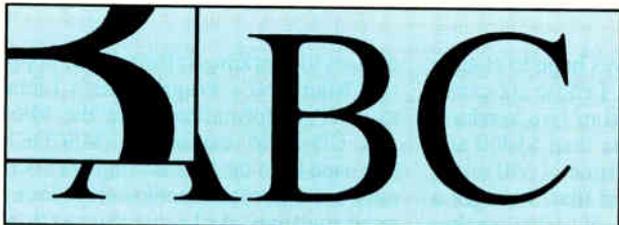
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HARDWARE

CD-ROM Drives: How Good Is the Third Generation?

DAVID A. HARVEY

The winter of our discontent with CD-ROM may be over. The technology is poised to bring optical databases to more businesses than ever thanks to new "third-generation" drives that have faster speeds and lower prices than their predecessors. Helping things along are an explosion in CD-ROM titles and vendors like Microsoft who plan a role for CD-ROM in recently announced multimedia campaigns.

This activity could represent a reversal in CD-ROM's fortunes. For years, the prices for CD-ROM drives, combined with slow data-access speeds and a dearth of titles, have kept the technology off most desktops. Makers of a so-called

third generation of drives hope to change that. For this roundup, I chose six external CD-ROM drives from five vendors. Each drive sells for less than \$1000 and lists an average access time of 350 milliseconds or less. Beyond that, I sought a representative sample of drive-mechanism manufacturers.

CD-ROM puts immense amounts of information—up to 650 megabytes—at your fingertips. Perhaps more than any other computer-based technology, CD-ROM can help you get your work done faster and more accurately than performing the equivalent tasks manually. In the course of this review, I've searched a database to double-check company ad-

dresses and pricing information, popped into Microsoft's Programmer's Library to verify information about the Microsoft CD-ROM extensions (MSCDEX), and used both the Oxford English Dictionary and Microsoft Bookshelf to look up word spellings. As I write this, a Chinon drive is hooked up to my stereo system playing an audio CD.

Unlike other optical technologies, CD-ROM is a publishing medium that is best suited to disseminating multiple copies of any given set of information. In fact, to induce buyers, more and more manufacturers are starting to include bundles of prepackaged discs with their drives.

Available databases range from the general, like Grolier's New Electronic Encyclopedia, to the specific, like Matthew Bender's Intellectual Property Law. Just about any reference source you might need is quickly becoming available on CD-ROM. According to the market researcher Infotech, the number of titles grew from 1500 in 1989 to 2250 in 1990, and the number of installed drives rose to 1.25 million during that time.

Software and documentation are also finding their way onto CD-ROMs. Sun Microsystems, Microsoft, Hewlett-Packard, Corel Systems, and Novell are just a few of the companies that are distributing massive quantities of information on CD-ROM. In fact, Microsoft's multimedia extensions for Windows will be distributed only on CD-ROM.

Better Performance

The growing excitement over CD-ROMs is due partly to the third-generation drives. With faster access times, improved data transfer rates, and other design improvements, they reach new lev-

BYTE ACTION SUMMARY

■ **WHAT THIRD-GENERATION CD-ROM DRIVES ARE**
CD-ROM drives with a rated average access time of 350 ms or better.

■ **LIKES**
Greater speed means less time waiting for your database to catch up with your thoughts. Improved audio capabilities begin to make an all-in-one drive for data and audio a reality.

■ **DISLIKES**
Continuing high prices and some nonstandard SCSI adapters. Also, the lack of RCA jacks, emergency-eject mechanisms, and continuous reads on some of the drives.

■ **RECOMMENDATIONS**
For performance and design quality, go with either the PLI or the Hitachi CDR-1750S drive.

■ **PRICE**
Chinon CDC-431, \$895 (includes SCSI card)
Hitachi CDR-1700S, \$815
Hitachi CDR-1750S, \$965 (SCSI adapter kit, \$180)
PLI CD-ROM, \$999 (includes Trantor T128 SCSI adapter)
Texel DM-5021, \$549 (includes Trantor T128 SCSI adapter)
Toshiba TXM-3201A1, \$950 (includes SCSI adapter)

els of performance and functionality.

Most important are the average access times of 350 ms. Access time is extremely important to CD-ROM because the data transfer rate of a drive is fixed at 150 kilobytes per second, so the time it takes the head to seek to a particular piece of information largely determines the performance of the drive.

However, access time alone isn't everything. The Hitachi CDR-1700S, rated as one of the fastest in that regard, turned in the poorest performance results in my Data Transfer test (see part a of the figure). The second key to performance is continuous-read technology. There is a world of difference between 150-KB transfers at the drive and 150-KB transfers at the bus. Continuous read delivers the maximum amount of data at the bus and greatly improves performance.

Instead of fetching a sector and then waiting for a software command to get the next sector, continuous-read drives grab the next few sectors, transfer them to the drive's cache, and send the data along to the bus. The result is an even flow of data between the CD-ROM drive and your computer. In practical terms, this means that scrolling doesn't jump and data transfer performance in general is far better.

Continuous read is also vital when you try to display animated sequences. On drives that don't have it, animations look jerky, almost like stop-motion photography. For this reason, to meet Microsoft's multimedia specifications, a CD-ROM drive must have continuous-read technology.

But performance isn't everything. Reliability and convenience are also crucial to a winning CD-ROM drive. One of the single greatest causes of data errors on a



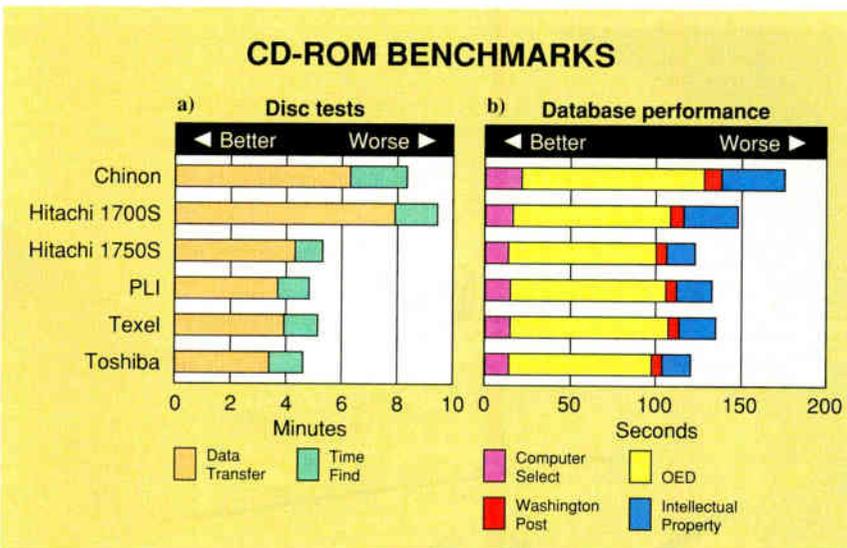
Third-generation CD-ROM drives offer data-access times of 350 ms or better and entrance to an ever-widening world of databases. The six drives tested are built by (from top) Chinon, Texel, Toshiba, PLI, and Hitachi.

CD-ROM is dust. When the read head is occluded, it can't properly decode the light reflected by the lands and pits on the disc's surface, and data gets scrambled. To eliminate this problem, a number of third-generation-drive manufacturers have added self-cleaning lenses and double-sealed drive enclosures.

The Hitachi units were the most sophisticated in this area, offering a fully

sealed cabinet, a double-door mechanism, and a self-cleaning lens. Second in the cleanliness department was the PLI, which also sported a self-cleaning lens. Although the Toshiba unit that I saw didn't have much dust protection, the company's latest model (which should be out by the time you read this) is based on the same drive mechanism I reviewed and should have a sealed enclosure.

continued



(a) When weighting the Time Find and Data Transfer tests equally, the PLI drive ranked highest in overall data speed. The BYTE Lab's Time Find was used to search for nonexistent files on a test CD; data transfer times measure how long it took to move a 14-MB directory using XCOPY from a CD-ROM to a hard disk.
 (b) Hitachi's CDR-1750S, with a generic SCSI adapter and high-performance drivers, was the overall winner in the tests measuring the time needed to complete a complex search on each of four separate databases. Timing began when the start-search key was pressed and ended when the screen displayed a search-completed message.

Bus Ride

One of the best pieces of news with this group of drives was that almost all (the Hitachi CDR-1700S was the exception) came with generic SCSI-1 adapters. A long time coming, this move to standard SCSI should greatly enhance the technology's acceptance in the market. In an attempt to milk the last drops of performance out of earlier-generation drives, manufacturers frequently developed proprietary SCSI adapters, and you could neither daisy chain standard SCSI peripherals to those adapters nor string drives by different manufacturers off the same interface.

Moreover, my testing revealed that the Hitachi CDR-1700S, the one drive that strayed from generic SCSI, suffered from markedly impaired performance. This is significant because Hitachi's CDR-1750S, a unit based on the same drive mechanism but with a generic SCSI bus, ranked near the top in performance.

To get the drive to talk to DOS, you need to have the Microsoft extensions. MSCDEX uses the network interrupt (2F hexadecimal) to communicate between the device driver and DOS. Make sure your dealer supplies you with the latest version: MSCDEX 2.2.

Data aside, for the moment, one of the second most frequently asked questions about a CD-ROM drive is, "Does it play

music?" Most of them do. Of the group I tested, the Chinon was the best at this task. Equipped with both phone and audio jacks, the Chinon comes with a remote control that lets you play audio CDs anytime.

Flipping a DIP switch on the back of the Toshiba and turning the unit off and on allows you to play audio CDs, start to finish. Tapping the eject button for less than 1 second skips the head to the next track. Unfortunately, the Toshiba supports output only through a stereo headphone jack. The rest of the drives, save the PLI, come with both stereo RCA and headphone jacks, but they let you play audio CDs only via software control. Notable in this respect are the Texel and the Hitachi drives, which come with useful audio-play utilities.

A final point to consider when you're choosing a CD-ROM drive: Databases are still expensive—too expensive, considering that the industry seems to be desperately seeking users. Something's got to give, and it's my hope that database prices will soon drop. To avoid getting stung, buy your drive from a manufacturer or reseller that includes a bundle of software. Currently, Pioneer, Sony, and Hitachi are offering, or have plans to offer, bundles along with their drives. Many resellers and OEMs are following suit.

A Day at the Races

I tested the third-generation drives using a suite of benchmarks designed to evaluate both performance and compatibility. The standard test platform consisted of a Gateway 2000 386/33 equipped with 8 MB of memory, a 387 math coprocessor, a 200-MB Intelligent Drive Electronics hard disk drive, and a Diamond Speed-Star Plus Super VGA card. Additionally, I used a SoundBlaster Pro audio card with a disabled SCSI adapter to test compliance with the Microsoft multimedia extensions for Windows. I performed these tests under DOS 5.0.

Each card used its default port, or I/O address, unless that address conflicted with the SoundBlaster. To keep things even, I set MSCDEX to eight internal buffers and ran them only in conventional memory.

To test generic drive functionality, I first used XCOPY to move a 14-MB directory from the C.A.R.R.S. Shareware CD-ROM to the fixed disk. Then I used the BYTE Lab's Time Find to search for a nonexistent file on the CD (see part a of the figure).

My database tests (see part b of the figure) measured the time needed to complete a complex search on each of four databases. Timing began when I pressed the start-search key and ended when the screen displayed a search-completed message. The databases I used were Ziff-Davis's Computer Select, Matthew Bender's Intellectual Property Law, UMI's Washington Post on Disc, and the Oxford English Dictionary on CD-ROM.

I measured multimedia/continuous-read capabilities by displaying animations from National Geographic's Mammals disc and by playing animations on a demonstration version of Microsoft's Multimedia Bookshelf. I played two sample animations, timed the results of the animation, and made subjective notes on the quality of playback.

Additionally, I kept my eyes on the drive-activity light. On drives that have the continuous-read capability, the light stays on during long read operations; on drives without continuous read, the LED blinks on and off as data is read, displayed, and read again. I repeated each test three times, and the results are averages of those times.

I evaluated compatibility by starting up and accessing the CD-ROM drives under both QEMM 5.12 and a beta version of the Multimedia extensions. Under the extensions, I ran a demonstration version of Microsoft's remarkable Multimedia Bookshelf, as well as a demo of the updated version of DOS Bookshelf.

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CD-ROM DRIVES

To test audio performance, I used the Microsoft Multimedia Player demo, bundled with the extensions, to access and play music on an audio CD. If the drive had both RCA and headphone jacks, I directed audio through both of those outputs. I played headphone output through a pair of amplified speakers; I directed RCA output to the "CD-in" input on a receiver and played the audio through a pair of speakers.

Chinon CDC-431



What the Chinon CDC-431 lacks in speed, it almost makes up for in features. Despite a rated access time of 350 ms, the Chinon gains the dubious honor of running dead last in most of the benchmark results.

The drive came bundled with a discrete chip set SCSI card, MSCDEX 2.2, a disk caddy, a remote control unit, and an AC converter to supply power to the drive.

The Chinon appears not to use a continuous-read mode, and the test animation was jerky and slow. But despite its relative slowness, the Chinon is the most fully featured of all the drives I saw. With an LED display window, emergency eject, power and busy lights, and RCA and volume-controlled headphone jacks, the drive was also the best looking model. I particularly liked its sophisticated audio capabilities.

The remote control lets you skip between tracks; start, stop, and pause the music; play random tracks; scan tracks; perform "track hopping"; and repeat either the last or all tracks played. The audio functions worked as well as those of any midrange audio player.

I like this approach a great deal for the times when I want both CD music and data without having to use software to control the music. However, you will sacrifice a fair amount of performance if you go this route.

Hitachi CDR-1700S and CDR-1750S



The Hitachi CDR-1750S, with a standard SCSI adapter, lived up to its reputation for speed. But its proprietary-bus cousin, the CDR-1700S, was a true disappointment. The CDR-1700S came in at or near the bottom in all the benchmarks and failed to perform up to its specifications under real-world conditions.

There are two main differences between the two Hitachi drives: The CDR-1700S has only a 32-KB cache buffer, and it uses Hitachi's proprietary parallel interface, which was developed primarily for XT-class machines. The CDR-1750S has a 64-KB cache and uses a true SCSI adapter.

When played on the CDR-1700S, the sample animations were jerky, almost

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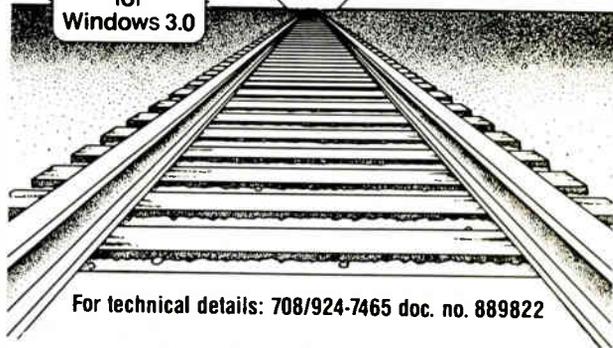
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flip-book quality. Part of the problem is that the device driver I received reads data, turns off an interrupt, and then waits for the next command (the drivers supplied with the CDR-1750S don't need to go through this procedure). Both the smaller cache size and the relative inefficiency of the Hitachi bus conspire to impede playback on the CDR-1700S.

That drive fared equally poorly on all the other tests. The performance difference is so great that I really cannot recommend the CDR-1700S. Rather, I suggest you spend \$150 more for the SCSI-based CDR-1750S.

The CDR-1750S comes with a Future Domain TMC-845 SCSI card, a disc caddy and cables, several audio utilities, and version 2.2 of Microsoft's MSCDEX, which enables the CDR-1750S to perform continuous reads.

The drive itself (the same for both models) is certainly the most solidly designed and fully featured of the lot. The enclosure is hermetically sealed to prevent dust from getting into the electronics. It also has an automatic lens-cleaning mechanism and a double-door system to reduce dust in the caddy area. Disc-loaded, disc-use, and power-on LEDs grace the front of the cabinet, as does an emergency eject hole, a headphone jack, and a volume knob. The back has two Centronics SCSI connectors, an array of switches to set up the SCSI modes, and stereo RCA jacks.

My experiences with Hitachi's CDR-1750S and its "evil twin," the CDR-1700S, underscore the importance of overall design (including cache size, interface, and drivers) in creating high-performance CD-ROM drives. When you buy, be certain that the drive you choose comes with a SCSI adapter and absolutely the most recent drivers available.

PLI CD-ROM



Peripheral Land's drive is a Sony CDU-541-1 mounted in an enclosure designed to fit beneath the chassis of a Mac SE. PLI's Macintosh orientation is evident in the manual (which avoided the subject of PC installation), in the omission of both a device driver and MSCDEX, and in a

SCSI cable that was too short to connect between the drive and the host adapter. Luckily, the PLI CD-ROM came bundled with an OEM version of a Trantor T128 SCSI adapter, and I was able to use the software and cable from that package to install the drive.

Although the trappings were inadequate for PC users, the drive itself performed extremely well, ranking among the best of the drives that I tested. I was quite pleased by the PLI/Sony design and performance. Animation was as smooth as that on the Toshiba drive, and the PLI simply flew through the compatibility tests.

The enclosure has a fan, RCA jacks, the usual set of SCSI-option DIP switches, two Centronics-style SCSI connectors, a headphone jack, a volume switch, and emergency-eject and drive-use indicators. Additionally, the continuous-read Sony drive has a built-in lens cleaner.

However, I didn't like the fact that the RCA and headphone jacks put out sound at the same time. Consequently, plugging in your headphones will not shut off the signal going to external speakers, which was not the case with the rest of the drives.

Texel DM-5021



Although the Texel DM-5021 placed in the middle of the benchmarks, it does support continuous reads, and the test animation displayed smoothly. Missing from the drive were RCA jacks and an emergency-eject mechanism.

What distinguishes the drive, aside from its sleek brushed-aluminum case, is the bundled Trantor SCSI adapter. The card comes with drivers, MSCDEX 2.2, a disc-test program, a program to play audio CDs, and programs to lock and unlock the disc and eject it from the drive. Like the Future Domain card bundled with the Toshiba, the Trantor is capable of supporting other SCSI devices. Trantor also makes a parallel adapter plug that lets you run SCSI devices through your printer port.

One thing to note about Trantor-based CD-ROM drives: Most drives are identified to MSCDEX as a device named

MSCDXXX, where the X's represent a unique drive ID. The Trantor identifies itself with a device ID of TSLCD. If you have any software that writes directly to the device, you'll need to change it to recognize TSLCD. For example, Grolier's Encyclopedia, which bypasses MSCDEX, is invoked by the command EEPGM -cXXXXXX, the X's representing the device name. To start Grolier's with a Trantor-based system, you type EEPGM -cTSLCD, or edit the Grolier's batch file to do the same thing.

Toshiba TXM-3201A1



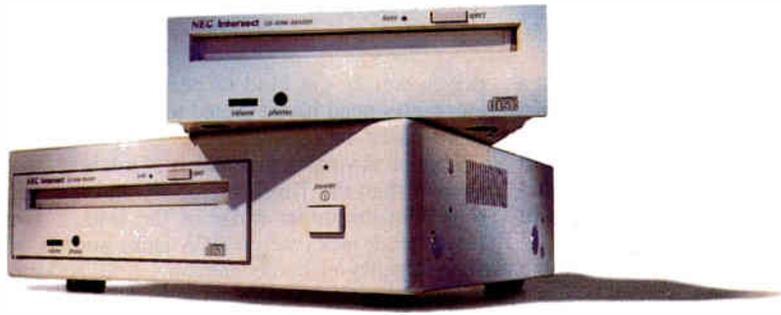
The Toshiba TXM-3201A1 was a leader in many of the benchmark tests. However, it was also the most feature-poor of the drives. It has a standard SCSI adapter and came bundled with a Future Domain TMC-840 card, which allows you to configure among four base addresses and two interrupts and set the time-out delay. I also ran the drive under the TMC-845 card with the Hitachi drivers. I noticed a slight performance improvement with that combination.

The drive itself has a drive-activity light, an eject button, two Centronics-style SCSI connectors, and DIP switches to set parity and arbitration and to activate the test function. You can set up the drive to run in an audio-only test mode, allowing you to play music CDs, and you can use the drive in either a horizontal or a vertical orientation.

I was bothered by the drive's eject switch. It took a long time for the drive to eject a disc, and several times I apparently pressed for the wrong duration and had to push the eject button again. I also didn't like the volume control. Instead of a slider or a knob, the Toshiba has a four-position switch. Even at the lowest setting, I still could hear sounds from the speakers. I was also bothered by the lack of an emergency-eject hole, a power-on status light, and RCA connectors.

Along with the adapter and drive, the Toshiba kit includes a CD-ROM cable, a disc caddy, a demo disc, a terminator, and version 2.10 of MSCDEX.

Ergonomics aside, it's hard to get better performance than that offered by the Toshiba. It scored high in the tests. It ran



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through the compatibility tests without a hitch. When I used it to play animations, the results were smooth and natural. By the time you read this, a new model will be out. It's slated to use the same mechanism that the TXM-3201A1 uses but will offer improved dust protection.

Pick List

The third generation of CD-ROM drives mostly lived up to my expectations. Although still on the pricey side, these

drives deliver the kind of performance you really need if you intend to use CD-ROM-based data frequently.

If price is your main concern, look no further than the Texel. It's \$549, and it scored in the upper range of the tests. However, it lacks stereo RCA jacks and an emergency-eject mechanism.

Overall, I liked the Hitachi CDR-1750S and the Sony-based PLI drives best. Both ranked near the top in the performance tests, both had well-designed

enclosures with the playback and audio controls you really need when using CD-ROMs frequently, and both offered automatic lens cleaning. When considering performance and design, choosing between the two is a coin toss.

On the other hand, I cannot recommend the Chinon or the Hitachi CDR-1700S drive unless you're definitely not going to run applications with animated sequences or video playback. Their inability to handle the test animations, coupled with their slowness, makes them inadvisable purchases. ■

David A. Harvey is a computer journalist based in Houston. He specializes in optical and multimedia technologies and software. You can reach him on BIX as "daharvey."

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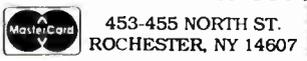
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APPLICATION

Quattro Pro 3.0 vs. Lotus 1-2-3 Release 2.3

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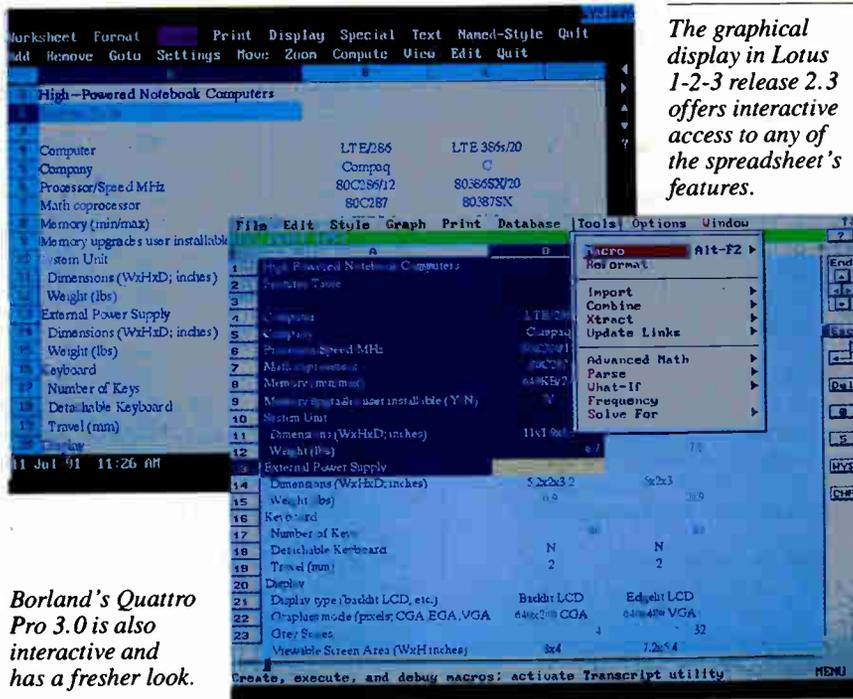
If you're a die-hard DOS user laboring with a 286- or even an 8088-based machine, at least two worthy spreadsheets have now been redesigned with you in mind. Lotus 1-2-3 release 2.3 and Borland's Quattro Pro 3.0 are aimed at spreadsheet users who happen to be low on hardware but high on expectations. Both of these products offer proprietary WYSIWYG interfaces, good graphing and charting, excellent output capabilities (both include quality type from Bitstream), and admirable pure spreadsheet abilities in the areas of problem solving and analysis.

However, what makes these products most appealing is that they are pretty nimble at delivering all this promise and potential on just about any type of hardware platform, from 512-kilobyte XT's on up. To test Quattro Pro 3.0 and 1-2-3 release 2.3, I approached the evaluation on two levels.

First, I ran the products through a series of benchmark tests in both their WYSIWYG and non-WYSIWYG modes. The tests mimic activities spreadsheet users perform regularly: file loads, moving ranges, recalculating a worksheet, scrolling through a worksheet, and so on. However, I also worked through some more-subjective scenarios, including building charts and graphs and generally trying to get a feel for what these two products are like in daily use.

I tried to strike a balance by performing the bulk of the testing on what I consider to be a low- to midrange system: a 386SX with 2 megabytes of memory and a VGA display. I also loaded and ran the products on both a 486 machine and a 286 AT to get a feel for how they worked at the top and bottom of the hardware spectrum.

In most cases, 1-2-3 release 2.3 tested out faster—sometimes significantly so. But in terms of overall usability and other areas, 1-2-3 was not always the winner. Both products advance the state of the art at the entry level of the spreadsheet market. However, there are enough differences between them in terms of overall design and execution that there are some good reasons to consider one over the other, depending on your situation.



The graphical display in Lotus 1-2-3 release 2.3 offers interactive access to any of the spreadsheet's features.

Borland's Quattro Pro 3.0 is also interactive and has a fresher look.

Lotus 1-2-3 Release 2.3

This latest addition to the 1-2-3 family is in many ways a response to the direct competition from Borland's Quattro Pro. Some of the added features were offered first in Quattro Pro, but by responding in kind, Lotus has made release 2.3 a much more attractive product at every level.

The key addition is a fully interactive WYSIWYG environment. You can invoke this environment as an add-in product that you can automatically start each time you run 1-2-3 or that you can turn on whenever you wish. Unlike earlier preview modes, the graphical display in release 2.3 offers interactive access to any of the spreadsheet's features. The display itself is about as WYSIWYG as you can hope for under DOS, including display of all fonts (four Bitstream Speedo fonts are included), colors, and so on.

Manipulation of spreadsheet elements within the graphical display is fairly effortless, with access to either the familiar slash commands or full mouse support. You can point and click to specify ranges, and edit or insert rows or columns quickly and easily.

Interestingly, one of the biggest attractions of 1-2-3—its heritage—is also a

slight Achilles' heel. Rather than start with a clean slate, Lotus was obligated to use the basic spreadsheet technology it has had for years in order to ensure compatibility. Still, Lotus has done an admirable job adding features while improving performance.

In most of my performance tests, release 2.3 was the hands-down winner. For instance, it loaded a file almost twice as fast as Quattro Pro 3.0 and was much faster at moving a range and recalculating the BYTE benchmark spreadsheet. In the non-WYSIWYG mode, it was still faster, although the margin was much closer. Not surprisingly, both spreadsheets shaved time off their results when they ran in character-based mode. I also found that Lotus 1-2-3 was faster across all the different hardware platforms that I tested.

There are other new features in release 2.3 that are worth noting beyond its speedy performance and its WYSIWYG mode. The output and spreadsheet publishing features have been enhanced to allow a one-step method for creating drop shadows, and the ability to compress (or expand) a worksheet automatically so that it fits neatly on a page. The latter feature will be a big boon for many

BYTE ACTION SUMMARY

■ **WHAT QUATTRO PRO 3.0 AND LOTUS 1-2-3 RELEASE 2.3 DO**

Provide a graphical WYSIWYG environment and other spreadsheet enhancements that require as little hardware as an IBM XT with only 512 KB of RAM.

■ **LIKES**

Lotus 1-2-3 release 2.3 is very fast and touts an interactive WYSIWYG mode. Quattro Pro 3.0 makes generating charts and graphs a simple process, and as the top-of-the-line spreadsheet for Borland, it packs in even more features than 1-2-3 release 2.3.

■ **DISLIKES**

The 1-2-3 release 2.3 GUI carries the additional baggage of the original 1-2-3 user interface. Quattro Pro 3.0 is noticeably slower than 1-2-3 release 2.3.

■ **RECOMMENDATIONS**

If you are already a 1-2-3 user, Quattro Pro 3.0 may not offer enough to encourage a switch, but you'll certainly find plenty of reasons to upgrade to 1-2-3 release 2.3. Otherwise, Quattro Pro 3.0 is a solid performer, and if absolute speed is not a critical issue for you, its graphing and charting abilities make it a better choice.

■ **REQUIREMENTS**

IBM XT, AT, PS/2, or compatible with 512 KB of RAM (1-2-3 release 2.3 requires only 384 KB for non-WYSIWYG mode).

■ **PRICE**

Lotus 1-2-3 release 2.3, \$495
Borland Quattro Pro 3.0, \$495

■ **FOR MORE INFORMATION**

Borland International, Inc.
1800 Green Hills Rd.
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users who have been frustrated at having to go back and edit the entire sheet when there was one row or column too many to print out.

Font support has been increased to allow access to more type styles, and the graphing module has also been improved with three-dimensional effects and more colors. Overall, however, Quattro Pro 3.0 puts out better-looking graphs and charts. I also liked the spreadsheet Auditor, which is used to document forms in a worksheet (or range) and can quickly pinpoint format relationships and other areas that otherwise require laborious, manual tracing.

On top of these features (and a helpful file viewer borrowed from Magellan), release 2.3 offers full backward compatibility and all the conventional 1-2-3 features that you have come to either love or hate. One notable improvement from version 2.2 is enhanced memory management, making it possible to create much larger worksheets.

By taking the best of what it already had and responding nicely to competitive challenges, Lotus has produced a spreadsheet that should satisfy those who want more from their software without having to make costly hardware upgrades.

Quattro Pro 3.0

Quattro Pro may have started its life as a less expensive alternative to 1-2-3, but it has grown up to take on an independent character as a superb spreadsheet product. Quattro Pro 3.0's approach differs from 1-2-3's in several ways. First, this is really *the* spreadsheet for Borland, so it packs in more features and power than release 2.3 while accommodating low-end hardware.

Second, since it isn't wedded to an older spreadsheet technology as 1-2-3 is, Quattro Pro has a newer, fresher look overall. This is particularly apparent in the WYSIWYG mode, which matches release 2.3 for its interactive abilities but far exceeds it in appearance and ease of use. For example, a button bar on the right makes switching from WYSIWYG mode to character-based mode a snap, whereas 1-2-3 requires multiple commands to do the same thing. There are also sculpted buttons, a powerful zoom command, and other refinements.

Several other features that exist in 1-2-3 are also found in Quattro Pro, such as the ability to adjust a worksheet to print on a single page, which Borland calls Print-to-Fit. There is also a new sideways printing mode for handling extra-large worksheets, and of course a 1-2-3 command mode that makes 1-2-3 users into

instant Quattro Pro experts.

But the real advantage of Quattro Pro 3.0 lies primarily in the areas of graphing and presentations. There is a superb screen-show feature that includes a technology (called Sound F/X) that lets you add sound to presentations, 24 transition effects for screen shows, and graphs that far outshine what is available with release 2.3. Not only are there more and better graphing options, but they are easier to build with Quattro Pro 3.0 than with 1-2-3. The same holds true for the built-in drawing package, which affords smoother and more robust spreadsheet annotation. For example, Quattro Pro includes a snap-to Grid feature for more precision in the placement of objects. If you're looking for the more graphical of these two spreadsheets, Quattro Pro 3.0 is it.

Quattro Pro offers exemplary analytical features, including a goal-seeking technology, an advanced linking and consolidation feature (you can link as many as 63 spreadsheets), and the ability to more easily adjust row and column heights (in either mode).

But despite pretty much equivalent or superior features on most counts, Quattro Pro 3.0 suffers somewhat on the performance front. In WYSIWYG mode, 1-2-3 was three times as fast at executing a Copy function and more than twice as fast doing a recalculation. It's not so much that Quattro Pro is slow but that 1-2-3 release 2.3 is very fast across the board.

However, despite the fact that 1-2-3 outpaced Quattro Pro 3.0 on the benchmark tests, I preferred working with Quattro Pro. I found it easier to create charts and graphs with, easier to produce high-quality output with, and generally as capable on "pure" spreadsheet functions. When you factor in a high degree of 1-2-3 compatibility, the ability to open as many as 32 worksheet (or graph) windows, and a strong macro capability, Quattro Pro 3.0 is a formidable competitor.

Which Spread?

Choosing between these two products is not a simple task. And the decision goes far beyond whether you want a product that squeezes out the maximum performance from your equipment (such as 1-2-3) or one that is easier to use and looks great (such as Quattro Pro).

For one thing, it's worth looking at exactly what you do with your spreadsheet. Lotus 1-2-3 may be faster at loading files, but how often during the day do you load files? Many people do most of

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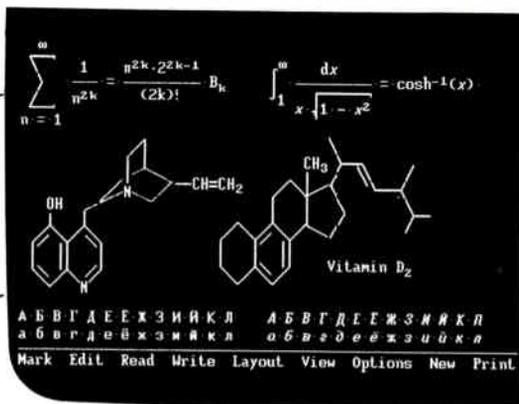
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QUATTRO PRO VS. LOTUS 1-2-3

their work with one or two worksheets. And what about recalculation speed? Do you tend to work on a large worksheet and continually run what-if scenarios? Or do you build lots of new worksheets or prepare presentations? The answers to these questions can help to steer you toward one product or the other.

My favorite is Quattro Pro 3.0, in part because I find the overall look and feel and feature set the most appealing. Also, because I tend to do spreadsheet work a bit more sparingly than some, a perfor-

Quattro Pro's
advantage
lies in graphing
and presentation.

mance difference of a few seconds is not a major issue for me.

However, Lotus 1-2-3 release 2.3 demands serious consideration, at least because of the huge installed base of Lotus users and of 386SX and lower equipment. With its vastly improved WYSIWYG interface and additional features without any loss of speed, release 2.3 is a most attractive product. It offers 1-2-3 users all the things that have made that product popular, along with enough new twists to keep it current and even invite in new spreadsheet users. Quattro Pro 3.0 is a great product when viewed on its own merits. But for current 1-2-3 users in the character-based world, it may not have enough to entice users to switch from what is now both familiar and improved.

Those who do switch won't be disappointed. If you are light on hardware, you have some solace in the fact that you are laden with choices for a great spreadsheet. For anyone in the market for a character-based spreadsheet with power, flexibility, and an improved interface, both of these products offer first-rate choices. ■

Jon Pepper, a spreadsheet user since the early days of VisiCalc, is a consultant and writer who has written many articles on spreadsheets for several national magazines. He can be reached on BIX c/o "editors."

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specifically. **BYTE** asked each vendor to beef up the base configurations to incorporate a coprocessor. Intel offers a 487SX, but the list price of \$599 makes buying a Tempo is the only system I tested that included a 487SX coprocessor socket—an

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486SX MACHINES

SYSTEM CONFIGURATION AS TESTED

	Everex Tempo 486SX/20	American Mitac 4270E	IBM PS/2 Model 90 XP 486 SX-0G9
Processor	486SX/20; 487SX socket	486SX/20; Weitek WTL4167 socket	486SX/20
Memory	4 MB of RAM; 64 KB of CPU cache	4 MB of RAM; 64 KB of CPU cache	8 MB of RAM
Mass storage	105-MB Quantum IDE hard disk drive; high-density 5¼-inch TEAC floppy disk drive	100-MB Conner IDE hard disk drive; high-density 5¼-inch TEAC floppy disk drive	160-MB IBM SCSI hard disk drive; high-density 3½-inch floppy disk drive
Display	Evervision 800- by 600-pixel, 256-color VGA board and VGA monitor	Mitac 800- by 600-pixel VGA controller; Mitac multifrequency monitor	IBM XGA graphics adapter; IBM 8515 XGA monitor
Keyboard	101 keys	101 keys; PS/2-compatible	101 keys; PS/2-compatible
I/O expansion	Two serial ports; one parallel port; two open 8-bit slots; three open 16-bit slots	Two serial ports; parallel port; PS/2 mouse port; four open EISA slots	Serial, parallel, and PS/2 mouse ports; three open Micro Channel slots
Other	DOS 4.01, Windows 3.0, serial mouse	DOS 4.01	DOS 4.00

BYTE ACTION SUMMARY

- **WHAT 486SX COMPUTERS ARE**
Low-cost 486 systems sans floating-point capabilities.
- **LIKES**
All three systems are solidly built.
- **DISLIKES**
Performance is about equal to less expensive 386/33 systems.
- **RECOMMENDATIONS**
Everex's Tempo 486SX/20 offers the best price/performance.
- **PRICE (as tested)**
Everex Tempo 486SX/20, \$4112
Mitac 4270E, \$4415
IBM PS/2 Model 90 XP 486 SX-0G9, \$11,155
- **FOR MORE INFORMATION**
American Mitac Corp.
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San Jose, CA 95134
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Everex Systems, Inc.
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(800) 821-0806
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IBM Corp.
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Department ZW1
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White Plains, NY 10604
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indication that Everex actually designed the motherboard for the 486SX, rather than retrofitting a 486DX system board. I experienced no compatibility problems; performance was about on a par with the fastest 33-MHz 386 systems that BYTE has tested (see the benchmarks). The Tempo includes thorough documentation and comes with a one-year warranty and three months of on-site warranty service.

Everex also offers a 486SX in its high-end Step line that didn't arrive in time for this review: The Step 486SX/20 includes a more advanced cache and uses a replaceable processor card. A stripped system with 1 MB of RAM, floppy disk drive, and keyboard starts at \$2999.

Mitac 4270E

The EISA-based American Mitac 4270E made the smallest footprint on my desk. The \$2995 base price includes 1 MB of 80-ns DRAM, a 64-KB secondary write-back CPU cache (expandable to 256 KB), a high-density floppy disk drive, extended (800 by 600 pixels) VGA, two serial ports, one parallel port, a PS/2 mouse port, a keyboard, and DOS 4.01. My review system configuration retails for \$4415.

The 4270E is clearly a retrofit of the company's 4280E 486DX system. It uses the same BIOS and setup utilities. The board lacks a 487SX socket but includes a Weitek WTL4167 math coprocessor socket. The Weitek and cache memory sockets sit under the drive bays; accessing them is difficult.

Mitac failed to change the system BIOS to accommodate the 486SX. It still sets the coprocessor bit in the system equipment variable. Programs that use the equipment-check interrupt to determine if a math coprocessor is present incorrectly determine that a coprocessor is present and fail to run properly. The

BYTE Lab got around the problem by using Debug to manually modify the equipment variable. A Mitac spokesperson said the problem should be fixed by the time you read this.

The system has five EISA expansion slots. The multifunction board (with serial and parallel I/O, hard and floppy disk drive, and VGA controllers) occupies one slot. A proprietary memory slot holds a board with 16 SIMM sockets that hold up to 64 MB.

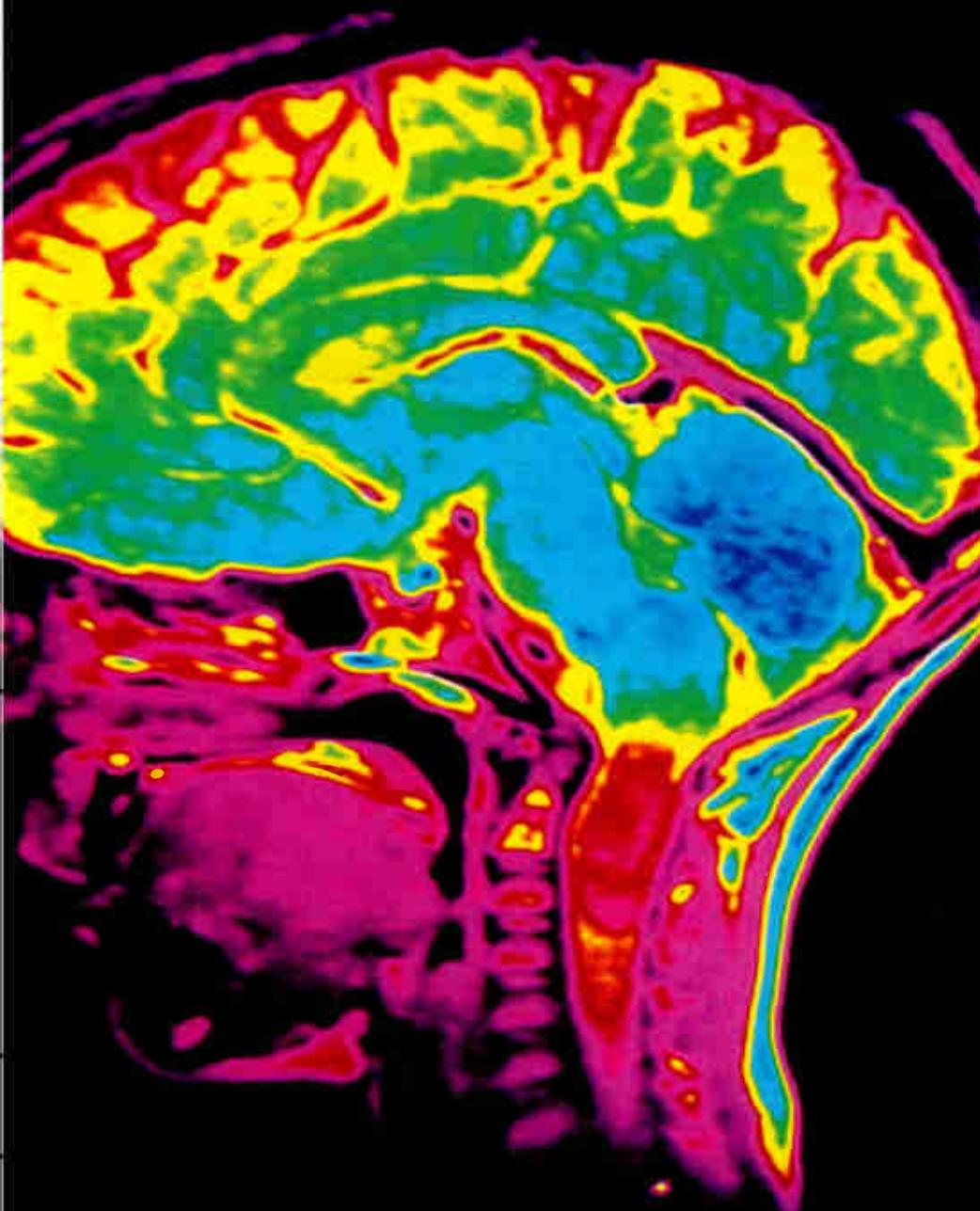
The chassis includes two standard 5¼-inch half-height drive bays and one low-profile 3½-inch drive bay. My machine had one of each type available. The chassis also includes a mounting area for another 3½-inch hard disk drive. The video monitor is adequate, but not as bright or consistent as the Evervision monitor. The system is FCC Class A certified (business use only) and includes a one-year on-site service warranty. The overall construction appears to be good, but it doesn't include any EISA peripherals and didn't perform as the EISA label would lead you to expect.

IBM PS/2 Model 90 XP 486 SX-0G9

The IBM PS/2 Model 90 486 SX base system includes 4 MB of 70-ns RAM, an ALPS high-density 3½-inch floppy disk drive, an integrated 1024- by 768-pixel XGA video adapter, one serial port, a parallel port, a PS/2-type mouse port, a PS/2 101-key keyboard, a SCSI hard disk drive controller with a 512-KB cache, and either an 80-MB or 160-MB hard disk drive. The retail price for the base system is \$8345; a 160-MB system is \$8945. I tested the 160-MB SCSI hard disk drive. In BYTE's test configuration, the system sells for \$11,155—priced for a system that's intended to establish a new low-end 486 price mark.

IBM's new 486SX-based Model 90

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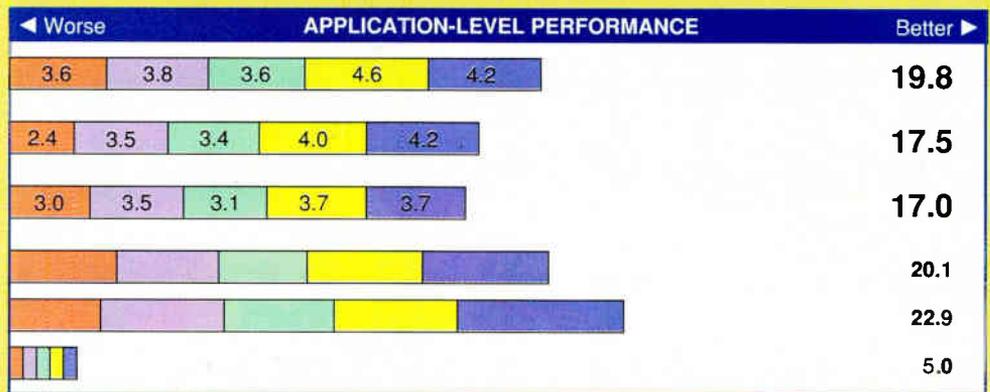
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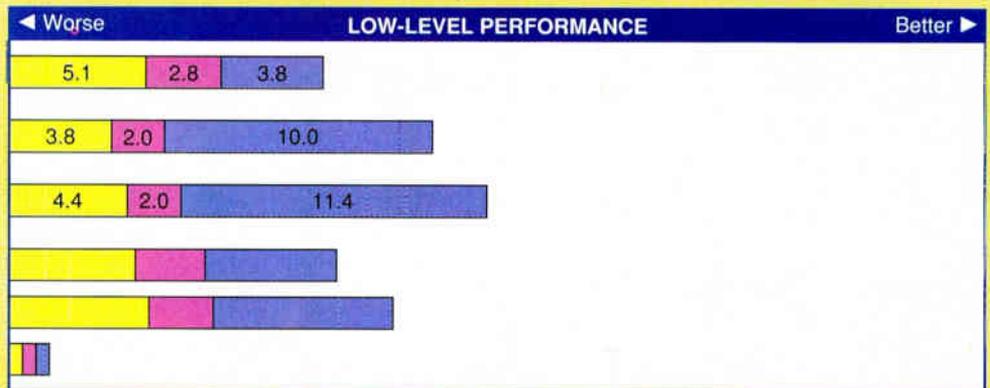
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DOS BENCHMARKS



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CONVENTIONAL BENCHMARKS

	LINPACK (single) (MFLOPS)	Dhrystones (Dhry./sec.)
Everex 486SX/20	0.01281	16156
IBM PS/2 90 XP 486	0.01228	15944
Mitac 4270E	0.01748	15754
Club Hawk I 386/33	0.32630	14871
Arche Legacy 386/33	0.32680	15324
IBM AT	0.02105	2318

For application and low-level benchmarks, results are indexed and show relative performance; for each individual index, an 8-MHz IBM AT running MS-DOS 3.30 = 1. For all benchmarks, higher numbers indicate better performance.

The BYTE low-level benchmark suite identifies relative performance at the hardware level; the application benchmarks evaluate real-world performance by running a standard test suite using commercially available applications. Application indexes include tests using the following programs: WordPerfect 5.0; Desktop Publishing: Aldus PageMaker 3.0; Database: Borland Paradox 3.0 and Ashton-Tate dBase IV; Compilers: Microsoft C 5.1 and Borland Turbo Pascal 5.5; and Spreadsheets: Lotus 1-2-3 release 3.0 and Microsoft Excel 2.1. We tested these machines without 487SX math coprocessors, excluded the CAD and Scientific/Engineering application benchmark suite, and changed the cumulative application indexes to reflect relative performance within this class.

The BYTE Lab introduced version 2 of the DOS benchmarks in the August 1990 issue (see "BYTE's New Benchmarks: New Looks, New Numbers"). Benchmark results for machines reviewed under previous versions aren't directly comparable. To obtain a copy of the benchmarks, join the listings area of the byte.bmarks conference on BIX or contact BYTE directly.

uses a 486SX processor card but is identical to the company's 486DX-based systems in all other respects. The 486SX module itself appears to be a simple modification of the company's 486DX module, judging by the modification wires on the card. The module doesn't

include a 487SX socket; you replace it with a 487SX processor card (\$1345) or a 25-MHz (\$2745) or 33-MHz (\$4445) 486DX card. IBM has announced a 50-MHz 486DX card as well.

The sturdy, well-constructed Model 90 has four Micro Channel expansion

slots; one holds the SCSI hard disk drive controller. The system's two 3½-inch drive bays are occupied, leaving two 5¼-inch half-height drive bays available. IBM's proprietary high-density SIMMs fit into two memory boards that fit into dedicated slots. The system accepts up to

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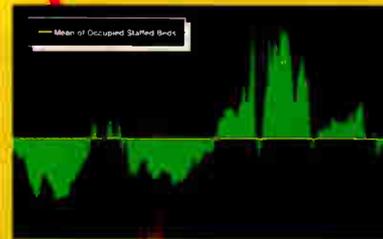
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32 MB of RAM using 2-MB (\$565) and 4-MB (\$1095) modules.

I experienced continuing problems with the 8515 monitor I tested. The first one I received had a defective brightness control. IBM sent a second unit, which had an improperly functioning contrast control. The third monitor worked properly but still didn't offer a good-quality image. If you go with the IBM system, I suggest a different monitor.

The system showed no functional quirks, but—aside from solid construction and the Micro Channel expansion slots—it also showed no particularly outstanding features. The system, which doesn't include a secondary CPU cache, didn't excel on the CPU benchmarks; the SCSI hard disk drive performance was also disappointing. The system comes with a one-year warranty and is FCC Class B compliant.

See How They Run

The 486/25 systems BYTE has tested outperform the 486SX systems across the board; their typical CPU performance indexes hover around 6.5. Some cached 33-MHz 386 systems also beat the Mitac

and IBM machines in BYTE's low-level CPU tests. Arche's Legacy 386/33, with its 128-KB CPU cache, posted a 5.2 CPU index that bested all three 486SX contenders, but its list price of \$6005 is nearly \$2000 higher than the Tempo's price. However, Club's 33-MHz 386 Hawk I (now the Falcon 333) pulled a 4.7 CPU index and sells for just \$2399.

Within the group, Everex's Tempo 486SX/20 is the clear performance winner, despite a relatively slow video subsystem. Its 5.1 CPU index kept it well ahead of the IBM PS/2 Model 90. The Mitac system's anemic 3.8 CPU index came as a surprise, since the system included an external 64-KB CPU cache. The Mitac did well on the video tests, however. The Tempo also had the best disk performance. I didn't expect the mediocre 2.0 index for IBM's hard disk drive subsystem, which includes a high-performance caching SCSI controller with a 16-millisecond hard disk drive.

Final Analysis

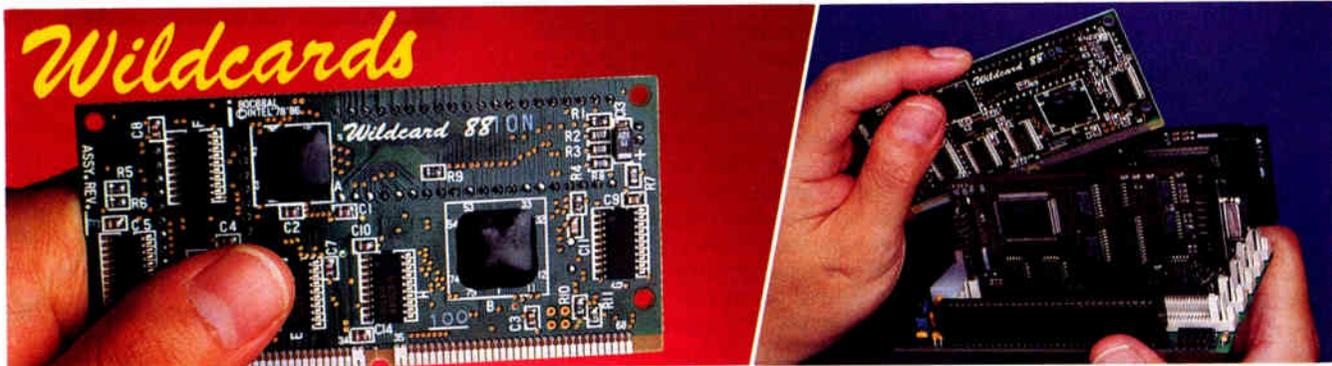
Technologically, 486SX systems don't currently provide any real advantages over existing 386DX and 486DX de-

signs. If anything, the bizarre 486SX/487SX design is likely to confuse many buyers. None of these systems holds a clear price or performance edge over many cached 33-MHz 386 systems, but that's likely to change as Intel drops the 486SX chip price further and as system vendors revamp their product lines. Intel also hopes to entice buyers with specialized processors that will fit into the 487SX socket.

If you'll never need a math coprocessor, a 486SX system is worth a look. You should, however, still comparison-shop against fast 386DX-class systems before making your decision. Of the 20-MHz 486SX systems tested here, the Everex Tempo offers the most for your money. It's well constructed, performs reasonably well, and has the backing of a reputable manufacturer. ■

Roger C. Alford is a consulting editor for BYTE. He is also president of Programmable Designs, a Michigan-based consulting firm, and author of the Programmable Logic Designer's Guide (Howard W. Sams, 1989). You can reach him on BIX c/o "rogera."

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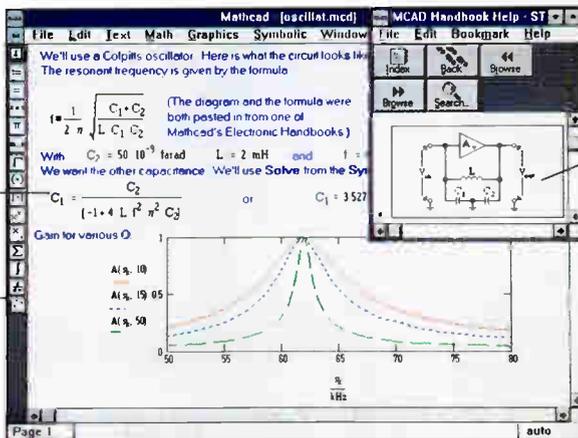
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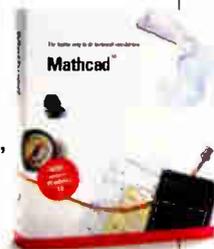
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New NetWare Versions, Options Broaden Appeal

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Novell's new NetWare product lineup represents more than just another version upgrade. A single product, NetWare 2.2, replaces Entry Level System I and II, Advanced NetWare, and SFT NetWare. The easy-to-install NetWare 2.2 offers the same benefits to small and large LANs alike. NetWare 3.11, Novell's new high-end server software, finally delivers transparent file access for Mac, OS/2, Unix, and Open Systems Interconnection clients. I tested NetWare 2.2 and 3.11, as well as three NetWare 3.11 connectivity options that complete the Unix, Mac, and OSI links: NetWare NFS 1.1, NetWare for Macintosh 3.0, and NetWare FTAM 1.1.

I put NetWare 2.2 and 3.11 through their paces both at my home office and at work. My home-office LAN consists of an ALR PowerPro file server (with a 33-MHz 486 CPU, a 330-megabyte hard disk drive, and 9 MB of RAM), with a Gateway 2000 386/33, a PC Brand 486/25, a 12-MHz 286, a 6-MHz IBM AT, and a Mac IIfx as workstations. I used Thomas-Conrad 4045 4/16 Token Ring cards with 128 kilobytes of on-board RAM, running at 16 megabits per second, along with a Dayna DL2000 LocalTalk card to connect the Mac.

At work I've got four NetWare 3.11 servers, about 70 286 and 386 workstations, and a mixture of IBM, Western Digital, Gateway Microsystems, and Thomas-Conrad 4-Mbps Token Ring cards. I used an IBM RISC System/6000 PowerServer 320 at the office to test NetWare's TCP/IP connectivity.

NetWare 3.11

You can buy NetWare 3.11, the successor to NetWare 3.1, in 20-, 100-, or 250-user configurations. The "386" designation is gone from the product name, but NetWare 3.11 still runs only on 386 or 486 CPUs. Prices range from \$3495 for 20 users to \$12,495 for 250 users.

This release fulfills Novell's promise to support several different workstation environments. The server can store files from DOS-, Macintosh-, OS/2-, Unix-, and OSI-based client workstations transparently. In order to do this, NetWare 3.11 sets aside special "name spaces" on

The Install NetWare Loadable Module display makes NetWare 3.11 server installation easy. The remote management feature lets you upgrade NetWare 3.1 servers from the supervisor's console.



the server. You load optional server modules (NetWare loadable modules, or NLMs) to manage these name spaces. Each directory entry for a file holds a DOS-style name. The corresponding name-space entry (two 128-byte areas) contains machine-specific name information. For example, a file that originates on an OS/2 workstation can retain its extended attributes (long name, creation date, and so on), and a Mac file uses the name space to hold long name and Finder (resource fork) information.

The Mac, DOS, and OS/2 file-sharing features worked well. I loaded NetWare for Macintosh, created a Microsoft Word document on the Mac, revised the same file with Microsoft Word for Windows on a PC, and performed a final revision under Word/Presentation Manager on an OS/2 workstation. In each instance, I couldn't tell that the file originated on a different kind of computer. NetWare for Macintosh complies with Apple File Protocol 2.0 and with AppleTalk Phases I and II.

NetWare's open architecture extends beyond its file system to include new transport layer interfaces based on Novell's Open Data Link Interface. These allow a wide range of connectivity options, including IPX/SPX, NetBIOS, LU 6.2 (APPC), Named Pipes for DOS and OS/2 workstations, TCP/IP, a Berkeley 4.3 Sockets interface, and AT&T Unix System V Streams Transport Layer Interface (TCI). As yet, though, not many manufacturers include ODLI drivers with their network adapters.

If you store files from many different

kinds of workstations on your server, you're naturally concerned about backing all of them up. The NetWare 3.11 SBACKUP utility lets you back up and restore all server files, regardless of origin, to an internal server tape drive. The name-space information goes onto the backup tape, too. I backed up and restored DOS, Macintosh, and OS/2 High Performance File System files with ease.

To try out the TCP/IP NLM included with NetWare 3.11, I first put my AIX-based RISC System/6000 PowerServer 320 on a separate Token Ring segment and used a NetWare 3.11 server with NetWare TCP/IP loaded to internally route IP packets from a DOS workstation to the separate RISC System/6000 segment. I used the Ping utility to see if the server would let me talk to the RISC System/6000; it worked nicely. NetWare TCP/IP's "IP tunneling" feature enables NetWare 3.11 LANs to communicate across TCP/IP internetworks. To get IPX packets from one NetWare server to another across a TCP/IP link, NetWare wraps the IPX packets in an IP envelope and transfers them across the internetwork.

I also used my IBM RISC System/6000 to test NetWare NFS 1.1. I loaded IBM's Network File System implementation on the RISC System/6000 and NetWare NFS on the NetWare file server. After I made the proper entries in the /etc/hosts and other setup files on the RISC System/6000, I created an empty directory and used the Unix mount command to turn the empty directory into a remote view of the NetWare 3.11 file



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NEW NETWARE VERSIONS

server. I then could access the NetWare file server from the Unix client using Unix commands and programs.

The NetWare FTAM NLM is a file transfer facility that connects NetWare 3.11 servers to OSI-based networks. It's fully GOSIP 1.0-compliant; GOSIP and MAP 3.0 clients can use FTAM to share NetWare print services. This is Novell's first OSI-compliant product; in the future, I'd like to see Novell go beyond supporting mere file transfers.

NetWare 3.11 wants to be your client/server platform. If you're a programmer, you'll like the server debugging facility, which you can access from any workstation. You can test your NLMs by loading, testing, and unloading them without rebooting the test server. Novell offers several NetWare developer's tools, including the "memory protection NLM" (for avoiding wild pointers) and relatively easy to program transport protocols.

NetWare 2.15's FCONSOLE workstation utility monitors server activity. NetWare 386 did away with it. Now it's back, thanks to the Remote Management Facility utility (see the screen shot). You can use RMF to monitor a server or to upgrade NetWare at a second server. I installed an old NetWare 3.0 product on the PC Brand computer and used RMF to perform an upgrade to 3.11. The second server must reboot partway through the process, so you should set things up so the second server boots into NetWare. Remote installation works well, but you must follow the steps in the manual carefully. RMF works across the LAN cable or, if you put a modem on the file server, across dial-up lines.

NetWare 3.11 includes all the features and capacities of its predecessors in terms of reliability, security, RAM size, disk size, and file size (see the features table). Installing NetWare 3.11 is easy. I ran the EISA configuration utility on the ALR PowerPro and then asked my 15-year-old son to do the installation. He finished in about a half hour, stopping only to ask what optional NLMs I wanted automatically loaded in the AUTOEX-EC.NCF file. Novell even simplified the workstation shell generation process somewhat; what used to be SHGEN is now called WSGEN.

The on-line help system could use improvement. The data is there—all 1.7 MB of it—but the nonintuitive NFOLIO user interface makes finding what you need difficult. You can move the cursor around the screen anywhere with cursor keys and even scroll the screen with PageUp and PageDown. Only when you use the Tab key does the cursor jump to a

BYTE ACTION SUMMARY

■ WHAT NETWARE DOES

This network operating system offers file and printer sharing and other connectivity options for Mac, PC, and Unix clients.

■ LIKES

NetWare 2.2 is now easier to install. NetWare 3.11 options allow connection of Mac, OSI, and Unix clients. Both offer strong security and reliability.

■ DISLIKES

NetWare 3.11 lacks peer-to-peer capability; you can share (or back up) only those files that reside on the file server.

■ RECOMMENDATIONS

NetWare 2.2 is the right choice for small- to medium-size LANs where data integrity is paramount. A large LAN, or one that has a diverse mixture of workstation types, is a good candidate for NetWare 3.11.

■ PRICE

NetWare 2.2, \$895-\$5495
NetWare 3.11, \$3495-\$12,495
NetWare NFS 1.1, \$4995
NetWare for Macintosh 3.0, \$895-\$1995
NetWare FTAM 1.1, \$995

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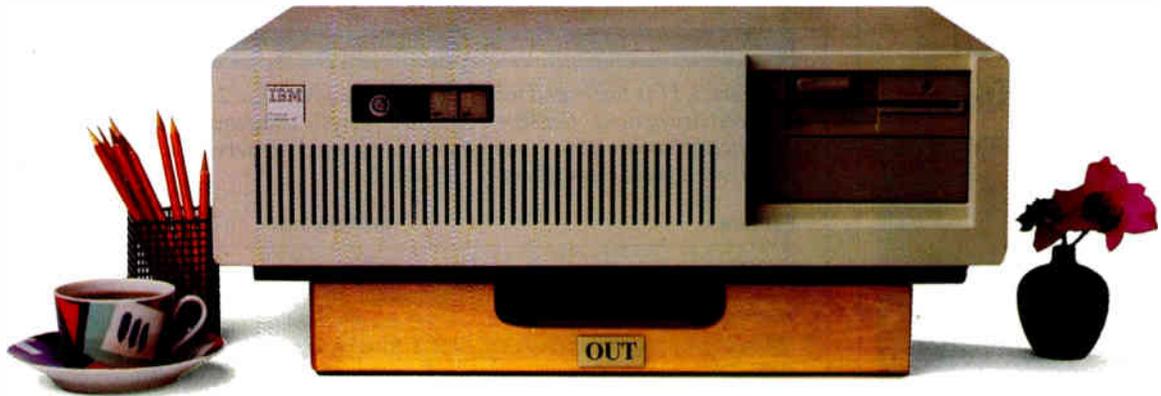
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subtopic name. Then you press the Enter key to get help for that subtopic.

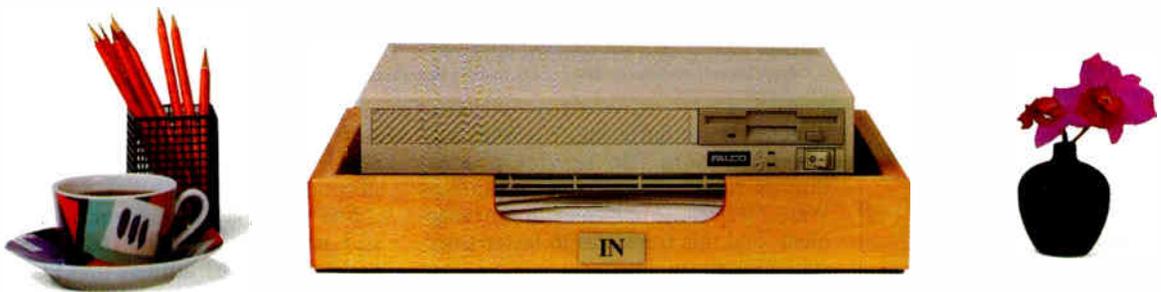
Performance is better with NetWare 3.11, due in part to the new Turbo file allocation table. Each volume contains a FAT—an index to one or more disk allocation blocks in which a file resides. NetWare keeps the entire FAT in server memory and creates a Turbo FAT for files larger than 64 entries. This provides faster access for larger files.

Another NetWare 3.11 feature, dynamic memory allocation, parcels out cache buffers for file buffering, NLM memory requests, FAT buffering, and

BIG IS OUT.



SMALL IS IN.

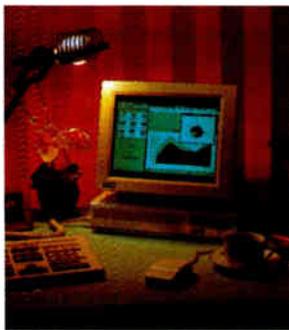


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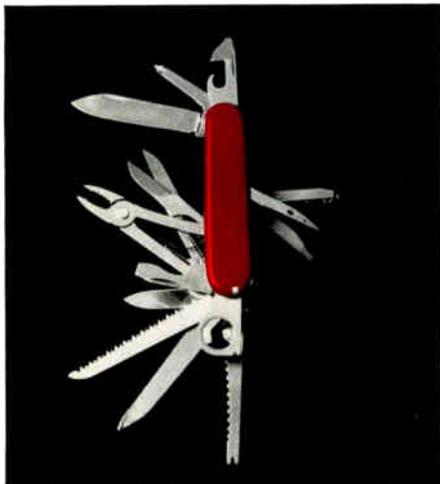
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FEATURES COMPARISON: NETWARE 2.2 VS. NETWARE 3.11

NetWare 3.11 is faster and more powerful than NetWare 2.2 and offers more connectivity options. NetWare 2.2 is functionally comparable to SFT Advanced NetWare 286. It supports nondedicated file servers and is easier to install than previous versions of 286 NetWare.

Feature	NetWare 2.2	NetWare 3.11
Operating-system type	16-bit	32-bit
Minimum server CPU	286	386
Minimum server RAM (50 users)	2.5 megabytes	6 megabytes
Maximum memory supported	12 megabytes	4 gigabytes
Hard disk space required	5 megabytes	9 megabytes
Maximum server disk space	2 gigabytes	32 terabytes
Maximum disk volume size	255 megabytes	32 terabytes
Configurable with nondedicated server	Yes	No
Server applications	VAPs	NLMs
Dynamic resource allocation	No	Yes
OS/2 clients	Yes ¹	Yes
Macintosh clients	Yes ²	Option
NFS clients	No	Option
OSI clients	No	Option
Network cards supported	8- or 16-bit	8-, 16-, or 32-bit

¹ HPFS-style long names not supported by NetWare 2.2.

² AppleTalk only emulated by version 2.2 but directly supported by version 3.11.

directory table buffering. NetWare 3.11 can have more file service process threads running concurrently than NetWare 2.2 because of its memory management, and this translates to faster workstation response times.

The BYTE standard File I/O benchmarks showed NetWare 2.2 to be no faster than version 2.15c. Version 3.11 is about as fast as version 3.1, but it's 15 percent faster than the other 286 versions of NetWare. To keep things on an even keel, I performed the benchmarks on exactly the same hardware each time.

NetWare 2.2

Novell has crystallized all versions of 286 NetWare into a single product: NetWare 2.2. As with NetWare 3.11, price differences for NetWare 2.2 relate only to the number of users supported. Functionally, version 2.2 is quite similar to SFT Advanced NetWare 286. All 2.2 products provide exactly the same features; for example, a five-workstation LAN has the same system fault tolerance level as a 100-user LAN. Version 2.2 is available for five, 10, 50, or 100 users. Prices vary from \$895 for five users to \$5495 for 100 users. (See the table for a comparison of NetWare 2.2 and 3.11.)

The installation process is almost as simple as that of NetWare 3.11. In the default basic installation mode, you answer just three questions, wait a brief moment while the ZTEST disk test runs, and then shuffle a few floppy disks. That's all

there is to it. The long-running COMP-SURF program is still there, but only as an optional step.

You won't have a problem if you have 3.11 and 2.2 servers on the same network; most of the utilities (the PUBLIC directory files) are the same. The utility programs are smart enough to recognize the NetWare versions and behave accordingly. For example, NetWare 3.11 has eight file access rights you can have; NetWare 2.2 has only seven. Both SYSCON and RIGHTS show the correct information depending on which kind of server you're viewing.

Choosing Sides

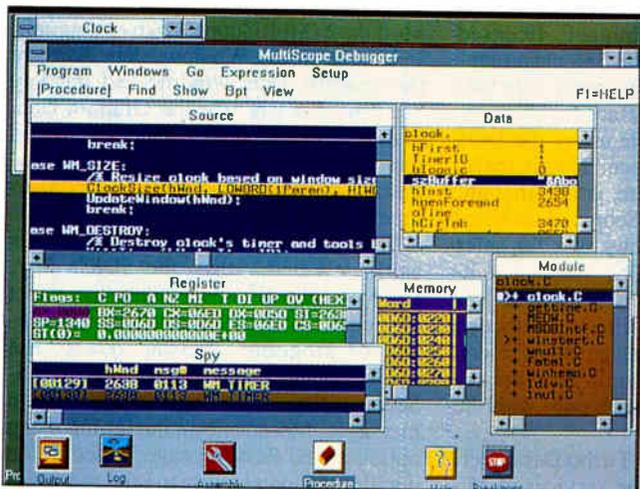
Versions 2.2 and 3.11 of NetWare offer excellent security and reliability. Both are easy to install, and NetWare 3.11 finally delivers long-awaited connectivity options to Novell customers who have DOS, OS/2, Mac, and Unix computers. NetWare 2.2 is an expensive solution if you are creating a small, entry-level LAN, but your five-workstation LAN will have many of the same features and functions as someone else's 95-workstation NetWare 3.11 LAN. ■

Barry Nance manages a 70-node NetWare LAN. He is the author of Network Programming in C (Que Publishing, 1990) and is the editor of the IBM Exchange and moderator of the lans conference on BIX, where you can reach him as "barryn."

SOFTWARE

Debuggers for Windows Shows Promise, Lacks Polish

JON UDELL



The MultiScope Debuggers for Windows uses the Multiple Document Interface to create a virtual debugging desktop.

Windows developers, like the proverbial barefoot shoemaker, routinely forgo the benefits of their craft. Because the dominant tools for building Windows programs work in character mode, the people who crank out all those gorgeous Windows applications must ironically spend much of their time in a far less inviting workplace. MultiScope's latest shot at CodeView and Turbo Debugger shatters that long-standing truism.

Earlier this year, the company shipped a set of Windows-hosted, DOS-targeted debuggers (see "The MultiScope Debuggers Make Debugging Easier," May BYTE). Now the other shoe has dropped. The newest member of the tribe of MultiScope Debuggers not only runs under Windows, it also debugs Windows programs. The result is (forgive me) a win/win situation.

MultiScope's DOS, OS/2, and Windows debuggers have much in common. Like their DOS cousins, Windows debuggers do run-time and postmortem debugging, exploit 386 debug registers to watch memory locations at processor speed, operate remotely over serial or network connections, and graphically depict structured data. In fact, the package reviewed here is a superset of the one reviewed in May. It includes the DOS-

targeted tools and adds a corresponding set of Windows-targeted ones.

Club MED

Let's talk about the postmortem debugger (WPMD) first. Why? Because, no matter how great your run-time debugger may be, you'd better not find yourself using it too often. Run-time debugging should be a last resort; it's never very productive even under the best of circumstances. DOS developers should practice defensive programming, and MultiScope's MED (Monitor Execution and Dump) utility, which made its debut with MultiScope's OS/2 debuggers and carried forward to the DOS products, makes for a powerful defensive ally. Like its cousins, the Windows-oriented MED system comprises linkable libraries (for C, Modula-2, Pascal, FORTRAN, and BASIC) that dump memory and registers into a file that the postmortem debugger—using the same interface as its run-time counterpart—can statically examine.

One good way to use MED is to redefine the standard C `assert` macro to call the MED dump routine. If a function that should have returned true didn't, `assert` normally just halts the program and reports the source code line at which the failure occurred. With a MED-enhanced

`assert`, you can force a dump and then inspect the entire context of the program at the point of failure: registers, variables, call chain, even the Windows global heap. MED will also save the crash-time screen, which the postmortem debugger can then display. If a beta tester in another time zone happens to have been the person who triggered the dump, so much the better. It's tough to reconstruct complex sequences of events leading up to a crash from verbal reports, but the dump file—like a jetliner's cockpit recorder—tells the story.

Under Windows there's also a less powerful (though still quite handy) use for MED. Even if you do not link your application with the MED library, the monitor can catch a protection fault, or "unrecoverable application error" in Windows-speak, and write a dump file. Just load the monitor, which runs as an icon, and then run any program compiled and linked with CodeView-compatible debugging information. If your program heads south and suffers a UAE, you may be able to salvage a black box from the wreckage and find out why.

I say "may" because I discovered that the presence of MED can shift things around. One program into which I inserted an intentional out-of-bounds memory reference would reliably suffer a UAE on its own, but never when MED was monitoring it. The Heisenberg uncertainty principle that so often plagues debugging evidently applies to MultiScope. So I recommend the more active approach: forced dumps triggered by assertion failures.

Here, unfortunately, I still ran into some troubles. One of the dumping functions, `MEDQueryDump`, is supposed to enable you to choose whether to dump or continue. It puts up a modal dialog box, but didn't always work properly. When I called it from within the main window procedure, instances of the dialog box stacked up on the screen as messages hit the program's queue, and I had to quit the debugger. Much more disturbing, the dumping functions sometimes just didn't dump, depending on which options (i.e., screen, kernel, heap) I'd selected in the monitor and which program I was debugging. I'll grant that a safety net with a few holes in it is better than none, but the holes ought to be mended.

Windows Run-Time Debugging

Even the most carefully instrumented code will eventually need to be debugged

■ WHAT MULTISCOPE DEBUGGERS FOR WINDOWS IS

A Windows 3.0-hosted, source-level, multilanguage debugger for DOS and Windows programs.

■ LIKES

There is nothing else like it; this Windows-hosted program debugger brings all the benefits of the MultiScope DOS debuggers to Windows programmers, plus Windows-specific features.

■ DISLIKES

There are a number of serious flaws, ranging from interface issues to outright failure of certain features. Some problems are attributable to Windows' weak hooks for debuggers, but most are specific to this product.

■ RECOMMENDATIONS

If you need a Windows-hosted Windows debugger, buy this one—but be prepared to work around its flaws and limitations.

■ REQUIREMENTS

IBM PC compatible with 286 or higher (386 required for advanced debugging modes), 2 MB of RAM, DOS 3.3 or higher, Microsoft Windows 3.0, and Windows 3.0 SDK.

■ PRICE

\$379

■ FOR MORE INFORMATION

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application has focus, Ctrl-Alt-SysRq drops you back to the debugger.

In general, the functions provided map to their counterparts in the DOS-targeted debugger. However, there are a few differences owing to peculiarities of Windows. For instance, although WRTDP supports hardware-assisted watchpoints on 386/486 machines (Turbo Debugger for Windows doesn't), you can watch only individual variables, not ranges.

According to the company, the range-watching technology in the DOS-hosted and DOS-targeted debugger, licensed from Nu-Mega, relies on 386 page-mapping features available under the Virtual Control Program Interface. The page-mapping isn't accessible under the DOS Protected Mode Interface. That is really a Windows architecture issue, though, not any fault of MultiScope. And since protected-mode Windows is a far safer environment than DOS, range-watching—while desirable—is somewhat less necessary. Another wrinkle: Although the Windows debugger presents menu options for I/O and interrupt breakpoints, these options work only with the 386 DOS debuggers.

Like CodeView and Turbo Debugger, MultiScope relies on the services of Microsoft's WINDEBUG.DLL, a Software Development Kit (SDK) component that provides hooks for Windows debuggers. Unfortunately, WINDEBUG.DLL has never done a very satisfactory job. If you're accustomed to the MultiScope DOS debugger and you then switch to the Windows debugger, you may wonder why you've got to exit and restart the debugger to restart the debugged program. Again, it's a Windows issue. Try Turbo Debugger for Windows, which also of necessity uses WINDEBUG.DLL, and you'll see the same behavior. Help is on the way in the form of Windows 3.1's Open Tools interface, a specification that both Borland and MultiScope have had a big hand in shaping.

Once you have loaded your program, the many-windowed MultiScope toolkit comes into play. I particularly like the ability to relate variables in the Data window to the display in the Memory window. At one point, while debugging my Windows version of Life, I had the game screen and its supporting memory visible side by side and could watch both change with each generation.

Structure browsing works intuitively in the Data Window, and if you use the View Address option in the Memory window, you can chase pointers there as well. The Data Window toggles between local and global data with a hot key. You

can set breakpoints in the Source or Assembly windows; the latter can display assembly, a mix of source code and assembly, or just op codes. The Breakpoint window lists active and disabled breakpoints but, annoyingly, won't let you edit the pass count, condition, or expression evaluation attached to a breakpoint. In the Watchpoint window, you specify up to six nonstructured variables that, when read, written, or read or written, will trigger a break. The Expression window evaluates expressions in C, Pascal, or Modula-2 (MultiScope's native tongue).

Unique to the Windows debugger are the Graphic Data window and the Spy window. I really like the Graphic Data feature. When I deal with fancy nested data structures, I'm helpless without diagrams; MultiScope draws and navigates them effortlessly.

The Spy window, however, needs work. It's better than the SDK's Spy, since you can directly monitor the effect of specific lines of source code on the debugged program's message queue. But unlike the Borland equivalent, MultiScope's Spy can't set breakpoints on messages. Moreover, an intriguing menu option called Post Message, billed in the documentation as a way to send messages to the debugged program, led nowhere. MultiScope axed the feature at the last minute while leaving the menu option in place. Even worse, I often hung the debugger while using the Spy window.

It's said that you can recognize pioneers by the arrows in their backs. I hope that won't be MultiScope's fate. Clearly this is a breakthrough product—nothing else debugs Windows programs this way. Yet it's also clear that release 1.00 isn't polished. I suspect that's because the innovations that enable it to surmount Windows 3.0's weak tools interface sapped more time and energy than expected.

Since those heroic efforts will have been partly responsible for an improved Windows 3.1, which in turn will benefit tool developers and users alike, it pains me to have to quibble. But I must report that I'm about equally impressed with and disappointed in the MultiScope debuggers for Windows. If you're a professional Windows developer, you might gladly put up with considerable frustration to gain leverage not otherwise available, and may therefore find this product—even in its current form—to be a must buy. When the kinks get worked out, though, it could be a world-beater. ■

Jon Udell is a BYTE senior technical editor at large. He can be reached on BIX as "judell."

interactively, and the tools available to date have not made that task pleasant. Not everyone can afford a dual-monitor setup, and screen-swapping solutions quickly become tedious. MultiScope's run-time debugger for Windows (WRTDP) really is a dream come true: Debugger and debuggee act like coequal applications under standard or 386-enhanced Windows. The debugger exploits the Multiple Document Interface with great success: It's a complete desktop, with 15 subwindows/icons, but you can sweep it away with a click to reveal the executing target application. When the

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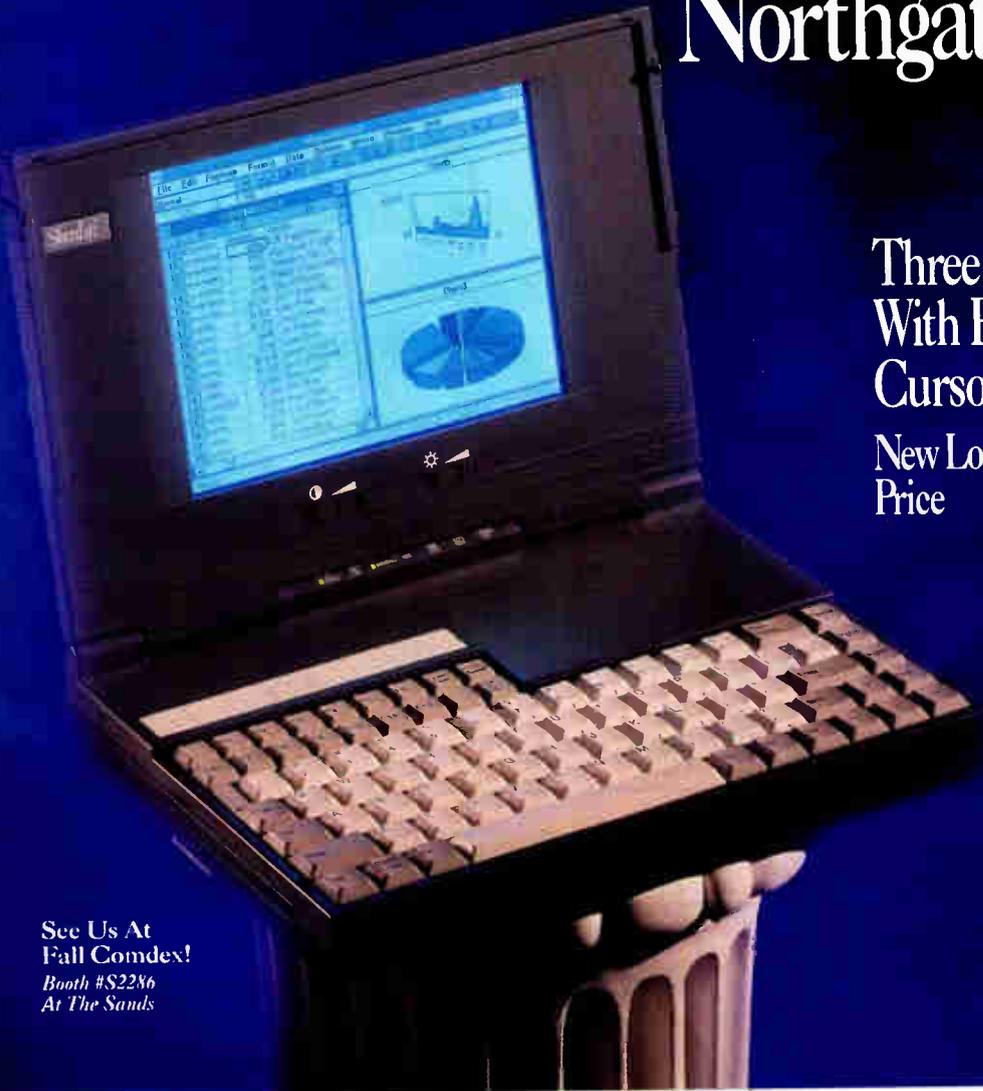
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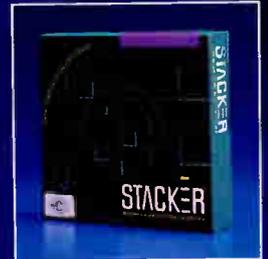
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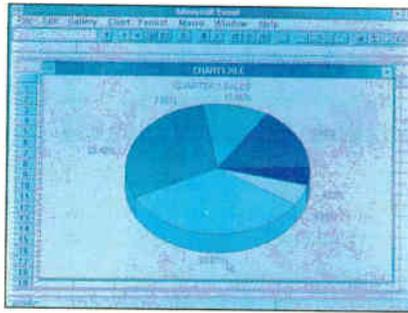
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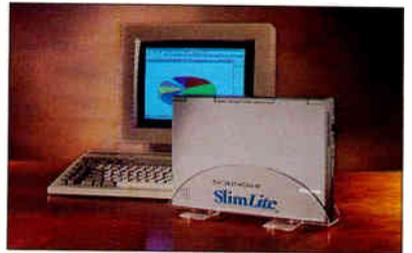
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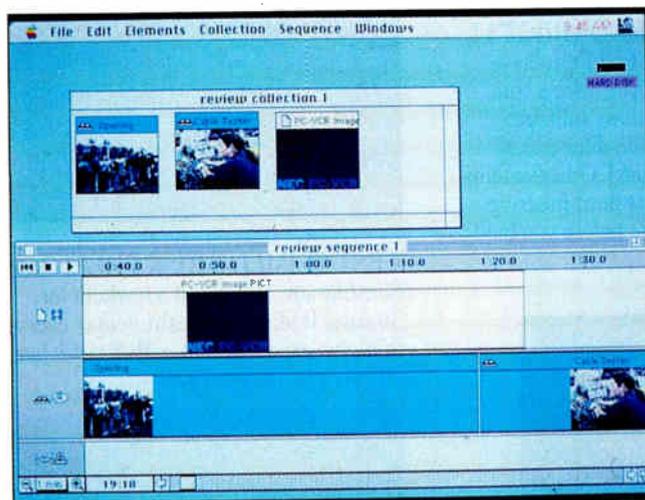
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APPLICATION

Build Multimedia Presentations with MacroMind's MediaMaker

TOM YAGER



MediaMaker builds presentations from collections of picons, or picture icons. You assemble picons in collections, as shown in the windows at the top of the screen. To complete the presentation, you combine collections into time-queued sequences (shown at the bottom of the screen).

Effective business presentations, like good jokes, are a matter of timing. Holding an audience's interest has as much to do with the pace and flow of a presentation as it does with its content. But traditional slide or overhead-transparency presentations leave timing largely to chance. What's more, a complex audiovisual presentation can turn the presenter into an octopus, reaching here and there to trigger this slide or that videotape on cue. Each pause or gaff puts more distance between the audience and the material.

What's needed is a way to simplify the problems of timing and synchronization of various audio and video sources. With MediaMaker 1.1, MacroMind (creator of the two-dimensional animation/presentation application Director) has come up with a first-rate solution for Mac users. MediaMaker lets you build presentations that combine laser disc video, videotape, CD audio, computer graphics, computer animation, and Mac digitized sounds. You select snippets of material and then preview and assemble them into a presentation that you can display on the Mac or export to videotape. A complete MediaMaker setup would include a pair of MediaMaker-supported consumer videotape recorders (or one

tape and one laser disc), a display card with live video input, MacroMind Director, MacroMind 3-D (or some other 3-D rendering/animation package), and possibly a paint program (see "Multimedia-Lab Test" on page 304).

Once you learn MediaMaker, power presentations come together quickly, and even major changes are a snap. But the deeper you dig, the more interesting MediaMaker becomes.

From the Ground Up

My love affair with MediaMaker started when I began building my first collection. A *collection* is a group of icons (MacroMind calls them *picons*, for picture icons). Picons represent the presentation's raw materials—fragments of audio, video, and graphics. You can have any number of collections on the screen at once. Each collection has its own window (see the screen), and each collection can contain any mix of media.

You move picons from various collections into a time-line window called a *sequence* (it's the window shown at the bottom of the screen). The top of the window is notched with time markers. There are separate layers for audio, video, and graphics. You drag picons into the sequence window and place them beneath

the time marker representing the time in the presentation at which you want the material to appear. If you want to put on a slide show that displays each slide for 30 seconds, you just drag the picons for the PICT images into the sequence window at 0:00, 0:30, 1:00, 1:30, and so on. You can adjust the duration of each picon either through the picon's dialogue or by stretching one edge of the picon's image in the sequence window. In the case of the slide show, each picon would be set for a time of 30 seconds to avoid gaps between images. Dead space in MediaMaker defaults to a user-definable background color. The sequence window is split into layers that reflect the ability to overlay certain types of media; for example, audio can overlay any type of visual data.

With the proper graphics card (e.g., the VideoLogic DVA-4000 or Truevision NuVista+ cards that I used in this review), you can layer PICT graphics and PICS animations atop live video. With the DVA-4000, you can scale live video to any size and present it in a window that you can position anywhere on the screen. MediaMaker's strength lies in its overlay capability. You can create a presentation that combines audio, recorded video, and still images, layered as you see fit, and output it in real time, in one pass.

Inside a Picon

For each type of medium, an associated dialogue determines how you use the material. When you build a presentation using images from video, laser disc, and CD audio, MediaMaker displays a remote-control panel in the dialog box that lets you search until you find the portion you want to use. You select a segment by marking the start and end points as they go by (you can trim them manually). This positional information, along with some other parameters, is stored in the picon. If the picon represents a still image or computer animation, it becomes a postage stamp-size snapshot of that image (or the animation's first frame). For videotape or laser disc, you can easily digitize a selected frame into a picon. By combining easily identified graphical images and user-definable names in each picon, the program makes it easier to manage large numbers of media segments.

Even though these icons make manipulating the segments of a presentation easier, MediaMaker does not, for the most part, have the power to create any

new material. The sounds and pictures that MediaMaker brings together must be imported. There are exceptions: The dialogue associated with digitized audio records new sounds (through Farallon's MacRecorder), and you can create a videotape with MediaMaker that becomes part of a later production. For the material not created inside MediaMaker, the program allows you to launch a user-defined editing application (e.g., a paint program for graphics or Director for 2-D animation). This is an added bonus, assuming you have enough memory (or System 7.0).

MacroMind sells a pair of external programs that can create raw materials for MediaMaker: MacroMind 3-D and MacroMind Director (see "Director Takes Charge of Mac MultiMedia," October 1990 BYTE). With these programs, 3-D and 2-D animations can become part of a MediaMaker presentation. But you're not limited to using only these two products—any program that produces PICT still-image files or PICS animation files can contribute to your presentation.

In my tests, I worked with Electric-Image Animation System (a 3-D rendering and animation package from Electric Image) and produced impressive-looking animations that I later added to a MediaMaker collection. In doing this, I ran into a couple of limitations. First, when I played back an animation from a PICS file, the playback rate was extremely slow—1 frame per second or worse. Also, MediaMaker seemed to have some trouble managing the color map. Each frame of the animations I used was rendered at 8 bits (256 colors), but MediaMaker trimmed the color map, leaving the image looking mottled and generally awful. Oddly, MediaMaker displayed a single PICT image taken from the same animation without these problems.

You can solve this speed problem with MacroMind Accelerator, a program that speeds display of most animations by delta-encoding the graphics information; only the data that changes gets updated. If you have a gigantic logo lumbering across the screen, it still moves pretty slowly, but with Accelerator, you can play back at a respectable speed objects that are more reasonably sized.

Video Tricks

If videotape is a part of your MediaMaker mix, you need to keep in mind a

BYTE ACTION SUMMARY

■ WHAT MEDIAMAKER IS

A presentation tool that combines video, graphics, animation, and audio.

■ LIKES

MediaMaker's icons and timeline interface greatly simplify the creation of even complex presentations. The ability to use inexpensive video hardware brings limited video production capabilities to anyone with a Mac.

■ DISLIKES

No support for MIDI, slow playback of PICS animations (without MacroMind's Accelerator), and no interactive capability.

■ RECOMMENDATIONS

Buy MediaMaker for its impressive results in a broad range of presentation types. Its output will please board members and trade-show attendees alike.

■ PRICE

\$695

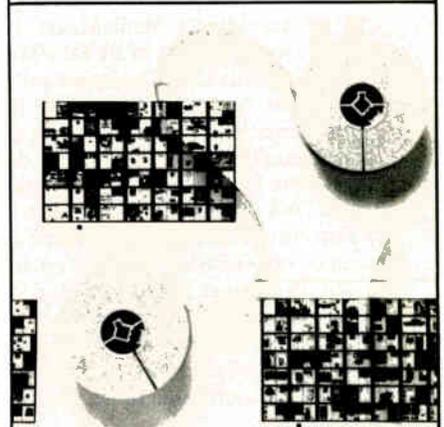
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few tricks. Videotapes cannot be randomly accessed as quickly as laser discs. When putting together your presentation, you should avoid putting two videotape segments directly next to each other. If you're working live (i.e., if the audience is watching the direct output of the Mac), there will be an awkward pause while MediaMaker seeks the new tape position. If you're printing to a tape (i.e., outputting the presentation to a tape), you can pause the tape while the seeking is going on. That effectively eliminates the seek delay on the finished tape, but it will glitch any other material

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Multimedia-Lab Test

MacroMind's MediaMaker 1.1 was evaluated in BYTE's Multimedia Lab. The review called for the services of a Mac IICI with 8 megabytes of memory and an 80-MB internal hard disk drive. The displays were driven at first by a VideoLogic DVA-4000 Mac card and then by a Truevision NuVista+. Both cards are capable of overlaying graphics on live video. In addition, I used VideoLogic's Mediator scan converter to send the DVA-4000's output to a tape. The animations I produced were written to a SuperMac LaserFrame rewritable optical disk.

For three-dimensional modeling and animation, I used Swivel 3D Pro from Paracomp and ElectricImage Animation System (with the accompanying Mr. Font Type 1 font extruder) from Electric Image. I used MacroMind's Director to produce the 2-D animation and titling. The Multimedia Lab borrowed consumer videotape and laser disc equipment from MacroMind to provide video input. An NEC PC-VCR Super VHS video recorder recorded MediaMaker's output.

A Killer Serial Interface

MediaMaker is able to deal with a wide variety of video input partly because of a quiet revolution in consumer electronics. VCRs, camcorders, and laser disc players in the subprofessional (consumer or "prosumer") class are more frequently appearing with high-function serial interfaces. If you use a Macintosh with the right cables, you can control one or two video devices without any expensive hardware. The computer sends commands through the serial cable that drive the tape or disc transport, and the VCR or laser disc player then sends back status reports, including the tape's or laser disc read head's position.

Consumer videotape equipment's precision is limited: MediaMaker's positional accuracy with video is around 1 second. That doesn't seem like much until you try to synchronize events precisely on the tape with sounds or overlaid computer graphics. MediaMaker improves the program's accuracy when used with a VCR that produces frame-accurate time code.

MacroMind has been working with

video vendors and third-party software companies to ensure that the bulk of serially controllable consumer video equipment is covered. MediaMaker ships with built-in control for Sony and Pioneer laser disc players and for video recorders and camcorders that are equipped with Control-L- (or Local Application Control Bus) or Control-S-compatible interfaces.

I confess that this recent trend toward serial control standards in inexpensive equipment caught me off guard; the Multimedia Lab was not equipped with any MediaMaker-compatible consumer video equipment. MacroMind lent me a Sony 8mm VCR and laser disc player, and NEC came through with its amazing PC-VCR (which is clearly not consumer-quality but more of a computer peripheral (see "Computers Go Video with NEC's PC-VCR" on page 307). The combination was enough to give MediaMaker a real workout. I could have used the lab's professional video gear through an external interface (supported by MediaMaker), but for the sake of time, I chose to use the consumer equipment instead.

that is layered over the video. This is particularly noticeable with CD audio: A second or so of the music is lost. This isn't a flaw in MediaMaker; it's just the way these devices work.

The best scheme is to fill the seek gaps in your presentation with full-screen graphics or animations. MediaMaker will seek, as a background operation, to the next tape segment while the program displays the graphic. As long as the filler lasts longer than the tape seek time (a requirement that is not hard to satisfy), the audience won't notice any gaps. If you really need to have two video segments next to each other, you can "mix down" your raw video (with MediaMaker, if you like). Essentially, this involves transferring video segments onto a tape that you can play continuously without seek breaks.

Meet Your Maker

MediaMaker is an incredible program, but there are, of course, some things I

wish MacroMind had done differently (or done at all). The most glaring omission is MIDI. A MIDI component is a drawback in the sense that it would occupy one of the serial ports (e.g., you wouldn't be able to control a recording video deck), but for those users who wish to create their own music synchronized to the presentation, there is no substitute.

Another minor weakness in MediaMaker is the lack of an overall project file that opens all your collection and sequence windows for you. As it stands now, to pick up where you left off, you need to manually open each collection and sequence you used. Under MultiFinder, you can open a sequence by switching to the Finder and clicking on a collection's or a sequence's icon. This is something I wish all Macintosh applications could do.

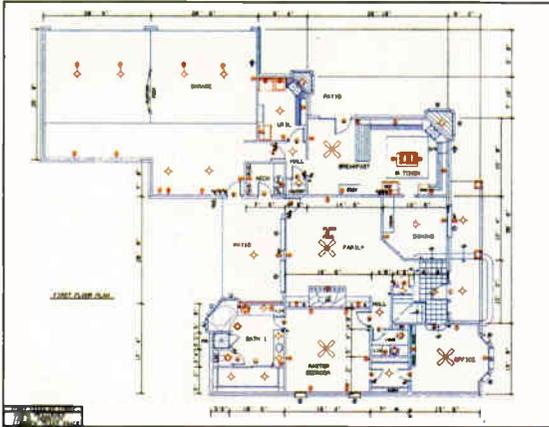
Finally, MediaMaker lacks interactive control. It should be possible to mark segments of a presentation and jump be-

tween them by keyboard or mouse control. You can have a presentation pause until you press a key, but there's no way to alter a presentation's straight-ahead flow.

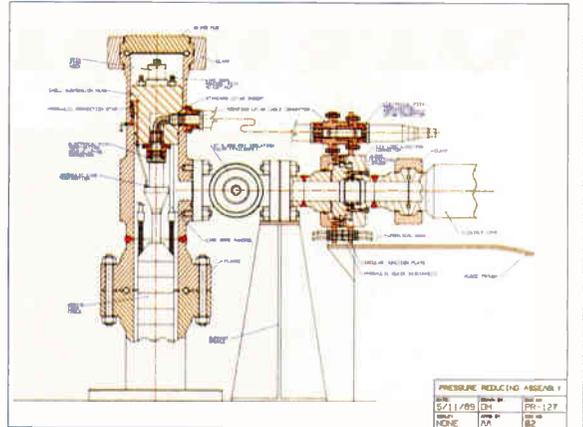
The system requirements for MediaMaker aren't much, considering what the application can do. However, you shouldn't underestimate the time it will take to create your first presentation. Most of the learning process lies in getting used to the applications that create the presentation's raw materials. Once you understand how the pieces work together, MediaMaker is easy and even fun to use. But more important, now that MacroMind's MediaMaker is here, the people who snoozed through your slides and overheads will now be on the edge of their seats. ■

Tom Yager is a technical editor for the BYTE Lab. He oversees BYTE's Multimedia Lab. He can be reached on BIX as "tyager."

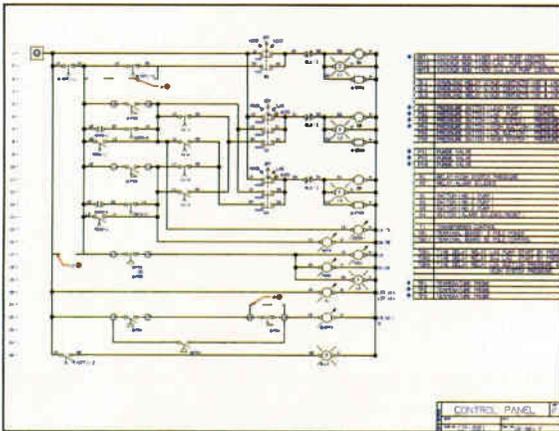
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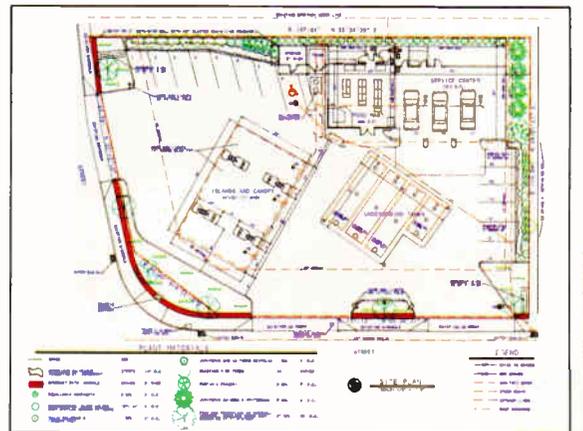
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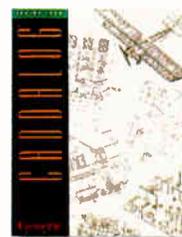
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HARDWARE

Computers Go Video with NEC's PC-VCR

TOM YAGER

The multimedia revolution has left behind many of those who could most benefit from it. In the past, those who couldn't afford to press laser discs or purchase expensive computer-controllable videotape recorders had no way to create their own interactive video applications.

Now there's a very attractive answer: NEC's PC-VCR. It looks like an ordinary, if high-end, VCR, but its humble facade conceals an intelligence and precision that make it a perfect match for those applications that call for combining a computer with video and audio. The VCR side of the PC-VCR is top-shelf: The Super VHS capability delivers much higher resolution than ordinary VHS, and the hi-fi stereo audio is crisp and clear.

The Uncommon VCR

NEC's PC-VCR isn't a high-end yuppie toy for catching those pricey "Honeymooners" reruns. Simply put, the PC-VCR is, as its name suggests, a computer peripheral. There are two groups of features that place it in that class.

The first thing that differentiates the PC-VCR from ordinary video equipment can be seen from the rear: a 25-pin RS-232 connector. Through this interface, any serial device (computer, terminal, or modem) can send commands to the PC-VCR and get response codes back.

The manual lists 80 commands and response codes. Transport controls such as play and rewind are there, of course, but there are others that have special meaning for applications that require onboard video. Everything from the on-board character generator to the ability to record a four-character alphanumeric ID on a tape is available through the PC-VCR's command set, and much more. It's obvious that the PC-VCR's designers wanted to give developers access to virtually everything a VCR is capable of.

The other special quality of the PC-VCR is its ability to seek reliably to a specific frame on a tape. A single command *stripes* a tape, even a prerecorded one, with a proprietary time code that assigns a number to every frame on the tape. A striped tape can be accurately positioned



The PC-VCR looks mild-mannered enough, but inside is a precise transport and an intelligent computer interface.

to any frame with just a single command; the PC-VCR's logic locates the address, pauses the tape, and notifies the application. Note, however, that this is not the same kind of frame accuracy that is needed to handle computer animation. The PC-VCR can't do frame-by-frame recording, and NEC doesn't represent that it can.

Address numbers are not arbitrary; they are expressed either as seconds and frames (30:7) or as frames (907). The PC-VCR's software includes a number of commands that make it easy for developers of multimedia presentations to query the device to determine the address of a particular scene or frame.

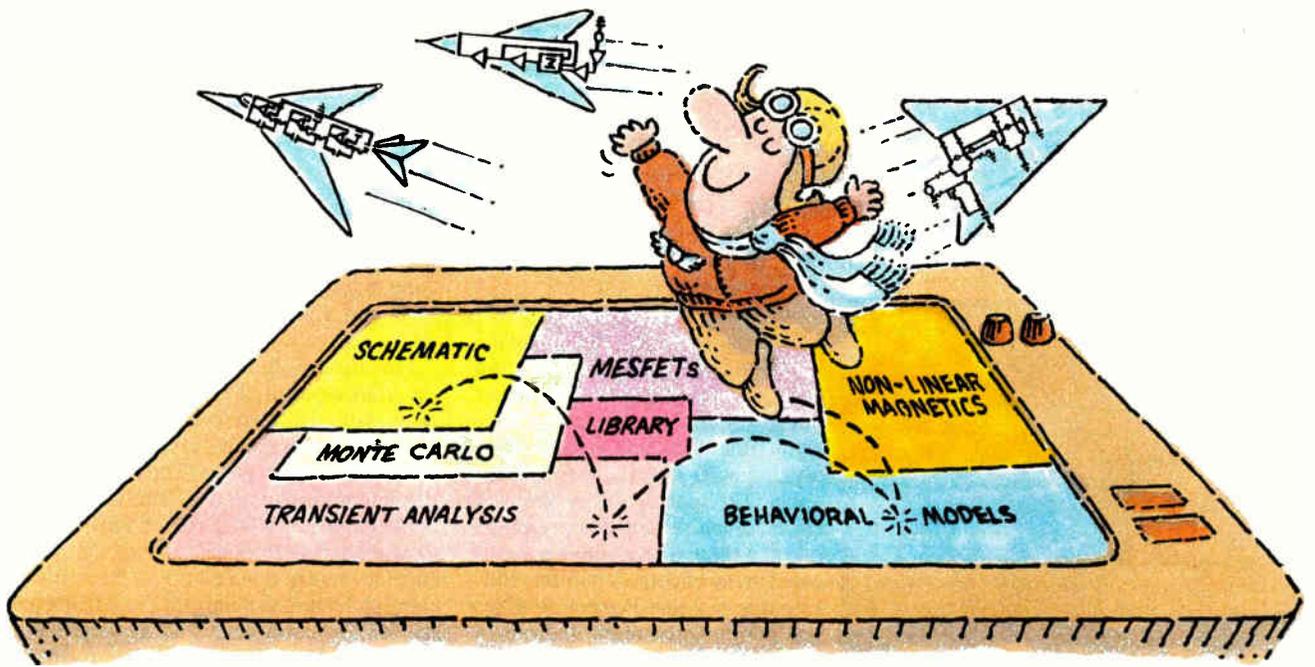
Addresses are recorded separately from the audio and video. A set of input and output connectors on the back lets you copy the address data, along with the audio and video, from one PC-VCR to another. With this, tapes can be distributed along with software that expects certain passages to be located at specific addresses. Even with copies, the accuracy of the addressing can be maintained, and the results can be kept predictable.

The PC-VCR is a robust computer peripheral, useful for everything from interactive software to indexing news clips. Stepping down to ordinary VHS mode, a \$5 tape can hold 6 hours of material, with the quality of the video and audio higher than what's delivered by most digitize-to-disk methods.

The Long Search

The greatest drawback is the speed of the search. The PC-VCR performs address searches intelligently, running the tape at maximum speed until it "guesses" it's near the requested address, and then shuttling at a reduced speed, reading the addresses until the right spot is found. Even with this optimization, however, a long expanse of tape will take several seconds to traverse.

Fast-forwarding from the beginning of a tape to a spot 20 minutes in, for example, took 43 seconds. That's a long time to be staring at a blank screen (no worthy developer would leave that space blank), but depending on the information, locating it accurately can be more important than the time it takes to find it. Furthermore, the ability to add to or modify the



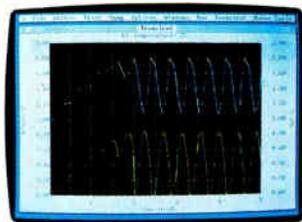
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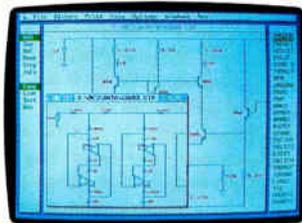
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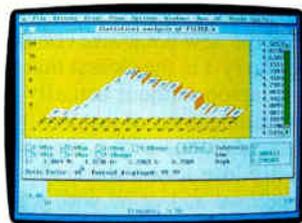
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A grammar checker that pushes the technology: PowerEdit presents each sentence one at a time, along with a complicated array of control buttons.

Grammar and style checkers keep popping up. When the BYTE Lab staff recently reviewed a group of products (see "Can a Grammar and Style Checker Improve Your Writing?," August BYTE), we noted that none of them ever came up with particularly inspiring comments. We had hoped that at least one of them would make suggestions that an English teacher might make.

Reader 1.10 from Langsoft handles 400,000 different words and claims to have a much better grasp of the English language than the packages in the August review. Running it requires a PC, 400 kilobytes of RAM, 2 megabytes of hard disk space, and MS-DOS 2.1 or higher. Reader takes in ASCII files, creates a markup copy, and gives you a complete report on the screen. Reader's comments aren't as good as a human's, but they're pretty good. On the August review test documents, it fared better than some of the competition. Not only that, but it's inexpensive; Langsoft will send you a copy for \$69 plus \$10 for shipping and handling.

A software company in Texas is out to prove that they do everything bigger and better there. Artificial Linguistics' PowerEdit 1.0 (\$295) is the best grammar checker that the BYTE Lab staff has ever seen running on a desktop. It requires an EGA or VGA monitor (it runs in a graphics display mode), 12 MB of hard disk space, 470 KB of RAM, and at least a megabyte of extended or expanded memory. If you have a 386 or a 486, Power-

Edit loads a special 386 protected-mode kernel for added performance. Its file support is limited to WordPerfect 5, Microsoft Word 5, or ASCII.

After you write your text, PowerEdit analyzes it. The proofing software loads the document from disk, thinks about it, and writes out analysis files. This can take some time: On a 25-MHz 386, analyzing a 10-KB ASCII file takes about 12 minutes; then the fun starts. Each sentence is presented one at a time, along with a complicated array of control buttons. Suffice it to say that PowerEdit gives you good commentary and plenty of control (see the screen). If you choose to enable all the comments, you will be bombarded with more suggestions than ants at a picnic.

Maybe that's PowerEdit's biggest problem. It speaks with so much authority that you're tempted to follow every suggestion it makes. Like any software, it's not perfect, and it's still your responsibility to pick out the good comments from the bad. It's not a tool for the novice writer, but it sure beats the competition.

A Book-Size Desktop Computer



The BYTE Lab staff also looked at one of the new book-size computers. The Carry-I is the closest that we've seen to a laptop without actually being one. With dimensions of just 9½ by 7 by 1¾ inches, someone with a messy office could easily lose it in a stack of papers. The version we had came with 4 MB of RAM, an 80-MB hard disk drive, and a 3½-inch 1.44-MB floppy disk drive. The processor was a 386SX running DR

DOS at 16 MHz. Surprisingly, there's a half-length 8-bit slot inside if you want to add a modem card, network card, or some other adapter. Two nine-pin serial ports and a parallel port are already in place.

For display, the Carry-I can support any VGA monitor. The BYTE Lab's unit came with its own 9-inch VGA color monitor, whose case creaked noisily whenever we adjusted it. The display had alignment problems, too. The Carry-I's detachable keyboard is not full-size; some of the keys, such as PageUp and PageDown, are doubled up on the arrow keys, and you must activate them using a special Function key. The keyboard is noisy, too, and it crackles like an old IBM XT keyboard.

We noticed some people on the BYTE staff gravitating toward the Carry-I, perhaps in response to its unimposing profile and understated appearance. This certainly would be a fine computer for anyone who likes keeping an uncluttered desk. Although we were initially concerned about cooling problems (there is no fan, and the temperature is regulated by convection only), the Carry-I performed for weeks without a hitch. It's no barn-burner in the performance arena, but this is a good machine for anyone whose desk space is at a premium.

Remote-Access Alternatives

In a recent issue, we looked at several communication servicers for remotely accessing your LAN (see "Journey to Faraway LANs," July BYTE). But not every LAN needs a fancy solution that can handle multiple inbound sessions. So we looked at a few alternatives for those of you who might need to support only a few remote users. These products offer remote access to your network, but they won't support more than one or two sessions. Each fills a different niche; one may be just what you're looking for.

Lanport-II

Lanport-II is a stand-alone serial-port interface that attaches to your network and supports inbound and outbound communications. The small box (4 by 7½ inches) houses a CPU, RAM, ROM, an Ethernet adapter, and two serial ports. Remote users can dial into your

LAN to print or transfer files without dedicating a PC. Lanport-II also redirects remote-control sessions to any PC on the network that's running Co/Session host software.

The Lanport-II lets LAN workstations share access to two modems for outbound communications and lets you dial into the network. It supports Hayes-compatible modems running at up to 19.2 kilobits per second. It's no substitute for a remote-control package if you want to run applications remotely, but the \$795 list price (including Co/Session) makes it less expensive than dedicating a PC if file access is all you need. It's also an inexpensive way to share modems.

In + Touch

Cross Communications' In + Touch (\$395) is a remote-control product with a twist; it can redirect a single session on a gateway PC through the LAN cable to any available host machine on a NetWare LAN. (The gateway PC supports two sessions on a NetBIOS LAN.) Users who are away from the office can call in and control their PCs without having their own modem. Instead, these remote users contend for the use of a single, shared modem.

In + Touch consists of a redirector TSR program that runs in the background on the gateway computer with the shared modem, and a processor TSR that resides on each machine that you want to control. You call the gateway computer, log in, and then select from a list of available processor machines. From there, the program works like any other remote-control program: You run applications on the controlled machine, which sends its display to and receives keystrokes from the remote computer.

In + Touch is best suited for frequent travelers who would benefit from having remote access to their office computers—presuming that the demand is light enough for them to share a modem.

The ComCube Station

Cubix has a space-saving alternative to dedicating a standard 286 PC for remote-control sessions. The ComCube Station puts a complete 286 diskless workstation in a box that measures just 12 by 2 by 10 inches. The base system includes a built-in network adapter with boot PROM, a 286 CPU running at 12 MHz, 1 MB of RAM, and a CGA display subsystem for \$1095; the company offers color VGA as an option. It also accepts up to 4 MB of

RAM and has a 287 math coprocessor socket and a serial and a parallel port.

The ComCube won't save you money, but it takes up a fraction of the space of a dedicated 286 PC, and the ability to manage the device remotely is handy.

pcAnywhere IV/LAN

Like In + Touch, pcAnywhere IV/LAN can redirect a single incoming remote-control session through a gateway PC to control other computers on a LAN. The gateway computer can also share its modem for outbound communications, but you must configure the gateway exclusively as an inbound or outbound machine.

Both remote and LAN users can establish a remote-control session with a host PC. pcAnywhere IV/LAN costs \$495; software for each remote user costs \$99. The program performs relatively fast screen updates by communicating only

screen changes and using data compression. But pcAnywhere IV/LAN has a daunting maze of menu options through which you must pass to properly configure the remote host and gateway machines. A pop-up menu lets you run a DOS shell program on the remote machine but leaves you with insufficient memory to run any programs. Other options refresh the screen, capture the current display for later review or printing, and transfer files between the host and the remote site. pcAnywhere IV/LAN's good performance gives it a clear edge over In + Touch. ■

—The BYTE Lab

Reviewer's Notebook provides new information—including version updates, new test data, long-term usage reports, and reader feedback—on products and product categories that have been previously reviewed in BYTE.

ITEMS DISCUSSED

Carry-I Model 9305 \$2800
Flytech Technology, Inc.
3008 Scott Blvd.
Santa Clara, CA 95054
(408) 7273-7373
fax: (408) 727-7375

Circle 781 on Inquiry Card.

ComCube Station
12-MHz CGA \$1095
12-MHz VGA \$1295

Cubix Corp.
2800 Lockheed Way
Carson City, NV 89706
(800) 829-0550
(702) 883-7611
fax: (702) 882-2407

Circle 782 on Inquiry Card.

In + Touch
1 modem \$395
5 modems \$695
20 modems \$995

Cross Communications Co.
1881 Ninth St., Suite 302
Boulder, CO 80302
(303) 444-7799
fax: (303) 444-4687

Circle 783 on Inquiry Card.

Lanport-II \$695
with Co/Session \$795
Microtest, Inc.
3519 East Shea, Suite 134
Phoenix, AZ 85028
(800) 526-9675
(602) 971-6464
fax: (602) 971-6963

Circle 784 on Inquiry Card.

pcAnywhere IV/LAN \$495
DMA
1776 East Jericho Tpke.
Huntington, NY 11743
(516) 462-0440
fax: (516) 462-6652

Circle 785 on Inquiry Card.

PowerEdit 1.0 \$295
Artificial Linguistics, Inc.
2301 North Akard, Suite 200
Dallas, TX 75201
(800) 800-4254
(214) 720-7291

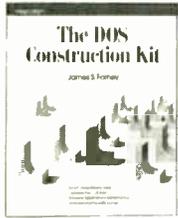
fax: (214) 880-9604
Circle 786 on Inquiry Card.

Reader 1.10 \$79
Langsoft, Ltd.
5 Rosemont Rd.
London W3 9LT, U.K.
44-081-992-2056

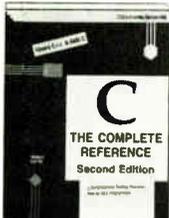
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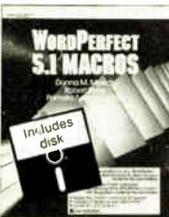
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9309P \$28.95
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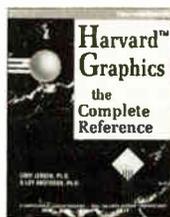
3279 \$36.95
Counts as 2



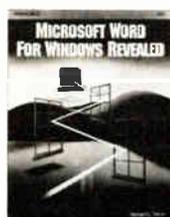
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Counts as 2



062885-8 \$39.95
Counts as 2



881621-1P \$27.95
Counts as 2



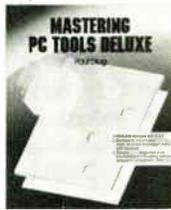
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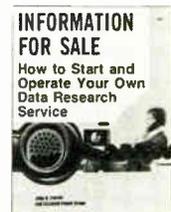
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3679P \$22.95



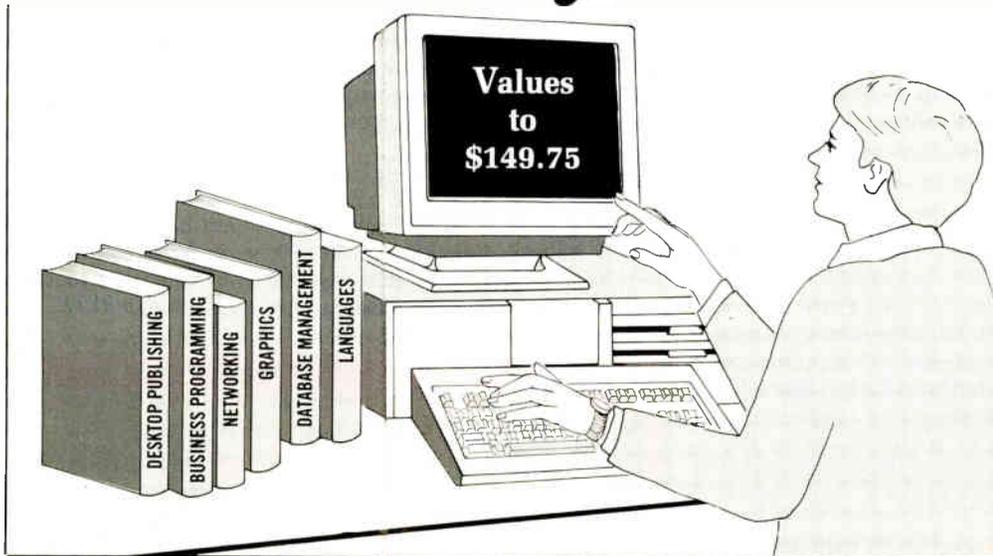
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3057P \$15.95



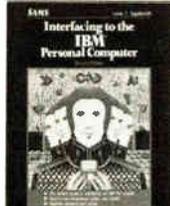
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029662-6 \$24.95



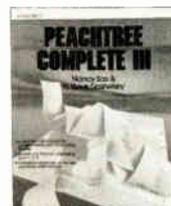
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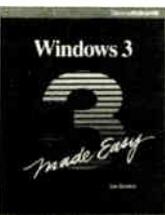
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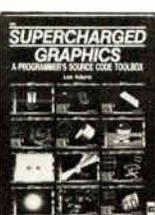
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3738 \$26.95



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3418P \$26.95



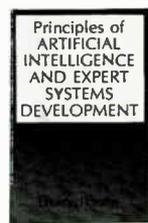
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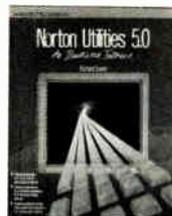
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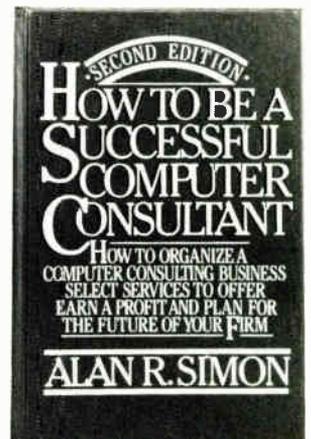
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881693-9P \$29.95



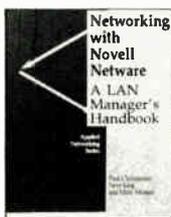
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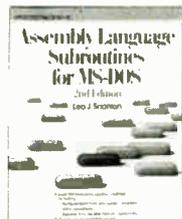
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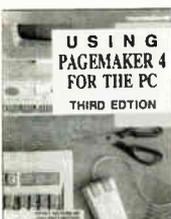
2951P \$18.95



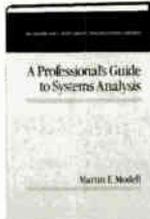
044118-9 \$49.95
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3649P \$24.95
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881629-7P \$26.95
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042632-5 \$39.95
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881736-6P \$27.95
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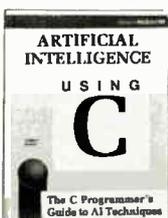
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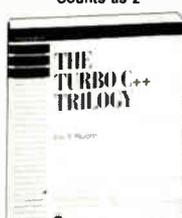
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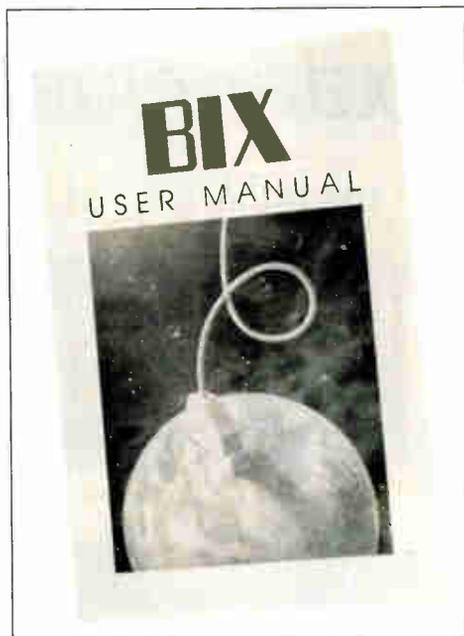
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HIGH-END PRINTING ON A LOW-END BUDGET



If you're buying or upgrading a laser printer, the decision to pay more for extra features—such as PostScript, soft fonts, additional RAM, and printer font cartridges—can be agonizing. The confusion that results often leads to overbuying, where you purchase everything in sight because you fear you'll wind up with a printer that won't meet your needs.

You may be surprised to discover that you can print complex documents with vector graphics, raster images, and text in different fonts without having downloadable soft fonts, printer font cartridges, or PostScript. You may be even more surprised to discover that adding these features can actually have a negative effect, decreasing the performance of your printer and making your system difficult to configure.

The advent of inexpensive font managers for DOS, OS/2, and Mac systems—utilities that keep you from having to manually handle some of the font operations—has radically changed the printer purchase/upgrade game. For most applications, type managers take many of the configuration problems out of buying or upgrading a printer.

These options have not always existed. For many years, you couldn't produce a professional-looking document with a personal computer. When dot-matrix printers first appeared, their price was high in comparison with devices that produced better quality output. Finally, the Hewlett-Packard LaserJet family revolu-

tionized personal computer printing.

LaserJet printers produced high-quality text with limited graphics, but they were still expensive. On the Macintosh side, the PostScript-based Apple LaserWriter gave birth to desktop publishing. However, many people still found that the price to join the DTP club was steep and meant changing personal computer platforms.

Today, hardware and software components are more in step with each other. Personal computer users can now produce top-quality documents on a wide range of output devices.

Fonts Are Us

Ironically, it would take a book to come close to covering the subject of fonts. On the surface, fonts seem so simple, but, instead, the subject is complicated because there is no standard way of defining, selecting, or storing them. Applications, printers, and operating systems use fonts in different ways. Fonts are a little easier to understand when you group them into two categories: bit-map and outline.

Traditionally, typefaces have been stored on local hard disks or in printer ROM as bit maps (pixels that

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type managers to print
complex documents
on any output device
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form the shape of each character). Each character bit map represents a character in a particular point size and type style. For example, the letter *a* in 10-point Times Roman is represented by one bit map, while the same letter in 12-point Times Roman requires another bit map. Bold and italic versions of the letter *a* in

Adding the font's special symbol characters (e.g., copyright, trademark, and bullets) takes another 100 bit maps. A reasonable collection of typefaces can therefore push a hard disk to its maximum capacity.

Another characteristic of bit-mapped fonts is that you need two different sets—

dots per inch, while most PC printers vary anywhere from 70 to 300 dpi. Bit-mapped characters are resolution-dependent, which means that a 12-point Helvetica bit map can look fine on-screen but may be almost unreadable on a 300-dpi laser printer, and vice versa.

Screen fonts remain on your disk until

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FONT MANAGERS

for the proper rendition of the characters.

ATM and FaceLift are able to store each font's bit map in a RAM *font cache* so that the conversion from outline to bit-map format occurs only once. The larger your font cache, the more font bit maps you can store in RAM.

Font managers provide true device-independent printing of fonts. This means you can print high-end fonts (e.g., Adobe's PostScript Type 1 or Bitstream's Speedo fonts) on any printer, regardless of the device's characteristics. For non-PostScript laser-printer owners, this is good news. In fact, most documents that you can print on a PostScript printer can now be printed on a non-PostScript device. For example, with a nine-pin Epson FX-100 dot-matrix printer, without an upgrade or setup modification, you can print any of the 35 standard fonts that come with a PostScript printer.

Font Managers and Page-Description Languages

Font managers are printer independent because they are not tied to a particular page-description language (e.g., PostScript) or printer command language (e.g., HP's PCL). When you select the Print command to print a document, the font manager acts as a filter between the application and the print driver.

When you use ATM, the Windows dynamic link library, ATM.DLL, is loaded by ATMSYS.DRV. Both of these files are in your Windows SYSTEM subdirectory, and ATMSYS.DRV is specified within the SYSTEM.INI file. The DLL checks the Windows environment to see what kind of printer is active.

If it detects a PostScript printer, ATM acts as a pass-through filter, handing all information directly to the printer driver without conversion. If a non-PostScript printer is detected, ATM checks the printer driver to determine if the fonts specified in the printer's WIN.INI file are installed on the printer. This specification includes soft fonts, native ROM fonts, and/or font cartridges.

Assuming the active printer supports the fonts used within the document, ATM will provide the font ID number and character location to the printer driver. The driver packages this data as a series of printer-specific commands (e.g., PCL escape sequences) along with printer commands for any other graphics in the document. The printer will then manipulate, or rasterize, the font information.

If the printer does not support the particular font you want to print, the font bit maps created by the type manager are

embedded into the appropriate printer commands by the print driver. This format is usually a series of PostScript, PCL, Diablo, or Epson commands. ATM and FaceLift simply require that you have the appropriate printer driver (e.g., HPPCL.DRV) loaded under Windows.

True printer independence is possible only with PostScript. While PCL is a good printer command language, it does not have all the capabilities of PostScript. Currently, PCL is limited to 75-, 150-, and 300-dpi resolution, whereas PostScript can be printed in any resolution, including 400, 600, 1200, and 2400 dpi. However, for many PC users that implement beginning or intermediate desktop publishing or word processing on a 300-dpi printer, PCL will fill the bill.

For example, a Microsoft Word for Windows document would not be affected by changing from a PostScript printer to an HP LaserJet. The document would keep the same fonts, look the same on the screen, and look virtually the same on the printed output.

If your intention is to use a 300-dpi laser printer as a previewing device for a 2400-dpi phototypesetter or a color printer, then PostScript is your only solution. Using PCL to preview documents on a 300-dpi printer before sending them to a 2400-dpi PostScript phototypesetter can cause numerous problems, because PCL will format the page differently at 300 dpi.

The Upgrade Game

The price of printer fonts has stayed relatively high over the past few years. At sites with multiple printers, you will have to factor this substantial up-front investment into your decision concerning which printers will get new fonts.

Not only is the financial investment high, but these fonts require a lot of time to install, hard disk space to store, and printer RAM to process. Font cartridges reduce some of the installation time and the hard disk storage requirements, but they do not resolve the other issues. Not only has the advent of font and type managers eliminated many of the problems, but they also can add new functionality to older output devices.

At a street price of less than \$70, font managers represent a much less expensive—and sometimes more effective—alternative to PostScript and font-upgrade products. A PostScript cartridge for your printer or host-based PostScript interpreters (e.g., Freedom of Press and GoScript Plus) can run between \$200 and \$500.

These products give you most of the

PRINTER-OUTPUT COMPARISON

Epson FX-100

HP LaserJet

PostScript

WinWord 1.1

Additional Information Ab

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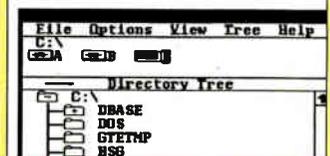
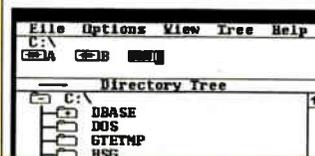
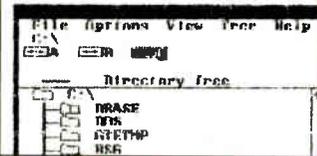
PageMaker 3.01

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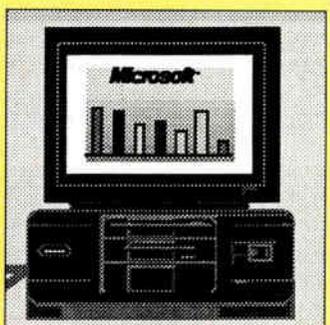
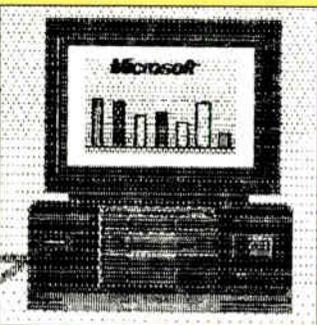
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When started, the MS-DOS Shell v the disk drive (usually C:\) that he the Shell. In order to work with f must select another drive. As sho displayed below the menu bar, w

Text/graphics



PowerPoint (using printer fonts)



Graphics

As you can see, with any of these printers, your style, format, and font maintain their integrity. Therefore, with the use of a type manager, you gain device independence for your document output. (Reproduction is 300 dpi for the PostScript and LaserJet printers and graphics mode for the Epson versus about 2400 dpi for magazine-quality reproduction.)

benefits of PostScript, but you may not need all these features. Even if you are working with a PageMaker document that incorporates line graphics, TIFF images, and PostScript fonts, you do not necessarily need PostScript. In most cases, a font manager and PCL compatibility on your laser printer will suffice to give you reasonably high print quality.

Gaining Device Independence

To demonstrate that you can inexpensively print high-quality material, we produced each of three documents on an

Epson dot-matrix printer, an NEC LC 890 in PostScript mode, and an NEC LC 890 in LaserJet-compatibility mode. Using a font manager, we printed these documents by simply selecting the printer of choice and sending them to that device. We never had to reselect fonts, reorient graphics, or modify page configurations. All of the 35 available PostScript Type 1 fonts reproduced faithfully.

As you can see in the figure, the output of a complex PageMaker document on a dot-matrix printer, using PostScript's Type 1 fonts and some graphics

examples, produces surprisingly good results. Although the document is not camera-ready quality, it is acceptable for proofing. The dot-matrix device also produced the slowest output times, but they were not unacceptably slow. We liked the fact that we were able to print a document of proof quality that was intended for a higher-end device without any reformatting or font selection.

This capability has some advantages. Say that you're working with a laptop computer away from the office and you want to proof your work without the

A PRINTOUT SHOOT-OUT

For this test, we printed documents of increasing complexity on three types of printers. While the Epson (dot-matrix) printer took far longer than the other printers, its output was still acceptable for proofing purposes. The Adobe Type Manager-equipped HP LaserJet actually printed less-complicated documents faster than the non-ATM PostScript printer. The machine that we used for this test was a 33-MHz 386 with a 130-MB 17-millisecond hard disk drive; 4 MB of RAM; Windows 3.0; ATM for Windows; and DOS 3.3.

Document	Time (In minutes:seconds)		
	Epson	LaserJet with ATM	PostScript without ATM
WinWord 1.1	4:00	0:53	1:23
PageMaker 3.01	4:30	1:35	2:23
PowerPoint	10:30	6:03	2:50

hassle of reformatting your document to conform to the specifications of another printer. If you are using a font manager and have a variety of printer drivers installed, you can send your document—along with its high-end fonts—to an Epson dot-matrix printer or any other printing device that happens to be available.

The output of the same PageMaker document on a LaserJet-compatible printer produced better results than on the dot-matrix printer. But the most interesting point is that printing in HP LaserJet mode was more than twice as fast as that of the same printer in PostScript mode. Even if you have a PostScript printer, you might gain a significant speed advantage by reconfiguring it to operate as an HP LaserJet, if it has that capability. For long documents, the time savings can be substantial (see the table).

In our experiment, we had just the opposite results (quality and speed) from the LaserJet output when we printed a complicated document (Microsoft PowerPoint). Try working with your own printer in both modes to find the combinations of text and graphics that yield the best results for you. Another significant factor is the difference in print quality. The output quality of our Word for Windows and PageMaker documents was identical in PCL and PostScript modes, but the complex PowerPoint image was better with PostScript. PCL handled shading poorly, while PostScript produced a much better representation of this full-color VGA screen image.

Although PCL may be faster than PostScript (which is now called *level 1* by Adobe) in certain circumstances, PostScript level 2 (a new version of the language) printers will probably be faster

than PCL. However, few PostScript 2 printers are available now.

Limitations Are for Real

A font manager can produce great benefits, but it can have a negative effect on video refresh times, because it may have to create screen fonts in real time versus using prebuilt bit-map fonts. Font caches (provided with both ATM and FaceLift) can reduce this problem, but you may not have enough RAM for an effective caching system.

Doug Grismore of Adobe Technical Support suggests using a font cache of between 64 kilobytes and 256 KB of RAM, based on the number of fonts you regularly use. We recommend at least 1 to 2 megabytes of extended memory to run font managers effectively.

Also note that font managers perform a function normally carried out on the printer. ATM is just the font-rasterizer portion of the PostScript interpreter. Because of this, your host computer is performing tasks normally handled by the printer. If you run only one or two applications simultaneously under Windows, you should see little degradation in performance. But if you operate in more complex environments involving background processes, your system could temporarily slow down.

Host-based font rasterization can also create additional traffic on a network. Because the fonts are sent as bit maps rather than as font names and character locations, more data is moved across the cable to the printer. For smaller networks, this operation may not be an issue, but for larger networks, the extra overhead can substantially reduce the network's performance.

Although font managers technically eliminate the need for the hard disk space required to store prebuilt bit-map fonts, they do require 25 KB to 40 KB per outline font. Although 10 outline fonts can take up to 0.5 MB of disk space, the equivalent in bit-map fonts could be over 2 MB, depending on how many point sizes you install.

If your PC environment is fairly complicated, you should enter the world of font managers with caution. The use of older or poorly written printer and video drivers with font managers may cause conflicts in your system.

The popularity of font managers has resulted in a dramatic increase in new versions of drivers from OEMs. Make sure these drivers will work with your chosen font manager before converting. Also, take the time to carefully select how many outline fonts you want to use. The use of too many fonts may force your font manager to perform poorly, in terms of speed and system stability.

In addition, make sure your network drivers and memory managers will work in concert with the font manager. Font managers use extended memory, as do many network and print drivers, and memory-address conflicts could result in a Windows "Unrecoverable Application Error." Not all Windows applications will work correctly with these font managers. Try your critical applications with these products to make sure they perform smoothly before making a purchase.

Blessings in Disguise

Font managers are a blessing to those who have low- to medium-level printing needs. They allow output normally associated with full-blown PostScript-quality printers and cost much less.

Font managers reduce the need for expensive printer font cartridges and soft fonts even further, and they make configuration easier. While PostScript is the only solution in many situations, most PC users can use font managers to produce professional documents with a far lower investment of time and money.

Font managers are a new entry into the Windows environment, and there's room for stability and performance improvements. As these products mature, many of the compatibility problems and workarounds will be eliminated. ■

Jeffrey H. Lubeck and Bruce D. Schatzman are systems consultants in the Seattle area. They provide systems design and implementation services throughout the U.S. You can contact them on BIX c/o "editors."

February 25, 1991. *InfoWorld* reports:

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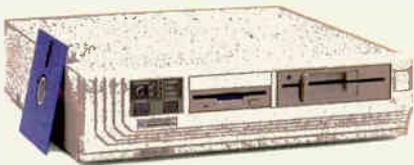


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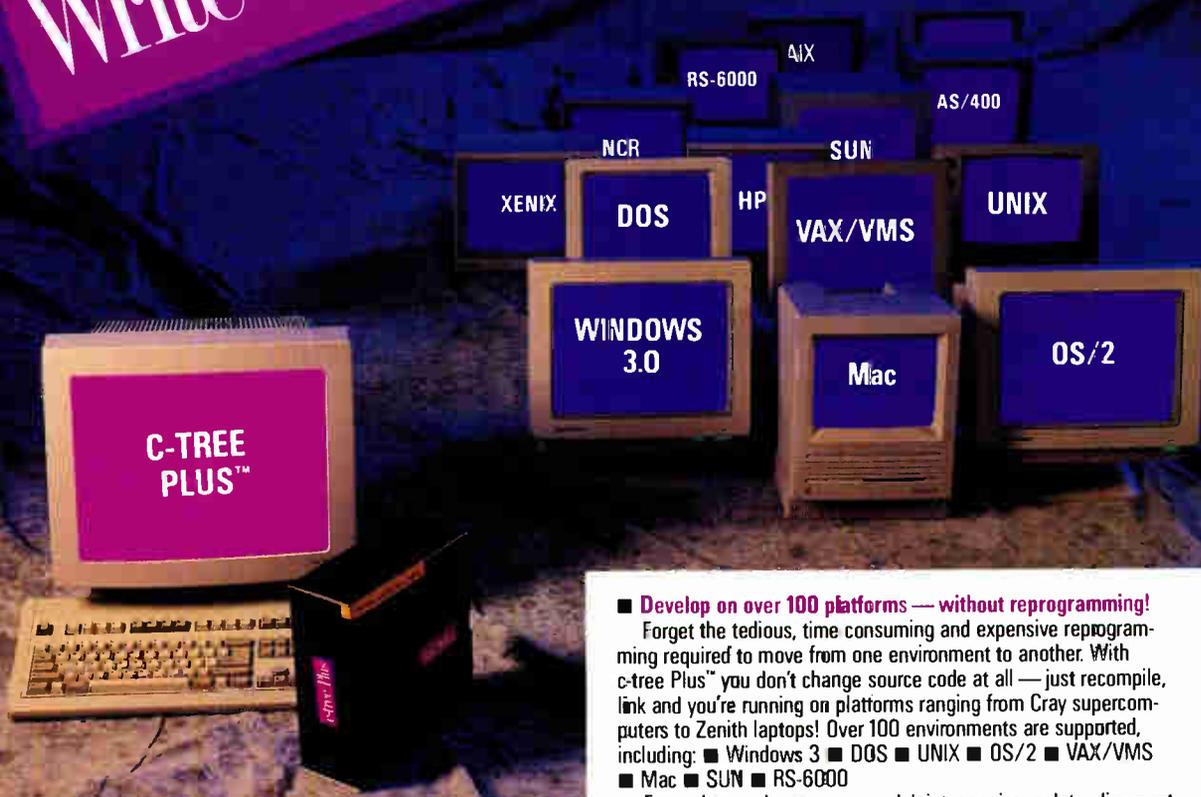


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INHERIT THE WIN



Over the past couple of years, I have participated in a number of debates about whether the Microsoft Windows and OS/2 Presentation Manager (PM) programming systems can be considered object-oriented. Although there seems to be no lack of confusion or dissent about what makes a programming system object-oriented as opposed to object-based or class-based, the consensus appears to be that these systems cannot be considered object-oriented programming (OOP) systems unless they support hierarchical inheritance of classes.

What Makes a System Object-Oriented?

For the sake of discussion, you can classify programming interfaces into procedure libraries, object-based systems, class-based systems, and OOP systems. Each succeeding classification incorporates the features of the preceding category and imposes a higher level of structure and sophistication.

A *procedure library* is simply a collection of routines for developing applications. It may have no inherent structure, although there may be requirements as to the order in which certain procedures can be called.

An *object-based system* allows for direct modeling of either real-world or abstract entities, and it encapsulates the data and the routines used to query or manipulate each object into a logical, self-contained unit. This programming paradigm incorporates methods for highly structured and restricted access to information.

A *class-based system* includes templates that describe key information required to create an instance of an object, usually including default values. It supports multiple distinct instances of an object, each of which can be totally independent of one another, while in an object-based system they cannot.

For a system to be considered object-oriented, it must support polymorphism (i.e., the ability of different objects to respond to the same message in their own way) and hierarchical inheritance of classes. In an *OOP system*, you create tree-structured hierarchies containing classes built on other classes—a method that simplifies the modeling of object-relationship classifications.

Object encapsulation simplifies the representation of a well-defined item, such as a physical entity (e.g., a car or a window), or something more abstract or intangible (e.g., imaginary numbers or a model of an alternate universe). An object consists of data coupled with a set of routines, known as methods, that are used exclusively to access and manipulate the object. The only operations that can be performed on an object are those defined as methods for the object. Invoking a method

Are Windows and Presentation Manager object-oriented systems? If so, they must support object encapsulation, polymorphism, and class inheritance.

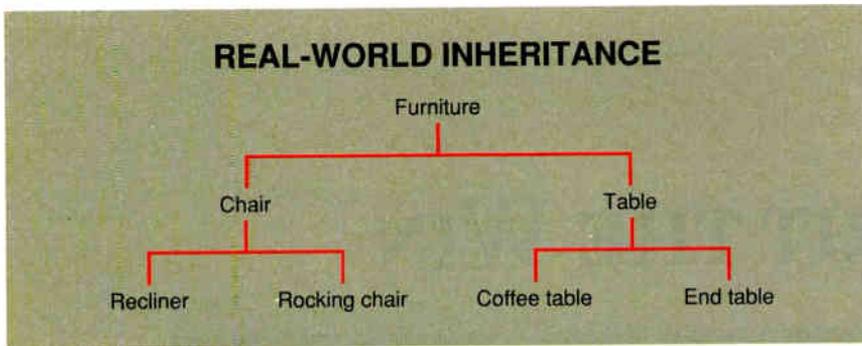


Figure 1: An inheritance tree for Furniture.

for an object is referred to as *sending a message*.

Classes

Windows and PM meet the requirements of an object-based system, since each window object logically encapsulates its data with a message-processing procedure. Classes are used to create different instances of objects that share the same base set of properties; each instance contains the same methods but differs in the data that it contains. If any two objects of

the same class contain the exact same information, they exhibit exactly the same properties, so it's possible to create highly reusable classes for generalized objects. This can help reduce code redundancy and development time. Bugs are usually restricted to small sections of code, so they're easier to find and fix.

In PM, you create an object class by registering a class name, specifying class properties, supplying the data storage requirements for each object, and providing an address of the procedure

that processes all messages. In Windows, you also specify some additional default information, including any special class-specific data that you desire. In either system, when you create a window, you specify class name and some instance-specific information; this ensures that any instance of a window of a specific class has the same base properties. Both PM and Windows also meet the requirements of a class-based system.

Polymorphism and Inheritance

Polymorphism, often called *operator overloading*, lets you define an operation for each instance of an object based on its class. Windows and PM provide a limited form of polymorphism using message identifiers. A *message identifier* is an integer value that a windows procedure uses to identify which message-processing method to use. The window's procedure inspects the identifier and performs the appropriate actions, if any. For example, WM_PAINT is a message that all visible windows are expected to be able to process. The system sends this message whenever it is necessary to refresh all or part of the window.

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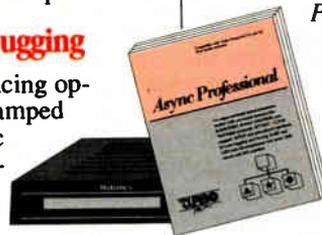
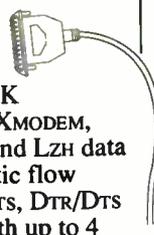
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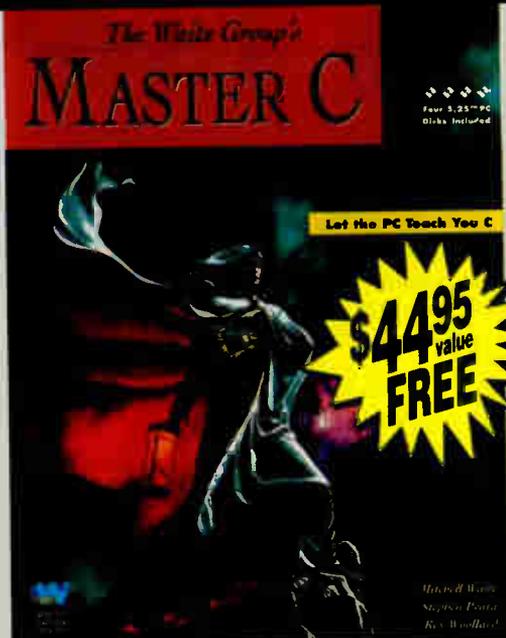
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Listing 1: A demonstration of class inheritance for PM. This procedure registers a new window class that inherits some of its class data from another class, called the SuperClass.

```
#define INCL_WIN
#include <os2.h>
PFNWP APIENTRY InheritClass
(HAB hab,
 PSZ pszSuperClass,
 PSZ pszRegisterClass,
 PFNWP pfnwRegister,
 ULONG styleExclude,
 ULONG styleInclude,
 USHORT cbWinExtra,
 PUSHORT pcbQwOffset)
{
    CLASSINFO cls1;

    if (WinQueryClassInfo (hab,
        pszSuperClass, &cls1)
        && WinRegisterClass (hab,
            pszRegisterClass,
            pfnwRegister,
            (cls1.flClassStyle
                & ~ styleExclude)
            | styleInclude,
            cls1.cbWindowData
            + cbWinExtra))
    {
        if (pcbQwOffset)
            *pcbQwOffset =
                cls1.cbWindowData;
    }
    else
    {
        cls1.pfnWindowProc =
            (PFNWP) NULL;
    }
    return cls1.pfnWindowProc;
}
```

Listing 2: A demonstration of class inheritance for Windows. This procedure registers a new window class that inherits some of its class data from another class, called the SuperClass.

```
#include <string.h>
#include <windows.h>

//define a type named 'PFNWP' for pointers to window procedures
typedef LONG(FAR PASCAL *PFNWP)(HWND, unsigned, WORD, LONG);

FARPROC InheritClass
(HANDLE hInstSuperClass, //Super class's instance
 LPSTR pszSuperClass, //Name of super class
 HANDLE hInstApplication, //Application's instance
 LPSTR pszRegisterClass, //Name of class to register
 PFNWP pfnwRegister, //Register class window proc
 int styleExclude, //Disallowed class styles
 int styleInclude, //Additional class styles
 int cbWinExtra, //Additional window data
 int * pcbQwOffset) //Return offset to win data
{
    /* Return super class window proc */
    FARPROC lpfnSuperClass = (FARPROC) NULL;
    WNDCLASS wc;
    memset (&wc, 0, sizeof (wc));
    if (GetClassInfo (hInstSuperClass, pszSuperClass, &wc))
    {
        lpfnSuperClass = (FARPROC) wc.lpfnWndProc;
        if (pcbQwOffset)
            *pcbQwOffset = wc.cbWndExtra;
        wc.lpfnWndProc = pfnwRegister;
        wc.cbWndExtra += cbWinExtra;
        wc.hInstance = hInstApplication;
        wc.lpszClassName= pszRegisterClass;
        wc.style &= ~ styleExclude;
        wc.style |= styleInclude;
        if (!RegisterClass (&wc))
            /* ERROR - class not registered! */
            lpfnSuperClass = (FARPROC) NULL;
    }
    return lpfnSuperClass;
}
```

Inheritance enhances the attributes of a class-based system to let you define specialized classes from more general classes. The specialized class (i.e., the inherited class) takes its default base properties from the more general class (the super class). Any class, other than the topmost class in a hierarchy, can be an inherited class, a super class, or both.

It's easy to find examples of inheritance in the real world. You know, for instance, that a recliner is a specific type of chair because it has all the basic properties. Similarly, a chair is a piece of furniture. A table is also a piece of furniture, and a coffee table is a specific type of table. These relationships are represented by the inheritance tree in figure 1.

In both PM and Windows, the plan is to create objects that represent an image in an area of the screen, can interact with

the user, and perform some specific functions in response to different events. Not all window objects implement all these characteristics, but all inherit a base set of properties from the basic system class. (In fact, this system class is so basic that it doesn't even have a class name.) Whenever a new class is registered, it inherits this ultimate super class by default.

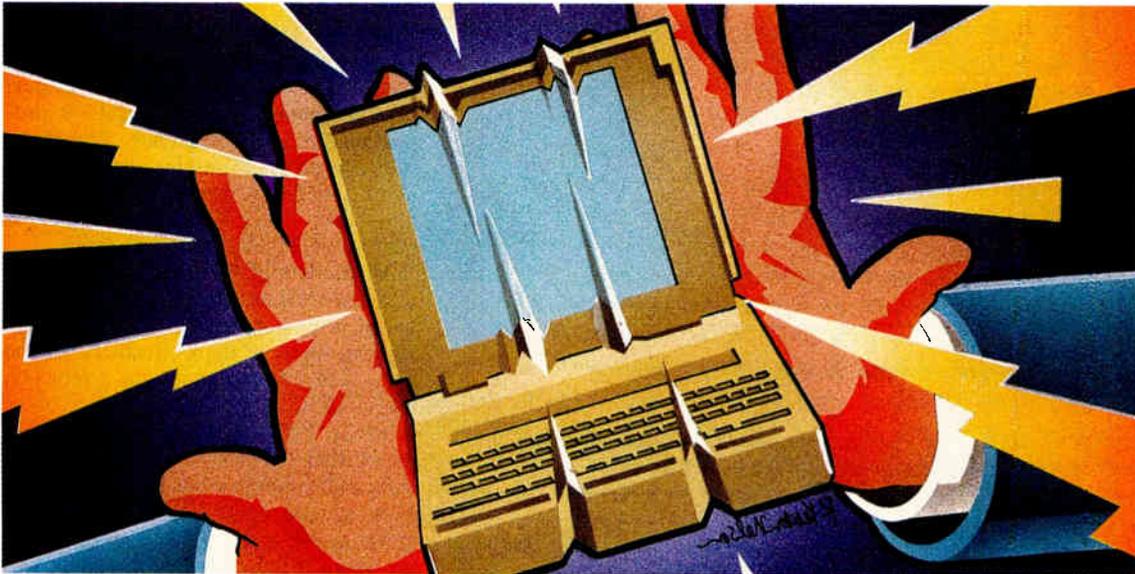
Can you create your own classes containing a specified set of properties and then use inheritance to include those properties in other, more specialized classes? This is an important question. If there is a way for PM and Windows to support user-defined inheritance, then they provide everything that makes an OOP system; otherwise, you're limited to the more restricted benefits of a class-based system.

A Technique

Class inheritance is a simple and powerful technique, similar to subclassing. But it doesn't change any existing class in any way, and it results in the definition of a new window class that inherits the base properties of an existing (super) class by default. To define a new PM or Windows class that inherits an existing class, you need to do the following:

- Obtain the class information for the super class by calling either `GetClassInfo` (in Windows) or `WinQueryClassInfo` (in PM).
- Save the address of the super class's window procedure along with the extra window data it requires.
- Modify the class information.
- Register the new class using the modified super class's information.

POWER MANAGEMENT



Power management—a technology that combines disciplines from chemistry and physics to chip design and software engineering—is an essential element of the battery-powered computers and consumer electronic devices of the 1990s. If you use a notebook or palmtop computer, a cordless or cellular phone, a calculator, a portable CD player, an auto-focus camera, a pager, or a digital watch, you rely on power management to keep that electronic marvel small, lightweight, and alive for a reasonable amount of time between battery charges or changes. In this article, I'll explore the details of this multifaceted technology, with an emphasis on what you can expect to see in the portable computers of the coming decade.

Battery life can make the difference between a highly successful product and a dismal failure. (NEC's original UltraLite—an otherwise brilliant product—suffered in the marketplace because its nonreplaceable battery was sometimes exhausted after only 90 minutes of use.) Therefore, designers must commit to squeezing every ounce of endurance out of their products. Every watt of power must be carefully budgeted, especially if the machine is small; a single milliamp of stray current can doom a palmtop's battery to early failure.

Where Does the Power Go?

Where, exactly, does the power go in a computer? The majority, as you might expect, is dissipated as heat

from chips and other components. Smaller amounts may leave as light from a backlit screen or LEDs, or as electromagnetic radiation. A fan turns electrical power into kinetic energy. Sound from the speaker, disk drives, and fan accounts for a small fraction of the power. The figure shows the power budget of a typical laptop computer.

But no matter how it's ultimately dissipated, most of the power can be accounted for by two simple equations. The first, which applies when a voltage is applied across a device that draws a steady current, is as follows:

$$P = V^2/R$$

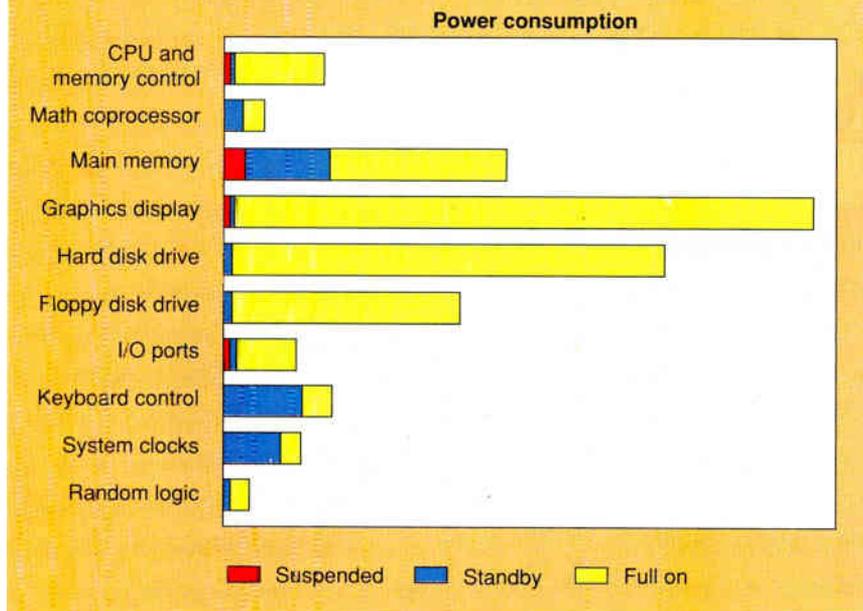
In other words, power is equal to the square of the voltage across a device divided by the resistance of that device. The second equation applies when an AC signal—a clock—drives a capacitive load:

$$P = CV^2f$$

where C is the capacitance of the device, V is the difference between the high and low voltages of the clock, and f is the frequency of the clock. The sections that follow refer back to these two equations and survey the

Here's how laptop and palmtop PCs can run for weeks on just a few small batteries

LAPTOP POWER CONSUMPTION BY COMPONENT



Backlit displays and hard disk drives—two features that laptop users demand—are the biggest consumers of power. (Figure courtesy of Intel Corp.)

tactics electronic designers use to save power.

Vary the Voltage

Since both equations show that power is proportional to the square of the supply voltage, dropping this voltage would be a good way to start reducing power. In fact, many chips already use this tactic (but it's not obvious by looking at their specification sheets). Although they accept a 5-volt power supply and use it to drive their outputs, they run at a lower internal voltage to conserve power.

When the chips can handle it, one of the best ways to lower power consumption is to run the entire system at a lower-than-normal voltage. Atari's Portfolio fuels a 5-V 80C88 microprocessor and other logic with three AA alkaline cells, or about 4.5 V, to produce a 20 percent power savings. Newer chips can make even more aggressive reductions possible. Intel has a version of the 186 that's rated for 3-V operation, and it's possible to make pure CMOS devices that run at 2 V. The main limitation is that every device connected to these parts must be able to work at the reduced voltage.

Squash Static Loads

Perhaps the most common type of power sink in modern logic circuits is what en-

gineers call a *static load*—a path between power and ground that has a low or moderate resistance. (As the first equation shows, the power that is lost to a static load is proportional to this resistance.) The most common kinds of static loads are pull-up and pull-down resistors and resistor ladders. All kinds have power-saving alternatives.

Pull-up and pull-down resistors can be replaced by active elements (i.e., transistors), which consume power only when a signal line is changing state. Resistor ladders, which are used to generate voltages, can be made of resistors with very large values or replaced entirely by active circuits. An active voltage source is a much more power-efficient way of obtaining a specified voltage than a resistor ladder alone.

If the resistors in a resistor ladder are large, then a load placed midway up the ladder will lower the voltage at the tap by partially shorting out the lower half. On the other hand, if the ladder resistors are small, the ladder itself will draw too much current. A better solution is to use a high-resistance voltage ladder as the input to a low-power operational amplifier. The "op amp" will source only the current necessary to keep its output at the required voltage, and the ladder—whose total resistance can be on the order of

megohms—won't consume much power.

Hewlett-Packard's HP 95LX palmtop, which gets weeks of use from two AA cells, uses ultralow-power operational amplifiers as voltage sources. They're considerably more expensive and more complex than resistors, but the power savings are worth it. Poqet Computer's Poqet and the Atari Portfolio both use CMOS application-specific ICs that eliminate static loads to reduce power consumption.

Stop the Clock

As the second equation shows, the power consumed by clock signals—a large part of a computer's power budget—is proportional to their frequency. Therefore, if it's possible to reduce a computer's clock speed—or, better, stop the clock altogether—without having an impact on performance, it's well worth doing.

Virtually all CPUs can run at frequencies several times slower than their rated speed, but stopping the clock is more trouble on some than on others. If the CPU is of a dynamic design, it relies on the clock to refresh the contents of its internal registers. Stopping the clock means that you must save the processor's state and restore it when the clock comes back on. By contrast, when the clock starts again, a static CPU simply picks up where it left off when the clock was stopped.

Many support chips, as well as integrated CPUs such as AMD's 286LX and Intel's 386SL, contain the logic required to slow or stop the clock (see "Portable Chips," December 1990 BYTE). The trick, as you'll see later, is deciding when this can be done without user inconvenience.

Beef Up the Battery

Semiconductor vendors seem to double chip capacities every year and a half, while battery technology seems to be evolving at a snail's pace. The HP 95LX palmtop's components are dwarfed by the batteries that power them. In general, batteries are the largest (and heaviest) components of portable computers—especially palmtops. The desire to keep battery weight and cost down is the ultimate motivation for all the power-saving techniques discussed here.

Although the situation isn't likely to change much in the near future, a few developments show promise. Makers of nickel-cadmium batteries report that they're making cells more resistant to the memory effect, which shortens battery life when a cell isn't fully discharged before it's recharged.

Also, increasing numbers of portable computer vendors are using nickel metal-hydrate rechargeable batteries, which don't suffer from memory effects and have a higher power capacity per unit weight than nickel-cadmium batteries. Other developments on the horizon include batteries with plastic electrodes and new electrolytes. However, nickel-cadmium batteries are still cheap and plentiful, which will keep them popular for a long time. (For more on battery technology, see "Power to the Portables," May 1990 BYTE.)

Dim the Display

Display quality is usually cited as the number-one criterion for laptop sales: Consumers simply won't buy a computer with a display they can't read comfortably. Yet, as the figure shows, the display is usually the single most power-hungry component of a portable computer.

The ideal low-power display would be an electrochemical analog of the displays used at airports and sporting arenas: A small pulse of current hides or exposes a dot, which latches into place and requires no more power until it changes state again. Unfortunately, while flat-panel displays that exhibit this behavior—often called *static displays*—have been prototyped, they're still too slow and too difficult to manufacture to be used in current laptops. Instead, virtually all battery-powered computers use *dynamic displays*—such as LCDs—that require constant refreshing to maintain an image.

Portable makers can choose from two types of passive LCDs. An ordinary *twisted nematic* display has a lower capacitance per cell, meaning less power at a given refresh voltage and frequency. However, a *supertwist nematic* display has a higher capacitance and a longer persistence, which means that it can be refreshed less often. On balance, supertwist displays use more power—but people want them. The Portfolio, the HP 95LX, and the Poqet all use supertwist displays to achieve high contrast ratios.

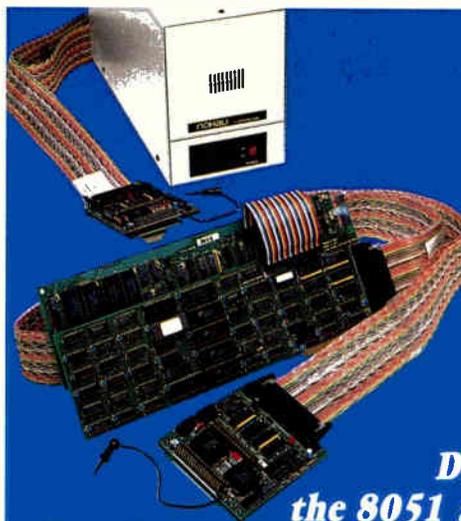
The size of the display has a dramatic effect on power consumption. Given a constant scan rate (generally no slower than 50 Hz to avoid flicker), the frequencies of the clocks that drive the display must go up in proportion to the number of lines. What's more, the time available to charge the capacitance in each individual pixel is now smaller, so the voltage must also go up by a factor proportional to the square root of the frequency. Thus, as indicated by the second equation, display power increases as the square of the number of display lines.

How do different machines handle the display power consumption problem? A peek inside the case of the Portfolio reveals that it uses a standard Hitachi chip with internal pull-ups and an external character ROM to drive its 10-row by 40-column LCD. This may be one reason why it goes through batteries faster than the HP 95LX and the Poqet despite having the smallest display.

The HP 95LX uses custom chips and a resistor ladder with a high total resis-

tance to save power when driving its 16-row by 40-column display; it also lowers its scan rate from 70 Hz to 50 Hz when running from the battery.

But of all the portables on the market today, the Poqet goes the furthest to reduce display power consumption. Using a balanced analog drive circuit with active voltage generation and no static loads (claimed to be 10 times more efficient than other schemes), it boasts a full 25-row by 80-column display and *still* runs



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for weeks on a pair of AA cells.

None of the palmtops have backlit displays, but most notebooks are—by popular demand—lit by fluorescent tubes or electroluminescent panels. Backlighting requires relatively large amounts of power from high-voltage supplies and is the main reason that typical battery life in the current crop of notebooks allows only 3 to 4 hours of useful work. It's possible to conserve, of course, by turning off the light after a period of inactivity. It's also

possible to power down the entire display and display controller, copying the controller registers and the contents of the screen to main RAM.

Refrain from Refreshing

Few palmtop or notebook computers can get away without having at least 256 kilobytes—and preferably 512 KB or more—of RAM. But what type do you choose? DRAM—the densest type—is also the cheapest, but it draws the most power.

Static RAM, by contrast, draws the least power but is the most expensive and the least dense. *Pseudostatic* RAM chips lie in between. Because they consist of DRAM with invisible on-chip refresh, they're denser and less expensive than SRAM chips. The designers of the HP 95LX found pseudostatics to be the best choice; the required amount of SRAM would have taken up twice the room and would not have fit comfortably on the main board.

Pseudostatics are too expensive, however, when the required amount of system memory gets large. And notebook designers, whose machines are expected to run Windows 3.0 and other memory-hogging programs, must satisfy customer demand for megabytes of standard DRAM that's upgradable with commodity parts. For this reason, the designers of chips such as the 286LX and the 386SL—as well as chip-set vendors—implement three techniques: slow refresh, staggered refresh, and column-address strobe before row-address strobe (CAS-before-RAS) refresh.

Slow refresh consists of performing DRAM refresh cycles less frequently when the processor is "asleep" than when it's running at full speed. Engineers have discovered by experimentation that some brands of ordinary DRAM chips can retain data far longer than the rated time before they must be refreshed; more conservative people can specify DRAM chips that have been designed and tested for slow refresh capabilities.

Staggered refresh means the memory chips are refreshed one at a time rather than all together, keeping instantaneous power consumption low.

CAS-before-RAS refresh, a seldom-used mode found in many DRAM chips, lets internal counters on the DRAM chips provide the addresses of rows to be refreshed. This saves the power that the system would expend if it had to turn on buffers and supply the row addresses itself.

Reduce the ROM

ROM is another area where system designers can save significant amounts of power. The Apple II, for example, had a weak power supply and very little power for peripheral cards. Therefore, Steve Wozniak experimented with the notion of placing a transistor switch on the power pin of each peripheral EPROM; the transistor only powered up the memory while it was being addressed. Although this approach was technically a violation of the EPROM chip specification, it worked wonderfully and saved tens of milliamps



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	Executing DIR, TYPE, or CD command	55.9
Spreadsheet	Waiting for input	88.1
	Editing or moving between cells	67.5
Word processor	Waiting for input	91.3
	Typing, printing, or cutting and pasting	89.3

per board.

Modern microcomputers can use similar tactics. In fact, they can go one step further. If they shadow the EPROM in RAM, they can turn the EPROM off completely after its contents have been copied. There are two more advantages to this approach: First, 8-bit rather than 16-bit EPROM can be used with no speed penalty; second, the BIOS can be stored in compressed form and decompressed as it is shadowed, making it possible to use a smaller, less costly chip. This last point is especially important in systems with flash EPROM, which still carries a premium price.

Chopping Chips

When it comes to power management, the general rule is, the fewer chips, the better. Some of the most power-hungry parts of chips are the buffers on output pins, which (as mentioned earlier) often run at higher voltages than the internal logic. What's more, each buffer must be prepared to drive the signal through the (sometimes considerable) capacitances of traces, wires, and the inputs of other chips. Clocking more chips also means a more extensive distribution network with more losses, as per the second equation.

Microprocessor vendors are helping to fight this problem of too many chips with highly integrated solutions. The 286LX is an AT on a chip; the 386SL and its companion 82360SL make nearly a complete PC. Chips & Technologies, Headland Technology/Cirrus Logic, VLSI Logic, and dozens of other vendors make motherboard chip sets that reduce power consumption and board complexity. Nearly all add special hardware assists for power management.

The 386SL is notable in several respects. Besides integrating all the standard AT peripheral chips, it introduces a new interrupt called the System Management Interrupt. The SMI, which can be triggered by many events of interest to power management software, has a priority even higher than that of a non-

maskable interrupt (NMI).

When an SMI occurs, it throws the processor into an otherwise inaccessible address space and a mode similar to the 386SX's real mode. Once in this mode, the processor can manipulate the special timers, counters, and flags that help the 386SL monitor system power consumption. Intel claims that a key advantage of having a special mode is that a system's power management software will work regardless of what operating system is running. However, this is perhaps optimistic: Idle detection in different operating systems is best done on an individual basis and should use special knowledge of operating-system conventions.

One laudable 386SL feature is that it contains the controller and tag RAM for a cache (implemented by the external SRAM). This clears the way for another power-saving feature: If the cache detects a hit, the chip can avoid the overhead of generating a memory bus cycle. Likewise, if there's a miss, there's no need to take the cache's SRAM out of its low-power standby mode.

Finally, if all these integrated wonders still leave out circuitry you need (or want) to add, you may not have to pay a big power penalty. Many parts (like AMD's Zero Power programmable array logic) now have low-power standby modes, making it easy to implement the glue you need in a few chips.

Power-Hungry Peripherals

Many peripheral devices other than a computer's screen present power-saving opportunities. Serial ports, for instance, soak up a great deal of energy when they are turned on. RS-232 outputs typically maintain a voltage of ± 12 V across a 9000-ohm termination resistor. Some machines skimp on the voltage, running the port at 0 to 5 V instead, but this invites compatibility problems. What's more, the universal asynchronous receiver/transmitter (UART) chip usually needs its own clock for baud-rate generation. None of these power sinks is a

major problem in a laptop, but palmtop computers like the HP 95LX and the Portfolio burn batteries quickly if the serial port is left on.

Why can't a computer just shut down a serial port automatically? Unfortunately, on some architectures—notably that of PC clones—it's tough to tell when a port is in use. The BIOS, which has notoriously poor support for serial communications, has no calls that tell the machine to open or close a port; an application simply starts using it at will.

Without the important clues provided by such calls, a computer can only guess at the truth. And if it guesses wrong—perhaps because it hasn't seen any characters at the serial interface for a while—you may find that your mouse doesn't work when you reach for it after several minutes of typing. In fact, the now-ubiquitous serial port-powered mouse poses a dilemma: Shutting off the port disables or resets the mouse, but leaving it on lets the rodent siphon precious power from its host.

There are no 100 percent solutions to the problem of serial port power management. However, power management software can watch for key signals—such as Carrier Detect and Data Terminal Ready—which suggest that the port is in use. If a mouse driver is installed, the software can detect it and make a call to reinitialize the mouse after shutting down the port. Special hardware in several chip sets can detect accesses to the UART's I/O ports. In the HP 95LX, the serial port is normally off while the built-in applications run. But it turns on at the DOS prompt or when DOS programs are running—unless you shut it off manually.

Internal modems often power down during idle periods, waiting for a ring or a bus cycle from the host CPU. Some models draw power from the telephone line; others use energy from an incoming ring signal to wake up from an idle state. The keyboard controllers in most PC compatibles are small computers themselves, which means that they—like their bigger siblings—can invoke their own power-down sequence when they're idle. Intel's 80C51SL has this type of software masked into its internal ROM. The HP 95LX uses a custom controller that does not scan the keyboard continuously; instead, it awakens when a key is pushed and then checks to see which key it was.

Floppy disk drives in virtually all systems can remain powered down much of the time, and Intel has just introduced a low-power version of its 82077 floppy disk drive controller chip. Hard disk

drive access is also a rare event in many applications, so the drive and controller can be shut off during idle periods. Portable disk drives are shrinking—from 3½ inches to 2 inches and less—and since the moment of inertia of a disk increases as the fourth power of the radius, this means that it takes less energy to spin it. As the drive is turned off, it may be possible to harness the momentum of the spinning platter by using the motor as a generator and charging a capacitor—although I've never seen this technique used in a commercial drive. Another power saver is to use the right hard disk drive interface. While SCSI is the best interface for many applications, it requires power-consuming terminators on each end; IDE is better when power is at a premium.

Many systems can power down a parallel port when it's not in use. However, this can be risky; some devices—such as “dongles”—borrow power from the parallel port and require it to be on to work. Math coprocessors can be another problem area. Most math chips aren't static and can't be powered down while the CPU is running; about the best the system can do in these cases is to slow down the clock.

A few other areas can yield small, but significant, power savings. Eliminating a fan is easy to do if the rest of the system isn't dissipating much power—although as Macintosh and Apple II owners have learned, it isn't always wise to skimp on ventilation. LED indicators, which can consume as much as 15 mA each, can be removed. Finally, many systems offer an option to turn off the system's speaker—a significant power saver on palmtops like the Portfolio.

Indicating Idleness

One of the greatest technical challenges in the field of power management is determining when a system is really idle. While embedded system software and the built-in applications on the Poqet, the HP 95LX, and the Portfolio are designed to tell a system exactly when it is idle, programs that were meant to run on standard desktop machines don't do this. Thus, portable makers have had to develop algorithms that “guess” what a program is doing and determine whether it's OK to slow down or stop the CPU. These guesses must be accurate; if they are not, battery life or performance will be hurt. The table shows idle times for typical DOS-based activities.

Digital Research's BatteryMax (incorporated in DR DOS), Phoenix Technologies' Miser BIOS technology, and the

algorithms hidden within the Poqet computer's ROM chips are examples. All watch the current program to see when it accesses the keyboard. If a program rapidly polls the keyboard—or, better, makes a BIOS call that does not return control until a key is pressed—it's probably waiting for user input; the CPU can be slowed down or stopped until you type something.

DOS's idle interrupt (INT 28 hexadecimal) means that DOS is waiting for a keyboard character inside its get line function. And if a program asks DOS for the time of day again and again, it's also a reliable indicator that the program is waiting for a certain amount of time to elapse before continuing. Most power management systems consider entering power-saving modes after a certain number of calls have been made to these functions.

Alas, repeated calls to the idle function doesn't *always* mean that a machine should be slowed down or stopped. A spreadsheet, for instance, will check the keyboard regularly during long recalculations to see if you want to interrupt it. Most communications programs will alternate between checking the keyboard and watching a flag in RAM that indicates that an interrupt service routine has buffered an incoming character. And a TSR program that polled the clock could fool a system into thinking that no useful work was going on.

Thus, the power management software must be clever. In the case of the spreadsheet, it could note that idle calls during recalculation come less frequently than when you type information into a cell. In a communications program, it might note that the serial port was active and set to a high baud rate, requiring fast service. It could also track the loading and unloading of TSRs, distinguishing their calls from calls made by the main program. Screen, disk, and communications port accesses are useful *negative* indicators of idleness and can be used to rev up the CPU to full speed when the program is doing real work.

Power management software works best when it gets a boost from special hardware. Some TSRs and applications can foil power management schemes by performing direct hardware accesses and capturing interrupts—for instance, if a keyboard enhancer takes over the BIOS keyboard services. Others, such as background file transfer programs, need the system alive to do their jobs. And if a program contains its own direct mouse support (rather than using a standard mouse driver), a system may power down

the mouse port by mistake.

All these problems can be avoided via hardware that can trap direct accesses to peripherals and note when interrupt vectors are altered. The 386SL and 82360 build these functions right in—with timers that can keep track of how long it has been since a peripheral was accessed. Third-party chip sets provide similar capabilities, and future BIOSes—as well as operating-system software such as DR DOS and the ROM version of MS-DOS 5.0—are expected to take advantage of them, too.

All these approaches are ultimately workarounds, however. Multitasking operating systems, such as OS/2 and Commodore's AmigaDOS, know for certain when a task is idling; in fact, the Amiga's EXEC (its multitasking kernel) already halts the 680x0 when no task is able to run. OS/2, which truly isolates applications from the physical hardware, knows exactly which applications are active and which peripherals those applications need. And when Unix is implemented on a system with memory protection, it offers similar capabilities. As the world moves slowly but inexorably to more powerful operating systems, PC power management will become more of a science and less of a black art.

Ultimately, the development of power-saving technology will help everyone. Chips that consume less power and therefore run cooler are likely to be more reliable than those that burn your fingers when you touch them. Battery-powered devices that were formerly “dumb” will be able to include built-in intelligence. Satellites and space probes—which are limited by the amount of power they can generate via solar panels—will be able to convey and process more information. Palmtop computers that are as powerful as today's supercharged desktop systems may soon run on a single watch battery. In short, power management will change the world by making computers available virtually anywhere, anytime—with no need to plug them into a wall socket. ■

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TWO TEXT EDITORS

In my nearly 20 years of using and programming computers, I've spent a great deal of time looking at text editors. Starting with a line editor on a PDP-8, through a dark period of keypunch machines, then into the dimly lit world of mainframe time-sharing-option edit, and finally into the brightness of PC-based text editors, I've searched for an editor that felt "right" to me. I'm still looking for the perfect text editor, but in my search I've found a shareware product that comes as close as any commercial effort.

It has the strange name of Boxer, and the author is David Hamel. It has many of the same features as the commercial product Brief, which is known by many programmers as the Cadillac of text editors. Boxer does multiple files in multiple windows; you can begin an edit session with `B *.DOC`, create a few windows, and edit multiple files on the same screen (the Boxer executable file is named `B.EXE`).

It's Good in the Ring

Boxer has an undo feature you'll like if you've ever typed something that you've instantly regretted. Boxer's menu mode is especially useful for commands you don't use very often. It makes good use

Choose from a heavyweight shareware program or a free compact contender

of a mouse, if you have one, and it has both word processor and printer control commands. You can tell Boxer to show you an ASCII chart, a calendar, context-sensitive help, or, if you want, 50 lines of text instead of 25 on a VGA monitor.

You can do search-and-replace operations across multiple files. You can even tell Boxer to search all edit files for occurrences of a word or phrase. It puts the results in a file named `BOXER.FND` so you can see them. The search function uses wild cards and regular expressions. Like Brief, Boxer supports "bookmarks" (it calls them "anchors"). If you've already trained your fingers to use the commands and keystrokes of a different text editor, you can use Boxer's reconfigure utility to give Boxer the same look and feel as the editor that you now use.

Boxer is a full-featured text editor that I think you'll be comfortable with during

long edit sessions. I don't have space here to mention all its features, so you'll have to see for yourself what it does. Try it out; that's shareware's big advantage over commercial software. If you like Boxer, remember to send the author the requested \$35 registration fee. You'll get a quick-reference card and free telephone technical support. For a \$50 registration fee, the author also sends out a printed, bound manual. Source code, unfortunately, is not available.

One drawback to Boxer (and, for that matter, to Brief) is that you can't easily cart it around on a disk. But there are several programs that you can. One of them is a small, fast, free (public domain) tool from David Nye, who by day is a physician in Wisconsin. Called simply `E`, this editor is one that you can take with you when you need to edit files on computers other than your own. You may even want to make it your everyday, regular text editor.

While not as full-featured as Boxer, `E` has many editing functions: block move/delete, search and replace, word wrap, edit two files at once, and others. David Nye includes the source code to the program. Depending on whether you prefer a Cadillac or a Porsche, one of these text editors should suit your style. ■

MAC/Tom Thompson

Rather Switch Than Fight?

You're working along merrily inside a word processor on a Mac running System 7.0 with several applications in the background. You finish with the text, and it's time to switch to something else. Want something other than a menu selection to handle the task switch?

Applicon 2.0 lets you do so. After you drag Applicon to the Startup folder and reboot, it creates small windows, or *tiles*, that represent loaded applications. Clicking on, say, a graphics application tile swaps you to that application. These tiles display the application's icon and the first nine characters of its name, making the current tasks easy to recognize. Have a document hogging the entire screen? Applicon lets you define a screen "hot spot" that brings it to the foreground when you put the mouse there. Applicon is easy to use, reliable, and free. It was written by Rick Holzgrafe.

UNIX/Ben Smith

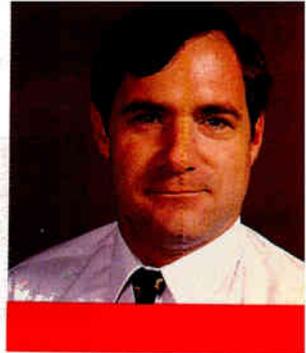
Fancy Patches

Larry Wall is the developer of some of the best freely available Unix software. Many people even think his contributions are part of the standard Unix distribution; the patch utility is one.

The problem is this: Sometimes programmers don't write complete and flawless programs on the first try. If they are shipping source code, it is easy to ship just the differences between the earlier version and the current version. They can easily create a change list using the Unix `diff` utility and then send the list as an E-mail message to the owners of full source code.

With patch, you can apply the changes (via an E-mail message with embedded `diff` output) to your sources simply and efficiently. Not only that, but you can more easily see what changes are being made when that is all you receive. I use patch with authors' corrections. First I review the `diff` file to see what they want to change. If all is OK, I patch it to the original.

Editor's note: Software Corner programs are available in a variety of formats. See "Program Listings" on page 5 for details. We solicit your contributions for this column. If you've written a program or utility that you think others might find useful, let us know. We'll pay \$50 for any program we use. Write to: Software Corner, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.



TOM THOMPSON

NETWORKING WITH SYSTEM 7.0

Any new version of the Mac OS fills MacFolk with anticipatory dread. AppleTalk network administrators have particular reason to worry because compatibility problems multiply their headaches by the number of users on the network. If you're concerned that upgrading to System 7.0 will break the reliable network that you've worked so hard to construct, you can rest easy.

I've worked with System 7.0 on an AppleTalk network for several months. I did hit some snags, but System 7.0's new capabilities are worth the effort. These include peer-to-peer file sharing, Ethernet and Token Ring drivers, Interapplication Communication (IAC), and Apple events messaging. Here's a quick rundown on these features and those issues you should know about to avoid problems. (For an overview of System 7.0, see "Seven's a Success," June BYTE.)

Ready Access

System 7.0 provides peer-to-peer-based file sharing, as does Sitka's Tops network software. File transfers occur directly between computers; you no longer need a file server as an intermediary. You can easily share a Mac's folders, hard disk drives, CD-ROMs, or a combination of all three.

Doing this doesn't require a knowledge of rocket science: You simply click on the objects you want to share and select Sharing from the Finder's File menu. File sharing has little impact on your Mac's performance unless someone copies files to or from a shared object, and degradation occurs only for the duration of the transfer.

A trio of Control Panels (cdevs) let you start or stop file sharing, arrange access rights to your Mac and shared objects, and monitor user access. The Sharing Setup cdev switches file sharing on or off. It also sets a network name and password for your Mac, and it determines if

other users can use the IAC function to link applications (more on this later). The Users & Groups cdev lets you arrange access privileges for your Mac and its shared objects. Finally, a File Sharing Monitor cdev displays the shared objects and a list of users who are currently accessing your Mac. You pick a name from this list and disconnect the selected user if the situation warrants it.

With file sharing active, your Mac resembles an AppleShare file server. Coworkers use the Chooser desk accessory to connect to your Mac, and shared objects appear as volumes in the Items window.

Providing shared file services this way was a smart design decision. From the network administrator's perspective, setting up file sharing is similar to setting up an AppleShare server, only easier. AppleShare users know right away how to access the shared objects. The biggest win, however, is that this design lets Macs running System 6.0.x access the shared information as well. File sharing shows Apple's thorough attention to implementation details that makes the software reliable and useful. For example, you can't eject a shared CD-ROM until you turn off file sharing.

File sharing improves the Mac's ability to exchange or distribute files, but you won't want to scrap your dedicated file servers. A dedicated server is a more reliable information container for critical data. You wouldn't want to be writing billing information to a shared folder on a software development machine, would you? You'll also want to use dedicated servers to tightly control or restrict access to information.

As a network administrator, you can choose not to install System 7.0's file-sharing option. Users then must pass information through the file servers, as they did using System 6.0.x. Applications can still exchange data directly because certain forms of IAC operate by

establishing independent client/server network sessions with your Mac. However, you can even disable this form of communication through the Sharing Setup cdev.

If you must use file sharing while handling sensitive information, consider carefully how you're going to prevent unauthorized access to the information. One wrong setting in the Users & Groups cdev makes a company's future plans or personnel files available to everyone.

If you use Apple's CD-ROM drive, you'll have to upgrade the driver to version 3.1 so it can operate with System

What you should know before upgrading your AppleTalk LAN to System 7.0





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HANDS ON / NETWORKS

7.0. Also, for now, you can't run System 7.0 on an AppleShare 2.0 file server. Thus, System 6.0.x client/server applications (e.g., E-mail or group schedulers) that run in the foreground on an AppleShare server will work, but they won't support System 7.0-specific features. Apple will correct this difficulty with the release of AppleShare 3.0 sometime later this year.

The Ethernet Route

If your livelihood depends on moving massive files about, you have probably stepped up from LocalTalk to Ethernet. Or your Mac network might be talking to a bevy of Unix workstations hanging off an Ethernet backbone. In either case, System 7.0 helps because it comes with an Ethernet driver.

ITEMS DISCUSSED

Carbon Copy Mac 2.0 \$99
Microcom, Inc.
55 Federal Rd.
Danbury, CT 06810
(203) 798-3800
fax: (203) 798-3917
Circle 1146 on Inquiry Card.

Designer\$895
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1804 North Shoreline Blvd.
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(415) 960-0765
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MacCon + IIE\$379
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Sunnyvale, CA 94089
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System 7.0
Personal Upgrade Kit..... \$99
Group Upgrade Kit.....\$349
Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010
Circle 1149 on Inquiry Card.

Timbuktu 4.0.....\$195
Farallon Computing, Inc.
2000 Powell St., Suite 600
Emeryville, CA 94608
(415) 596-9100
fax: (415) 596-9020
Circle 1150 on Inquiry Card.

I've used System 7.0 on my Mac IIci to communicate with BYTE's Unix systems over LocalTalk, using a Cayman Systems' GatorBox as a bridge, or directly, using Apple's EtherTalk NB board. But I've heard reports of compatibility problems with some Ethernet boards. Some of the trouble stems from System 7.0's use of the AppleTalk Phase 2 communication protocol, which expands the maximum number of nodes from 254 to 16 million. In these instances, the current fallback position is to use EtherTalk Phase 1 drivers until board vendors can upgrade their software.

One exception in this area is Asanté Technologies' Ethernet boards. I used its MacCon+IIE board, swapping it for the Apple EtherTalk NB board in the IIci, and it worked fine with Apple's Ethernet device driver. Asanté has licensed Apple's Ethernet driver and claims that its boards are register-compatible with Ethernet hardware from Apple. By using Apple's own driver, the MacCon+IIE continues to function, even after a major revision like System 7.0. Other vendors will sort out problems such as these over time, but for now, check with the board

vendor about possible driver or firmware upgrades before switching your Ethernet network to System 7.0.

Another casualty is MacTCP 1.0.1. Like AppleShare, it didn't work with System 7.0 as we went to press. Apple says that a free MacTCP upgrade should be out by the time you read this.

Talk to Me

IAC lets applications exchange live data by forwarding document updates or by exchanging commands and data with other active applications. While IAC is not a networking feature per se, it is designed to link applications running on different AppleTalk nodes.

The simplest form of IAC is the Publish/Subscribe mechanism, where one system publishes all or part of a document and relays changes to users who "subscribe" to that data. The conduit that these changes pass through is an edition file that the publisher's application creates. Subscribers complete the connection by using the Standard File dialog box that appears when they select Subscribe from the Edit menu. System 7.0's file-sharing capability helps make this

Publish/Subscribe feature possible.

I've experimented with Publish/Subscribe using beta versions of Claris's MacWrite Pro word processor and Resolve spreadsheet. I changed cells containing benchmark results in Resolve on the Mac IIci; several minutes later, these numbers changed in a MacWrite Pro document on a Mac Portable running System 7.0. The Publish/Subscribe feature lets you keep all network users up to date on a variety of information.

More interesting is System 7.0's ability to let applications converse using special messages called Apple events. A Mac statistics application might send data to a charting application and request a specific type of plot. The charting application would then send the finished plot back to the caller. Both applications can reside on the same computer or on different computers on the same network.

The most dramatic example of this that I've seen is Ray Dream's Designer, a solid-modeling-cum-ray-tracing application. If you are using Designer on a Mac LC, you can send a wireframe file to another Mac—perhaps a IIfx—running Designer. The IIfx performs the

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computationally expensive ray-tracing operation and ships the finished image back to your LC. It's easy to imagine hanging several IIfxs or 68040-based Macs on a network to act as process servers. These would handle heavy-duty jobs (e.g., large compiles, image processing, or spreadsheet computations).

Taking the Plunge

Once you've decided to upgrade, you (or your network administrator) won't have to carry a stack of floppy disks from machine to machine. The Group Upgrade Kit contains a CD-ROM with a network-savvy installation application. First, you upgrade your Mac to System 7.0 (don't forget to upgrade the CD-ROM driver). Next, you mount the CD-ROM, turn on file sharing, and set the CD-ROM as shared. You then walk to each Mac and use the Chooser to sign onto your Mac and select the CD-ROM. Finally, you double-click on the installation application, pick the software to install, and let System 7.0 do the rest. Installation times vary according to the network type and CPU. A Mac SE installation took 13 minutes on BYTE's LocalTalk network;

It's easy to hang several Macs on a network as process servers.

an installation on a IIfx was completed in 8 minutes. Your mileage may vary.

If you have to support a mix of Macs running both System 7.0 and System 6.0.x, you'll have to upgrade the latter to AppleTalk Phase II to communicate properly with System 7.0. You also must place a LaserWriter 7.0 driver on those Macs that are running System 6.0.x. The driver is compatible with both operating systems, eliminating what I call the "dueling drivers" syndrome. This occurs when users running different versions of

the printer driver generate alternating print jobs. Each user must sit through a laser-printer restart to load the proper driver before the job can start.

As a network administrator, you're bound to field questions about new features or problems. Fortunately, you can stay at your Mac and offer help. Microcom's Carbon Copy Mac 2.0 and Farallon's Timbuktu 4.0 remote-control programs are System 7.0 compatible. Both let you view and control a networked Mac's screen. You can observe users' problems or guide them through new features. Both also function between System 7.0 and System 6.0.x Macs. Every network administrator should own one of these packages, if only to maximize efforts and minimize headaches. ■

Tom Thompson is a BYTE senior technical editor at large. He has a B.S.E.E. from Memphis State University and manages BYTE's AppleTalk network. He can be reached on BIX as "tom_thompson."

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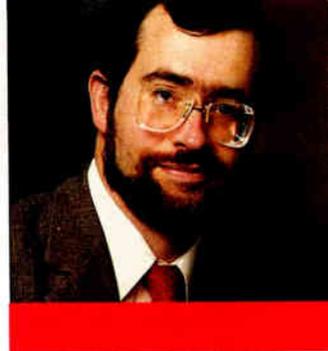
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GETTYING UP TO SPEED

In the old days of dial-up computing, there were teletypewriters. They worked at 110 bps. And all was right with the universe.

Then someone invented terminals that worked faster: 300 bps. Why, some people said you could hurt your eyes trying to read text at such a blistering speed. The next thing you knew, someone came up with a device that was just barely legal, an acoustic coupler. You'd hook up a terminal to one and dial a number, and a computer would whistle at you. When you put the phone's handset into this coupler, you could type at 300 bps, as if you were in the same room with the computer. Amazing.

Of course, the computer end needed a fancy device called a modem, which you rented from the phone company at \$200 per month or so. The coupler was legal only because it didn't have any electrical connection to the phone system. Everyone knew that if you hooked up a gadget directly to the phone system, you could be arrested for interfering with the phone company.

Things Have Changed a Bit

We've gotten a few more options since then: 300 bps paused briefly at 600 bps (anyone else remember the PMMI S-100 modem board?), and it went all the way to 1200 bps for quite a while. Then came 2400 bps for most of the world. Here's a trivia question for extra credit: What's the weirdest speed *still* available on Unix systems? (You'll find the answer at the end of the column.)

A company called Telebit came out with a proprietary system called Packetized Ensemble Protocol, which allowed bidirectional, error-corrected dial-up operation at a maximum effective rate of around 18,000 bps. Proprietary systems generally don't work well in the global realm of telecommunications, but Telebit did two things right in its marketing plan. First, it embedded the Unix UUCP

"g" protocol into the modem's firmware, so that the modem itself could effectively run UUCP without adding to the computer's CPU overhead. Second, the company offered its TrailBlazer modems to any registered site on Usenet for half price.

When you're shipping tens of megabytes of data per month, anything that will cut down your phone bill by a factor of 5 to 10 is worth taking a look at. Once some larger sites got TrailBlazer modems to exchange data with each other, everyone whose computer talked to theirs wanted one, and the effect snowballed. While certainly not Ethernet speed at just over 1 kilobyte per second, Telebit's modems deliver enough reliable performance to make them a de facto standard at Unix sites. A new model, the T2500, supports V.32 9600-bps transfers as well as the lower speeds.

A Unix Daemon

Marx Brothers fans will recall Chico in *A Day at the Races* calling, "Getty ice cream!" I have had to scream at the Unix getty daemon ever since I got my Telebit modem because of the interaction between the intelligent modem, the gosh-darn getty (for "get tty," where "tty" is short for teletypewriter), and the silly serial port.

In the old days, ports were hard-wired to one speed, so to change data transfer rates, you had to open up the computer and move a jumper. We dreamed of software-programmable serial chips. Now that they're here, there are problems.

The getty daemon attempts to connect with a terminal, sets the data transfer rate and other line parameters, and invokes the login command if everything goes well.

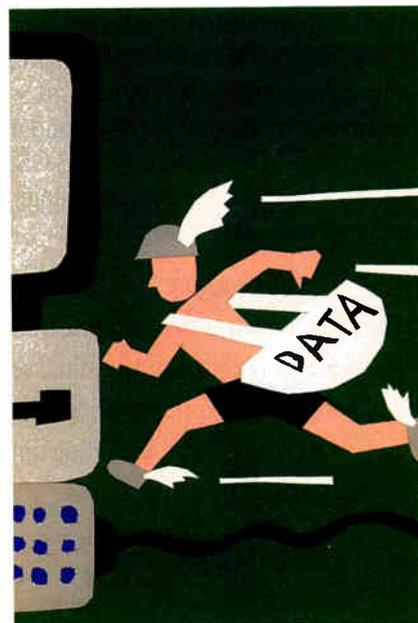
Theoretically, getty expects one of two types of operation. The first, and simplest, is a fixed data transfer rate, such as when you plug in a hard-wired terminal at 9600 bps. You set up the

/etc/inittab file to say something like this:

```
SE1b:23:respawn:/etc/getty
        tty1b m
```

and that's all. This continuously respawns (restarts) the getty daemon on your /dev/tty1b port, assuming an initial line speed of m, which can be looked up in the file /etc/gettydefs. On my system, m corresponds to 9600 (and, yes, you can put "9600" into the inittab file instead of m, but you need an entry in gettydefs to match). If the line beginning with m in gettydefs also ends with

**Unix telecommunications
have come a long way since
the days of teletypewriters
... or have they?**



an m, getty will always keep the line at 9600 bps.

Changing the Rate

This relates to getty's rudimentary line-speed changing ability. When a break "character" (actually, holding the line low for 200 milliseconds) is received while getty is reading the input port, getty assumes that the person on the other end is signaling that the line speed is incorrect. In that case, getty will look at the end of the corresponding input line to see what data transfer rate to try next. This is confusing, so I'll give an example. The inittab line reads as follows:

```
SE1c:23:respawn:/etc/getty
tty1c 2
```

That leads getty to the entry in gettydefs beginning with the number 2, which looks something like this:

```
2 # B1200 HUPCL OPOST ECHOE #
B1200 SANE IXANY #\r\nlogin: # 3
```

This sets the line speed on port /dev/tty1c to 1200 bps (on most machines).

If a break is received, getty examines the 3 at the end of this entry, which looks almost the same except that it sets the line to 2400 bps. At the end of that entry is one that tries 300 bps, which then brings us back to 1200. Thus, by continually sending breaks, you cycle getty (and the port) from 2400 to 1200 to 300 and back to 2400 bps.

Problems

The whole operation of cycling through data transfer rates is necessary because multispeed modems are capable of answering at any of these speeds. The problem arises because Telebit modems are very configurable, with over 100 registers that can be set. The modem itself can detect the incoming data transfer rate. However, it looks for the character a rather than a break. So it is possible that getty and Telebit can conflict with each other while each one searches for the correct data transfer rate.

Fortunately, there is a Telebit option to lock the interface at any desired speed (19,200 bps is generally used). In this way, getty can also be set to that speed, and data will flow between the modems

at any speed the modems find palatable. Unfortunately, the problem doesn't stop there, because calls coming in at low speeds will sometimes find themselves talking to the modem at 2400 bps and to the computer at another data transfer rate altogether. Judging by some of the traffic on Usenet, it's not only BYTE columnists who have this problem.

Another problem with the classic version of getty is that it must be shut down for you to be able to dial out on the port. One widely distributed solution for this problem is uugetty, a serial-port monitor designed for working with modems. The uugetty replacement works with the UUCP programs to shut off the getty-type port monitoring for incoming signals when there is an outgoing call. It also creates a lock to prevent more than one UUCP activity at the same time. Unfortunately, uugetty's problems of configuration and the data transfer rate switching are the same as with getty. A typical uugetty entry in the inittab looks like this:

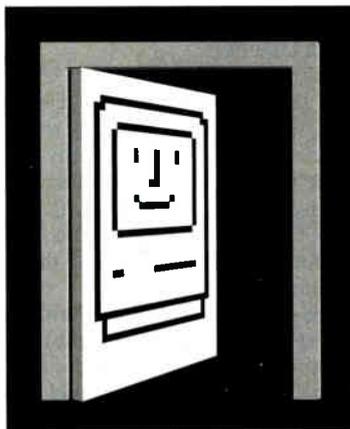
```
SE1d:23:respawn:/usr/lib/
uucp/uugetty -t 60 tty1C TB19200
```

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Notice that I have used a -t option to time-out the line after 60 seconds (in this example) of inactivity; this prevents unsuccessful log-ins from holding onto the modem. I also used a special gettydefs entry for my Telebit modem fixed at 19,200 (between the modem and the port):

```
TB19200# B19200 HUPCL OPOST
ONLCR TAB3 BRKINT IGPAR IXON
IXANY ISTRIP ECHO ECHOE ECHOK
ICANON ISIG CS8 CREAD # B19200
HUPCL OPOST ONLCR TAB3 BRKINT
IGPAR IXON IXANY ISTRIP ECHO
ECHOE ECHOK ICANON ISIG CS8
CREAD #\r\nTelebit login:
#TB19200
```

Many modern versions of getty have the bidirectional and locking facilities of ugetty built in. But neither one has kept up with progress at the hardware level.

As usual, where corporate America fails, individual initiative may provide the answer. I'm about to test the "getty kit" released to Usenet by Paul Sutcliffe Jr. (devon!paul) a while back. (You can also get it from BIX or Demolink.) It not only can detect data transfer rate changes by reading a carriage return (a bit more intuitive than the break), but also can automatically read the data transfer rate from Telebit status messages. It has debugging and logging. It can even be programmed with an expect-send sequence, as you've come to know and love in UUCP.

So why isn't the "getty kit" installed already? Well, for one thing, this is one time that I want to read *all* the documentation first (getty is a rather important program, and I'd hate to mess something up). And second, what would I have to write about if everything worked perfectly all the time?

Epilogue

The days of getty are numbered. Unix System V release 4.0 has replaced getty and ugetty with the single program ttymon and gettydefs with ttydefs. SVR4 has an entire multilayered port management system. Without SVR4's system administration menu, you need an advanced degree to configure all this stuff. But progress isn't entirely fault-ridden; the new port management system is more configurable, produces an amazing variety of reports, and might even work.

Trivia answer: Well before modern-day letter-quality output devices like the daisy-wheel printer (whoops, sorry, I

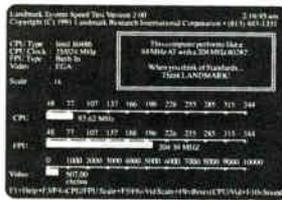
mean laser printer), what did people do for fancy troff output? It seems that someone came up with a way, involving solenoids, code translation tables, and other kludges, to hook up an IBM Selectric typewriter to a computer. Based on the maximum speed the Selectric could run without turning its insides into a molten mass of pot metal, the interface was rated at 134.5 bps. Check your /etc/gettydefs file for evidence of this archaic nonsense. ■

David Fiedler has been a consultant and writer on Unix topics for over a decade and has started several Unix publications. His company, InfoPro Systems, produces corporate image and marketing videos for high-tech firms. You can reach him on BIX as "fiedler."

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It was on an early April morning when I found myself crowded into a small conference room to watch a demonstration on JMP, SAS's new statistical graphics package made specifically for the Macintosh. Since I had no idea what a statistical graphics package was capable of doing, I was prepared to watch the demonstration, take notes on meaningless jargon, and then leave knowing little more about how to use a statistical graphics package than I had before.

Indeed, when the demonstration began, my worst fears were realized when I heard such statements as, "With the model leverage plot, there is the model analysis variants table, and, with each effect, there is an analysis of each effect," and "The Y's by Y's platform produces an outlier plot showing the Mahalanobis distance of each point from the multivariate centroid." To make matters worse, several members of the group attending the demonstration would oh and ah over these statements and ask questions that rivaled them in sheer incomprehensibility.

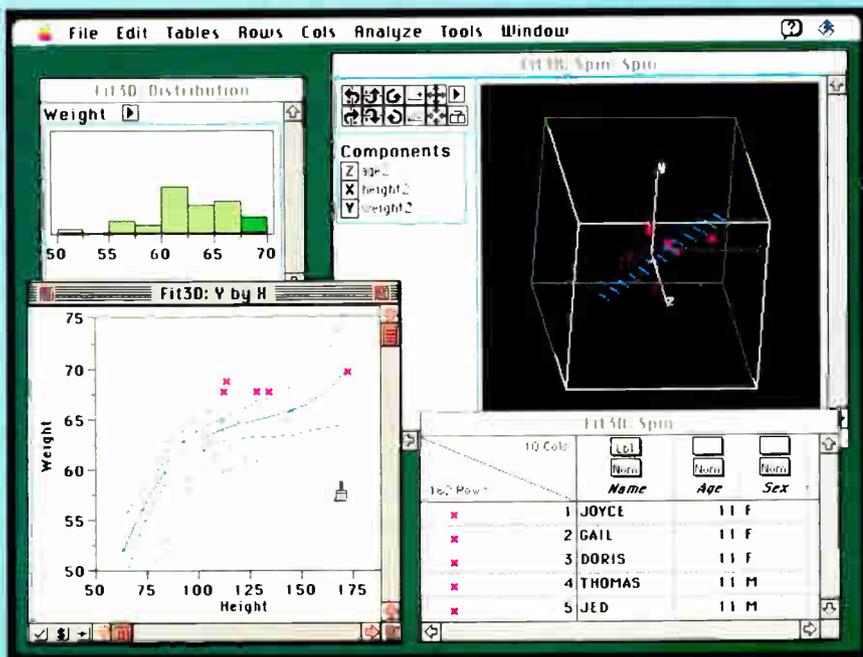
As the demonstration progressed, however, I became fascinated with the number of things JMP offered that, judging from the reactions of the more knowledgeable members of the group, were absent in other statistical graphics packages. Even more amazing was the fact that I found myself understanding the function of nearly every feature in JMP, even though I had no idea what the statistical jargon associated with each function meant.

And that, in a nutshell, is the beauty of JMP.

from the University of New Mexico
CIRT Newsletter, June 1990

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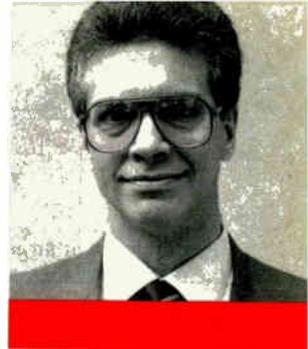
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LOUIS J.
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CLASS CONFLICT

Windows 3.0 is hot, and so is object-oriented programming in C++. What could be hotter than the combination of developing Windows applications in C++? Use C++ to organize and encapsulate the complexity of Windows. Get access to the power of Windows without the pain. It sounds great in theory, but in practice...

The problem is that Windows is really complicated. Its application programming interface (API) includes more than 500 functions and defines more than 200 messages that a window may need to respond to. Thus, it's not easy to just casually whip up a hierarchy of C++ classes to simplify Windows development. Still, several software tool developers are marketing or are about to market a library of C++ classes for developing Windows applications.

At this time, none of the C++ class libraries I have seen for Windows development are fully satisfactory. This isn't surprising. The market for such products is only now emerging.

Part of the problem lies in the fundamental mismatch between C++ and Windows: Their programming models are incompatible. The natural C++ implementation of Windows functionality is, in fact, effectively impossible.

The Message Dilemma

Let me explain that dire pronouncement. Every window in Windows belongs to a class. The behavior of members of the class is defined by the window procedure associated with the class. Simplifying it slightly, when Windows is running, it sends messages to a window by calling that window's class procedure, passing it four parameters.

The basic task of a window's class procedure in C is to identify the message it has been sent, to process the message, and to return control to its caller. Strictly speaking, all window class procedures

must be able to process all possible Windows messages. As a practical matter, a window class will provide customized processing for a limited subset of all possible messages and will pass the remaining messages to a predefined Windows function, `DefWndProc`, which provides default processing for whatever message it receives.

The natural approach when creating a C++ class to encapsulate this behavior is to define a function (method) corresponding to each message that the class must understand. Thus, a class derived from that class would redefine only the functions corresponding to the messages destined to get special processing.

Unfortunately, this approach is ruled

**Windows and C++
should be a natural match.
Why aren't they?**



out immediately by the fact that there are 65,536 possible 16-bit message values, and there would have to be 65,536 distinct functions in the base class. If the definition of each function required as few as 50 characters, the class definition alone would require 32 megabytes. It would exceed the capability of any C++ compiler I am aware of and would, in any case, take unconscionably long to compile. Thus, the natural implementation is impossible as a practical matter.

Having ruled out this solution, one possibility is to simply reproduce the underlying Windows approach by deriving C++ classes that can, when necessary, override an ancestral `DispatchMessage` function. This is the approach taken by Genesis Development's Tier C++ class library. As Genesis puts it, "You receive unaltered MS_Windows messages in the same way you would see them in a C windows application." It is clean, but it essentially leaves the programmer back at the underlying Windows level. The programmer has to know which messages to process and which not to process, and must become familiar with the specific meanings of the parameters associated with the messages to be processed.

I don't find such an approach unconvincing, but I've spent six years developing Windows applications in C, and I have a firm grasp of what messages are flying back and forth and an understanding of what they signify. Still, I ask myself, if all that's been done is to barely disguise Windows window class procedures, has anything significant been accomplished?

A Compromise Solution

An alternative approach, which is more or less the one taken by both ImageSoft's `CommonView` and CNS's `C++/Views`, is to compromise between these two extremes. This middle ground involves defining special functions associated with the messages most commonly requiring window-specific processing and giving

the programmer an escape hatch to get at the underlying messages. That way, you can provide customized methods for those messages that do not have their own specific methods in the base class.

Implementations of this approach perform some preprocessing (e.g., of message parameters) before calling the function associated with the message, and they may also do some cleaning up after the function returns. The net result is that they hide some of Windows' complexity and make the message function more abstract and easier to understand.

An advantage of this approach is that it hides details of the underlying message traffic and can present a higher level of abstraction to the programmer, making the system easier to learn. Also, if the abstractions are well chosen, Windows, OS/2 Presentation Manager, Motif, Open Look, Macintosh, and other GUIs can be made to look alike. Thus, theoretically, you could port a C++ program written for one GUI to another one by swapping in a new implementation of the C++ class library and recompiling.

In practice, it's not so easy. Windows predefines over 200 system messages. The rest of the possible message values are reserved either for additional system messages or for programmer-definable messages. Of the system messages, some 30 or 40 merit special treatment in individual functions. That leaves over 100 messages that would have to be handled by a programmer-coded dispatcher at the underlying Windows message level.

As long as the programmer sticks to the predigested messages, application development is simplified. When the predefined functions do not meet the developer's needs, however, there is a double problem. First, the developer must learn enough about the Windows API to see if the underlying message traffic contains information that can meet the needs. Second, the developer must learn how to drop down to the message level and write the appropriate code.

Unfortunately, in the implementations of both CommonView and C++/Views, this is nowhere near as straightforward as it sounds. Neither one makes it easy to access the underlying messages. This is intentional. Both programs try to provide an abstract interface at the C++ level that can serve for multiple GUI environments. Code that accesses the GUI-specific message flow will lose portability.

In effect, both C++/Views and CommonView set up formidable obstacles to prevent developers from gaining easy access to the full range of Windows' capabilities. As a theoretician, I understand

their motivation. As a practical developer, I resent it mightily. If I am implementing a Windows application, I want all of Windows' power available. If I decide to produce code that is not portable to other GUIs, I don't want to have to fight with my tools in order to do so.

It seems clear in view of the foregoing that about the best that can be expected from a set of C++ classes for Windows in this connection is an implementation that provides explicit support for processing the most common messages and requires detailed knowledge of Windows to process the remaining messages. That still leaves a problem: How does the programmer get at the remaining messages?

Ordinarily, in a C++ class definition there is no great difference between a member function that overrides an inherited function and a member function that has no earlier ancestors. Thus, in a C++ class library for Windows, there should be no significant difference between the definition of a function that overrides an inherited message-handling function and a function for handling a message that isn't handled by an ancestor class.

I want to be able to write something like the following because it is the most natural from the standpoint of C++ programming:

```
class clMyWindow : public clWindow
{
// Override ancestral processing
// of message WM_XXXX
WORD WM_XXXX_Method();
// Handle message WM_ABCD not
// handled by ancestors
WORD WM_abcd_Method();
};
```

But this is impossible as it stands, because there is nothing to link WM_abcd_Method with the Windows message WM_ABCD, and it has already been shown that predefining functions for all message values is impracticable.

The next best thing would be to devise (magically, because I don't know how else to do it) a preprocessor macro or a modification to C++ that would allow something like the following:

```
class clMyWindow : public clWindow
{
// Handle message WM_ABCD of
// category WINDOWS_MESSAGE
HANDLE_MESSAGE( WINDOWS_MESSAGE,
WM_ABCD, WM_abcd_Method() );
};
```

The advantage of a magical incantation like the above is that it gathers all the

information together in one place rather than requiring it to be scattered among routines that are not obviously related to one another.

It is clear enough what the code ultimately generated by this magic has to do. For each message category (e.g., WINDOWS_MESSAGE in the above), set up a static lookup table containing message/function correspondences. When a message of category WINDOWS_MESSAGE arrives at the C++ object, search for the message value in the lookup table and execute the corresponding (possibly virtual) function. If the message value is not in the lookup table, pass it up to the immediate ancestor of the class and repeat the process.

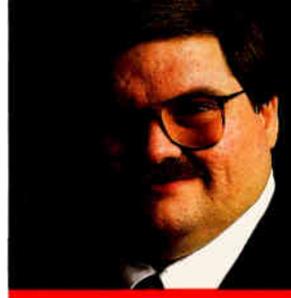
This programming construct could be used in two more situations in almost every Windows application: processing menu selections and processing data-entry field numbers in dialog box windows. In fact, a construct like this is even more valuable in these two contexts because there is no such thing as "the most commonly processed menu item numbers" or "the most commonly processed data-entry field numbers." Thus, there is no way to predefine functions corresponding to menu selections or data-entry fields as it is possible to predefine functions corresponding to Windows messages.

As a matter of fact, C++/Views uses an approximation of this technique for menu processing, and both C++/Views and CommonView use it for data-entry field processing. These class libraries do not, however, magically create the message/function lookup table statically at compile time, as I have suggested. Both of them require the programmer to build the required table indirectly at execution time, so coding is required in addition to simply defining the appropriate message-processing functions. I find the process rather awkward.

This difficulty is not the only one that stands in the way of developing a C++ class library suitable for developing Windows applications, but it's deeply pervasive. I suspect that all Windows C++ class libraries will remain vaguely (or not so vaguely) unsatisfactory until a concise solution appears. ■

Louis J. Cutrona Jr. is president of Xian Corp., which provides software tools and consulting services for Windows and OS/2 Presentation Manager. You can reach him on BIX as "lcutrona."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.



DON CRABB

MAC REALITIES

Virtual reality is real. Although that sounds like an oxymoron, it's the case if you have a Mac that has Virtus WalkThrough. What is virtual reality? I can best describe it by showing how this program handles it. In WalkThrough's case, the whole point is to view the design ideas of another person without resorting to a physical model. It lets you climb over, get inside, and look underneath any object, building, vehicle, appliance, or whatever that can be modeled in three dimensions on a computer screen. It's best used by architects, engineers, and designers who are conceptualizing a new building and want to walk through the plan before committing to the construction of an expensive physical model.

But can't you do that with any CAD program? No, you can't. CAD software excels at the precise design of actual objects in two- and three-dimensional space. Want a wall that's 11½ feet long? No problem. With Claris CAD or AutoCAD, you can do that easily. Want to walk through a 3-D model that you just created and look around for further design ideas? No way.

Although other programs let you take a fixed-path walk-through of a design, they don't let you specify the exact path you want to take while modifying it on the fly. That gives WalkThrough a real advantage in this game of virtual realities. Point and click is all you need to do to walk through a model.

WalkThrough functions as a kind of CAD appetizer, if you will. The time to use it is in the thinking/planning/doodling/conceptualizing stage of the design process—not when you're cranking out building dimensions for a civil engineer to check for load and bearing stresses. As such, WalkThrough is not a replacement for a 3-D CAD program. Instead, it makes the CAD application more efficient by helping you get a clear design in mind before committing it to a CAD

model. To help in that process, WalkThrough can export any of its files in the DXF format common to 3-D solids modeling. If you need other formats, you can use a graphics format translator (Claris sells one).

WalkThrough's own files are amazingly small. The sample file you see displayed in the screen shot is only 14 kilobytes in size (of which only slightly more than 7000 bytes are actually in use). Compare that to an 8-bit PIC animation file (e.g., one created by MacroMind Director) that animates the same sequence, where you'd be using over 100 megabytes, maybe as high as 200 MB. WalkThrough performs its apparent file size reduction magic by not actually storing an animation—the file contains only the information WalkThrough needs to draw images that let you walk through your design.

This means that WalkThrough designs aren't photo-realistic. You can easily see jaggies and similar display artifacts, but that's not the point of the product. The point is speed and performance. To walk through a drawing takes seconds, not the minutes (or hours!) it might take to walk through a 24-bit photo-realistic PICT file. Still, WalkThrough supports 24-bit color, if you need it. It can also handle translucent surfaces (e.g., windows or water).

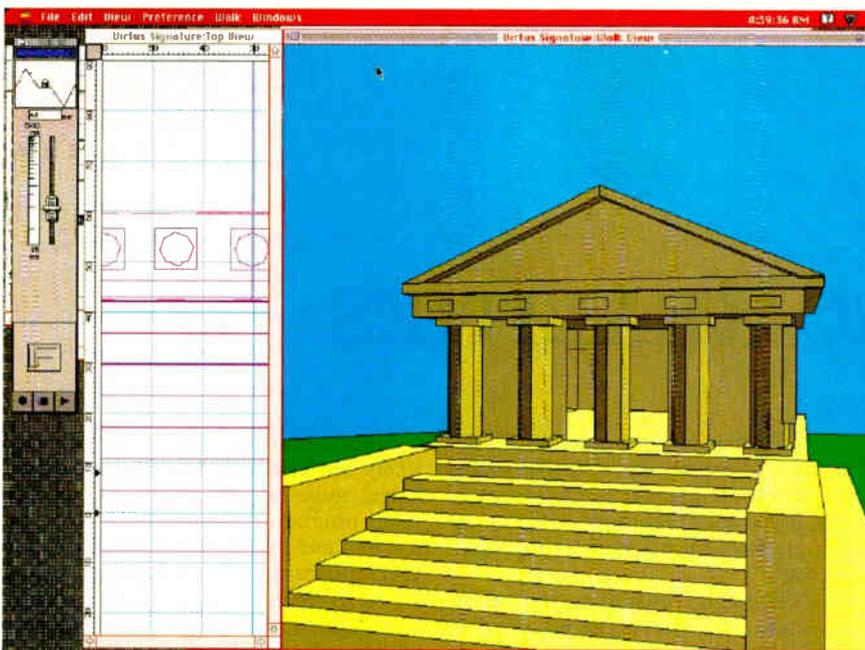
The program supports Design View (2-D) and Walk View (3-D) modes. In the Design View mode, you get good planar and 2-D solids tools for creating your designs. Walk View lets you control the 3-D color display and walk-through of your design.

Although this view modality might seem to get in the way of designing, it doesn't, since you can switch between both views dynamically. If you have a large monitor (a must for design work, anyway), you'll have plenty of room to display the Tool palette, Design View, and Walk View.

Since users of WalkThrough will most likely be those who have already established some rapport with a 2-D or 3-D CAD program, Virtus wisely chose to use tool and usage metaphors from such CAD programs. The Tool palette makes it easy to create layers in your design and to manipulate those layers. Even fiddling with the planar primitives and geometric solids is about as easy as it gets. Although I'm no design pro, I was able to get the hang of WalkThrough just by fooling around with the sample models. I resorted to the excellent manual on only

**Virtual reality,
tracking files,
and making your setup
compatible
with System 7.0**





Virtus WalkThrough lets you visualize an object before designing it in detail.

a few niggling points.

WalkThrough is a unique bit of software that uses the Mac's mature GUI to great advantage. I hope that Virtus takes advantage of System 7.0 features in its next release. Imagine how cool it would be to have your WalkThrough document hot-linked to your 3-D solids modeler and to your word processor, so that you could fine-tune a design and then prepare a report for the client.

Software of the Month: PipeLine

If you've been using System 7.0 since May 13, you're probably just now getting around to using Publish/Subscribe, the Interapplication Communication hot-link feature. The reason, of course, is that software publishers are just now getting their System 7.0-savvy applications to market.

If you're using Publish/Subscribe, you could very well be asking yourself, how can I keep all my published and subscribed files straight? Good question, since the System lacks any special feature to give you a road map. This is especially important since you can have published files subscribed to by multiple other files, while other subscribed files can be subscribers themselves. This can result in a glorious daisy chain that will bring your Mac not to ecstasy, but to a screeching halt (I know, I've tried it).

Enter PipeLine, Claris's answer to this file-tracking nightmare. PipeLine creates charts that look an awful lot like

the simplest network charts that Mac-Project II can draw (the beauty of shared code modules!), each showing all your linked documents with all their various and sundry interdependencies. Come to think of it, that's not at all unlike what a network project management chart does. But only PipeLine does it automatically for all your published and subscribed files.

PipeLine, which will be available from Claris sometime early next year, shows each document's location, its size, and its type. Also, it lets you launch any part of any document simply by double-clicking on the proper icon in the PipeLine window. PipeLine then runs the necessary applications for updating the entire composite document and leaves the creating applications launched on your screen so you can edit whatever parts you need to. Very slick, indeed.

I want PipeLine now, and so will you if you start using the Publish/Subscribe feature heavily.

Tip of the Month

If you're like me, you've modified your Mac to within an inch of its life. Add-on accelerator boards, fast 24-bit graphics boards, add-on SCSI speedup boards, and more of this ilk, plus lots of INITs and cdevs to make the add-on hardware really cook and give us the Mac exactly how we want it. Sadly, if you've run Apple's Compatibility Checker HyperCard stack from the System 7.0 Group or

Personal Upgrade Kits, you got a rude surprise: Many INITs and cdevs don't work yet under System 7.0—and some may never work.

Happily, there are some workarounds for some of these "problem" extensions. Many of the extensions that misbehave under System 7.0 are just fine from a 32-bit-clean standpoint (usually the biggest drawback to System 7.0 compatibility). What trips them up is System 7.0's new System Folder organization, with its new subfolders for Control Panels, Extensions, Apple Menu Items, and the like. Many cdevs, for example, won't work if they are placed into the Control Panels subfolder. The same is true for many INITs when they are placed in the Extensions subfolder. These happen automatically when you drag the things into the System Folder. The solution is to place these offending files at the "root level" of the System Folder, where they work fine.

Then it's time to use another feature of System 7.0 software, aliasing. Create aliases for the INITs and cdevs in your Control Panels and Extensions subfolders. This little trick often saves the day by letting the extension find what it needs to find, while not upsetting System 7.0's predilection for putting stuff where it thinks it has to go. ■

Don Crabb is the director of laboratories and a senior lecturer for the computer science department at the University of Chicago. He is also a contributing editor for BYTE. He can be contacted on BIX as "decrabb."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

ITEMS DISCUSSED

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Virtus WalkThrough 1.03\$895
 Virtus Corp.
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 Cary, NC 27511
 (919) 467-9700
 fax: (919) 460-4530
Circle 1152 on Inquiry Card.

ASK BYTE

DAT's DAT

Recently, I installed two Tecmar DataVault digital tape drives to back up my company's LAN file servers. Since the type of tape required was not specified, I bought audio-grade digital audiotape cassettes. I've now heard there are data-grade DAT cassettes that are more reliable when used for backups. So far, we haven't had any problems, but are we inviting disaster?



Bob Martinez
New York, NY

To get the best advice, I went straight to Tecmar's technical-support staff. They said that with continued use of an audio-grade cassette, you could encounter read and write errors. They have tested and recommend the following data-grade DAT cassettes: the Tecmar 811788, Maxell HS-4/60, JVC R-120, TDK R-120, Denon R-120DT, Sony DT-120, and Axia DA-120.—S. W.

Viruses or Viri?

I need to learn about computer viruses. Any information you can give me would be greatly appreciated.
Janessa Overton
Blue Ridge, GA

We reviewed several antivirus software packages in "R for Safer Data" in the August BYTE.

For a good technical overview of how a virus functions and how to prevent infections, I recommend Computer Viruses: A High Tech Disease by Ralf Burger (Abacus Software, 1988, ISBN 1-55755-043-3).

Another source of information is the National Computer Security Association (4401-A Connecticut Ave. NW, Suite 309, Washington, DC 20008, (202) 364-8252; fax (202) 364-1320; BBS (202) 364-1304 or -1305). Members of the association receive a bimonthly newsletter and access to the BBS. They can also purchase books that describe computer viruses, security procedures, and coping with data disasters.—S. W.

Keycodes and Security

I am looking for a specific device that connects a standard IBM AT keyboard and the keyboard port. It must translate certain keycodes into nothing (i.e., ignore them), a different code, or a sequence of codes. A desirable extra would be the ability to scan security badges. The device must respond to four classes of badges, producing different editing actions at each level.

I need the ability to reprogram the unit (I have EPROM programming equipment). I remember reading about such a device in BYTE, but I can't track it down.

Peter Hillary
Dublin, Ireland

I wasn't able to find such a gadget anywhere. However, I think there's an easy way to solve your problem. Numer-

ous magnetic card readers will connect to the keyboard as you describe. Normally, these are used for reading the magnetic stripes on the back of credit cards (as in point-of-sale terminals). You could easily use one of these for your security badge scanner. Simply have your security badges magnetically striped, or, even better, have your users take a personal credit card and use that for security access. People aren't likely to leave a personal credit card ly-

ing around. Your system software can read the back of the card, look it up in a database, and determine the user's access level.

Card-scanner manufacturers often advertise in The Buyer's Mart (located in the back of each BYTE) under "Bar Code." You can also contact Vertex Industries (23 Carol St., P.O. Box 996, Clifton, NJ 07014, (201) 777-3500; fax (201) 472-0814) or American Magnetics (740 Watson Center Rd., Carson, CA 90745, (213) 775-8651; fax (213) 834-0685).

The code translation is pretty easy to do in software. Keyboard interrupts are fielded by interrupt 9 hexadecimal in an AT. If you install your own device driver, you can trap the keystrokes, come up with replacements, and funnel them back into the keystroke buffer. Another method is the keyboard intercept (interrupt 15h, function 4Fh). Each time you press a key, the BIOS calls this routine to handle keyboard remapping. By default it does nothing, but you can have it do anything you like.

—H. E.

A PC Doing a Mac's Job

I am a systems engineer for a large data communications company. I spend much of my time doing systems drawings of large networks and systems overviews. For several years, I've used a company-owned Mac SE/30 with a Hewlett-Packard LaserJet IIP printer.

I recently purchased a 386SX-20 computer, fully loaded, to do my design work on. But I have been unable to find a drawing package for the IBM environment that will put out anywhere near the quality of product, or be as easy to use, as MacDraw on the Mac. I have tried several packages, including XVT Draw, GEM Draw, and Applause. I have also tried several CAD programs, but all those seemed to be more than I need. Any information would be appreciated.

Donald J. Durden
Yorba Linda, CA

MacDraw is one of those unique packages—incredibly simple, yet very powerful. You're right; there's nothing else quite like it.

One step up in object-drawing software is the class normally used for generating PostScript images. On the Mac, that would include Adobe Illustrator and Aldus FreeHand. Your PC (with Windows 3.0) will let you run Illustrator and CorelDraw. Of the two, I prefer Illustrator's working style, but the PC version of Illustrator is hopelessly behind the times. You may find CorelDraw to your liking. Many people do.

continued

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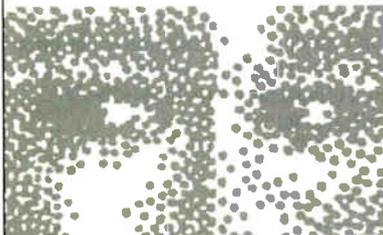
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ASK BYTE

Before you give up on CAD software, consider some of the lighter packages. Generic CADD may do the trick for you. If you prefer the pull-down Mac-like interface of Windows, you might check out Ashlar's Vellum. This is a serious CAD package with an easy interface that's downright fun to use. It does require a math coprocessor, so I hope your fully loaded 386SX has a 387SX in it.

—H. E.

Not Much of an Upgrade

Ever since installing a hard disk drive in my XT clone and switching from WordStar 3.3 to WordStar 6.0, I've been unable to use one of my favorite software packages: Hammerlab's Lettrix. With Lettrix loaded, instead of the printer's carriage doing its usual reset before printing, my Panasonic KX-P1080i adds garbage to the first line of what it prints. I'm assuming it's WordStar 6.0 that Lettrix is incompatible with. However, WordStar's technical-support service has been unable to help me solve the problem. Hammerlab says that it hasn't updated Lettrix since 1986 and does not plan to do so.

Is there anything I can do to make Lettrix function with WordStar 6.0? Will another product function well it? I'd like something that can do some of the more exotic things Lettrix does (e.g., Greek, Hebrew, and Cyrillic alphabets), but I'm mostly concerned with the capability of printing things like "high and wide" letters and footnotes.

Christopher Kennedy
Villa Alemana, Chile

Bit-map font-generation software like Lettrix has always been a popular add-on for word processors, and it's a shame when you have to give up an old favorite. In this case, however, you may have to.

I called WordStar International about your problem, and it had one suggestion. Sometimes a printer has more than one emulation. It's possible that Lettrix is running the printer in one emulation, and WordStar 6.0 is running in the other. See if you can tell WordStar to use another emulation.

If that fails, you have no choice but to scrap Lettrix and try something else. Try LaserTwin and SuperFonts from Editor's Choice Software ((206) 243-7496). LaserTwin gives your Panasonic printer LaserJet emulation, and SuperFonts gives you a font capability similar to that of Lettrix. To get the Greek and Hebrew fonts, you may need the company's TurboFonts package.—H. E.

Sticky Labels Are a Pain

We are a small nonprofit educational corporation with a mailing problem. Printing labels on our Epson dot-matrix printer, peeling them off, and applying them to envelopes is a cumbersome, time-consuming chore. Our mailing volume, about 2500 pieces two or three times a year, doesn't justify buying a \$5000 envelope printer. Are you aware of any low-cost printing devices for addressing size 10 envelopes?

Robert W. Pomeroy
Cornish, ME

ASK BYTE

The obvious alternative is an inexpensive laser printer, but they have two problems: The paper trays won't hold huge stacks of envelopes, and most laser printers don't feed envelopes reliably. I've owned several laser printers that seemed to take great pride in shredding anything remotely resembling an envelope.

Two printers devoted to addressing envelopes and postcards have recently been introduced. The Address-Writer is a \$595 dot-matrix printer that can hold up to 100 envelopes or 250 postcards and can handle a variety of sizes. There are both Mac and PC versions. It is available from CoStar (22 Bridge St., Greenwich, CT 06830, (800) 426-7827; fax (800) 388-4888).

Address Express is an ink-jet printer for labels, envelopes, and postcards. It costs \$1195. It is designed for use with PC or Mac networks. A wide variety of Hewlett-Packard-compatible soft fonts or Adobe and TrueType fonts are supported. Address Express is available from Tidemark (39899 Balantine Dr., Suite 320, Newark, CA 94560, (415) 490-5583; fax (415) 490-4047).

The least expensive way to address your mailings is to use a mailing service with the Cheshire labels process. Basically, you print your mailing list on wide pin-feed computer paper, four or five addresses across. The mailing service uses a special machine that cuts the paper into labels, applies glue, and sticks them to your envelopes. The whole process is cheap (a few cents per label), and you can use your trusty old wide-carriage Epson printer. The mailing service you choose can fill you in on the details.

Another possibility is sending your mailing list to a service in electronic format. Many services have one of those fancy envelope printers, or they can format and print your list for Cheshire labeling. Either way, for the volumes you're concerned with, a mailing service may be the way to go.—H. E.

Sounding Off

Could you tell me where I can find a sound board to install in my computer?

Pedro Nuno Santos
Mafra, Portugal

Two of the most widely used sound boards are Brown-Wagh's Sound Blaster Pro and the Ad Lib Gold. Either board will let you make some sound impressions. Contact information for these two companies is listed below.

Brown-Wagh Publishing
130-D Knowles Dr.
Los Gatos, CA 95030
(800) 451-0900
(408) 378-3838
fax: (408) 378-3577

Ad Lib, Inc.
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—S. W. ■

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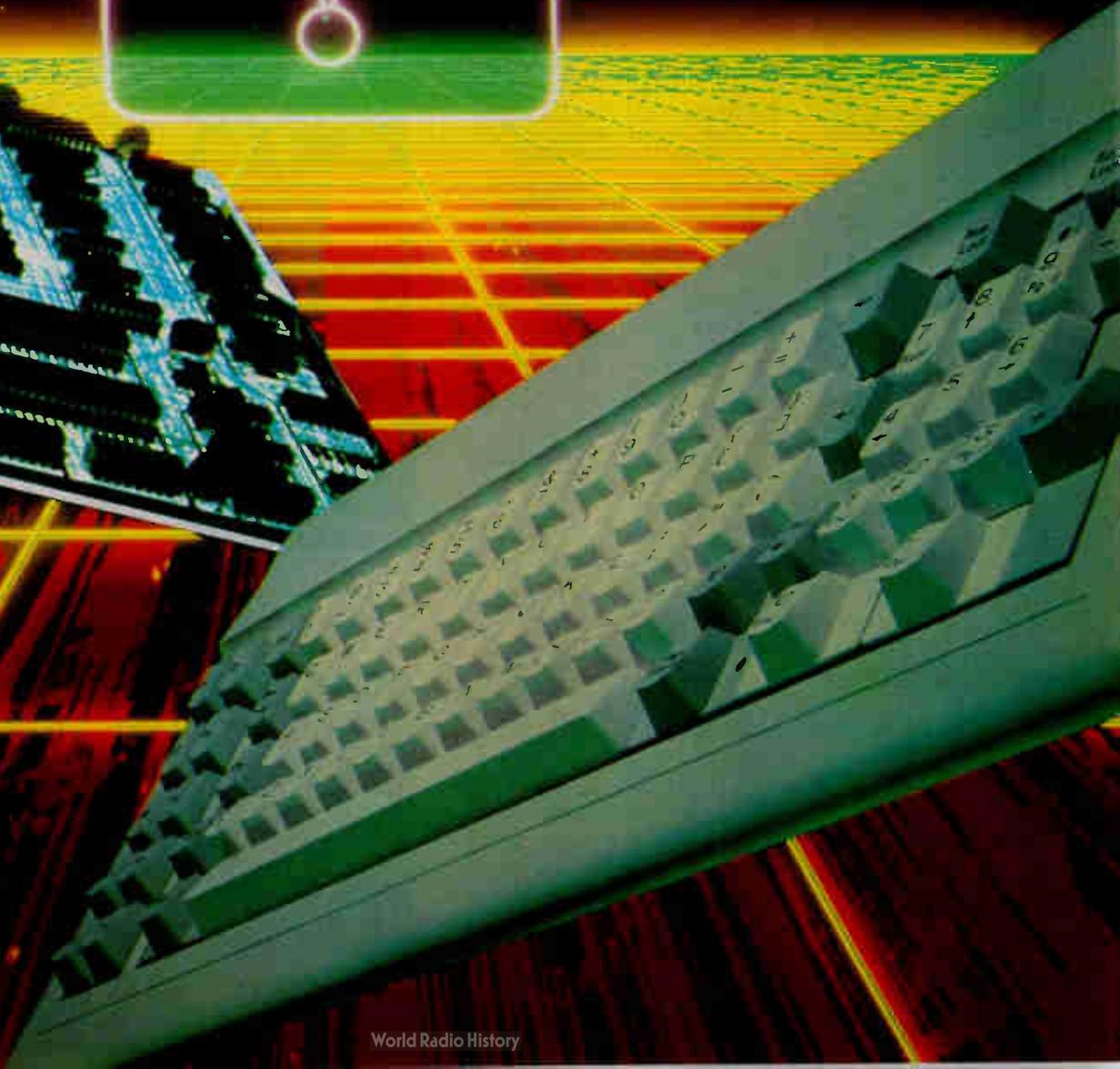
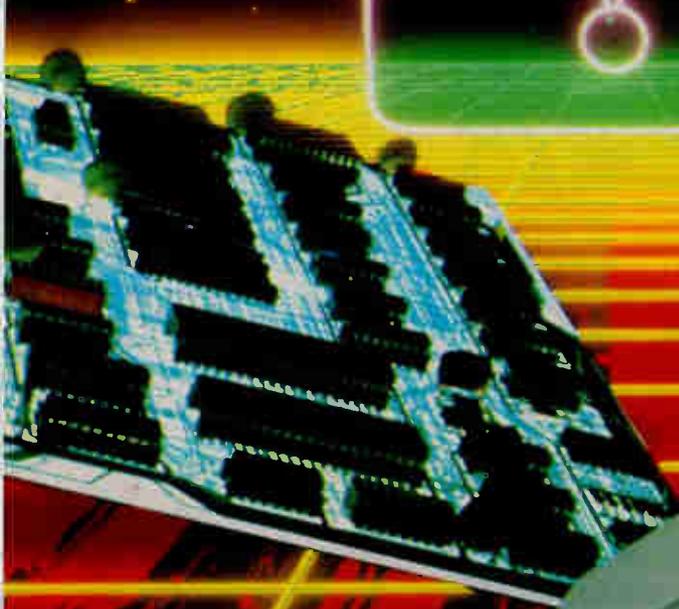
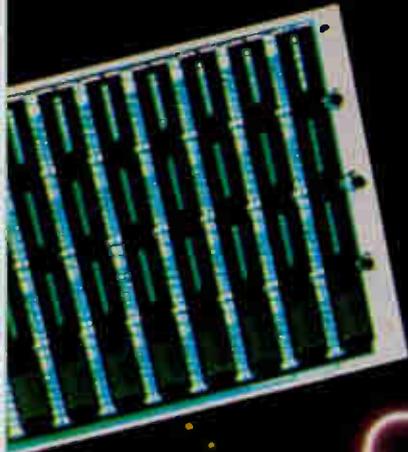
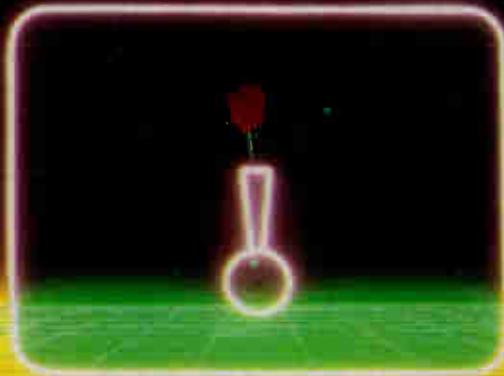


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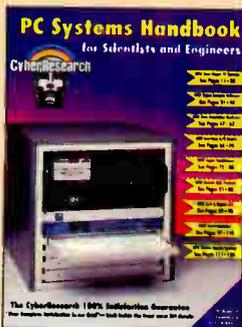
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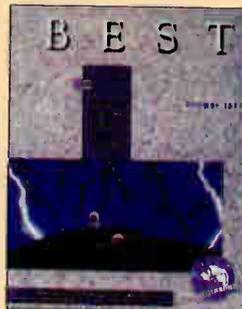
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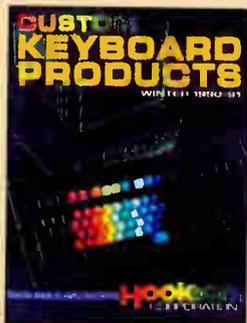


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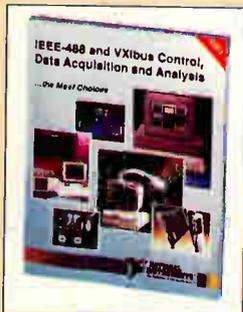
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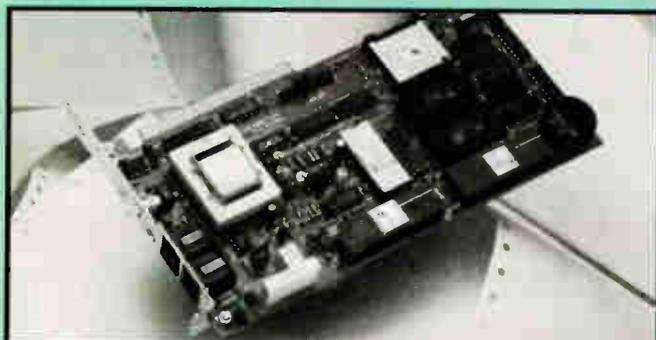
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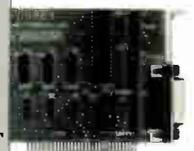
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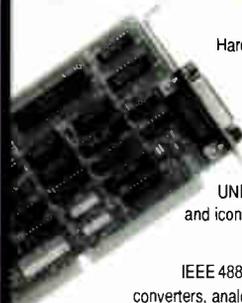
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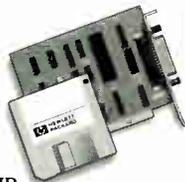
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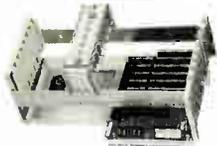
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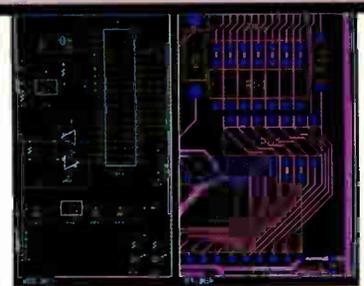
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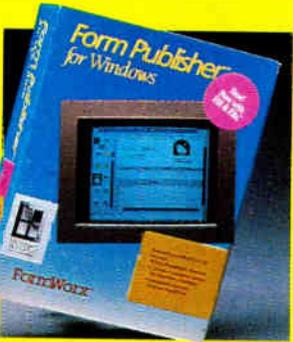
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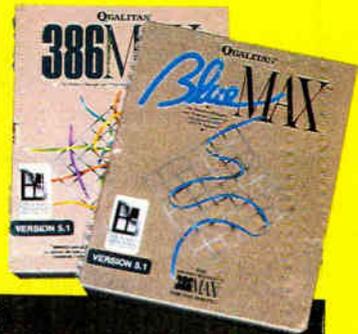
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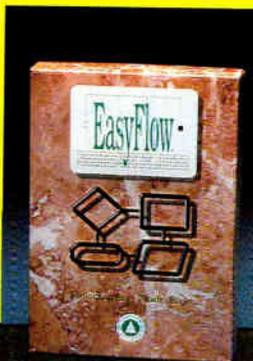
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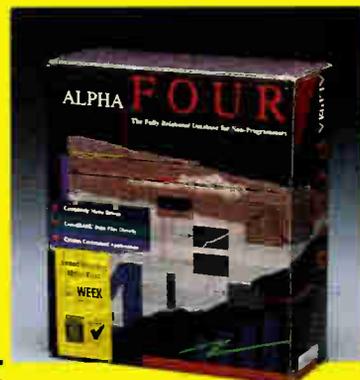
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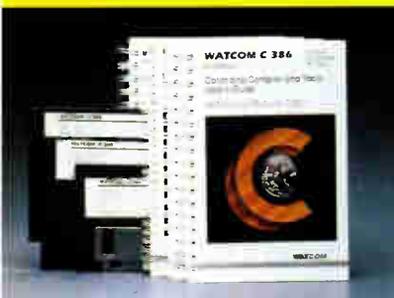
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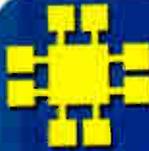
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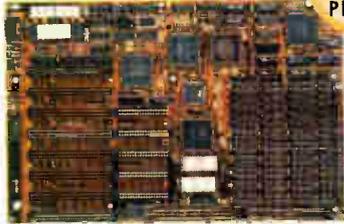
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Listing 1 provides the PM version of a procedure, `InheritClass`, that can be used to register an inherited class in one easy step, although it restricts some of the information that can be specified for the inherited class. Listing 2 contains a version of this procedure for Windows. Table 1 lists the parameters used in these examples. The parameters of these procedures are nearly identical; the only exceptions are the specification of an application anchor block handle in the PM version and the need for two instance handles in the Windows version.

In the Windows version, to obtain the class information, you need the instance handle of the application or dynamic link library (DLL) that registered the super class. Also, you have to specify an instance handle when registering the inherited window class. PM, on the other hand, only requires the application's anchor block handle—you don't need a handle to obtain a preregistered class's information, which is rather nice.

The remaining parameters of both versions of the `InheritClass` procedure specify the name of the super class to inherit, the name of the new class to register, the address of the window procedure of the new class, and the amount of extra window data that the new class requires. There are also two parameters to specify which class style bit flags must or must not be set. All other flags are inherited from the super class.

If the new class requires extra window data, you can use the last two parameters to specify the amount of extra data that you need and to retrieve the offset in the window data. `InheritClass` returns the address of the superclass's procedure unless the new class can't be registered, in which case it returns `NULL (0)`.

Guidelines

As with defining any window class, registering the new class is the easy part. Much harder, and considerably more interesting, is the design and development of the message processing in the window procedure.

First, and most important, the procedure must pass on all messages that the new class doesn't process to the super class's window procedure and must also return the result that the super class hands back. In PM, for example, you could do the following:

```
return (* pfnwpSuperClass)
    (hwnd, msg, p1, p2);
```

For windows, you would use a slightly different syntax:

FUNCTION PARAMETERS		
Table 1: Parameters used in the class inheritance example. Those variables designated "PM" are specific to the Presentation Manager example in listing 1; those with "W" are specific to the Windows example in listing 2.		
Input		
hab	PM	A handle to the calling application's anchor block.
pszSuperClass		A NULL-terminated string containing the name of the super class.
pszRegisterClass		A NULL-terminated string containing the name of a new class to register that will inherit the super class.
pfnwpRegister		A pointer to the window procedure of the new class.
styleExclude		Class style flags that can be set in the super class but must not be set in the new window class.
styleInclude		Class style flags that must be set in the new window class regardless of whether or not they are set in the super class.
cbWinExtra		Extra bytes of window storage data required by the new window class. This is added to the window data required for the super class.
pcbQwOffset		A pointer to a 2-byte storage area that will be modified to contain the offset in the window's storage data to the specified extra data. This pointer may be NULL if the new class does not require any extra window data.
hInstSuperClass	W	A handle to the instance of the application or DLL that registered the super class, or NULL if the super class is a standard window class.
hInstApplication	W	A handle to the instance of the application or DLL that is registering the new window class.
Output		
*pcbQwOffset		The offset to the new window class's window data is placed in the buffer, if one is provided. For PM, this offset is used in calls to <code>WinQueryWindowULong</code> , <code>WinQueryWindowUShort</code> , <code>WinSetWindowULong</code> , and <code>WinSetWindowUShort</code> ; for Windows, it is used in calls to <code>GetWindowLong</code> , <code>GetWindowWord</code> , <code>SetWindowLong</code> , and <code>SetWindowWord</code> .
Return PFNWP	PM	A pointer to the super class's window procedure is returned if the new class was successfully registered, or NULL if the class could not be registered for any reason. The new window class must call this procedure to pass any unprocessed or partially processed messages.
FARPROC	W	A pointer to the super class's window procedure is returned if the new class was successfully registered, or NULL if the class could not be registered for any reason. The new window class must pass any unprocessed or partially processed messages to this procedure by calling <code>CallWindowProc</code> with this address.

```
return CallWindowProc
    (pfnwpSuperClass, hwnd,
     msg, p1, p2);
```

In this example, `pfnwpSuperClass` is the address that `InheritClass` returned. This single line represents the minimum requirement of a window procedure for an inherited window class. It may seem simple, but it's very powerful: With this line, the new class inherits all the power and processing of the super class.

Of course, there's not much point in creating a new class if the only difference between it and another class is the class name, so the next step is to define what should be done when the window is cre-

ated and destroyed. The creation process (triggered by `WM_CREATE`) typically stores a pointer to the dynamically allocated buffer in a 4-byte space in the window data area. Conversely, on receipt of a `WM_DESTROY` message, the destruction process should extract the pointer from the window data and free the buffer's memory. To get or set the data, you must use the window data offset you obtained when you registered the class. For example, to insert a pointer in your data in PM, you would do the following:

```
WinSetWindowULong (hwnd,
    OffsetToData,
    DataAddress);
```

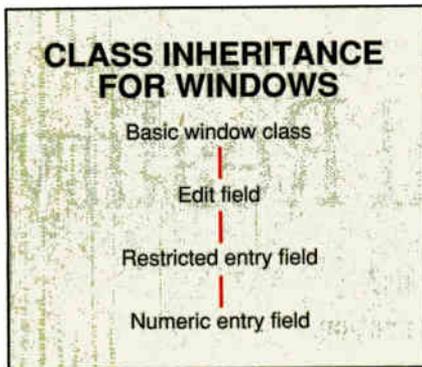


Figure 2: The inheritance tree for the sample program.

To retrieve the data pointer any time after it has been inserted, you use

```
DataAddress =
    WinQueryWindowULONG
    (hwnd, OffsetToData);
```

For Windows applications, the calls are almost identical:

```
SetWindowLong (hwnd,
    OffsetToData,
    DataAddress);
DataAddress = GetWindowLong
    (hwnd, OffsetToData);
```

Usually, the creation process needs to do more than initialize window instance data. For example, most control window classes allow the specification of style flags that let the user select various features. You must decide whether to simply let the super class handle these flags, add new flags, or provide your own set of replacement flags. Letting the super class handle the style flags is easiest.

Defining new style flags can create problems; any flag you use for your special purpose might be used for a different purpose by the super class in a future version. Replacing the default flags with your own set of flags also poses some problems: You must extract these flags from the window style and then set up the style using the super class's flags before you can call the super class's window procedure, and your flags will not reflect any future styles to the super class.

You can add any other required processing during window creation, but you must be sure that the super class's window procedure is called before message processing completes. Your window procedure may process other messages partially or totally, or it may altogether ignore the processing of some messages. To inherit the processing of any message,

the message must be passed to the super class's window procedure at some point; when and how is your option.

An Example

The real key to the power of class inheritance is the ability to create hierarchies of inherited classes. The program listings available with this article (see page 5 for details) demonstrate a simple linear hierarchy for Windows. The collective hierarchy represented by the classes created in this program is shown in figure 2.

These window classes provide a simple demonstration of class inheritance. As this example demonstrates, inheritance provides a great deal of power with a small amount of programming.

Potential Pitfalls with Windows

Windows poses some potential problems with this technique of class inheritance. The most serious is that you must know the instance handle used to register the super class. If you don't have this handle, `GetClassInfo` will fail. How, then, can you inherit a global class defined by another application or DLL? Fortunately, there is a way to get this information. Windows provides two procedures, `GetClassWord` and `GetClassLong`, that provide the class information for any window. Thus, you can create a dummy instance of the super class and use the resulting window handle to get the information you need to register the inherited class.

Another problem is extra class data. Unlike PM, Windows allows extra class-specific data to be added for any registered class. If the super class has any such extra data, `InheritClass` reserves the class data for it but will not fill it in. To properly support this data, you need to get the super class's extra data using `GetClassWord` or `GetClassLong`, as described. To insert the data into the inherited class, you need to create a dummy instance of the new class after it has been registered and then use `SetClassWord` or `SetClassLong`.

Similarly, `InheritClass` doesn't support the addition of class data to the inherited class. If you wish, you can add another parameter to include this feature. As with window data, you'd need to save the offset in the new class to this data and initialize the data using the `SetClass` procedures.

You might consider storing the super class's window-procedure address and the offsets to the inherited class's window and class data in the extra class data. This may seem desirable, as it eliminates the need for global variables; as you'll

see, however, I don't recommend this.

Assume a minimum of 8 extra bytes of class storage at the end of each inherited class, and place the address and offsets there in a specified order. Then, whenever a message is received, this information can be retrieved from the class information. For example, if the super class's window-procedure address is always stored in the last 4 bytes of the extra class data, you could do the following:

```
TotalExtraClassData =
    GetClassWord
    (hwnd, QW_CBCLSEXTRA);
OffsetToSuperClassProc =
    TotalExtraClassData - 4;
SuperClassProcAddr =
    GetClassLong (hwnd,
    OffsetToSuperClassProc);
```

Unfortunately, this doesn't work! Consider what would happen if you inherited a class from a previously inherited class:

1. An inherited class's window procedure receives a message, and the above technique is used to pass it to its super class.
2. The message is received by the super class, which is also an inherited class. It uses the above procedure to pass the message to its super class.
3. The super class does not find its super class—it finds its own window procedure! The program goes into an infinite loop.

Obviously, some more sophisticated technique is required to search the class data for the proper information at each level of inheritance. I do not believe that any such complexity or processing overhead is worth the effort.

Achieving the OOP Advantage

Both PM and Windows support the OOP paradigm. However, it is your responsibility to exploit these features to the best advantage.

Careful planning and attention to detail can lead to the development of highly reusable window classes and easily enhanced applications. You'll need to experiment and gain some experience to achieve the full advantages of OOP—but the advantages are well worth the effort. ■

David Van Camp is a consultant specializing in the design and development of OS/2 Presentation Manager and Microsoft Windows applications and class libraries using object-oriented techniques. He can be reached on BIX c/o "editors."

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Charlie Chaplin, one evening in 1964, was firm about what had gone wrong. In Hollywood—cinema's Eden—a director felt free to shout, "There's a flood in town!" open some hydrants, and leave the rest to the clowns and the camera-cranks. That was how one picture actually got made.

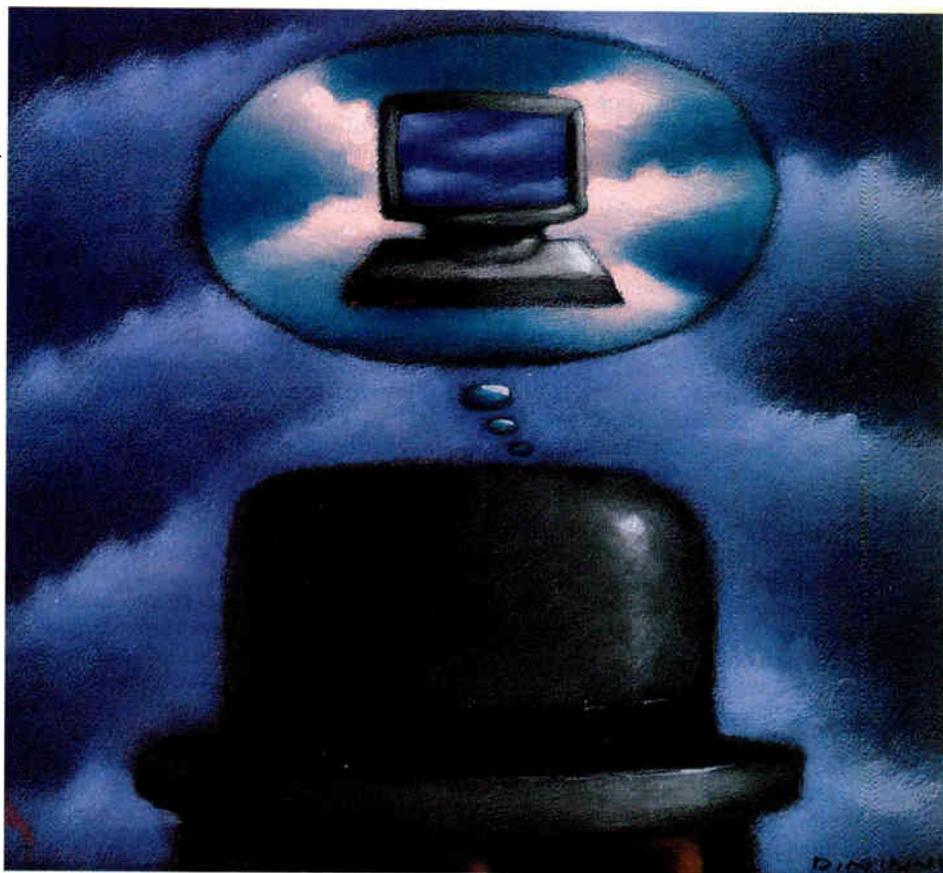
But Hollywood had followed the new-fangled sound track clear out of Paradise. For now *talk* was expected, and whenever someone spoke, a mike needed to be right above the clown's head, just high enough to elude the camera's view. To position that mike, the crew (becoming more numerous than the clowns) had to know who'd be speaking next, which meant a script, and which also meant firm agreement on where every clown would be standing each time he spoke. And that meant endless rehearsing, mainly to program interaction with the crew. Spontaneous miming had no place anymore. Thus had sound put finis to a golden age.

Concerning his one appearance with Buster Keaton—the great fiddler-pianist sequence in *Limelight*—Chaplin was brusque: "It was good at 9 a.m. But we couldn't shoot till 3. I think we rehearsed it to death."

And I realized what *Modern Times* was about: a myth at least a century old when it was made, freedom versus a technology that imprisons. (Chaplin let the nearsighted think it was about sentient poor versus mindless rich. I doubt it. All during that cold Swiss January evening, rich Charlie's chauffeur sat outside in the Rolls.)

Even Chaplin, though, could be nearsighted. For silent film had meant technology, too; so had the music hall of his boyhood, with its drumrolls and spots. "The theatre," writes Julian Hilton, is "an art form intrinsically enabled by technology... a complex aesthetic machine" with components—"sets, lighting, costumes, effects—driven by the collective imagination."

So theatre doesn't reject the paradox that it's "simulated yet real," and Hilton wants that principle to help us rethink machine emulation of people (e.g., expert systems). Simulation didn't have to wait for cogs and pulleys; Aristotle saw "children's play (which so often involves role play) leading to theat-



rical plays." But when technology is available, simulation co-opts it: a kid waving a flashlight, an accountant booting a spreadsheet.

You'll find Hilton's essay in *Dialogue and Technology*, offshoot of a 1988 Stockholm conference on culture, language, and AI. There you'll also find Susan Bassnett on how translating a set of knitting instructions from Swedish into English meant not just dictionary lookups but total recasting, so differently do Swedish and English knitters approach the job; and Stephen Toulmin on why the ancient dream of an exact language flourished in the seventeenth century and again around 1900.

Like all conferences, that one seems to have been usefully inconclusive. AI, you see, is a generic term for mimicry of something human, and the conferees remind us that mimicry we can see through needn't be a confession of failure, although

AI gurus do mumble about the immature state of the art. Hilton notes that we'll not credit a fine performance unless it clearly is a performance; an actor *become* King Lear is simply mad. (Ronald Colman in *A Double Life*—1947—played an actor who played Othello till he thought he was Othello and ventured to smother his wife. Now *that's* a case of being taken over by a program.)

One speaker at the Stockholm conference even suggested that a system will exhibit real intelligence once it can know, as people do, what's best forgotten—for we tend to forget on principle. Jorge Luis Borges wrote a chilling story ("Funes the Memorious") about a man powerless to forget anything: no, not leaf #3907 on oak tree #118,465. But machines forget on no principle save buffer overflow or power interrupt, research libraries on none save paper disintegration. One estimate of what's a-crumble in the Library of Congress is 25 trillion perishable bytes. Quick, get it onto a CD-ROM! (And next, do what?)

Magnus Florin, a Swedish theatreman, reminds us that worry about one's life getting mechanized was a favorite theme in the early 1800s. In a story by E. T. A. Hoffmann, a young man falls in love with a girl named Olimpia, who turns out to be a perfect automaton; but since "she" can dance, speak, play the piano, and sing, she's been passing for "a perfect creature," albeit without a soul. And in a famous H. C. Andersen story, the duet between a real and an artificial nightingale breaks down because "the real nightingale sang in its own fashion, and the artificial bird worked by wheels." Being immutably perfect, the wheel-driven bird was the one the Emperor fancied.

And my favorite story about the poet William Butler Yeats has the BBC offering him the gift of a batteryless (plug-in) wireless, and Yeats phoning his wife in Dublin to ask, "Georgie, do we have electricity?" Out of fear of getting entrapped by the mechanical, he'd trained himself not to notice such things.

Which brings us around to Toulmin's piece on the dream of an exact language. Although he concentrates on the German philosopher Leibniz, a readier example is the British John Wilkins, Dean of Ripon, whose "Essay Towards a Real Character and a Philosophical Language" (1667) offered a remedy for all the ambiguities of mere spoken tongues that jest grew up natchery. Being, for one thing, literally unspeakable, Wilkins's universal language never caught on. Yet it was but one of many such projects, and Toulmin is arrested by their vogue in the 1600s and their renewed vogue around 1900 (when Esperanto and Volapük were contrived).

People worry about language, Toulmin concludes, at a time when too many uncertainties converge. In the seventeenth century, those uncertainties were religious; surely, a universal tongue would help sift clashing faiths down to some enlightened core? Around 1900, Euclid's certainties and Newton's were under simultaneous assault; and, once again, behold a debate about language (as, what are words like *space* and *time* really saying?). Language, the assumption went, is something to think with, and the *Principia Mathematica* of A. N. Whitehead and Bertrand Russell seemed to have outlined an unambiguous language for doing that, until Kurt Gödel (1931) demolished its dream of an intact whole system.

The unambiguous languages we now strive to master—Pascal, C, APL—are meant only to guide hardware; no one seems to dream of wooing a bride in C. What we do dream that C and its kin may be good for, oddly enough, is to help us construct

domains where people can enjoy some liberating illusion; in *Artificial Reality II*, Myron W. Krueger offers a survey.

Back in 1971, Krueger set up Metaplay, which detected visitors' footsteps as they moved around the room and then let them try to walk through a maze projected on the end wall. (As you moved, a symbol representing you moved in synchrony.) If you tried to cheat by stepping over a boundary, the maze had ways of retaliating. But even if you didn't cheat, the rules would keep changing until ultimately success was impossible (*Modern Times?*).

Yes, "the popular stereotype of dehumanizing technology seemed fulfilled." Yet people stayed involved willingly, and, to hear Krueger tell it, they came to realize that the maze was no threat but "a vehicle for whimsy . . . poking fun at their compulsion to walk through it." (As to why they felt such a compulsion, he fingers "our educational system," which he seems to think is the really sinister machine.)

More generally, "an artificial reality is a graphic fantasy world in which a person uses her whole body to participate in an experience created by the computer." This is "a culture-defining concept," applicable "to aesthetic, scientific, and practical ends simultaneously." You've certainly read about it recently in the nontech media: the video-goggles, sensor-gloves, the illusion that you're climbing on a moon of Saturn, or training a robotic dog.

Krueger has wilder visions. He'd like cars to express the driver's feelings: embarrassment, annoyance. "If the car were coated with an electroluminescent phosphor, it could blush or turn livid."

Meanwhile, the passenger could be "participating in a cellular artificial reality. . . . It may become common for a person walking down the street or sitting in a bus to carry on an animated conversation with a phantom colleague." Then we're told of Steve Robinson's "solar-powered bicycle . . . connected to the world of computer-based information. . . . He views the screen through a Reflection Technology Private Eye display and inputs by typing in binary using buttons on the handle bars. While on the road, he can read electronic books, listen to CDs, and write of his travels." We're not told how he deals with traffic lights.

And we circle toward the machine, spun off a typewriter, that fed Charlie Chaplin corn from a cob with a carriage return. No viewer of *Modern Times* has forgotten that detail. But here's *Modern Times* being recycled as Utopia. One of two things has happened: Either high-tech dreaming is going plumb crazy, or Chaplin was this century's grimmest pessimist. "Even our pets," thinks Krueger, "may put on goggles and join us in artificial realities." What Charlie might have done with that theme is something to dream of. ■

Dialogue and Technology, Bo Goeranzon and Magnus Florin, eds., Springer, 1990, \$49, ISBN 0-387-19574-2.
Artificial Reality II, Myron W. Krueger, Addison-Wesley, 1991, \$29.25, ISBN 0-201-52260-8.

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Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Kruieger has
wilder visions, like
cars expressing
the driver's feelings.





STOP BIT

BONNIE J.
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HOW TO BE A HERO

Are you the personal computer troubleshooter in your organization? Would you like to decrease your troubleshooting workload so you'll have more time for creative projects or a chance to use all that new software flowing into the office? Here's how.

Anyone who has been in the field of personal computer troubleshooting can appreciate the top-down approach to finding the source of a computer problem: (1) check for user errors, (2) check external cables, (3) check internal cables, and (4) check the boards and chips through diagnostics.

Helping users help themselves can save you a lot of troubleshooting

In the majority of cases, you'll find that service requests are the result of user errors. That being the case, preventing user errors will eliminate the bulk of a troubleshooter's "Band-Aid" runs. Here are some simple steps that you can follow to

build users' confidence and enhance their knowledge of currently used applications:

- *Don't assume that lack of computer knowledge is lack of intelligence.* A common mistake is thinking that someone who is computer illiterate is therefore incapable of being taught. If you're starting from ground zero with a new user, explain things in simple terms.

One of our trainees began working with a personal computer just a year ago. Now she's designing her own spreadsheets for a complex rating system. "Trainers often forget what it's like to not know anything about computers," she says. "They use words and phrases that a trainee doesn't understand. To a new user, that kind of language is totally foreign."

- *Eliminate errors by educating users.* When you are rushed, it is tempting to push a few keys, solve the problem, and walk away. Unfortunately, this makes users feel inadequate, and it will neither prevent them from making the mistake again nor teach them how to correct the error on their own.

When you teach users a new procedure, make sure they write it down. When someone writes down a procedure, you can be assured that they are grasping what you are telling them.

- *Make training applications-oriented.* As you train users, have them work on actual projects. As one of our employees said, "If I can't relate the training to something I'm doing, it's just a procedure and doesn't seem

real." In addition, it's important to involve users when you customize a program specifically for their application.

During training, have the user sit at the helm. Hands-on learning is the best kind! Don't jump in and start pressing keys without first explaining what you are doing.

- *Be willing to answer all questions with a helpful attitude.* The tone of your voice when a user calls requesting information can make all the difference. Even if you are busy, the simple instructions you give users on the phone can save them hours of frustration. If it isn't a question you can answer by phone, go to their location to get more details.

As the executive assistant to our president explained, "If our troubleshooter weren't so cooperative and helpful, I wouldn't call at all. I would do it another way or figure it out myself, which might take a lot longer. There's always the typewriter!"

There may also be problems that are beyond your expertise. If users have questions that you can't answer immediately, reassure them that you will get back to them.

- *Reinforce the learning process.* Write down the steps that you just taught the user to accomplish his or her task. Type it out neatly and give the user a copy. Keep a copy in your files for other employees. In some instances, you may want to distribute printed summary sheets to all employees who will be performing the same task.

Praise people when they have completed a task without your assistance. Positive reinforcement will increase their confidence and encourage them to explore and solve their own software problems.

Following these tips could turn you from being an overworked troubleshooter to being a hero once in a while. The time and effort you spend up-front will pay off in the long run. ■

Bonnie J. Djouadi is computer applications trainer at Ohio Hospital Insurance Co. in Columbus, Ohio. She has 10 years of training and software applications experience. You can reach her on BIX c/o "editors."

Stop Bit is a forum for informed opinion on personal computing topics. The opinions expressed are those of the author and not necessarily those of BYTE. Your contributions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

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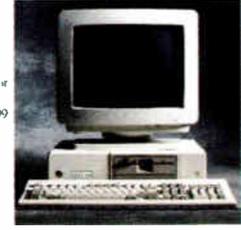
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