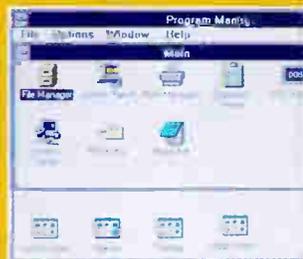


BYTE

A MCGRAW-HILL PUBLICATION

**Sneak Preview:
Windows 3.1**

Page 38



Silicon Graphics' New **Indigo**

**A Hybrid 3-D
Graphics/Business
Computer**

Third-Generation CD-ROMs
Adding OOP to Windows
Networking Mac System 7.0
FORTRAN 90
Office of the Future
Under the Hood: Laptop Power



PLUS
NetWare 2.11 and 3.11
1-2-3 Release 2.3 vs.
Quattro Pro 3.0
16 PC, Mac, and Unix
Group Schedulers
The New Norton Desktop
LapLink Pro
3 New 486SXes
MediaMaker and FrameMaker

0 2662

09
5275

11550

HEMPSTEAD NY
23 KENSINGTON CT
BILL BURNS
9100 000333518 FEB94 HIA 4414
11550 *****5-DIGIT

\$3.50
0360-5200

Lotus 1-2-3 Release 2.3

that simplifies the job of documenting and analyzing worksheet logic.

Of course, you won't just like what Release 2.3 does. You'll like how it feels. It's quick and smooth. With a WYSIWYG (what-you-see-is-what-you-

get) graphical environment that lets you format text, data, and graphics "live" on screen. With the mouse, you can execute

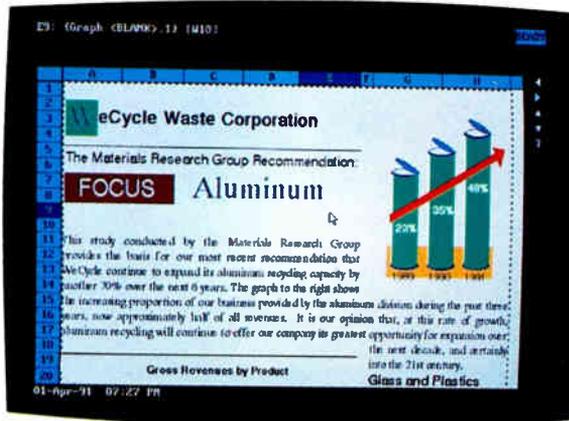
commands, highlight cells or ranges, open dialog

boxes, place and size graphs, change type styles, fonts and point sizes. All with unparalleled speed and ease.

What's more,

Release 2.3 gives you a wide range of printing and reporting capabilities. Including the capacity to place as many live graphs on a worksheet as you'd like.

Along with 96 type style combinations, drop shadows,



With its WYSIWYG graphical environment, you can do all your formatting "live" on screen. Which means you'll always know what your output will look like before you print.

new 3D-effect graphs, drawing and annotation tools, and the most font support, choices of colors and shading available.

Compatibility? As with any 1-2-3 product, it's no problem. Because Release 2.3 will read all of the files you've created on previous versions of 1-2-3, including files you've formatted using Always™ and Impress™. So you'll preserve all your work, as well as your training.

To order your upgrade direct from Lotus* call **1-800-TRADE-UP, EXT. 1231**. Or see your Lotus Authorized Reseller.

*Please have your credit card and product package ready when you call. In Canada, call 1-800-668-1509.

An unimpressive report is something you'll never have to create again.

Align titles or text across a range of columns—left, right, or center—with one simple command.

You can wrap text around graphs automatically.

Add freehand drawings or symbols to call attention to critical data.

A feature that only 1-2-3 offers to DOS spreadsheet users is the ability to embed as many "live" graphs on a worksheet as you'd like.

Improved, 3D-effect graphs can add even more impact to your report.

Mix bold, italics, underlines, colors, and typefaces to create over 100 text style combinations—more than any other spreadsheet.

Thanks to Auto Compress, you can easily make an entire report fit on one page.

The new Lotus 1-2-3 for DOS

Lotus

Now you can
upgrade
your spreadsheet
without upgrading
your hardware.

Introducing Lotus

There's a lot to like about the new Lotus® 1-2-3® for DOS Release 2.3.

For starters, it's not just a graphical spreadsheet. It's a fast, graphical spreadsheet for DOS. It's easy to use.

And it works as well on an older XT with just 512K of memory as it does on the newest 486 machine.

It also shares many fea-

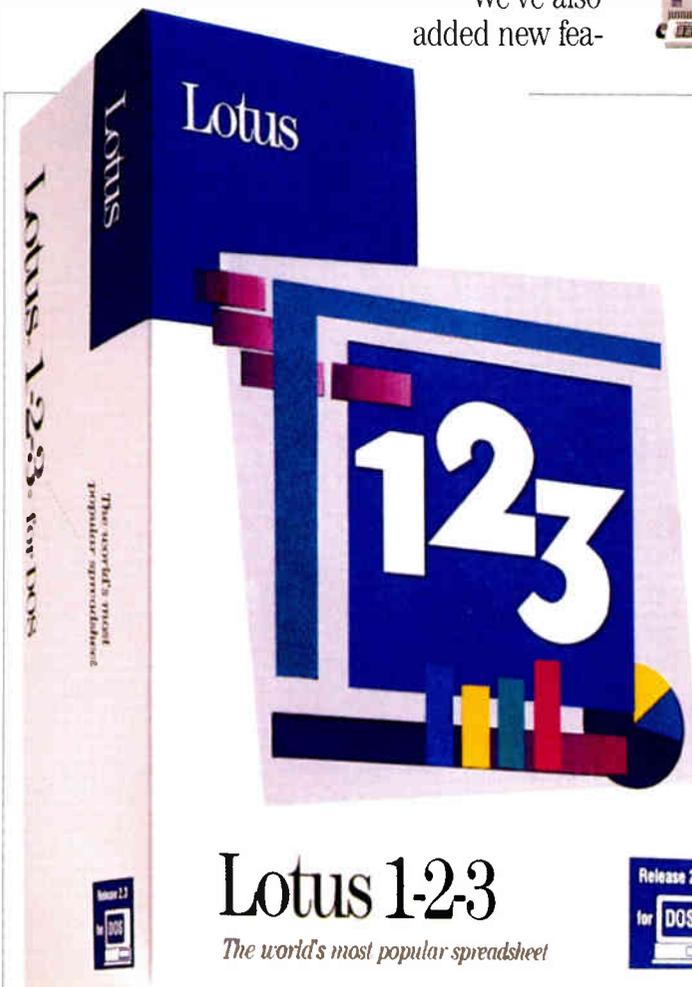
tures in common with our powerful 3D spreadsheet 1-2-3, Release 3.1. Including its superb spreadsheet formatting and publishing capabilities and full mouse support. Along with its popular Auto Compress feature that gives you a trouble-free way of making larger worksheets print on a single page.

We've also added new fea-

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



Lotus 1-2-3 Release 2.3 runs smoothly and quickly no matter what hardware you're running it on.



WHAT'S NEW IN LOTUS 1-2-3 RELEASE 2.3.

- A WYSIWYG graphical environment with live on-screen formatting
- Lotus Magellan viewer technology for fast file previewing, retrieving and linking... all without leaving your active worksheet
- More graph types, including 3D-effect graphs and graph annotation capabilities
- 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
- New printer drives that support all leading laser and dot-matrix printers
- Context-sensitive, interactive Help and an on-line tutorial

WeCycle Waste Corporation
 The Materials Research Group Recommendation:
 FOCUS: ALUMINUM

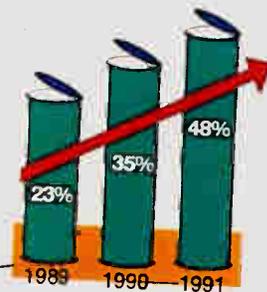
... research Group provides the
 ... continue to

This study
 basis for
 expand :
 next 6
 report
 during

WeCycle Waste Corporation

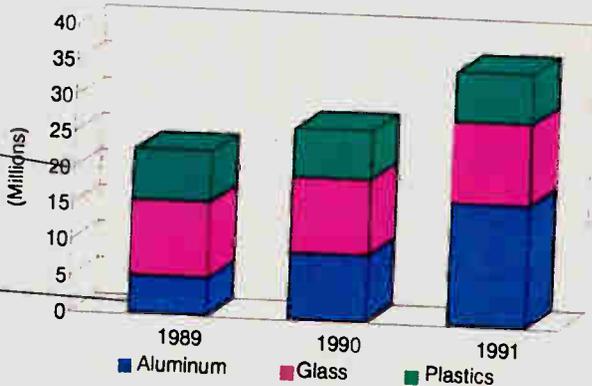
The Materials Research Group Recommendation:

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

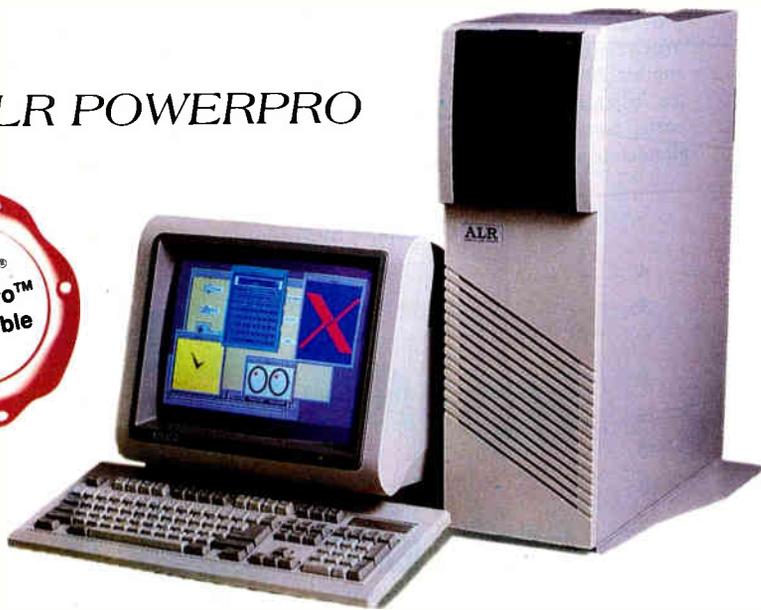
It is our opinion that sources of aluminum products will be pressed close to their limits over the next decade.

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

The only EISA-based file server

The ALR POWERPRO



The concept is as simple as the law of gravity, yet as revolutionary as the theory of relativity...

Build a superior system and sell it for an irresistible price. That's exactly what we've done with the **ALR POWERPRO VM Series**. These systems have everything you could want in a powerful network server or multiuser host. **Fast 32-bit processors** complemented by a substantial **64-KB cache** provide excellent CPU

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.

Yet the POWERPRO sells for less than you'd expect for a system of this caliber.

The POWERPRO VM 386/33 with its **33-MHZ i386™** processor starts at just **\$4,995**. Or you can select one of our **20-MHZ i486SX™**, **25-MHZ i486™** or **33-MHZ i486** models. Just choose the level of power you need today.

Prices and configurations subject to change without notice. Verify competitive pricing and configurations with manufacturer. Prices based on U.S. dollars. ALR is a registered trademark of Advanced Logic Research, Inc. All other brand and product names are trademarks or registered trademarks of their respective owners. © 1991 by Advanced Logic Research, Inc.

upgradeable DMP Ready under \$5,000

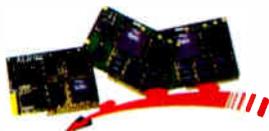


Manufacturer Model	ALR [®] POWERPRO VM 386/33	Compaq [™] SYSTEMPRO [™] 386/33	AST [™] Premium [™] 386/33TE
CPU	33-MHz i386	33-MHz i386	33-MHz i386
BUS Architecture	EISA	EISA	EISA
RAM Standard	5-MB	4-MB	4-MB
Floppy Standard	1.2-MB	1.44-MB	1.2-MB
Total Slots	12	11	10
Starting List Price	\$4995	\$11,999*	\$6495
Upgrade Path	20-MHz i486SX 25-MHz i486 33-MHz i486 Dual Processing 33-MHz i486	Dual Processing 33-MHz i486 *includes 240-MB Hard Drive and VGA controller	25-MHz i486 33-MHz i486



**SMP
Certified**

With ALR's modular "Just Upgrade the CPU!"[™] processor upgrade technology, you can upgrade processing power simply by swapping CPU modules.



With ALR you'll get higher performance in just a snap!

Speaking of adding processors, the ALR POWERPRO is also the only affordably priced server/host system to give you an upgrade path to **SYSTEMPRO[™] compatible dual processing.** Just plug in our POWERPRO 33-MHz i486 MP1 and MP2 modules, and the POWERPRO will instantly become a true symmetrical dual processing system. The POWERPRO can truly deliver mainframe-like computing power for a PC price today!

Who says you have to pay more to get a great system? The ALR POWERPRO sets a new standard for performance, flexibility, and value. To find out more, call: **1-800-BUY-POWER**

ALR[®]

Advanced Logic Research, Inc.
9401 Jeronimo Irvine, CA 92718
TEL: (714) 581-6770 FAX: (714) 581-9240

Available at these selected resellers:



BYTE

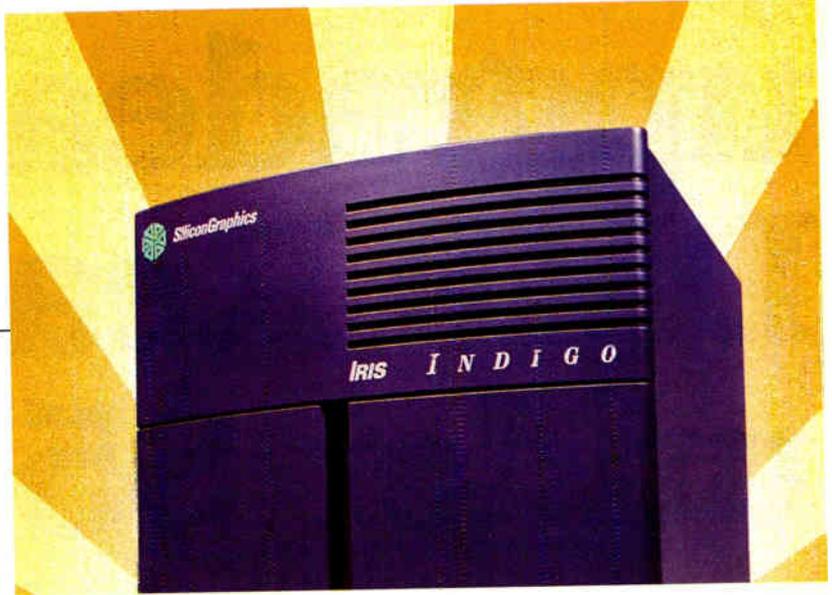
September 1991 Volume 16, Number 9

COVER STORY

FIRST IMPRESSIONS

Unix Goes Indigo

PAGE 40



NEWS

- 25 MICROBYTES**
The Apple/IBM alliance may make it easier to mix Macs and PCs.
- 38 FIRST IMPRESSIONS**
Repairing the Cracks in Windows
An early version of Windows 3.0's long-awaited successor.
- 43 Reach Out and Link Someone**
LapLink's latest version adds a new interface and works via a modem.
- 48 AcerAnyWare 1120NX,**
a nifty notebook loaded with useful features

Norton Desktop for Windows, make Windows more useful with an integrated shell

Adobe Illustrator 3.0 for the Next, all the Mac features, and more

FrameMaker 3.0, the newest incarnation of a multiple-platform program for desktop publishing

Frontier 1.0, finally, scripting for the Mac

- 60 WHAT'S NEW**
Printers, a new environment for Windows applications, and more.

FEATURES

- 122 True Data**
A look at techniques for ensuring the authenticity of the data you send, receive, or store.
- 135 64-bit Computing**
64-bit micros may be coming to desktops near you.
- 147 Classic Languages, Part 1: FORTRAN**
First in a series on language survivors.

BYTE SOFTWARE RESOURCE SERIES

- 153 Windows 3.0 Applications**
The state of the market.

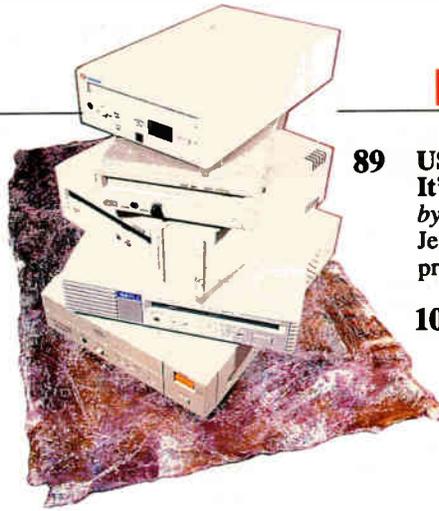
STATE OF THE ART

- 204 THE OFFICE OF THE FUTURE**
Introduction
- 207 Visions of Tomorrow**
What will the office of the future be like?
- 215 Corporate Connections**
Wayne Rash Jr. describes how networks that span entire companies will change the way you work in the 1990s.
- 227 Downsizing: Bane or Boon?**
Downsizing saves money, increases efficiency, and changes the role of MIS.
- 233 Is America Losing Its Edge?**
Some of the best and brightest scientists are leaving U.S. research labs.
- 245 Resource Guide: Office Automation Software**



REVIEWS

- 250 SOLUTIONS FOCUS**
Getting Groups on Schedule
The BYTE Lab tests 16 group schedulers.
- 268 CD-ROM Drives:**
How Good Is the Third Generation?
Will CD-ROM's promise be fulfilled?
- 279 Quattro Pro 3.0 vs.**
Lotus 1-2-3 Release 2.3
Two worthy GUI spreadsheets.
- 285 A Trio of 486SX Machines:**
Better Than 386 Systems?
Price and performance don't quite add up for these 486SX machines.
- 293 New NetWare Versions, Options Broaden Appeal**
Dramatic improvements in connectivity and ease of installation.
- 297 Debuggers for Windows Shows Promise, Lacks Polish**
MultiScope's latest debugger does Windows programs.
- 302 Build Multimedia Presentations with MacroMind's MediaMaker**
MediaMaker sets the pace with captivating presentations.
- 307 Computers Go Video with NEC's PC-VCR**
There's more to this high-tech VCR than meets the eye.
- 310 REVIEWER'S NOTEBOOK**
Improvements in grammar checking, a book-size desktop, and more.

**OPINIONS**

- 89 USER'S COLUMN**
It's All Digital
by Jerry Pournelle
Jerry looks at multimedia products.
- 105 BUSINESS CONNECTION**
Your First LAN: Do It Yourself?
by Wayne Rash Jr.
Find out what it takes to install a LAN yourself.
- 117 ROUNDTABLE**
Computing's New World Order
Will market forces change the PC vendor landscape?
- 390 PRINT QUEUE**
Dreams of Artificial Reality
Recent books examine the mind-machine connection.
- 392 STOP BIT**
How to Be a Hero
Smart training practices produce smart users.
- 10 EDITORIAL**
Thanks for the Memory
- 18 LETTERS**
More on bittersweet legacies and bubble sorts.

HANDS ON

- 315 High-End Printing on a Low-End Budget**
Champagne output on a beer budget.
- 325 SOME ASSEMBLY REQUIRED**
Inherit the Win
Taking advantage of the object-oriented attributes of PM and Windows.
- 329 UNDER THE HOOD**
Power Management
How portables squeeze power from their batteries.
- 336 SOFTWARE CORNER**
Two Text Editors
Free (or almost): two text editors, a patching utility, and an application switcher.
- 337 NETWORKS**
Networking with System 7.0
by Tom Thompson
System 7.0 provides peer-to-peer capabilities.
- 341 THE UNIX /bin**
Gettying Up to Speed
by David Fiedler
Tips on talking to modems with the getty daemon.
- 345 BEYOND DOS**
Class Conflict
by Louis J. Cutrona Jr.
The Windows/C++ mismatch.
- 347 MACINATIONS**
Mac Realities
by Don Crabb
A new software concept, and tips for Mac happiness.
- 349 ASK BYTE**
DAT cassettes, viruses, keycodes, and more.

READER SERVICE

- 383** Editorial Index by Company
384 Alphabetical Index to Advertisers
386 Index to Advertisers by Product Category
Inquiry Reply Cards: after 384

PROGRAM LISTINGS

- From BIX: Call (800) 227-2983
On disk: See card after 368

INSIDE BYTE

BYTE (ISSN 0360-5280/91) is published monthly with an additional issue in October by McGraw-Hill, Inc. U.S. subscriber rate \$29.95 per year. In Canada and Mexico, \$34.95 per year. Single copies \$3.50 in the U.S., \$4.50 in Canada. Executive, Editorial, Circulation, and Advertising Offices: One Phoenix Mill Lane, Peterborough, NH 03458. Second-class postage paid at Peterborough, NH, and additional mailing offices. Postage paid at Winnipeg, Manitoba. Registration number 9321. Printed in the United States of America. Postmaster: Send address changes, USPS Form 3579, and fulfillment questions to BYTE Subscriptions, P.O. Box 551, Hightstown, NJ 08520.

REGIONAL SECTION
begins after page 88

INSIDE **BYTE**

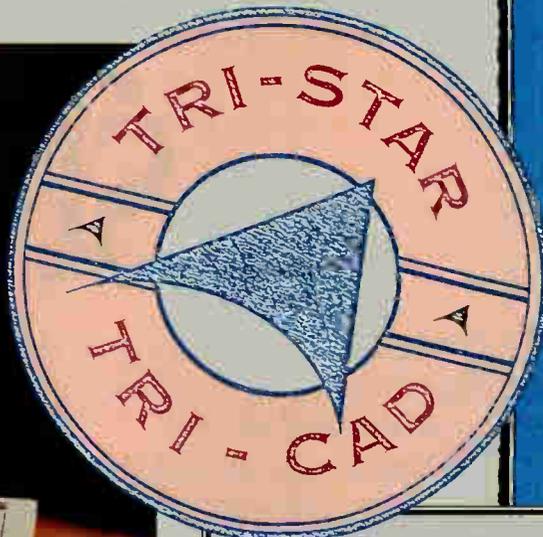
BYTE Topic Index and Author Guide

This index helps you find articles that contain information on each of the listed topics. (The topic list changes each month.) Combined with the table of contents (page 4) and the Editorial Index by Company (page 383), you can identify articles by type, subject, title, author, or product discussed.

BASIC 60, 89	GUI 38	PRINTERS 60	WORKSTATIONS 40
C++ 345	LOCAL-AREA NETWORKS 60, 105, 250, 293, 310, 337	PROGRAMMING 56, 60, 147, 325	WYSIWYG 279
CD-ROM 268	MACINTOSH 56, 60, 302, 336, 347	REMOTE CONTROL 250, 310	
COMMUNICATIONS 60	MINIATURIZATION 245	RISC 135	AUTHORS
CONNECTIVITY 43	MODEMS 60, 341	SECURITY 122	Alford, Roger C. 285
DESKTOP PUBLISHING 54	MULTIMEDIA 60, 89, 297, 302, 307, 390	64-BIT COMPUTING 135	Andrews, David 60
DOS 297, 336	MULTIPLATFORM 54	SPREADSHEETS 279	Appleby, Doris 147
DOWNSIZING 227	NEXT 52	STORAGE 215, 245	Barker, D. 25, 54
ENCRYPTION 122	OBJECT-ORIENTED PROGRAMMING 325, 345	SYSTEM 7.0 56, 337	Crabb, Don 117, 347
FAXES 60	OFFICE AUTOMATION 204, 207, 215, 227, 233, 245	TELECOMMUNICATIONS 341	Cutrona, Louis J. Jr. 345
FONT MANAGERS 315	OPERATING SYSTEMS 293	386SX 60	Djouadi, Bonnie J. 392
FORTRAN 60, 147	PORTABLES 48, 60, 329	TRAINING 207, 392	Eglowstein, Howard 250
486 60	POSTSCRIPT 315	TRAVELING 43	Fiedler, David 341
486SX 285	POWER MANAGEMENT 329	UNIX 40, 60, 336, 341	Glass, Brett 329
GRAPHICS 52		VCR 307	Grehan, Rick 250
GROUPWARE 204, 207, 215, 227, 233, 245		VIDEO 307	Harvey, David A. 268
		WINDOWS 3.0 38, 50, 60, 89, 153, 297, 325, 345	Joch, Alan 233

THE RIGHT DECISION

Student Body Leader



Tri-CAD workstations are the hands-down choice of the world's leading CAD training schools and Universities.

Schools such as the University of Texas and the world's largest CAD training center – The CAD Institute, insist on Tri-CAD quality.

We designed the Tri-CAD family with one goal – to build the best CAD workstations available anywhere, at any price.

Now, for a limited time, every Tri-CAD Workstation includes FastCAD – the fastest CAD in the microcomputer world.

Whether you're looking for your first CAD package or adding a new workstation, FastCAD® will change your mind about CAD once and for all. Written in assembly language, FastCAD is the undisputed speed champion. It zooms the fastest. Pans the fastest. And draws the fastest. Period.

TRI-CAD WORKSTATIONS

TC 425i
\$4195

TC 433i
\$4395

With EISA BUS
Add \$500

UPGRADES:

- 12"x17" DIGITIZER \$250
- 2MB HD CACHE CARD \$395
- RENDITION II/256V \$695
- 21" FST COLOR DISPLAY \$995

ADVANCED FEATURES INCLUDE:

- ◆ Intel 80486 Processor with Integrated 8K Cache & Math Coprocessor
- ◆ 8MB of High Speed 32-Bit RAM
- ◆ 64K High Speed Static RAM Cache
- ◆ 210MB Fast Access Hard Drive
- ◆ 1.2MB 5.25-inch Floppy Drive
- ◆ 1.44MB 3.5-inch Floppy Drive
- ◆ 16-Bit SVGA Card with 1MB RAM
 - ◆ 17" Non-Interlaced 1024 x 768 FST Color Monitor
 - ◆ Microsoft DOS 5.0
- ◆ Panacea CAD Display List Driver
- ◆ Quality 101-Key Tactile Keyboard
- ◆ Two Serial Ports & One Parallel Port
 - ◆ 12"x12" Digitizer with Cursor
 - ◆ FastCAD Design and Drafting Software – A \$795 Value

"Tri-Star is king of the 33MHz 486 Mountain."

PC WEEK
Analyst's Choice
February 18, 1991

Circle 312 on Inquiry Card.

ALL TRI-CAD COMPUTER SYSTEMS INCLUDE:

- ◆ 2 Year Parts & Labor Warranty
- ◆ 60 Day Money Back Guarantee
- ◆ 12 Month On-Site Service
- ◆ Overnight Parts Replacement
- ◆ Lifetime Toll-Free Technical Support

All prices and specifications subject to change without notice. We accept MasterCard, Visa & Discover (No Surcharge), AMEX (3% Surcharge), or COD. University & Corporate PO's are welcome. (1%10, net 25). Money back guarantee does not include shipping charges. On-Site service available in most U.S. locations. 2 Year Warranty includes system and keyboard; non-Tri-Star assembled peripheral items such as printers and monitors are covered for 1 Year. All systems have been verified or certified to comply with part 15 of the FCC rules for a Class A or Class B computing device. FCC Class A systems not intended for home use. FastCAD is a registered trademark of Evolution Computing. 386 & 486 are trademarks of The Intel Corporation. Product names mentioned herein may be trademarks and/or registered trademarks of their respective companies.

TRI-STAR
COMPUTER CORPORATION

1.800.678-2799

707 West Geneva, Tempe, Arizona 85282

Tech Support 1.800.688-TECH

Telephone 602.829-0584

Fax 602.345-0110

Monday - Friday 6:00am-6:00pm PST

Saturday 8:00am-3:00pm PST

Why your next should be a

Graphical computing is the way the world is going. The editorials agree. The industry pundits agree. Even our competitors' ads agree.

The kind of computing Apple® Macintosh® personal computers first made popular back in 1984 is the way a computer should work.

But with a head start of several years, a long history of innovation and an architecture optimized for graphical computing from the very beginning, Macintosh remains the definitive form of graphical computing.

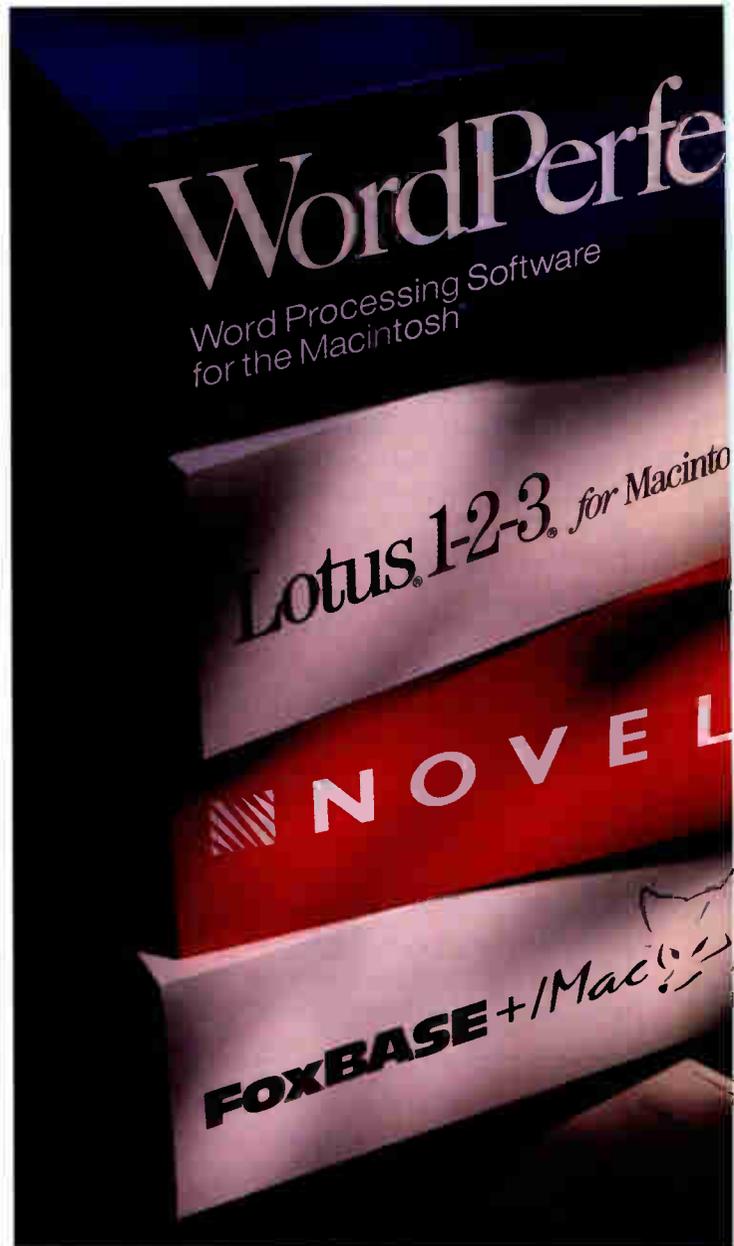
And now, with new Macintosh versions of some of the most popular DOS programs, you can have all the benefits of a Macintosh without sacrificing any of your investment in MS-DOS PCs, applications and data.

Take Lotus 1-2-3 for Macintosh. It's a whole new kind of Lotus 1-2-3 created expressly for Macintosh. The editor of the industry newsletter *Softletter* calls it nothing short of "a design triumph."

It has the power you expect from the world's most popular spreadsheet. Plus exciting new features like the flexibility to directly manipulate data, text and graphics all in the same file. And a new level of charting, graphing and drawing capability that's unique to Macintosh. (And it's fully compatible with all other versions of 1-2-3.)

Or consider the new WordPerfect for Macintosh. Its compact, easy-to-understand menus and streamlined dialog boxes give you easy access to all the features you're used to from the leading word processor, along with some exciting new capabilities added just for Macintosh.

For example, a graphics and drawing package is built



For more information about Lotus 1-2-3, call 800-TRADEUP, ext. 6007. About FoxBASE+/Mac, call 800-837-FOX2. About WordPerfect, call

© 1991 Apple Computer, Inc. Apple, the Apple logo, Mac, Macintosh and "The power to be your best" are registered trademarks, and SuperDrive is a trademark of Apple Computer, Inc. Lotus 1-2-3 for Macintosh will be available in fall 1991. Lotus and 1-2-3 are registered trademarks of Lotus Development Corp. UNIX is a registered trademark of Unix System Laboratories, Inc. OS/2 is a registered trademark of International Business Machines Corp. dBASE is a registered trademark of New Era Software, Inc. Mention of third party products is for informational purposes only.

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.

There's even Novell NetWare for Macintosh, which connects Mac[®] into the most popular PC networking software in the world today. It lets you take advantage of the networking capabilities built into every Macintosh personal computer to integrate with virtually any other operating system: MS-DOS, Windows, OS/2 and even UNIX and SNA environments.

All these programs take advantage of the built-in Apple SuperDrive™ disk drive to let you easily exchange information between your MS-DOS PCs and Macintosh computers on a standard 3½" floppy disk.

Like all Macintosh programs, they let you copy work you've done from one and paste it into another, so their combined power is even greater.

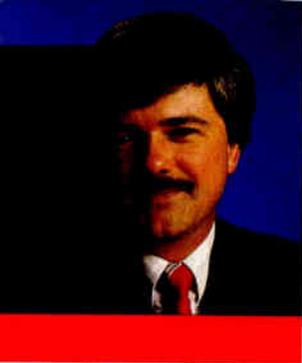
For more information on all these programs, see the phone numbers listed below. Or visit the authorized Apple reseller nearest you.

You'll discover that Macintosh may be the most powerful, flexible, affordable DOS computer you can buy today. The computer with the power you really want. The power to be your best.®



800-526-7820. About NetWare, call 800-NETWARE. For the name of the authorized Apple reseller near you, call 800-538-9696, ext. 825.

Lotus Development Corporation, FoxBASE+ and FoxBASE+/Mac are registered trademarks of Fox Software, Inc. WordPerfect is a registered trademark of WordPerfect Corp. NetWare is a registered trademark of Novell, Inc. MS-DOS is a registered trademark and Windows is a trademark only. All product specifications and descriptions were supplied by the respective vendor or supplier. All understandings, agreements or warranties, if any, take place directly between the vendors and the prospective users. This ad was created using Macintosh personal computers.



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.

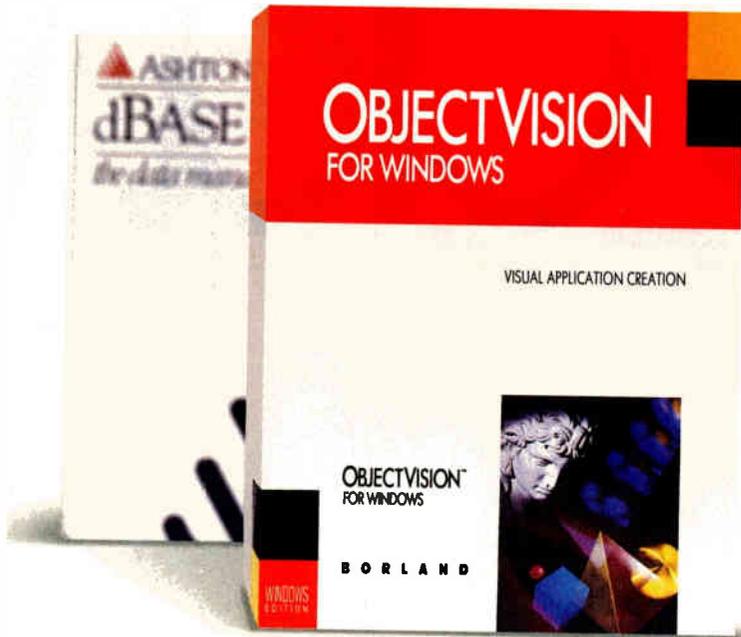
But if you need space, don't wait: Any memory management software is better than no memory management software; and almost all software is better than the relatively primitive tools supplied with DOS 5.0.

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

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

dWindows!

(from Borland)



Borland's new ObjectVision™ lets you create Windows applications that directly access dBASE files. Now it's easy to get the graphical Windows environment you want *and* access to your dBASE files. And developing ObjectVision applications is fast because there is *no programming required*.

ObjectVision transparently connects to all of your corporate data including Paradox,® Btrieve and ASCII files, as well as to other Windows applications via DDE. You can even access Paradox and dBASE files in the same multiuser environment making it the ideal Windows front end for all your data.

ObjectVision.

The power of visual programming.

Creating an attractive forms user interface is easy using ObjectVision's visual programming. You simply draw the elements of your application on the screen using ObjectVision's WYSIWYG graphical tool. Add the program's underlying logic by drawing intuitive decision trees. Then, as simple as a mouse click, create data links to connect the fields in your

application with the fields in your database. It's that simple. And that powerful.

All of ObjectVision's applications are developed incrementally, like a spreadsheet. So when you add new logic, or modify an object, you see results *instantly*. There's no waiting through an edit/compile/test cycle.

No extra royalty fees with ObjectVision Runtime!

For a one-time price of \$495 you can take advantage of ObjectVision Runtime (sold separately). Runtime allows you to develop and distribute ObjectVision Windows applications to an unlimited number of users. All without extra royalties!

DOFFER!

Now, for a limited time* you can buy ObjectVision for ONLY \$99⁹⁵ (a tremendous savings off the \$495 list). And it comes with our standard 60-day, money-back guarantee. You risk nothing. **See your dealer** or call **1-800-331-0877** today.

B O R L A N D
Software Craftsmanship

CODE: MV48

*Offer good until September 30, 1991. Pricing is in U.S. dollars. Dealer prices may vary. Offer good in U.S. and Canada only. Copyright © 1991 Borland. 1800 Green Hills Road, P.O. Box 660001, Scotts Valley, CA 95067 BI 1411

Circle 46 on Inquiry Card (RESELLERS: 47).
World Radio History

Déjà Vu

THE NEW COMPAQ DESKPRO 486/50L.

Seems we've been here before. Once again, the most powerful PC you can buy—in fact, the most powerful in existence—comes from Compaq.

The new COMPAQ DESKPRO 486/50L Personal Computer has everything for the most voracious power users, and for intensely

demanding networks. It has Intel's fastest, most powerful microprocessor—the 50-MHz 486 (more than 50% faster than the 33-MHz 486). A second-level cache so big (256 Kbytes) that 99% of the time, the data you need will be instantly accessible. A more-than-generous 8 megabytes standard RAM. Superfast 12-ms

fixed disk drives for superfast access to stored data. Advanced VGA graphics. Plus a full complement of EISA 32-bit bus master expansion slots. It's COMPAQ FLEX Architecture at its finest, providing the speed and performance that power users crave.

Who's it for? Designers and engineers longing to stretch CAD/CAE to its limits. Software developers who want compilation

room.



without limitation. Scientists who seek accelerated analysis. Anyone who wants to push Windows wide open and watch graphics-based applications fly.

What's good for one power user is also ideal for a group. Exceptional processing speed, expandability, and practically limitless storage (more than 20 GB) make it an extraordinary network server and multiuser host.

But doing something this new and exciting isn't new to us. Compaq has a history of building the top-performing PCs in their class. With the highest standards of reliability (to save you money) and compatibility (to save you headaches). And outstanding support.

The Compaq Customer Support Center at 1-800-345-1518 puts you in touch with Compaq technical experts who can

complement your dealer's know-how.

For details and the location of your nearest Authorized COMPAQ Computer Dealer, call 1-800-231-0900, Operator 164. In Canada, 1-800-263-5868, Operator 164.

COMPAQ

It simply works better.

BYTE

EDITOR IN CHIEF
Frederic S. Langa

EXECUTIVE EDITORS

New York: Rich Malloy
Peterborough: Michael Nadeau

MANAGING EDITOR
Anne Fischer Lent

ASSISTANT MANAGING EDITOR
Lauren A. Sticker

NEWS

New York:
News Editor: Andrew Reinhardt
Peterborough:
Sr. Ed., Microbytes: D. Barker
Sr. Ed., New Products: Stan Miastkowski
Associate News Editors, What's New: David Andrews, Martha Hicks, Carol Swartz
Editorial Assistant: Amanda Waterfield
San Francisco:
Bureau Chief: Kenneth M. Sheldon
Sr. News Editor: Owen Linderholm
Associate News Editor: Ellen Ullman
Editorial Assistant: David Silverman
UK/Europe: Bureau Chief: Andrew Redfern

BYTE LAB

Senior Editor: Dennis Allen
Technical Director: Rick Grehan
Technical Editors: Stephen Apikl, Alan Joch, Robert Mitchell, Tom Yager
Testing Editors/Engineers: Stanford Diehl, Howard Eglowstein, Stanley Wozla
Lab Assistant: Selinda Chiquoine

STATE OF THE ART

Technical Editor: Robert M. Ryan

FEATURES

Technical Editors: Janet J. Barron, Ben Smith

SENIOR TECHNICAL EDITORS, AT LARGE
Tom Thompson, Jon Udell

SPECIAL PROJECTS

Senior Editor: Gene Smarte

SENIOR CONTRIBUTING EDITOR

Jerry Pournelle

CONTRIBUTING EDITORS

Roger C. Alford, Don Crabb, David Fiedler, Martin Heiler, Hugh Kenner, Wayne Rash Jr.

CONSULTING EDITORS

Jonathan Amsterdam, Nick Baran, Laurence H. Loeb, Trevor Marshall, Mark J. Minasi, Barry Nance, Dick Pountain, Phillip Robinson, Peter Warner

ASSOCIATE TECHNICAL EDITORS

Eden Bingham, Susan Colwell, Jeff Edmonds, Tom Kevan, Cathy Kingery, Margaret A. Richard, Warren Williamson

EDITORIAL ASSISTANTS

Office Manager: Peggy Dunham
Assistants: Linda C. Ryan, June Sheldon

DESIGN

Director: Nancy Rice
Associate Director: Joseph A. Gallagher
Designer: Jan Muller
Assistant Designer: Rebecca Magill
Technical Artist: Alan Easton

OPERATIONS AND FINANCE

Director: Claudia Flowers

OPERATIONS

Director: David M. Cohen

Production Director: David R. Anderson
Senior Editorial Production Coordinator: Virginia Reardon
Editorial Production Coordinators: Barbara Busenbark, Denise Chartrand
Systems Manager: Sherry Fliske
Applications Manager: Donna Sweeney
Typesetter: Christa Patterson

Advertising Services Manager: Linda Fluhr

Senior Advertising Services Representative: Lyda Clark
Advertising Services Representative: Dale J. Christensen
Materials Representative: Karen Kingley
Creative Services Mgr: Susan Cinsbury
Production Artist: Lillian J. Wise
Production Coordinator: Rod Holden
Quality Control Manager: Wai-Chiu Li
Operations Assistant: Christine Tourgee
Advertising Services Assistant: Roxanne Hollenbeck

FINANCE

Business Manager: Kenneth A. King
Assistants: Marilyn Parker, Diane Henry, JoAnn Walter, Jeanne Gatcombe, Jaime Huber, Agnes Perry

MARKETING AND PLANNING

Director: L. Bradley Browne
Marketing Communications Manager: Pamela Petrakos
Public Relations Mgr: Dawn Matthews
Asst. Promotion Manager: Lisa Jo Steiner
Marketing Art Dir.: Stephanie Wamesky
Associate Art Director: Sharon Price
Sr. Research Analyst: Julie Perron
Copyrights Coordinator: Faith Kluntz
Reader Service: Cynthia Sands
Marketing Assistant: Carol Sanchioni

CIRCULATION

Director: Glyn Standen
Subscriptions Manager: Paul Ruess
Subscriptions Assistant: Holly Zilling
Newsstand Manager: Vicki Weston
Distribution Coordinator: Karen Desroches
Back Issues: Louise Menegus
Direct Accounts Coordinator: Ellen Dunbar

PUBLISHER
Ronald W. Evans

Publisher's Assistant: Donna Nordlund

ADVERTISING SALES

Associate Publisher/Vice President of Marketing: Steven M. Vito
Administrative Assistant: Carol Cochran
Eastern Advertising Director: Arthur H. Kossack (312) 616-3341
Western Advertising Director: Jennifer L. Bartel (214) 701-8496

NEW ENGLAND
Daniel D. Savage (617) 860-6344

EAST COAST
Kim Norris (212) 512-2645
Ariane Casey (212) 512-2368

SOUTHEAST
John Schilin (404) 843-4782

MIDWEST
Kurt Kelley (312) 616-3328

SOUTHWEST, ROCKY MOUNTAIN
Alison Keenan (414) 701-8496

SOUTH PACIFIC
Ron Cordek (714) 753-8140
Alan El Faye (213) 490-5243

NORTH PACIFIC
Bill McAfee (408) 879-0361
Roy J. Kops (415) 954-6728
Leslie Hupp (408) 879-0361

INSIDE ADVERTISING SALES
Director: Liz Coymann (603) 924-2516
Assts.: Susan Monkton, Vivian Bernier

NATIONAL ADVERTISING SALES
Mary Ann Goulding (603) 924-2664
Patricia Payne (603) 924-2654
Jon Sawyer (603) 924-2665
Barry Echavarria (603) 924-2574

BYTE BITS (2x3)
Mark Stone (603) 924-2695

THE BUYER'S MART (1x2)
Joseph Mabe (603) 924-2656

CATALOG SHOWCASE/INT'L CARDS
Ellen Perham (603) 924-2598

REGIONAL ADVERTISING SECTIONS
Brian Higgins (603) 924-2651
Barry Echavarria (603) 924-2574
Larry Levine (603) 924-2637

BYTE DECK
Ed Ware (603) 924-2596

EURO-DECK
James Ball (603) 924-2533

INTERNATIONAL ADVERTISING SALES STAFF
See listing on page 385.

PERSONNEL

Human Resources Admin.: Patricia Burke
Assistant: Fran Wozniak
Receptionist: Beverly Goss

HOW TO CONTACT THE EDITORS

HOW TO CONTACT THE EDITORS
We welcome your questions, comments, complaints, kudos, and submissions.

MAIN OFFICE: One Phoenix Mill Lane, Peterborough, NH 03458, (603) 924-9261.
WEST COAST: 425 Battery St., San Francisco, CA 94111, (415) 954-9718; 15635 Alton Pkwy., Suite 290, Irvine, CA 92718, (714) 753-8140.

NEW YORK: 1221 Avenue of the Americas, New York, NY 10020, (212) 512-3175.

UK/EUROPE: Wimbledon Bridge House, One Hartfield Rd., Wimbledon, London SW19 3FU, England, 011-44-81-543-1234.

ELECTRONIC MAIL: On BIX, send to "editors." All BYTE editors and columnists also have individual mailboxes on BIX for easy access.

MCI: 250-0135 BYTE Magazine. Many editors also have individual MCI addresses in their own name.

OTHERS: Many editors also are reachable through uunet, AppleLink, CompuServe, and numerous other services.

U.S. fax: Editorial: (603) 924-2550
Advertising: (603) 924-7507

SUBMISSIONS

SUBMISSIONS
Authors: We welcome article proposals and submissions. Unacceptable manuscripts will be returned if accompanied by sufficient return postage. Not responsible for lost manuscripts or photos.

Vendors: We welcome news of your new products; please call the News department or the BYTE Lab at the earliest possible date. We cannot be responsible for unsolicited product samples.

SUBSCRIPTION CUSTOMER SERVICE
Outside U.S. (609) 426-7676; inside U.S. (800) 232-BYTE. For a new subscription—(800) 257-9402 U.S. only, or write to BYTE Subscription Dept., P.O. Box 555, Hightstown, NJ 08520. Subscriptions are \$29.95 for one year, \$54.95 for two years, and \$74.95 for three years in the U.S. and its possessions. In Canada and Mexico, \$34.95 for one year, \$64.95 for two years, \$87.95 for three years. In Europe, £29 (U.S. \$50) for fast surface delivery, £41 (U.S. \$70) for air delivery. All other countries, U.S. \$150 for air mail delivery only. Single copy price is \$3.50 in the U.S. and its possessions, \$4.50 in Canada. Foreign subscriptions and sales should be remitted in U.S. funds drawn on a U.S. bank. Please allow six to eight weeks for delivery of first issue.

PHOTOCOPIY PERMISSION:

Where necessary, permission is granted by the copyright owner for those registered with the Copyright Clearance Center (CCC), 27 Congress St., Salem, MA 01970, to photocopy any article herein for personal or internal reference use only for the flat fee of \$1.50 per copy of the article or any part thereof. Correspondence and payment should be sent directly to the CCC, 27 Congress St., Salem, MA 01970. Specify ISSN 0360-5280/91, \$1.50. Copying done for other than personal or internal reference use without the permission of McGraw-Hill, Inc., is prohibited. Requests for special permission or bulk orders should be addressed to the publisher. BYTE is available in microform from University Microfilms International, 300 North Zeeb Rd., Dept. PR, Ann Arbor, MI 48106, or 18 Bedford Row, Dept. PR, London WC1R 4EJ, U.K.

Copyright © 1991 by McGraw-Hill, Inc. All rights reserved. BYTE and BIX are registered trademarks of McGraw-Hill, Inc. Trademark registered in the United States Patent and Trademark Office.



Member

BIX BYTE INFORMATION EXCHANGE

DIRECTOR
Stephen M. Laliberte

BUSINESS AND MARKETING
Secretary: Patricia Bausum
Marketing Services Coordinator: Denise A. Greene
Billing Services Coordinators: Tammy Burgess, Donna Healy
Editorial Assistant: Brian Warnock

TECHNOLOGY
Programmer/Analyst: John Spadafora
Systems Consultant: Gary Kendall

EXCHANGE EDITORS
Amiga Exchange: Joanne Dow;
Entertainment and Leisure Exchange: Rich Taylor;
IBM Exchange: Barry Nance;
Macintosh Exchange: Laurence H. Loeb;
Programmers Exchange: Bill Nicholls;
Professionals Exchange: David Reed;
Tojerry Exchange: Jerry Pournelle;
Writers Exchange: Wayne Rash Jr.

BIX, the "BYTE Information Exchange," is a worldwide, low-cost, on-line information service featuring industry news, downloadable software, powerful electronic mail, previews of upcoming BYTE articles, the full text of published issues of BYTE, and source and/or executable code for BYTE benchmarks and noncommercial software mentioned in feature articles. BIX also offers unmatched "conferences" on virtually every computer-related topic imaginable, where you can share information with thousands of other computer pros. To subscribe via modem, set your communications software to full duplex, 7 bits, even parity, 1 stop bit, and then call 800-225-4129; in MA, call (617) 861-9787. International, call NU1310690157800. Then hit the Enter/Return key and enter "BIX" when asked to log in; then enter "BIX.VILLE" when asked for a name. For current fees and more information, call (800) 227-2983 or (603) 924-7681 on voice phone.

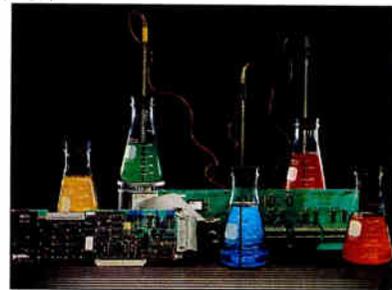
DEMOLINK

BYTE program listings are available at (617) 861-9787 (set modem at 8-1-N, 2400 or 1200 bps). Enter Demolink.

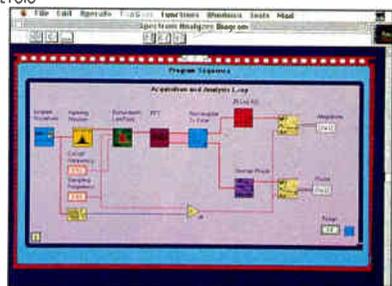
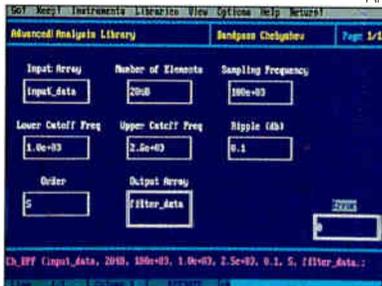
OFFICERS OF MCGRAW-HILL, INC.:

Chairman, President and Chief Executive Officer: Joseph L. Dionne, Executive Vice President, General Counsel and Secretary: Robert N. Landes, Executive Vice President; Walter D. Sarwatka, Senior Vice President, Treasury Operations; Frank D. Penglase, Executive Vice President and Chief Financial Officer; Robert J. Bahash, Executive Vice President, Administration; Thomas J. Sullivan, Senior Vice President, Corporate Affairs, and Executive Assistant to the Chairman: Mary A. Cooper, Senior Vice President, Editorial; Ralph R. Schulz.

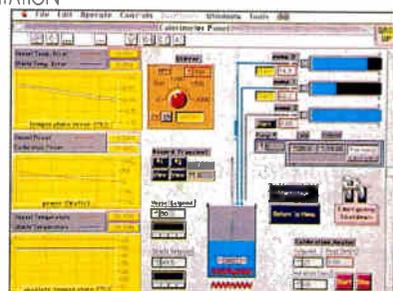
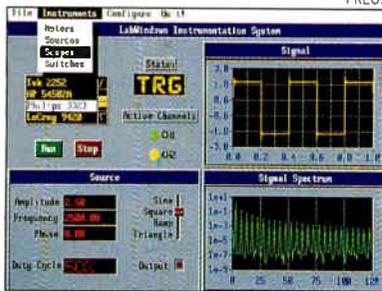
ACQUISITION



ANALYSIS



PRESENTATION



We've given you the best of both worlds...

LabWindows® 2.0
for DOS-based computers

LabVIEW® 2
for Macintosh computers

All You Have To Do Is Choose!

In the 1980s, National Instruments pioneered two paths to the future of instrumentation. LabWindows, an automatic code generation and program development system for the C and BASIC programmer. And LabVIEW, the first graphical programming system to offer ease of use without sacrificing programming flexibility and performance.

LabWindows and LabVIEW address all of your instrumentation needs. You can control GPIB, VXI, and RS-232 instruments, and plug-in data acquisition boards. You can integrate data analysis. And, you can build your own graphical user interfaces.

Today, LabWindows and LabVIEW are leading the revolution in instrumentation software. Through innovative programming methodologies and powerful development tools, LabWindows and LabVIEW are paving two paths to the future—a future in which *The Software is the Instrument*. All you have to do is choose!

Call for your free demo disks (512) 794-0100 or (800) 433-3488 (U.S. and Canada).



6504 Bridge Point Parkway
Austin, TX 78730-5039

Australia (03) 879 9422 • Denmark (45) 76 73 22 • France (1) 48 65 33 70 • Germany (089) 714 5293
Italy (02) 4830 1892 • Japan (03) 3788 1921 • Netherlands (01720) 45761 • Norway (03) 846 856
Spain (908) 604 304 • Switzerland (056) 45 58 80 • U.K. (0635) 523 545

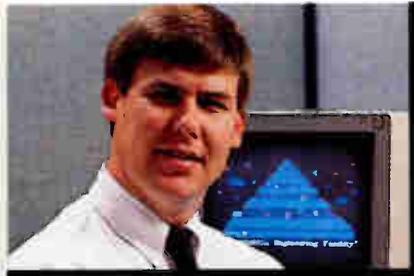
Product names listed are trademarks of their respective manufacturers. Company names listed are trademarks or trade names of their respective companies.
© Copyright 1991 National Instruments Corporation. All rights reserved.

The IEF™ can help you develop unprecedented quality, productivity



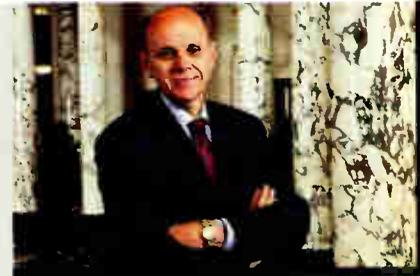
"The IEF is a superior tool for implementing Information Engineering because it integrates the entire process from planning through code generation. We're deploying the IEF throughout the corporation."

David V. Evans
Vice President
Director, Information Systems
J.C. Penney



"Our On-line Banking system has been in production for more than 12 months—500,000 transactions a day—without a single code failure. And we had very few enhancements to do. Our users got what they needed the first time out."

Mark Quinlan
Senior Programmer/Analyst
Huntington National Bank



"To meet the dramatically reduced time-to-market requirements for our products, we need high-quality systems that can be changed fast. That's why we've chosen the IEF as the CASE solution for our entire organization."

John Pajak
Executive Vice President
Mass Mutual Life Insurance



"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."

Paul R. Hessinger
Chief Technology Officer
Computer Task Group



"I've seen other CASE tools fail, so I raised the bar high when we evaluated the IEF. It passed with flying colors. I could not be happier with my decision to adopt the IEF company-wide."

John F. Mott
President
AMR Travel Services



"Our users were extremely pleased when we finished our first project—a 60-transaction system—in one-half the budgeted time. We had tried interfaced CASE tools without success. IEF integration makes the difference."

Giorgio Sorani
Division Head – MIS
Lubrizol



"We are using the IEF to develop a new generation of manufacturing systems replacing over 300 existing systems. We estimate that IEF will increase our productivity by between 2-to-1 and 3-to-1 for new systems development."

Wal Budzynski
Head of Operations, Systems/Computing
Rolls-Royce



"The IEF offers dramatic improvements in productivity, yet it's easy to learn. One example: We trained 23 developers, including 18 new hires, and then completed a large order processing system—300 transactions—all in only 20 months."

Venkat (Vinnie) Tiruvilumala
Director, CPC/PPC Information Systems
SONY Corporation



"Our first IEF system was completed faster, and with fewer errors, than any system I've ever seen. If I had to go back to the old ways, I'd find another job...outside the DP world. It means that much to me."

Mogens Sorensen
Chief Consultant
Nykredit (Denmark)

Open information systems with activity and maintainability.

The success of Texas Instruments CASE product is proven—in the field.

Major companies have used TI's CASE product, the Information Engineering Facility™ (IEF™), for everything from rebuilding aging high-maintenance-cost systems to development of new enterprise-wide strategic systems.

Study shows zero code defects.

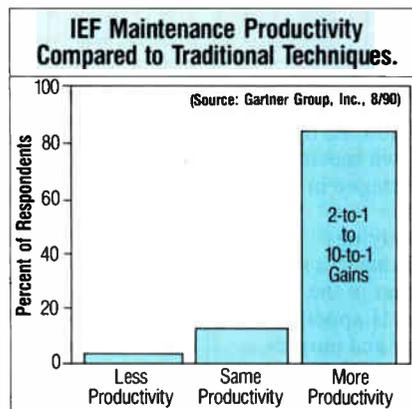
The quality of IEF-developed systems is remarkable. In recent CASE research by The Gartner Group, application developers were asked to report the number of abends they had experienced. (An "abend" is a system failure or "lock-up" caused by code defects.) *IEF developers reported zero defects—not one abend had occurred in IEF-generated code.*

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.

Mainframe applications can be developed and tested on a PC.

With our new OS/2 toolset, you can develop mainframe applications, from analysis through automatic code generation, on your PC. Then, using the IEF's TP monitor simulator and the diagram-level testing feature, you can also test these mainframe applications without ever leaving the PC.

More environmental independence coming—develop on PC, generate for DEC/VMS, TANDEM, UNIX.

The IEF has generated applications for IBM mainframe environments (MVS/DB2 under TSO, IMS/DC, and CICS) since early 1988. Soon you'll be able to develop systems in OS/2 and then automatically generate for other platforms. DEC/VMS, TANDEM and UNIX are scheduled for availability in 1991. More will

follow. We are committed to increased environmental independence in support of the Open Systems concept.

We are committed to standards.

IEF tools and IEF-generated code will comply with standards as they emerge. We will adhere to CUA standards and to the principles of IBM's AD/Cycle and DEC's COHESION—and we will support Open Systems environments centering around UNIX. In any environment, the COBOL, C and SQL we generate adhere closely to ANSI standards. Our presence on standards committees helps us keep abreast of ANSI and ISO developments affecting the CASE world.

Full-service support.

Of course, our technical support, consultancy, training courses, satellite seminars, and other informational assistance will continue apace. We also offer re-engineering and template services. This full-service support will remain an integral part of the IEF product.

For more information call 800-527-3500 or 214-575-4404.

Or write Texas Instruments, 6550 Chase Oaks Blvd., Plano, Texas 75023.

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.

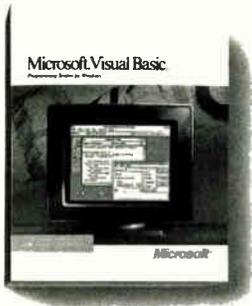
George A. Pohl
Oneida, NY

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



Visual Basic inspires experts to use strong language.

“Visual Basic surpasses all other tools... Visual Basic is strikingly fast, and the applications it creates are equally responsive.”
– Peter Coffee, *PC Week Labs*
May 20, 1991

“It’s the best way we know to create applications for Windows... [Visual Basic] introduces a wholly new, effective style of programming that yields extremely fast development cycles... Visual Basic produces quick, small executables... an extraordinarily powerful and flexible tool.”
– J.D. Hildebrand, *Computer Language*
July 1991

“Visual Basic is a superb environment for developing full-blown Windows applications.”
– Joel Shore, *Computer Reseller News*
June 10, 1991

“Visual Basic will succeed as few products ever have... An incredible power tool for existing programmers of any level.”
– Steve Gibson, *InfoWorld*
May 27, 1991

“... the perfect user programming environment for the 1990s.”
– Stewart Alsop, *InfoWorld*
May 27, 1991

© 1991 Microsoft Corporation. All rights reserved. Printed in the U.S.A. For more information inside the 50 United States, call (800) 541-1261, Dept. T60. Customers in Canada, call (416) 568-3503. Outside the U.S. and Canada, call (206) 936-8661. Microsoft and the Microsoft logo are registered trademarks and Windows and Visual Basic are trademarks of Microsoft Corporation. PC Week quote reprinted from PC Week May 20, 1991. © 1991 Ziff Communications Company.

PROGRAMMER'S CHOICE

Key Features

- Fast, full-featured programming language.
- Create .EXE files with no royalty or runtime fee.
- Visual design tools for click-and-drag development of graphical applications.
- Sophisticated Windows-based applications can include all standard Windows controls, multiple windows, dialogs, custom menus, drag-and-drop, and programmatic graphics.
- Paste-link and programmable Dynamic Data Exchange (DDE).
- Support for Dynamic Link Libraries (DLLs).
- Online, context-sensitive Help.
- Detailed online tutorial.
- Sample code and full-featured example applications.
- Incorporate bitmap graphics, metafiles, and icons.
- Sophisticated debugging tools.



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

In October 1989, Cyrix delivered the world's best math coprocessor.

Now it appears we've also made all coprocessors more affordable.



PC Week
June 24, 1991

When Cyrix opened for business in 1988, we were considered more an upstart than a startup. Because much to the annoyance of the industry's then sole supplier, we created a math coprocessor for the PC standard that was more powerful than theirs.

Not surprisingly, they were not very happy. Because our presence in the market gave consumers a choice that, for the first time, might not be made in our competitor's favor. Cyrix prospered, and we became a successful company. So successful, in fact, that it appears our competitor has been forced to revise its pricing policy.

We at Cyrix welcome this move. Because like all the effects of competitive forces in a free market, we

believe the consumer ultimately benefits. And to this end, we're already at work designing the next generation of products that will allow consumers to achieve further enhancements in PC performance and productivity.

So if you're in the market for a math coprocessor, you should consider us as seriously as our competition does. And then buy the best. Buy Cyrix. Just call 1-800-FASMATH for more information or for the name of the dealer nearest you.

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.

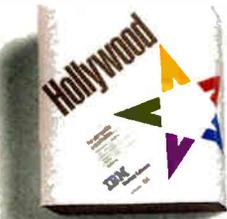
Richard N. Wisan
Oneonta, NY

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

Presenting Hollywood. It's where your idea can become a star.



Some presentation packages don't take your ideas very far. And even if they do, chances are pretty good it won't be exactly where you want to go.

PRESENTATIONS MADE SIMPLE.

But now there's Hollywood.™ A whole different kind of presentation tool that makes it easy for anybody to create complete presentations with real star quality. The steps are quick, simple—even

fun. First, Hollywood has an integrated outliner to help you organize your thoughts. Next, you select a look from a variety of exciting templates designed by professional graphic artists. Then Hollywood gives you an overview feature and lets you view and edit your entire presentation as a whole, not just page by page, so even sweeping changes aren't a big deal. And finally, you



can produce your award-winning output in any combination of slides, overheads or hard copy. Or for some real show biz, present it in a lively screen-show format.

Hollywood runs in the Windows™ 3.0 environment and gives you a supporting cast of fully scalable fonts, dynamic special effects, a comprehensive spellchecker and more. And because it's compatible with most popular graphics and spreadsheet software, importing and changing data is easy, too.



In Canada call 1 800 465-1234.

Take the first step. Try Hollywood and give your ideas the big break they deserve.

IBM is a registered trademark and Hollywood is a trademark of International Business Machines Corporation. Windows is a trademark of Microsoft Corporation ©1991 IBM Corp.

Circle 136 on Inquiry Card.

World Radio History



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. ■

IMPORTANT NEWS

ZEOS has just released a new line of HIGH PERFORMANCE, LOW COST computer systems. Based on upgradable CPUs, these new systems are absolutely incredible. Suggest you review this report right away.

**APPROVED
FOR RELEASE**

ZEOS Engineering Department
Specification Detail

Upgradable. High Performance. Low Cost. Unbelievable? Believe it! Because now ZEOS® gives it all to you in one complete package.

Starting complete with the ZEOS 386-25s at only \$1395 right thru '486-33 MHz systems starting at \$1795, computing will never be the same again! And it's not just the prices that make these new systems hot. It's Performance and Upgradability as well.

UPGRADABLE CPU

When we first sat down to design these new systems, we wanted computers that would *blow the doors off* anything else out there. Plus, we wanted you to be able to upgrade from one CPU to another as your computing requirements changed, *without having to buy an entirely new system*. The results?

Incredibly low cost, high performance systems so very advanced you can move freely from the '386 family of processors to the latest '486s all without a moment's hesitation.

Now, you can pick your power! Today *and* tomorrow. Choose from high speed '386-25 and 33MHz systems, either cached or non-cached, plus the '486SX and '486-33MHz with or without a secondary cache. Whichever you decide upon you



Upgradable.

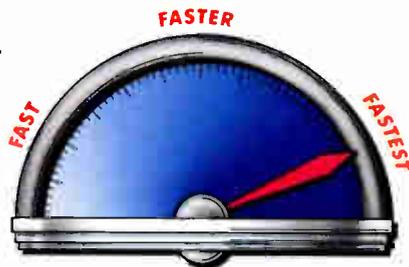
Hot New ZEOS '386



know that as your computing requirements change, your processing power can change as well. But are the prices really that good?

Yes. *Absolutely Yes!* The prices really *are* that good, and the quality too. Because when you buy from ZEOS you're buying directly from the manufacturer.

Starting with the main system board, your new computer is designed and built by us right here in Minnesota. That saves money for you. And your ZEOS factory direct advantages are evident not only in the price, but in the performance and quality of your system too.



Z • SPEED METER

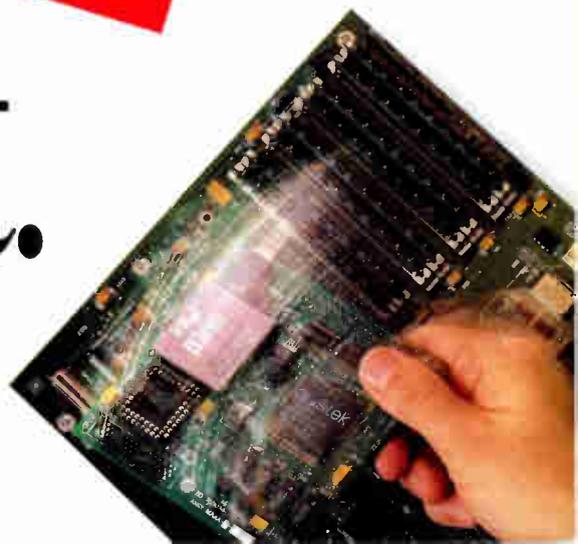
To help you select the processor option that's right for you, we have developed the Z-Meter. The Z-Meter shows you the relative performance gains achieved by moving from one processor module to another—fast, faster, fastest! No matter which system you select you can be sure of one thing—these babies are Hot!

So if you're looking for a high speed, upgradable, rock solid system supported like none other *and* you want incredibly low prices, you've found your company. And your computer. Read on!

This ZEOS ad reviews each of four money saving upgradable system packages based on processor type. Take your pick from these or allow us to custom build whatever you require. Be certain also to read the section entitled "Why ZEOS is Your #1 Choice!"

Low Cost.

and '486 systems!



ZEOS COMPLETE SYSTEM PACKAGE #1

- The Processor and Speed of your choice plus future upgradability!
- 1MB of High Speed 53ns DRAM, expandable to a system total of 32MB right on the motherboard.
- 42MB High Speed IDE hard drive with its own cache.
- 1.2 MB or 1.44 MB Teac® floppy drive.
- ZEOS 14" flat screen Hi-Res amber monitor with Tilt/Swivel base.
- Shadow RAM and EMS support for enhanced performance.
- ZEOS/RS 101 key SpaceSaver keyboard.
- Two Serial, one Parallel & one Game Port built right onto the motherboard.
- 7-16, 1-8 bit expansion slots. 80387 math co-processor support for '386 systems.
- Rugged ZEOS SpaceSaver case with twin cooling fans for added reliability and product life.
- Seven drive bays and our custom 300 Watt power supply for your future expansion!
- Includes ZEOS 24 Hour a Day Toll Free Technical Support and Customer Satisfaction package.

PACKAGE #1

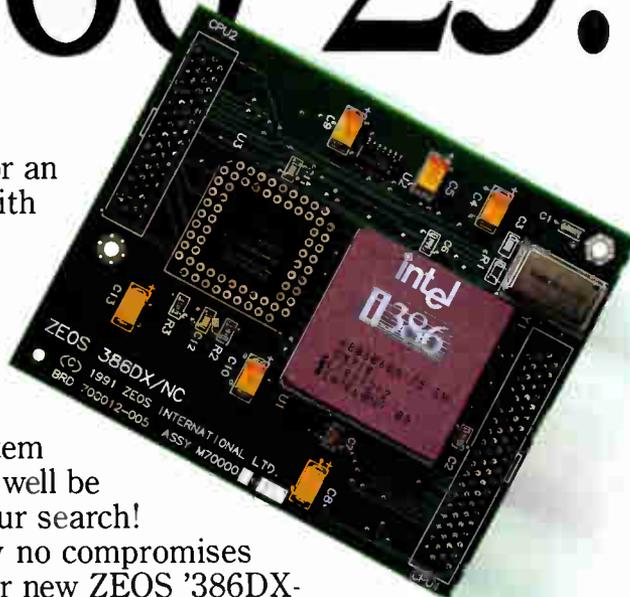
INCREDIBLE ZEOS PACKAGE #2

We take Package #1 and upgrade your ZEOS Modular System to include:

- 2 full Megabytes of Rip-roaring 53ns DRAM.
- Our incredible 85MB IDE hard drive with its own built in cache.
- Both the Teac® 1.2MB and 1.44 MB floppy drives.
- The awesome Diamond SpeedStar Plus VGA graphics card Complete with 1MB DRAM.
- ZEOS 14" High Res VGA Mono Monitor with Tilt & Swivel base.
- Microsoft® DOS plus Microsoft Windows plus a Microsoft Mouse.

PACKAGE #2

386-25!



If you're looking for an economical system with a lot of power, you'll definitely want to start by taking a good look at the amazing ZEOS 386-25.

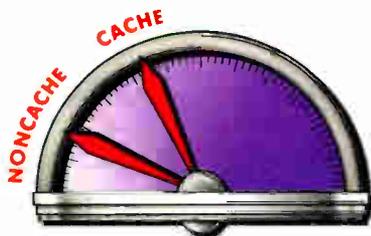
At only \$1,395 for our Complete System Package #1, this may well be the place you end your search! There are absolutely no compromises with this system. Your new ZEOS '386DX-25 is a full powered ZEOS system packing all the punch you'll need for virtually any desktop applications. Not only that, but your new ZEOS 386-25 also comes with all of your ZEOS *designed in* extras.

These extras start right with your own upgradable processor.

You have the power you need now *and* the ability to add more later!

Being able to upgrade processors helps protect your investment now and for a long time to come. That's ZEOS. And that's just for starters!

Perhaps the first thing you'll notice is your incredibly fast IDE hard drive. Designed for speed, yours will show everybody what speed is all about. As for floppy drives, we use only



Z-SPEED METER: ZEOS 386-25

The ZEOS 386-25 is perhaps the perfect desktop system. For even more power, add a blazing 128K Cache for only \$200!

genuine Teac®. They're the very best. It's quality you'll come to appreciate. You'll also like the fact that they both plug right into the motherboard, saving you an extra expansion slot. And when it comes to expansion, ZEOS is the winner once again!

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,

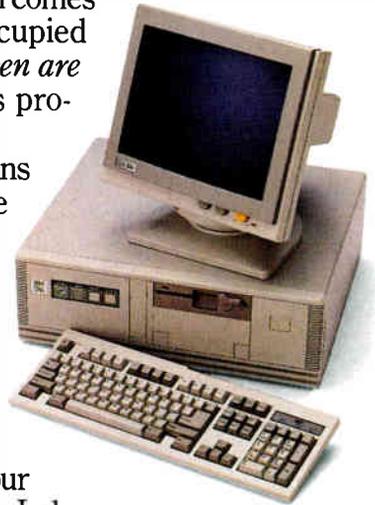
\$1,395

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.

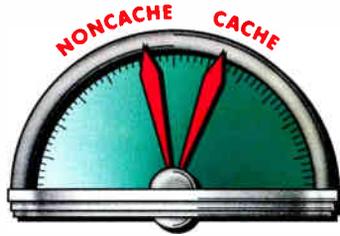
There are many advantages of selecting your new ZEOS 386-25. We've touched on a few of these advantages here while many more are discussed later in the section entitled "*Why ZEOS is your #1 Choice!*" Things like *24 Hour a Day Toll Free Technical Support*, our 30 day Money Back guarantee, warranties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

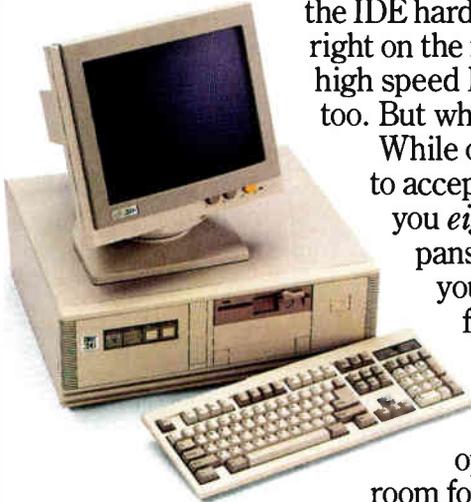
Using the very latest in surface mount and VLSI (Very Large Scale Integration) technologies, we have increased reliability, lowered costs and made room to do some other very special things. Like integrating the IDE hard disk and floppy drive interfaces right on the motherboard. We've put our high speed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

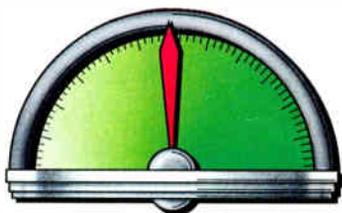
Consider performance and price, consider quality and service and support. Then choose from the systems here or let us add anything you wish from our huge list of available options. Whatever you select, it all comes down to this: The incredible ZEOS 386-33 is the *very best buy* for you. So why not give 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.

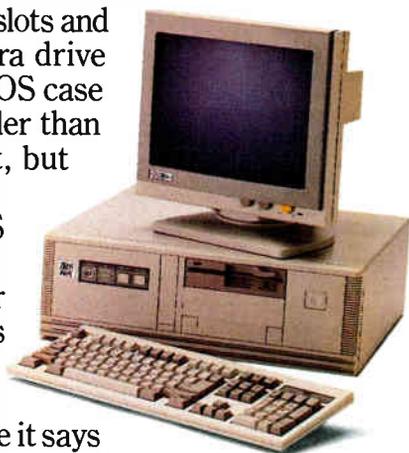
There are many reasons to buy your new ZEOS 486SX-20, not the least of which are Price, Performance and Quality.

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.

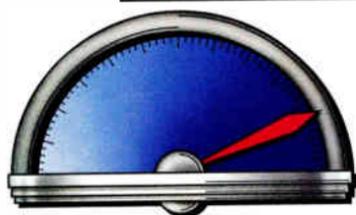
Price. Performance. Quality and Support. There are *many* reasons to buy your new ZEOS 486-33 system. Plus, your ZEOS advantages include *24 Hour a Day Toll Free Technical Support*, our *30 Day Money Back Guarantee* and ironclad warranties, just to name a few (for more ZEOS advantages see the section 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

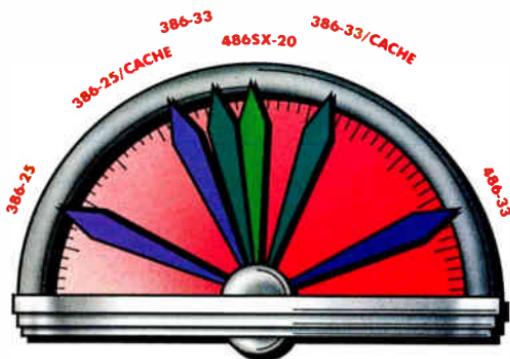
Now, ZEOS lets you pick the power you want for the price you want to pay! And with your new ZEOS modular system, the computer that's right for you today is also the computer that's right for you tomorrow.

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

**CALL NOW TOLL FREE
800-423-5891**

FAX Orders: 612-633-1325
Hearing Impaired (TDD):
800-228-5389

Govt. & Educ.: 800-245-2449
Outside US and Canada
Call: 612-633-6131

MasterCard, VISA, Discover,
Am Exp, Z-CARD, COD and
Leasing Programs.
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!*

FAX Orders Dial:
612-633-1325
In Minnesota Call:
612-633-4591
MasterCard, VISA,
Discover, AmEx,
Z-Card and COD
Open 24 Hours a
day, 365 Days a year.

Call Now Toll Free
800-423-5891



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.

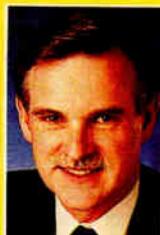
Future RISC-based Macs using a single-chip implementation of IBM's RISC System/6000 chip set. Single-chip implementation of the RISC System/6000, to be called Power PC, will be manufactured by Motorola. Apple and IBM will use the Power PC microprocessors in workstations and file servers.

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

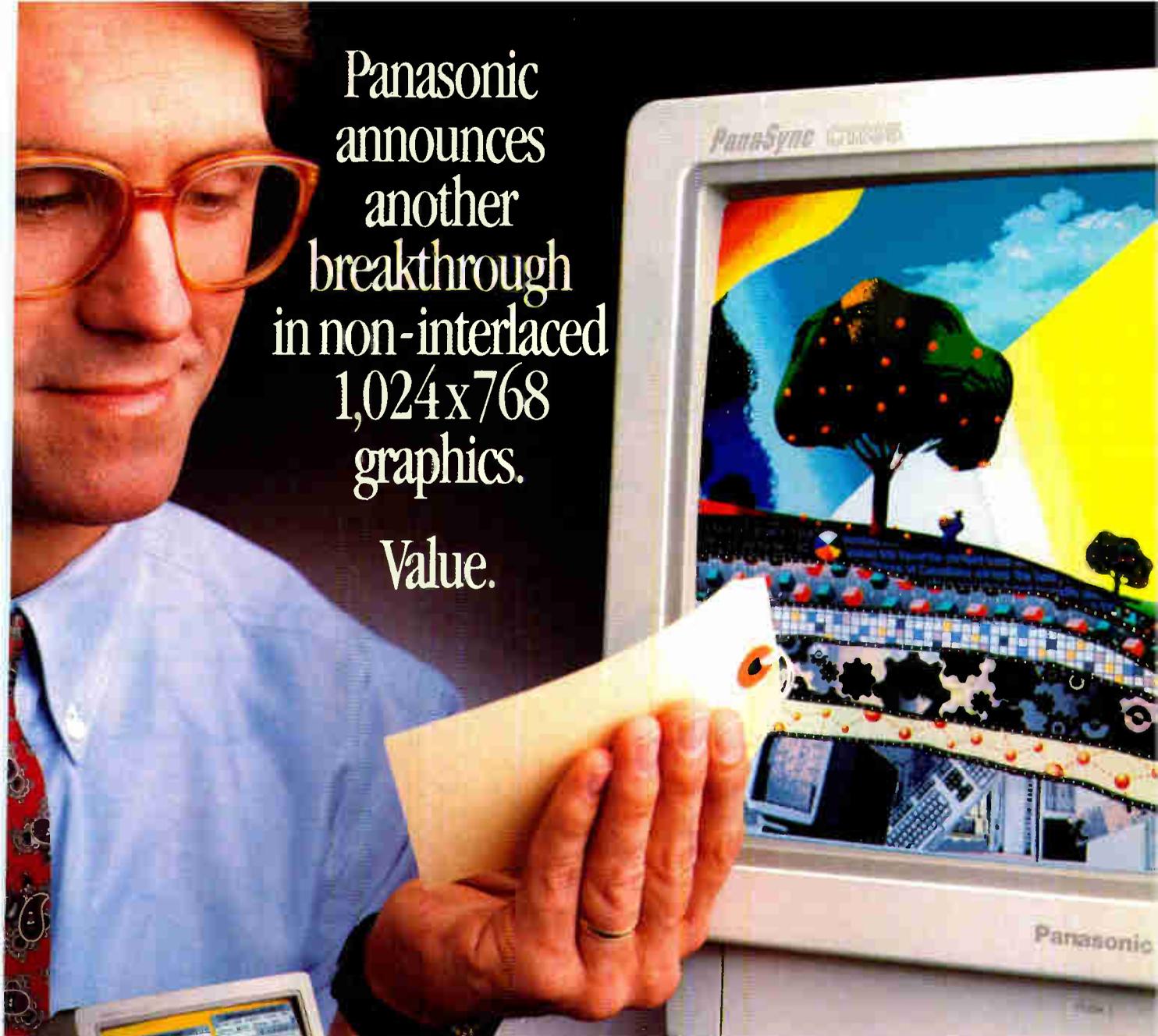
The most common reaction to the Borland buy-up of Ashton-Tate was **astonishment at the price tag** of \$440 million. Lotus senior vice president **Frank King** said that he was "surprised at the price Borland paid for technology that wasn't very modern," especially considering that Borland has its own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



Panasonic
announces
another
breakthrough
in non-interlaced
1,024x768
graphics.

Value.



If you thought you'd have to compromise on your next High Resolution monitor, think again. With its new 14" PanaSync™ C1395, Panasonic® brings all the compelling clarity and richness of non-interlaced graphics within reach.

Turn it on, and you'll see your most graphics-intensive applications in a whole new light. Compared to interlaced monitors, images will be sharper, edges cleaner, details finer. With noticeably less flicker. Because now you're getting the whole picture, not just every other line. And the C1395 is as easy on your eyes as it is on your wallet.

Like all Panasonic monitors, the C1395 has excellent ergonomics. Controls are front-mounted, and a tilt-swivel stand is included.

So, whether your desktop is MS-DOS, a MAC II* or one of the other leading workstations, before you spend several hundred dollars more on a new monitor, spend a few minutes at your authorized Panasonic dealer. He'll show you that value has never looked so good.

For further information on the PanaSync C1395 Multi-Frequency Monitor, telephone 1-800-742-8086.

*MAC II is a registered trademark of Apple Computer, Inc.
An optional cable is required for Macintosh, the C81M2.

*Monitors, Computers, Peripherals, Printers,
Copiers, Typewriters & Facsimiles*

Panasonic
Office Automation 

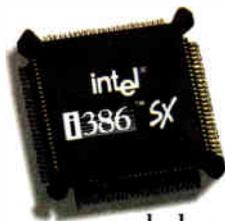
Engineered for the office. Designed for people.

Circle 220 on Inquiry Card.

A true of power, and

*Current DOS users can purchase a 5.0 upgrade package. To order your version of DOS 5.0, see your IBM Authorized Remarketer, or call 1 800 IBM-7699 to order a single copy. IBM, Personal System/2 and PS/2 are registered trademarks and Micro Channel is a trademark of International Business Machines Corporation. 386 is a trademark of Intel Corp. ©1991 IBM Corp.

story fame SX.



Right from the start, the IBM PS/2® Model 55 SX hit the bestseller list, making it the leading i386™ SX machine. And now IBM is opening a whole new chapter with 386 SX 20 MHz models designed to meet your needs.

The Personal System/2® Model 57 SX brings new levels of value to a Micro Channel™ PS/2, providing data integrity and increased performance for multitasking and networking. Standard 4MB RAM is upgradable to 16MB, 80 or 160MB hardfiles are available, and five expansion slots/four DASD bays offer true flexibility and expandability. Our two newest AT-bus PS/2s deliver powerful performance at practical prices. Models 40 SX and 35 SX have 2MB RAM upgradable to 16MB and fast 40 or 80MB hardfiles.

The 40 SX has five slots/four bays, while the 35 SX packs its power into a smaller footprint.

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.

To get the full story, including our "PC Trade-In Offer," contact your IBM Authorized Remarketer or IBM marketing representative. For a remarketer near you, call 1 800 272-3438, ext. 386.



How're you
going to do it?
PS/2 it!



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. □

The Pros Rate SuperCalc5 Higher Than Lotus 1-2-3 And Microsoft Excel.

... Day...
Loden, president of Microsoft reseller Lodan
... built-in defaults."
... Computer Associates and
... Computer Associates and Lotus Products, say

VARBUSINESS			
Spreadsheet Report Card			
	SuperCalc5	Lotus 1-2-3	Microsoft Excel
Ease of use	7.30	6.50	7.11
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.

The people who sell, install, and support them for a living. The survey asked hundreds of spreadsheet dealers and resellers all kinds of questions to find out what the pros rate as the best spreadsheet. And the pros told them.

SuperCalc⁵. In virtually every category from ease-of-use to technical support, SuperCalc5 was rated higher than Lotus[®] 1-2-3[®] and Microsoft[®] Excel.

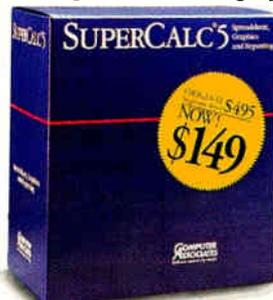
We're not surprised. While Lotus and Microsoft have been fussing over their many different spread-

sheet versions, we've been stuffing one spreadsheet, SuperCalc5, with everything you would ever want. From spreadsheet linking to 3-D graphics and beautiful, presentation-quality output, SuperCalc5 has it all.

And it runs on just about any PC.

But the best part is the price. At \$149.00, SuperCalc5 costs less than half the price of Lotus 1-2-3 and Excel. Heard enough? Call 1-800-645-3003 today for the name of the nearest dealer where you can buy the best spreadsheet there is.

If you're willing to spend a couple hundred dollars less.



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. □

We slash interface development time better than ever!

INTRODUCING VERMONT VIEWS™ v3.0 WITH POWERFUL NEW FEATURES.

Here's great news from the leader in C-language interface development: our brand new version of Vermont Views with Designer now adds the graphical features your end-users are demanding to the power and flexibility we've always offered!

You get fast, simple screen management.

THE DESIGNER, the interactive screen designer included with Vermont Views, sets the standard for sophisticated, character-based screen management. With it, you can create pull-down menus, data entry forms with scrollable regions, choice lists, memo fields, and a wide variety of validated field types. The Designer allows fast application prototyping, code generation, and total management of forms, menus, and fields. It also provides DOS mouse support, exploding windows, shadow borders, plus radio and pushbuttons. Which means you can quickly produce all those client-pleasing features that give your product that special edge.

GUARANTEED FOR LIFE!

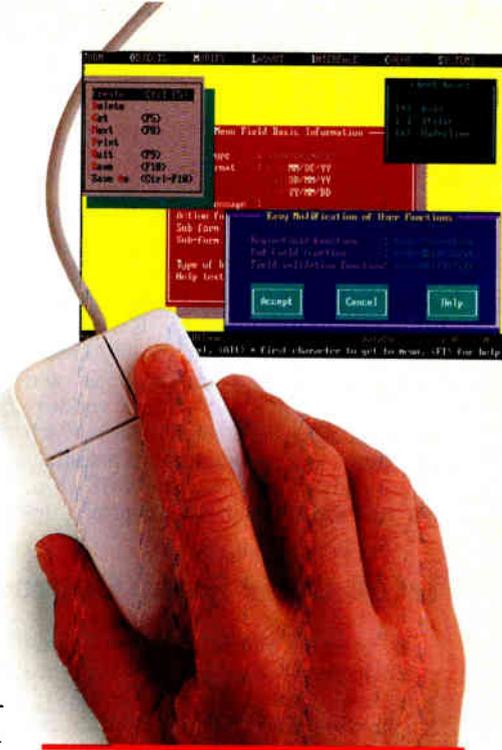
We're so sure you'll love Vermont Views v3.0 that we make this iron-clad, money-back guarantee. If you're ever dissatisfied, for any reason, return it for a prompt, no-questions-asked refund. (All you have to do is assure us that our code has not been incorporated into any application.)

The ultimate system for interface development.

Vermont Views is a truly *universal* solution. Whether you're a programmer working alone, or in a multi-user site developing in DOS, OS/2, UNIX, XENIX, or VMS, Vermont Views can meet your needs. Use Vermont Views with any database that has C-language interface, such as Oracle, Informix, Btrieve, db_Vista and C-tree. Vermont Views is platform independent, and you'll never have to pay any runtime fees or royalties.

Vermont Views with Designer includes a C library of over 550 functions. This means you get sophisticated control over things like key handling, linked list processing, keyboard control, international language, data and time conversion routines, string handling, memory management, and application speed.

Available source code, graphics support and DOS extended mem-



Now with DOS mouse support!

ory support mean Vermont Views is the ultimate tool for professional interface development.

Put DOS graphics in your applications

If you don't want to face the hassle and expense of GUI programming, you can now use Vermont Views™ GraphEx to put DOS graphics into your applications. GraphEx allows all Vermont Views windows, menus, and forms to work in CGA, EGA, VGA, and Hercules graphics modes. This means you can use your favorite graphics packages to create charts, graphs, and other exciting images to enhance your text displays.

FREE DEMONSTRATION KIT!

Call or fax us today for more information and a free demo kit. Ask about our free, no-risk, in-home trial of Vermont Views v3.0!

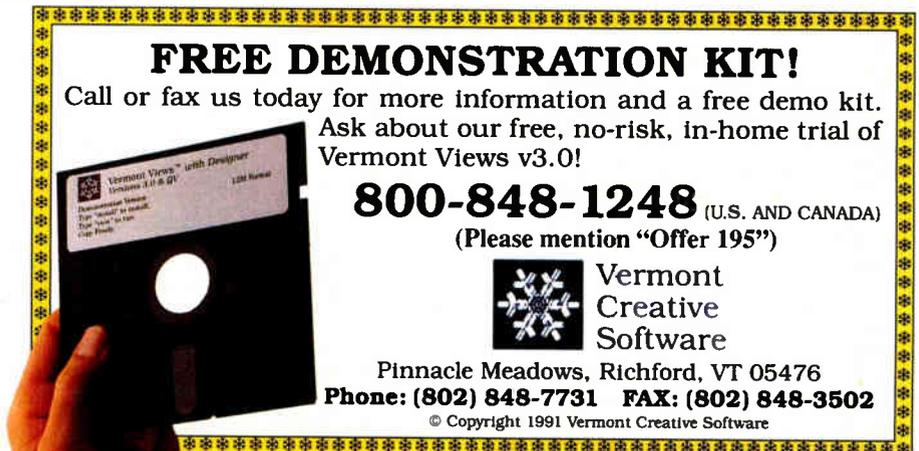
800-848-1248 (U.S. AND CANADA)
(Please mention "Offer 195")



Vermont
Creative
Software

Pinnacle Meadows, Richford, VT 05476
Phone: (802) 848-7731 FAX: (802) 848-3502

© Copyright 1991 Vermont Creative Software



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

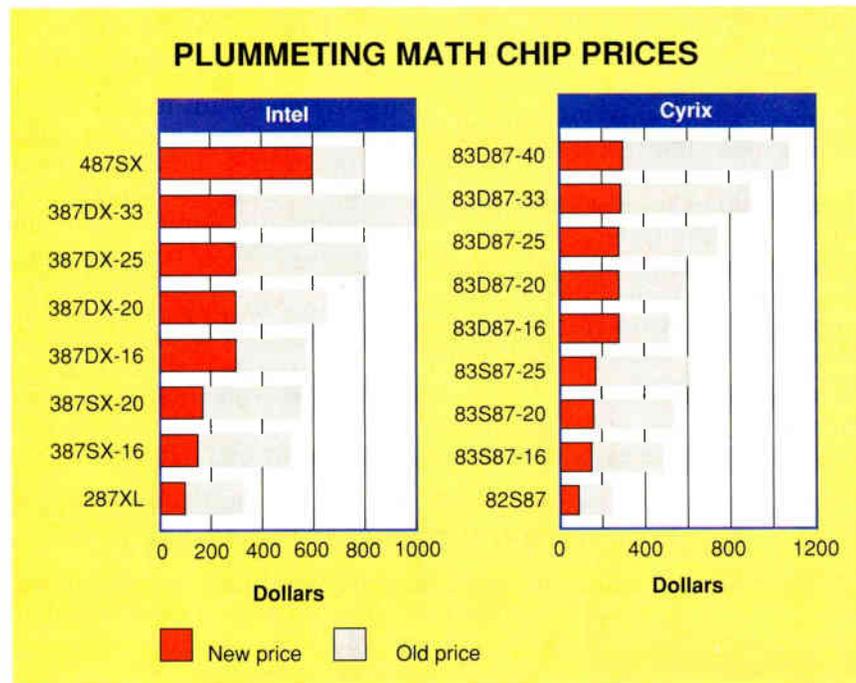
Intel, Cyrix Slash Coprocessor Prices

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.

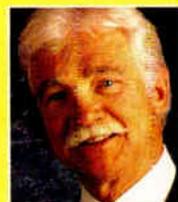
—D. Barker



TECHNOLOGY NEWS WANTED. The news staff at BYTE is interested in hearing about new technological and scientific developments that might have an impact on microcomputers and the people who use them. If you know of advances or projects relevant to microcomputing, please contact the Microbytes staff at (603) 924-9281, send mail on BIX to Microbytes, or write to us at One Phoenix Mill Lane, Peterborough, NH 03458. An electronic version of Microbytes, which offers a wider variety of computer-related news on a daily basis, is available on BIX.

NANOBYTES

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. ■



Your business is safe with us.
No matter how big it gets.



We're ready right now with a 4 megabyte diskette for your 4 megabyte drive—a new product for the next generation of expanding data storage. We're ready when you are—in any size, capacity or format you need.

That's why more business protects important information on 3M brand diskettes and data cartridges than any other brand in the world.

Call 1-800-888-1889 ext.6 to find out more.



Innovation working for you™

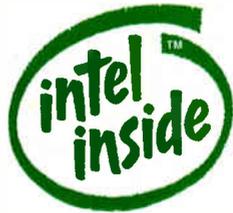
4 mb diskettes require compatible drives. ©3M 1991.



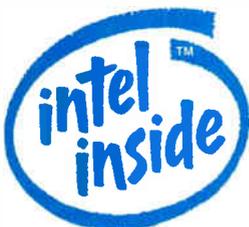
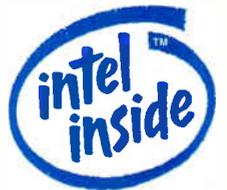
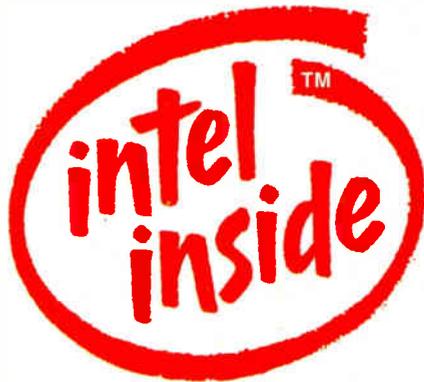
Worldwide Sponsor 1992 Olympic Games
36USC380

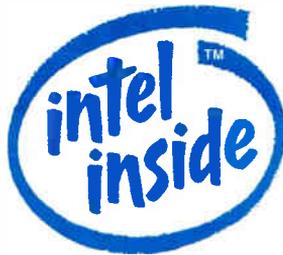
Circle 8 on Inquiry Card.

World Radio History

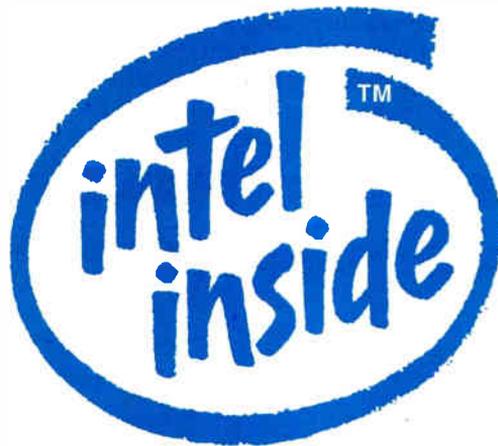


How to spot the





very best PCs.



It's really quite easy. Just look for PCs that have a genuine Intel microprocessor inside. Either the Intel386™, Intel386™ SX, Intel486™ or Intel486™ SX microprocessor.

Intel is the world's leader in microprocessor design and development. In fact, Intel introduced the very first microprocessor. So with Intel inside, you know you've got unquestioned compatibility and unparalleled quality. And you'll

know you're getting the very best PC technology.

So look for the Intel Inside symbol on ads for leading PCs. Or call 800-548-4725 for more information. It'll show you've got an eye for spotting the best.

intel®

The Computer Inside.™

Intel386, Intel486 and the Intel Inside logo are trademarks of Intel Corporation. All rights reserved. ©1991 Intel Corporation.

Circle 147 on Inquiry Card (RESELLERS: 148).

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

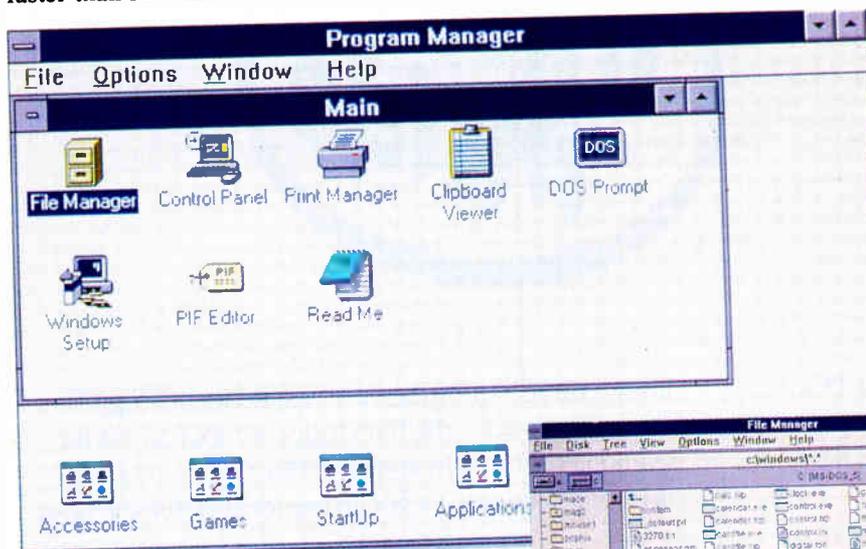
One of the most criticized aspects of Windows 3.0 is its File Manager—and with good reason. It lacks all but the most basic abilities to display and work with files. Its shortcomings have led to a major market in Windows add-ons (see the First Impression of Symantec's Norton Desktop for Windows on page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

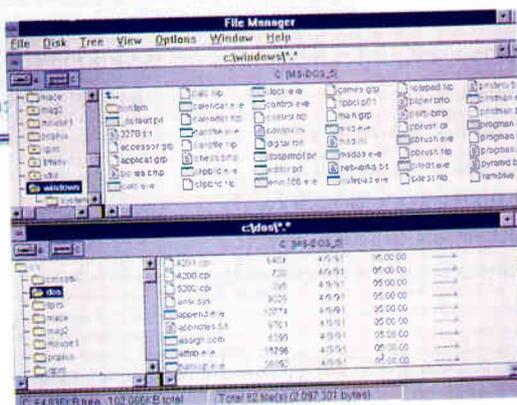
Because it has been talked about so widely by Microsoft officials, one not-surprising feature of Windows 3.1 is the inclusion of TrueType. This is the intelligent outline font technology developed by Apple and included in that company's recently released System 7.0.

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.
1 Microsoft Way
Redmond, WA 98052
(800) 426-9400
(206) 882-8080
fax: (206) 883-8101

Circle 1269 on Inquiry Card.

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
 Entry-level stand-alone (with 8 MB of interleaved RAM, a 236-MB hard disk drive, operating system, and bundled software): \$9995
 Power user (with 16 MB of interleaved RAM, a 432-MB hard disk drive, operating system, and bundled software): \$12,500

Silicon Graphics, Inc.
 2011 North Shoreline Blvd.
 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!

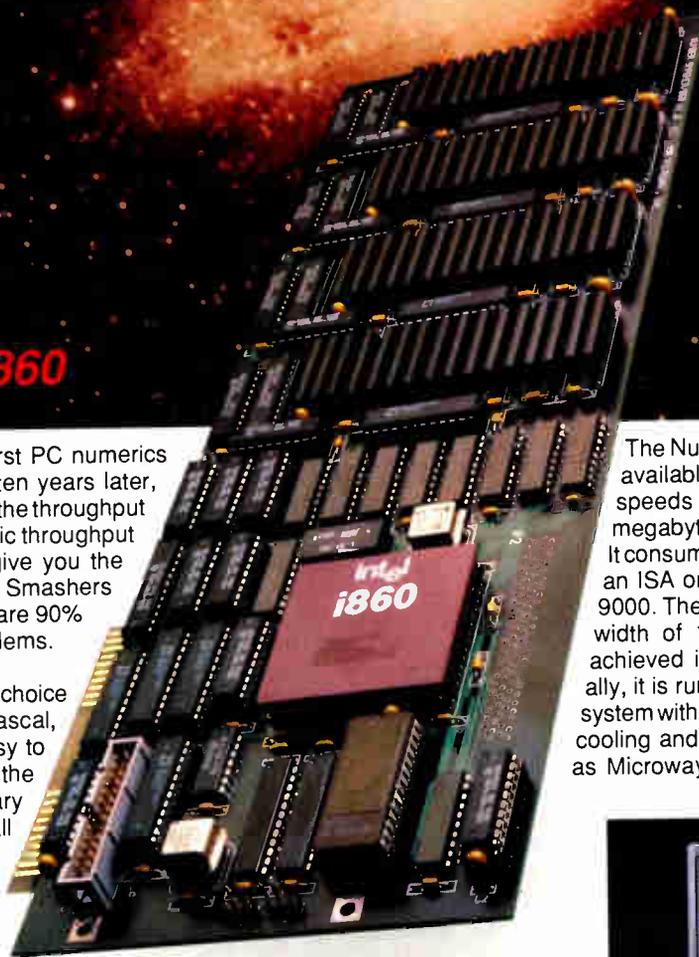
Number Smasher[®] -860

In 1982 when Microway introduced the first PC numerics tools, an 8087 delivered 50 Kflops. Just ten years later, Number Smasher-860 delivers 1600 times the throughput of the 8087. Its 80 megaflops of raw numeric throughput and 10 Linpack megaflop vector rating give you the speed of a Cray. In addition, two Number Smashers have been clocked at 135 Megaflops and are 90% efficient running fine grained parallel problems.

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.

XTEND-860 makes it possible to write mixed applications which use a 286, 386 or 486 to handle human interfaces while calling on the i860 to do computations. We offer libraries for processing vectors, linear algebra, graphics and DSP. Optional tools include a vectorizer, symbolic debugger, and profiler. We also develop custom versions of Number Smasher-860 for OEMs who need to tailor the i860's power to their applications.

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.



**For more information on Microway products
or our i860 Seminar, please call 508-746-7341.**



Microway[®]

The World Leader in PC Numerics

Corporate Headquarters, Box 79, Kingston, MA 02364 USA • TEL 508-746-7341 • FAX 508-746-4678
U.K./Europe 081-541-5466 • France 01 43 2 69593 • Germany 069-75-2023 • Holland 40 836455 • Italy 02-74.90.749 • Norway 6 892020

World Radio History

Reach Out and Link Someone

FRED LANGA

**LapLink Pro breaks
free of the local
cable connection with
remote installation
via cable and a host of
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.

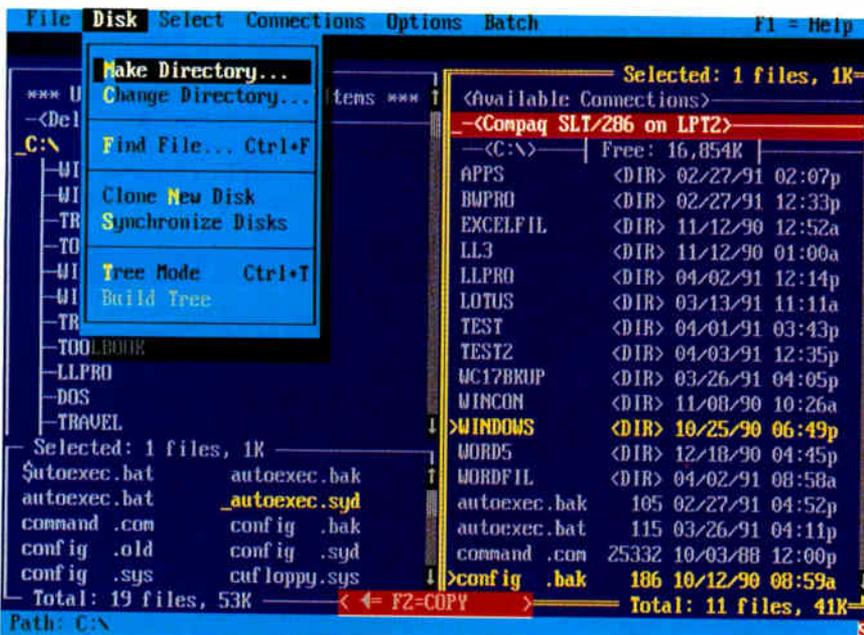
That's flashy, but it's not the feature I liked best. For me, the new interface is what really sets this version apart from the earlier ones.

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.

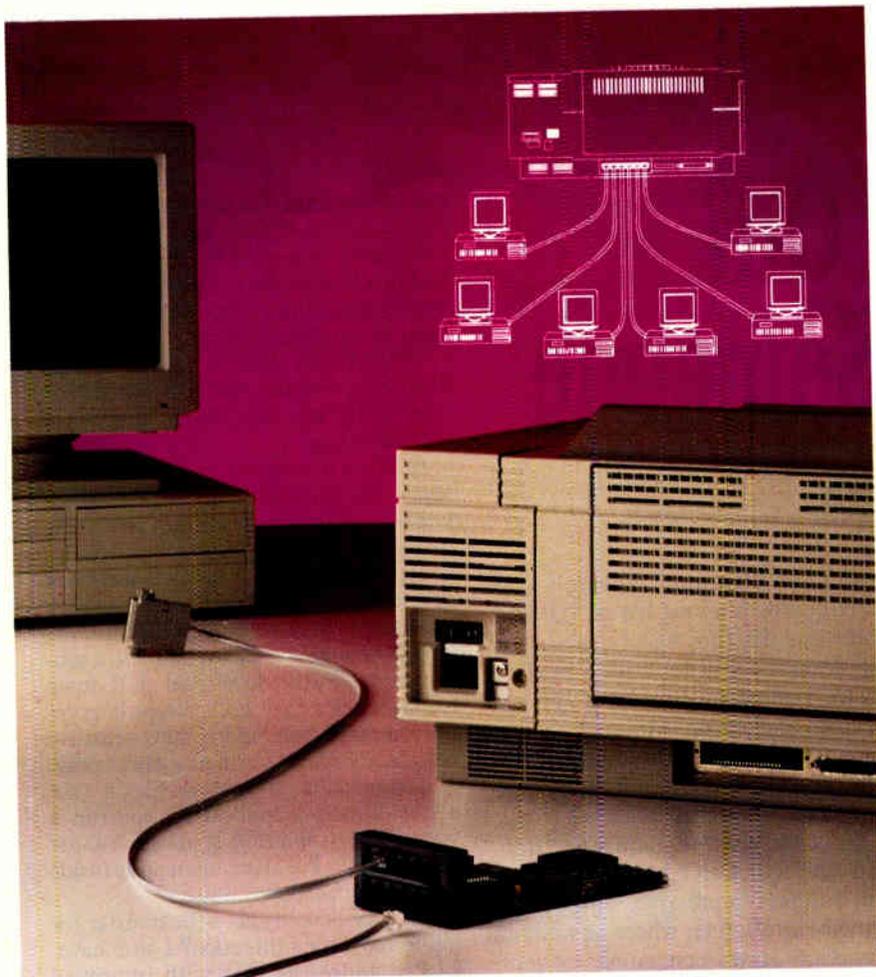
If you make time-sensitive file selections (i.e., all files created before or after



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

Hassle-Free Printer Sharing

for the HP LaserJet II, IID, III and IIID



"The ServerJet is the smoothest and most practical way I know to share a LaserJet."

Frank J. Derfler, Editor
PC Magazine, 1/15/91

Here's how you and your co-workers can have your own HP LaserJets without breaking the corporate budget.

It's called **SimpLAN ServerJet**.

Simply plug the *ServerJet* into the 'Optional I/O' slot of your HP LaserJet. Stretch phone cable, up to hundreds of feet, to each computer. Then, 12 people can simultaneously *whoosshh* documents to the LaserJet at speeds as fast as 115,200 baud.

No more wandering down the hall with floppy in hand.

Or borrowing someone else's LaserJet.

Or wasting time waiting to print.

The *ServerJet* is available in a variety of models with up to 4MB of buffer memory. And because your office may have printers other than HP LaserJets, ASP Computer Products offers a complete line of printer sharing solutions.

To order your *ServerJet* or for more information call ASP at:

800-445-6190



ASP COMPUTER PRODUCTS, INC.

1026 W. Maude Avenue, Suite 305
Sunnyvale, California 94086
Phone: 408-746-2965 • Fax: 408-746-2803

SimpLAN & ServerJet are trademarks of ASP Computer Products, Inc. / HP LaserJet is a registered trademark of Hewlett-Packard Co.

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

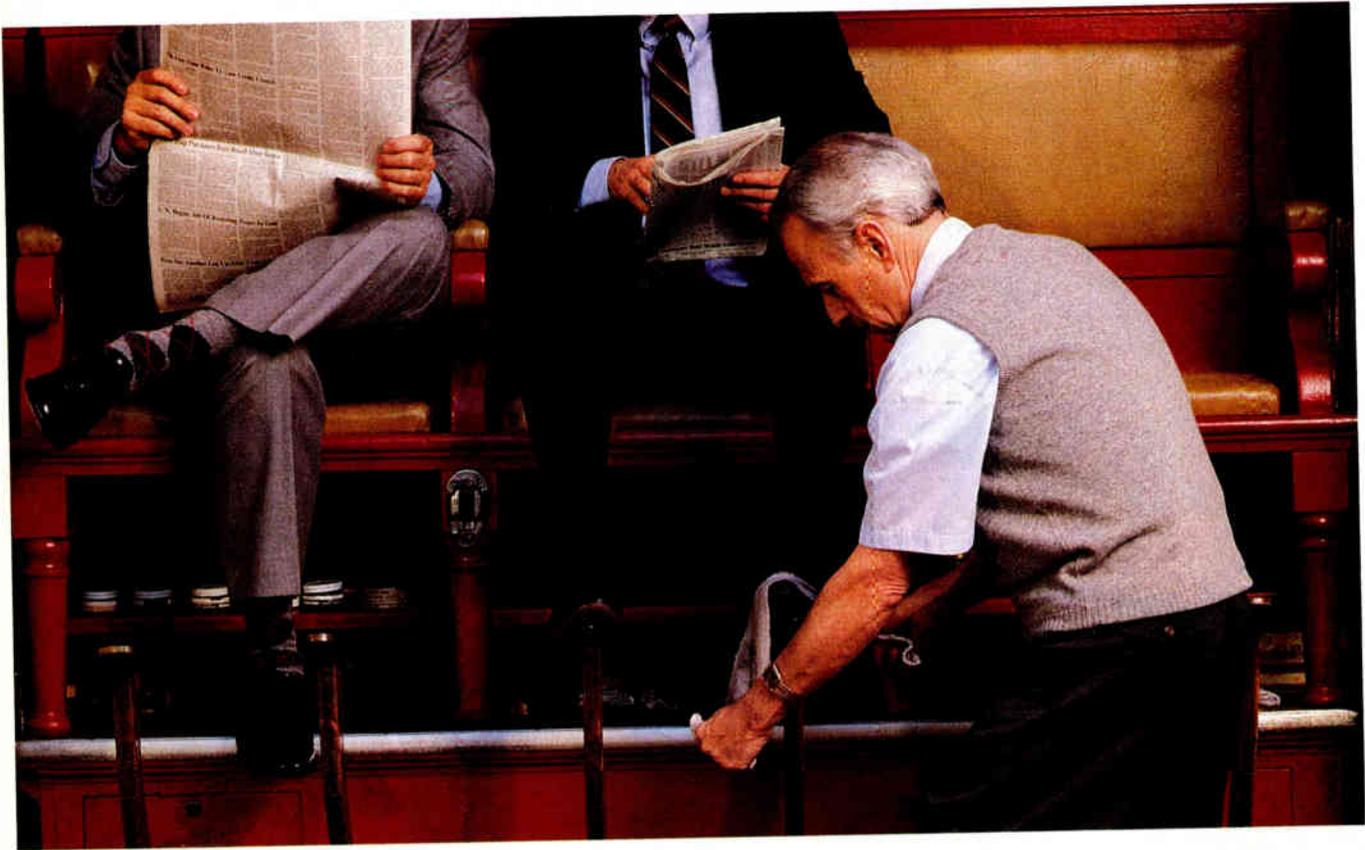
LapLink Pro 4.0
\$149.95

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

Traveling Software, Inc.
18702 North Creek Pkwy.
Bothell, WA 98011
(800) 343-8088
(206) 483-8088
fax: (206) 487-1284

Circle 1153 on Inquiry Card.

People are always looking for affordable ways to make a better impression.



Soon a lot more people will be looking their best. Because now the best features of the HP LaserJet III printer are more affordable.

The new LaserJet IIIP printer features HP's exclusive Resolution Enhancement technology. An innovation that provides 300 dpi print quality superior to that of ordinary laser printers. The PCL5 printer language, with font scaling and HP-GL/2, brings even more to your documents.

Call 1-800-752-0900, Ext. 2255 for your nearest authorized HP dealer. Adobe and PostScript are registered trademarks of Adobe Systems Inc. in the U.S. and other countries. • Suggested U.S. list price. © 1991 Hewlett-Packard Company PE 12109

Fourteen bit-mapped and eight internal scalable typefaces give you thousands of options. And, to make things even more interesting, the LaserJet IIIP produces patterns, shading, spirals, and mirror images. In portrait or landscape.

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

IDEAF-CUS

A viable new market

Quarterly Analysis Comparison of Growth in Sales

High warranted reputation

What you will following our...
The result was Living Ma...
During the early 1980's, when...
What you will following our...
Even Living Machine network...

Tell them about the new LaserJet IIP.



requires less time to print than many laser printers with higher ppm rates.

For versatility, the LaserJet IIP has a multisized paper tray that accepts various sizes of paper and envelopes. An optional Adobe® PostScript® cartridge is available. And, of course, the LaserJet IIP is compatible with all major software and HP LaserJet accessories.

The good looks you get with the newest HP LaserJet look

even better when you consider the price. Just \$1,595.* For a faxed data sheet, dial (208) 344-4809 from your FAX machine and enter document I.D. number 9600. Now everyone can add a little polish to their work.

HP Peripherals
When it's important to you.



Circle 130 on Inquiry Card.

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.

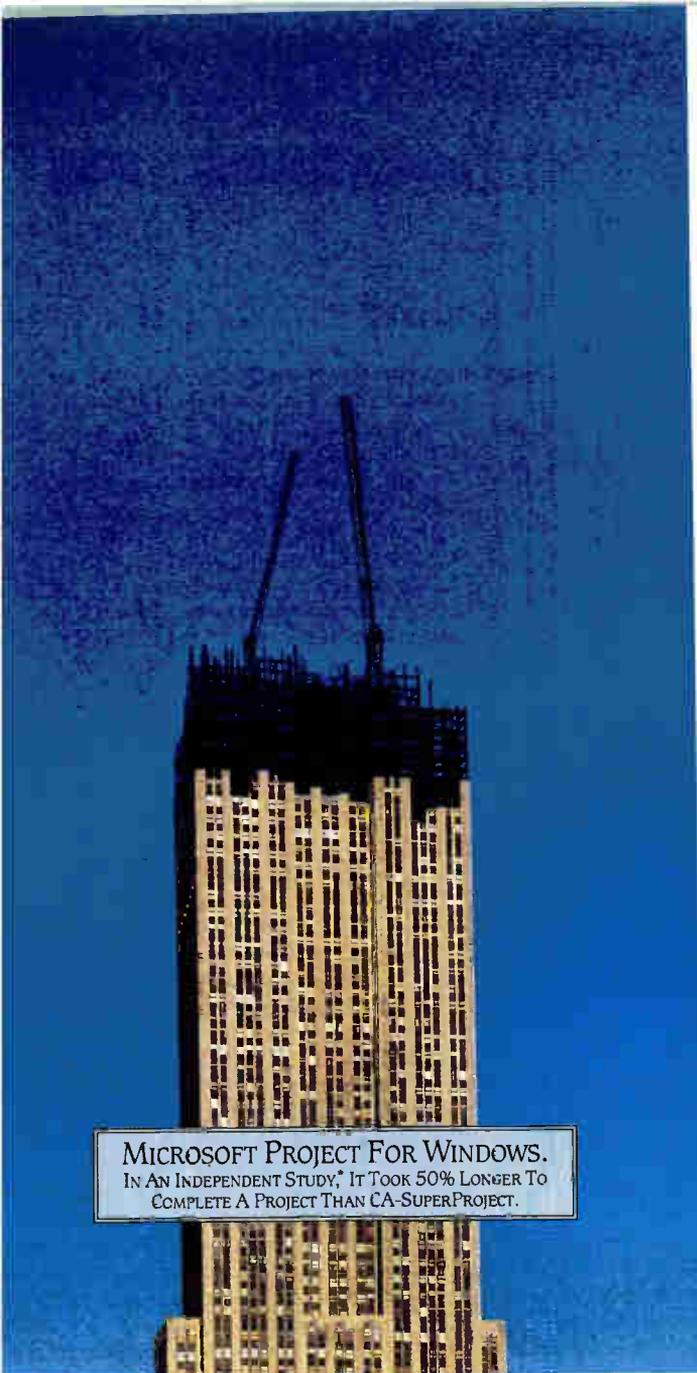
The **AcerAnyWare 1120NX** isn't the least expensive notebook computer available, but pound for pound it's a real value. Acer has set a standard for comparison that other notebook makers will have to hurry to catch.

—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.
401 Charcot Ave.
San Jose, CA 95131
(800) 538-1542
(408) 922-0333
fax: (408) 922-0176
Circle 1264 on Inquiry Card.



MICROSOFT PROJECT FOR WINDOWS.
IN AN INDEPENDENT STUDY,* IT TOOK 50% LONGER TO
COMPLETE A PROJECT THAN CA-SUPERPROJECT.



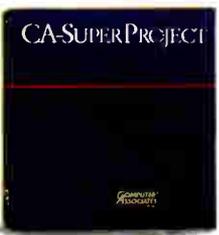
CA-SUPERPROJECT.
WITH MORE EFFICIENT SCHEDULING ALGORITHMS, IT HELPS
YOU BRING PROJECTS IN ON TIME AND ON BUDGET.

Identical Project. Different Project Manager. Can You Spot The Difference?

Efficiency. Accuracy. Dependability.
Required skills for any project manager. But not as common as you'd think. In a recent independent study of the five leading project managers—all scheduling the same project—the completion dates varied by as much as five months.
CA-SuperProject® finished first in 214 working days. Microsoft® Project finished last in 323 working days.



CA's Computing Architecture For The 90s Protects Your Investment.



with the most-efficient project manager, the difference will be obvious.

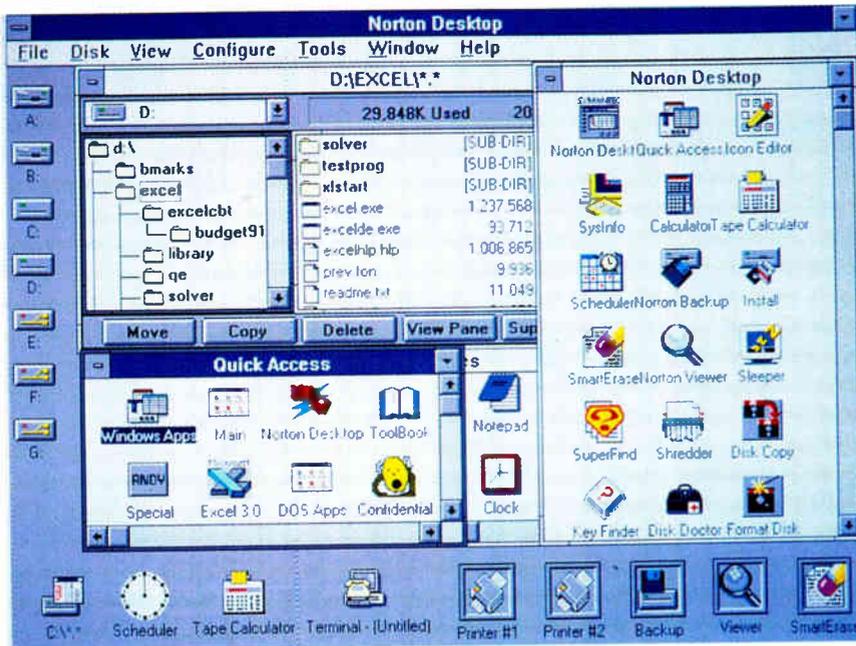
ment of resources and gives you completion dates you can bet your career on. It's also incredibly easy to use. You can create projects in minutes.
And with a few clicks of the mouse, you'll have presentation quality Gantt, PERT, Cost/Resource and Work Breakdown charts.
So call 1-800-645-3003 today to find out the location of your nearest dealer. Because once you've worked



© 1991 Computer Associates International, Inc., 711 Stewart Avenue, Garden City, NY 11530-4787. All trade names referenced are the trademarks or registered trademarks of their respective companies. * March 1991 study published by ISoft Decision, Inc., including CA-SuperProject 2.0, Microsoft Project For Windows, Symantec's Timeline 4.0, ABT Project Workbench and Scitor's Project Scheduler-5.

Circle 67 on Inquiry Card.
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.

Symantec Corp.
10201 Torre Ave.
Cupertino, CA 95014
(800) 441-7234
(408) 253-9600
fax: (408) 253-4092
Circle 1265 on Inquiry Card.

"My Dolch 486™ is awesome. . ."

"Hey, I now own the *perfect portable* that lets me get my work done anywhere. Not just a few files . . . everything I had on my desktop!"

"Powerful? You bet! After I downloaded all my desktop stuff, on its *420 MB HD*, I still had plenty of room left and it screamed through everything at *14.5 MIPS!*"

"My Dolch P.A.C. is setting new 'rules.' It's portable, fast and I still can add *4 full-size internal expansion cards*. Wow!"

"You have to see the brilliant display — I mean really see it. *TFT* is the *latest color technology*, that's fully VGA compatible."

"Hey! Don't take my word for it. Experts like PC Magazine judged my Dolch P.A.C. to ' . . . *outclass all other portables*' and picked Dolch three years in a row as Editors' Choice!"



1988



1989



1990

"Get a Dolch today, choose a 286™, 386SX™, 386DX™ or a 486™ like mine. . . *clearly the best PC you can buy today, and it happens to have a handle.* Get a lot more work done—where and when you want."

Why Wait? . . . Call today.

1-800-544-IPAC

In Canada call Laptech 1-800-561-4527

Dolch.

ROAD-POWER FOR THE BEST OF US

Dolch Computer Systems • 372 Turquoise Street • Milpitas, CA 95035 • Tel: 408-957-6575 • Fax: 408-263-6305

™286, 386SX, 386DX, and 486 are registered trademarks of Intel Corporation

Circle 101 on Inquiry Card.

The Next Illustrator



THE FACTS

Adobe Illustrator 3.0
for the Next
\$500

Adobe Systems, Inc.
1585 Charleston Rd.
P.O. Box 7900
Mountain View, CA 94039
(800) 922-3623
(415) 961-4400
fax: (415) 961-3769
Circle 1266 on Inquiry Card.

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.

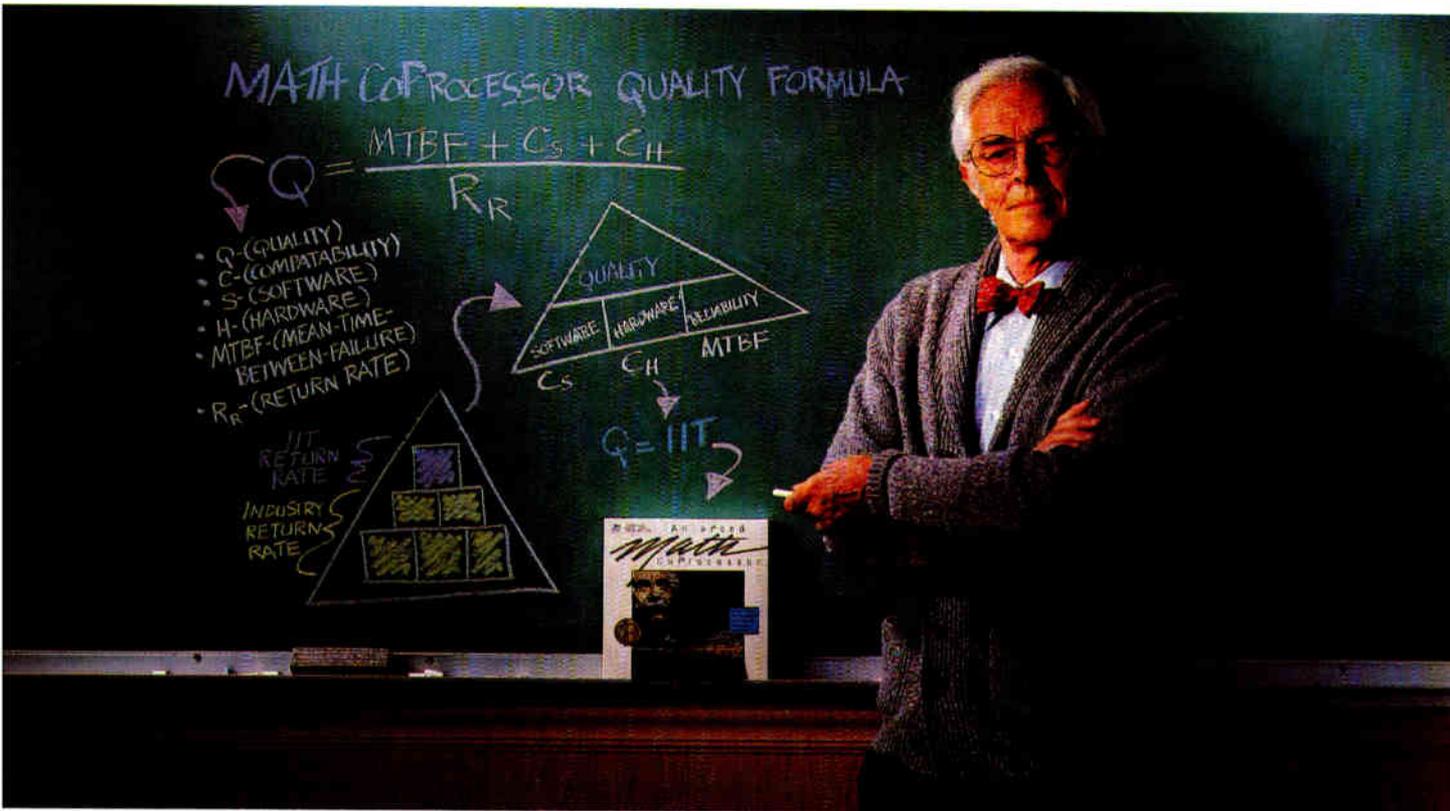
Beyond what I've discussed, Illustrator 3.0 is a complete illustration package. The package works well with both color and gray-scale Next systems, and an included utility turns color images into camera-ready color separations. Unlike with the Mac version, images *can* be modified in preview mode.

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

It's simple math. Our chip is better by 5:1.



*Our iit Advanced Math CoProcessors have a return rate one-fifth that of the industry standard.**

Here's proof that iit Advanced Math CoProcessors are perfect additions to your 286, 386, or 386 SX PC. They are compatible with application software that supports math coprocessors. And they are compatible with popular PC operating systems, including DOS, UNIX, and OS/2, and GUI's like Windows 3.0.

With this kind of quality, we can guarantee the iit Advanced Math CoProcessor for the lifetime of your computer. We back our *Lifetime Warranty*** with state-of-the-art wafer processing, packaging, rigorous process control, and testing. No wonder we have a lower return rate and better reliability than the industry standard.

Our Advanced Math CoProcessors speed up your graphics, CAD/CAE, spreadsheets, and other calcula-

tion-intensive applications. They are certified by leading application software vendors, BYTE-rated, and guaranteed for the lifetime of your computer.

For quality, compatibility, and performance, specify iit Advanced Math CoProcessors. Call 1-800-832-0770 for your nearest dealer.

For quality in mathematics, count on iit.™



INTEGRATED INFORMATION TECHNOLOGY, INC.

*Write for detailed Quality and Reliability Test Report. OS/2 is a trademark of IBM Corporation. MS-DOS and Windows are trademarks of Microsoft Corporation.
**Limited lifetime warranty. UNIX is a registered trademark of UNIX System Laboratories, Inc. © 1991 Integrated Information Technology, Inc. All rights reserved.

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.

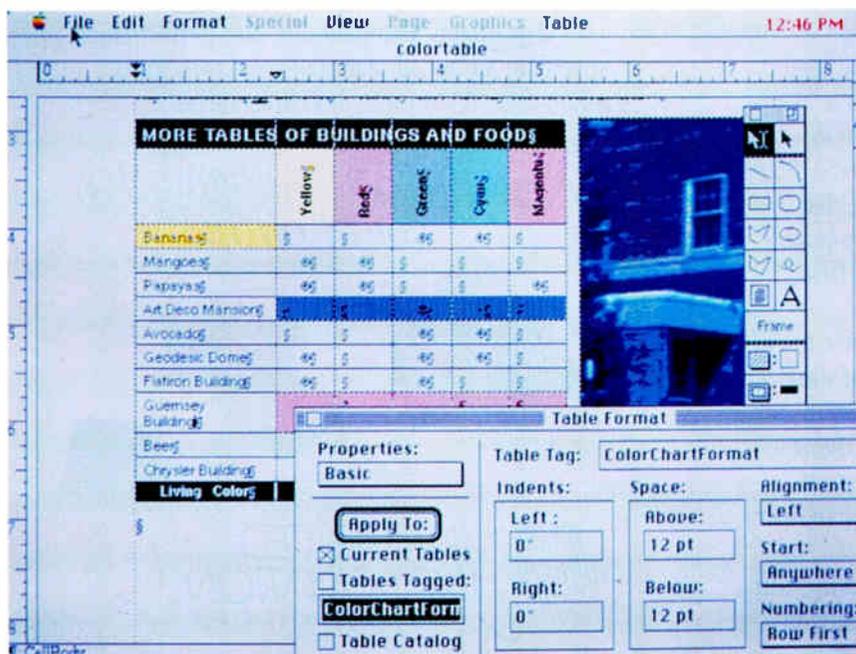
Frame Technology has thrown in a few other neat little tricks, including timed saves, a refined help system, and notifica-

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



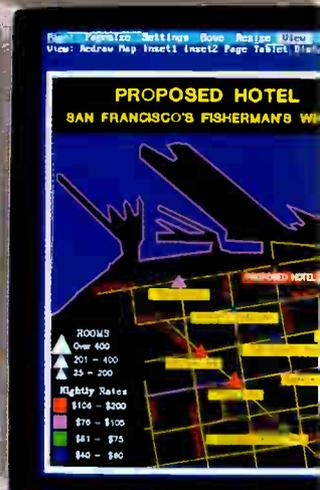
THE FACTS

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.

Frame Technology Corp.
1010 Rincon Cir.
San Jose, CA 95131
(408) 433-3311
fax: (408) 433-1928
Circle 1267 on Inquiry Card.

A MAP FOR ALL REASONS...



Most business people still view maps as a tool used only for planning things like an RV vacation, or teaching geography to the kids. At Strategic Mapping we're helping businesses use maps to enhance their information systems. By linking maps to a database or spreadsheet on a personal computer, we've taken the classic model of an atlas into the 21st century. Now, over 20,000 companies – including many of the Fortune 500 – are using our ATLAS★Software to help make critical business decisions for a multitude of reasons.

Target Marketing – Companies such as General Foods, Prudential Insurance and American Express are leveraging their sales and marketing program dollars with ATLAS★Software by focusing on the right customers – in all the right locations.

Sales Territory Management – Sony, 3M and Eastman Kodak use

ATLAS★Software to manage their sales territories more efficiently – maximizing profits.

Site Selection – Citibank, Kaiser-Permanente, and Pizza Hut are taking the guesswork out of selecting new business locations by using ATLAS★Software.

Distribution Planning – Federal Express, Miller Brewing and Coca-Cola are radically improving productivity and efficiency with ATLAS★Software – making certain that deliveries are on time, and on budget.

Research shows that 85% of business databases contain critical location based information, yet most businesses fail to view their information geographically. With ATLAS★Software, you can visualize your database, and even print high quality map graphics and database reports – adding sizzle to your presentations.

Other PC software programs use maps to display data, but only Strategic Mapping, Inc. provides the combination of power, ease of use and affordability that has made us the leader in desktop mapping since 1984.

Call us today for a free information kit and demo disk. You'll see why we were rated #1 by *PC Week* – and why *MacUser* gave us their 5 mice rating.

CALL: 408/985-7400
FAX: 408/985-0859

Strategic Mapping, Inc.
4030 Moorpark Ave., Suite 250
San Jose, CA 95117

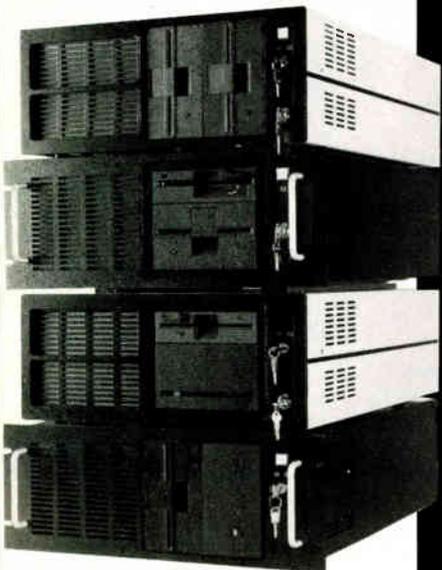
Strategic Mapping is a registered trademark of Strategic Mapping, Inc. ATLAS★Software is a trademark of Strategic Mapping, Inc. ©1991 Strategic Mapping, Inc. All rights reserved.

Circle 289 on Inquiry Card.



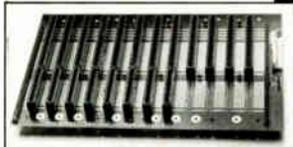
Rack & Desk PC/AT Chassis

Integrand's new Chassis/System is not another IBM mechanical and electrical clone. An entirely fresh packaging design approach has been taken using modular construction. At present, over 40 optional stock modules allow you to customize our standard chassis to nearly any requirement. Integrand offers high quality, advanced design hardware along with applications and technical support *all at prices competitive with imports*. Why settle for less?



- Rack & Desk Models*
- Accepts PC, XT, AT Motherboards and Passive Backplanes*
- Doesn't Look Like IBM*
- Rugged, Modular Construction*
- Excellent Air Flow & Cooling*
- Optional Card Cage Fan*
- Designed to meet FCC*
- 204 Watt Supply, UL Recognized*
- 145W & 85W also available*
- Reasonably Priced*

Now Available
Passive Backplanes



INTEGRAND

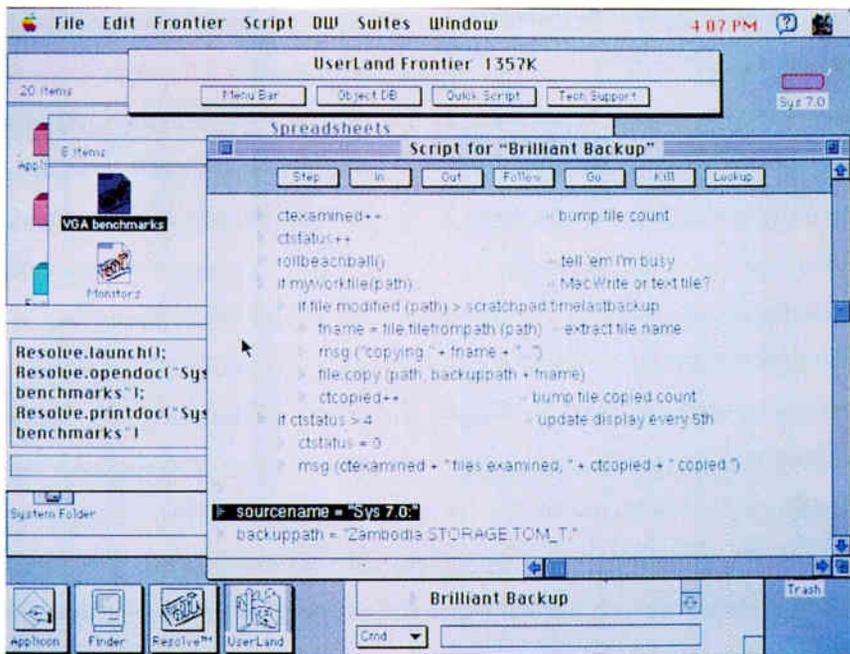
RESEARCH CORP.

Call or write for descriptive brochure and prices:
8620 Roosevelt Ave. • Visalia, CA 93291
209/651-1203
TELEX 5106012830 (INTEGRAND UD)
FAX 209/651-1353
We accept Bank Americard/VISA and MasterCard
IBM, PC, XT, AT trademarks of International Business Machines
Drives and computer boards not included.

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.
490 California Ave.
Palo Alto, CA 94306
(415) 325-5700
fax: (415) 325-9829
Circle 1268 on Inquiry Card.

RISC FREE!

Free i860™ Processor and i860/APX Software!

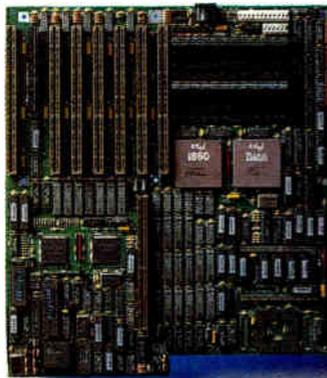
By now, you've probably heard about our industry-first 4860™ MotherBoard that packs the power of the Intel 80486 CPU with the Intel 80860 RISC processor (i486™ + i860 = 4860).

What you haven't heard is that, for a limited time, when you buy a 4860 MotherBoard with 8MB of RAM, Hauppauge will give you an i860 RISC processor and the i860/APX operating system at no additional cost.

Why *give* you this capability? Because you'll enjoy a level of processor performance never before seen in a PC. Our bet is that you'll be so impressed, you'll come back for more!

A PC Revolution: In the PC environment, the 4860 is a 486-based MotherBoard with the new EISA I/O bus. It runs over 2 times faster than 386 computers and delivers mainframe power for applications including CAD, LAN and desktop publishing. This board is fully compatible with DOS, IBM's OS/2, Novell Netware and SCO-UNIX. What's more, Hauppauge's 4860 supports up to 64 MBytes of memory *without* a RAM expansion board.

RISC-Y Business: The i860 processor is ideal in complex applications, performing up to 25 million floating-point operations per second. It adds to the power of the 486, so you can run rings around ordinary PCs.



By adapting Intel's APX (Attached Processor Executive) software to our 4860 MotherBoard, we've created a way to exploit the power of the i860 to give you *practical* multiprocessing. In fact, i860/APX

provides a base for entirely new applications made possible by the advent of the i860 RISC processor.

Technical Features: 25 or 33MHZ 486/860 • 4 Mbytes of high speed RAM expandable to 64 Mbytes shared between i486 and i860 processors • Socket for optional Intel Turbo Cache 485™ and Weitek 4167 • 7 EISA I/O slots • 64-bit expansion slot for optional high-speed graphic frame buffer • 1 parallel, 2 serial ports and a built-in PS/2-style mouse port.

Enjoy a RISC-free investment. Our 4860 MotherBoard is designed with the world's highest performing microprocessors. So you can have the world's highest performing PCs and workstations.

For more information, call **1-800-443-6284**.

Hauppauge Computer Works, Inc.
91 Cabot Court
Hauppauge, New York 11788
Telephone: 516-434-1600
Fax: 516-434-3198
In Europe (49) 2161-17063
In Australia: (7) 262-3122

Hauppauge!

Available at your local computer dealer.

Trademarks: OS/2, IBM, Intel 386, i486, i860 and Turbo Cache 485™: Intel Corp. • DOS and Xenix: Microsoft Corp. • 4860, 4860 MotherBoard: Hauppauge

Circle 128 on Inquiry Card.

World Radio History



Why you need a 16"

Because the MultiSync® 4D color monitor, with 46% more active display area than a 14" screen, lets you see more of your applications on-screen at one time. The digitally controlled MultiSync 4D also supports high resolution graphics, from VGA up to 1024 x 768 at 70 Hz non-interlaced.

And with Dynamic Beam Focusing, your Windows™ will be clearer from

MultiSync is a registered trademark of NEC Technologies, Inc. Windows is a trademark of Microsoft, Inc. ©1990 NEC Technologies, Inc.

Computers and Communications

For technical information call 1-800-FONE-NEC. In Canada, 1-800-NEC-INFO.

Circle 204 on Inquiry Card.

MultiSy

edge to edge

Optimized for

have techno

the graphics

So, if you'd

For 46% more information call 1-800-826-2255.

NEC

A 486 in a Choice of Styles

Slimline, desktop, or tower? Take your pick with the Cumulus/486 system. With Microsoft Works and Windows 3.0, all models ship with the software loaded and pre-configured.

Standard features include your choice of a 25- or 33-MHz microprocessor, VGA graphics, up to 32 MB of RAM on the processor board, a dual-button mouse, and a 101-key keyboard.

Options let you customize your machine with a 40-, 100-, or 200-MB hard disk drive, additional RAM, a second floppy disk drive, and a caching system in 64-KB and 256-KB capacities. Also available are a second math coprocessor, which works in conjunction with the one that is standard, and a voice/data/fax board.

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

Circle 1271 on Inquiry Card.

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.

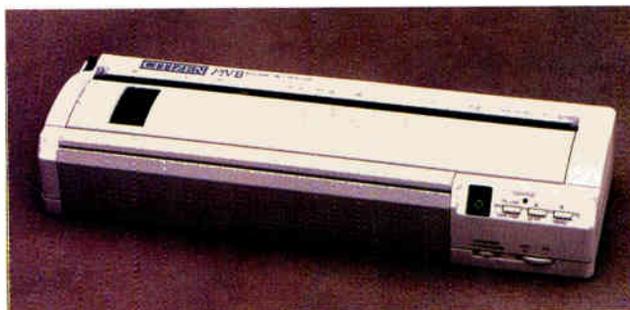
Able to print on almost any type of paper, as well as handle envelopes and transparencies, the PN48 prints quietly, powered by a rechargeable nickel-cadmium battery. The printer has a friction-feed path as well as a bottom-loading straight-path paper feed, and it prints in eight type styles. The PN48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

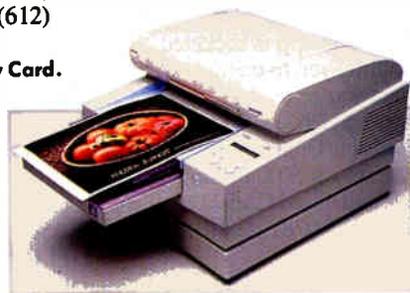
Price: \$1995.

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.

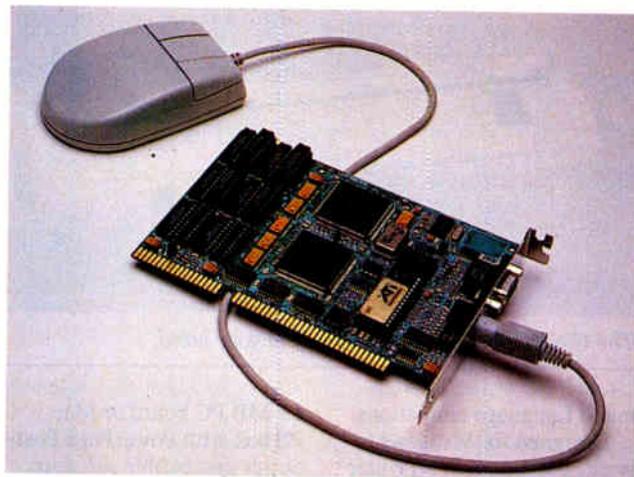
The 8514/A and VGA modes both support 1024- by 768-pixel noninterlaced graphics, as well as 70- and 72-Hz vertical refresh rates. Graphics Vantage uses custom driver software and proprietary VLSI chips to accelerate graphics-intensive environments. A Windows 3.0 driver uses ATI's scalable Crystal Fonts 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

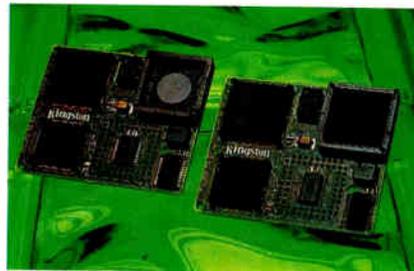
You can easily upgrade your 286 PC to 386SX speed with the SX/Now 386SX processor upgrade board. Just plug the SX/Now board into the 286 processor socket on your system board, and you've increased your system performance by 250 percent, according to Kingston.

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.

Circle 1284 on Inquiry Card.



SX/Now provides 386SX processing power for your 286.

Your Best Source for

BORLAND

Products !

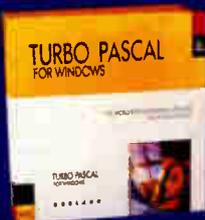
CALL TODAY !



TURBO PASCAL FOR WINDOWS

Turbo Pascal for Windows makes programming Windows applications easy by giving you a Windows integrated development environment.

- Takes full advantage of the Windows Graphical User Interface including features like Multi-Document Interface (MDI), Dynamic Link Library (DLL) and Dynamic Document Exchange (DDE).
- Edit, compile and run programs from within Windows.
- Includes Borland's *Object Windows* and *Turbo Windows*, for debugging even the toughest Windows programs.
- No need for the Microsoft[®] Windows[™] Software Development Kit.



SPECIAL LOW PRICE-CALL TODAY FOR DETAILS!

List: \$250 **NOW: \$169** FAXcenter # 1861-0019

TURBO C++ & TURBO VISION

Borland's award-winning Turbo C++ compiler now comes with Turbo Vision, an application framework for building DOS text mode applications. The combination of Turbo C++ and Turbo Vision shortcuts development time by giving you a ready-made user interface with menus, scroll bars, mouse support, and an event-driven architecture that you can plug right in to your applications. High-level objects like an editor, calculator, calendar and more are ready for you to add to your applications with just a few lines of code. If you want the fast path for DOS programming, choose Turbo C++ and Turbo Vision.

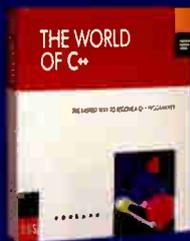


List: \$199.95 **NOW: \$135** FAXcenter # 1861-0022

C++ TRAINING VIDEO!

VISIONS Borland Video Series The World of C++

The World of C++, an instructional video course, is the fastest way to become a C++ programmer. With 21 easy lessons, all aspects of the C++ language are presented in a clear logical order. Applicable to any AT&T 2.0-compatible C++ compiler/translator for DOS, Windows, OS/2, Macintosh or UNIX. C++ made easy, get started today!



List: \$199.95 **NOW: \$139** FAXcenter # 1861-0021

Programmer's Paradise is your source for the entire line of BORLAND products!

LIST	PRICE	LIST	PRICE
Borland C++	495	Turbo C++	99
ObjectVision	99	w/ Turbo Vision	200
Paradox 3.5	795	Turbo Debugger & Tools	150
Paradox Engine	495	Turbo Pascal 6.0	149
Quattro Pro 3.0	495	Turbo Pascal Pro	299
Competitive Upgrade	129	Turbo Pascal for Windows	250
Sidekick 2.0	99	The World of C++ Video	199



A Division of Voyager Software Corp
1163 Shrewsbury Ave., Shrewsbury, NJ 07702

1-800-445-7899

Corporate: 800-422-6507
(CORSOFT Division)

International: 908-389-9228
Customer Service: 908-389-9229
Canada: 800-445-7899
Fax: 908-389-9227
FAXcenter: 908-389-8173

POLICIES

Phone Orders
Mon-Fri 8:30 AM-7 PM EST, Sat 9:30-2:30 EST. We accept MC, Visa, AMEX. Domestic shipments, please add \$5 per item for shipping/handling by UPS ground. For domestic COD shipments, please add \$3. Rush service available.

Mail or FAX / International / POs
Phone number required with order.

FAXcenter (908) 389-8173

Call from your FAX telephone, and follow the instructions to receive more information on the products featured above!

Corporate Accounts

Call CORSOFT, our corporate sales division. Ask about volume purchase agreements.

Returns

Subject to \$25 processing charge.

* All prices subject to change without notice.

Programmer's

ROGUE WAVE TOOLS.h++ C++ CLASS LIBRARY

Tools.h++ is "The Standard" in C++ classes. Tools.h++ delivers all the essential classes including Strings, Dates, Times, BTree, complete Collection Classes, Regular Expressions, Linked Lists, Queues, Stacks, & more! All classes support isomorphic persistence. Version 4.0 provides Windows 3.0 DDE & Clipboard support, & DLL compiling. Tools.h++ is a great example of how to write true C++ code with smaller executables, code sharing, & effortless maintenance. Tools.h++ does your dirty work for you!

List: \$199 Ours: \$179

FAX (908) 389-8173



WindowsMAKER™ PROFESSIONAL

The fastest way to create Windows applications. Generates the Windows .EXE w/ complete source & production files (no royalties). Point & Click to define the user interface. Animate your design to instantly test its look & feel. Make changes on the fly without compiling. Custom code is preserved during code regeneration. A state-of-the-art programming tool. Supports C++.

List: \$995 Ours: \$795

FAX (908) 389-8173



MKS RCS 5.1 SPECIAL OFFER!

FREE MKS Make with every purchase!

MKS RCS: A project management tool that helps you control and track change. MKS RCS features locking, branching, merging, version tracking and much, much more! MKS Make: Automatically updates changes to files, according to the links specified. Together they make a powerful team which can help bring a project in on time, on spec, and on budget on your DOS and/or OS/2 PC.

List: \$249 Ours: \$199

FAX (908) 389-8173



WATCOM C8.0/386

Unleash 386 power on your Microsoft C code with WATCOM C8.0/386, a 100% ANSI C optimizing compiler and run-time library generating applications for 32-bit 386 protected mode. With C8.0/386, you can go beyond the 640K DOS limit. Library and source compatibility with Microsoft C simplifies porting 16-bit applications to the 386. Significant features include: full-screen source-level debugger; protected mode version of the compiler; execution profiler; linker; graphics library. Run-time compatible with WATCOM F77/386.

Standard List: \$895 Ours: \$719

Professional List: \$1295 Ours: \$969

FAX (908) 389-8173



386/486 Development

Intel 386/486 Code Builder	489
Lahey EM/32 w/OS 386	1119
PharLap 386 Dos Extender	439
PharLap 386 VMM	259
WATCOM C Prof. 386	969
WATCOM Fortran 386	929
Zortech C++ Devel. 3.0	599

Assembly/Disassembly

Advantage Disassembler	279
ASM Flow Professional	179
MS Macro Assembler 6.0	105
Sourcer w/ BIOS Pre-Proc.	109
Spontaneous Assembly	169
Turbo Debugger & Tools	105
Visible Computers 286	89

Basic Compilers

MS Basic Prof. Dev. Sys.	349
MS Quick BASIC	69
Visual Basic	139

Basic Libraries & Utilities

DB/Lib Professional	142
Dialogic	85
GraphPak Professional	129
ProBas	135
ProBas HyperHelp Toolkit	109
ProBas Telecom Toolkit	70
ProBas Toolkit 3.0	89
ProMath	94
ProScreen	89
P.D.Q.	129
QuickPak Professional	179
QuickScreen	129
QuickWindows Advanced	119

**GUARANTEED
BEST PRICES***

C/C++ Compilers

Borland C++	325
Instant C	449
Microsoft C 6.0	339
MS QuickC	69
MS QuickC w/QuickASM	139
Turbo C++	69
WATCOM C Professional	419
Zortech C++ 3.0	339
Developer's Edition 3.0	599
Science & Eng. 3.0	849

CASE TOOLS

Analysis Manager 3.0	175
EasyCASE Plus 3.0	399
EasyCASE Professional 3.0	529
Personal CASE	179

C-Code Generators

C Source w/ Source	479
PRO-C	695

C Communications

BreakOut II	189
C Asynch Manager	139
Essential Comm	259
Greenleaf CommLib	287
Greenleaf ViewComm	319
SerialTest	259
SilverComm C Asynch	215
View 232	149

**CORPORATE CUSTOMERS
CALL CORSOFT!**

C File Management

Btrieve	479
C Data Manager	259
Code Base 4.2	225
c-tree Plus	459
Essential Btree	159
Faircom SQL Server	419
Toolbox, Prof. Edition	935
Toolbox, Special Edition	635

**THOUSANDS MORE PRODUCTS
AVAILABLE! IF YOU DON'T SEE
WHAT YOU WANT, CALL US
ANYWAY!**

C General Libraries

C Function Library	79
C TOOLS PLUS	109
C Utility Library	199
Greenleaf Functions	179
Greenleaf SuperFunc.	239
Turbo C Tools	109

C Memory Management

"C" EMM	169
HEAP Expander	72
Hold Everything	149

C Screens

C Worthy	359
Greenleaf Data Windows	315
HI-SCREEN XL	129
Panel Plus II	395
Vermont Views	415
Vitamin C	289
VC Screen	125

C- Additional Products

Bar Code Library	319
Clear Plus for C	169
Code Check	479
C-Doc	169
MKS LEX & YACC	197
Objective C	239
Oxygen	CALL
PC Lint	105
PCYACC Professional	459
TimeSlicer	279

C-Translators

BAS-C	339
Commercial	799
286 Version	1029
FOR-C	589
w/ Source	849

C++ Libraries/Utilities

3 in 1 for C++	169
C++Views	419
Codebase ++	225
Greenleaf Comm ++	289
M++	265
M++, addit. products	CALL
Rogue Wave Math.h++	179
Rogue Wave Tools.h++	179
TIER	399
Win++	225
Zinc Library	179
w/ Source	269

COBOL

Micro Focus COBOL/2	1129
w/ TOOLSET	129
Personal COBOL	629
MS COBOL	629
Realia COBOL	849

Database Development

Clarion Personal	72
Clarion Professional	525
Clear Plus for dBase	169
Clipper	521
D Clip	192
Database Graph. Toolkit	259
dBASE III +	475
dBase IV Devel. Edition	845
dBFast Plus	269
dGE	249
Dr. Switch-ASE	153
Flipper	249
FoxBASE	249
FoxPro	489
FUNCKy Library	225
Paradox 3.5	549
QuickSilver	419
R&R Code Generator	129
R&R Report Writer	219
SilverComm	215
Silver Pak	299
Superbase 4	619
UI II Touch & Go	315
UI Programmer II	475

Debuggers

Multiscope Debugger (DOS)	99
Periscope Debuggers	CALL

Documentation

All Clear	229
Interactive Easyflow	125
Source Print	74
Tree Diagrammer	74

DOS Extenders

Ergo OS/286 Dev.Kit	629
PharLap 286 DOS Extender	439

Editors

Brief	CALL
KEDIT	125
Multi Edit	89
Multi Edit Professional	159
Norton Editor	85
Sage Prof. Editor	249
SPF/PC	199
Vedit Plus	115
Wylbur	179
EDIX	155

**Call FAXcetera
(908)389-8173**

**for instant additional
information on the
best selling products
highlighted in the
green shaded areas.**

Embedded Systems

C6 TO PROM	129
Link & Locate ++ Ext.	399
Paradigm LOCATE	35

Expert Systems

Best Choice 3	79
Database Toolkit 2.0	115
KnowledgePro	339
Logic Gem	105

FORTRAN

Lahey F77L	535
Lahey Personal FORTRAN	89
MS FORTRAN	299
WATCOM Fortran 77	449

Graphic Libraries

Baby Driver	199
Essential Graphics	189
Graf/Drive Plus Developers	269
GrafPrint Personal	59
GrafPrint Plus	119
GSS Graph. Dev. Toolkit	685
GX Effects 2.0	169
GX Graphics	199
GX Text 2.0	135
Halo	279
Halo Professional	395
Halo Windows Dev. Toolkit	419
Menuet	279
PCX Programmer's Toolkit w/ Source	249
SUNSHOW Products	599
Turbo Geometry Library	CALL
Victor Image Library	179

Linkers/Profilers

Blinker	225
Charge	89
Plink86 Plus	335
.RTLInK/Plus	295

OS/2

CASE:PM for C or C++	1895
MS OS/2 Present. Mgr.Tkt.	349
SHIELD Series	CALL
Smalltalk/V PM	395

Pascal

Asynch Library	135
Object Professional	149
Power Tools +	109
Topaz	89
Topaz Multiuser	135
TSR's Made Easy	45
Turbo Magic	169
Turbo Pascal 6.0	105
Turbo Pascal for Windows	169
Turbo Pascal Professional	209
Turbo Plus 5.5	155
Turbo Professional	99
Turbo Vision Toolkit	109

**PROGRAMMER'S PARADISE—
FOR SERVICE, SELECTION
AND SAVINGS!**

Prototyping

Dan Bricklin's Demo II	265
Proteus 5.0	249
Show Partner F/X	355

Version Control/Make

MKS MAKE	119
MKS RCS	199
PolyMake	149
Professional PVCS	419
Sourcerer's Apprentice	399
TLIB	119

Windows Development

3 in 1 for C	143
Actor	199
Actor Professional	399
CASE:W	435
CASE:W Corporate	929
CODEPAO for Windows	95
dBFAST/Windows	269
DbxSHIELD	549
DialogCoder	479
Drover Toolbox/Wind.	239
InstallSHIELD	349
KnowledgePro Windows	439
LogSHIELD	369
MemSHIELD	369
MS Windows Devel. Tikit	349
Multiscope for Windows	289
ObjectVision	95
ProtoView	625
RFFlow	115
Sage Control Pak	535
Smalltalk/Windows	395
Spinnaker Plus	349
ToolBook	349
Whitewater Res. Tikt	CALL
WindowsMaker	635
WindowsMaker Prof.	795

**THE NEW FALL CATALOGS ARE
HERE! IF YOU HAVEN'T
RECEIVED ONE,
CALL US TODAY!**

Utilities

386MAX	114
AboveDISC	64
AboveMEM	75
Blue MAX	135
Central Point Backup	89
DIS DOC Professional	225
Dynamic Memory Ctl.	72
EZ-Install	219
HIJAAK	139
Hold Everything	159
Info Spotter	69
Label Master	399
MKS TOOLKIT	199
Move'em	79
Norton Anti-Virus	99
Norton Commander	99
Norton Utilities 6.0	129
Opt-Tech Sort/Merge	119
Paranet Turbo	72
PC Tools Deluxe 7.0	115
PreCursor	79
SpinRite II	65
Squish Plus	75
SUNSHOW Image Libry.	CALL
Switch-It	90
Tree86	69
UpShot	89
Zeno	239

Windows Applications

Communications	
Crosstalk for Windows	125
Dynacomm Asynch for Windows	189
Faxit for Windows	129
WIN Connect	82
WinFax	49

Environment

Windows 3.0	99
w/ MS Mouse Bus	159
MS DOS 5.0 Upgrade	65

Database & Forms

dBFAST/Windows	269
FormBase	CALL
Object Vision for Windows	CALL
SQL Windows	1199
Superbase 4 Windows	425

Graphics/Publishing

Adobe Illustrator/Wind.	299
Adobe Streamline/Wind.	269
Arts & Letters	
Graphics Composer	245
Graphics Editor	419
Corel Draw 2.0	389
Micrografx Charisma	345
Micrografx Designer	485
MS PowerPoint	319
OmniPage 386	469
OmniPage Professional	655
PageMaker	499
PC Paintbrush/Windows	53
Publisher's Type Foundry	385
Ventura Publisher	585

Spreadsheet

MS Excel	319
Wingz	339

GUARANTEED BEST PRICES*

Products listed here are backed by the following guarantee: Should you see one of these products listed at a lower price in another ad in this magazine, **CALL US!** We'll beat the price, and still offer our same quality service and support!

Terms of offer:

- Offer good through September 30, 1991.
- Applicable to pricing on current versions of software listed.
- September issue prices only.
- Offer does not apply towards obvious errors in competitors' ads.

*Subject to same terms and conditions

DialogCoder

DialogCoder is a powerful Windows CASE tool and source generator for dialog boxes. The user-interface components of an application provides a unique animation feature for testing. Supports conditional states, multiple triggers, linked controls, custom controls, automatic code regeneration (including custom code), owner-drawn controls, edit field validation, color, generation of DLLs; and much more. Generates both C and C++ source code, saving weeks of costly coding and debugging time for each project.

List: \$499 Ours: \$479

FAX ORDER # 3293-0001



EZ-INSTALL 4.0

Produces professional, comprehensive installation routines for software. Includes Installation Aid, a menu-driven facility that guides the developer through installation options, then generates installation configuration and creates distribution disks. Reduces development time, ensures correct installation, reduces support calls. Checks/modifies user's CONFIG.SYS, AUTOEXEC.BAT, Windows .INI files, system environment, and more. Toolkit includes compression utility, large-file splitting utility and EZ-PAINT screen painter. Source included/royalty-free. DOS List: \$249 Ours: \$219

OS/2 List: \$349 Ours: \$315
DOS & OS/2 List: \$449 Ours: \$399

FAX ORDER # 3293-0001



ATTENTION CORPORATE CUSTOMERS

Call **CORSOFT** (800) 422-6507

- Select from over 5,000 titles—and we special order too!
- Get quick delivery at great prices on Microsoft, Borland, Lotus...etc. We buy software directly from all the major publishers, and keep plenty of stock on hand. And we're now an authorized IBM software dealer!
- Ask about volume purchase agreements, contracts, and personally assigned inside & outside sales representatives.

CORSOFT is a Division of Voyager Software Corp



A Division of Voyager Software Corp
1163 Shrewsbury Ave., Shrewsbury, NJ 07702

1-800-445-7899

Corporate: 800-422-6507

(CORSOFT Division)

International: 908-389-9228

Customer Service: 908-389-9229

Canada: 800-445-7899

Fax: 908-389-9227

FAXcetera: 908-389-8173

POLICIES

Phone Orders

Mon-Fri 8:30 AM-8 PM EST, Sat 9:30-2:30 EST. We accept MC, Visa, AMEX. Domestic shipments, please add \$5 per item for shipping/handling by UPS ground. For domestic COD shipments, please add \$3. Rush service available.

Mail or FAX / International / POs

Phone number required with order.

FAXcetera (908) 389-8173

Call from your FAX telephone and follow the instructions to receive more information on the products featured above!

Corporate Accounts

Call CORSOFT, our corporate sales division. Ask about volume purchase agreements.

Returns

Subject to \$25 processing charge.

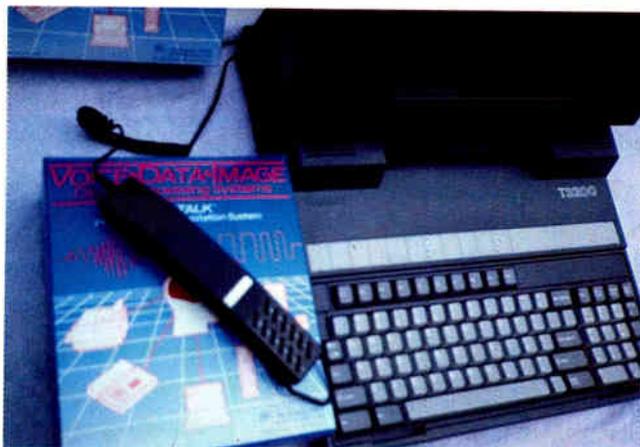
* All prices subject to change without notice.

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.

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.

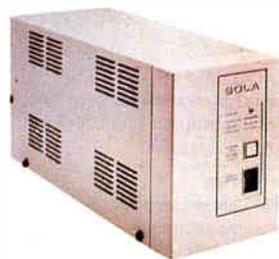
Price: \$299.
Contact: Pacific Data Products, Inc., 9125 Rehco Rd., San Diego, CA 92121, (619) 552-0880; fax (619) 552-0889.

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.



Power Sleuth works while Windows 3.0 is running other applications.



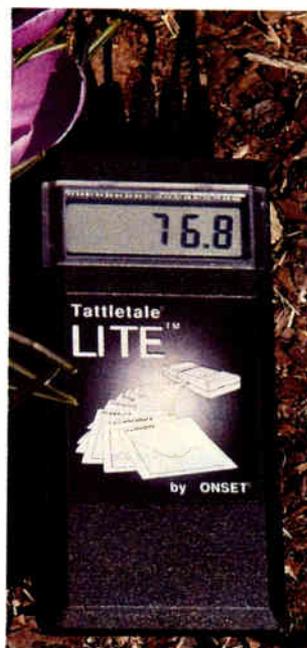
Data Logging by Battery

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.**

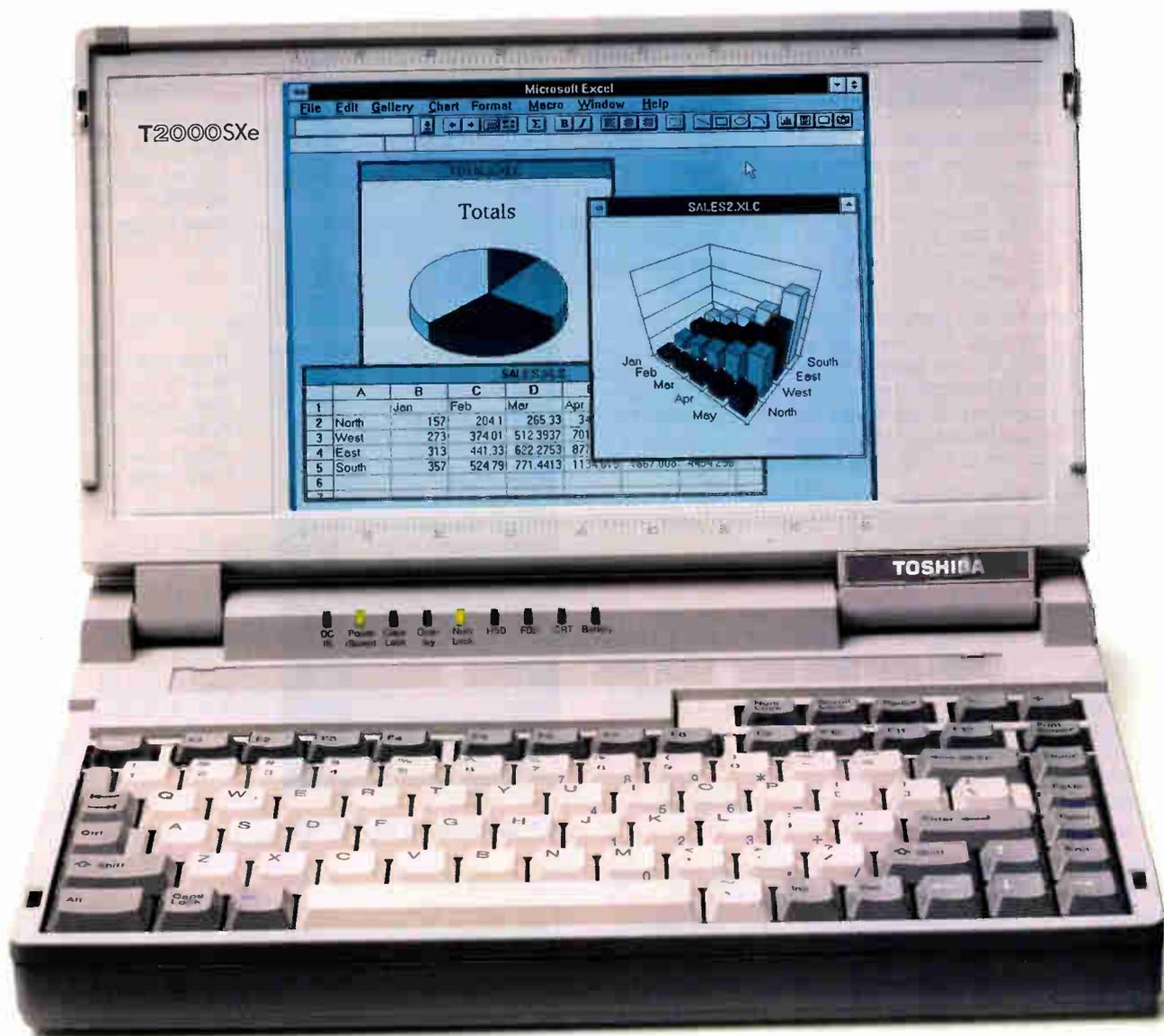
Contact: Onset Computer Corp., 199 Main St., North Falmouth, MA 02556, (508) 563-9000; fax (508) 563-9477.

Circle 1289 on Inquiry Card.



Tattletale Lite

THE MOST USEFUL TO COME ALONG



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.

FULL COMPUTER SINCE FEBRUARY.

THE E STANDS FOR EXTRA POWER.

Like the T2000SX, the T2000SXe weighs a minuscule 6.9 pounds, it boasts a 386SX processor, and it supplies up to 60 MB of hard disk storage space. But, and here's the news, the T2000SXe gives you a bigger dose of speed (20MHz) and more memory (2-10 MB RAM).

Of course, the T2000SXe also offers Hypertext, a VGA screen, full modem capabilities (including available cellular and fax accessories), full-size sculpted keys on its keyboard and a host of additional benefits that make other notebooks look more like memo pads.

A LONGER LASTING BATTERY.

The most useful computer isn't of much use if its battery doesn't last long.

That's why the T2000SXe, like the T2000SX, is armed with a Nickel Hydride battery. Nickel Hydride is proven to deliver 22% more power per ounce than the NiCad batteries found in other portable computers. In fact, according to Byte magazine, the battery on Toshiba's T2000SX lasted well over three hours on a 90-minute charge. Outlasting

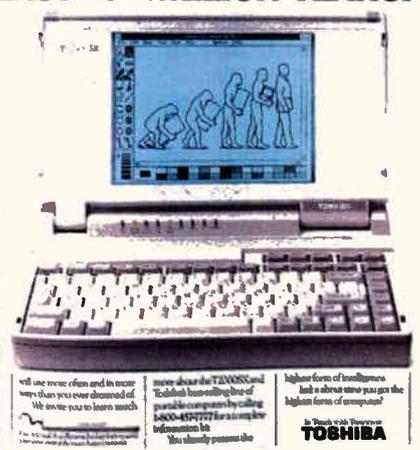
INTRODUCING THE MOST USEFUL COMPUTER TO COME ALONG IN THE LAST 15 MILLION YEARS.

The most useful computer in the world.

The first computers were large and crude. Over time, they became smaller and smarter. Today, computers have reached their highest form in what is called the Toshiba T2000SX notebook computer.

Quite simply, the T2000SX is a most useful piece of technology. It's small, it's portable, and it's powerful. It's the only notebook computer that can run a full range of software, from word processing to spreadsheets to databases. It's the only notebook computer that can run a full range of software, from word processing to spreadsheets to databases. It's the only notebook computer that can run a full range of software, from word processing to spreadsheets to databases.

... (text continues in columns) ...



... (text continues in columns) ...

After testing eight of the top notebook computers on the market, Byte Magazine said, "Buy the Toshiba T2000SX." Wait'll they try the T2000SXe.

every other notebook they tested and lasting twice as long as some.

To get even greater battery life, the T2000SXe offers Toshiba's highly acclaimed AutoResume. A special feature that allows you to shut your computer down and start up precisely where you left off. Without the hassle of rebooting, restarting applications and reloading files.

NOW THERE ARE EVEN MORE CHOICES.

At Toshiba, we've always believed that no one computer is right for everyone. That's why we've also

added a more affordable notebook to our line called the T2000. Featuring a 12MHz, 286 processor, it's designed for people who don't need all the power of the T2000SX or the T2000SXe.

If you'd like to learn more about the world's most useful notebook and portable computers, please call us at 1-800-457-7777.

Well, that's the latest. Three incredible notebooks that fit your needs, your briefcase and now your budget.

Isn't technology wonderful?

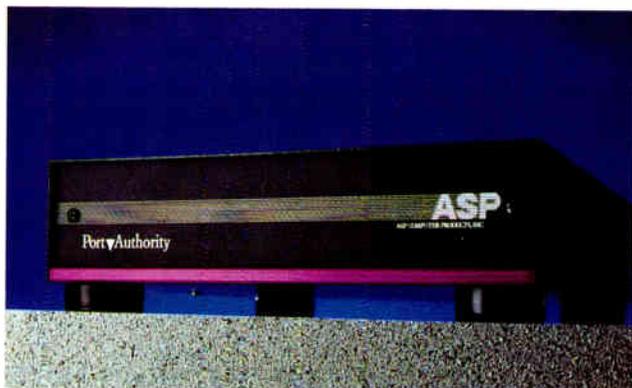
In Touch with Tomorrow
TOSHIBA

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).

See us at
 **COMDEX/Fall '91**
 Booth #4050, Sands EXPO

 **FLYTECH GROUP INTERNATIONAL**

U.S.A.: TEL # 408-7277373.7277374 FAX # 408-7277375 TAIWAN: TEL # 2-7852556.7827538 FAX # 2-7852371.7837970 GERMANY: TEL # 69-746081.746453 FAX # 69-749375 HONGKONG: TEL # 305-1268 FAX # 796-8427

DISTRIBUTORS AUSTRALIA: SIGMA DATA TEL # 61-2-9573777 FAX # 61-2-9572013 BRAZIL/PARAGUAY: MICROFACE TEL # 21-3258589 FAX # 21-3259354 TEL # (305) 4770222 FAX # (305) 4773208 BELGIUM: CELEM S.A. TEL # 32-41-676434 FAX # 32-41-676515 SOUTH AFRICA: PC MART TEL # 27-11-23-0131 FAX # 27-11-23-3248 CHILE: G & G S.A. TEL # 56-2-2271518 FAX # 56-2-494784 FRANCE: M3C TEL # 33-1-4827-1976 FAX # 33-1-4230-5916 GERMANY: MACROTRON TEL # 49-89-420-8233 FAX # 49-89-423-745 GREECE: ALTEC TEL # 30-1-8832017 FAX # 30-1-8816187 HONG KONG: PARKLY TEL # 852-303-1288 FAX # 852-796-8427 HUNGARY: MINOR TEL # 361-1224-687 FAX # 361-1415-656 ITALY: PRIMA TEL # 39-522-518599 FAX # 39-522-518599 ISRAEL: MLL TEL # 972-3-7515511 FAX # 972-3-7516615 KOREA: MCCOY TEL # 82-2-7436055 FAX # 82-2-7431896 INDIA: UNICORP TEL # 91-11-6831341 FAX # 91-11-631557 BEETA TEL # 852-3676153 FAX # 852-7240843 MALAYSIA: COMTEC TEL # 60-3-274-9898 MEXICO: TRIONICA TEL # 52-5-2591221 FAX # 52-5-2591447 NORWAY: SECUS TEL # 47-2-722-510 FAX # 47-2-722-515 NETHERLAND: KN TEL # 31-20-6584141 FAX # 31-20-6597436 SINGAPORE: TRANSNIKO TEL # 65-4758408 FAX # 65-4713603 SPAIN: ABACO TEL # 34-185-11652 FAX # 34-185-08093 SAUDI ARABIA: FIFA TEL # 966-8348798 FAX # 966-8335215 SWITZERLAND: EURO SOFTWARE TEL # 41-22-622-020 FAX # 41-22-615-650 UNITED KINGDOM: CENTERPRISE TEL # 44-256-463754 FAX # 44-256-843174

Circle 116 on Inquiry Card.

THE NEW STANDARD

CARRY-1

THE POWER THAT MOVES YOU...

ZENITH DATA SYSTEMS UPSETS THE BALANCE



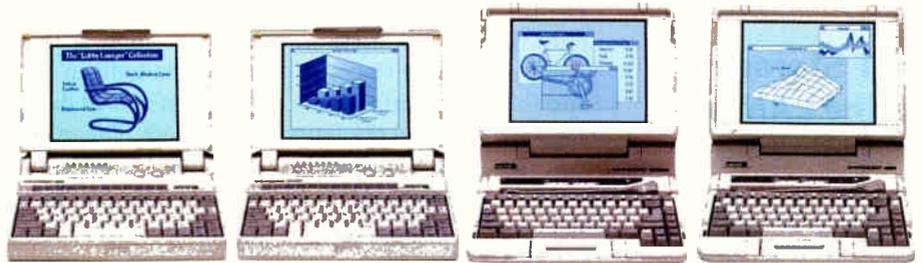
**MastersPort
386SL**

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.

INTRODUCING 5 NEW PORTABLES FROM ZENITH DATA SYSTEMS.

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.

ZENITH
data systems

Groupe Bull

Intel386 and i486 are trademarks of Intel Corporation. MastersPort, SupersPort, Premier System Management and Intelligent Power Management are trademarks of Zenith Data Systems Corporation. MS-DOS, Microsoft and Windows are trademarks of Microsoft Corporation.

Copyright © 1991 Zenith Data Systems Corporation

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.

MouseMan for
the Right Hand



MouseMan for
the Left Hand



MouseMan
Cordless
Radio Mouse



For more information, call:

800-231-7717 ext. 2606

In CA: 800-552-8885 ext. 2617.



Tools That Power The Desktop.

Circle 170 on Inquiry Card (RESELLERS: 171).

MouseMan for the Right Hand and MouseMan for the Left Hand are for IBM® PC's and compatibles and Macintosh® systems. MouseMan Cordless is for IBM PC's and compatibles only. TM (R). Trademarks are registered trademarks of their respective holders.



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:

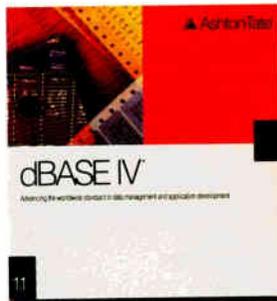
“Among the top ranking programs, dBASE IV (version 1.1) is the most well-rounded, with solid performance, versatility, and usability.” Commenting on speed, *Software Digest* points out that “dBASE IV produces all three test reports as fast as or faster than FoxPro/LAN.” As for Ease of Use and Ease of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

REPRODUCTION OR QUOTATION IN WHOLE OR IN PART IS PROHIBITED WITHOUT PRIOR WRITTEN PERMISSION. All rights reserved. © 1990 by NSTL, Inc., Plymouth Corporate Center, Plymouth Meeting, PA 19062, 600-223-7073.

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.

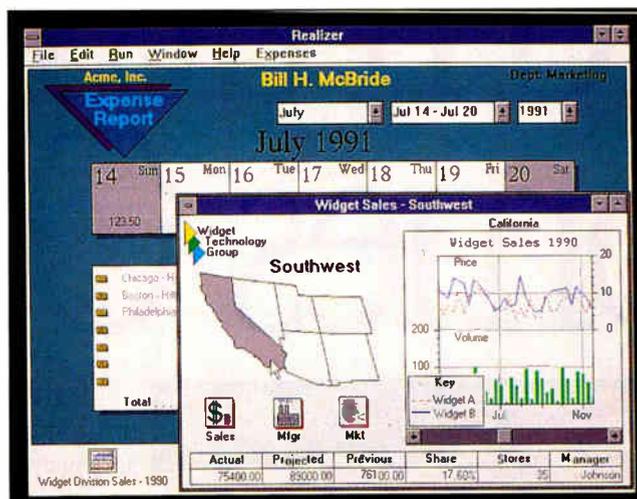
Advanced functions include a scheduler for timed events; triggers or links among tools to create associations and interactions throughout applications; a serial communications library; Dynamic Data Exchange support for building real-time systems or hot-linking data between applications; and access to 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

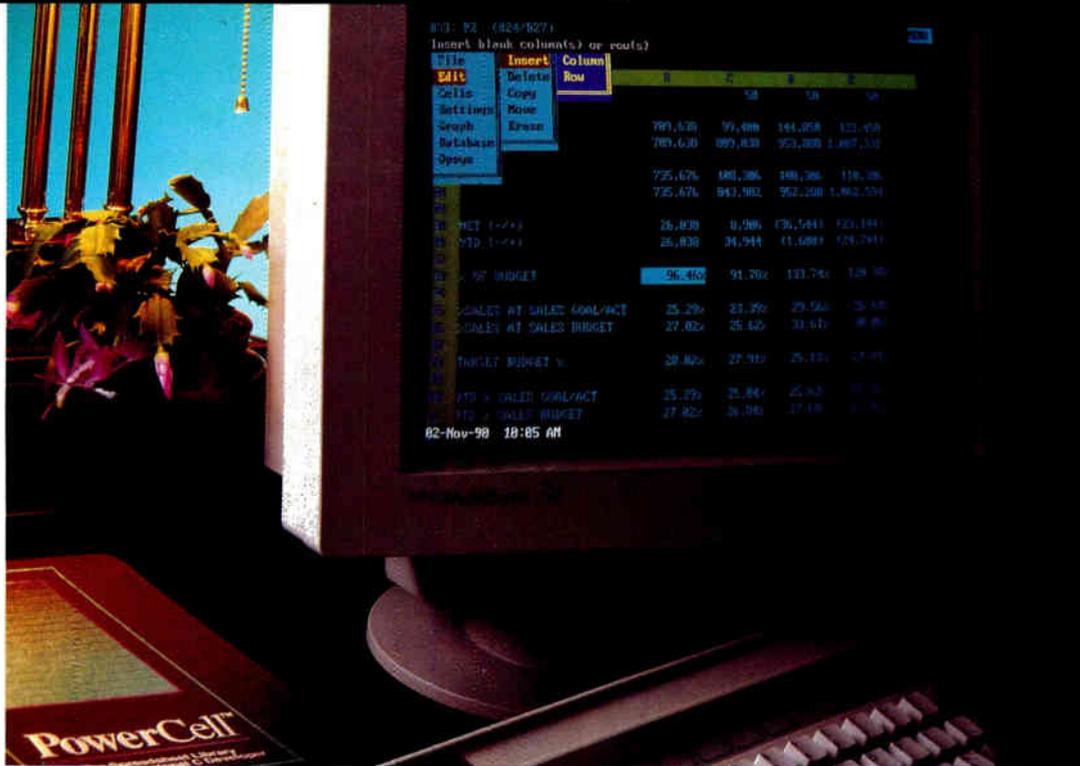
Dimensional Reasoner is a programming tool for checking calculations in science, financial, engineering, and simulation applications written in FORTRAN and BASIC. The program provides an automated method for testing programs, useful for applications with extensive code or those developed by programming 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

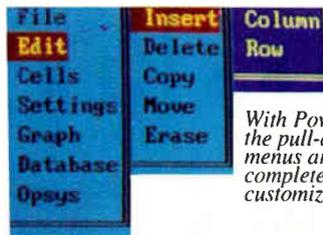
With PowerCell, Developing C Applications Just Got Easier.

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

RAIMA™
CORPORATION

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.

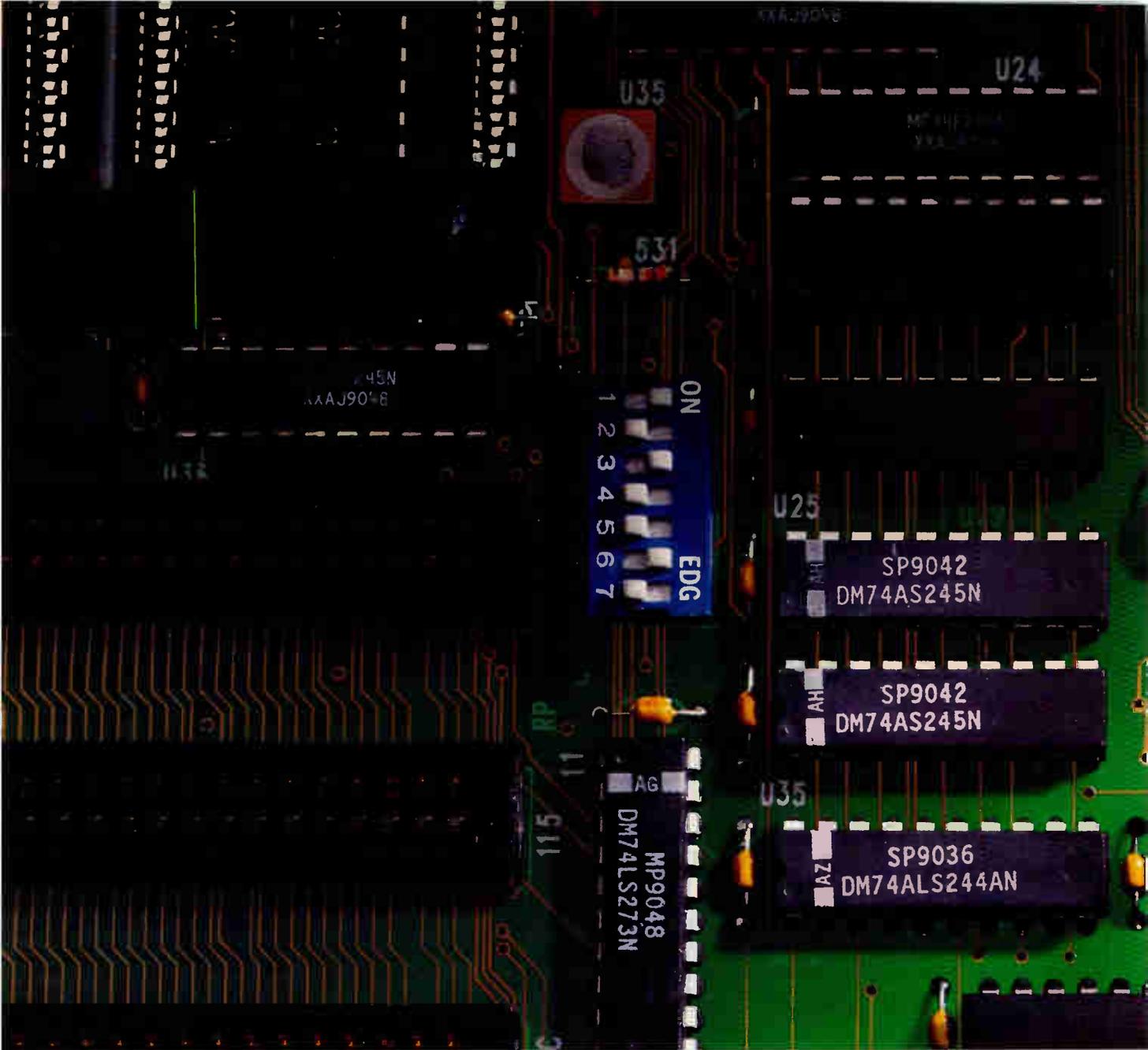
Raima Corporation 3245 146th Place S.E., Bellevue, WA 98007 USA (206)747-5570 Telex: 6503018237 MCI UW Fax: (206)747-1991
International Distributors: Australia: 61 2 419 7177 Austria: 43 222 8139838 Belgium: 32 2 734 9818 Brazil: 55 11 531 5297 Central America: 506 28 07 64 Finland: 358 080405350 France: 33 1 46 09 27 84
Germany: 49 7022 34077 Italy: 39 49 829 1285 Japan: 81 33 865 2140 Mexico: 52 83 49 53 00 The Netherlands: 31 2503 26312 Norway: 472 38 48 88 Singapore: 65 294 6714 Sweden: 46 13 411 588
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

Copyright ©1991 Raima Corporation. All rights reserved. PowerCell and db_ are registered in the U.S. Patent and Trademark Office.

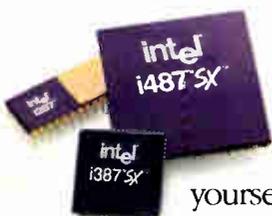
World Radio History

Circle 265 on Inquiry Card.

BY91PC



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.

intel[®]

The Computer Inside.™

Circle 149 on Inquiry Card (RESELLERS: 150).

World Radio History

Learn Windows Using Multimedia

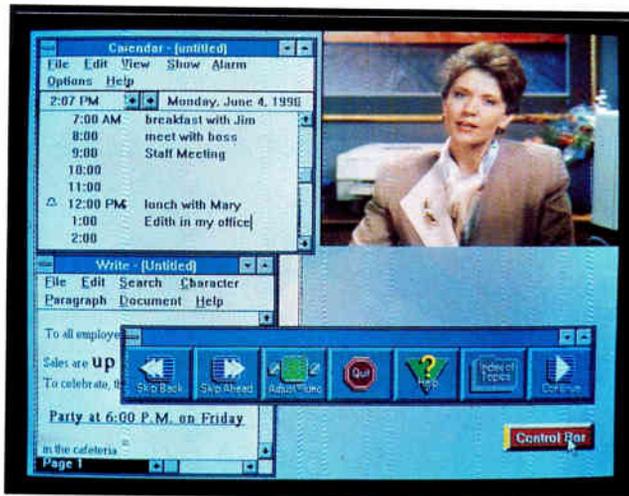
Companies with PCs looking to standardize on Windows 3.0 can use a new multimedia program from Comsell to teach the skills and fundamentals necessary to run Windows applications. The interactive Windows Basics program uses motion-video sequences and a talking on-screen instructor to teach you how to 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.

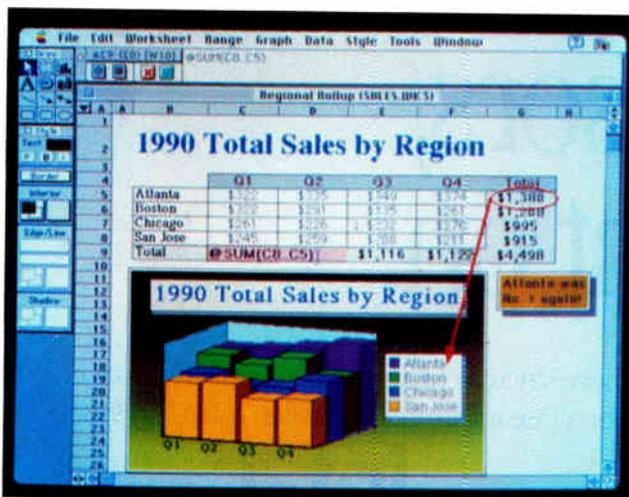
Along with offering a tight integration of its applications, Claris says, Resolve can meld Publish & Subscribe with XTND file translation so that workgroup publishing can include work created on non-Mac platforms.

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.
- Flexible yet powerful Algorithm Development System supporting Symbolic Pinout Mapping allows customization of all applications according to specific needs. Add new programming algorithms, implement On-Board Programming, create custom test programs.
- Up to 296 overcurrent protected mixed analog & digital pins/channels; Voltage Source & Sink,
- Universal Programmer supports virtually all devices on the market and features: True Self Calibration/Diagnostics, Programmable Current Generator, Part Insertion Sensing, Continuity Test, True State Machine Testing, Handler Interface; Adapters for Gang, PLCC, etc...



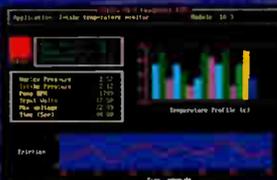
PROGRAMMER



ALGORITHM DEVELOPMENT



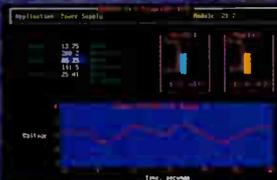
DATA LOGGER



CONTROLLER



POWER SUPPLY



TESTER



from \$995

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



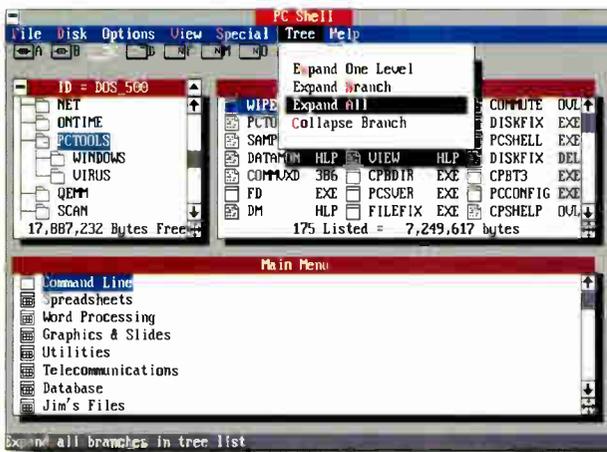
B&C MICROSYSTEMS INC.

750 North Pastoria Avenue, Sunnyvale, CA 94086 USA

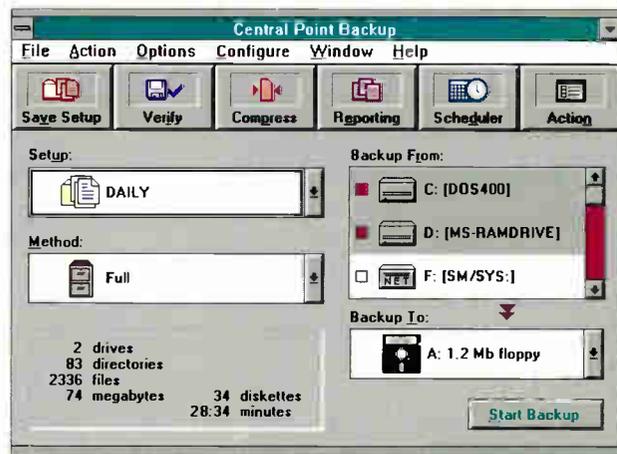
(408) 730-5511
FAX (408) 730-5521

DISTRIBUTORS WANTED

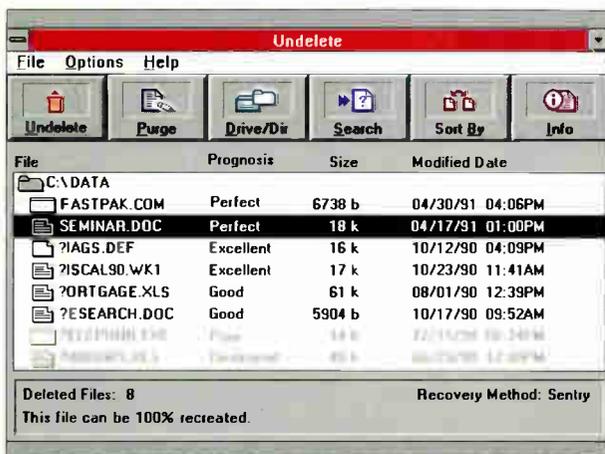
“We Chose PC Tools The Best Technology



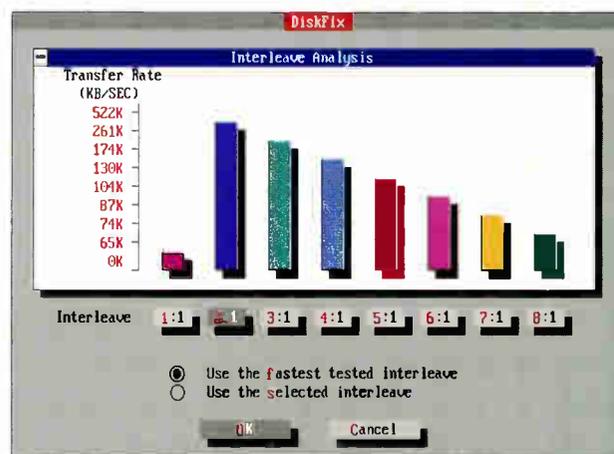
DOS 5.0 Compatible Shell & File Manager. Designed for DOS 5.0 keystroke and menu compatibility, PC Tools 7.0 gives you a powerful system for launching applications and managing your hard disk. Includes viewers for 37 popular programs.



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.



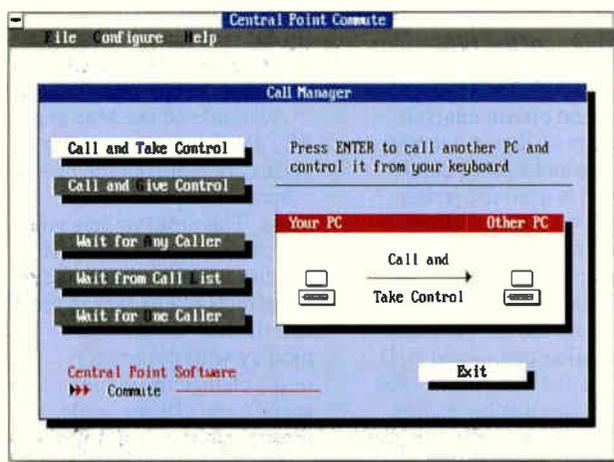
DOS and Windows Undelete. Our new Undelete moves erased files to a "safety zone" on your disk - local or network. It's compatible with the technology we licensed to Microsoft for DOS 5, but provides even better protection.



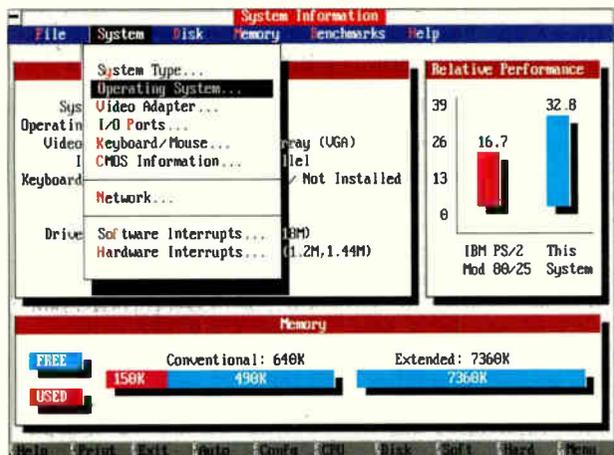
Disk Maintenance and Repair. To help avoid disk crashes and optimize data transfer, our DiskFix™ now does non-destructive, low-level reformatting. DiskFix solves dozens of other disk problems as well.

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.

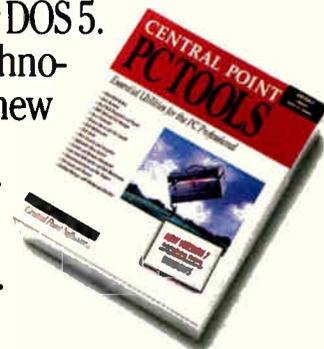
Introducing PC Tools™ 7.0.

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.



Central Point Software®
INC
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-

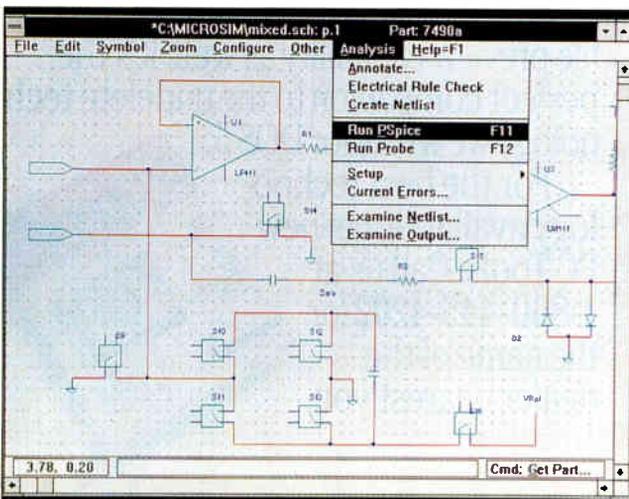
tion, and circuit analysis through its direct interface to PSpice and Probe. Schematics is available under Windows 3.0 and Open Windows on Sun workstations.

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.

Circle 1309 on Inquiry Card.

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
Tel. (519) 886-3700 Fax (519) 747-4974

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. **Circle 1312 on Inquiry Card.**

YET THE CHAMPION OF THE PEOPLE IS GATEWAY 2000 — AND THE BEST VALUE SHALL PREVAIL!



Once upon a time, you had to spend a king's ransom to possess a personal computer. In those days there lived a young rebel who dedicated himself to opposing this tyranny. He gathered about him a band of renegades and fashioned a company that sold the same quality technology directly to the people at a fair price. That company was called Gateway 2000.

Over the years the people grew to love Gateway's computers and the merry men and women who built, sold and serviced them — so much so that the PC Titans felt the pinch. Not to be outwitted by a troop of outrageous mavericks, the Mighty Titans declared war on the forest people. They made much ado about rolling heads and slashing prices in a fierce battle for market share, even though their

crusade resulted in a paltry savings.

The battle rages today. But you know how the story ends. The Titans, having grown to lumbering proportions, are no match for the swift, lean woodsmen. The best value shall prevail. When it comes to price, quality and service, the arrow that flies straight and true belongs to Gateway 2000, the legendary Champion of the People.

So buy a Gateway and live happily ever after.



"You've got a friend in the business."

THE PC TITANS HAVE DECLARED WAR...



GATEWAY 2000 SYSTEMS

16MHZ 286 VGA

- Intel 80286 Processor
- 2 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 40 MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 512K
- 14" Crystal Scan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 1 PS/2 Mouse Port
- 124 Key AnyKey™ Keyboard
- New MS DOS™ 5.0

\$1395

16MHZ 386SX VGA

- Intel™ 80386SX Processor
- 2 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 40 MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 512K
- 14" Crystal Scan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 1 PS/2 Mouse Port
- 124 Key AnyKey™ Keyboard
- Microsoft™ Mouse
- New MS DOS 5.0
- MS Windows™ 3.0

\$1495

20MHZ 386SX CACHE

- Intel 80386SX Processor
- 32K Cache RAM
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 80 MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 512K
- 14" Crystal Scan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 1 PS/2 Mouse Port
- 124 Key AnyKey™ Keyboard
- Microsoft Mouse
- New MS DOS 5.0
- MS Windows 3.0

\$1795

25MHZ 386 VGA

- Intel 80386 Processor
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 80 MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 1 MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124 Key AnyKey™ Keyboard
- Microsoft Mouse
- New MS DOS 5.0
- MS Windows 3.0

\$1995

BEST BUYS

- Get our 33 MHz 386 Cache system, same configuration as listed, with a 120 MB IDE hard drive instead of the 200 MB drive.

\$2395

- Same features as our 33 MHz 486 Cache system except this machine has 4 MB RAM, instead of 8, and a 120 MB IDE hard drive, instead of the 200 MB drive in our standard configuration.

\$2845

33MHZ 386 CACHE

- Intel 80386 Processor
- 64K Cache RAM
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 200 MB 15ms IDE Drive with 64K Multi-Segmented Cache
- 16-Bit VGA with 1 MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124 Key AnyKey™ Keyboard
- Microsoft Mouse
- New MS DOS 5.0
- MS Windows 3.0

\$2695

25MHZ 486 CACHE

- Intel 80486 Processor
- 64K Cache RAM
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 200 MB 15ms IDE Drive with 64K Multi-Segmented Cache
- 16-Bit VGA with 1 MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124 Key AnyKey™ Keyboard
- Microsoft Mouse
- New MS DOS 5.0
- MS Windows 3.0

\$2995

33MHZ 486 CACHE

- Intel 80486 Processor
- 64K Cache RAM
- 8 MB RAM, Expands to 64 MB
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 200 MB 15ms IDE Drive with 64K Multi-Segmented Cache
- 16-Bit VGA with 1 MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124 Key AnyKey™ Keyboard
- Microsoft Mouse
- New MS DOS 5.0
- MS Windows 3.0

\$3395



The Extras – That Don't Cost Extra At Gateway

- 30-day money-back guarantee
- One-year warranty on parts and labor
- Free bulletin board technical support
- Toll-free technical support for the life of the machine
- Custom 124-key programmable AnyKey keyboard standard with all systems
- Free on-site service to most locations in the nation
- Replacement parts sent via overnight shipping free of charge
- Leasing options for commercial customers
- Non-interlaced color monitors standard with all 386 DX and 486 systems

Due to the volatility of the DRAM market, all prices are subject to change. Prices do not include shipping.

Sales Hours: 7am-10pm Weekdays, 9am-4pm Saturdays (CST)

New Expanded Service Hours: 6am-Midnight Weekdays, 9am-2pm Saturdays (CST)



8 0 0 - 5 2 3 - 2 0 0 0
610 Gateway Drive • N. Sioux City, SD 57049 • 605-232-2000 • Fax 605-232-2023

AnyKey, Intel, Microsoft, MS DOS and Windows are trademarks or registered trademarks of their respective companies. © 1991 Gateway 2000, Inc.



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.**

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.

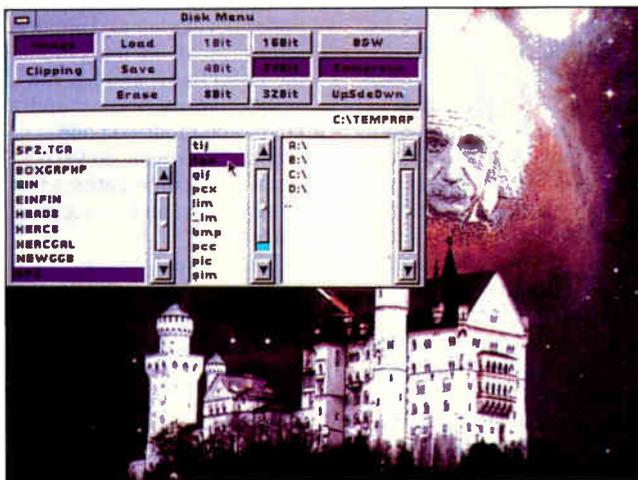
You can also change the orientation of graphs and other objects. For example, if you publish a graph from Excel to Canvas, then once you're in the draw program, you can modify the shape of the graph. When you modify the data in Excel, the modified data appears in the Canvas document, but the graph retains 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.



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.

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.

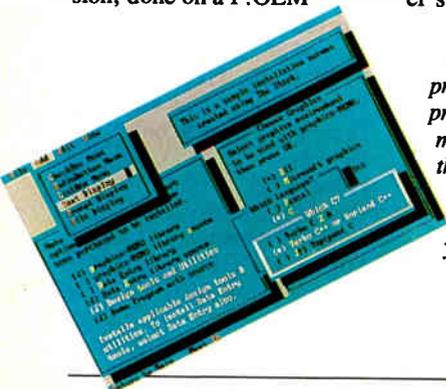
No More PCL Coding

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.

Circle 1006 on Inquiry Card.



FINALLY

THE WORLD'S FIRST & ONLY
MULTI-MEDIA OPTICAL DISK/CD-ROM DEVICE

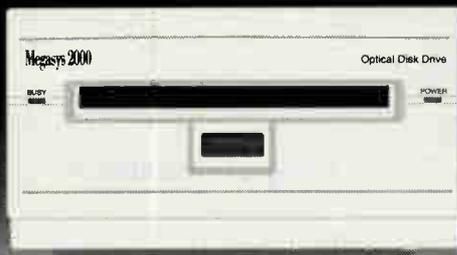


Megasys 2000

**ALL THREE
TECHNOLOGIES
COMBINED AT
ONE LOW PRICE**

- REWRITEABLE
One Gigabyte per Cartridge (approx.)
- WORM
One Gigabyte per Cartridge (approx.)
- CD-ROM
5"(680MB) & 3"(128MB) Standards

• 5 1/4" FORMAT



**AVAILABLE
NOW**

only \$4995

1-800-634-2797

NSB ————— **1-800-MEGASYS**

NATIONAL SERVICE BUREAU, INC. • 5990-K UNITY DRIVE • ATLANTA • GA • 30071

Circle 605 on Inquiry Card.

World Radio History

CONTROL UP TO 96 PC FILE SERVERS WITH 1 KEYBOARD AND MONITOR USING...

COMMANDER by cybex



- No external power
- "One-Touch" selection
- Shows PC power status
- "AutoBoot" Feature boots attached computers without operator intervention after power failure
- Mix PC, PC/XT, PC/AT and PS/2
- Mouse support available
- TTL (MDA, CGA, EGA) up to 600 feet away
- VGA up to 400 feet
- Each unit accommodates from 2 to 8 PCs
- Up to 12 units can be cascaded
- Mounting kit available for 19" rack installation

Dealer Program Available

Cybex Corporation

2800-H Wallace Ave. ● Huntsville, Al 35805 ● (205) 534-0011 ● FAX (205) 534-0010

COMTRADE

WHERE QUALITY IS EVERYTHING.

20 MHz 386 SX ONLY \$1,450

- 2 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 42 MB IDE 32K Cache Drive
- 16 Bit Super VGA with 1 MB
- 14" Color VGA 1024*ni* Monitor
- 2 Serial, 1 Parallel & 1 Game Ports
- Enhanced 101-key Keyboard
- Desktop or Mini-vertical Case
- MS-DOS & Hi-Res Serial Mouse
- 89MB 17ms drive add \$120



25 MHz 386 VGA ONLY \$1,790

- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 89 MB 17ms IDE 32K Cache Drive
- 16 Bit Super VGA with 1 MB
- 14" Color VGA 1024*ni* Monitor
- 2 Serial, 1 Parallel & 1 Game Ports
- Enhanced 101-key Keyboard
- Desktop or Mini-vertical Case
- MS-DOS & Hi-Res Serial Mouse
- 130MB 16ms drive add \$100

33 MHz 386 Cache ONLY \$2,090

- 64K Cache RAM
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 130 MB 16ms IDE 64K Cache Drive
- 16 Bit Super VGA with 1 MB
- 14" Color VGA 1024*ni* Monitor
- 2 Serial, 1 Parallel & 1 Game Ports
- Enhanced 101-key Keyboard
- Desktop or Vertical Case
- MS-DOS & Hi-Res Serial Mouse



33 MHz 486 Cache ONLY \$2,690

- 4 MB RAM & 487 Coprocessor
- 64K Cache Expandable to 256K
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 130 MB 16ms IDE 64K Cache Drive
- 16 Bit Super VGA with 1 MB
- 14" Color VGA 1024*ni* Monitor
- 2 Serial, 1 Parallel & 1 Game Ports
- Enhanced 101-key Keyboard
- Desktop or Vertical Case
- MS-DOS & Hi-Res Serial Mouse

40 MHz 386 Cache ONLY \$2,290

- Same configuration as our 386/33.

*Nice, very nice.
Non-interlace, flicker-free VGA.*

25 MHz 486 Cache ONLY \$2,550

- Same configuration as our 486/33.
- 210MB 15ms drive add \$240

Non-interlace 1024x768 Super VGA Monitor & 1MB Video RAM CARD for All Systems.

With 1 MB video RAM, our 14" non-interlace Super VGA monitor with a 0.28mm dot pitch will display crystal clear, flicker-free 1024x768 image at full 256 vivid colors. Our 1024*ni* monitor also has the auto-sensing feature to ensure centering images in any resolution. With this feature, no manual adjustment is needed in switching between 640x480, 800x600, or 1024x768.

Absolutely the best graphics package available.

COMTRADE 386/33

"A solid Windows 3.0 platform for an amazingly low price, top-notch components, good documentation, excellent support."

"It looks like a plain clone, but it's built like the proverbial brick house, with outstanding support."

"It's also a high performance machine, at a price that could stun a corporate purchasing officer."

"The staff is knowledgeable and friendly."

"In short, this machine is one fast hummer."



PC Sources, Feb 1991

Our customer lists go on & on

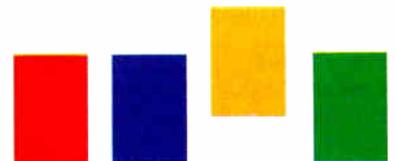
Since 1986

University of Florida
Honeywell
Department of Agriculture
General Electric
UCLA
Johns Hopkins Hospital
Bell Atlantic
University of Alaska
Jet Propulsion Laboratory
AT&T
University of Michigan
Johnson & Johnson
USC
University of Toronto
Motorola
U.S. Naval Hospital
Xerox Corporation
Washington State University

The Best Quality & Support Assurance.

- Unlimited Toll-Free Service & Support
- One Year Parts and Labor Warranty
- 30-Day No-Risk Money Back Guarantee
- Prompt Shipment of Replacement Parts
- Nationwide On-Site Service Available
- Each system is tested for 24 hours before shipping, absolutely no exception.

That is true value.



COMTRADE

"where quality is everything"

800-969-2123

AmExpress
Discover

*Each month thousands of buyers choose COMTRADE.
... the results of superior quality, service & price.*

VISA
Master

1016-B Lawson Street • City of Industry, CA 91748 • Phone : 818-964-6688 • Fax : 818-964-2492
All Comtrade systems are FCC approved • SX, 386 & 486 are trademarks of Intel Corporation.

Circle 588 on Inquiry Card (RESELLERS: 589).

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.

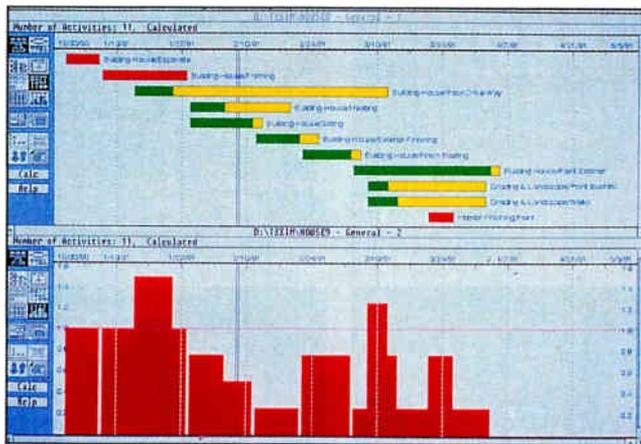
The program's interface provides WYSIWYG reports. It also supports PostScript and color PostScript devices.

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.

Circle 1011 on Inquiry Card.

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.

Price: \$69.95.

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

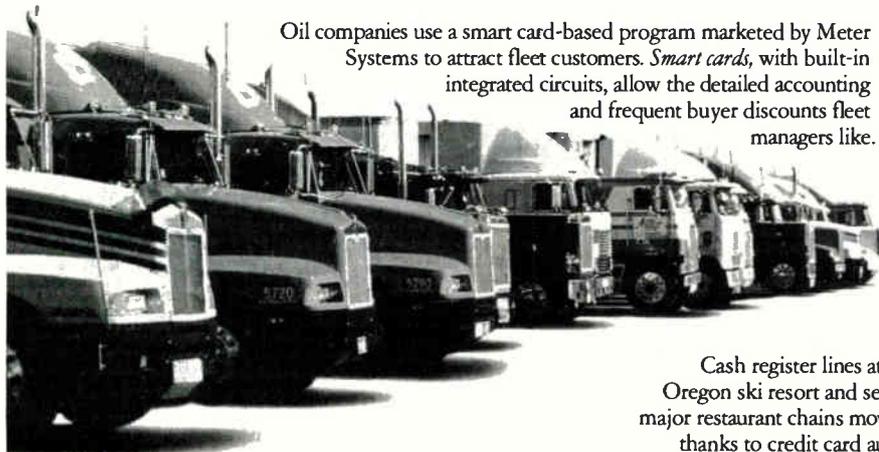
Although computerizing your business has many advantages, it can also have disadvantages. One of the more mundane disadvantages is that when you buy an accounting program you're often required to buy pre-printed blank checks.

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.

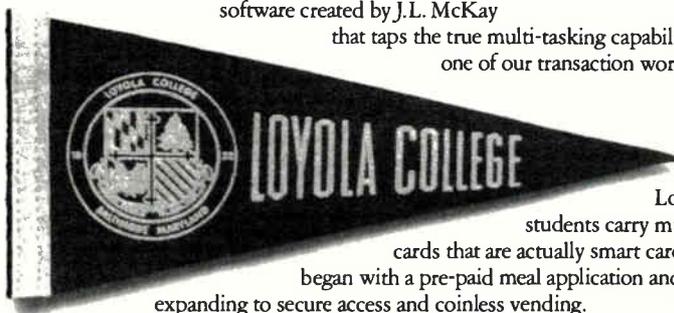


Oil companies use a smart card-based program marketed by Meter Systems to attract fleet customers. *Smart cards*, with built-in integrated circuits, allow the detailed accounting and frequent buyer discounts fleet managers like.



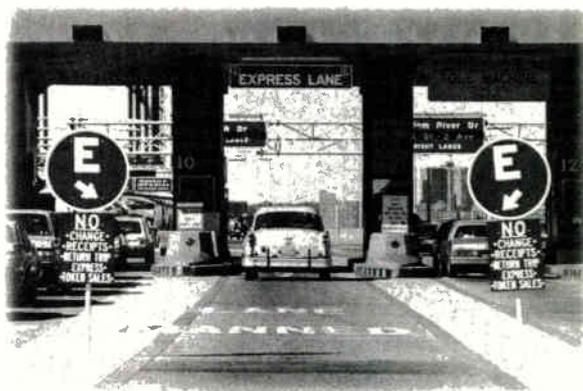
Cash register lines at an Oregon ski resort and several major restaurant chains move faster thanks to credit card authorization software created by J.L. McKay that taps the true multi-tasking capability built into one of our transaction workstations.

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.



TO THE BANK.

As the news spreads, more companies are taking card-based data transaction technology from DataCard, adding their application development expertise, and selling that combination to new customers in all types of markets.

So why not you? Our products offer open architecture based on current computing technology to let you take full advantage of your problem-solving abilities. Plus, we offer responsive, in-depth technical support and a worldwide service network established in our decades of service to retail, travel, healthcare, education, and financial markets.

To get started, just call 1-800-328-8623, ext. 1813, and ask for our information package outlining the advantages of DataCard's VAR program. Our ideas are here for the taking, wherever you want to run with them. **DataCard™**

©1991 DataCard Corporation. All rights reserved.

Circle 591 on Inquiry Card (RESELLERS: 592).

World Radio History



The Panama Canal Opened a Pathway Between Continents. UNIX EXPO INTERNATIONAL Will Connect You to the New Land of Open Systems.

You need UNIX and Open Systems.

UNIX offers you hot new workstations, highly flexible networks that can integrate the information flow in your company, advanced client/server applications...and more. Today's best solutions are UNIX solutions.

You need UNIX because it's the fastest pathway to Open Systems. It will shift the balance of power away from your suppliers...away from your competitors...to you.

That's independence. That's why the business market for UNIX nearly doubled in the past two years. That's why 70% of MIS managers surveyed called UNIX "my operating system of choice for addressing my

business problems in the '90s."

And that's why you should attend UNIX EXPO INTERNATIONAL.

It's the world's largest gathering of UNIX and Open Systems vendors for business. Bar none.

You'll see solutions from 225 exhibitors—the most ever to participate in a UNIX business show.

Hardware, system software, vertical and horizontal solutions, multimedia, even the latest shrink-wrapped packages.

You'll benefit from a conference sharply focused on six critical UNIX/Open Systems, all in one place. It's your shortcut to the future.

For more information, call us today at 212-391-9111.

UNIX EXPO
INTERNATIONAL

Your Pathway To Open Systems

October 30–November 1, 1991 Jacob K. Javits Convention Center, New York City

UNIX is a registered trademark of UNIX Systems Laboratories. UNIX EXPO INTERNATIONAL is not affiliated with UNIX Systems Laboratories. Produced and managed by National Blenheim Expositions, Inc.

Circle 616 on Inquiry Card (RESELLERS: 617).

World Radio History

Notebooks: USA Made, FCC 'B'

Features: RAM Exp to 4MB, 1.44MB Floppy, 640x480 VGA CCFT LCD Backlit Display, 83-Key Keyboard, 3 Hour Battery, External VGA Port, Serial, Parallel Ports, And Weighs **ONLY** 6.5 Pounds!!!

Windows V3.0 \$70, With System Purchase



386sx 20MHz Notebook, 40MB Hard Disk, 2MB RAM \$2095

386sx 20MHz Notebook, 20MB Hard Disk, 2MB RAM \$1865

386sx 20MHz Notebook, 20MB Hard Disk, 1MB RAM \$1795

386SX 16MHz System \$976

Motherboard Upgrade Option:
Upgrade your Strobe computer motherboard, and protect your investment.

286AT 16MHz System \$853

386DX 25MHz System \$1135

STANDARD FEATURES

1MB RAM Installed, 8MB Max
1.2MB Floppy Drive
1.44MB Floppy Drive
44MB Hard Disk, 28ms Access
640x480 Mono VGA Monitor
800x600, 256K VGA Card
1:1 IDE Dual HDC / FDC Controller
101 Key Enhanced Keyboard
Two Serial, One Parallel, And Game Port
DOS, OS/2, Novell, Unix Compatible

386SX 20MHz 32k Cache \$1075

One Year Parts Warranty

Unlimited Tech. Support

386DX 40MHz 64k Cache \$1375

386DX 33MHz 64k Cache \$1199

Lifetime Labor Support

Free Mouse With System

486 25MHz, 4MB 128k Cache \$1895

486SX 20MHz System \$1495

486 33MHz, 4MB 128k Cache \$1995

Upgrade to 1024x768 SVGA Monitor 0.28dp, with 1MB 1024 Video Card For \$225
1024x768 Multisync (non-interlaced), with 1MB 1024 Video Card For \$295

Upgrade The Hard Drives: 88MB HD, 18ms \$125 104MB HD, 17ms \$195
142MB HD, 15ms \$225 210MB HD, 15ms \$450 360MB HD, 15ms \$1195

Upgrade Memory To: 2MB RAM \$65 4MB RAM \$149 8MB RAM \$320

Open 9AM to 5PM, PST
Monday - Friday
10AM to 3PM, SAT.

MotherBoards

386 25MHz No Cache \$355
386 33MHz, 64K Cache \$465
486 25MHz, 128K Cache \$1065

5 YEAR EXTENDED WARRANTY Optional.
72 HOURS BURN-IN.
CALL FOR DETAILS.

STROBE COMPUTER

(800) 888-5095

15480 Arrow Hwy. #201, Baldwin Park, CA 91706, Info (818)962-0060 Fax (818)813-1483

A Platform for Wireless Communication

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.

Circle 1014 on Inquiry Card.

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.

Circle 1016 on Inquiry Card.

PC TRONICS

NoteStar★

Standard System Includes All Of The Following:

Processor:

- 32 Bit 80C386SX/16MHz CPU
- 8/16MHz Switchable System Speed

Memory:

- 2MB Onboard RAM, Expandable to 8MB
- System BIOS, Video BIOS with Shadow Function

LCD Display:

- 64-Gray Scale

Memory Expansion Chips:

- 80ns ZIP-type DRAM

I/O Connections:

- 1 Printer Port
- 1 External Keyboard Connector
- 1 External CRT Port for Color VGA Monitor
- 1 RS-232 Port
- 1 External FDD and RS-232 Pack Connector
- 1 Bus Expansion Pack Connector

Expansion Compartments:

- 2 Expansion Compartments for Battery and Optional Function Packs

Disk Storage:

- 1 Internal 3.5" 1.44MB Diskette Drive
- 1 20MB or 40MB or 60MB Internal Hard Disk Drive

Keyboard:

- 83 Keys - Function Keys 1 - 12

Power Supply:

- 2 Battery Packs
- Autoswitching 110 V/220 V AC
- Adapter/Battery

Physical Dimensions:

- Width: 12"
- Length: 9"
- Height: 2"

Weight (including 2 battery packs):

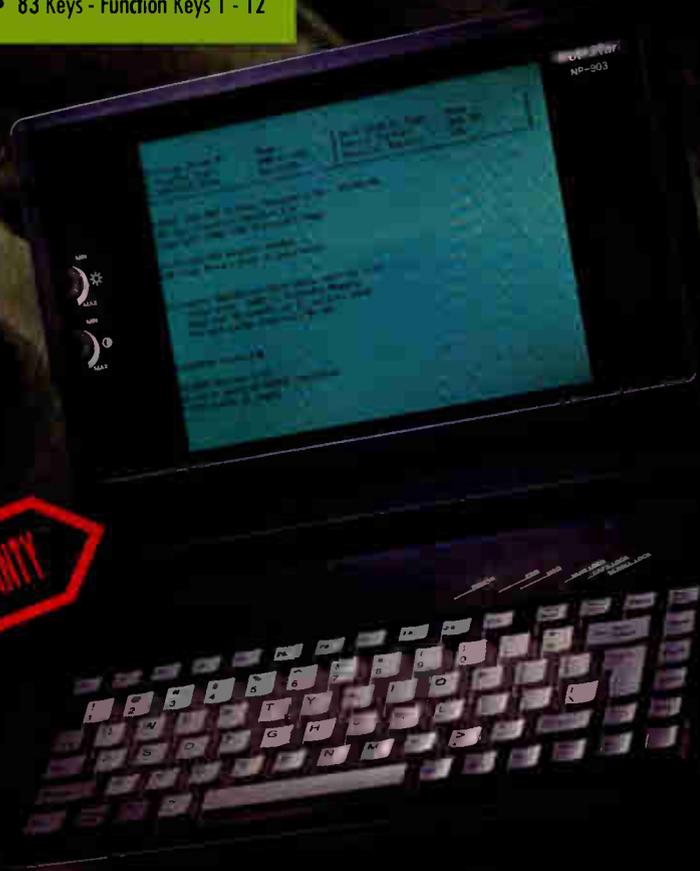
- 7.7 Pounds

Software:

- MS DOS 4.01
- Windows 3.0
- Video Utility
- Power Management Utility

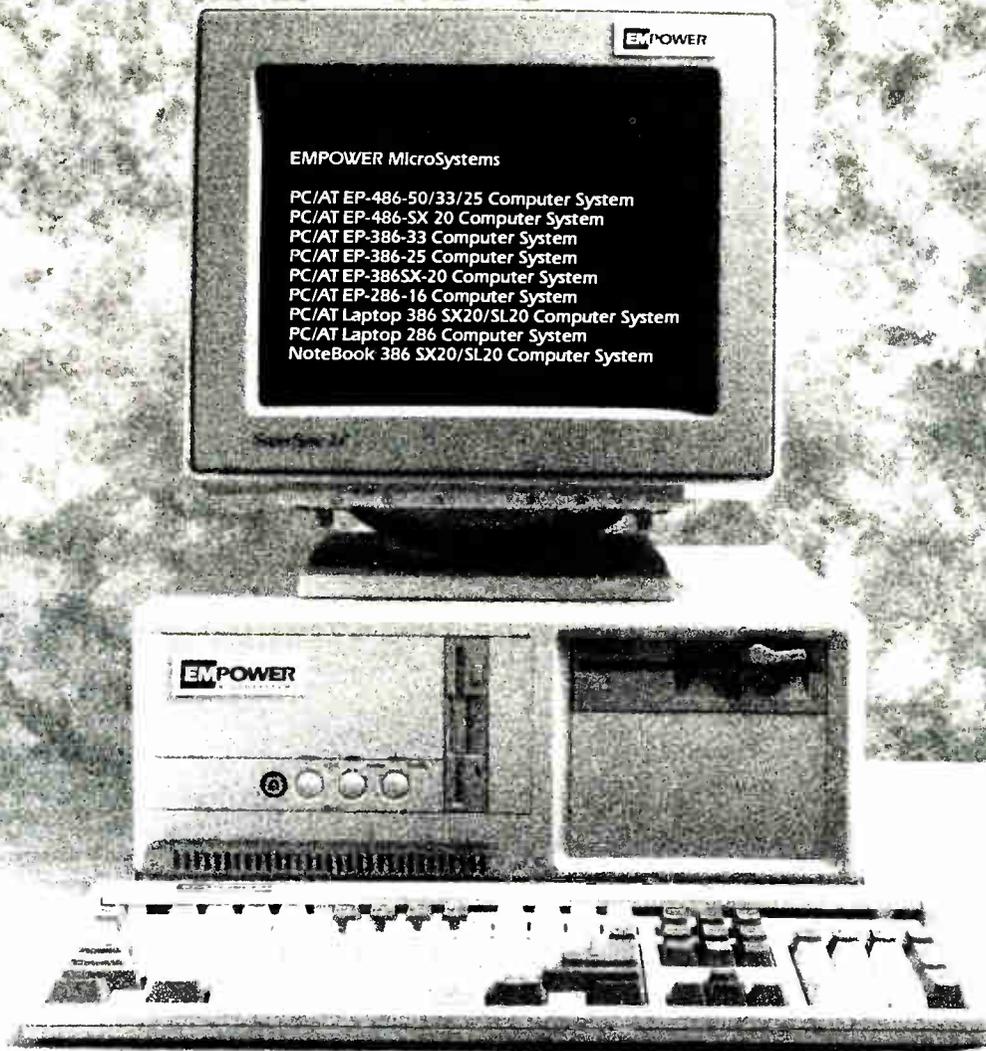
Standard Features With:

\$1950 20MB
\$2195 40MB
\$2295 60MB



1-800-999-1997

Toll free order hours: M-F 7a-7p Sat 9a-5p Customer service hours: M-Th 8:30-6:00 F 8:30-5:00 Sat 10:00 -5:00 Payment methods: Visa, MasterCard, Discover, Money Orders, Cashiers, Personal or Company Check
Return merchandise must be accompanied by authorization number and all original packing materials. Prices and availability subject to change.
PCTronics 1420 E 78th St Minneapolis, MN 55423 **Circle 610 on Inquiry Card (RESELLERS: 611).**



THE FIRST COMPUTER FOR OPEN MINDS.

Empower MicroSystems proudly offers the world's first fully affordable line of open system, high performance personal computers designed to work in a multi-operating system environment.

What does that mean?

It means that now you can run software and networks written for DOS, Windows, or UNIX.

All at the same time. And on the same machine.

Empower gives you the power to run the software and networks that meet your needs, not those of the computer manufacturer.

PRICED TO CHANGE THE WORLD.

But the best news is the price performance!

Empower MicroSystems is making these powerful, Intel-driven 486, 386, and 286 open architecture computers affordable.

And that's good news for all of us.

EMPOWER MICROSYSTEMS.

Designed and built by Empower MicroSystems in Milford, New

Hampshire, the complete line of Empower computers for business, medical, industrial and personal use is available through your local computer dealer, or directly from the manufacturer.

For more information and a copy of our product brochure, call Empower MicroSystems toll free at:

800/628-7015

EMPOWER
MICROSYSTEMS

EMPOWER MicroSystems, Inc. 7 Meadowbrook Drive, Milford, New Hampshire 03055 Telephone 603/673-1011 800-628-7015 Fax 603/673-1460

All of our components and systems are covered by warranty. All systems are available in desktop or tower configurations. Alternative configurations can be quoted upon request and are available for immediate delivery. To satisfy your multi-tasking and mathematical processing requirements, parallel processing and co-processing enhancements will be available in the near future.

Circle 595 on Inquiry Card (RESELLERS: 596).

World Radio History

BACKPACK. IT'S A DRIVE OF A DIFFERENT COLOR.



Add a diskette drive without horsing around inside your computer — just plug Backpack into your parallel port! Connect your printer to the Backpack drive. No tools. No hassles. No interface cards. Backpack works with IBM and compatibles including PCs, XTs, ATs, PS/2s, PS/1s, and laptops. It's available in 5.25"



and 3.5" and comes complete with everything you need. So don't horse around inside your computer, add an external drive the easy way—plug in a Backpack! Hard Disk models and tape backup available soon.

MicroSolutions
Computer Products

132 W. Lincoln Hwy., DeKalb, IL 60115
815-756-3411 Fax: 756-2928

Circle 618 on Inquiry Card.

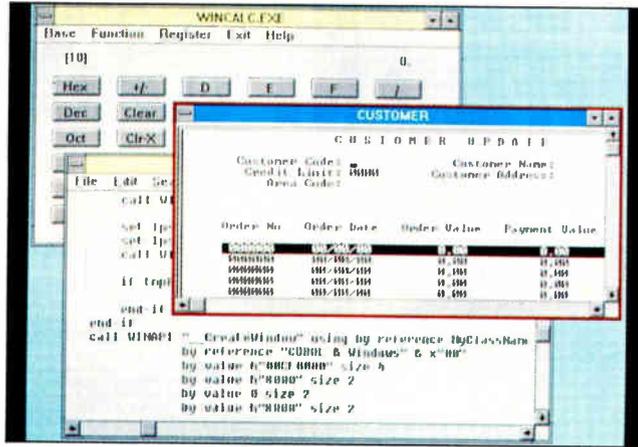
Micro Focus Does Windows, Mainframes

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.

Price: \$199.

Contact: Sophco, P.O. Box 7430, Boulder, CO 80306, (303) 444-1542.

Circle 1019 on Inquiry Card.

We Made our Computers Larger on the Inside and Smaller on the Outside.



Inside, our desktop portables have been redesigned to give you two full ISA standard 16-bit slots. Expansion capability that's usable even with hard and floppy drives installed.

On the outside we're smaller than competing portables, lighter on your checkbook too. But the Novas still weigh in with heavy performance. We offer 386SX-20 or 386DX-33 processing, the new 32,000 color VGA display and the most advanced network cards.

And our small computers can take up to 16 Megs of RAM and 200 Megs of hard disk storage!

Don't pay a lot for a little computer. Order an SX-20 at our special introductory price, only:

\$595

Circle 586 on Inquiry Card
(RESELLERS: 587).

Prices and specifications subject to change.

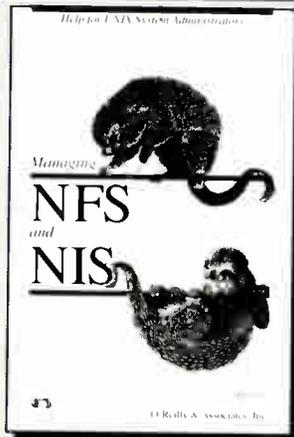
nova

800-875-7580

Computers First Inc, 27 W 20th St. NY, NY 10011
Service: 212-366-6673, Fax: 212-366-6686
Visa, MasterCard, American Express accepted.



Books That Help People Get More Out of Computers



Managing NFS and NIS

By Hal Stern. 434 pages
ISBN 0-937175-75-7. \$27.95

A modern computer system that is not part of a network is an anomaly. But managing a network and getting it to perform well can be a problem. This book describes two tools that are absolutely essential to distributed computing environments: the Network Filesystem (NFS) and the Network Information System (formerly called the "yellow pages" or YP).

As popular as NFS is, it is a black box for most users and administrators. This book provides a comprehensive discussion of how to plan, set up, and debug an NFS network. It is the only book we're aware of that discusses NFS and network performance tuning. This book also discusses the NFS automounter, network security issues, diskless workstations and PC/NFS. It also tells you how to use NIS to manage your own database applications, ranging from a simple telephone list to controlling access to network services. If you are managing a network of UNIX systems, or are thinking of setting up a UNIX network, you can't afford to overlook this book.

A19Y
B1U1

For a free catalog of titles, write or call:

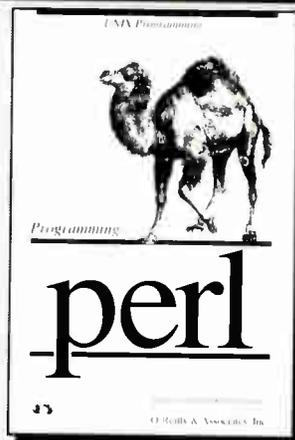
Programming Perl

By Larry Wall & Randal Schwartz
482 pages, ISBN 0-937175-64-1.
\$29.95

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.

"Perl is the most significant general-purpose tool to hit the UNIX world in years. If you haven't used Perl, it's a lot like C with *awk*, *sed*, *grep*, shell programming, and just about everything else included. In particular, system administrators have found it handy, since they're the ones most often tasked with writing or maintaining convoluted shell scripts. Some test and manufacturing groups at computer vendors are now considering using Perl as their one-and-only language for test engineers."—*login*, June 1991



O'Reilly & Associates, Inc.

632 Petaluma Ave. • Sebastopol, CA 95472
(800) 338-6887 • (707) 829-0515



Watch it! Hundreds of dollars are disappearing from your company—four cents at a time. The latest postal increase will make your company measurably poorer—unless you do something.



Hundreds, even thousands of dollars are disappearing from your company—four cents at a time. The latest postal increase will make your company measurably poorer—unless you do something.

Your best move? Get ArcList and AccuMail from Group 1 Software to take advantage of postal discounts for ZIP+4® and Carrier Route even postal barcoding. You can also rid your databases of costly duplicates, perform standardization, send personalized letters, and more. Installation is easy on your IBM-compatible PC (with 640K and hard



AccuMail of postal coding—your address

What's 4¢ to a big company like yours?

disk)—there's even a LAN version available.

If you're feeling pinched by the latest postal increase, call Group 1 Software for the dealer nearest you.



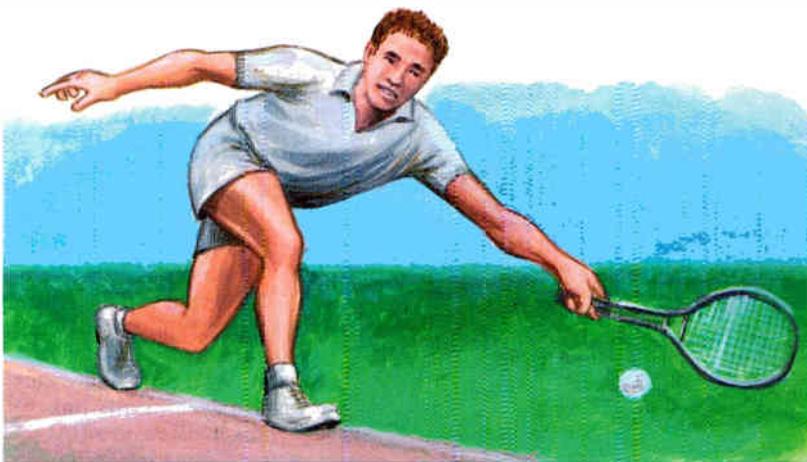
1-800-368-5806

GROUP 1
GROUP 1 SOFTWARE

6404 Ivy Lane, Suite 500, Dept. P-BZ61
Greenbelt, Maryland 20770-1400

ZIP+4[®] CODING • POSTNET[®] BARCODING • PRESORTING • DUPLICATE ELIMINATION

ZIP+4[®] and POSTNET[®] are registered trademarks of the U.S. Postal Service. All others are registered trademarks of Group 1 Software, Inc. ©1990 Group 1 Software, Inc.



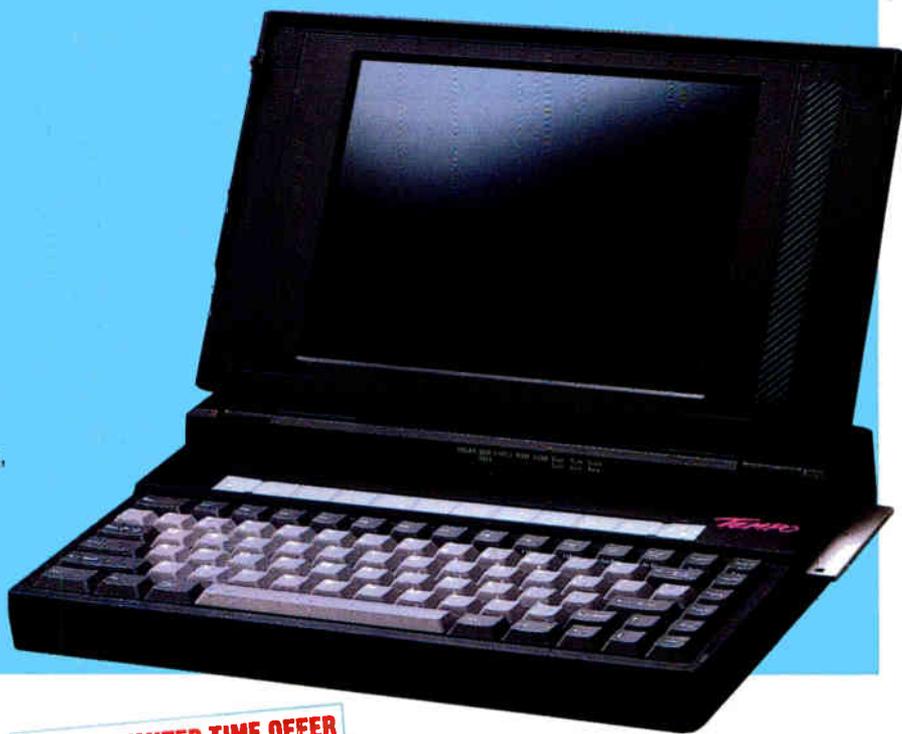
GRAND SLAM MATCH



& MANCHESTER

TEMPO LX FULL POWER NOTEBOOK COMPUTER

Powered by the Intel 80386SX processor running at 20 megahertz, this EVEREX Computer is a lightweight and powerful portable computer. The TEMPO LX is an aggressively priced and feature rich high quality product from an American company, EVEREX - EVER for EXcellence.



- Weighs less than 7 Pounds
- 3-1/2" 1.44MB Floppy
- 40MB or 60MB Hard Disk
- 1MB RAM (Expandable to 5MB)
- Parallel Port, Serial Port
- Backlit High Contrast VGA Display
- External Monitor Port
- NiCad Battery with AC Adapter/Recharger
- DOS 4.01

SPECIAL LIMITED TIME OFFER
Windows 3.0, EVEREX Mouse
and Carrying Case included,

SYSTEMS INTEGRATION
NETWORKING
CONNECTIVITY
CAD/CAM
DESKTOP PUBLISHING



Authorized *EVEREX* Dealer

MANCHESTER EQUIPMENT COMPANY, INC.

"The Computer Supply and Equipment Experts"

50 MARCUS BOULEVARD ■ HAUPPAUGE, NEW YORK 11788 ■ (516) 435-1199

New York City: (212) 629-6969 ■ Boca Raton: (407) 241-7900 ■ Tampa: (813) 962-8088 ■ Boston: (617) 739-1555

Circle 604 on Inquiry Card.

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

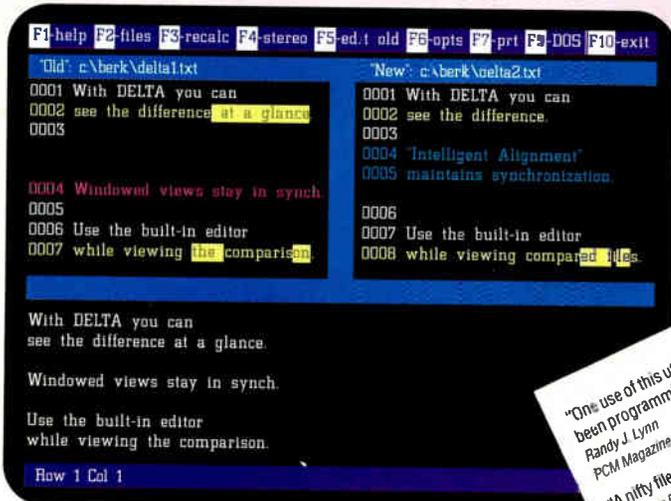
98225, (206) 676-0999; fax (206) 671-1131.
Circle 1026 on Inquiry Card.

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.
Contact: Sirlin Computer Corp., 225 Lowell Rd., Hudson, NH 03051, (603) 595-0420; fax (603) 595-7779.
Circle 1027 on Inquiry Card.

BEYOND COMPARISON!



Go beyond the clumsy performance and limited features of traditional file comparison utilities... DELTA provides a state-of-the-art comparison tool. Invaluable to all DOS users, DELTA is a must for programmers.



TO ORDER CALL
800-542-0938

MasterCard
 or VISA
 Accepted
\$100
 30-DAY MONEY-BACK GUARANTEE

- ▶ Intelligent Alignment
- ▶ Intuitive User-interface
- ▶ Directory Comparison
- ▶ Built-in Editor

"One use of this utility and I wondered how I have been programming this long without it!"
 Randy J. Lynn
 PCM Magazine

"A nifty file comparison program."
 Jonathan Erickson, Editor-in-Chief
 Dr. Dobbs' Journal, 9/90

"I saw DELTA and I found it marvelous."
 Professor Czapski
 Hebrew University of Jerusalem

"DELTA is a fantastic product."
 Richard Block, Sr. Software Engineer
 Diatek, Inc.

"A handy little program."
 Ken Pugh
 C User's Journal, 11/89

"The best file comparison program I know of is called DELTA."
 Steve Cummings
 Computer Currents

Requires 384K and DOS 2.0 or higher. A hard disk is recommended.

215 Berkeley Place
 Brooklyn, NY 11217
 BBS: 718-638-2239
 Voice: 718-398-3838

OPENNetwork
 POWER TOOLS FOR POWER USERS

Power Programming Tools for UNIX

If you plan some serious UNIX programming, plan on talking to Liant. We offer the broadest scope of high performance programming tools and industry standard languages available for open systems.

Our proven technology means total reliability in our products, and unsurpassed portability for your applications. Which is why UNIX developers worldwide have made us their #1 programming source.

CodeWatch, a window-based source-level debugger, comes bundled with all LPI languages. CodeWatch allows you to debug using the conventions and symbols of each language.

Designed for rapid creation of error-free programs, it even allows for easy debugging of multiple language programs. CodeWatch also lets you test existing code.

LPI C is an ANSI standard C compiler with an integrated preprocessor to boost compilation times. It also provides extensions for compatibility with non-ANSI C programs.

LPI C++ is a true 32 bit C++ compiler, based on a complete implementation of the AT&T 2.1 specs. It is compatible with cfront, ANSI C and K&R C code.

LPI COBOL supports ANSI COBOL-85 and COBOL-74, is

88open OCS certified

and gives extensions to comply with other COBOL dialects.

LPI FORTRAN is a high performance, ultra reliable FORTRAN-77 compiler providing a number of popular extensions, such as VAX-FORTRAN, FORTRAN-66, and UNIX access. Conforming to the X/Open standard, it is 88open OCS certified. LPI FORTRAN supports the Weitek Abacus coprocessor family and the Intel 80287/80387 coprocessors.

LPI PL/I is a full implementation of the ANSI PL/I X3.74 1981 General Purpose Subset and contains DEC and IBM extensions for compatibility with existing applications.

30 DAY MONEY BACK GUARANTEE.

Call today for benchmark and ordering information. And put the power of Liant to work for you. **1-800-833-3678**



Supported Systems

i386 SVR3, SVR4
i486 SVR3, SVR4
RS/6000 AIX
SPARC SunOS
M88000 SVR3
SUN-3 SunOS

All LPI Languages
U.S. government validated

LIANT

Liant logo type, language logos, and CodeWatch are trademarks of Liant Software Corporation, 959 Concord St., Framingham, MA 01701. 508-872-8700, FAX: 508-626-2221.

Circle 599 on Inquiry Card (RESELLERS: 600).

World Radio History

NEWS

WHAT'S NEW • WINDOWS GROUPWARE

Windows Contact Manager Gets Networked

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.

Also available in a single-user version, YourWay includes a contact database; a time, task, and call management system; a proportional-font letter processor with speller/thesaurus and automatic mail-merge; and a report generator.

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



As you work in the calendar mode of YourWay, you can check off completed calls or forward them to the next day.

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.

Circle 1028 on Inquiry Card.

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.

Circle 1029 on Inquiry Card.

OUTPERFORMING

When it comes to attracting the computer industry's best exhibitors and educators, showcasing the newest products and services and addressing issues relevant to computer networking and connectivity, there's only one trade show that consistently outperforms all others. **NETWORLD.**

Designed as a global marketing and sales event, the 91 Dallas show will be **NETWORLD'S** best performance yet. Over 450 vendors will line the show floor, each able to answer your toughest questions, offer solutions and deliver all the latest technologies. And you can choose from a variety of topics featured in **NETWORLD'S** Conference Program—more than 70 Seminars and 12 full-day Tutorials all guaranteed to leave you charged with the latest industry information.

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.

Circle 1031 on Inquiry Card.

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.

Circle 1030 on Inquiry Card.

ALL OTHERS.

So plan to attend. And take advantage of this powerful opportunity to put your company in complete control of today's rapidly expanding computer market.

Call 800-444-3976 for information. Experience for yourself why **NETWORLD** is outperforming all others.

NETWORLD 91 DALLAS

October 15-17, 1991
Dallas Convention
Center



Attention U.S. BYTE Subscribers

Watch for the next **BYTE DECK** mailing that will be arriving in your mailbox soon!

Use this as a fast, convenient tool to purchase computer products and services. It's loaded with essential hardware and software products that you should be aware of when making your buying decisions...and it's absolutely **FREE!**

If you have a computer product or service, and would like to reach 275,000 influential **BYTE** magazine subscribers, please give Ed Ware a call today at (603) 924-2596.

**BYTE
DECK**

Here's what a **BYTE Deck** advertiser has to say:

*"Galaticomm does a lot of card-deck advertising, and the **BYTE Deck** has consistently out-pulled every other deck we have ever used."*

Timothy Stryker, Galaticomm, Inc., Fort Lauderdale, FL



Catch More Viruses Faster



Network support and Windows compatibility.

Before they multiply ...

Dr. Alan Solomon has been researching viruses for years. He knows where to look and what to look for. His Anti-Virus Toolkit catches all known viruses *and* new viruses - in less time. No false alarms. No missed viruses. No slowed performance. No matter how many new viruses are developed.

Dr. Solomon has the jump on viruses. Do you?

Ontrack
COMPUTER SOFTWARE

DR. SOLOMON'S



1-800-752-1333

International: 612-937-1107 • Fax: 612-937-5815
6321 Bury Drive, Eden Prairie, MN 55346

Circle 606 on Inquiry Card (RESELLERS: 607).

World Radio History

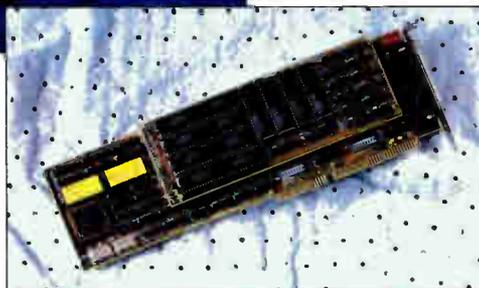


Datatrans 433e Host/Server and **433i Host** systems are engineered with every desirable feature for today's growing multiuser environment needs. Both systems have SCO operating system pre-installed and fully tested. The 433i Host provides a truly affordable solution for small-to-medium sized businesses. The 433e Host/Server is Ethernet ready, thus acts simultaneously as a UNIX multiuser host and a UNIX network server.

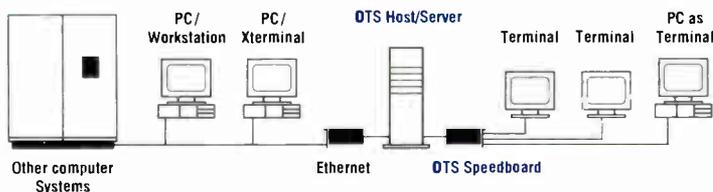
Free one year **Datatrans Express Loaner Policy** is included with these Host/Server systems, in addition to the normal one year warranty. In the unlikely event that our Host/Server system has a hardware problem and cannot be resolved over the phone, we will ship you a standard loaner via UPS Next Day Service. And we'll pay for shipping both ways.

Datatrans 433i PC/Workstation is a powerful engine designed for the computing/graphics intensive environment. It's fully compatible with all the industry standard operating systems and applications.

Datatrans 333i PC/Xterminal gives you the privilege to turn your DOS PC into an X-Windows system. You can run X applications if you have a need for GUI (Graphical User Interface), and still retain the DOS system capability.



Datatrans Speedboard™ is a proprietary integrated serial I/O controller, developed by Datatrans to handle heavy data transfer in a multiuser computing environment. With its on-board 16 MHz 80186 processor, up to 512 KB of memory buffer, and statistical supporting software, Speedboard relieves main CPU overhead and effectively accelerates I/O speed.



affordable

The UNIX Multiuser Solution

DTS 433e Host/Server

- 80486-33 MHz EISA
- 16 MB RAM (max. 64 MB)
- 1.2 GB SCSI drive arrays
- 700 MB tape backup
- Mono VGA display
- 32-user subsystem ready (max. 64-user)
- SCO UNIX V/386 OS installed
- Ethernet adapter ready

\$14,995

DTS 433i Host

- 80486-33 MHz ISA
- 8 MB RAM (max. 64 MB)
- 330 MB hard drive
- 120 MB tape backup
- Mono VGA display
- 8-user subsystem ready (max. 64-user)
- SCO UNIX V/386 OS installed

\$5,995

DTS 433i Workstation

- 80486-33 MHz ISA
- 8 MB RAM (max. 64 MB)
- 120 MB hard drive
- 17" SVGA color display
- Logitech mouse
- Ethernet adapter ready

\$4,995

DTS 333i PC/Xterminal

- 80386-33 MHz ISA
- 4 MB RAM (max. 32 MB)
- 80 MB hard drive
- 17" SVGA color display
- Logitech mouse
- SCO PC X/sight-TCP/IP installed
- Ethernet adapter ready

\$3,395

Call Toll Free

1-800-368-1688

Ask about our 30-day trial offer

DATATRANS

Datatrans Systems, Inc.

35-28 154th Street, Flushing, NY 11354
Tel: 718-445-6970 • Fax: 718-461-2822

Circle 593 on Inquiry Card (RESELLERS: 594).

486 33MHz Power!



STANDARD FEATURES:

4MB RAM, 120MB HD, SUPER VGA

\$2795.00

80486 33MHz 32 Bit Intel CPU
 4MB RAM-Expandable to 64MB
 MICRONICS Motherboard, Phoenix BIOS
 64K Cache (expandable to 256K)
 Desktop Style Case (Tower Option available)
 8 Expansion Slots (ISA 16 bit)
 EISA System - Add \$1000.00
 w/ 7-32 Bit EISA slots, 1-16 bit ISA
 220W Switching Power Supply

101 Enhanced Keyboard
 14" Non Interlaced SVGA Monitor, .28 dot
 1MB VRAM (1024x768 at 256 colors)
 1.2 and 1.44 MB Floppy Drive
 120MB 19ms IDE Hard Drive
 Serial, Parallel & Game Ports
 1 Year Limited Warranty-Parts and Labor
 Logitech Mouse and Windows 3.0
 MS-DOS 3.3, 4.01 or 5.0 included

Reasons to buy an LSI PROFESSIONAL COMPUTER

- ☐ 30 Day Satisfaction Guarantee
- ☐ Satisfied Customers Like...
 BOEING
 ROCKWELL INTL.
 CHRYSLER
 ARCO
- ☐ Toll Free Tech Support
- ☐ Top Rated MICRONICS Motherboard Options Available
- ☐ Complete line of 386 and 486 ISA and EISA Systems

Upgrades /Exchanges From Super VGA Systems

Standard VGA (640x480, 16 color)	deduct \$100
Super VGA 1MB (1024 at 256 colors)	add \$80
Super VGA 1MB VGA(non-interlaced)	add \$200
40 to 80MB Hard Drive (IDE 23ms)	add \$150
40 to 100MB (IDE 19ms)	\$200
40 to 120MB (IDE 18ms)	\$250
40 to 200MB (IDE 18ms)	\$550
40 to 200MB (IDE 15ms)	\$650
40 to 336MB (ESDI 16ms)	\$1150
40 to 650MB (SCSI 16ms)	\$2050
40 to 760MB (ESDI 16ms w/ EISA Caching Controller)	\$2945
40 to 760MB (SCSI 16ms)	\$2450
40 to 1.2 Gigabyte (SCSI 15ms)	CALL

HD Upgrades are from 40MB...deduct \$200 from 100MB System
 Call For Stand Alone Pricing

All LSI Professional Systems Are FCC Certified

MICRONICS
 COMPUTERS INC
 authorized distributor

Super VGA 386/33 System



Super VGA, 4 MB RAM, 120MB HD
 Complete Color System

386/33 Features

386-33 MHz CPU with
 64/128K SRAM Cache
 4MB RAM, exp. to 16MB
 Super VGA Card (512K)
 and 14" SVGA Color
 Monitor (1024x768,
 interlaced, .28 dot)
 1.2 and 1.44 Floppy Drives
 120MB 19ms IDE Hard Disk
 Desktop Case, 220W PS
 2 Serial, 1 Parallel, 1 Game
 101 Enhanced Keyboard
 MS-DOS, Logitech Mouse,
 Windows 3.0 included

New Low Price!

\$1845.00

386 25MHz Super VGA

1MB RAM, 40MB, 23ms Hard Drive
 Super VGA 1024 Display, 512K VGA Card

\$1295.00 Limited Time!!!
 Lowest Price Ever!!!

386SX 20MHz System

40MB, 1MB, Monochrome

\$945.00

286 12MHz System

40MB, 1MB, Monochrome

\$695.00

Components / Accessories

Logitech Mouseman Serial	\$ 69
Logitech Mouseman Bus	\$ 79
Logitech Trackman Serial	\$ 89
Logitech ScanMan Grayscale	\$315
Logimouse w/Windows 3.0	\$129
Logimouse Cordless	\$139

1.2MB Floppy	\$ 75
1.44MB Floppy w/bracket	\$ 79
IDE cntrl. with I/O	\$ 50
UltraStor ESDI 32K Cache	\$175
Ultra EISA/ESDI cntrl.	\$795

Printers

Brother 1324 (24 pin, 9 font)	\$259
Epson LQ510 (24 pin)	\$309
Panasonic 1123(24 pin)	\$279
Citizen GSX 140 (24 pin)	\$289
Color Kit for Citizen	\$ 50
Laser Printers (incl. toner)	
Brother 8V (HP III comp.)	\$1595
HP Lasers	\$CALL

Quality Service and Support Since 1984
 Locations Nationwide, including OUR NEWEST STORE
 12110 WESTHEIMER, HOUSTON TX 77077
 (713)497-7887



Lucky Computer Co.

LUCKY STAR INTERNATIONAL

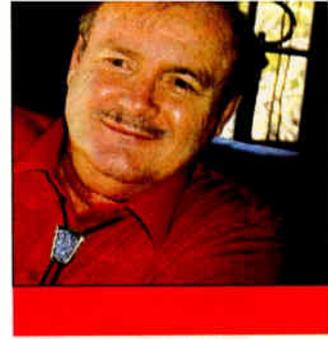
1701 Greenville Ave #602 Richardson, TX 75081 (214)690-6110 1-800-966-5825	2132 N. Collins Arlington, TX 76011 (817)265-1883 1-800-966-4056	17338 Southcenter Pkwy. Tukwila, WA 98188 (206)575-9060 1-800-367-5825	14220 NE 20th #D Bellevue, WA 98007 (206)643-2673 1-800-336-5825	10773 SW Bvtn.-Hills. Hwy Beaverton, OR 97005 (503)671-0961 1-800-348-5825	4151 Beltline Rd. #120 Addison, TX 75244 (214)702-8588 1-800-966-7687
-------------------------------------------------------------------------------------	---------------------------------------------------------------------------	---------------------------------------------------------------------------------	---------------------------------------------------------------------------	-------------------------------------------------------------------------------------	--------------------------------------------------------------------------------

Hours
 Mon-Sat 9am-6pm
 C.S.T./P.S.T.

Copyright 1991 Lucky Computer Company. Lucky Star International, MS-DOS, Intel, Micronics, are trademarks of their respective companies. All Prices/Specifications subject to change.

Circle 602 on Inquiry Card (RESELLERS: 603).

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

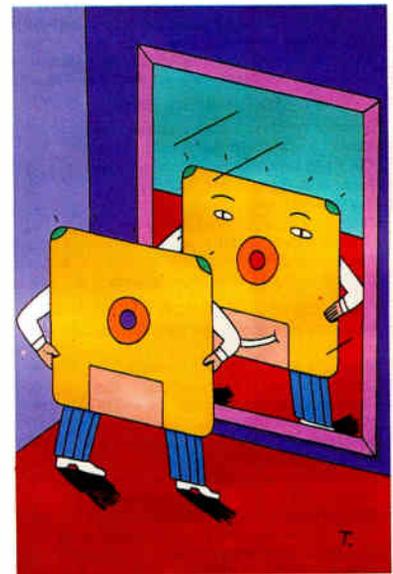
always wanted computer education to be like.

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



CD-ROM
 GUARANTEED LOWEST PRICES!

BUREAU OF ELECTRONIC PUBLISHING

MULTI MEDIA **NEW**

Countries of The World

The Ultimate International Reference Multimedia edition - includes: the full text of 106 country study books, color maps by Hammond, Inc. national anthems (sound), flags & more... includes historical setting, society, environment, economy, business stats, etc. \$495

Pioneer CD-ROM 6 Pak

6 discs bundled together for only \$395

- U.S. History on CD-ROM • Countries of the World
 - Sherlock Holmes • Shakespeare
 - Birds of America • Software Potpourri
- Six Pack & Minichanger (Save over \$1000) \$1489

U.S. History on CD-ROM

Winner 1991 OPA Best Educational Product Includes the full text of 107 U.S. History books with 1,000 images, tables & maps! **Microsoft** Windows 3 compatible. *Special with \$50 publisher's rebate - final cost only \$349

CD-ROM BUNDLES!

Get The Philips CM-50 Drive & Any 5 Of These Discs! Only \$597 Save up to \$1200

- Add \$100 for NEC CDR-36 Kit, \$400 for Hitachi 1700 Kit
- Microsoft** Bookshelf all time best seller
 - U.S. History on CD-ROM full text of 107 books
 - Illustrated Encyclopedia 21 volumes. VGA
 - CIA World Fact Book Non classified into Golden Immortal multi-media game
 - Between Heaven & Hell practical/perverse
 - Sherlock Holmes on Disc 221 Baker St. fans
 - Shakespeare on Disc "complet works"
 - Software Potpourri • Bible • Movie Database

CD-ROM Drives (ready to run)

- Denon DRD-253 Drive SCSI, built in speaker SALE Call
 - Hitachi 1700S kit (fastest drive) (1750S - \$849) \$799
- Also: Pioneer Minichanger, Chinan, CDT, Todd, NEC, WORM & Erasable drives, in-stock at best price - Call!

Multimedia Titles

- Desert Storm the full story from Time magazine - Mac \$39
- Mixed Up Mother Goose "fun" educational disc \$9
- CIA World Fact Book for international "business" \$99
- Santa Fe or Golden Immortal PC games \$9
- The Orient illustrated Interactive "tour" - Mac 249
- Sherlock Holmes or Shakespeare "complet" Call
- Grolier's Encyclopedia 21 volumes. VGA pictures Call
- Nat. Geographic / IBM Mammals pictures & text Call
- Compton's Multi-Media Encyclopedia 895

Libraries / Science / Business

- Movie Directory Database/Software Potpourri \$69
 - Between Heaven & Hell II even stranger Sale \$79
 - Magazine Rack educational/entertaining \$9
 - C Library or Ada or Shareware Grab Bag \$9
 - Time Compact Almanac current events 195
 - McGraw-Hill Ref. Set 100,000 terms; 7,300 articles 245
 - Speed Dial entire U.S. Yellow Pages on one disc 399
 - Microsoft Bookshelf best selling CD-ROM disc Best Price
 - Oxford Textbook of Medicine general reference 595
 - Business Lists on Disc desktop marketing 795
 - PC-Sig Library new edition, version 9 Call
 - Oxford English Dictionary over 250,000 headwords! 889
 - Telephone Directory East or West 995
 - CDTV Titles Call
- * MORE! Over 300 different titles available *
 Money back guarantee Free tech support
 CALL - Bureau On-Line CD-ROM Library,
 FREE access to 12 different CD-ROM Discs

FREE CD-ROM Product Guide CALL

Bureau of Electronic Publishing, Inc.

Dept. P, 141 New Road, Parsippany, NJ 07054

FAX # 201-808-2676

CALL: **800-828-4766** ORDERS
 201-808-2700 INFORMATION

USER'S COLUMN

Item: SuperMac Technology (485 Potrero Ave., Sunnyvale, CA 94086, (800) 624-8999, ext. 210, or (408) 245-2202, fax (408) 735-7250) has a whole bunch of hardware and software upgrades for your Mac, resulting in the ability to do video and audio editing. They were giving out a floppy disk with nearly a minute of full-motion video and audio (it's in a screen window, not full-screen) as a demonstration. Very impressive, and I'm likely to have more another time.

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-

"I can't believe it's not UNIX."

—Sean Fulton, UNIX Today!



Take it from the critics, Coherent is so close to UNIX, you won't believe your eyes. Or the price.

"Mark Williams Co. seems to have mastered the art of illusion; Coherent comes so fully qualified as a UNIX clone, you find yourself thinking 'I can't believe it's not UNIX.'"

—Sean Fulton, UNIX Today!, November 26, 1990

"...(Coherent) may be the best thing that has happened to UNIX yet."

—William Zachmann, PC Week, November 5, 1990

"If you want to come as close as you can to real UNIX for a low price, COHERENT can't be beat."

—Warren Keuffel, Computer Language Magazine, November 1990

"If you want a UNIX-like development and learning system for less than \$100...I don't see how you can go wrong with Coherent."

—David Fiedler, BYTE Magazine, November 1990

OVER 25,000 USERS, AND MORE EVERY DAY!

Why is Coherent now the world's best-selling UNIX clone?

	MWC COHERENT Version 3.2	SCO XENIX 286 Version 2.3.2.
No. of Manuals	1	8
No. of Disks	5	21
Kernel Size	64K	198K
Install Time	20-30 min.	3-4 hours
Suggested Disk Space	10 meg	30 meg
Min. Memory Required	640K	1-2 meg
Performance*	38.7 sec	100.3 sec
Price	\$99.95	\$1495.00

*Byte Exec benchmark, 1000 iterations on 20 MHz 386. Hardware requirements: 1.2 meg 5¼" or 1.4 meg 3½" floppy, and hard disk. Does not run on Microchannel machines.

NEW RELEASE 3.2

\$99.95*

Because like the original UNIX, Coherent is a powerful, multi-user, multi-tasking development system with a complete UNIX-compatible kernel and C compiler.

Features include Lex and Yacc, a vi editor, SCSI support and UUCP capabilities.

And Coherent comes with a full set of over 200 UNIX commands including text processing, program development, administrative and maintenance functions. All of it fully documented in our highly acclaimed 1200 page manual.

WHAT UNIX WAS MEANT TO BE.

Unlike current versions of UNIX, Coherent is lean and efficient. Small and beautifully powerful, the way UNIX was originally designed.

Coherent runs on affordable 286 as well as 386 and 486 based IBM-PCs and compatibles with space to spare. Enough space to keep DOS co-residing on your hard disk.

And it's so fast to install, so fast to learn and just so fast, Coherent leaves UNIX in the dust.

HARD TO BELIEVE? IT KEEPS GETTING BETTER.

Coherent gives you more value from the start and keeps on giving. Like regular updates with new and enhanced features. Our write-your-own device driver kit and COHware, contributed software on diskette.

There's also on-going free technical support via telephone. An active user network and a UUCP Bulletin Board System. *Plus, with our new 3.2 release:*

- A new Korn shell with sophisticated command-line editing.
- Postscript and PCL support for troff adding access to hundreds of new fonts.
- Improved UUCP support.
- International keyboard and character set support.

TAKE 60 DAYS TO CONVINCE YOURSELF.

Will you agree with the critics and Coherent's 25,000-plus users?

Try it. And if you don't think Coherent is everything you ever wanted in UNIX, we'll refund your money. No problem. No hassle.

You can't go wrong. So get to a phone, FAX or mailbox now and order Coherent today. At \$99.95, it's unbelievable.

1-800-MARK WMS
(1-800-627-5967 or 1-708-291-6700)
FAX: 1-708-291-6750

60-DAY MONEY BACK GUARANTEE!



**Mark Williams
Company**
60 Revere Drive
Northbrook, IL 60062

*Plus shipping and handling. Coherent is a trademark of Mark Williams Company. UNIX is a trademark of AT&T. XENIX is a trademark of Microsoft.

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

Avoid Transmission Failures On The Road.



Now your data transmission requirements don't have to change just because you're on the move. The WorldPort 2400/MNP® Class 5 Modem gives you high speed data compression and error correction in a fully portable package.

The WorldPort 2400/MNP weighs just 8 ounces, battery included. Yet it's impervious to the pounding and abuse of life on the road. It adapts to Bell and CCITT standards

world-wide. And it attaches to practically any public or private phone via RJ-11s or an optional acoustic coupler.

But best of all, it gives you the advantages of speed and accuracy that come only with an MNP modem: the convenience of data compression for higher throughput and the confidence of automatic error correction for data integrity. All in the palm of your hand.

It's travel insurance for those who can't afford transmission problems.

Call us today for the dealer nearest you:

1-800-DIAL-USR

U.S. Robotics®

The Intelligent Choice in Data Communications

MNP is a registered trademark of Microcom, Inc. U.S. Robotics and the U.S. Robotics logo are registered trademarks, and WorldPort is a trademark of U.S. Robotics, Inc.

NEW!

Borland C++ Support

C BEYOND 640K DOS

Let Phar Lap's new 286iDOS-Extender™ turn your Microsoft C compiler into a multi-megabyte power tool!

It's never been so easy to C beyond 640K DOS.

You've been hearing a lot lately about DOS Extenders and their ability to let you create large programs beyond the 640K DOS limit. Now Phar Lap® makes it easier than ever! With your copy of Microsoft C and our new 286iDOS-Extender you've got all the tools you'll need to quickly and easily build multi-megabyte protected-mode applications - often by simply relinking without making source code changes. 286iDOS-Extender enables you to build programs that have room for more features and capabilities without having to suffer with overlays or EMS. But the best news is you don't have to give up any of your Microsoft C tools, including your CodeView debugger.

And with 286iDOS-Extender you'll not only have plenty of memory for your applications but also for the Microsoft C 6.0 compiler itself. No more crippling "Out of Heap" messages when compiling under Windows or with networks.

Total Compatibility

Because 286iDOS-Extender is embedded into your program, it is invisible to the end-user. Your program looks exactly like any other DOS application. There's no new operating environment for your end-users to buy or learn. Any of the 30 million 80286, 386, or 486 PCs that can run MS-DOS or PC-DOS can run 286iDOS-Extender. And because Phar Lap products support the XMS, VCPI, and DPMS standards, applications built with 286iDOS-Extender can run under a variety of environments besides MS-DOS, including DESQview and all modes of Microsoft Windows.

Field Proven Technology

Phar Lap is also the developer of the award-winning 386iDOS-Extender™, which has been used in over 600 applications including AutoCAD 386 and IBM Interleaf Publisher.

386iDOS-Extender is designed for programs that require the ultimate in 32-bit speed and performance on 386 and 486 PCs. By utilizing either of our DOS-Extender technologies, industry leaders are keeping their competitive edge and delivering all the functionality and capabilities that their customers have been asking for.

So if DOS is looking smaller than ever, call Phar Lap today.

And C what it's like beyond 640K.

Phar Lap 286iDOS-Extender SDK

We open a world of memory.



Phar Lap Software, Inc.
60 Aberdeen Avenue
Cambridge, MA 02138
617-661-1510
FAX 617-876-2972

Trademark holders: 286iDOS-Extender™ and 386iDOS-Extender™ - Phar Lap Software, Inc.; Windows™ - Microsoft Corp.; DESQview™ - Quarterdeck Office Systems; Interleaf Publisher™ - Interleaf, Inc.
Registered trademark holders: Phar Lap® - Phar Lap Software, Inc.; MS-DOS®, Microsoft®, and CodeView® - Microsoft Corp.; AutoCAD® - Autodesk, Inc.; IBM® - IBM Corporation.
© 1991 Phar Lap Software, Inc.

Circle 239 on Inquiry Card.

World Radio History

Call Now!

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.

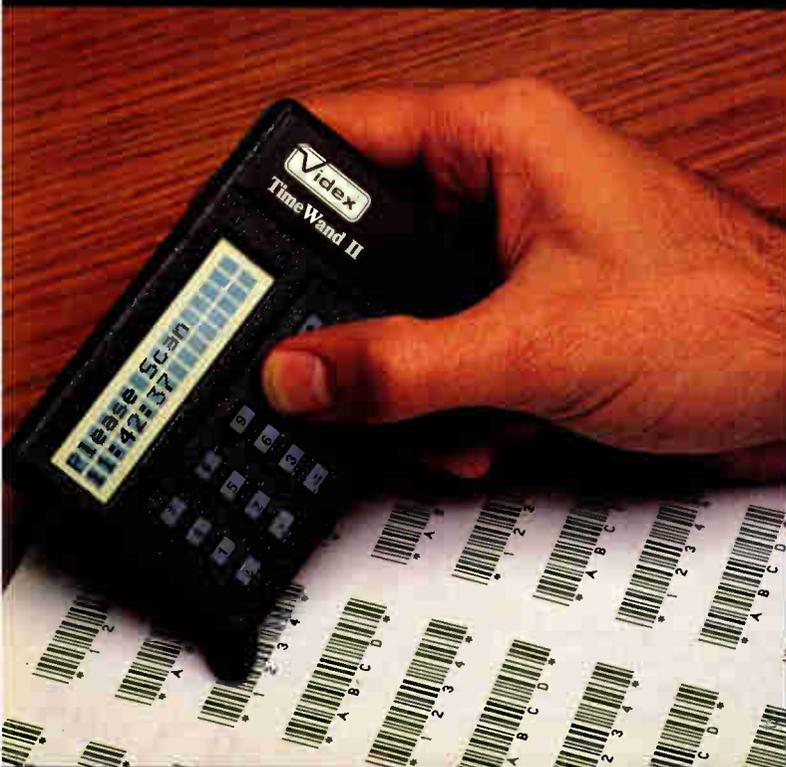
Realizer and Thunder

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

TimeWands



You have specific bar coding requirements. That's why we give you a choice!

TimeWand®II, with its cast metal case, is a ruggedized bar code reader ready for heavy-duty use. Its programmability allows your custom applications to be pre-set with prompts and cross-reference files. The large internal memory sizes of 32, 64, or 128K easily hold a day's worth of transactions, along with the date and time of each entry.

If your data collection needs are simpler, the original TimeWand I offers a cost effective alternative. The TimeWand I date and time stamps each bar code scan, like the TimeWand II, but is contained in a smaller and lighter package. Even though it is compact, the TimeWand I can still gather an impressive 2000 scans.

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

The Portable Bar Code Readers

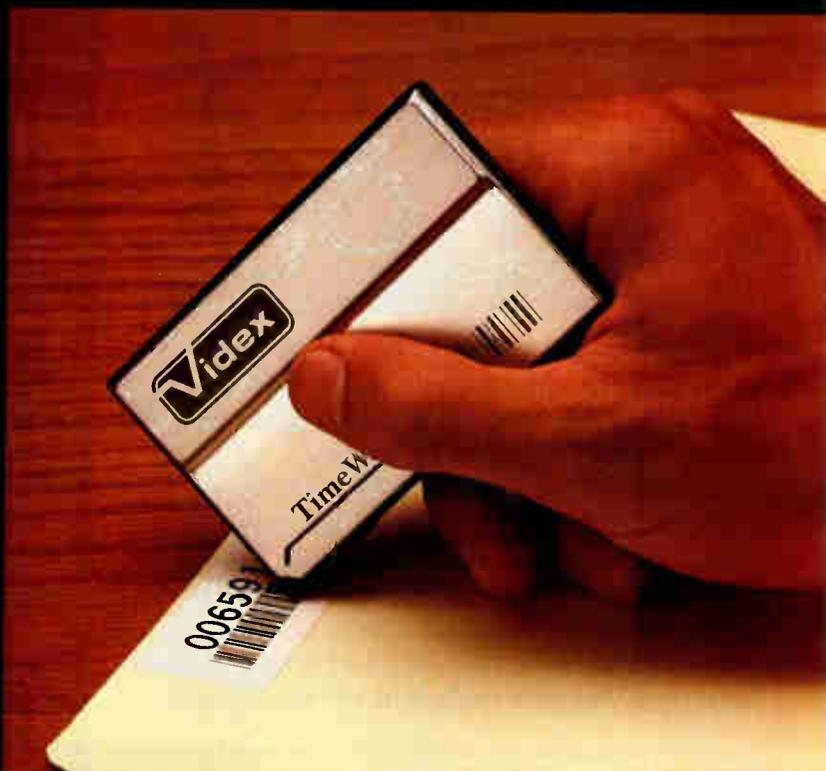
data is stored in an ASCII text file. This allows the data to be easily combined with a wide variety of software packages.

Choosing either TimeWand II or the original TimeWand I provides you with a quality bar code reader at an affordable price. Call Videx at 503-758-0521 and ask for your free information kit.

TimeWand II (32K).....\$698.00
TimeWand I (8K).....\$248.00



1105 NE Circle Blvd.
Corvallis, OR 97330-4285
503-758-0521 * FAX 503-752-5285



Videx and TimeWand are registered trademarks of Videx, Inc.

Circle 324 on Inquiry Card.

See us at COMDEX Fall, Oct. 21-25, Las Vegas, BOOTH #1696

World Radio History

The Complete System Upgrade.

Microsoft MS-DOS 5 Upgrade

Operating System Upgrade

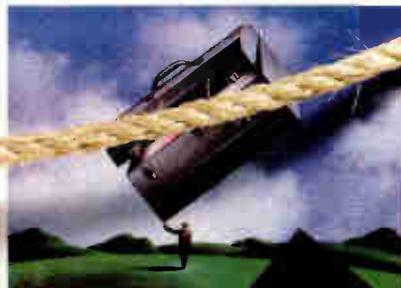
Includes 5.25" disk

CENTRAL POINT PCTOOLS

NEW
VERSION 7

Essential Utilities for the PC Professional

- ▶ Hard Disk Backup
- ▶ Data Recovery
- ▶ Hard Disk Diagnostics and Repair
- ▶ DOS Shell and File Manager
- ▶ Virus Protection
- ▶ Remote Access and File Transfer
- ▶ Disk Optimization
- ▶ Disk Cache
- ▶ Application Menu System
- ▶ System and Network Information
- ▶ Low-level Reformatter and Disk Maintenance
- ▶ Telecommunications and Fax Support
- ▶ Locate with Viewers
- ▶ Top Manager with Workgroup Scheduler



SAVE
\$80

AWARD-WINNING UTILITIES FROM:

Central Point Software INC.

Only \$99
with purchase of
MS-DOS 5!

Ask your dealer for details.

No PC should be without DOS 5.0. And no DOS 5.0 user should be without new Central Point PC Tools™ 7.0.

Only PC Tools 7.0 builds upon the data recovery actually in DOS 5.0. We know. We wrote it.

It's so good Brad Silverberg, Microsoft's VP in charge of DOS 5.0 said, "We chose PC Tools because it's the best technology on the market." (10/90)

Now PC Tools gives you even more. Like data recovery for networks. Automatic utilization of DOS 5.0's high memory. Virus detection. Award-winning remote software. Real Windows applications for Backup and

Undelete that are data and keystroke compatible with their DOS 5.0 counterparts. And the only DOS shell with a Microsoft-licensed visual display.

For a limited time, when you buy DOS 5.0, you can get PC Tools 7.0 for only \$99. That's \$80 off of the retail price of \$179.

So call 1-800-445-4309 today for the name of your nearest Central Point dealer. And upgrade your upgrade.

Central Point Software INC.[®]
Making Computing Safer, Simpler, Faster.

Central Point PC Tools is a trademark of Central Point Software, Inc. Names of other products mentioned herein are used for identification purposes only and may be trademarks and/or registered trademarks of their respective companies.

Circle 62 on Inquiry Card.

World Radio History

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

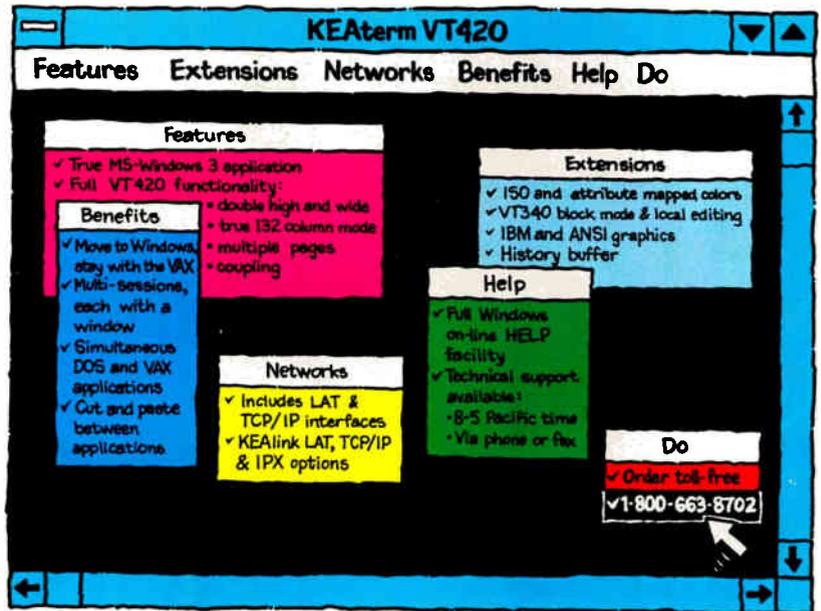
A few years ago, I recommended Dr. Peter Leimbiger's system for writing in Chinese on a PCompatible. At that time,

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

TRADE IN A COMPETITOR'S PRODUCT AND GET VT420 EMULATION FOR MS-WINDOWS FOR ONLY \$99. CALL FOR DETAILS!

VT Emulation Under Windows



Regardless of your PC operating system, KEA has VT emulation and connectivity products to meet your needs. KEA provides KEAterm VT emulation for MS-Windows; ZSTEM VT emulation for MS-DOS and SCO UNIX; the PowerStation VT layout keyboard for your PC; and KEAlink LAT, TCP/IP and IPX network products for connecting to your VAX or UNIX host.



Tel: (604) 431-0727 Fax: (604) 431-0818 Orders: 1-800-663-8702

KEA Systems Ltd., 3738 North Fraser Way, Unit 101, Burnaby, BC, Canada V5J 5G1
 Copyright © KEA SYSTEMS LTD. 1991. All rights reserved. KEAterm, KEAlink, PowerStation, ZSTEM and the KEA logo are trademarks of KEA Systems Ltd.
 All other brand and product names are trademarks or registered trademarks of their respective holders.

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

BUILD TO SUIT.

Now, you can create, update and print presentation-perfect flowcharts to your specifications — in no time!

Quick to master and a snap to use, Patton & Patton's flowcharting software is the standard of both large and small businesses around the world — and is available through all major software dealers.

See your dealer today! Or, for a "live," interactive demo disk, call: 800-525-0082, ext. 1109.
International: 408-778-6557, ext. 1109.

FLOW CHARTING

PATTON & PATTON
Software Corporation

Excellence in charting the flow of ideas!

Works on IBM & 100% compatible PC's, supports CGA/EGA/VGA and over 150 dot matrix and laser printers, with multiple print densities and 10 font sizes. **Creates multi-page charts, portrait or landscape, on most standard paper sizes.** Mouse or keyboard controlled. Supports International Characters.

IBM is a registered trademark of International Business Machines Corporation.



SOFTWARE DEVELOPERS

Rainbow Technologies Protects Software Better.

In More Places. For More Developers. And For More Good Reasons.

For the most solutions, best support and worldwide availability in PC, MAC and LAN software protection, there's no reason to look further than Rainbow Technologies.



THE PRODUCTS

Rainbow Technologies features:

- DOS, OS/2, Windows, UNIX, XENIX and MAC compatibility
- Protection for SPX/IPX and NetBios networked software
- Algorithm and memory devices to suit your application
- The most drivers/interfaces for quick implementation
- Proprietary ASIC designs for confidentiality
- Proven reliability—more than 1.5 million keys installed
- Transparent operation for the end user

1-800-852-8569

Protect your revenues. Call toll free today to plug Rainbow Technologies into your software plans. Evaluation packages are available.

THE COMPANY

Rainbow Technologies provides:

- World class technical assistance
- Custom application engineering
- Toll free Hot Line support
- Delivery in 5 days or less
- In stock availability in 15 countries
- Clear and comprehensive documentation
- The broadest warranty coverage available

AVAILABLE NOW!!!

The NetSentinel™
 Network Site License
 Management Key For Novell,
 OS/2, & NetBios Based LANs.
 Call Today For Details... 1-800-852-8569



Copyright © 1991 Rainbow Technologies, Inc. All product names are trademarks of the respective holders. Rainbow Technologies stock is traded on NASDAQ-RNBO

9292 Jeronimo Road, Irvine, CA 92718 • TEL: (714) 454-2100
(800) 852-8569 • FAX: (714) 454-8557 • Apple Link: D3058
Rainbow Technologies, Ltd., Shirley Lodge, 470 London Rd., Slough
Berkshire SL3 8QY, U.K. TEL: (44) 0753-541512 • FAX: (44) 0753-543610

Circle 267 on Inquiry Card (RESELLERS: 268).

World Radio History

ITEMS DISCUSSED

Computer Clip Art Portfolio Disks
for PC or Mac \$49.95 to \$169.95
T/Maker Co.
1390 Villa St.
Mountain View, CA 94041
(415) 962-0195
fax: (415) 962-0201
Circle 1154 on Inquiry Card.

**Corel Optical Disk
Interface Board**\$495
Corel Systems Corp.
Optical Products Division
1600 Carling Ave., Suite 190
Ottawa, Ontario,
Canada K1Z 8R7
(613) 728-8200
fax: (613) 761-9177
Circle 1155 on Inquiry Card.

DE-S7001 \$4695
Pioneer Communications
of America, Inc.
600 East Crescent Ave.
Upper Saddle River, NJ 07458
(800) 527-3766
(201) 327-6400
fax: (201) 327-9379
Circle 1156 on Inquiry Card.

Graphics Workshop Tool Kit\$149
Crescent Software
32 Seventy Acres
West Redding, CT 06896
(800) 352-2742 (orders only)
(203) 438-5300
fax: (203) 431-4626
Circle 1157 on Inquiry Card.

Harpoon \$59.95
Three-Sixty
2105 South Bascom, Suite 380
Campbell, CA 95008
(408) 879-9144
Circle 1158 on Inquiry Card.

HyperStore 1600 \$900
Configuration modules:
MFM \$300
RLL \$300
ESDI \$400
SCSI \$400

Perceptive Solutions, Inc.
2700 Flora St.
Dallas, TX 75201
(800) 486-3278
(214) 954-1774
fax: (214) 953-1774
Circle 1159 on Inquiry Card.

Realizer\$395
Within Technologies, Inc.
Laurel Corporate Center
8000 Midlantic Dr., Suite 201 S
Mount Laurel, NJ 08054
(609) 273-8881
fax: (609) 231-8991
Circle 1160 on Inquiry Card.

SDC Series 400
IDE\$845
SCSI\$845
ESDI\$895

Specialty Development Corp.
1001 Capital of Texas Hwy. S
Building I
Austin, TX 78746
(800) 284-7732
(512) 327-8608
fax: (512) 327-5233
Circle 1161 on Inquiry Card.

**Spaceship Warlock
CD-ROM** \$89.95
Educational Computer Services, Inc.
7434 Trade St.
San Diego, CA 92121
(800) 843-9497
(619) 536-9999
fax: (619) 536-2345
Circle 1162 on Inquiry Card.

SpinRite II\$89
Gibson Research Corp.
22991 La Cadena Dr.
Laguna Hills, CA 92653
(800) 736-0637
(714) 830-2200
fax: (714) 830-0300
Circle 1163 on Inquiry Card.

ThinX\$495
Bell Atlantic Corp.
575 East Swedesford Rd.
Wayne, PA 19087
(800) 688-4469
Circle 1164 on Inquiry Card.

Visual Basic\$199
Custom Controls Kit \$49.95
Microsoft Corp.
1 Microsoft Way
Redmond, WA 98052
(800) 426-9400
(206) 882-8080
fax: (206) 883-8101
Circle 1165 on Inquiry Card.

XianTianMa\$695
Asia Communications, Inc.
1117 Ste-Catherine W, Suite 606
Montreal, Quebec,
Canada H3B 1H9
(514) 434-9373
fax: (514) 434-9374
Circle 1166 on Inquiry Card.

XT-8380EH \$2325
Maxtor Corp.
211 River Oaks Pkwy.
San Jose, CA 95134
(408) 432-1700
fax: (408) 434-6469
Circle 1167 on Inquiry Card.

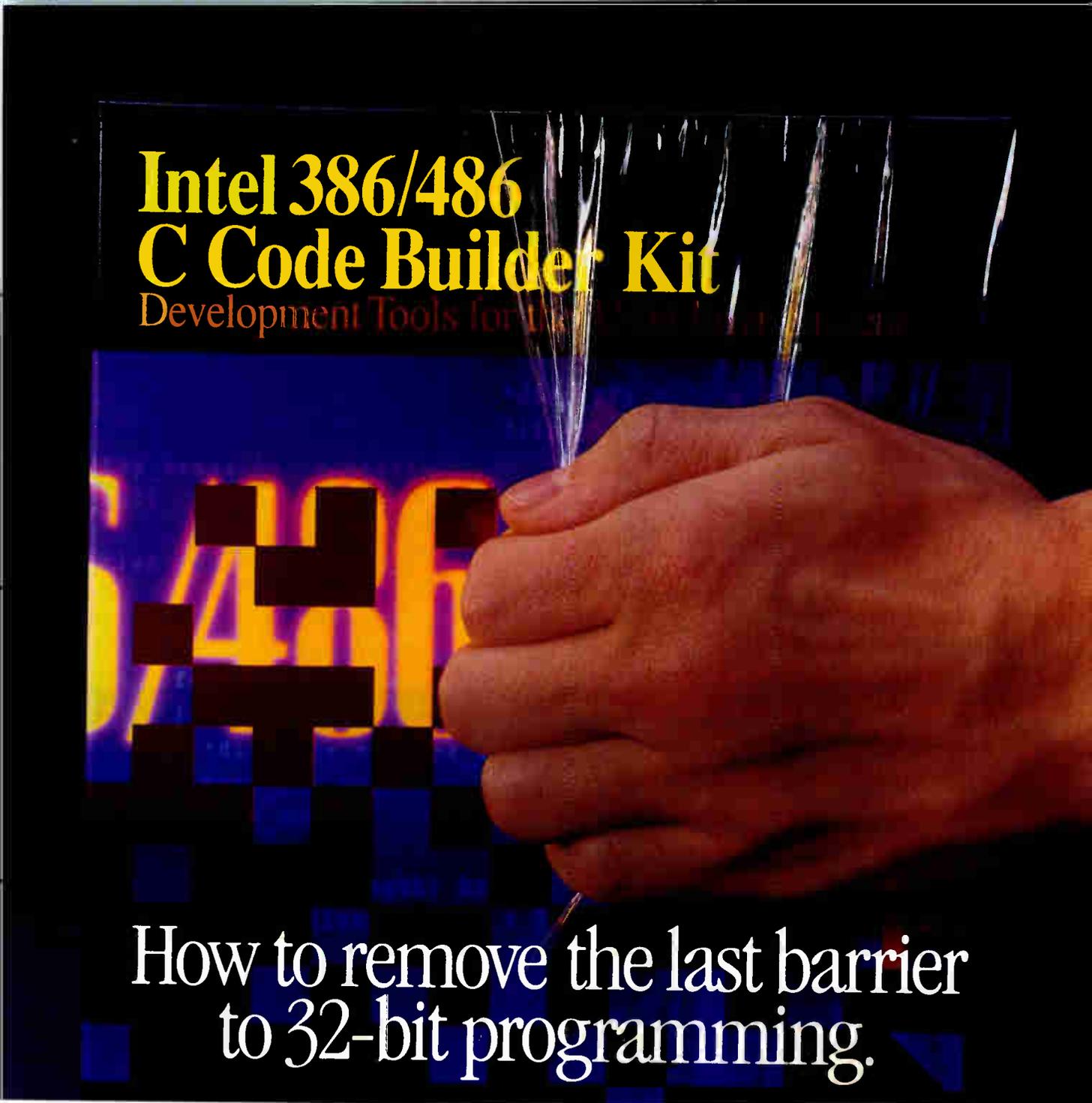
the generic battle scenario area you've chosen; press Alt-F1, an action documented in precisely one sentence buried in the back of the scenario editor manual; and load your edited scenario. Any other action will fail frustratingly.

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."



Intel 386/486 C Code Builder Kit

Development Tools for 32-bit Programming

How to remove the last barrier to 32-bit programming.

Open Intel's new 386/486 C Code Builder™ Kit. And tear into the increased memory and performance of 32-bit DOS protected mode.

True 32-bit software lets you take full advantage of Intel386™ and Intel486™ CPUs. Multiplying DOS performance up to five times, and moving beyond 640K.

And Code Builder is a one-vendor source for all your tools: a Microsoft- and ANSI-compatible Compiler and Libraries, Linker, Librarian, Make Utility, Source-level Debugger, and DOS Extender. So you can easily create applications compatible with DOS, Windows, and OS/2.*

The \$695 price tag includes free Intel support and a 30-day, money-back guarantee. With no royalties to pay. Ever.

Buy it from your local Intel dealer. Or call 1-800-525-3019 for fax document #9901. Because with Code Builder, the hardest thing about getting into 32-bit programming is opening the box.

intel®

The Computer Inside.™

©1991 Intel Corporation. To speak to a real person, call 1-800-538-3373. *DPMI compatibility with these operating systems is based upon publicly stated intentions of Microsoft Corp. and IBM Corp. Code Builder, Intel386, and Intel486 are trademarks of Intel Corporation.

Circle 145 on Inquiry Card (RESELLERS: 146).

2MB's of
Memory
expandable
to 16 MB's

16MHz's
80386SX
Processor

DIMENSIONS:
8.6"D x
11"L x
2.1" H

3.5"
Internal
Diskette
Drive

PC BRAND™

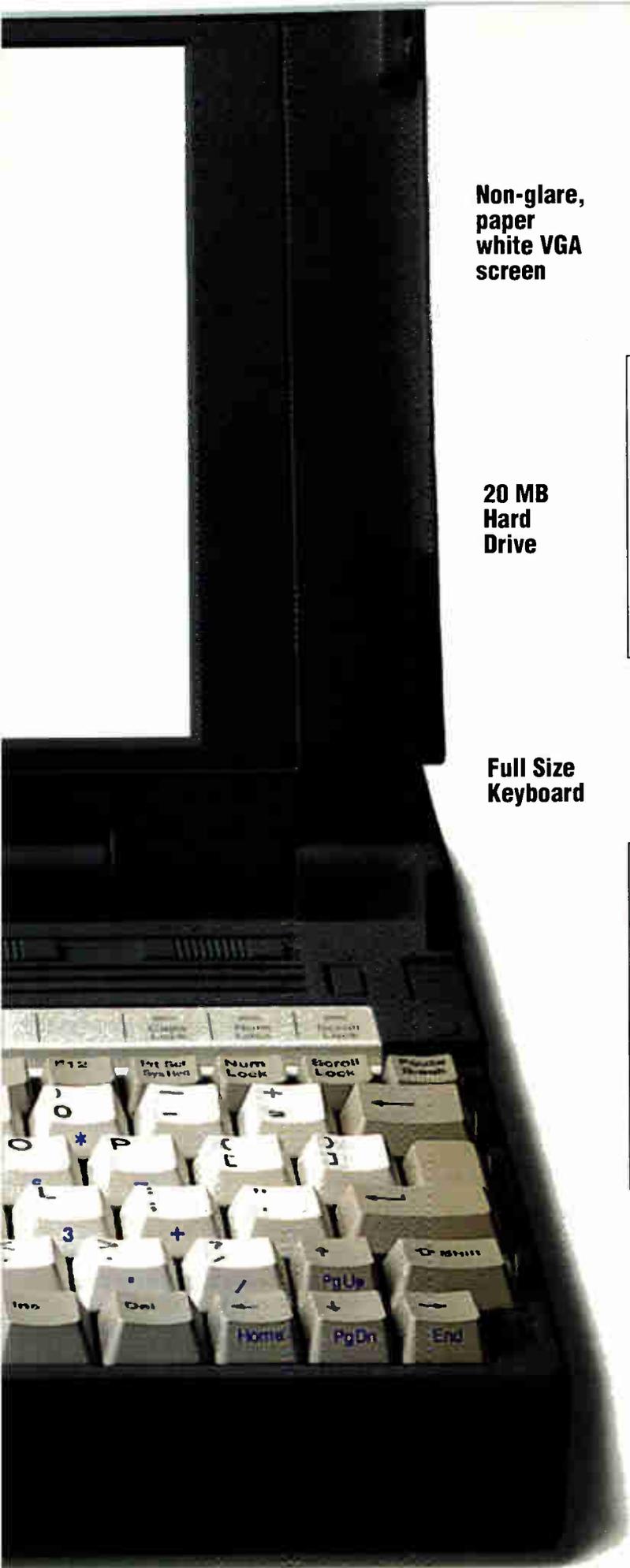
~~\$2195~~

\$1799*

Also Available

20MHz, 40MB Hard Drive
\$2665*

20MHz, 60MB Hard Drive
\$2995*



Non-glare,
paper
white VGA
screen

20 MB
Hard
Drive

Full Size
Keyboard

ACTUAL SIZE. ACTUAL PRICE.

Place this magazine across your lap. Looks pretty good, doesn't it? And at this price, it will also fit comfortably in your budget.

- | Specs: | Options: |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • 16 MHz 80386SX processor, • 2 MB RAM, • 20 MB hard drive, • 1.44 MB 3.5" internal diskette drive, • parallel port, • 2 serial ports, • VGA monitor port, • VGA-32 Grey Shades, • 9 inch non-glare VGA display, • power management system for extended battery life, • 3 hour battery pack, • AC adapter, • 8.6" D x 11" L x 2.1" H, 6.5 lb., • external keyboard connector. | <ul style="list-style-type: none"> • 40 MB and 60 MB hard drive, • memory upgrade kits to 16 MB, • internal modem, • fax modem, • three-slot expansion docking station, • pocket LAN adapter, • add-on numeric keypad, • automobile adapter, • extra battery pack, • MS-DOS[®], • nylon or leather carrying case, • Microsoft[®] Windows[™], • mouse. |

- | All Systems also Include: | Call Today: |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • 30-Day No Risk Money Back Guarantee • 1 Year Warranty • Unlimited Toll-Free Service and Support • Tech Support Bulletin Board | <ul style="list-style-type: none"> • For information and prices on our full line of PC Brand systems • About our matching portable printers |

Look and Compare Our 20 MHz, 40 MB System.

Features	PC Brand 386sx/20	Compaq LTE 386s/20	Dell System [®] 320N
Max RAM	16 MB	10 MB	5 MB
Base RAM	2 MB	2 MB	1 MB
Hard Drive	40 MB	30 MB	30 MB
Hard Drive Option	60 MB	60 MB	60 MB
Screen	VGA	VGA	VGA
Dimensions	8.6" D x 11" L x 2.1" H	8.5" D x 11" L x 2.2" H	8.5" D x 11" L x 2" H
Weight	6.5 lbs	7.5 lbs	6.4 lbs
Price	\$2,665.00	\$4,399.00*	\$3,399.00*

*List prices published by IDC and Hard Facts, April 1991.

PC BRAND[™]

Call 1-800-PC Brand

TEL 1-800-722-7263 FAX 1-800-722-7392

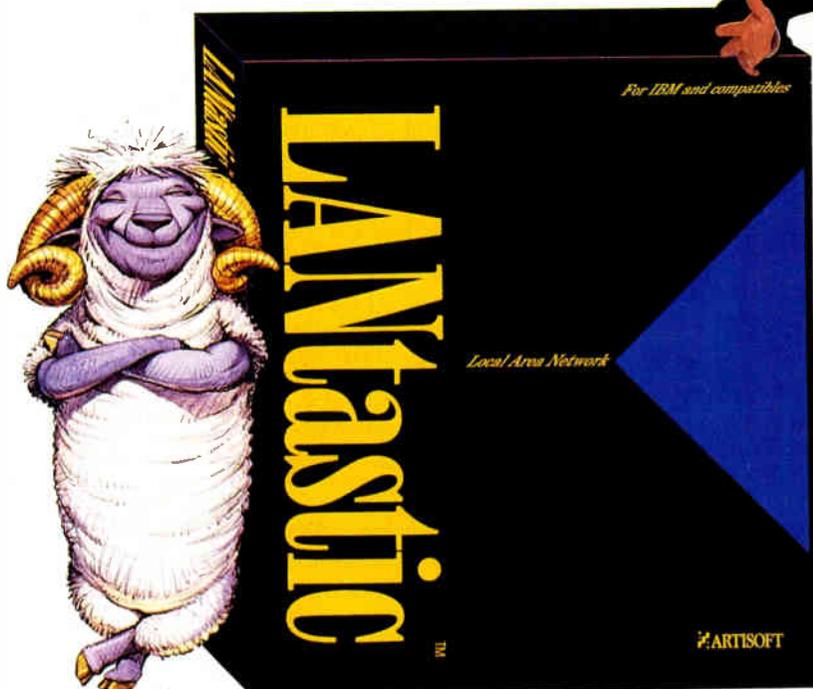
PC Brand, Inc. 877 Supreme Drive, Bensenville, IL 60106
International Fax #708-616-2888 International Voice
#708-860-2300. We are open Mon. thru Fri.: 7am to 7pm; Saturday
8am to 4pm Central Time. MasterCard, VISA, Discover, PC Brand
Direct Advantage MasterCard, Checks & Approved P.O.s Accepted.
Prices & specifications subject to change. 386SX, 387, 486 are
Trademarks of Intel Corporation.

* Sold out when gone, quantity limited.

Circle 223 on Inquiry Card.

BYTE991

“My biggest client was using Novell. When I installed LANtastic, they thanked me for giving back their computers.” —Dennis Reese, Reese Equipment Co. Plymouth, Indiana



ARTISOFT SHATTERS THE MYTH

1990
WINNER
PC Magazine Award
for Technical Excellence



PC
MAGAZINE
EDITORS'
CHOICE
May 29, 1990
www.pcworld.com



For more information call Artisoft or visit your Artisoft Authorized Five Star Dealer.



©1991 by Artisoft, Inc. All rights reserved. LANtastic is a trademark of Artisoft, Inc.

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.

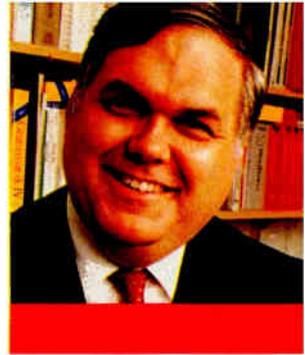
"We will now turn down a network job if we are forced to install Novell. We tell people that our network is really called FANtastic and that Artisoft just can't spell."

ARTISOFT

Revolutionizing Connectivity

Phone (602) 293-6363 Fax (602) 293-8065

Circle 28 on Inquiry Card.



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**

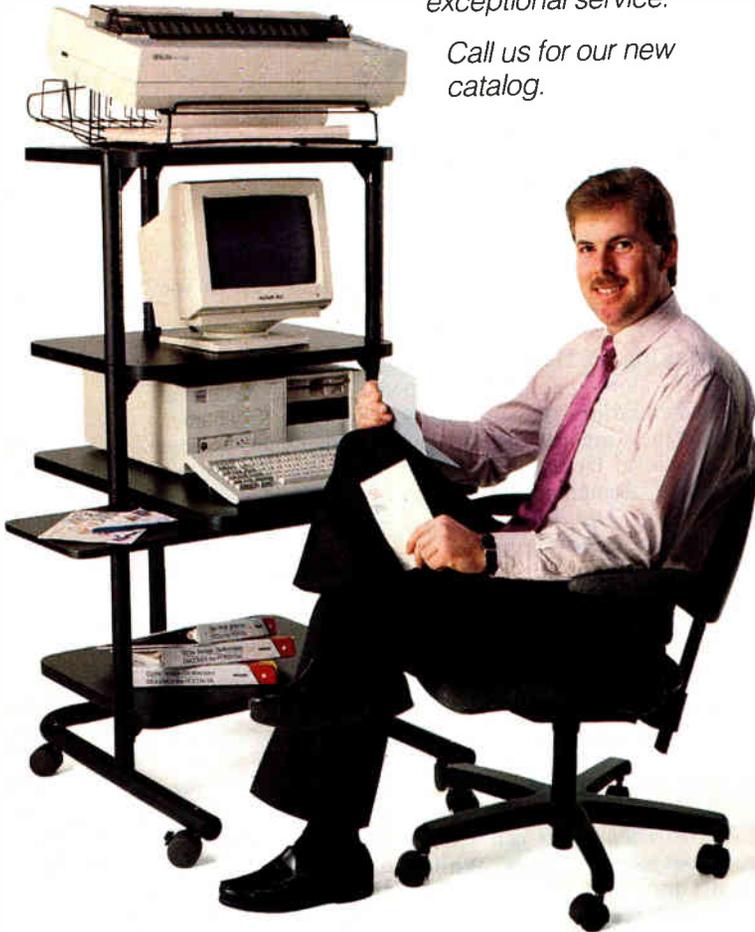


AnthroCart[®]

The best furniture you can buy for your equipment. Incredibly strong. Mobile. Flexible. Space saving. Lifetime warranty.

Choose different sizes and colors. Add the accessories you want. Discover Anthro's exceptional service.

Call us for our new catalog.



Free Catalog:
800-325-3841
6:30 AM to 5:00 PM PST



ANTHRO
Technology Furniture[®]

3221 N.W. Yeon St.
Portland, OR 97210
(503) 241-7*13
Fax: (503) 241-1619

GSA contract No. GS-00F-5040A
Available for OEM applications
Made in USA
Prices start from \$159
We ship in 48 hours

Anthro, AnthroCart and Technology Furniture are registered trademarks of Anthro.



BUSINESS CONNECTION

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

LOOKS LIKE A JOB FOR MINUTEMAN.

Spikes. Surges. Overvoltage. Undervoltage. Brownouts. These things happen. And they can do irreparable damage to your equipment and data. Unless you're protected with Minuteman Uninterruptible Power Supplies.

Minuteman protects all your equipment and data. All the time. In fact, in the event of power failure, it will safely and automatically shut down your network, using your operating system or our own software. Even if you're not there.



There's a Minuteman to fit your needs, large or small. Including 220-volt international models. And we ship orders the same day they're received.

So call us. You can't stop disaster from striking. But you can keep it from hurting you.

1-800-238-7272



STANDBY UPS MODELS

300 VA to 2300 VA
Sinewave output: 1 msec Transfer

ON-LINE UPS MODELS

500 VA to 10,000 VA
Static by-pass standard
True on-line sinewave outputs

UNATTENDED SHUTDOWN

Via your operating system or our software, interfacing:

Novell 286 VAP and 386 NLM
ELS Level II
AIX for IBM RS6000 Version 3.1 & up
AIX for IBM RT Version 2.2.1 & up
3COM
LAN Manager
Banyan Vines

AT&T 3B2

AT&T UNIX 386 Version 3.2

SCO UNIX 386 Version 3.2 & up

SCO XENIX 386 Version 2.3.2 & up

SCO XENIX 286 Version 2.2.1 & up

Sun OS Sun 4 Version 4.03 & 4.10 & up

Sun SPARC Version 4.03 & 4.10 & up

SUN OS Sun 3 Version 4.01 & up

DEC VMS Version 5.1 & up

Custom configuration any system



MINUTEMAN
UNINTERRUPTIBLE POWER SUPPLIES



International Models: 220v 240v
Novell approved UPS monitor boards

© Para Systems, Inc. 1455 LeMay Drive, Carrollton, Texas 75007 Phone: 214-446-7363 FAX: 214-446-9011

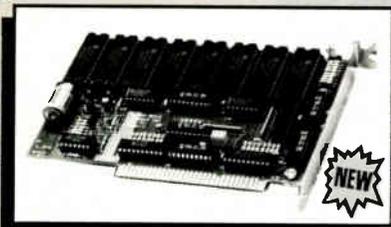
Circle 221 on Inquiry Card.

GTEK . INC.



Solid State Disk

► **PCDI-4**



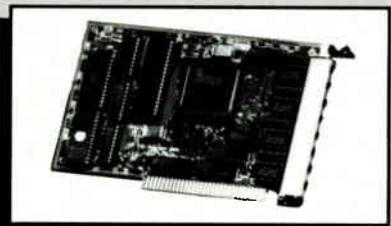
NEW

- Rugged, Superfast, All Silicon Hard Disk Replacement That Works Where Hard Disks Fail.
- On Board BIOS. No Drivers Needed.
- Up To 30 Megabytes Of Non-Volatile Memory.

Full 1 Year Warranty!

Intelligent Serial Coprocessor

► **PCSS-8I**



- On Board Processor Handles Serial Communication Tasks
- 32K - 128K *Dynamemory*™
- Eight Ports Per Board
- High Performance - Low Cost!
- DOS, SCO™ XENIX®, SCO™ UNIX® Drivers Included

Full 1 Year Warranty!

(E)Prom Programmer

MODEL 9000



- QuickPulse & Intelligent Algorithms
- Programs Eproms (up to 4Mb), EEPROMs And MPU's
- Up To 57K Baud
- Ultra Fast!

Full 1 Year Warranty!

Order 800-282-GTEK (4835)

GTEK . INC.

OEM & Dealer
Inquiries Welcomed!

DEVELOPMENT HARDWARE & SOFTWARE
P.O. Box 2310 • Bay St. Louis, MS 39521-2310 U.S.A.
Fax 601-467-0935
Mississippi & Technical Support 601-467-8048

All Registered Trademarks are sole property of their respective companies.

BUSINESS CONNECTION

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

Try it, For just \$4.95.*

Plug your computer into a world of information.

The easy, cost-effective information system from National Videotex, using AT&T's state-of-the-art digital network.

*For a flat fee of \$4.95 per month, you get unlimited access to National Videotex Network, the user-friendly information exchange. This includes free access to six services provided by USA Today Decision-line, "write-your-own" classified ads, and unlimited usage of the gateway functions.

National Videotex Network users may also access the expanding number of pay-as-you-go interactive and transactional services, directories, games, stock exchanges, environmental services and more. NVTEL multi-protocol communication software available at \$14.95.



To register call 800-348-0069

Don't Pay for What You Don't Need!

You don't need complicated hardware/software solutions to add CD-ROM access to your network. . . Just use OPTI-NET®!



Simply choose a workstation on your Novell® or NetBIOS® compatible LAN as your optical server. With the OPTI-NET software-only solution, it's that simple. And, it's proven. OPTI-NET has received the highest marks in published performance tests.

Or, choose the *new* OPTI-NET VAP Version and add CD-ROM drives directly to your Novell file server. This version offers remote network management using the standardized NetWare® menu-driven interface.

Choose the software used by over 4500 installations worldwide. . . Optical networking made simple—OPTI-NET!

If you need additional CD-ROM drives, Online can provide single- or multi-drive systems.

Call our Sales Department at 1-800-922-9204 for more information today!

ONLINE

Computer Systems, Inc.
Products Division

Sharing Information Through Technology™
20251 Century Boulevard Germantown, Maryland 20874
(301) 428-3700 (800) 922-9204 FAX: (301) 428-2903

PART OF REED INTERNATIONAL P.L.C.

Brand names are trademarks or registered trademarks of their respective companies.

BUSINESS CONNECTION

ITEMS DISCUSSED

AutoSketch.....\$249	LANtastic Starter Kit.....\$699
Symbols Library.....\$49.95	Artisoft, Inc.
Generic Software, Inc.	3550 North First Ave., Suite 330
11911 North Creek Pkwy. S	Tucson, AZ 85719
Bothell, WA 98011	(602) 293-6363
(800) 228-3601	fax: (602) 293-8065
fax: (206) 483-6969	Circle 1223 on Inquiry Card.
Circle 1222 on Inquiry Card.	

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.

**The Three
Most
Important
Reasons Why
Companies
Big and Small
are Turning to
PC Brand...**

PC BRAND™

Finally, a computer company that specializes in satisfied customers.

**New Lower Prices!
Call Today 1-800-PC Brand**

The Three Most Imp Companies Big and Small Price, Quality,

386/SX

Application Workstation

- 16MHz 80386SX CPU Operating at Zero Wait States
- 512K RAM (expandable to 8MB) ■ 40MB Hard Drive
- 12" Mono Graphics Monitor ■ Mono Graphics Card

\$997

Lease for:
\$39/month

Add \$150 for SX/20MHz with 64K Cache

386/SX

VGA Color Workstation

- 2MB RAM (expandable to 8MB)
- 40MB Hard Drive
- 14" VGA Color Monitor (640x480 res.)
- 16 Bit Super VGA Card

\$1,346

Add \$150 for SX20MHz with 64K Cache

Lease for \$52/month

386/SX

Super Windows Workstation

- 2MB RAM (expandable to 8MB)
- 80MB Hard Drive
- 14" Super VGA Color Monitor (1024x768 res.)
- 16 Bit Super VGA Card
- Dos 5.0/ Windows 3.0/ Mouse

\$1,695

Add \$150 for SX20MHz with 64K Cache

Lease for \$65/month

- On-Site Service by TRW†
- 30-Day Money Back Guarantee
- Our 5-Year Prorated Warranty
- Unlimited Toll-Free Support
- Volume Purchase Discounts
- Tech Support Bulletin Board.

"The PC Brand

386/SX

*performed at
least as well as
the far costlier
Compaq...*

*We simply began
marveling at
what is surely
the best bargain
in personal
computing."*

**Computer Buyer's Guide
PC Brand 386SX
Product Review**

We Will Customize

Any system to your exact specifications, with name brand Hardware and Software products from vendors like Novell, NEC, Paradise, ATI and many others, at outstanding prices. Call for quotation.



All Systems Feature:

- 1.2 MB or 1.44MB Floppy Drive
- 1 Parallel and 2 Serial Ports
- 101 Key Click/Tactile Keyboard
- 200 Watt Power Supply
- Real Time Clock/Calendar with 5-Year Battery
- Desk-Top or Slim-Line Case

Prices & specifications subject to change. †TRW-National Computer Maintenance Services-Free 90 Day on site service for 386/SX, 386/DX, and 486's for customers located within a 100 mile radius of any of over 200 TRW service centers. On site service for 286's available at extra cost. Call for details *Monthly payments based on 36 month Lease.

Important Reasons Why We are Turning to PC Brand and Support.



**"Best Low-Cost
Alternative Around"**

-PC Magazine,
25MHz 386 PC's

**"Faster than a
Speeding Bullet!"**

-Computer Shopper
Cover Story

**Ask About Our
Optional Service Plus
Program**

Guaranteed Trade-In
on your existing PC
Brand Computer when
you Up-Grade to one
of our more Powerful
models and On-Site
Service for up to 5-
Years. Call for details.

286's also
Available

Video Options

- Mono Graphics
- VGA Mono
- VGA Color (640 x 480)
- Super VGA Color (1024x768)

Case Options

- Slim Line
- Mini Tower
- Server Tower
- Desk Top

Hard Drive Options

- 40MB
- 100MB
- 320MB
- 80MB
- 200MB
- 640MB

386/DX-25

Application Workstation

- 25MHz 80386DX CPU Operating at Zero Wait States
- 1MB RAM (expandable to 16MB) ■ 40MB Hard Drive
- 12" Mono Graphics Monitor ■ Mono Graphics Card

\$1,377 Lease for:
\$53/month

386/DX-25 VGA Color Workstation

- 2MB RAM (expandable to 16MB)
- 40MB Hard Drive
- 14" VGA Color Monitor (640x480 res.)
- 16 Bit Super VGA Card

\$1,743
Lease for \$67/month

386/DX-25 Super Windows Workstation

- 2MB RAM (expandable to 16MB)
- 80MB Hard Drive
- 14" Super VGA Color Monitor (1024x768 res.)
- 16 Bit High Performance Super VGA Card with 1MB
- DOS 5.0/Windows 3.0/ Mouse

\$2,092
Lease for \$81/month*

PC BRAND

Call 1-800-PC Brand.

TEL 1-800-722-7263 FAX 1-800-722-7392

Circle 225 on Inquiry Card.

BYT991

PC Brand, Inc. 877 Supreme Drive, Bensenville, IL 60106 • International Fax # 708-616-2888 International Voice # 708-860-2300 We are open Mon thru Fri. 7am to 7pm, Saturday 8am to 4pm Central Time. MasterCard, VISA, Discover, PC Brand Direct Advantage MasterCard, Checks & Approved P.O.'s Accepted. Prices & specifications subject to change. 386, SX, 387, 486 are Trademarks of Intel Corporation.

**New Lower Prices!
Call Today 1-800-PC Brand**

The Three Most Important Companies Big and Small Price, Quality,

386/DX Cache Application Workstation

- 25MHz 80386DX CPU Operating at Zero Wait States
- Cache Processor with 32K Static RAM
- 1MB RAM (expandable to 16MB) ■ 80MB Hard Drive
- 14" VGA Monochrome Grey Scale Monitor (640x480 res.)
- 16 Bit Super VGA Card

\$1,697

Lease for:
\$65/month

Add * \$150 for 386/33MHz

386/DX Cache VGA Color Workstation

- 2MB RAM (expandable to 16MB)
- 100MB Hard Drive
- 14" VGA Color Monitor (640x480 res.)
- 16 Bit Super VGA Card

\$2,043

Add \$150 for 386/33MHz
Lease for **\$79/month***

386/DX Cache Super Windows Workstation

- 2MB RAM (expandable to 16MB)
- 100MB Hard Drive
- 14" Super VGA Color Monitor (1024x768 res.)
- 16 Bit High Performance VGA Card with 1MB
- Dos 5.0/Windows 3.0/ Mouse

\$2,272

Add \$150 for 386/33MHz
Lease for **\$88/month***

- On-Site Service by TRW†
- 30-Day Money Back Guarantee
- Our 5-Year Prorated Warranty
- Unlimited Toll-Free Support
- Volume Purchase Discounts
- Tech Support Bulletin Board.

*"...Flawless
Compatibility,
Lowest Price."*

**-InfoWorld,
PC Brand 386/33,
Product Review**



We Will Customize

Any system to your exact specifications, with name brand Hardware and Software products from vendors like Novell, NEC, Paradise, ATI and many others, at

**286's also
Available**



All Systems Feature:

- 1.2 MB or 1.44MB Floppy Drive
- 1 Parallel and 2 Serial Ports
- 101 Key Click/Tactile Keyboard
- 200 Watt Power Supply
- Real Time Clock/Calendar with 5-Year Battery
- Desk-Top or Slim-Line Case

Prices & specifications subject to change. †TRW-National Computer Maintenance Services-Free 90 Days on site service for 386/DX, 386/DX, and 486's for customers located within a 100 mile radius of any of over 200 TRW service centers. On site service for 286's available at extra cost. Call for details.*Monthly payments based on 36 month Lease.

Important Reasons Why We are Turning to PC Brand and Support.



*"The PC Brand
486/33 showed
better speed and
expansion than
machines costing
twice as much.
For a good number
of users, the
search for a 486/
33 will end with
this machine."*

**-PC Magazine,
PC Brand 486/33,
Product Review**

Ask About Our Optional Service Plus Program

Guaranteed Trade-In on your existing PC Brand Computer when you Up-Grade to one of our more Powerful models and On-Site Service for up to 5-Years. Call for details.

Video Options

- Mono Graphics
- VGA Mono
- VGA Color (640 x 480)
- Super VGA Color (1024x768)

Case Options

- Slim Line
- Mini Tower
- Server Tower
- Desk Top

Hard Drive Options

- 40MB
- 100MB
- 320MB
- 80MB
- 200MB
- 640MB

PC Brand, Inc. 877 Supreme Drive, Bensenville, IL 60116 • International Fax # 708-616-2888 International Voice # 708-860-2200. We are open Mon. thru Fri. 7am to 7pm; Saturday 9am to 4pm Central Time. MasterCard, VISA, Discover, PC Brand Direct Advantage MasterCard, Check & Approved PDAs Accepted. Prices & specifications subject to change. 386, SX, 387, 486 are Trademarks of Intel Corporation.

486/ISA

Application Workstation

- 25MHz 80486DX CPU Operating at Zero Wait States
- Built-In 8K 4-Way Set Associative Cache
- Optional 128K Secondary Cache (standard w/486/33MHz)
- 1MB RAM (expandable to 16MB) ■ 80MB Hard Drive
- 14" Monochrome Grey Scale Monitor ■ 16 Bit Super VGA Card

\$2,147

Lease for:
\$83/month

Add \$300 for 486/33MHz

486ISA

Super Windows Workstation

- 4MB RAM (expandable to 16MB)
- 40MB Hard Drive
- 14" Super VGA Color Monitor (1024x768 res.)
- 16 Bit High Performance Super VGA Card with 1MB
- DOS 5.0/Windows 3.0/Mouse

\$2,785

Add \$330 for 486/33MHz
Lease for \$107/month*

486ISA

Network Tower Server

- 4MB RAM (expandable to 16MB)
- 16 Bit Server LAN Adapter Card Supporting both Ethernet and 10-Base T
- 200MB Hard Drive
- 12" Mono Graphics Monitor
- Mono Graphics Card
- Server Tower Case

\$2,894

Add \$330 for 486/33MHz
Lease for \$111/month*

PC BRAND

Call 1-800-PC Brand.

TEL 1-800-722-7263 FAX 1-800-722-7392

Circle 226 on Inquiry Card.

BYT 991

**New Lower Prices!
Call Today 1-800-PC Brand**

PC Brand 486/33 EISA



486/33MHz EISA Application Workstation

- 486 33 MHz CPU Operating at Zero Wait States
- 256K Secondary Cache
- 4MB RAM (expandable to 64MB)
- 80MB Hard Drive ■ 16 Bit Super VGA Card
- 14" VGA Monochrome Grey Scale Monitor (640x480 res.)

\$3,997
Lease for: \$154/month*

486/33MHz EISA Super Windows Workstation

- 4MB RAM (expandable to 64MB)
- 100MB Hard Drive
- 14" VGA Color Monitor (192x768 res.)
- 16 Bit High Performance Super VGA Card with 1MB
- DOS 5.0/Windows 3.0/ Mouse

\$4,476
Lease for \$172/month*

486/33MHz EISA Network Tower Server

- 4MB RAM (expandable to 64MB)
- High Performance EISA Ethernet Card
- 200MB Hard Drive
- 12" Mono Graphics Monitor
- Mono Graphics Card
- Server Tower Case

\$4,826
Lease for \$185/month*

All Systems Feature:

- 1.2 MB or 1.44MB Floppy Drive
- 1 Parallel and 2 Serial Ports
- 101 Key Click/Tactile Keyboard
- 200 Watt Power Supply
- Real Time Clock/Calendar with 5-Year Battery
- Desk-Top or Optional Server Tower Case

Video Options

- Mono Graphics
- VGA Mono
- VGA Color (640 x 480)
- Super VGA Color (1024x768)

Hard Drive Options

- 40MB • 200MB
- 80MB • 320MB
- 100MB • 640MB

PC Brand, Inc. 877 Supreme Drive, Bensenville, IL 60104 • International Fax # 708 (616) 2888 International Voice # 708-860-2300. We are open Mon thru Fri 9am to 5pm, Saturday 8am to 4pm Central Time. MasterCard, VISA, Discover, PC Brand Direct Advantage MasterCard, Checks & Approved P.O.s Accepted. Prices & specifications subject to change. 386, SX, 387, 486 are Trademarks of Intel Corporation. Prices & specifications subject to change. TRW National Computer Maintenance Services-Free 90 Day on site service for 386/SX, 386/DX, and 486's for customers located within a 100 mile radius of any of over 20 TRW service centers. On site service for 286's available at extra cost. Call for details. *Monthly payments based on 36 month lease.

PC BRAND™

Call 1-800-PC Brand.

TEL 1-800-722-7263 FAX 1-800-722-7392

Circle 227 on Inquiry Card.

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,

DON CRABB
Contributing Editor

OWEN LINDERHOLM
Senior News Editor

LARRY LOEB
Consulting Editor

MICHAEL NADEAU
Executive Editor

BARRY NANCE
Consulting Editor

JERRY POURNELLE
Senior Contributing Editor

WAYNE RASH JR.
Contributing Editor

KEN SHELDON
West Coast Bureau Chief

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. ■

CSS:STATISTICA

CSS/3™ Complete Statistical System with over 1,000 presentation-quality graphs fully integrated with all procedures and on-screen graph customization ■ The largest selection of statistics in a single system; in-depth, comprehensive implementations of: *Exploratory techniques; multi-way tables with banners; nonparametrics; distribution fitting; multiple regression; general nonlinear estimation; logit/probit analysis; general ANCOVA/MANCOVA; stepwise discriminant analysis; log-linear analysis; factor analysis; cluster analysis; multidimensional scaling; canonical correlation; item analysis/reliability; survival analysis; time series modeling, forecasting; lags analysis; quality control; process analysis; experimental design (with Taguchi);* and much more ■ Manuals with comprehensive introductions to each procedure and examples ■ Integrated Stats Advisor expert system ■ Extensive data management facilities (powerful spreadsheet with formulas, relational merge; data verification; flexible programming language) ■ Optimized (plain English menus mouse) user interface: even complex analyses require just few self-explanatory selections (CSS can be run without manual; Quick Start booklet explains all basic conventions) ■ Macros, batch commands also supported ■ All output displayed in Scrollsheets™ (dynamic tables with pop-up windows and instant graphs) ■ Extremely large analysis designs (e.g., correlation matrices up to 32,000x32,000) ■ Unlimited size of files; extended precision; unmatched speed (Assembler, C) ■ Exchanges data (and graphics) with many applications (incl. Excel®, Lotus 3™, dBASE IV®, SPSS®) ■ Highest resolution output on practically all printers (incl. HP, Postscript), plotters, recorders, typesetters ■ IBM compatibles, 640k or more ■ Price: \$595.

Quick CSS™ Subset of CSS/3: all basic statistical modules (incl. data management) and the full, presentation-quality graphics capabilities of CSS/3 ■ Price: \$295.

CSS:GRAPHICS™ A comprehensive graphics/charting system with data management ■ All graphics capabilities of CSS/3 and, in addition, extended on-screen drawing, 19 scalable fonts, special effects, icons, maps, multi-graphics management ■ Hundreds of types of graphs ■ Interactive rotation and interactive cross-sections of 3D graphs ■ Extensive selection of tools for graphical exploration of data: fitting; smoothing; spectral planes; overlaying; layered compressions; marked subsets ■ Unique multivariate (e.g., 4D) graphs ■ Facilities to custom-design new graphs and add them permanently to menu ■ Import/export of graphs and data, 15 formats ■ Optimized (menu/mouse) user interface: even complex graphs require few keystrokes: all graphs on this page can be produced from raw data in less than 20 minutes ■ Macros, batch commands also supported ■ Unlimited size of files ■ Highest resolution output on all hardware (see CSS/3) ■ IBM compatibles, 640k or more ■ CSS:GRAPHICS is included in CSS:STATISTICA (available separately for \$495).

Megafile Manager™ Comprehensive analytic data base management system ■ Unlimited size of files (up to 32,000 fields or 8 MB per record) ■ Megafile Manager is included in CSS/3 and CSS:STATISTICA (separately: \$295).

CSS:STATISTICA™ A fully integrated system that combines all the capabilities of CSS/3 and CSS:GRAPHICS into a single extremely comprehensive data analysis system ■ Price: \$795.

Domestic sh/h \$7 per product; 14-day money back guarantee.

Circle 284 on Inquiry Card.

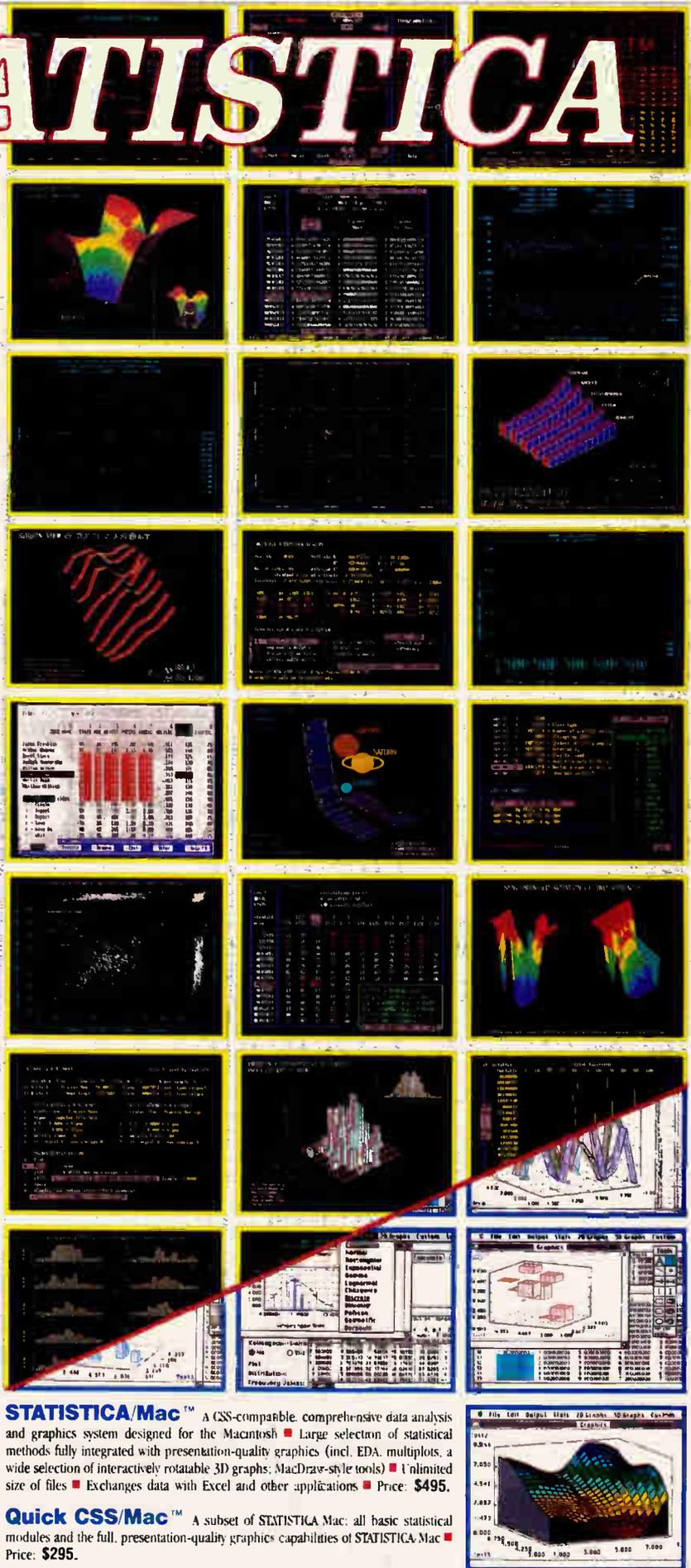


StatSoft™

2325 E. 13th St. • Tulsa, OK 74104 • (918) 583-4149
Fax: (918) 583-4376

Overseas Offices: StatSoft of Europe (Hamburg, FRG), ph: 040/4200347; fax: 040/4911310, StatSoft UK (London, UK), ph: 0462/462822 fax: 0462/482855, StatSoft Pacific (Melbourne, Australia), ph: 613-866-1766, fax: 613-866-3318, StatSoft Canada-CGO (Ontario), ph: 416-849-0737, fax: 416-849-0918 Available From: CORPORATE SOFTWARE and other Authorized Representatives Worldwide: Holland: Lemax BV 02065-98701; France: Concept 1 (1) 45669700; Sweden: AkademiData 018 240035; Spain: ADDLINK, SRL: ph: 34-3-459-0722

CSS, CSS 3, CSS GRAPHICS, Megafile Manager, Quick CSS, STATISTICA, StatSoft, dBASE IV, Excel, Lotus, MacDraw, Macintosh, Postscript are trademarks of their respective companies. SPSS is a registered trademark of SPSS, Inc.



STATISTICA/Mac™ A CSS-compatible comprehensive data analysis and graphics system designed for the Macintosh ■ Large selection of statistical methods fully integrated with presentation-quality graphics (incl. EDA, multiplois, a wide selection of interactively rotatable 3D graphs; MacDraw-style tools) ■ Unlimited size of files ■ Exchanges data with Excel and other applications ■ Price: \$495.

Quick CSS/Mac™ A subset of STATISTICA Mac: all basic statistical modules and the full, presentation-quality graphics capabilities of STATISTICA Mac ■ Price: \$295.



Pretty



Mission Critical Workstation 1448: Combines a CRT and CPU into one rugged NEMA-4 system with 9 option slots and 2 drive bays. A complete 386SX system from \$7395.

A PC that looks good in your office won't look good for long out in the plant.

Heat murders microprocessors. Dust decimates disk drives. Vibration victimizes video cards.

Any or all can wreck your entire operation.

The Texas Micro line of rugged, reliable ISA Bus products and systems are specifically engineered for those brutal industrial environments that eat pretty PCs for breakfast.

Durability built in from scratch

To ensure maximum durability we design and manufacture from scratch practically everything that goes into our systems, like passive backplanes which we pioneered for microcomputers in 1983. These backplanes accommodate a full complement of convenient, plug-in components, all compatible with Compaq DeskPro.® They're why our Mean Time To Repair (MTTR) is a phenomenal 10 minutes.

You won't find passive backplanes — or lower MTTR — in any of the leading office PCs.

More options mean more choices

We also build industrial-strength option cards to handle myriad functions, in addition to our 286, 386SX,™ 386DX™ and 486™ CPU cards in a full range of processor speeds. Our CPU card designs use Very Large Scale Integrated circuits and programmable array logic devices to reduce component counts by 50–60% which enhances reliability and resistance to physical stress. Ultimately, the design contributes to our remarkably long Mean Time Between Failures (MTBF): 70,000–100,000 hours, calculated against the MIL Standard Handbook 217E.

You won't find that kind of card selection — or MTBF — among the leading PC makers.

We pretest, test, and then retest



Mission Critical Rackmount 3014 & 8014 (above) each has 14 option slots, 3 drive bays. For computing where desktops die. A complete 386SX 3014 system from \$4395. A complete 386SX 8014 system from \$4675. Without monitors.

You won't find them torturing their systems like we torture ours either. Not only do we perform extensive "shake, rattle and roll" tests on each new design, we pretest all our systems before they leave our dock. We burn them in at 55C/131F for 48 hours straight



Tough.

just to make sure they can take the heat.

What's more, we shock mount our disk drives to stand up to vibrations surpassing Richter scale proportions and we use only high-reliability power supplies that can go for 100,000 hours MTBF.

Our guarantee is your guarantee

With all this reliability designed into our products, is it any wonder that we guarantee better support than any of the other leading PC makers? Every system comes with a full one-year, on-site warranty. Theirs don't. We also offer a toll-free number for technical and sales information, a regional network of sales engineers and engineering support for system integration.

Why the competition is no competition

	Backplane architecture	Shock mounted drives	48 Hr burn-in at 131 degrees	Total ISA slots	100,000 MTBF Power supply	Built like an M1A1	Manufacturers SRP
Compaq 386SX Model 84	No	No	No	5	No	No	\$3699
Texas Micro 2003	Yes	Yes	Yes	10	Yes	Yes	\$3950

Both systems similarly configured with 2MB RAM, Texas Micro-104MB hard drive, COMPAQ-84MB hard drive, 1.2MB floppy, VGA graphics, keyboard, monitor not included, purchase price discounts may vary by quantity and reseller

Texas Micro™ is a trademark of Texas Microsystems, Inc. All other trade names referenced are the service mark, trademark, or registered trademark of the respective manufacturer.

Tough systems at gentle prices

The leading office PCs may look prettier than ours. But our industrial-strength systems are designed to be more reliable, and to do it for no more money than it costs for the fancy office system.

Which makes a Texas Micro PC look a whole lot better in two places where it really counts:

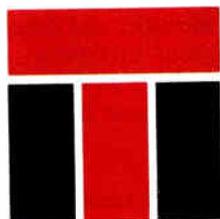
Your production line and your bottom line.



Mission Critical Benchtop 2003: With 10 option slots and 2 drive bays the 2003 makes desktop computing possible in extreme environments. A complete 386SX system from \$3950 without monitor.

For technical or sales information, call:

1-800-627-8700



TEXAS MICRO

10618 Rockley Road, Houston, TX 77099 • Tel 713-933-8050, Fax 713-933-1029

Circle 300 on Inquiry Card.

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.

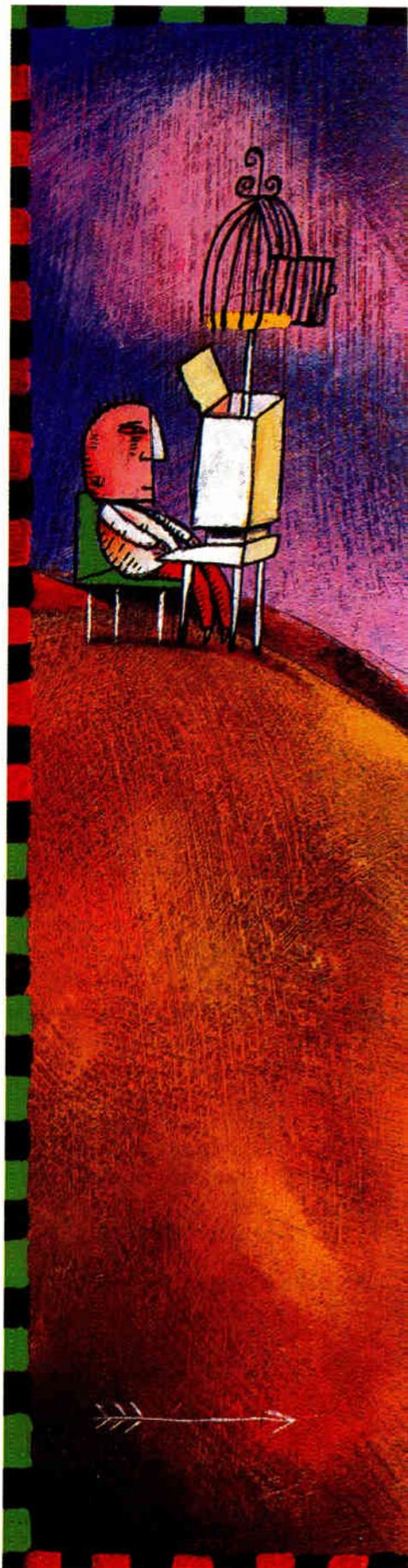
Recent cases from the crime files show how dishonest data is beginning to spread. In one incident, the outcome of a murder case hinged on the list of phone calls made by the defendant. MCI's internal records showed she made a phone call to a gun store, but the defendant produced her phone bill, which 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

BYTE ACTION SUMMARY

How do you know that the data on your hard disk or in your E-mail in basket hasn’t been fiddled with? Here are three options for maintaining its integrity—even over a network.

TI microLaser™ printers open new windows.



With powerful fonts and graphics, ease of use and economy.

By now you've heard how fast and easy Microsoft® Windows™ makes it to tap all that PC power you've got on your desk.

Well now there's an affordable, easy way to put that power on paper — microLaser from Texas Instruments.

Right out of the box, microLaser comes with what you need to print the razzle-dazzle pages of text and graphics you've dreamed of creating.

Just plug it in and go.

That's because microLaser PS models come with the Adobe® PostScript® language



POSTSCRIPT®



and the memory it takes to use it. Plus you get your choice of either 17 or 35 scalable fonts, starting at just \$1,999.*

When it comes to print speed, microLaser zips along at 6 ppm. If you need a shared printer solution, turn to its cousin, microLaser XL. This workhorse gallops at a formidable 16 ppm.

If all that isn't enough, just look at what else you get with microLaser. It's the smallest printer in its class. It handles more paper and envelopes in more ways. And it supports more than 4,000



software packages, including your Windows applications.

So when you add it all up,

you'll understand why MacUser needs the power, convenience and economy of microLaser. Let microLaser open new windows for you.

For the name of the nearest dealer, call **1-800-527-3500.**

The microLaser PS17 has earned the 1990 PC World Best Buy award; microLaser PS35 has earned the 1990 InfoWorld Excellent Value award and 4½ mice from MacUser, October 1990.

TEXAS INSTRUMENTS



*TI suggested retail price. (Dealers' prices may vary.) microLaser is a trademark of Texas Instruments Incorporated. Adobe, PostScript and the PostScript Logo are registered trademarks of Adobe Systems, Inc. Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation. ©1991 TI 71816

Circle 297 on Inquiry Card.

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:

```

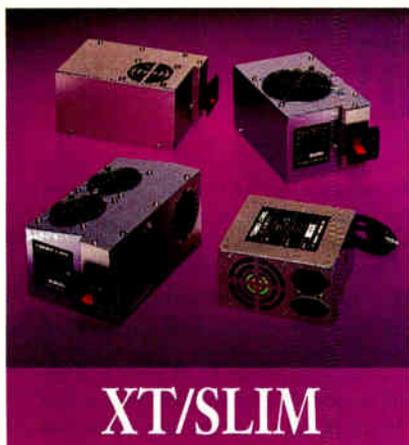
Begin with Block[0] through Block[3] filled with
  Key[0] through Key[3]. At the beginning, Key[0]
  through Key[3] are set to be 0.

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...

```

Power Packed & Built To Last.



XT/SLIM

STANDARD 200XT **\$69**

Economical This UL approved, fully tested unit is one of the best generic 200s available. Costs no more than our Standard 150 it replaces.

SILENCER 200 **\$129**

Ultra-Quiet Stop that irritating noise with the Silencer 200. Its large, low speed, German fan keeps your system 5° to 15° cooler and 84% quieter. Virtually inaudible! Great in the executive suite or home office.

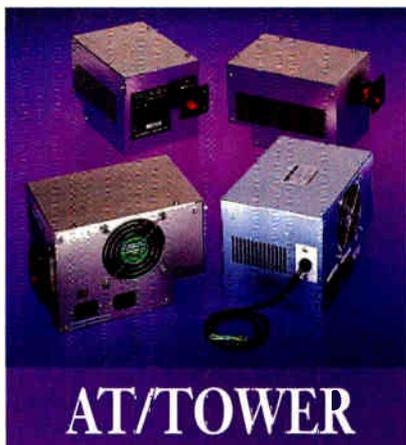
TURBO-COOL 200 **\$169**

High Performance Put AT power and 200% more cooling under the hood of your PC/XT with our UL approved Turbo-Cool 200. Its patented twin fan, sloped-cover design keeps your system 30° to 45° cooler, preventing data errors and other heat-related problems. Perfect for hot rod PCs and Mini ATs!

TURBO-COOL 300S **\$169**

Slim and Powerful Give your Slimline or Mini-Tower computer up to 100% more power and cooling with our low profile, direct replacement Turbo-Cool 300S. With a peak capacity of over 350 watts, it will easily start even the largest hard drives and peripherals!

Silencer, Turbo-Cool, and InnerSource are trademarks of PC Power & Cooling, Inc. Compaq and Deskpro are registered trademarks of Compaq Computer Corporation.



AT/TOWER

STANDARD 220 **\$99**

Economical This UL approved, fully tested unit is one of the best generic 220s available. Ideal for basic systems.

SILENCER 220 **\$139**

Ultra-Quiet Unrattle your nerves with the Silencer 220. Its custom, thermostatically-controlled fan maintains the correct system temperature while reducing noise by up to 95%. Great in the executive suite or home office.

TURBO-COOL 300 **\$189**

High Performance Upgrade your AT/386 with our powerful Turbo-Cool 300. This popular OEM unit features built-in line conditioning, UL/CSA/TUV approval, 2 year warranty, and a high-capacity, adjustable-speed fan that keeps your system 20° to 35° cooler for up to three times longer life. Great value!

TURBO-COOL 450 **\$349**

Maximum Performance The choice of PC professionals, our Turbo-Cool 450 features built-in line conditioning, autoselect input, independent regulation, external DC voltage adjustment, triple-stage output filter, 50cfm cooling fan, UL/CSA/TUV approval, 100,000 Hr. MTBF and 2 year warranty! Ideal for high-end workstations and network file servers.



COMPAQ

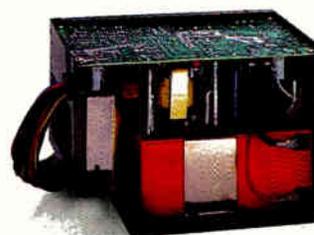
CP160 **\$169**

Original Portable Upgrade Double your power with our direct replacement CP160. Allows 286, 386, and hard disk upgrades.

CD270 **\$249**

Deskpro Upgrade The power user's power supply! Our direct replacement CD270 gives your 8086/286/386 Deskpro up to 70% more power and the reliability it deserves. Prevents nuisance rebooting. Advanced design includes autoselect 110V/220V. 2-year warranty.

INTERNAL UPS!



"An excellent product"
- PC Magazine, Nov. 27, 1990

Our UL approved InnerSource is the first AT/386 power supply with a *built-in* UPS. Its auto-recharge battery provides up to 15 minutes of reliable backup power for both your PC and monitor. This integrated protection costs less than a bulky 550VA external UPS, and it saves space, too. A Novell NetWare interface is available. \$395

Most orders shipped same day. We accept Visa, MC, COD or PO on approved credit.

PC POWER & COOLING, INC.

5995 Avenida Encinas, Carlsbad, CA 92008 • (619) 931-5700 • (800) 722-6555 • FAX (619) 931-6988

Circle 228 on Inquiry Card (RESELLERS: 229).

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.

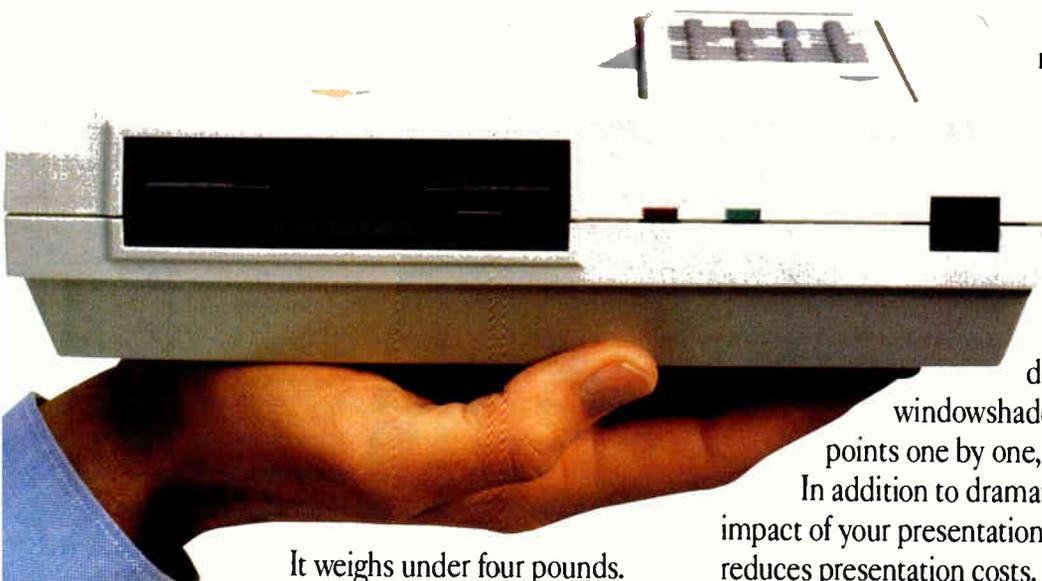
The public-key cryptosystems would be an ideal way to allow people to check the authenticity of a file except for two problems: The systems are relatively slow, and their use must be cleared by attorneys. If you want to make sure a file remains unchanged but you're not particularly concerned with secrecy, 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."

Take a lightweight presenter to your next presentation.



It weighs under four pounds.
It fits into an ordinary briefcase.

But if your living depends upon making presentations, the LiteShow II™ is no lightweight.

LiteShow II is a radical, new technological breakthrough from In Focus, the industry's leading innovator in LCD projection panels and presentation technologies.

LiteShow II makes dynamic, brilliant color computer-generated presentations—without the expense or baggage of a computer. Or the hassle and expense of overhead transparencies or color slides.

Create your presentation on any IBM/compatible, PS/2 or Macintosh computer. Then capture your presentation on a standard 1.44 MB, 3.5" floppy disk. Save as many as 50 images per disk. You can even mix and match images created in DOS, OS/2, Windows and Macintosh applications.

Using LiteShow II's built-in software, organize your images in any order you like. Just like a slide carousel. But unlike a slide carousel,

LiteShow II gives you a host of special effects.



In fact, LiteShow II makes slideshows look amateurish by comparison.

You can display 256 brilliant colors at 640 x 480 resolution.

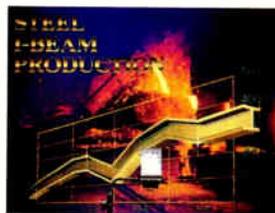
Animate your images with wipes, dissolves, timing effects, windowshades that reveal bullet

points one by one, and more.

In addition to dramatically increasing the impact of your presentation, LiteShow II dramatically reduces presentation costs.

An image displayed on LiteShow II costs about 6 cents compared to \$1.00 for an overhead transparency or \$15 for a color slide.* And LiteShow II itself costs less than a VGA laptop.

LiteShow II works with any multi-sync monitor or video/data projector. But for the most dramatic presentation team, couple LiteShow II with an In Focus PC Viewer® LCD projection panel. Its 640 x 480 resolution supports CGA, EGA, VGA, and Macintosh video standards.

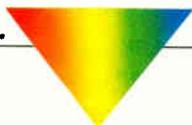


When you consider presentation impact, image quality, ease-of-use, flexibility, the

freedom to make last minute changes on the fly, the easy portability and the final, bottom-line cost, LiteShow II is the most persuasive and cost-effective way to make your point.

And there's nothing lightweight about that.

IN FOCUS SYSTEMS® INC.

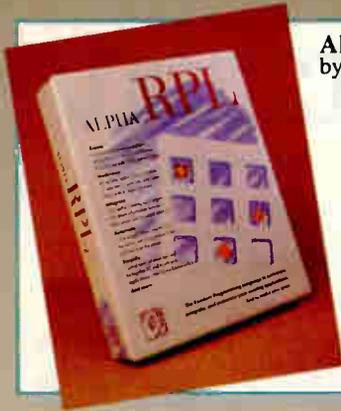


*Prices may vary although they'll never equal the economy of LiteShow II.

In Focus Systems® Inc. 7770 SW Mohawk Street, Tualatin, Oregon 97602. 1-800-327-7231. In Oregon, 503-692-4968 Fax: 503-692-4476.

LiteShow II is a trademark. PC Viewer and In Focus Systems are registered trademarks of In Focus Systems Inc. All other trademarks or registered trademarks are the property of their respective holders.

Professional developers require



Alpha RPL
by Alpha Software
Language for creating memory resident applications. Complete TSR programming environment including editor, debugger, and library manager. Automate complicated or repetitive tasks. Integrate various applications under common interface. Interpreted language contains over 230 commands and functions.
LIST: \$595 **PS Price: \$99**
(offer expires October 31, 1991)
FastFaxis 2138-009



Spontaneous Assembly 2.0
by Base Two Development
This award-winning assembly language library lets you write the fastest, tightest code...*fast!* It puts 700+ ready-to-use assembly language functions and macros at your fingertips, including a complete overlapping windowing system; high-speed console I/O; near/far/local heap management; array management, sorting, searching; program and environment control; full 32/64-bit integer math; sound and timer control; full memory model support and much more. Easy integration with C. Full source code included.
LIST: \$199 **PS Price: \$159**
FastFaxis 2695-001

386 DEVELOPMENT

386 Max 5.1	Price \$109	Clipper 5.0	570
386DOS Extender	479	dBASE IV	549
DESVIEW 386	189	dbFAST/PLUS	315
F77-EM32 + Ergo OS/386	1149	dbMAN V	219
FoxBASE+/386	479	dBXL	169
Metaware High C 386/486	935	Force dBASE Compiler	299
NDP Fortran 386	829	FoxPro	495
QEMM 386	89	FoxBASE + - V2.1	279
WATCOM C8.0 386 Prof.	1039	QuickSilver	395
Zortech C++ 386 Dev.	629		

ASSEMBLY

MS MASM	105	DBMS	
Spontaneous Assembly	159	CLARION Prof. Dev. V2.1	549
Turbo Debugger & Tools	119	D the data language	345
		Magic PC	499
		Paradox V3.5	555
		R:BASE 3.1	645

BASIC & ADD-ONS

BAS-C Commercial	829	DBMS TOOLS & LIBRARIES	
dB/LIB Professional	179	Artful Two	289
Microsoft BASIC PDS	349	BALEK Spreadsheet Compiler	399
MS QuickBASIC V4.5	69	CLEAR + for dBASE	179
QuickPak Prof. V3.21	189	CodeBase 4	279
		CodeBase++	279

C LANGUAGE COMPILERS

C Video Course	275	Comet Multiport	169
Instant C	479	Comm Tools for Clipper	269
Quick C	69	C Works	649
Microsoft C 6.0	349	dBASE Online	129
Watcom C Professional	439	dBX/dBport w/source	895
		dGE 4.0	279

CASE & PROTOTYPERS

Demo II V3.0	239	dQUERY MU	179
EasyCase Plus	449	dSalvage Professional	195
EasyFlow	199	Essential B-tree	149
G-Base	699	Faircom c-tree Plus	529
Instant Replay Prof.	575	FLIPPER Graphics Library	279
Layout	239	FUNcky.LIB	239
MetaDesign	329	Genifer	289
Pro-C w/Workbench	735	Net Lib	Call
Show Partner F/X	295	Novell BTrieve	479
		Pro Clip	185

COMMUNICATIONS ADD-ONS

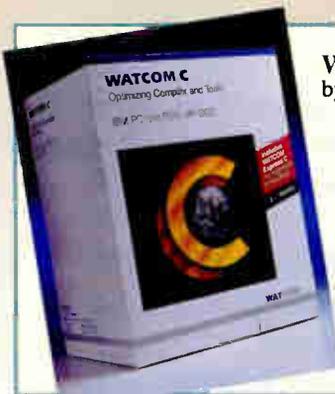
Blast PC Plus	245	R&R for dBASE & Comp.	229
C Asynch Manager 3.0	149	R&R Code Generator	129
Essential COMM	249	Scrimmage	139
Greenleaf Comm Library	329	UI2 Developer's Release	449
HyperACCESS/V	75		
Procomm Plus	99	DEBUGGERS/ DISASSEMBLERS	
QuickComm	129	Dis Doc Professional	229
		Multiscope for DOS	149
		Periscope/EM	259
		Periscope I/OK	459
		Periscope IV	Varies

DBASE

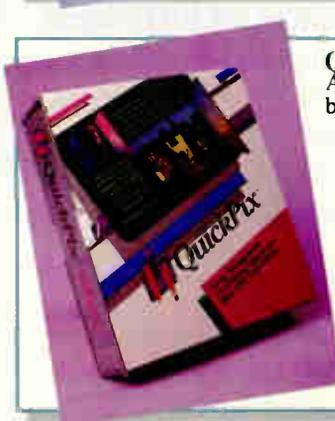
Alpha 4	469		
---------	-----	--	--



HiJaak Release 2.0
by Inset Systems Inc.
HiJaak 2.0 is a graphics conversion and capture utility that translates more than 36 graphics file formats. HIJAACK provides batch conversion capability from the DOS command line or from the user interface. Supported formats include GEM, PICT I&II, CGM, HPGL, PIC, DXF, PCX, MAC, TIF, and support for more than 16 group 3 fax devices. A 5K pop-up provides capture function of text screens, graphics screens, and laser printer output.
LIST: \$199 **PS Price: \$149**
FastFaxis 1085-003



WATCOM C 8.0/386 Prof.
by WATCOM
WATCOM C 8.0/386 is 100% ANSI C optimizing compiler/runtime library for Intel's 80386 architecture, generating applications for 32-bit protect mode. Features include: protected mode version of the compiler; VIDEO full-screen source-level debugger; MS library- & source-compatibility; execution profiler; high performance linker; graphics library; SAA compatible.
LIST: \$1295 **PS Price: \$1039**
FastFaxis 1044-005



QuickPix
Add Images To Any DOS
by PowerSoft, Inc.
Change the image of your database or any DOS application without reprogramming. QuickPix, an image management package, lets you integrate PCX and TIF graphics into new and/or existing programs. Add photos or quickly create document retrieval systems using dBASE™, R:BASE™, FOXPRO™, Paradox™, Lotus 1-2-3™ and WordPerfect™. QuickPix loads into high memory, EMS and HMA. It even allows black-and-white printing of color pictures.
LIST: \$495 **PS Price: \$479**
FastFaxis 5027-001

more than just products...

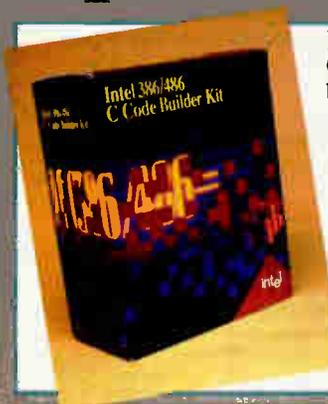


HALO Image File Format Library

Instant file support for your applications
by Media Cybernetics

Add image file reading and writing to your applications with the HALO Image File Format Library. Makes your application instantly compatible with hundreds of graphics and imaging products. Offers complete support for TIFF (Tagged Image File Format), PCX (PC Paintbrush), BMP (Windows Bitmap), and CUT (Dr. HALO). Works with Borland C++, Turbo C, Turbo C++, and Microsoft C.

DOS LIST: \$249 PS Price: \$199
Windows LIST: \$349 PS Price: \$279
FastFacts 86-073

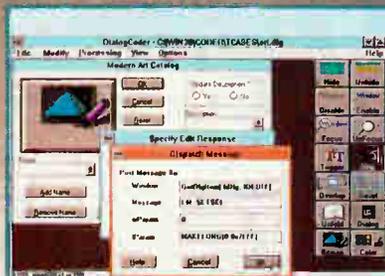


Intel 386/486 C Code Builder

by Intel Corporation

Open Intel's new 386/486 C Code Builder™ Kit. And tear into the increased memory and performance of 32-bit DOS protected mode. Inside, you'll find everything you need to develop 32-bit applications. That means you get a Microsoft and ANSI compatible C Compiler and Libraries, Linker, Librarian, Make Utility, and Source Level Debugger. We've even included a DOS Extender that's DPMI-compliant. Compliancy that enables easy migration to Windows from Microsoft. No royalties to pay.

LIST: \$695 PS Price: \$599
FastFacts 2799-028



DialogCoder

by Software Organization

DialogCoder is the tool for prototyping dialog boxes for Windows 3.0 applications. DialogCoder is a complete development environment with a built-in dialog editor, custom controls, a sophisticated code generator (C,C++) and a DLL builder. Provides edit field validation, custom code support, commented source code, and a built-in test environment. Supports

conditional control states, automatic code regeneration, owner-drawn controls, color, fonts and much more. Slices weeks of costly development time from any project.

LIST: \$499 PS Price: \$489 FastFacts 2048-001

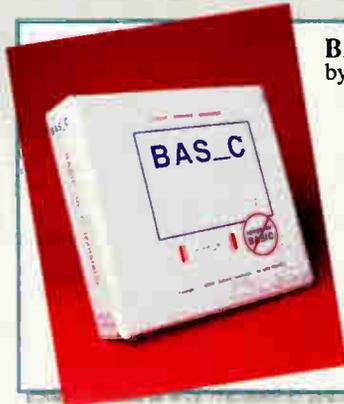


Whitewater Resource Toolkit

by The Whitewater Group®

An easy-to-use, interactive tool that lets you rapidly design the look and feel of new Windows applications, as well as alter existing Windows applications. Whether you are a C programmer, Actor® programmer, systems integrator, or an end user, you'll find the Resource Toolkit an invaluable tool for creating and modifying the look and feel of Windows applications.

LIST: \$195
PS Special Price: \$119.99
(offer expires 9/30/91)
FastFacts 800-015



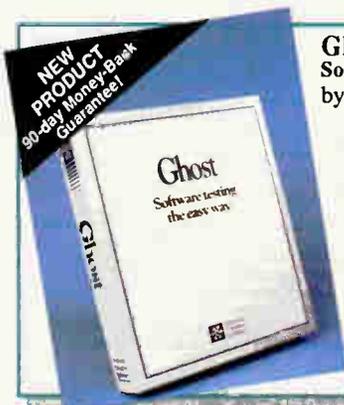
BAS_C Translator

by GoToless Conversion

BAS_C Translates BASIC/QuickBASIC to MS/Turbo C automatically. Guaranteed to generate a structured, indented, scoped, syntax error free C source code even if the original BASIC program is a spaghetti code. Run on MSDOS, XENIX and UNIX.

	LIST	PS Price
BAS_C Economy	\$375	\$349
BAS_C Commercial 5.3	\$895	\$829
BAS_C Commercial SCO 286 Xenix	\$1149	\$1049
BAS_C Commercial SCO 386 Xenix	\$1235	\$1159

FastFacts 675-005



GHOST

Software Testing the Easy Way.
by Vermont Creative Software

Ghost is an indispensable tool for automatic testing of all software. You can create complete test scripts and run them each time a change is introduced to your program. Ghost compares screen shots from your test before and after changes. You also get reports of all changes, quickly identifying bugs! Ghost needs no extra hardware and only 16K of memory.

LIST: \$195 PS Price: \$189
FastFacts 169-079

Sourcer 486 w/BIOS pre-proc.	149	F77L FORTRAN	549
Trapper	189	Microsoft FORTRAN	309
		RMFORTRAN	499
		Watcom FORTRAN 77	449

DEVELOPMENT TOOLS

AllClear	269	GRAPHICS	
ASMFLOW Prof.	179	Essential Graphics v3.0	349
Buzzwords dANALYST Gold	199	GFx Graphics Library	139
C-DOC	179	GraphiC	419
Charge	95	graphics-Menu	Call
CLEAR+ for C	179	GSS Graphics Dev't Toolkit	699
Codan	349	GX Effects	179
Diff'It	119	HALO	279
INSIDE!	119	MetaWINDOW/PLUS	369
Install	219	PCX Programmer's Toolkit	229
INSTALIT w/source	279	Victor w/source	279
MKS Make	129	VID and DIG Graphics	249
MKS RCS	229	Z-Phigs Lite	169
PC-Lint	115	Z-Phigs Professional	769
PolyMake	159		
PVCS Professional	439	HARDWARE	
.RTLINK Plus	419	2C87-20	329
Sourcerer's Apprentice Prof.	459	80387-33	289
The Documentor	229	Boca 1024 VGA	219
TLIB 5.0 Version Control	125	FasMath 83D87-16	359

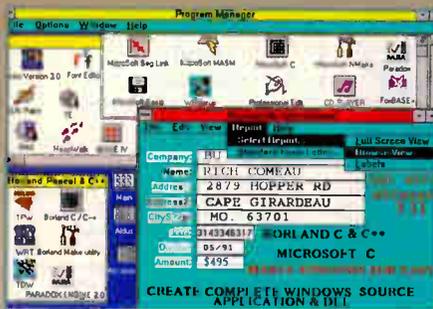
EDITORS

BRIEF	Call	Logitech Mouse	100
Cheetah	75	Model 200DL UPS	189
dBrief	119	Model 450AT UPS	329
Emacs	279	ST-251-1	339
Epsilon	229	ST-4096-1	599
KEDIT	139	OBJECT-ORIENTED/C++	
Sage Professional Editor	249	Borland C++	379
SPF/PC - V2.1	195	M++	279
Vedit +	159	Smalltalk/V	79
		Zinc Interface Library	175

FORTRAN

THE PROGRAMMER'S SHOP 1-800-421-8006

The Programmer's Shop is

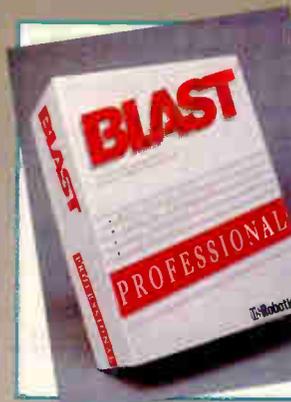


dANALYST GOLD 5.0 by Buzzwords

The ultimate development environment for MS Windows, C, C++, dBASE compatibles, and Paradox. Screen painter, report writer, source code generator, documenter, beautifier, source code analyzer, editor and much more. Versions support DOS, Microsoft Windows, or Unix. Network support multi-user applications.

One version supports dBASE compatibles, Paradox, C and C++. Comes with a video library, fast screen I/O. Creates Microsoft Windows multi-user source code applications.

LIST: \$495 PS Price: \$295 FastFaxes 966-057



BLAST Professional by Communications Research Group

New BLAST Professional is an all-in-one communications product that provides terminal emulation, file transfer, remote control and LAN support in a single easy-to-use program. Lets your PC talk to other PCs, on or off your LAN, plus MACs, VAXes, Unix and Zenix systems and over 350 other computers using more than 35 different operating systems.

LIST: \$295

Special Introductory Offer \$99!
FastFaxes 1674-034

C++ Science & Engineering	895
OTHER PRODUCTS	
BlueMAX	139
Carbon Copy	179
Dan Bricklin's PageGarden	89
Disk Dupe	69
Fast!	89
FastBack Plus	159
Flow Charting III	199
Grasp	319
HEADROOM	89
HiJaak	149
LapLink III	129
Link & Locate ++ - Extended	399
Mace Utilities	99
Math Advantage	475
Norton Anti-Virus	119
Norton Utilities 6.0	149
pcANYWHERE IV	159
PC Tools Deluxe 7.0	149
PC-KWIK Power Pak	119
Pre Cursor	89
Remote2	139
SpinRite II	89
System Sleuth Pro	109
TimeSheet Prof.	145
Turbo EMS	89

PASCAL

MetaWare Prof. Pascal	439
Microsoft Pascal	199
Quick Pascal	69
Turbo ASYNCH PLUS	159
Turbo Pascal 6.0	107
Turbo Professional	109

TEXT SCREEN ADD-ONS

C Worthy w/Forms w/ARCH	379
Greenleaf DataWindows	339
HI-SCREEN Pro II	319
Lexical Resolution	239
MEWEL Window System	279
POWER SCREEN	129
Vitamin C - source, menus	369
VC Screen - painter	139
Vermont Views Obj. + source	819

UNIX/XENIX

Computer Innovations C++	475
db_FILE/RETRIEVE MU	569
ESIX Systems	
ESIX/V Rel4 Dev. (2 user)	1229

ESIX/V unit	1595
Informix SQL	Varies
Interactive Systems	
Architech Applic. Platform	745
Architech Applic. Developer	1595
Architech Wrkstn Platform	1195
Architech Wrkstn Developer	1945
LPI-FORTRAN	929
M++ for Unix	379
M++ for Unix w/ source	579
Microport V/4 Complete	1425
Norton Utilities for Unix	269
Santa Cruz Operations	
UNIX Operating System	559
UNIX Development System	895
VP/ix	429
XENIX Operating Sys. 386	559
XENIX Develop. Sys. 386	689
WordTech Quicksilver	1295

WINDOWS & OS/2

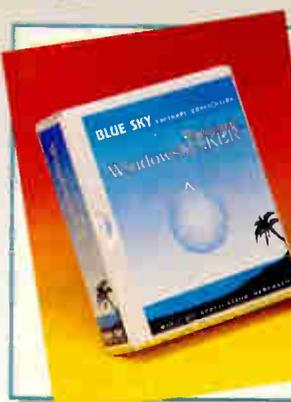
ACTOR	225
ACTOR Professional	449
BRIEF for OS/2	Call
Case: PM (for C or C++)	1899
Case: W Corporate Version	969
Class Manager	379
C-Trieve/Windows	385
C View	379
dBFAST/Windows	395
Graphics Server SDK	455
Instant Windows	479
KnowledgePro Windows	395
MS Windows V3.0	119
MS Windows DDK V3.0	365
MS Windows SDK V3.0	365
Multiscope OS/2 Debugger	349
Multiscope Windows Debug.	315
Object/1	989
ObjectVision by Borland	379
OptLink/Windows	319
OS/2 PM Toolkit 1.2	369
ProtoGen	189
ProtoView	675
Smalltalk/V PM	435
Tempo for Windows 1.1	89
Time after Time	75
ToolBook	349
Windows Maker	715
Windows Maker Professional	895



Enhance Windows and Supercharge DOS 5! by Qualitas

386MAX (for 386-based machines) and BlueMAX (For 386-based PS/2s) give your system MAXimum performance with Windows™ 3.0 support. Exclusive technologies include FlexFrame, to load more programs into high DOS than any other memory manager. And Qualitas memory managers used with DOS 5 free up more memory than ever before possible.

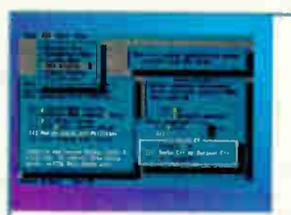
	LIST	PS	FastFaxes
386MAX	\$130	\$109	123-004
BlueMAX	\$155	\$139	123-010



WindowsMAKER™ Professional by Blue Sky Software™

The fastest way to create MS-Windows applications in C. Generates the Windows .EXE w/ complete source & production files (no royalties). Just Point & Click to define the Windows user interface. Lets you animate your design to instantly test look & feel and make changes on the fly without needing to compile. Custom code is preserved during code regeneration. This is the power-user version of the best-seller WindowsMAKER with a lot of added functionality.

LIST: \$995 PS Price: \$895
FastFaxes 2001-006



The Stork by Island Systems

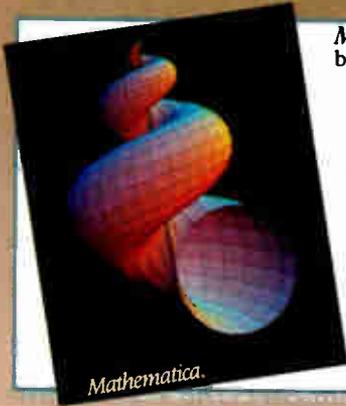
Creates a professional product installation without any programming or script files! The Stork installation software is a surprisingly easy-to-use set of on-screen design tools that deals with all facets of product installation. Features include customization menu interface; automatic hardware checks of target system (can dynamically abort

or modify the installation); customized directory structure with sub-directories for storing installed files; simulation mode to facilitate test of installation procedure and product-without loading diskettes; optional file compression using our utility or your favorite compression program; can spawn multiple external programs before or after the main installation; files can span multiple disks; auto edit of autoexec.bat, config.sys; creates and manages master disk set; incredibly easy to make changes to the installation procedure. No programming. No script files. No banners. No royalties. No nonsense!

LIST: \$175 PS Price: \$165 FastFaxes 1309-077

THE PROGRAMMER'S SHOP 1-800-421-8006

your source for solutions!

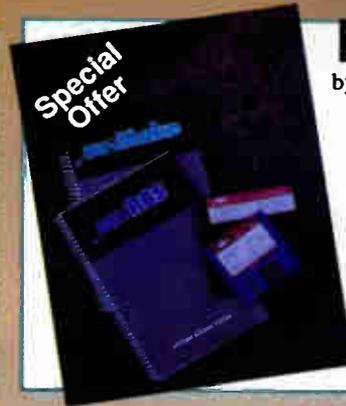


Mathematica® 2.0

by Wolfram Research

A system for doing numerical, symbolic, and graphical computation used both as an interactive calculation tool and a programming language. Numerical capabilities include arbitrary precision arithmetic and matrix manipulation. On systems with a sophisticated graphical user interface, users can create "Notebooks" that mix input, graphics, text, and sound. Generates graphics in PostScript form.

LIST: \$595 PS Price: \$560
FastFaxes 1394-001



FREE MKS MAKE

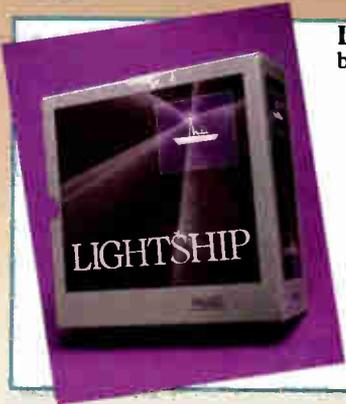
by Mortice Kern Systems

Buy MKS RCS 5.1 and receive an MKS Make for FREE

MKS RCS: Tracks changes made to any file; binary or text.

MKS Make: Automatically updates interdependent files. Offer expires October 15, 1991.

LIST: \$249 DOS PS Price: \$229
FastFaxes 469-002



LightShip™

by Pilot Software

LightShip™ is an environment for developing and using executive information systems (EIS) used on PCs and LANs.

- Data-Driven™ hot-spots for flexibility and low maintenance costs.
- Full support for Windows DDE standard for "snap-together" software.
- Ease-of-development through visual, object-oriented programming
- Just-in-time access to mission critical information on PCs, LAN servers, minis, or even mainframes and external sources.

LIST: \$795 PS Price: \$785
FastFaxes 4385-001



BORLAND C++ 2.0

by Borland International

Borland C++ is the complete C and C++ professional programming environment for DOS and Windows. Use existing C applications or move them to object-oriented programming (OOP) with C++. Borland C++ has new features and tools including support for 286 processors, megabytes of extended memory, and large hard-disks. Borland C++ also includes

Windows applications without purchasing the Microsoft SDK.

LIST: \$495

PS Price: \$379

FastFaxes 777-120

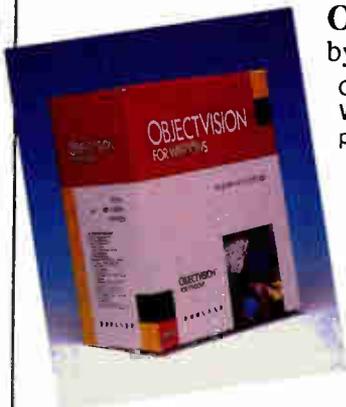


After Dark

by Berkeley Systems

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.

LIST: \$50 PS Price: \$50
FastFaxes 2900-003



ObjectVision

by Borland International

ObjectVision lets you create Windows applications... without programming! New Visual Programming technology uses graphical decision trees to represent and capture business rules. Non-technical users can easily create Windows business applications without traditional programming. ObjectVision applications are easily connected to a variety of popular databases, and operate in a multi-user mode over Windows-supported networks.

LIST: \$495

PS SPECIAL Introductory Price: \$99
FastFaxes 777-124

What is FastFaxes?

Access literature on any of our products via FAX machine. **FREE!**

Call 617-740-0025 from any fax phone!

Follow the voice computer's instructions and enter your product's code number. Then await your instant print out of product literature.



THE PROGRAMMER'S SHOP

800-421-8006

National Accounts
800-446-1185



90 Industrial Park Road, Hingham, MA 02043 • Canada 800-446-3846 • Mass. 617-740-2510 • FAX: 617-749-2018
Credit card orders processed *only* when product is shipped. All prices subject to change. Int'l. prices will vary.

BY991

Engineered to Survive the Real World.

Times like this, you'll be relieved that your notebook PC is the durable MiTAC 3026E WorkBook.

Relieved because after pushing the power-on switch, the WorkBook will light up and perform like brand new.

In fact, each MiTAC WorkBook is engineered to survive the hazards of coffee spills, untimely slips from desktops and rough travel abuse like no other notebook PC on the market today.

Proven Engineering Excellence

Advanced surface-mount engineering is combined with automated testing and old-fashioned hand inspection to guarantee your WorkBook will perform for years.

The WorkBook's thick, outer shell is reinforced to resist surface scratches and cracks. Beveled corners help absorb travel abuses and give the WorkBook a distinctive appearance.

Take a Closer Look at Our 20 MHz, 40 MB System.

Features	MiTAC WorkBook	Compaq LTE 386/20
Max Ram	8 MB	10 MB
Base RAM	2 MB	2 MB
Hard Drive	40 MB	30 MB
Hard Drive Option	60 MB	60 MB
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.

We can't promise you an indestructible system, but for top-rated 386SX 20 MHz performance and unmatched durability ratings, few can rival the super light 5.8 pound WorkBook.

The Ultimate Notebook PC for Only \$2,795

Inside, the WorkBook's specs are just as impressive. Standard features include a 40 MB hard drive, 2 MB of RAM, 3.5-inch 1.44 MB diskette drive and a 32 shades of gray VGA LCD screen with 640 x 480 resolution.

There are also external parallel, serial and VGA ports, a 3-hour play NiCad battery with 90 minute recharge, and a power saving suspend/resume key.

And like all members of the MiTAC family of powerful IBM compatible PCs, the WorkBook comes with a one-year warranty on parts and labor.

To order or for product literature call now: **800-544-2069**

American MiTAC Corporation

410 E. Plumeria Dr., San Jose, California 95134
Tel: (800) 648-2287, (408) 432-1160 Fax: (408) 432-0866.

MiTAC and 3026E WorkBook are trademarks of MiTAC International Corp. Copyright 1991.
Compaq LTE 386/20 is a trademark of Compaq Corp.



"Technology that makes a difference"

Circle 20 on Inquiry Card.

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

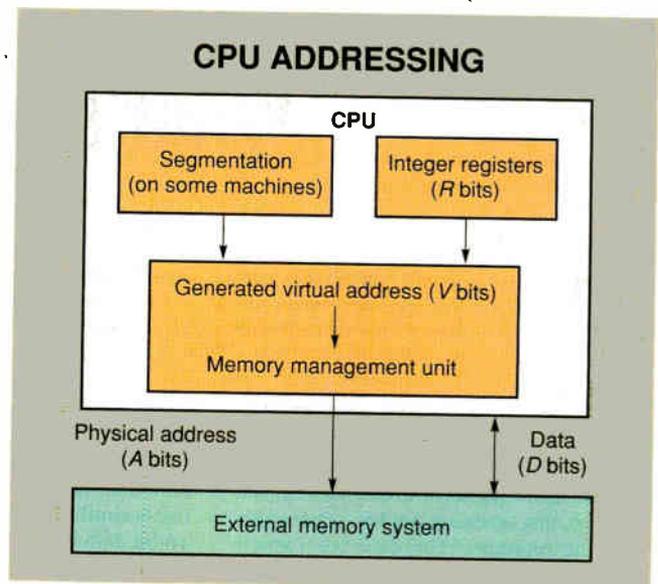


Figure 1: Efficient address arithmetic is limited by the integer register width (R). Actual memory access is limited by the virtual address size (V) and address bus width (A). Efficient memory I/O is limited by the data bus width (D).

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.

Kenneth M. Sheldon is a senior editor for BYTE. You can reach him on BIX as "ksheldon."

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

Enjoy a more colorful view from your Windows™.



Ultra Image with HiColor™
\$199.00
SUGGESTED RETAIL PRICE
 Windows™ AT 32,768 COLORS

Ultra Image

- Non-Interlaced
- 1280 x 1024 with 16 colors
- 1024 x 768 with 256 colors
- 800 x 600 with 32,768 colors
- 72 Hz Flicker Free Refresh

DRIVERS

- Wordperfect 5.1
- GEM 2.2/3.0/3.1
- Ventura Publisher 1.2/2.0
- Lotus 2.xx
- Symphony 1.1
- Wordstar 4.0/5.0
- AutoCAD 11/386
- AutoCAD 10/386
- Auto Shade 2.0 w/RenderMan
- 3D Studio
- Windows 3.0

Circle 317 on Inquiry Card.

Windows™ AT 32,768 COLORS



UNITED SOLUTIONS, INC.

115111 Tennessee Avenue, West Los Angeles, CA 90064 • (213) 473-2434

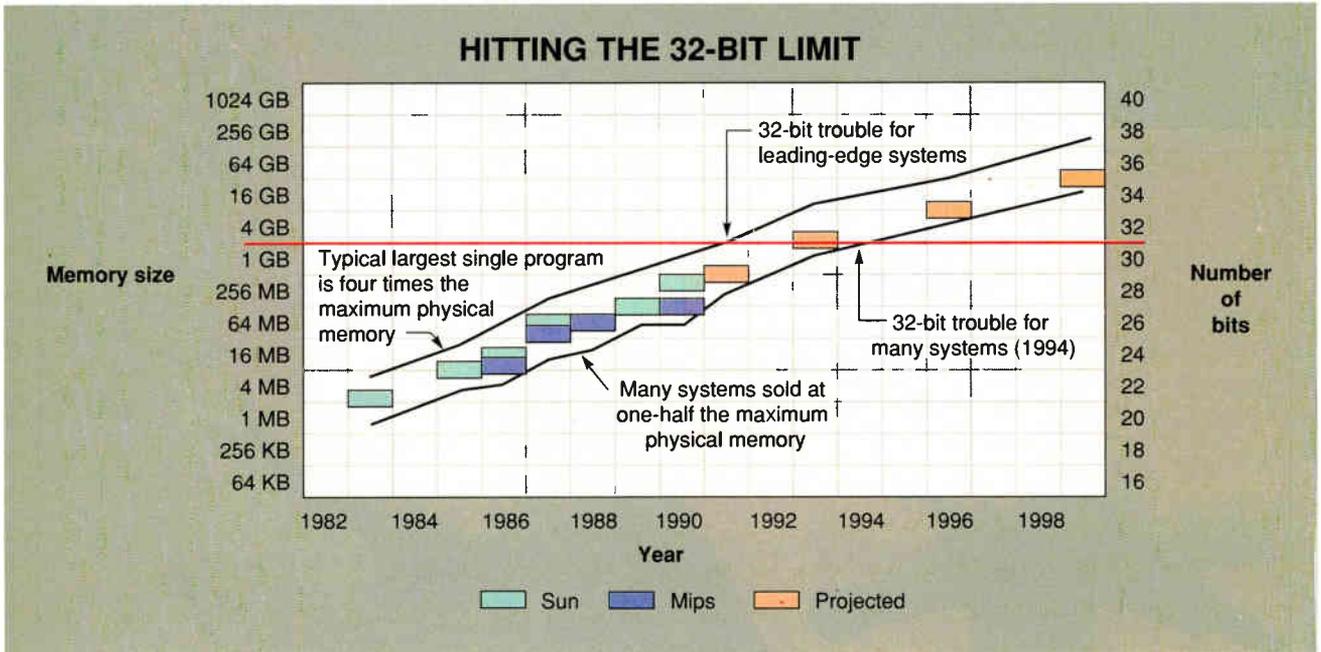


Figure 2: The memory sizes of a Mips and a Sun machine, year by year, using a logarithmic scale. The data points fall in a straight line, gaining 2 bits every three years, as they naturally follow DRAM curves. The top line shows virtual memory size at four times the maximum physical memory, hinting that 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.

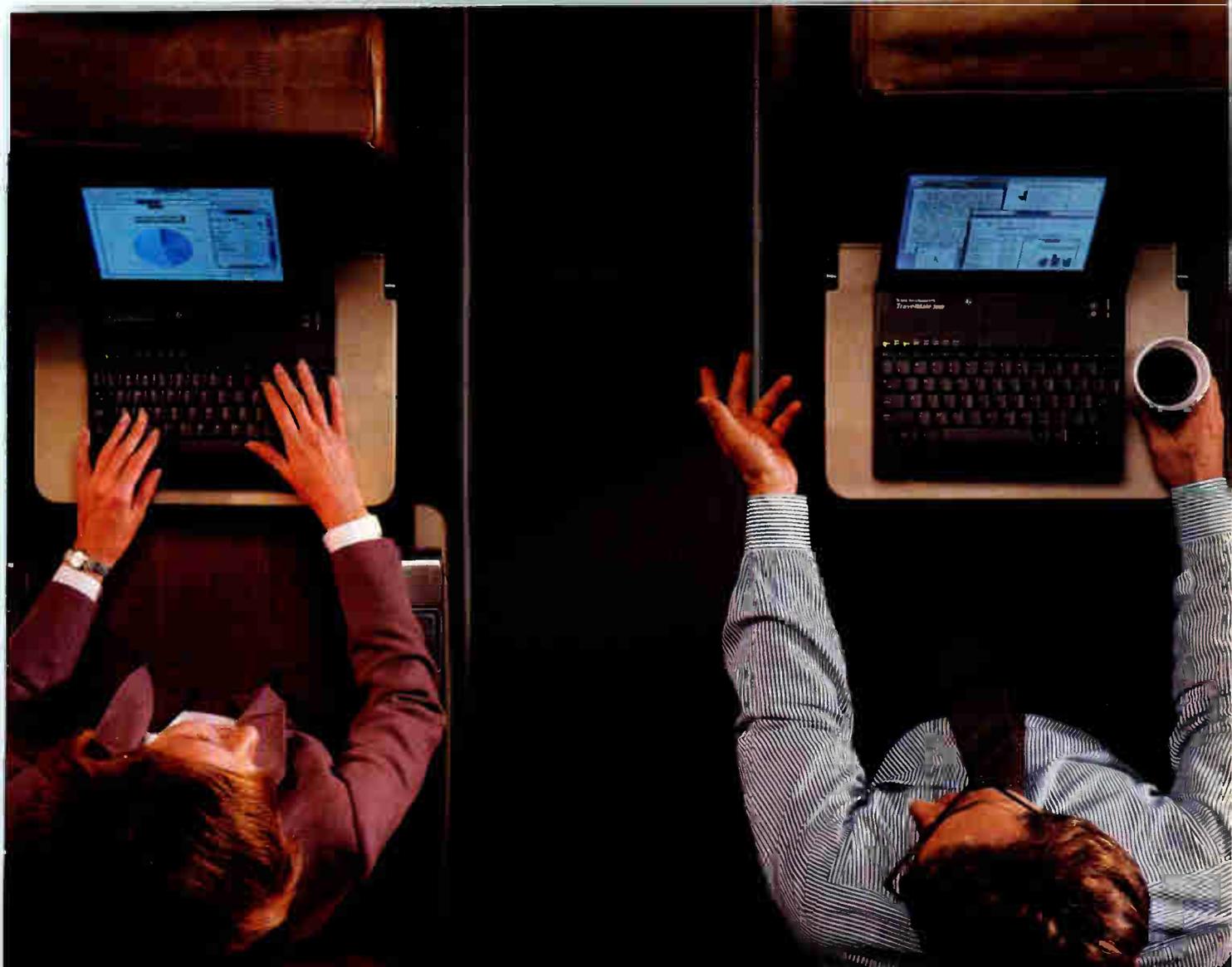
- **CAD.** CAD applications often include large networks of servers and desktops, in which the servers manage the databases and run large simulations. They naturally can make use of 64-bit software. Desktops navigate through the huge databases, and although they are not likely to map in as much data 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



The TI TravelMates. They're making a hit coast to coast.



The new look of power.

Editors across the country are praising the performance, size and weight of the Texas Instruments TravelMate™ 2000 and 3000 notebook computers.



"The TravelMate is as close as you can get to the ultimate portable." — *BYTE*, November 1990.

"Now TI assumes the lead in performance/pound/price measure of a notebook." —

PC Magazine, December 11, 1990.*

"Not until you hold this computer in your hands do you begin to understand what sets it apart from the pack." —



PC Computing, December 1990.**

Both TravelMate models are only 8½" x 11" in size, including a hard disk drive, and feature a 10" diagonal VGA display and comfortable full-function keyboard.



With the TM 2000 you get 286™ processing in a computer

that's 1.4" thin and 4.4 lbs. light. The TM 3000, meanwhile, packs 20MHz 386™ SX power into a mere 1.8" and 5.7 lbs.



Find out how to take the new look of power with you coast to coast. Or wherever your work takes you.

For the name of the dealer nearest you, call 1-800-527-3500.



TEXAS INSTRUMENTS

TravelMate is a trademark of Texas Instruments Incorporated. 286 and 386 are trademarks of Intel Corporation. * Reprinted from *PC Magazine*, December 11, 1990. Copyright © 1990 Ziff Communications Company. ** Reprinted from *PC Computing*, December 1990. Copyright © 1990 Ziff Communications Company. TravelMate 2000 has earned the following awards: 1990 *PC Magazine* Editor's Choice Award (October 16, 1990), 1990 *PC Magazine* Award for Technical Excellence; *BYTE* Award of Excellence; 1990 *PC World* Best Buy. TravelMate 3000 has earned the following awards: 1990 *PC Computing* Most Valuable Product; 1990 *BYTE* Award of Merit.

© 1991 TI 66123

Circle 298 on Inquiry Card.

Small Business Computers, Inc.
327 South Mill Street • Pryor, Oklahoma 74361
(918) 825-4844 • FAX (918) 825-6359

Circle 24 on Inquiry Card.

World Radio History

1+2=3 or E=MC²

64-BIT COMPUTING

Recycle

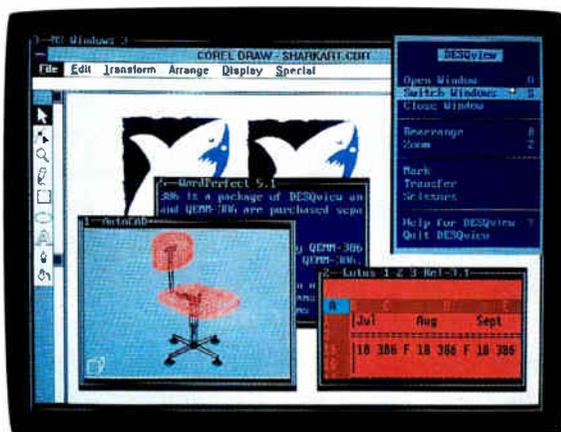
Everyone wants more productivity out of their computers.

But not everybody is willing to spend a fortune to get it. That's why Quarterdeck productivity software is outselling everyone else's—including Microsoft's.

DESQview Multitasks and Windows on Your PC

As early as 1982, computer enthusiasts found our products helped them set up their ideal working environment. Since then, step-by-step, we've improved DESQview into what some very knowledgeable people call "the best alternative to OS/2".

Today's DESQview allows you to multitask multiple programs in windows side by side—text programs; graphic programs. But best of all, you don't have to buy a lot of new hardware and software to use it. DESQview works with the PC and the programs you now own.



Over 1,000,000 users multitask their programs with DESQview.

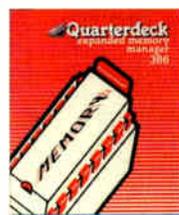
QEMM Breaks the 640K Barrier

Break the 640K barrier in DOS—and give your DOS programs up to 130K more room within the first megabyte of memory, plus another 96K of video memory, in some instances.

QEMM takes buffers, network drivers, TSRs and other memory-using utilities and moves them into idle areas between 640K and one megabyte.

It's not complicated. It's easy. Just type *Optimize* and QEMM does the rest.

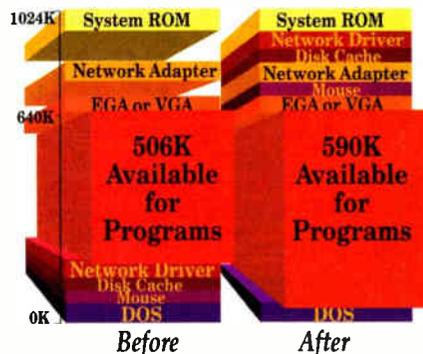
QEMM 386 is included with DESQview 386 to create the optimum operating environment for productivity oriented users of 386, 386SX and i486 PCs.



Number one.

QEMM 50/60 is designed to work in IBM® PS/2™ Model 50 and 60 PCs with specific IBM adapter boards.

QEMM is the #1 selling utility according to distribution sources. In fact, it was the number one selling



software package in the PC industry in April, May and June 1990.



These are some of DESQview's most recent awards



These are some of QEMM's most recent awards

your PC

Manifest Gives You In-Depth Knowledge of Your PC



Our newest utility is Quarterdeck Manifest, the best way to discover everything you ever wanted to know about your PC. Manifest shows you how memory is used, comparing memory speeds, and indicating how you can gain more room for your programs to work.

It can point you to as much as 130K of additional RAM your programs can use. It shows you which memory areas are faster. It even helps you compare add-in memory board performance.

Manifest does for memory what PC Tools Deluxe does for disks. And it's easy to use.



Manifest has been quick to win recognition

QRAM Optimizes the Memory of 8088 and 80286 PCs

Once you know where you can move those memory-hogging utilities, QRAM lets you do it. It even works on 8088, 8086 and 80286 PCs with EMS 4.0 or EEMS memory boards.

QRAM and Manifest help you get every last 'K' out of the hardware you own.

In fact, all our products are designed to give you more productivity out of the system you already have, whether 8088, 8086, 80286, 386SX, 386, or i486.

Quarterdeck Products for Everyday Heroes

Our mission is to protect your investment. Whether your PC is 9 years old or fresh out of the box, our products make it more versatile, more flexible; and help deliver performance dividends from your computer investment. Our products help fine-tune your PC which helps you do your work better, which makes you look good.

A Glimpse of the Future: DESQview/X

We're also looking ahead to the next wave of computer system development: enterprise computing. Our new



DESQview/X allows different computers with different operating systems to work together. Using the advanced X-windows environment, it lets users run programs on remote computers and watch them run in their PCs' windows. DESQview/X will be available later this year.

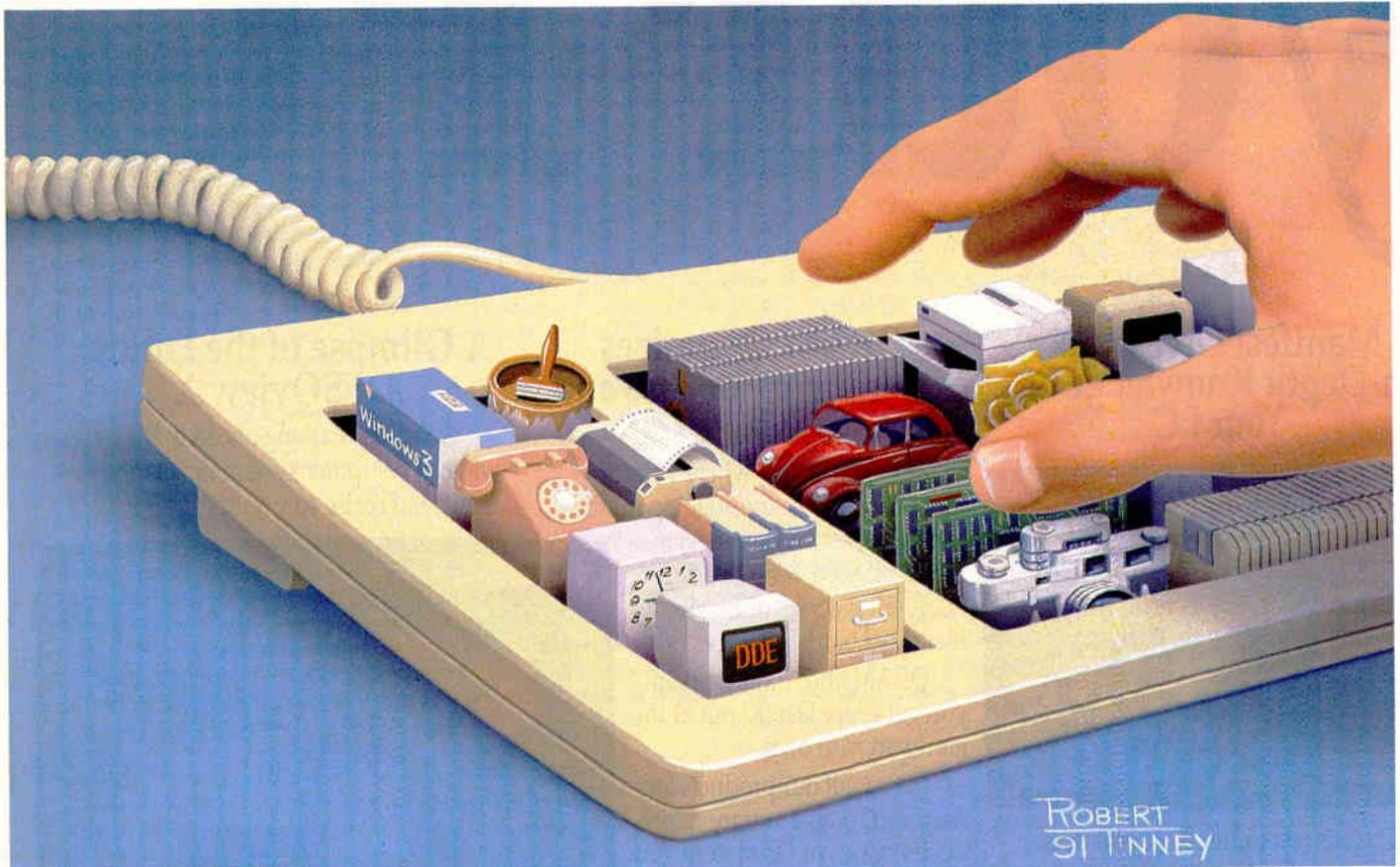
Quarterdeck products. The best way to get the most out of your PC today. And tomorrow.

Quarterdeck

150 Pico Blvd., Santa Monica, CA 90405 (213) 392-9851 Fax (213) 399-3802

Circle 262 on Inquiry Card.

Objects At Your Fingertips.



Now, if you want to develop applications for Windows 3.0, there's a fast and easier way to do it with the premiere object-oriented programming language. Smalltalk/V.[®]

With Smalltalk/V Windows, you can explore, prototype, build finished applications and ship them runtime free.

You can tap into applications using DDE so effortlessly you don't have to be a Windows expert to do it.

And with one of the world's most comprehensive class libraries, you can

choose our objects or easily build your own.

But whatever you develop, it will be portable between the Windows, OS/2 and Mac versions of Smalltalk/V.

With so much at their fingertips, more people are solving more problems with Smalltalk/V than any other object-oriented programming system.

At only \$499.95 and no runtime charges, you can solve them, too.

Just call us at (800) 922-8255.

And see why programming Windows has never been easier.

Join us at the
Smalltalk/V DEV CON
Smalltalk/V Developers Conference '91
September 11-13 1991.

Smalltalk/V Windows

DIGITALK

9841 Airport Blvd., Los Angeles, CA 90045 (800) 922-8255 (213) 645-1082 FAX (213) 645-1306

Smalltalk/V is a registered trademark of Digitalk, Inc. Other product names are trademarks or registered trademarks of their respective holders.

Circle 97 on Inquiry Card.
World Radio History



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	$\zeta(s) = \sum_{k=1}^{\infty} k^{-s} \quad (\Re s > 1)$

PCT_EX Typesetting Software

For professional publishing and the power to produce high-quality technical documents, scientific notation, mathematical formulas, and tables, rely on PCT_EX to make your work look its best.

The next step beyond standard desktop publishing, PCT_EX is the difference between average and expert. You'll get professional typesetting at amateur prices.

PC MAGAZINE wrote: "(With PCT_EX)... you can achieve incredible precision in formatting text, especially mathematical expressions."

INFOWORLD said: "No non- \TeX -based program has such typographical aesthetics... enormously flexible..."

New PCT_EX 3.0, with double the page-building capacity, is now available. For 386 computers, there's PCT_EX/386 and Big PCT_EX/386.

For a free product catalog and demo diskette call 415/388-8853. See the best for yourself!

Europe: (31) 703237241 • (49) 24167001 • (49) 80248011
(49) 73126932 • (44) 742351489 • (39) 290091773
Asia: (886) 35265521 • Australia: (61) 34599671

PERSONAL
TEX
INC

12 Madrona
Mill Valley, CA 94941
Fax: (415) 388-8865

PCT_EX is a registered TM of Personal \TeX , Inc. \TeX is an American Mathematical Society TM. Site licenses available to qualified organizations. Inquire about PTI distributorships. This ad was typeset using PCT_EX and Bitstream fonts.

- 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.

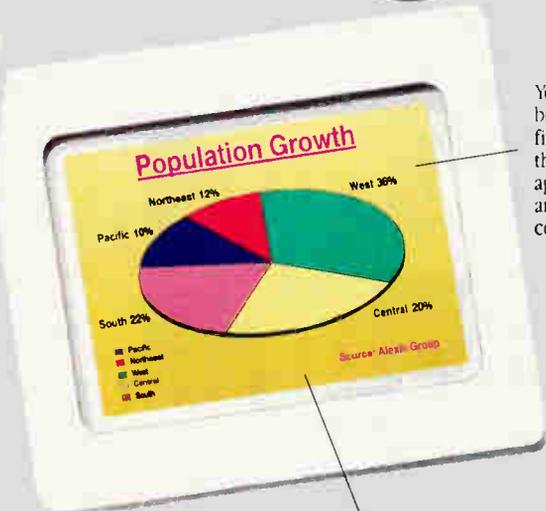
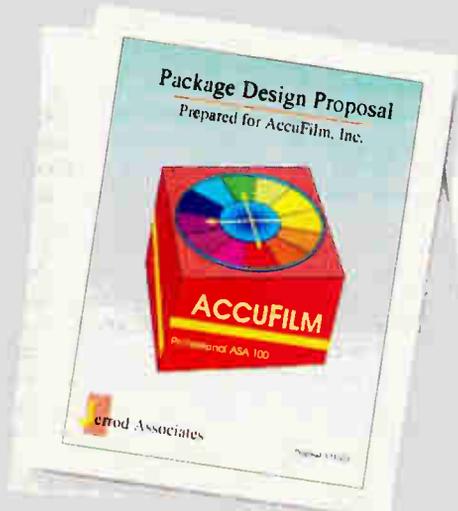
It still took until April of this year to get FORTRAN 90 through both of the committees. Industry involvement was intense, with some accused of merely trying to protect their investment while having their interests elsewhere (e.g., in C or Ada). After 13 years of often-bitter negotiations, the new standard—FORTRAN 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

Not only is the Phaser II PXi™ the first thermal wax printer with Adobe's PostScript™ Language Level 2 software, it also has HP-GL. What more could you want from a printer?



Now make your ideas even brighter.



You say you want brilliant color fidelity? Rest assured the Phaser II PXi is approved by Pantone and features TekColor™ color matching.

A screaming 24 MHz RISC processor and 6 Mb of memory make the Phaser II PXi the fastest color printer on the market. Really.

So you have this great idea. One that'll win an account. Break a sales record. Or simply make you look like a genius. Don't blow it with a color printer that won't do your brainwork justice.

Get the new Phaser II PXi, a thermal wax printer that works simultaneously with Macs, PCs and workstations. It can generate 16.7 million colors at 300 dpi, and it's cost-effective.

To see the quality of its output first hand, call **1-800-835-6100, Dept. 16J** and we'll send you a free sample.

The new Phaser II PXi. It'll make your ideas look as bright as they should.



Tektronix
The best and the brightest.

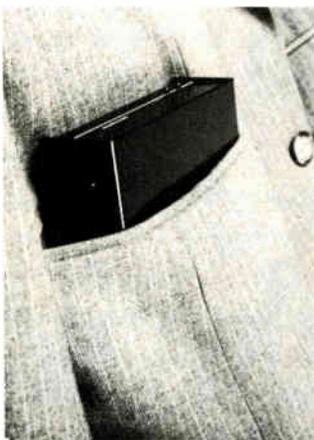
Phaser and Phaser II are trademarks of Tektronix, Inc. for color printers and related products. PostScript is a trademark of Adobe Systems Incorporated in the United States and other countries. Other marks are trademarks or registered trademarks of the manufacturers or marketers of the products with which the marks are associated. France: (1) 69 89 42 42. U.K.: 0903 52 56. Germany: (2) 09 96 9 12 24/44. Sweden: (0) 29 21 81. Holland: (0) 11 189. European Operations Center: (3) 800 835 6100.

Circle 295 on Inquiry Card.
World Radio History

EVER LEAVE A FILE AT HOME?

Keep all your files in your pocket wherever you go with **POCKETdrive™**

- Use the same environment at home, office & client sites
- Always work with the programs and utilities you know and love
- Gives you the extra storage you need
- Perfect for presentations, home offices and laptops
- Attaches instantly to any PC parallel port, no card needed
- Reliable. Light. Fast. Rugged.
- 30 day money back offer with full year warranty



POCKETdrive 40MB \$599

BOMB \$799, 120MB \$999, Optional Battery \$99

TO ORDER CALL 1(800) 275-6525 or FAX (212) 678-6143

"Smart Solutions for People on the Move"™

SIMPLICITY COMPUTING, INC. 415 Madison Avenue, 22nd Fl, New York, NY 10017

FINALLY, SERIOUS PC HARDWARE DIAGNOSTICS!

FREE INFORMATION
CALL
508-695-8459

The V-ATE family of test products provide solutions for PC field service, repair depot, R&D, manufacturing inspection & burn-in, and quality assurance testing.

- Test a PC system in seconds
- Insure ZERO hardware defects
- Test for PC Compatibility
- Quality Assurance Certification
- Replace costly test equipment
- Find failures in a 100% dead system
- Eliminate defective PC returns
- Increase customer satisfaction & lower costs thru product quality



VISTA MICROSYSTEMS, Inc.
6 Whipple St., No. Attleboro, MA 02760
Tel. 508-695-8459 • FAX 508-695-8688

CLASSIC LANGUAGES: FORTRAN

- control structure enhancements, including DO WHILE, DO (forever), and CASE statements
- improved I/O, especially for database records
- 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.

- Syntac boasts power and usability. SAS proves great power to users who master it and find it to be the easiest to learn and use. NTL 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 to detail does not guarantee the programs. Calculation errors can be very damaging 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	Value	Program	Version	Platform	Memory	Price	Pages	Comments
***	7.5	5	Systat	5	PC	60KB	\$3,270 modular	20	Rating Key (On a scale of 0 to 10): Overall Evaluation: ***** 9.0 or higher 6.0-6.9 5.0-5.9 All other numbers 7.0-9.9 6.0-6.9 5.0 or lower
***	7.2	3	SAS Applications System	5	PC	640KB	\$4,870 modular	24	Comments
***	7.2	4	Statgraphics	4.0	PC	512KB	\$195-\$3,040 modular	26	Overview 3-19 Recommendations 3 Power/Usability Chart 5 Ratings Analyses 13-19 Program Reports 20-31 Quality 32-40
**	6.5	4	SPSS/PC+	1990	PC	512KB	195 modular	22	

If you need statistical software, this is a statistic you should know.

SYSTAT is rated #1 by Software Digest®. In fact, SYSTAT is the only statistical analysis package to receive top honors from InfoWorld, PC Magazine and PC Week. According to Software Digest: "It is the only program that successfully blends robust features, good usability and performance, and many areas of uncommon strength from analytical graphs to powerful programming."

SYSTAT. The statistics speak for themselves.

For more information call or write: SYSTAT, Inc. 1800 Sherman Avenue, Evanston, IL 60201-3793 Tel. 708.864.5670 Fax: 708.492.3567



For international representatives call: Australia 61.3.8661766, Canada 416.424.1700, Denmark 45.64.406575, Finland 358.0.6923800, France 33.1.40935000, Germany 49.61.265950 (DOS), 49.30.310423 (Mac), Italy 39.587.213640, Japan 81.33.5902311, New Zealand 64.71.562675, Norway 47.3.892240, Sweden 46.7.6076207, Switzerland 41.31.416611, The Netherlands 31.340.266336, UK London 44.81.6926636.

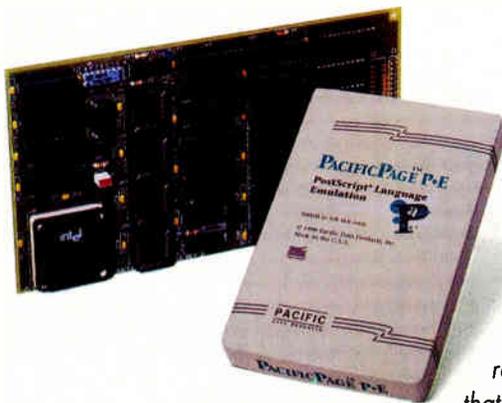
For IBM/compatible information circle 291; For Macintosh information, circle 292; For Reseller inquiries, circle 293 on Inquiry Card.

©1991 SYSTAT, Inc. Software Digest is a registered trademark of NSTL, Inc.

Make the Smart Choice in LaserJet PostScript Language Emulation Cartridges

	Pacific Data Products		Hewlett-Packard
	PacificPage P•E™	PacificPage XL™	PostScript Cartridge
Suggested list price including 2 MB memory	\$ 718*	\$ 999	\$ 1085
Time to output Ventura Scoop	2 minutes 23 seconds	39 seconds	2 minutes 54 seconds
Money-back guarantee	Yes	Yes	No
PostScript to PCL switching	Yes	Yes	No
Upgrade program	Yes	Yes	No
Warranty	Lifetime	Lifetime	One year

* Suggested list price of PacificPage P•E cartridge without a 2 MB memory board is only \$499.



"PacificPage swiftly and accurately renders some test EPS files that other interpreters distort, and had no trouble with any of the large and complex images I used for testing."

"An Intel i960™ RISC processor on the accelerator board helps the PacificPage XL print graphics more than six times as fast as the HP PostScript Cartridge"

Edward Mendelson
PC Magazine, (June 25, 1991)

Don't settle for less just to buy the Hewlett-Packard name. Ask for PacificPage PostScript® language emulation solutions from Pacific Data Products. You'll get a lot more, for a lot less.

Each PacificPage product for LaserJet® IIP, IID*, III, IIID, and IIIP printers is guaranteed to be completely compatible with all of your PostScript output. If you can create it, PacificPage can print it. If not, we'll give you your money back.

Choose from PacificPage P•E, our fastest stand-alone cartridge ever. Or PacificPage XL which combines the PacificPage P•E cartridge with a RISC-based accelerator board. Just slip the board into the LaserJet memory slot and you'll experience an incredible increase in printing speed. If you purchase the PacificPage P•E cartridge alone and find that your printing applications demand even greater speed, simply upgrade to PacificPage XL.

Why not get more for less? Buy PacificPage P•E and save almost \$400 over Hewlett-Packard. Or, save close to \$100 over Hewlett-Packard with PacificPage XL and amaze yourself with its speed. Make the smart choice. Choose PacificPage.

For more information call your nearest dealer or contact Pacific Data Products, 9125 Rehco Road, San Diego, CA 92121, USA. (619) 597-4607, Fax (619) 552-0889.

PACIFIC
DATA PRODUCTS

* The PacificPage XL accelerator board is not compatible with the LaserJet IID. Prices listed are manufacturer's suggested retail list price as of 6-25-91. Quotes reprinted from PC Magazine June 25, 1991. © 1991, Ziff Communications Company. PacificPage P•E and PacificPage XL are trademarks of Pacific Data Products, Inc. PostScript is a registered trademark of Adobe Systems Incorporated. HP and LaserJet are registered trademarks of Hewlett-Packard Company. i960 is a trademark of Intel Corporation. PhoenixPage is a registered trademark of Phoenix Technologies Ltd. © 1987, 1988 Phoenix Technologies Ltd. © 1991 Pacific Data Products, Inc. European Headquarters: Switzerland Tel (41) 22-412650, Fax (41) 22-410682.



WINDOWS 3.0 APPLICATIONS

Word Processors

Database Managers

Spreadsheets

Graphics

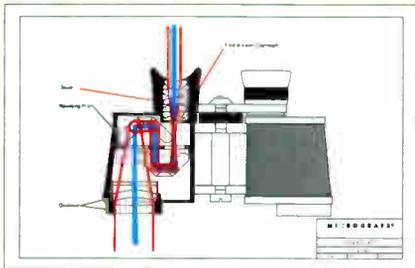
Communications

Utilities

Focus on Precision Illustration With New Designer 3.1

New!
3.1 Release
Free Trial Software

See for yourself. New Designer 3.1 turns your PC into a precision illustration tool, running under the Microsoft® Windows™ environment. You'll get more accuracy in technical illustrations, greater performance in graphic designs and higher speed in desktop publishing layouts. It's now easier to turn what you can imagine into an image all can see. Call for your free trial software and feel the high performance yourself.

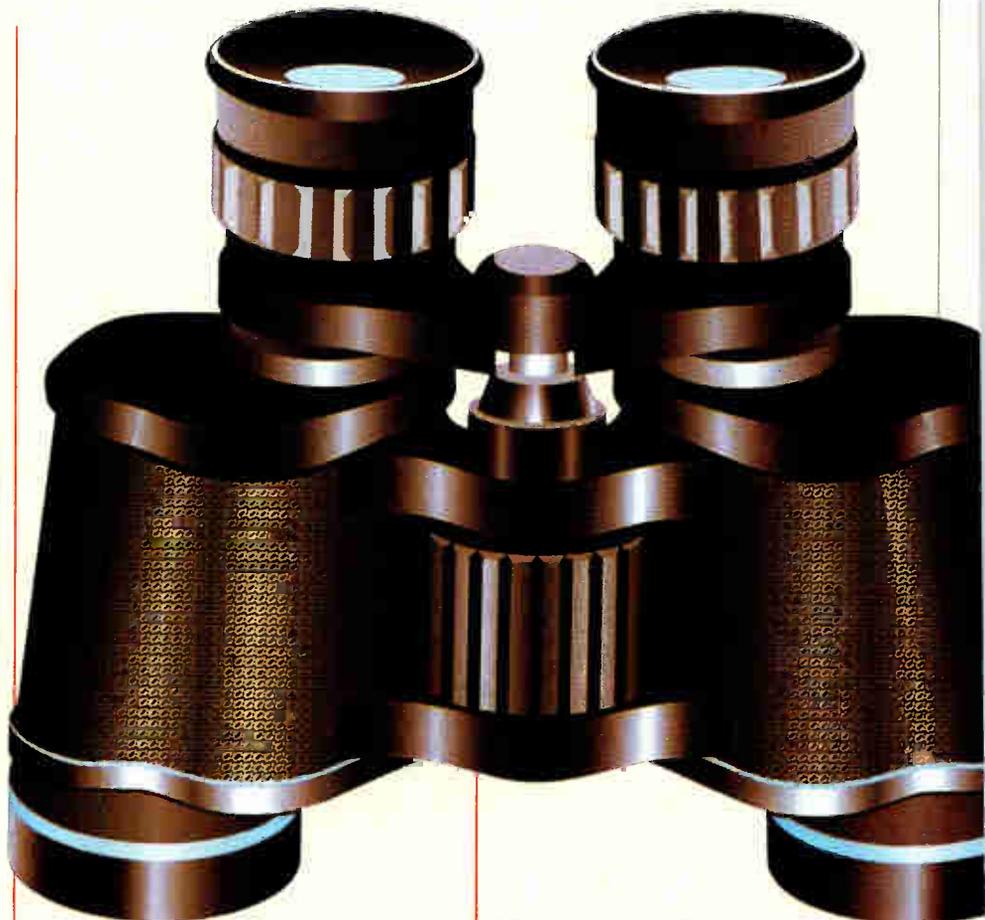


▲ Higher performance in Designer 3.1 speeds up drawings with faster wide styled lines—even wide dashed lines. Object snap points make precision a given.

The view from out front. With new Designer 3.1 you're ahead of the pack no matter how you look at it. With more usable features, higher performance operation and more flexible file handling, you'll be able to create and manipulate an image until it's just right. That's precision.

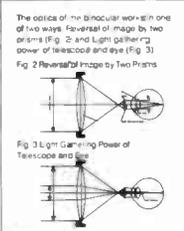


▲ Choose from 16.4 million colors and save any number of custom palettes for later use. Combine text and graphics with bitmapped images and true layering.



▲ "The power-users choice . . . a customizable toolbox has a tool for just about anything; precise and accurate autotracing utility, CAD-like layering and superb color-publishing capabilities," says PC Magazine.

▶ Desktop published articles become clearer with precision illustration from Designer 3.1. Multiple file formats speed up import and export of files.

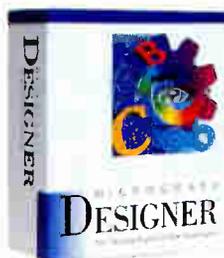


Outside perspective reflects well.

"Designer is an outstanding illustration package that receives Editor's Choice recognition. Designer is perhaps the most sophisticated of all the illustration packages," writes PC Magazine.

Software Digest reports that "Designer provides the best overall graphics package. The program offers state-of-the-art features, good performance, and unmatched ease of learning and use in a sophisticated package. Designer can handle virtually any free-form graphics or design task with ease." Designer was awarded a top-of-the-class rating.

Circle 188 on Inquiry Card.



Free hands-on trial. Call now, for a free working model of the new Designer, 800-733-3729, ext. 5050.

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.

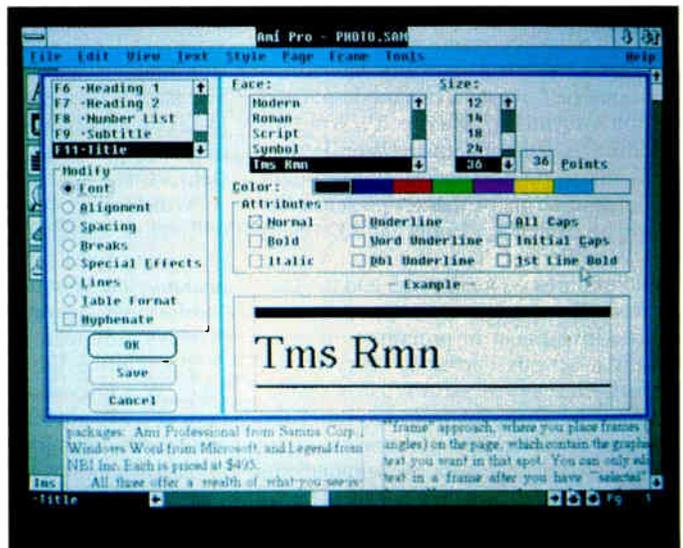
This supplement provides a view of the Windows applications market in six categories: word processing, database management, spreadsheets, utilities, graphics, and communications. We found nearly 60 products for this report. In fact, in several categories, we found so many products that we couldn't possibly 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."

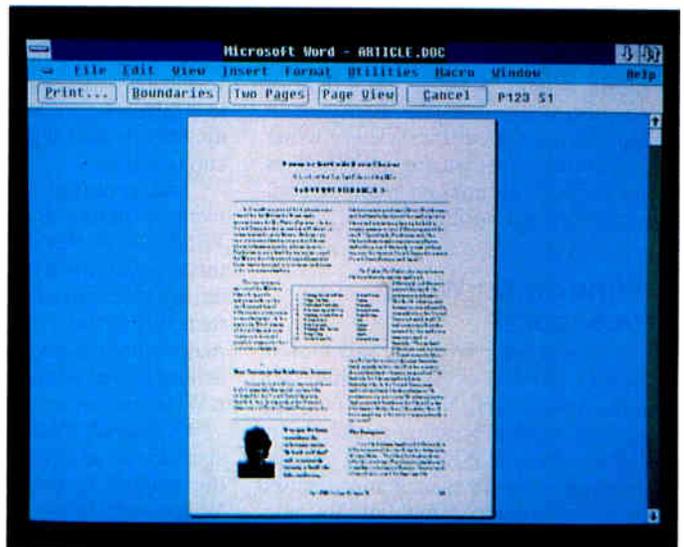
Casting an almost invisible shadow, meanwhile, is IBM, which has announced it will move from its character-based DisplayWrite word processor to a Windows-based package called Signature. Under joint development with XyQuest, maker of the XyWrite word processing package, Signature is to have a file format 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.



PORT CARD				Lotus Magellan Version 2.0	Zyindex Version 3.0
Text Retrieval Software				\$139	\$295
	(InfoWord weighting)	(Your weighting)	Ask Sam Version 4.2	Folio Views Version 2.0	
			\$295	\$495	
Price			Satisfactory	Excellent	Excellent
Performance	(75)	()	Good	Very Good	Good
Capabilities	(100)	()	Good	Excellent	Excellent
Record processing	(100)	()	Good	Satisfactory	Good
Search capabilities	(150)	()	Poor	Very Good	Very Good
Speed	(75)	()	Poor	Very Good	Very Good
Documentation	(100)	()	Satisfactory	Very Good	Very Good
Ease of learning	(75)	()	Poor	Very Good	Good
Ease of use	(75)	()	Poor	Very Good	Very Good
Error handling			Good	Satisfactory	Very Good
Support	(50)	()	Good	Satisfactory	Very Good
Support Policies	(50)	()	Satisfactory	Excellent	Excellent
Technical support	(150)	()	Good	Excellent	Excellent
Value			5.0	8.3	7.6
Final scores					8.5

#1 Text Retrieval Software

...it's easy to find needed information quickly with ZyINDEX™ ...

ZyINDEX lets you simultaneously search all your files, thousands of pages, even entire networks, with results in less than 3 seconds!

The search technique is easy. To find a word, just type it. Instructions are clear and readily available.

Versatile. Powerful. ZyINDEX provides the widest range of search techniques:

- Boolean Logic • Thesaurus
- Comments • Phrase Searches
- Numeric Range • Proximity Searches
- Wildcards • Conceptual Searches
- Field Searches ... and more.

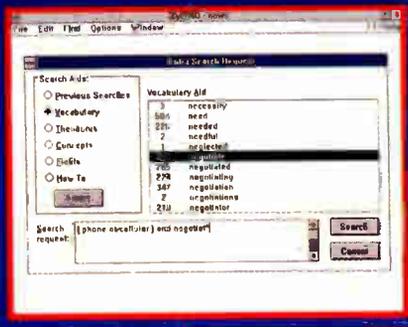
ZyINDEX simultaneously searches text located across multiple directories and files, regardless of file format.

Prepare your entire drive for searching with just one keystroke. Ideally suited for networks and frequently changing text.

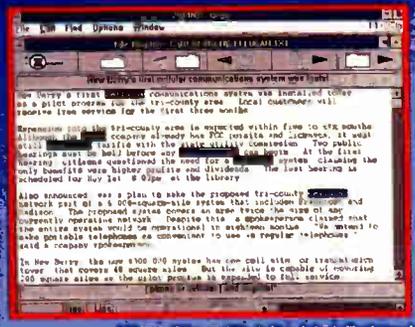
Select any file for viewing. Browse or jump from file to file or "hit" to "hit". Scroll through entire files at will.

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.

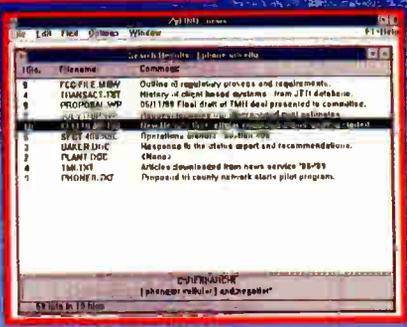
Available for DOS, Windows and UNIX.



Type a search request.



View file with hits highlighted.



List of files found.



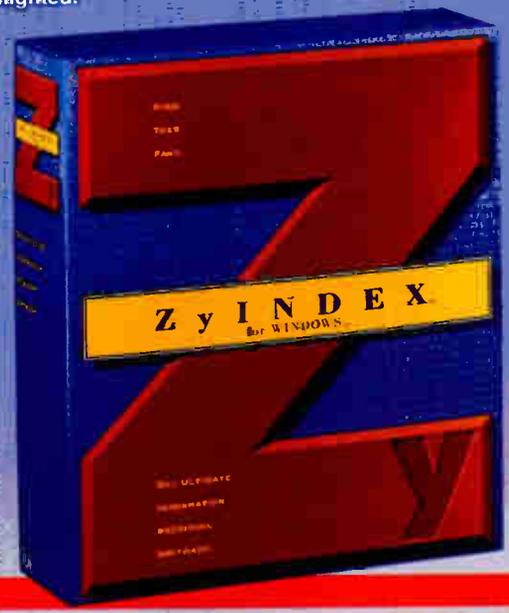
0 Lexington Drive
Buffalo Grove
Illinois 60089
(708) 459-8000
FAX (708) 459-8054

Call 1-800-544-6339
Demo disk available

BYTE Free Demo Download
DEMO LINK 617-861-9767*

Circle 345 on Inquiry Card (RESELLERS: 346).

©1991



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

AT 9 MS, HARDCARD MAKES WINDOWS

ZOOH!

HARDCARD II XL. THE HARD DRIVE THAT GIVES YOU THE SPEED, RELIABILITY AND ROOM TO GET THE MOST OUT OF WINDOWS.

With a 9ms effective access time,¹ Hardcard II XL™ for 286/386/486 computers opens up Windows™ like nothing before.

XL comes in 50 or 105 MB capacities and runs up to 9 times faster than a typical 28ms drive thanks to an impressive 1.4 MB per second sustained transfer rate.²

And it's priced surprisingly low.

Now that's impressive in itself. But even more impressive is Hardcard's reliability. The PC Magazine Hard Disk Service and Reliability Survey* ranked Plus® Hardcard® #1.

And it only takes a few minutes to get the XL up and running. Then watch Hardcard II XL run Windows to the hilt.

For more information or your nearest dealer, call 1 800 624-5545.

Circle 250 on Inquiry Card.



THE 9ms ERA

XL

HARDCARD II XL

Plus
A Quantum Company

*PC Magazine, September 25, 1990. 1. Typical application access time using DisCache® 2. As measured by Power Meter on a Compaq Deskpro 386 33MHz system. © 1991 Plus Development Corp. Plus and Hardcard are registered trademarks and Plus Hardcard II XL is a trademark of Plus Development Corp. Quantum is a trademark of Quantum Corporation. Other product and company names are trademarks or registered trademarks of their respective holders.



World Radio History

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."

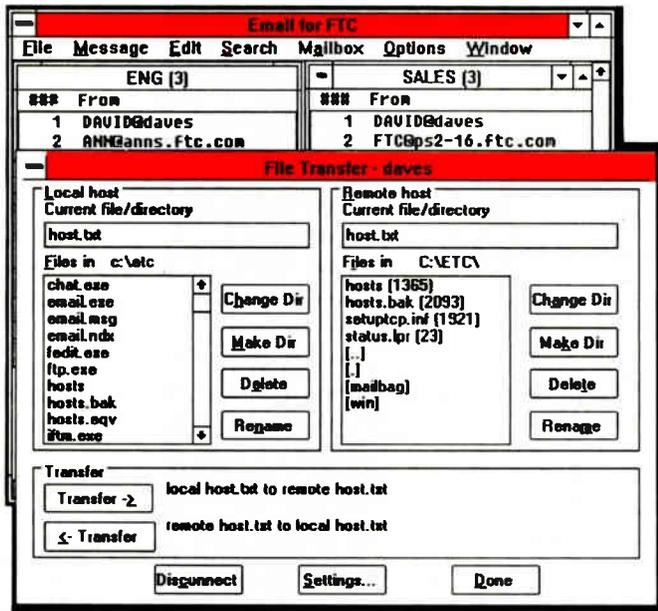
NBI—another ambitious pioneer in the field of Windows word processing—originally sold dedicated word processing systems in the law-office and networking markets. NBI left that hardware business behind in November 1989 to become a systems integrator and vendor of word processing software. Like Ami Pro's 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-

The BYTE Software Resource Series

Applications for personal computers are rapidly evolving. So to better provide you with additional information on software products, BYTE introduces its Software Resource Series. Periodically, BYTE will produce new installments of this series to address trends in applications software, to evaluate products in popular applications categories, or to provide resource listings. The information published in the BYTE Software Resource Series is supplemental and does not replace any regularly scheduled material in the magazine.

We welcome your comments on the series. Please send your correspondence to the BYTE Software Resource Series editor, or to "editors" on BIX.

SUPER-TCP™ for Windows



- Multi-document E-mail
- Access to X.400 Messaging
- Object-oriented File Transfer
- Multiple TELNET Sessions
- Network Printing
- NFS Client / Server
- SNMP Agent
- X.25/802.3/802.5 Connectivity
- NDIS & Packet Driver Support
- Sockets API

For More Information Call:

**Frontier
Technologies
Corporation**



10201 N. Port Washington Rd.
Mequon, WI 53092
(414) 241-4555
(414) 241-7084 FAX



CALL NOW
For A Special
\$20 Rebate Offer



It's been a long time since people have communicated so powerfully with windows.

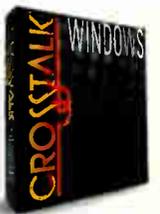
The power can be yours. CROSSTALK® for Windows is the feature-rich, high-performance communications solution for Microsoft® Windows.™ So you can do more with Windows than ever before.



You get a wide range of terminal emulation, file transfer support, and enhancements which bring the power of communications to the Windows environment. Retrieve information from hosts and information utilities, and "paste" it into other Windows programs. And use Dynamic Data Exchange (DDE) with pro-

grams like Microsoft Excel to build sophisticated applications. CROSSTALK for Windows uses a "phone book," so you can call with a click of the mouse. You can transfer files while using other Windows applications.

CROSSTALK, the standard in PC communications, continues to lead the competition by leveraging the potential of Windows like never before. Call 1-800-348-DCA-1 ext. 62DD for more information. *Now shipping v1.2 with VT 220/320 and LAN modem-sharing support.*



©1991 Digital Communications Associates, Inc. All rights reserved. CROSSTALK and DCA are registered trademarks of Digital Communications Associates, Inc. All other brand and product names are trademarks or registered trademarks of their respective owners.

Circle 89 on Inquiry Card.



Your business is safe with us.
Especially when it's really taking off.



Wherever you're growing, now you can get to over a gigabyte of capacity. Our new 3M Magnus™ 1.0 and 1.35 data cartridges are just the start to a whole new generation of increasing data cartridge speed and capacity. We're ready when you are.

That's why more business protects important information on 3M brand diskettes and data cartridges than any other brand in the world. Call 1-800-888-1889 ext.7 to find out more.

Innovation working for you™

3M Magnus 1.0 and 1.35 data cartridges require a compatible drive. © 3M 1991. Magnus is a trademark of 3M.



Worldwide Sponsor 1992 Olympic Games
36USC380

Circle 9 on Inquiry Card.

World Radio History

"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

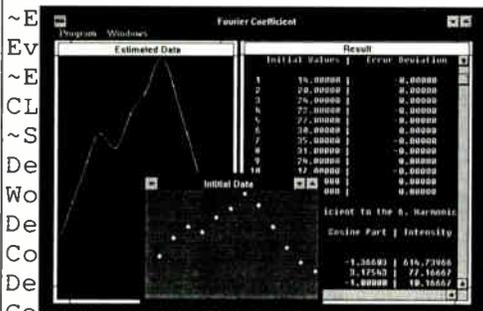
Besaha, president of Malachite, maker of Dossier for Windows. "The market is wide open for a well-marketed, well-conceived graphical database."

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

A look at GFA-BASIC code shows you how powerful Basic can be.



```

~E
Ev
~E
CL
~S
De
Wo
De
Co
De
Ge
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

```

Whether you're developing Windows 3.0 or MS-DOS applications, GFA-BASIC helps you get the job done quickly and efficiently. Over 900 system, mathematical, and GUI commands and functions eliminate the need to write pages of code.

GFA-BASIC gives you the structure of Pascal and the power of C, yet provides the simplicity of Basic. It supports strings and arrays larger than 64K and the use of EMS. And if you have routines already developed in C or Assembler, you can bind them into a GFA-BASIC program.

GFA-BASIC commands support clipboard, DDE, foreign DDL's, and dialog boxes. The SDK is not required for developing Windows programs. For analytical and technical applications, there are several hundred commands and functions for linear algebra, statistics, and trigonometry, eliminating the need for special libraries.

You can see for yourself how powerful GFA-BASIC is by asking for our free demo disk.

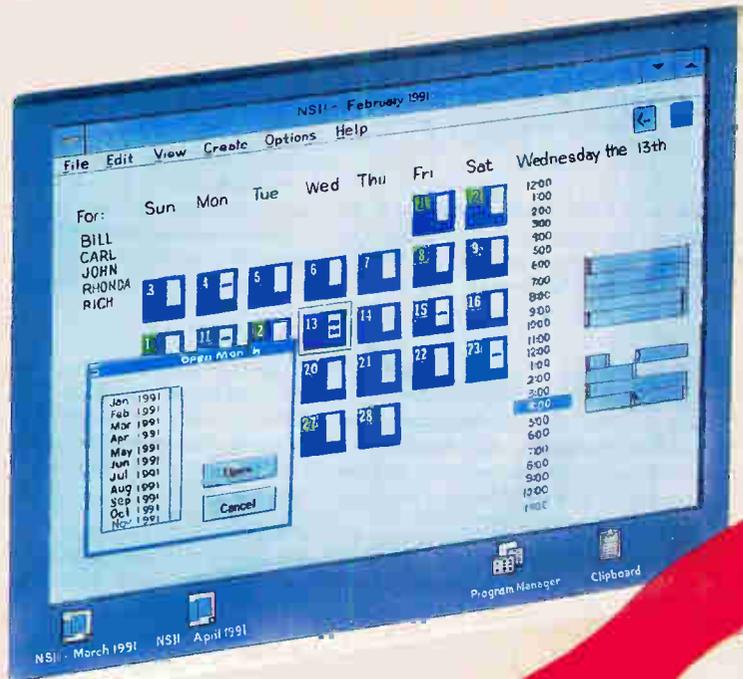
Call: 1-800-766-6GFA

Windows 3.0 and MS-DOS are trademarks of Microsoft Corporation.



Introducing

NETWORK SCHEDULER II[®] FOR WINDOWS



The Latest Member Of The NSII Family Has Arrived!

NETWORK SCHEDULER II introduces its new Windows Interface. By simultaneously sharing NSIIs full featured, time management system, DOS and Windows users can now schedule meetings, resources, conference rooms and equipment. Group scheduling has never been easier. End phone tag...all NSII users can view and update multiple calendars, sharing information to effectively plan meetings and conferences.

Across the hall or across the country, organizations of any size can benefit from the power and versatility of NETWORK SCHEDULER II. NSII runs on all LANs, is easy to use and pays for itself in days.

- MAKE MEETINGS, NOTES AND TODOs
- CONFIRM/DECLINE MEETINGS, RSVPs
- PRINT EXTENSIVE CALENDARS & REPORTS
- VIEW CALENDARS OF OTHERS
- SET ALARMS FOR IMPORTANT EVENTS
- RUN DOS & WINDOWS ON SAME SERVER
- REMOTE/LAPTOP CAPABILITY
- USER DEFINED SECURITY

Take control of your day. Install NETWORK SCHEDULER II and discover what 500,000 users already know!

For the location of a dealer near you and a free demo, call 800-237-4754.



MICROSOFT
WINDOWS
Version 3.0 Compatible Product

POWERCORE INC.

Circle 252 on Inquiry Card (RESELLERS: 253).

World Radio History

©1991 POWERCORE INC. One Diversatech Drive
Manteno, Illinois 60950-0756
815 468 3737 FAX 815 468 3867

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

.WK1 to .EXE with BalerXE™

BalerXE compiles 1-2-3® spreadsheets into custom tailored applications.

You may already use tools like C or Clipper® for developing TRANSACTIONAL applications. But for ANALYTICAL applications, now use a versatile spreadsheet engine as the core of your programs. Reduce development time while creating tamperproof spreadsheet-based programs for internal use or for sale.

BalerXE compiles worksheet formulas into fast, secure binary code and creates executable versions of your spreadsheets. Built-in libraries with over 170 Microsoft® C and BASIC tools, along with menu and macro-based tools provide almost unlimited customization. Distribute "Baled" programs like other commercial software, with no royalties or other software required.

"Baling" is believing.

Try BalerXE today, with a 30-day money back guarantee, for \$795. Or contact your software reseller. For more information, call for our free "Guide to Spreadsheet Compiling."

1-800-327-6108

Baler supports spreadsheet files with .WKS or .WK1 extensions, including Lotus® 1-2-3, Symphony®, Quattro Pro® and Excel®. "Baler," "Baled" and "Baling" are trademarks of Baler Software Corp. ©Copyright 1990 Baler Software Corporation. All rights reserved.

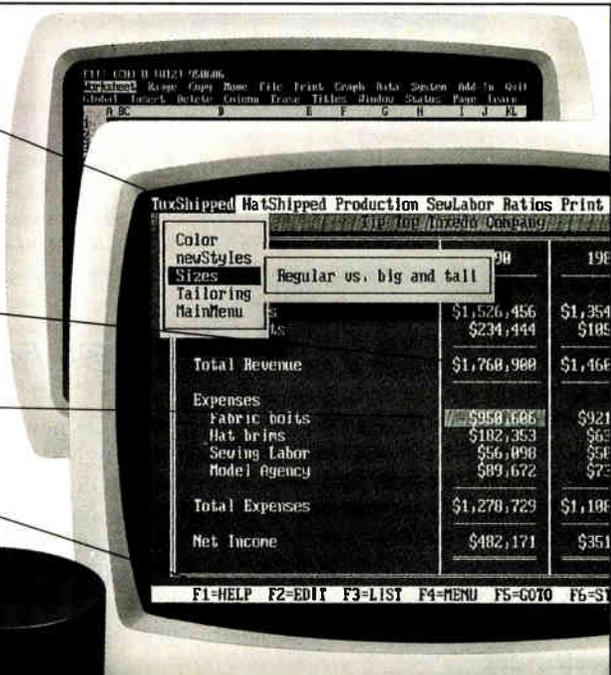
Four menu styles—
pull-down, pop-up,
horizontal and function-key.

Automatically support
expanded and virtual
memory, networks too.

Permanently freeze your
program's layout and
formulas.

dBASE®-like cell
templates and input
validation.

Custom context-
sensitive help system
with up to 1600 pages.



Baler™
SPREADSHEET COMPILERS
Baler Software Corp.
1400 Hicks Road, Rolling Meadows, IL 60008
708/506-9700 fax 708/506-1808

SIMPLICITY SUCCESS

You're on your way with WINDOWS and OS/2 Word Processing from DeScribe 3.0

Simple to use, DeScribe® Word Processor 3.0 places power at your fingertips. Let your thoughts fly because DeScribe smoothly matches your pace to help you streak across the finish line in record time.

Best of all, simplicity does not mean sacrifice. DeScribe includes all the advanced features you expect in a modern word processor and more! Like multilingual spell checking and thesaurus. Built-in definitions dictionary. Dynamic Data Exchange. Tables, drawing tools and more import filters for text and graphic formats than any other word processor on the market.

Plus, formatting is just a mouse click away with the unique Text Toolbox. Merge text and graphics. Draw lines. Be creative. Have fun. DeScribe is there to help you.

All done? Restore past work with DeScribe's unlimited UNDO. Snapshot automatically protects you from WINDOWS UAE's and those times when power goes out.

Still uncertain? Ask for a Trial Disk and take DeScribe for a test drive.

DESCRIBE® WORD PROCESSOR

Call Department 222 at:
1-800-448-1586
FAX 916-923-3447
MCI MAIL DESCRIBE



MICROSOFT
WINDOWS
Version 3.0 Compatible Product

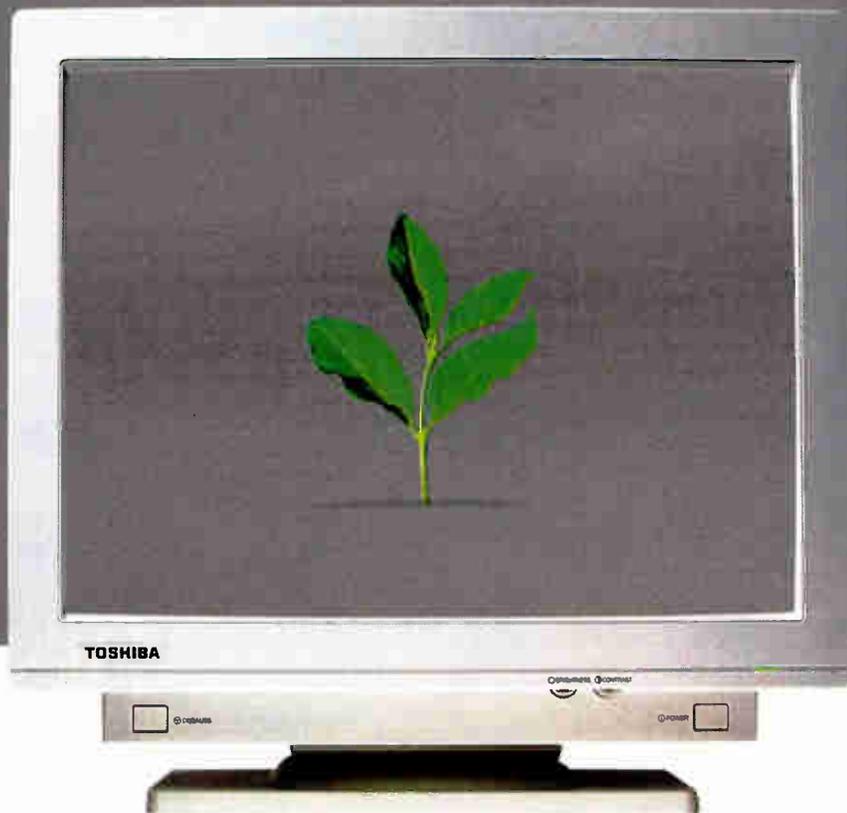


PRESENTATION
MANAGER.
COMPATIBLE PRODUCT

SEE US AT THE WINDOWS & OS/2®
CONFERENCE IN BOSTON, AUGUST 14-16,
BOOTH #827

World Radio History

Circle 93 on Inquiry Card.



Redefining the price-performance ratio in high-resolution color monitors

For the whole sweep of advanced, demanding applications: CAD, CAM, graphic design, desktop publishing, medical and scientific imaging, and Windowing.

Flat square technology and innovative focus system virtually eliminate distortion and flicker and reduce eye

strain. Both 17" and 21" monitors offer brilliant color and automatic scanning over wide frequency ranges (30-65KHz). VGA-, 8514A- and Mac II-compatible with resolution up to 1280 pixels x 1024 lines. Smart, compact design with handy controls and easy adjustments.

All this at undeniably realistic prices.

New 17" model
with 0.26 mm dot pitch

Toshiba FS. Recreating Reality, Affordably.

At \$3499 list the 21" is \$1000 less than the competition. At \$2100 list the 17" delivers far more monitor than anything else in its price range. Seeing is believing. Try a Toshiba at your dealer's. For more information phone or fax today:

1-800-253-5429

Extension 321 708-541-1927 fax

17" \$2100 list



21" \$3499 list



In Touch With Tomorrow

TOSHIBA

Circle 304 on Inquiry Card (RESELLERS: 305).

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)
1065 East Hillside Blvd., Ste. 300
Foster City, CA 94494
(800) 843-8615
Circle 1438 on Inquiry Card.

Coromandel Industries, Inc.
(ObjectTrieve)
70-15 Austin St., 3rd Floor
Forest Hills, NY 11375
(800) 535-3267
Circle 1439 on Inquiry Card.

GenSoft Development Corp.
(dBFast for Windows)
4122 128th Ave. SE, Ste. 200
Bellevue, WA 98006
(206) 562-0690
Circle 1440 on Inquiry Card.

MDBS, Inc.
(M/4 Windows)
P.O. Box 5268
Lafayette, IN 47903
(800) 344-5832
Circle 1442 on Inquiry Card.

Raima Corp.
(DB_Vista III)
3245 146th Place SE, Ste. 230
Bellevue, WA 98007
(800) 327-2462
Circle 1444 on Inquiry Card.

Software Products International
(WindowsBase)
10240 Sorrento Valley Rd.
San Diego, CA 92121
(800) 937-4774
Circle 1445 on Inquiry Card.

Software Publishing Corp.
(SuperBase 2, SuperBase 4)
19 Landings Dr.
Mountain View, CA 94043
(415) 902-8710
Circle 1443 on Inquiry Card.

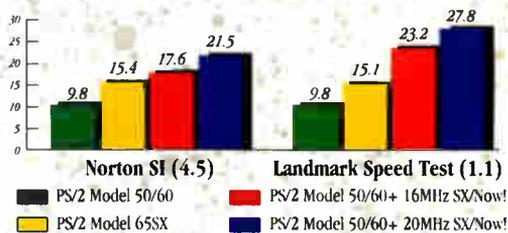
SX/Now! Processor Upgrade

Don't replace your system...

For Windows, for OS/2, for today's software, you need 386SX processing power. With Kingston's SX/Now!™ you can replace the processor on your 286 based computer—not the entire system.

...upgrade your processor!

By combining a 16 or 20Mhz 386SX processor with 16KB of cache memory and an onboard clock, SX/Now! increases system performance by over 250%—without taking an expansion slot!



Fully compatible

SX/Now! is fully compatible with your system's hardware and software. And it is covered by Kingston's five year warranty.

Cost-effective performance

So, to get the speed and processing power your software requires, choose the cost-effective solution, SX/Now! from Kingston.

Manufactured by

Kingston
TECHNOLOGY CORPORATION™

(800) 835-6575

(714) 435-2600

FAX (714) 435-2699

17600 Newhope St. Fountain Valley, CA 92708

All trademarks and registered trademarks are of their respective companies.

Circle 163 on Inquiry Card (RESELLERS: 164).

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
Circle 1446 on Inquiry Card.

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
Circle 1450 on Inquiry Card.

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."

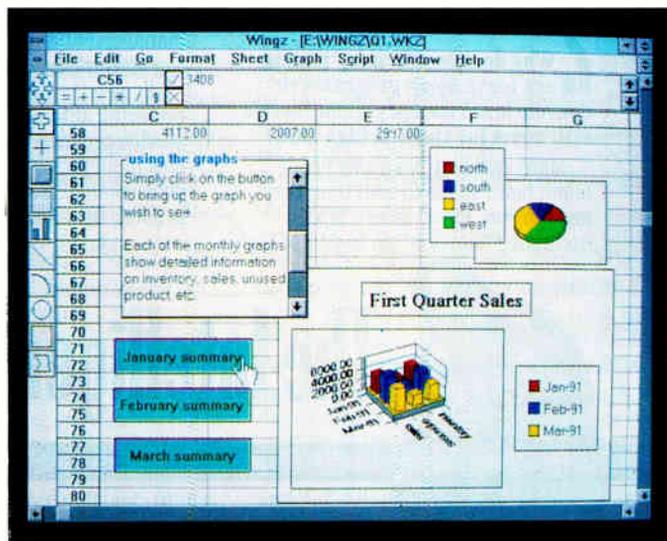
Informix has decided to take the high road with Wingz, emphasizing graphics for presentation.

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.

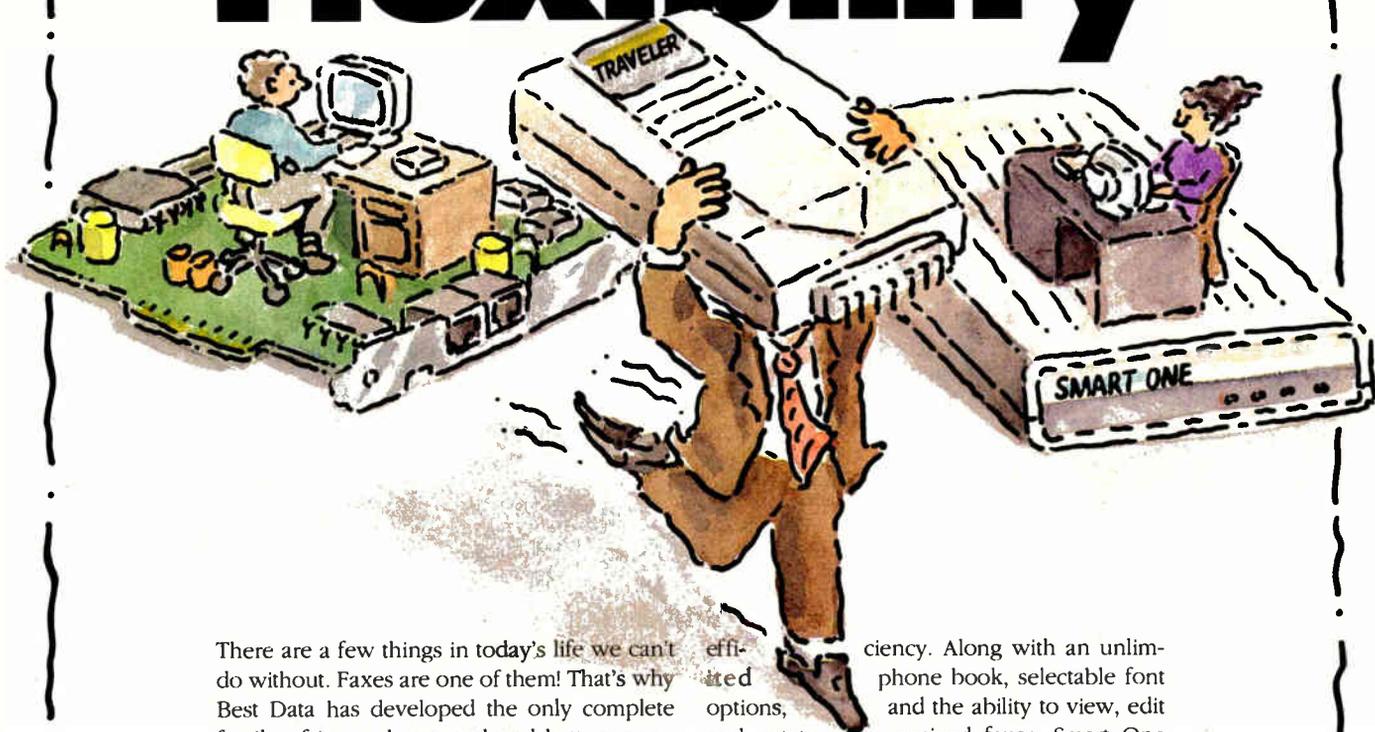
And All the Others

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



WINDOWS
COMPATIBLE

Fax Flexibility



There are a few things in today's life we can't do without. Faxes are one of them! That's why Best Data has developed the only complete family of internal, external and battery-operated pocket-sized fax modems. Now you can fax whenever and however you want with reliable, affordable Smart Ones™ or Smart One Travelers™ from Best Data, a feature-packed family of fax/data modems that lets you fully capitalize on the power of the fax.

Whether you choose our slick internal half-card, handsome desk top unit, or convenient pocket-size fax/modem, you'll enjoy 9600 bps send-and-receive fax and 2400 bps modem

efficiency. Along with an unlimited options, and rotate received faxes, Smart One lets you read d-Base III format files for fax broadcasting. And, since Smart One fax/modems are built according to the latest industry standards, you have the freedom to use any commercial fax software.

For anyone with a PC, laptop or MAC, Smart One's three unbeatable packages provide total faxing freedom. Call us at **(818) 773-9600** and we'll hook you up with a Smart One dealer near you.

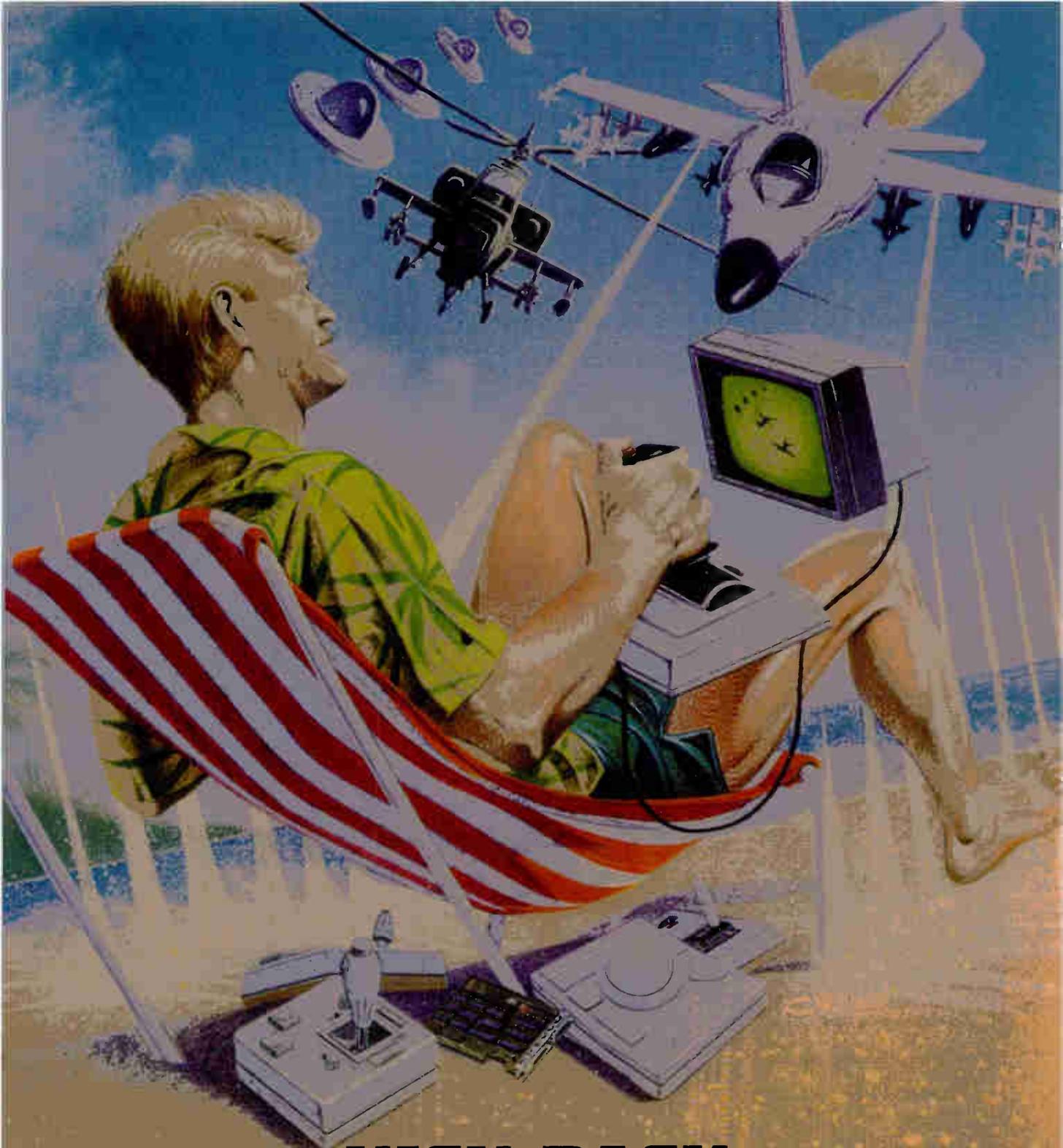
 **BEST DATA**
PRODUCTS, INC

9304 Deering Avenue, Chatsworth, CA 91311
Tel 818/773-9600 • Outside CA 800/632-2378 • Fax 818/773-9619
Best Data Europe • DeLescluzestraat 63 • 2600 Antwerp, Belgium
Tel 32 03 281 0645 • Fax 32 03 281 0612

Circle 40 on Inquiry Card.

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



KICK BACK

and relax, you've got a CH Products Controller!



Flightstick™



Mach I™ and
Mach I Plus™



Mach II™ and
Mach III™



GameCard III Automatic™
GameCard III Automatic/MCA™



RollerMouse™

970 Park Center Drive
Vista, California 92083
(619) 598-2518
To order: (800) 624-5804



Made in USA

Available for Apple, Mac, IBM PC/PS2
and compatible computers.

Circle 64 on Inquiry Card (RESELLERS: 65).

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
Circle 1451 on Inquiry Card.

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.



FASTCache-SX v1.2
November 26, 1990

THE WINDOWS™ 3.0 SOLUTION:

FASTCache-SX™ — Triples your AT speed with a 386™ SX from \$495.

FASTCache-SX/Plus™ — SPEED plus the MEMORY you need on a single board!

FASTCache-SX is your most cost effective upgrade path to the world of 386-based computing. Designed to work in most ATs and compatibles, FASTCache-SX or FASTCache-SX/Plus converts your 286 into a 20 MHz 386SX powerhouse that outperforms most 386SX and some 386DX based systems. You'll run all your old 16-bit software plus new applications customized for the 386's speed and 32-bit memory, like Windows 3.0 in "386 enhanced mode."

Speed ... Memory ... Compatibility

Both FASTCache-SX and SX/Plus are 100% compatible with your AT's hardware and software. Their 32K (optional 64K), four-way set associative cache gives your AT zero-wait-state performance accessing 16-bit memory. Most applications run two or three times faster, providing the equivalent performance of more expensive 386/387DX-based systems.

- Features a genuine Intel 386SX running at 20 MHz.
- Quick and easy installation with our user friendly manual.
- Optional 387™ SX delivers up to 1.7 MegaWheatstones, making it ideal for AutoCAD, Lotus and PostScript interpreters.
- Runs Windows 3.0 in "386 enhanced mode," DESQview-386, and OS/2.
- Landmark rating of 27 MHz and Norton SI rating of 22.4.
- Outperforms most 386SX-based motherboards and accelerators!
- Runs in over fifty 286™ systems including: AST, AT&T, Acer, Compaq, CompuAdd, Dell, Epson, EVEREX, HP, IBM (AT, PS/2-30-286, XT-286), NEC, NORTHGATE, Packard Bell, PC Limited, Tandy, Unisys, Wang, Wyse, Zenith and ZEOS.

FASTCache-SX/Plus includes sockets for up to 8 megabytes of extended memory. Since 386 multi-tasking applications such as Windows 3.0 run faster with more memory, FASTCache-SX/Plus is the ideal Windows solution.

The 20 MHz FASTCache-SX lists for \$495; the SX/Plus is just \$100 more — \$595. An installation kit (required) costs between \$50 and \$95, depending upon the type of 286 socket. Installing the FASTCache-SX is easy, even for PC novices. Both boards include a one year warranty.

Look closely before you buy a competitor's SX upgrade. Most use smaller direct mapped caches, only run in IBM systems, and only work with DOS. FASTCache-SX is the only product that runs all your software in over 50 different systems, and it is backed by the best technical support in the industry.

Call (508) 746-7341 to order your FASTCache-SX today!

No Risk Offer: FASTCache-SX and SX/Plus come with unconditional, 30-day, money-back guarantees. Your complete satisfaction is guaranteed or your money back!.



Microway®

intel, 286, 386, 387 are trademarks of Intel Corp. Windows is a trademark of Microsoft. FASTCache and Microway are trademarks of Microway, Inc.

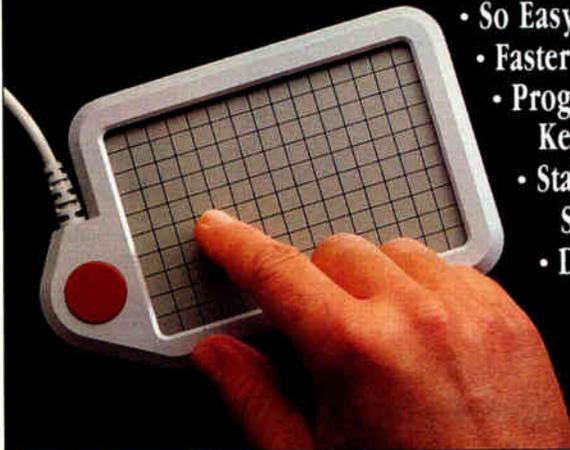
Corporate Headquarters, Box 79, Kingston, MA 02364 USA • TEL 508-746-7341 • FAX 508-746-4678
U.K./Europe 081-541-5466 • France 01 43 2 69593 • Germany 069-75-2023 • Holland 40 836455 • Italy 02-74.90.749 • Norway 6 892020

UnMouse™

Incredibly Productive. Ingeniously Creative.

Move the cursor effortlessly. Just slide your finger over the glass, then press to click. Plus it comes with special templates, each offering up to 60 programmable function keys. And it even works with a stylus.

- So Easy, It's Intuitive
- Faster than a Mouse
- Programmable KeyPad
- Stationary, Saves Space
- Draw, Trace, Doodle



Call
1-800-UNMOUSE

TEL: 508-694-9900
FAX: 508-658-9550

MicroTouch

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

During commercials, it's a computer.

For only \$395 you can turn your PC monitor into a television set, and never be out of touch again. With a keystroke you'll be able to change to your favorite news, soap or sports channel, find out what's happening, then return to your work.

DESKTOPTV is an add-in board that turns your PC into a 119 channel color television set with an on-screen control panel. And because DESKTOPTV has separate controls for audio and video, you can listen to your favorite TV channel while using your computer.

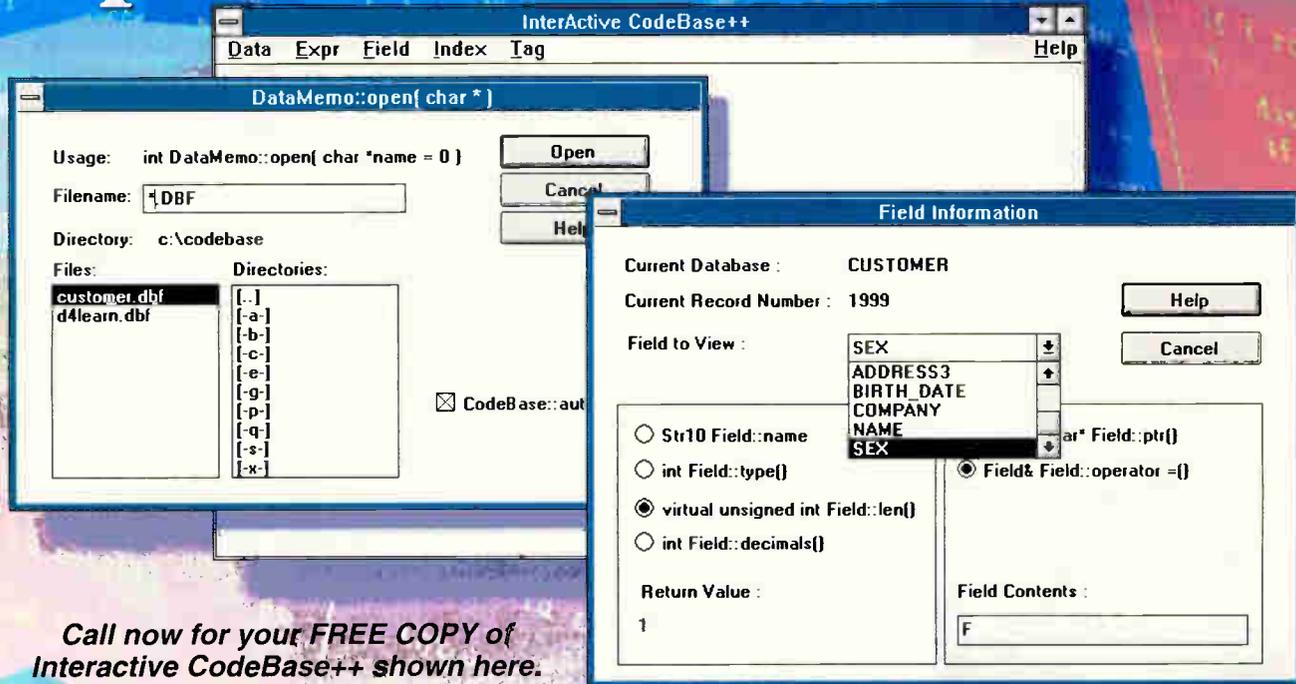
Order yours today by phoning 1-800-866-7288.

If you don't think DESKTOPTV is the best way for a hard-working professional to keep in touch with the world, return it within 30 days of purchase and we'll refund your money.

DESKTOP TV

A NEW PRODUCT OF AVIEW TECHNOLOGY 416/922-6555

Why do dBASE professionals use C++?



Call now for your **FREE COPY** of Interactive CodeBase++ shown here.

• dBASE Functionality

Use CodeBase++, a C++ class library, for database management.

• Object Oriented Syntax

dBASE Code

```
* Assign to field LAST_NAME
LAST_NAME = "Jones"
```

CodeBase++ Code

```
// Assign to field LAST_NAME
LAST_NAME = "Jones" ;
```

• Low Memory Requirements

A CodeBase++ .EXE file is as small as 20k.

• Speed

"CodeBase++ is fast: I indexed a .dbf of 10,000 records in 32 seconds; dBASE IV took 40 seconds." Kathy Cea, DBMS

• Portability

CodeBase++ ships with a Microsoft Windows 3.0 DLL.

• Compatibility

Codebase++ is completely compatible with dBASE and Clipper data and index files.

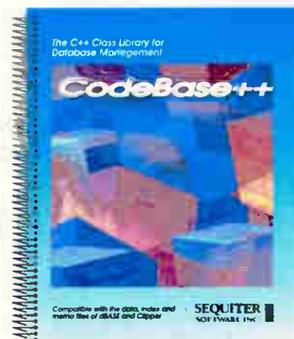
CodeBase++

The Power of dBASE, the Versatility of C++

SEQUITER
SOFTWARE INC.

TEL. 403•437•2410
FAX 403•436•2999

#209,9644-54 AVE., EDMONTON, AB, CANADA T6E-5V1

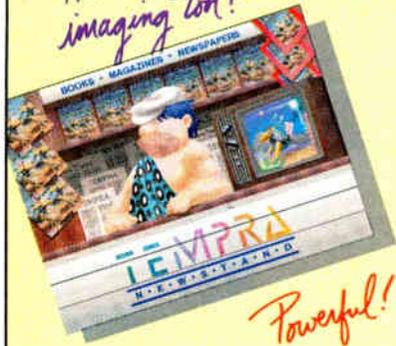


Circle 273 on Inquiry Card.

World Radio History

TEMPRA™

The ultimate personal imaging tool!

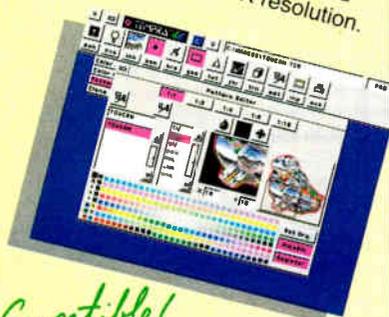


Powerful!

Up to 16.7 million colors.

Productive!

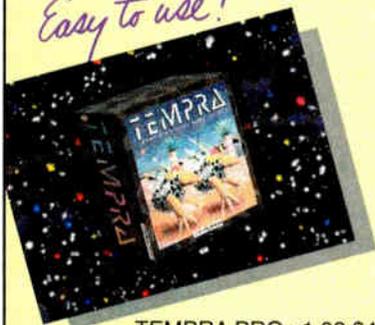
Over 275 painting options to create, scan, edit, and print original art and photographs, up to 8Kx8K resolution.



Compatible!

DOS application that runs under Windows, with .GIF, .TIF, .WIN, .TGA, .PCX, and .AVC file formats.

Easy to use!



TEMPRA PRO v1.02 \$495

TEMPRA GIF v1.02 \$149

TEMPRA Primer Demo \$15.95*

*Shipping/Handling included

1-800-852-MATH (6284)

mathematica
INCORPORATED

402 S. Kentucky Ave., Suite 210
Lakeland, FL 33801
Phone: 813-682-1128
Fax: 813-686-5969

BYTE SOFTWARE RESOURCE SERIES

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

Using CA-Cricket Present's simple outline interface and auto-templates for frame lay-

GATEBUSTERS!



SONY CD ROM FREE
with any 486 EISA & ISA 5550 Models

2 YEAR WARRANTY!
ALL SYSTEMS

\$3,599 | **\$4,599**
486-33 ISA* | 486-33 EISA**

- 32-Bit Intel 80486/33 MHz CPU
- Burst Mode Support
- Zero-Wait 64KB (Exp. to 256KB) High Speed Cache*
- Zero-Wait 128KB High Speed Cache**
- 4MB Zero-Wait State 32-bit Memory on the World's Best Motherboard made by AMI (Expands to 32MB*/96MB**)
- 8 Expansion Slots: 7-EISA and 1-32/8 bit**
- Sony 1304 HG 14" SVGA Monitor (1024 x 768 Resolution, Non-Interlaced)
- Orchid ProDesigner II VGA Card with 1MB RAM
- 207MB 15ms Maxtor IDE Hard Drive
- Teac 1.2 and 1.44 Floppy Drives
- 2 Serial/1 Parallel Ports I/O*
- 2 Serial/2 Parallel Ports I/O**
- PC Power & Cooling 300 Watt Power Supply
- Vertical Case: 6 Bays/Security Lock/LED (Also shown is our optional deluxe case 12 1/2ht bays with 450 watt power supply)
- Keytronics 101-key Enhanced Keyboard
- AMI BIOS/CMOS Set-up/Diagnostics/Clock/Calendar
- 3-Ring Cloth Binder for Manual and Software
- 10-year Lithium Battery/TOUCHE Tool
- 800 number for Lifetime Technical Support
- TRW On-Site Service Available to Most Locations
- Federal Express Replacement of Defective Components
- FCC B Certification

\$2,999

386-33 MHz COMPLETE SYSTEM

Upgradable to 486 with Plug In Board!

LEADING THE WAY!

State of the art technology is what you receive when you order a **TOUCHE** computer. The heart and soul of any computer is the motherboard. An AMI in a **TOUCHE** computer is quite simply the very best. We mean what we say and here are the facts!

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.

QUALITY

We take great pride in the fact that we include a 2-year replacement part warranty on every component. Gateway, Northgate, and Dell include only a 1-year warranty. After you buy a **TOUCHE** you'll never need to worry which component might fail after only 1-year of use! Even more importantly replacing failing parts can be extremely expensive. Investigate the cost of repairing your IDE or ESD1 hard drive. There goes a whopping \$300-\$400! Maybe you'll get it back in working condition after 3 or 4 weeks. We won't even try to guess what happens when their motherboard fails! You simply can't afford to buy any system which offers you only a 1-year warranty!

The quality and craftsmanship that go into every **TOUCHE** computer is unmatched in this industry. All systems are diligently assembled in Darien, Illinois by our team of dedicated technicians. We guarantee that you will receive a custom-built configuration exactly as ordered using our uncompromising WYSIWYG standards. Be certain when you're shopping, that other companies provide you with a list of the manufacturer and model number of every component they plan (promise) to use in their system.

From the world-renowned AMI motherboard to the #1 rated PC Power Cooling switching power supply EVERY component we use is simply unbeatable.

MORE FACTS

GATEWAY? Ask them about their EISA systems. They don't even offer this very latest standard in computer technology. Did you know every customer who ordered a 386 computer from **TOUCHE** since early 1990, over 1 year ago, can easily upgrade to a 486 with our simple plug-in card for only \$999? Not a single GATEWAY, NORTHGATE, or DELL computer purchased in 1989, 1990 and most of 1991 can be upgraded from 386 to 486 like the tremendous number of customers who have already taken advantage of this state of the art option **TOUCHE** offers. We're sure they'll gladly take your order for a new 486 though. Give yourself a break and buy a **TOUCHE**!

Call **TOUCHE** and speak to one of our sales associates today!



Made in the USA

TOUCHE

MICRO TECHNOLOGIES

A PC PROS Company
8205 South Cass Avenue Darien, Illinois 60559
708/810-1010 Fax 708/810-9490



WHO YA GONNA CALL?

708/810-1010

Circle 230 on Inquiry Card.

World Radio History

Who Helps Apple II Pros...

- Get quick answers to tough coding questions
- Interact with other Apple II developers
- Download source code, utilities, and other programs
- Keep up with the latest Apple II developments
- Send and receive private e-mail with binary attachments
- Chat with other Apple II developers in real time

BIX - The on-line service
for people who know the
Apple II.

All for just \$39 for three months plus \$3 per connect hour weeknights and weekends or \$6 per connect hour weekdays*.

Don't wait, register now! Just set your communications program for full duplex, 2400 or 1200 baud, 7 bits, even parity, 1 stop bit. Have your Visa, MasterCard or American Express card ready. With your modem, call 800-225-4129 or 617-861-9767 and subscribe on-line. Its' easy, at the login prompt enter **bix** and at the Name? prompt enter **bix.appleii**.

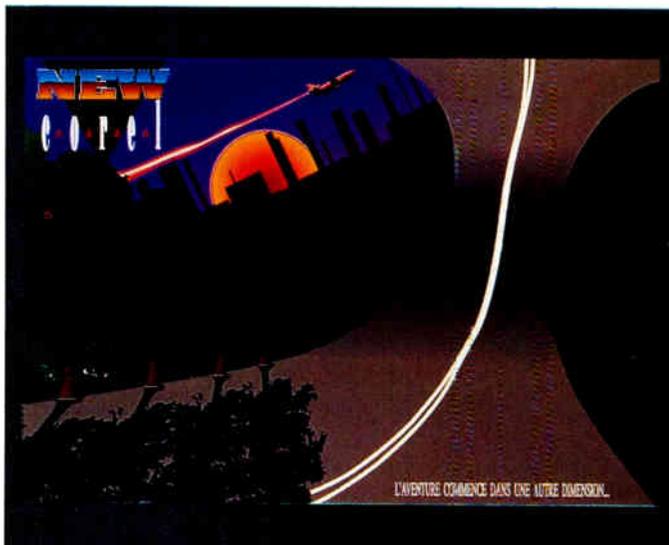
*Connect fees are for access via BT Tymnet and are subject to change.

BIX

800-227-2983 or 603-924-7681

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.

Imagine getting twice the Bernoulli for two-thirds the price.

The new Bernoulli 90MB.



Welcome to the next generation of removable storage, the new Bernoulli® 90 from the leader in removable storage—*lomega*®.

At 90 megabytes per removable disk, we've more than doubled our capacity. Yet the new Bernoulli 90 is actually less expensive than our own Bernoulli 44. A lot less. And with a new, 19-msec* effective access time, a lot faster, too.

But the best part is, it's all Bernoulli. Rugged, reliable, endless storage. The new Bernoulli 90 is exactly what storage-intensive users—like Windows users—demand.

More value.

If you need more storage, you'll welcome the Bernoulli 90, since Bernoulli is now comparable in price to a hard disk upgrade. So why not just buy another hard disk? Consider what you *don't* get with a hard disk.

You don't get infinite storage in 90-megabyte increments—hard disks fill up. You don't get 180MB of easy, on-line backup. You don't get the

security of removing your data and locking it up. You don't get the ability to safely ship your data anywhere on shock-resistant disks. You don't get a technology that frees you from head crashes. And you don't get Central Point's Backup software.

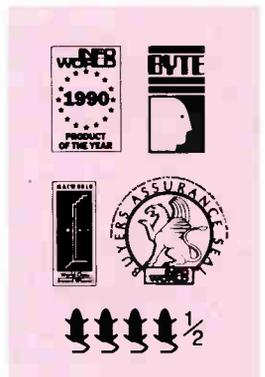
In short, you don't get a Bernoulli.

More ways to get attached.

The new Bernoulli 90 is a welcome relief from pigeonholing technologies. Bernoulli is compatible with every major operating system, as well as workstations. Just take your pick.

More recognition.

Leading publications have given Bernoulli some welcome recognition, but our biggest supporters are Bernoulli users. In fact, we have a 98 percent satisfaction rate. Perhaps it's due to our worldwide support network, and our 24-hour** drive replacement service.



Bernoulli at a Glance.

Drive Specs.

Effective access time: 19 msec
Transfer rate: Up to 20Mbits/sec
MTBF: 60,000 hours

Disk Specs.

Capacity: 90MB formatted
Warranty: 5 years
Shock tolerance: 1,000Gs
Drop height: 8 feet

Units Sold.

Drives: 700,000
Disks: 4,000,000



Welcome to the 90s.

And as if 98 percent wasn't enough, we've designed the 90 to read 44MB disks, and we're instituting an attractive Bernoulli upgrade program to help get every current Bernoulli user into the 90s. And protect your investment.

Call 1-800-777-4084.†

Questions? We don't blame you. There's a lot more you should know about—like our free 90MB disk offer, drive configurations, Bernoulli Technology,®

and specific pricing.

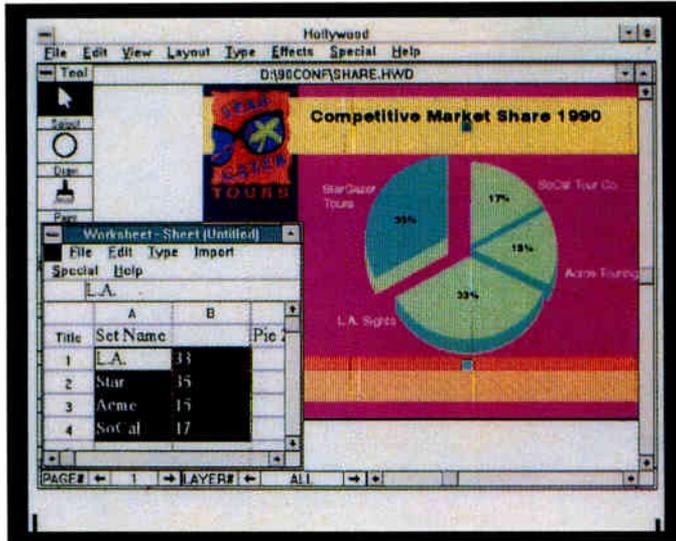
So we've prepared a free brochure that you can have by placing a simple phone call. Find out today what a welcome change the new Bernoulli can be. Before the 90s leave you behind.

ΩMEGA®
Makers of Bernoulli

© 1991, Omega, the Omega logo, Bernoulli and Bernoulli Technology are registered trademarks, and Bernoulli Means Security For Your Data is a trademark of Omega Corp. All other products are registered trademarks of their respective companies. *Less than 13 msec with included caching software. **U.S. only. †Phone number for U.S. and Canada. Internationally, call 322-720-99-16. For customer service questions, call 1-800-456-5522.

Circle 154 on Inquiry Card (RESELLERS: 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

ABC Flowcharter for Windows

"Simply the easiest way to document procedures."



ABC Flowcharter™ makes drawing and editing flowcharts easier than ever. It's loaded with features that help you make and edit charts in a fraction of the time needed with other flowcharting or drawing programs.

ABC Flowcharter's advanced link feature lets you break complicated procedures into smaller, more manageable steps. Just click on a shape to display a sub-chart or procedure. It's that easy.

Ask your dealer for a demonstration or call 1-800-227-0847 for more information. See for yourself why ABC Flowcharter is quickly becoming the standard flowcharting tool for the Fortune 1000. Retail price \$295.

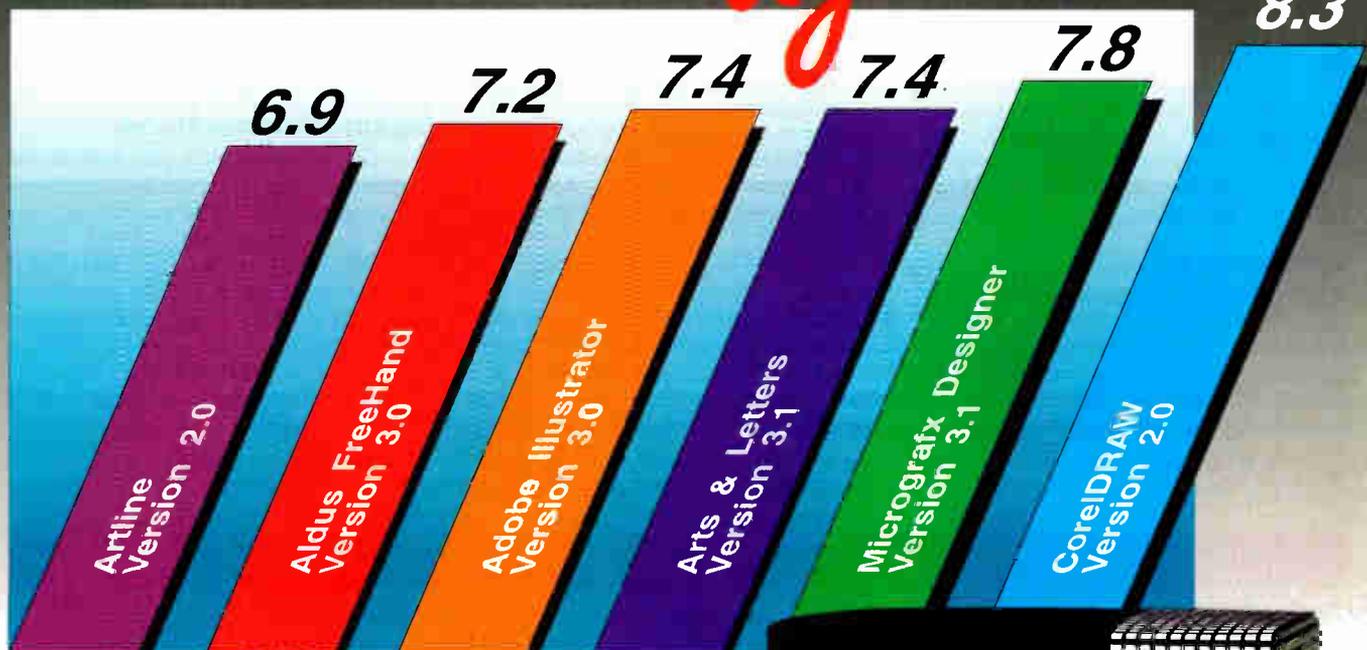
Roykore™

2215 Filbert St.
San Francisco, CA 94123
415-563-9175

PCs beat Macs for Illustration

again!

THE SCORES



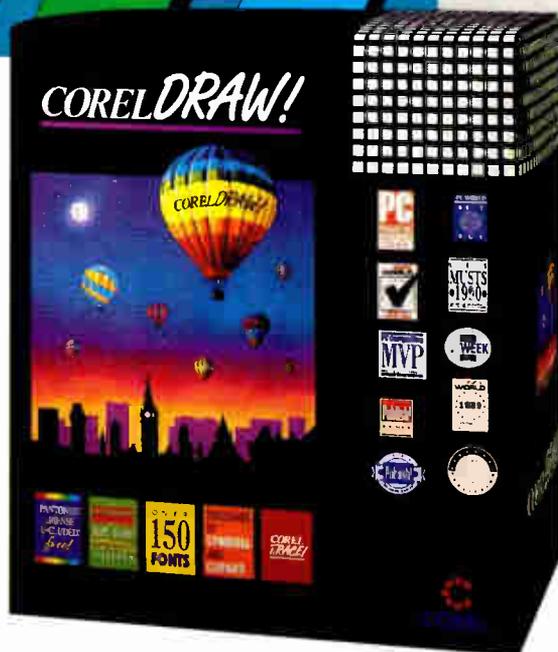
InfoWorld Product Comparison June 17, 1991

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.



Available for Windows, OS/2, CTOS, UNIX and in floppy and CD-ROM formats.

 **COREL**
TEL: (613) 728-8200
FAX: (613) 728-9790

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

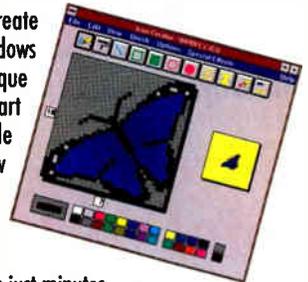
Microsoft Windows' basic communications program, written by Future Soft Engineering, supports XMODEM and Kermit protocols and provides DEC VT100, VT52, and ANSI emulation. But its COMM.DRV file uses nonstandard COM3 and COM4 addresses, does not support the first-in/first-out buffer in the standard 16550A universal asynchronous receiver transmitter, and limits transmission speed to 19.2 KB per second.

INTRODUCING



FREE BONUS!
 Each package of Icon Creator includes our Cursor Control™ utility Free!

Icon Creator gives you the power you need to create spectacular icons, and take full advantage of Windows 3. Now you can customize Windows by making unique icons for every application, batch file, or document. Start with an existing icon or clip art and just make simple modifications, or start from scratch and create all new icons. Icon Creator is simple to use, yet provides the power you need to unleash your creativity and produce the ultimate icons.



With Icon Creator you'll be creating colorful new icons in just minutes. Get the Power to create icons with Icon Creator.

Icon Creator is another product from Software Workshop - the icon specialists.

FEATURES:

- Complete set of drawing tools
- Sophisticated image manipulation capabilities
- Import and export icons from applications (EXE and DLL files) as well as from icon libraries (ILY and IL files).
- Capture any portion of the Windows screen and use the Paste Manager to create an icon from it.
- Drawing grid and position indicators
- Converts Windows icons to OS/2 format
- Multi-level Undo and Redo
- Context Sensitive Help
- Creates custom cursors.
- Edits Software Workshop's Icon Pak I and II icons.
- Plus many more!



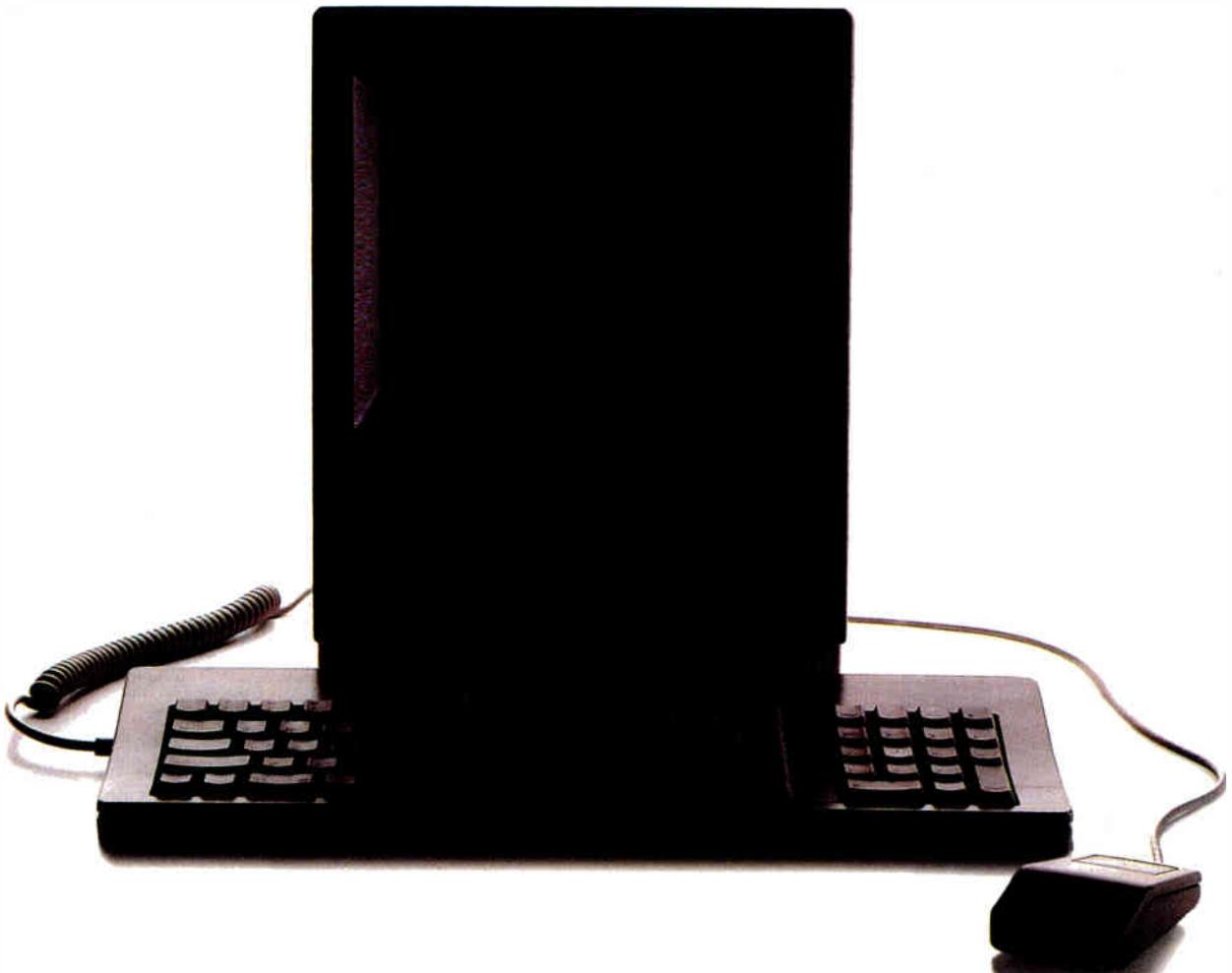
Software Workshop, Inc.
 75 South Mountain Way
 Orem, UT 84058
 801/224-6865
 FAX: 801/224-8121

Order Today! 1-800-762-9550

\$49.95 plus 5.00 S/H

Visa M/C Amex accepted

Or visit your Software Etc, CompUSA, or Best Buy store.



What gives you icons and folders,
is easier than Windows,
and comes with \$25 back?

NewWave for Windows

Until now, if you wanted a PC desktop that's as easy to use as a Mac, you've been left in the dark.

But now you can add HP NewWave to Windows for a simpler desktop. It turns all your DOS and Windows files and programs into icons. Then lets you group them in folders, by project, the way you do on your real desktop.

A file and its program are automatically linked. They open simultaneously. You save steps, and never have to worry about

where things are on your PC.

The result? Your work is easier to organize and faster to complete. All for about the cost of a mouse.

Best of all, this is just one of the advantages that made NewWave *PC Magazine's* "Environment of the Year."

Buy it at your dealer today. Our \$25 rebate offer is about to end.



Buy now and
get \$25 back

Purchase HP NewWave between 8/1/91 and 10/31/91, then send this coupon, original product registration card, and your original sales receipt to HP Program Awards Center, P.O. Box 59058, Minneapolis, MN 55459-0058. Must be postmarked by 11/15/91.* Suggested Retail Price \$195. Actual price may vary.

Name & Title _____

Company _____ Phone _____

Street Address _____

City, State, Zip _____

Want to learn more? Get our interactive demo disk (\$3.95 handling charge)

Call 1-800-345-9111 x 23A1

*Dealers of HP products and their employees not eligible. Allow 6-8 weeks for your check to arrive.

Windows Communications Programs: Company Information

Future Soft Engineering, Inc.
(DynaComm for Microsoft Windows)
1001 South Dairy Ashford, Suite 203
Houston, TX 77077
(713) 496-9400
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)
1000 Alderman Dr.
Alpharetta, GA 30201
(800) 348-3221
Price: \$495
Circle 1470 on Inquiry Card.

Software Ventures
(Microphone II for Windows version 2.0)
2907 Claremont Ave., Suite 220
Berkeley, CA 94705
(415) 644-3232
Price: \$295
Circle 1471 on Inquiry Card.

Wall Data, Inc.
(Rumba 3.1)
17769 Northeast 78th Place
Redmond, WA 98052
(800) 433-3388
Price: \$495
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

Testing The F-15 Fighter



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

The Challenge

Every time he straps in, a military pilot puts his life on the line. He trusts his aircraft to respond instantly in split-second supersonic maneuvers. Constant testing and re-testing of his jet's hydraulic control systems are essential to assuring success—and survival.

The Application

HR Textron's F-15 STS Test Stand takes the computer-controlled hydraulic system that controls a jetfighter's flaps and ailerons through tests that simulate flight situations. A graphical user interface includes test fail dialogue boxes and menu trees that lead the operator through a complex series of diagnostic procedures. Limit-testing, self-calibration and archiving of results are handled by the test stand's integrated database.

The Solution

The system software for the test stand was developed using the db_VISTA III DBMS from Raima. Rich Rutkowski, Director of Engineering for the project, looked at the relational database products available and determined that they fell short of the design specifications. "Only db_VISTA III handled the complex data relationships, and also provided the speed and portability

necessary for this application. We're not close to using all the power and flexibility db_VISTA III has to offer."

Whether in aerospace or in accounting, finance or manufacturing, critical applications demand the unique advantages of db_VISTA III:

- **Speed** — faster access to data
- **Portability** — supports most environments
- **Royalty-free** — increase your profits
- **Source Code Available** — total programming flexibility

Call Raima and find out how db_VISTA III can pass your next application development test.



Over 90,000 missions were flown in the recent Persian Gulf conflict. Allied forces lost only five aircraft to mechanical failure — an incredible record made possible in part by exhaustive, thorough performance testing.

\$195

**Special db_VISTA
 Developer's Edition**

Developer license only; not for distribution.

Windows

DOS

OS/2

Call: 1-800-275-4724

db_VISTA™ III
Database Management System

In Washington State call:
 (206) 747-5570

Circle 266 on Inquiry Card.

RAIMA™
 CORPORATION

Specifications

Relational B-tree indexing. Network data model. Relational SQL query and report writer. Single & multi-user. Automatic recovery. Built-in referential integrity. Supports: MS-DOS, MS Windows, UNIX, SCO UNIX, SunOS, QNX, VMS, Macintosh, OS/2 compatible. Most C Compilers and LANs supported.

Raima Corporation 3245 146th Place S.E., Bellevue, WA 98007 USA (206)747-5570 Telex: 6503018237 MCI UW FAX: (206)747-1991
 International Distributors: Australia: 61 2 419 7177 Austria: 43 222 8139838 Belgium: 32 2 734 9818 Brazil: 55 11 531 5297 Central America: 506 28 07 64 Finland: 358 80405350 France: 33 1 46 09 27 84
 Germany: 49 7022 34077 Italy: 39 49 829 1285 Japan: 81 33 865 2140 Mexico: 52 83 49 53 00 The Netherlands: 31 2503 26312 Norway: 472 384888 Singapore: 65 294 6714 Sweden: 46 13 111 588
 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 Copyright ©1991 Raima Corporation, All rights reserved. db_ is registered in the U.S. Patent and Trademark Office.

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, APCC 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

Most Windows 3.0 users are satisfied with Windows' Program Manager and File Manager shells. But some feel more comfortable using their favorite character-based

Now from

LIFEBOAT
SOFTWARE

Dan Bricklin's[®] Demo II[™]

Turn raw ideas into visual concepts.

Experience for yourself why over 30,000 people have made Demo II version 3.0 the leading tool for producing program prototypes, demonstrations and tutorials.

- ◆ Demonstrate commercial software to potential customers without shipping live software.
- ◆ Produce effective tutorials that interactively teach products.
- ◆ Create Computer Based Training for a fraction of the cost of dedication CBT authorizing software.

Suggested Retail Price \$249

Version 3.0 Includes:

- ✓ Built-in Mouse Support
- ✓ Text Overlay on Bitmapped Graphics
- ✓ Memory Swapping
- ✓ VGA Support
- ✓ Autosave Options
- ✓ CUA Template System

800-447-1955
908-389-0037

LIFEBOAT
SOFTWARE

A Division of Voyager Software Corp
1163 Shrewsbury Avenue
Shrewsbury, NJ 07702

Demo II is a trademark of Lifeboat Software.

Dan Bricklin's is a registered trademark of Daniel Bricklin. The vegetable is a trademark of Software Garden, Inc.

EXPERIENCE

Salvation™

Windows Management System

Microsoft® opened your computer with Windows™. Vitesse opens the door for you with Salvation!

Salvation is the friendliest graphic user interface (GUI) available to Windows users. Replace and integrate most Windows file utilities with Salvation.

Salvation's exclusive **BUTTON LAUNCHERS™** offers the ability to easily launch either Windows or DOS applications. You automatically or manually program **BUTTON LAUNCHERS™** and add your own personal icon.

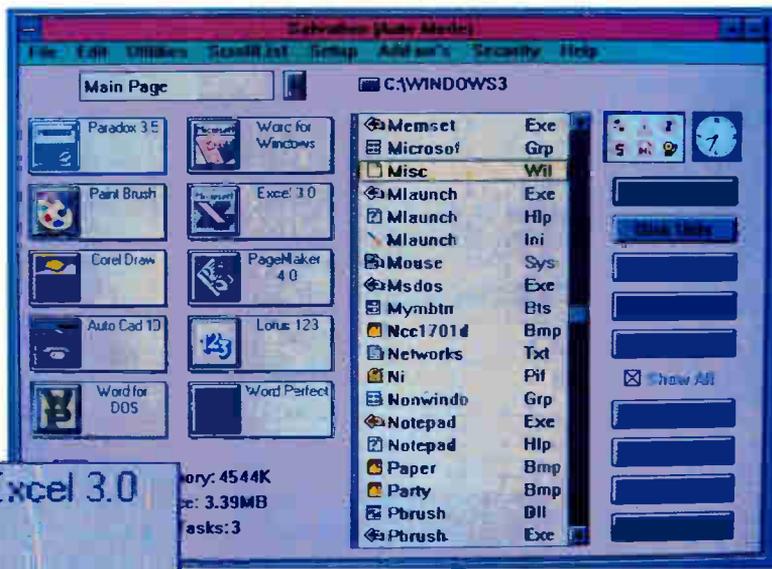
Salvation file utilities makes management of all your disks a simple task. You can move copy, delete, rename, or easily create both files and subdirectories. In addition to launching, Salvation automatically handles text and graphics files. Salvation even provides security access to your files.

Salvation's features gives your computer maximum power and the most understandable GUI in the PC environment.

EXPERIENCE SALVATION for only \$179.95 (suggested retail) **Circle 331 on Inquiry Card (RESELLERS: 332).**

Contact your dealer or call Vitesse at (800) 777-7344 FAX (818) 813-1273. DEALER INQUIRES WELCOME. We accept VISA & Mastercharge.

© Copyright 1991 Vitesse, Inc.. All Rights reserved. All company and product names are trademarks of their respective companies.



MICROSOFT
WINDOWS
Version 3.0 Compatible Product



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.

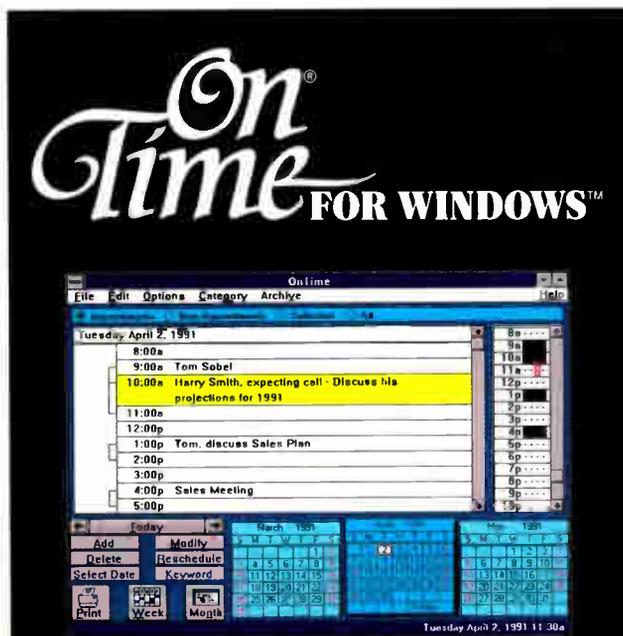
DOS-based application developers are

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



OnTime[®]
FOR WINDOWS[™]

Day Planner Screen

Win the time management battle and grow rich with OnTime for Windows - the finest, easiest to use PC calendar on the market.

Try it without risk!
\$129.95
30 day money back guarantee
1-800-345-6747
Network versions available



Complete Systems

COMPLETE WINDOWS SYSTEM	
386-16, 42MB, SVGA	\$1,595
386-25, 80MB, SVGA	\$2,295
4386-33, 210 MB, SVGA	\$3,495

Sterling Technologies, Inc.
800-488-9410
713-686-9400
Call for a free brochure



MC, Visa, Discover, Am Ex, Member BBB

Command Your Environment with E'vent™ Manager for Windows™



EASY TO USE

E'vent Manager uses an innovative 'point and click' interface that allows you to quickly click through lists of applicable words to build error-free, English-like statements that tell E'vent Manager which events to monitor and what commands to execute. For example:

IF the time is after 8:00:00 PM and it has been 30 minutes since the last user input

THEN output '[f]p' to Spreadsheet post a message box that says 'Printing Document'

No programming experience is required. E'vent Manager is simple enough for a novice to use while still satisfying the demands of the most power-hungry users.

PRACTICAL APPLICATIONS

Anyone interested in increasing computer efficiency by taking advantage of unused computer time and by making time at the computer more productive will find significant uses for E'vent Manager. Its work automation capabilities will appeal to any user, regardless of technical expertise or business size.

E'vent Manager helps you create custom solutions to meet your specific needs in the Windows environment and works with the software you currently own.

FOR MORE INFORMATION

Call Merasoft Corporation
800-368-1596 for information
800-368-0362 to order
FAX: 801-225-9984

For machines running Windows 3.0 or higher.
Suggested Retail Price: \$179.99 USD

Introducing the "Missing Utility" for Windows: an "agent" that will change the way you compute!

- Gain power and control over your Windows environment.
- Replace many of the utilities required for enhanced system operation and automate the use of all other utilities and applications.
- Customize your computer and applications to meet specific needs.
- Never again worry about whether you remembered to save or back-up your work.
- Assign the commands you use most to the extra mouse buttons you use least.
- Keep your computer working through the night.

You decide what E'vent Manager should do for you. No other application gives you the power and control over all your software that E'vent Manager provides.

DYNAMIC EVENT MANAGEMENT™

'Events' constantly occur in a computer --keys are pressed, applications open and close, periods of time elapse when nothing occurs, etc. Through the power of Dynamic Event Management (DEM), E'vent Manager monitors 180 time and system events inside the computer and can make intelligent decisions about when to execute the commands you specify.

With E'vent Manager, the possibilities are endless!

Circle 181 on Inquiry Card (RESELLERS: 182).



MERASOFT™

Merasoft Corporation 384 East 720 South, Suite 204, PO Box 1918, Orem, UT, 84059-1918

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
Shells Management Tools

Abacus Software
 (Becker Tools 2.0 Plus)
 5370 52nd St. SE
 Grand Rapids, MI 49512
 (800) 451-4319
 Price: \$129.95
Circle 1473 on Inquiry Card.

Access Softek
 (Prompt)
 3204 Adeline St.
 Berkeley, CA 94703
 (800) 521-6263
 Price: \$129.95
Circle 1474 on Inquiry Card.

Central Point Software, Inc.
 (PC Tools 7.0)
 15220 Northwest Greenbrier Pkwy.,
 Suite 200
 Beaverton, OR 97006
 (503) 690-8090
 Price: \$179
Circle 1475 on Inquiry Card.

hDC Computer Corp.
 (hDC File Apps)
 6742 185th Ave. NE
 Redmond, WA 98052
 (800) 321-4606
 Price: \$129.95
Circle 1476 on Inquiry Card.

Aldia Systems, Inc.
 (Time After Time)
 P.O. Box 37634
 Phoenix, AZ 85069
 (602) 866-1786
 Price: \$79.95
Circle 1069 on Inquiry Card.

hDC Computer Corp.
 (hDC Icon Designer)
 6742 185th Ave. NE
 Redmond, WA 98052
 (800) 321-4606
 Price: \$59.95
Circle 1070 on Inquiry Card.

GetC Software, Inc.
 (File Shuttle Express)
 P.O. Box 8110-182
 Blaine, WA 98230
 (800) 663-8066
 Price: \$139.95
Circle 1073 on Inquiry Card.

hDC Computer Corp.
 (hDC FirstApps)
 6742 185th Ave. NE
 Redmond, WA 98052
 (800) 321-4606
 Price: \$99.95
Circle 1477 on Inquiry Card.

hDC Computer Corp.
 (hDC Windows Express)
 6742 185th Ave. NE
 Redmond, WA 98052
 (800) 321-4606
 Price: \$99.95
Circle 1478 on Inquiry Card.

Metz Software
 (File F/X)
 4018 148th Ave. NE
 Redmond, WA 98052
 (206) 869-6292
 Price: \$129.95
Circle 1479 on Inquiry Card.

Wilson WindowWare
 (Command Post)
 2701 California Ave. SW, Suite 212
 Seattle, WA 98116
 (800) 762-8383
 Price: \$49.95
Circle 1068 on Inquiry Card.

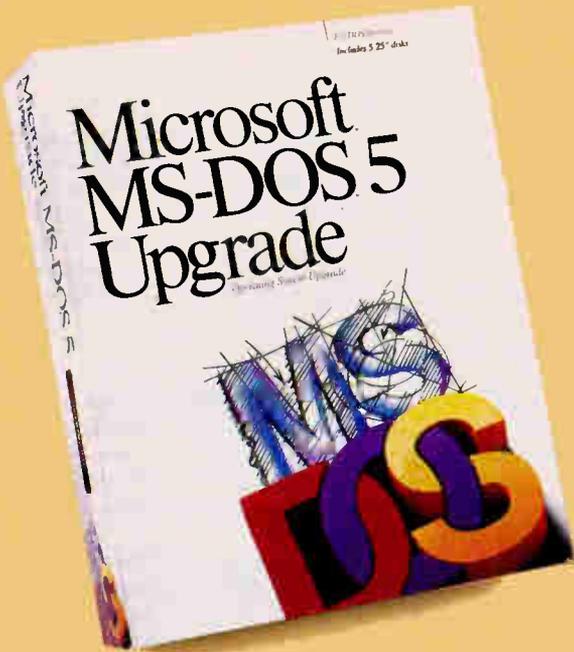
Specialized Utilities

Merasoft Corp.
 (E'vent Manager)
 P.O. Box 1918
 Orem, UT 84059
 (800) 368-1596
 Price: \$179
Circle 1071 on Inquiry Card.

Metz Software
 (Lock 3.0)
 4018 148th Ave. NE
 Redmond, WA 98052
 (206) 869-6292
 Price: \$49.95
Circle 1072 on Inquiry Card.

File Transfer Utilities

Traveling Software, Inc.
 (WinConnect)
 18702 North Creek Pkwy.
 Bothell, WA 98011
 (800) 343-8080
 Price: \$99.95
Circle 1074 on Inquiry Card.



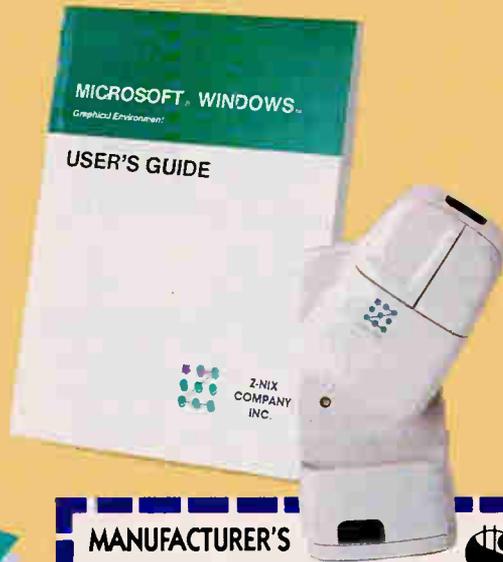
DOS 5.0 CORDLESS MOUSE UPGRADE BUNDLE SALE

When you upgrade to MSDOS 5.0 and Z-Nix cordless mouse you get the world's most advanced cordless mouse, alone or bundled with Windows 3.0. And you get up to 60% off the regular retail price, plus an extra \$10 manufacturer's rebate.

So why upgrade anywhere else?



OR



+

MANUFACTURER'S
REBATE **\$10**

\$10

Z-NIX
COMPANY
INC.
211 Erie St., Pomona, CA 91768 Tel: (714) 629-8050

Radio Shack

COMPUSA
THE COMPUTER SUPERSTORE

CompuAdd
RETAIL SUPERSTORES

CELEBRATING OUR 38TH YEAR
Fretter
SUPERSTORES

Circle 342 on Inquiry Card (RESELLERS: 343).

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."

Microsoft Windows 3.0

Your Source for Windows and Desktop Publishing Products

Specializing in Windows Desktop Publishing products including:

M MICROGRAFX
JVC Monitors
 2048x1024 resolution
 Non-Interlaced
intel
Microsoft
APPIAN Number Nine
 Graphics Cards
ADOBE
 Fonts
IMAGE-IN
EPSON
 Scanners
ALDUS
COREL
CALERA
LM LASERMASTER™ Certified Publishing Consultant

Call today for the **Best service** and **Pricing** on **Microsoft Windows Desktop Publishing** products! Ask for free catalog.

P **INFINITE POSSIBILITIES**
 Box 603 - 817 Stratford, Bedford, TX 76095-0603
(817) 268-1581
 Fax (817) 282-2564

All brand, product names and logos are trademarks or registered trademarks of their respective companies. Graphics simulates Microsoft Windows 3.0, a product of Microsoft Corporation.

Plug-in Conversion From Mouse to Touch

Our mouse emulation software and touchscreen hardware is truly the plug-and-play way to build touch input capability into your Windows™ application. You can buy a monitor from us with a touchscreen already installed or a touchscreen monitor conversion kit.



In either case, we'll also send you a free copy of our Windows 3.0 touchscreen mouse emulation software. Install the software on your

touchscreen-based system and you can perform all mouse functions just by touching the screen (and you can still use your mouse)! We also offer mouse and keyboard emulators for OS/2™ and MS-DOS. Call: Elographics, 105 Randolph Road, Oak Ridge, TN 37830 FAX: 615-482-4943 TEL: 615-482-4100

ELOGRAPHICS
the touchscreen company

©1991 Elographics. OS/2 is a trademark of IBM. Windows is a trademark of Microsoft Corporation

Attraction™

is the easiest way to add up to 16MB of high-speed Extended Memory for WINDOWS™!

- Ideal 4MB - 16MB memory board for WINDOWS.
- Also use with DOS™, OS/2™, XENIX™ and UNIX™.
- Attraction+ can provide the minimum 4MB requirement to run WINDOWS with speed.
- A 16-bit memory board for your 286, 386 or 486 PC.
- Add pairs of 1MB or 4MB SIMMs to get from 2MB to 16MB of memory. This board grows with your budget and needs.
- Capable of "Zero-Wait-State" performance.
- Switchless installation with supplied setup software.
- Five-year warranty.

Call the Memory Hotline toll-free for special Byte pricing!

Newer™ TECHNOLOGY
 7803 E. OSIE, SUITE 105
 WICHITA, KS 67207
 FAX (316) 685-9368

MEMORY HOTLINE **1-800-678-DRAM** (678-3726)

How to Capture a Wild Beast

Clip'n Save

lets you have your screen in a flash

The simplest and most intuitive screen capture program is now available for Microsoft Windows. Many options available including freehand capture and single-key screen printing. Works in mono, gray, and 16 to 16 million colors. Reads and writes BMP, DIB, TIF, PCX, GIF, and EPS. Also available for OS/2 Presentation Manager.

ORDER NOW! SATISFACTION GUARANTEED!

DYNALINK TECHNOLOGIES
TO ORDER: 1-800-522-4624
or 1-514-489-3007

Dynalink Technologies Inc. P.O.Box 593, Beaconsfield (QC) Canada H9W 5V3



PROFESSIONAL LEVEL COMPUTERS

Custom built and integrated for you.

ACCOUNT EXECUTIVES

Trained professionals who will assist you in configuring your Professional Level Computer System. Your personal contact before, during and after your purchase.

SUPPORT

1-800, Toll-Free Technical support for the lifetime of your system. Trained technicians capable of troubleshooting, diagnosis and integration assistance. System Engineers also available.

WARRANTY

One year, on-site warranty through Texas Instruments, with 9- to 24-hour response time (the best in the industry!), highly trained on-site technicians, one year parts and labor, air shipment of replacement parts. Extended warranties also available.

GUARANTEE

30-Day Satisfaction Guarantee. No fine print. No penalties. No restocking fee. No shipping costs.

PAYMENT

Visa, MasterCard, AMEX, Company Leasing, Approved Purchase Orders, C.O.D., Individual Financing

FLOPPY DRIVES

Chinon or TEAC

MONITORS

ACT, TWE, Viewsonic, Sony, Seiko, Nanao, Mitsubishi, NEC

SOFTWARE

Configured, installed, tested. Microsoft, DOS, Windows 3.0, Wordperfect, Lotus, Quarterdeck, Adobe, Corel, Aldus, Unix, Novell, SCO

NETWORKING

Novell, Unix, Xenix. Completely configured file-servers and workstations. Software loaded, hard drives compurfed, network cards installed and tested, cabling prepared.



MOTHERBOARDS

286-16, 386SX-16, 386-SX20&25&33 Cache, 486-25&33 ISA Cache, 486-25&33 EISA Cache

ACCESSORIES

Mouse, Trackballs, FAX Carls, Modems, Keyboards

DIGITIZERS, PLOTTERS, SCANNERS

Summasketch, Kurta, Calcomp, Roland, HP, Houston Instruments, Mitsubishi

VIDEO CARDS

Diamond Speedstar (TSENG 4000), STB, Orchid, Artist, Vermont, Video 7, ATI, Cardina

PRINTERS

Dot Matrix, Laser, Inkjet, Panasonic, Texas Instrument, Canon, NEC, QMS, Star

MEMORY

70ns or 80ns SIMM, SIP, DRAM
1MB - 64MB

HARD DRIVES

Seagate, Maxtor, Conner, Micropolis

CONTROLLERS

Western Digital, Ultrastor, Adaptec, DPT, Always, IDE, ESDI, SCSI



M4 Tower

M1 Tower

Desktop SF

Desktop

M2 Tower

M3 Tower

M5 Tower

THE POSSIBILITIES
ARE ENDLESS



Automated
Computer
Technology Corp.

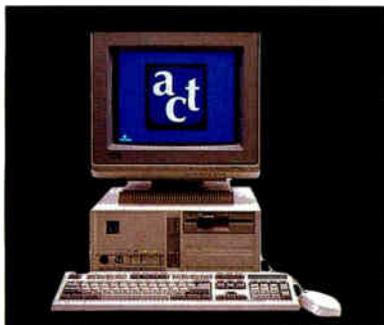
PROFESSIONAL LEVEL
PERFORMANCE

Automated Computer Technology Corporation • 10849 Kinghurst, Houston, TX 77099 • (713) 568-1778

ACT offers this complete integration at competitive prices. Who else can combine this level of performance, customization, service and support? No one. Call (800) 521-9237 for more information.

SUPERIOR SERVICE AND SUPPORT

Custom Performance Integrations. . .

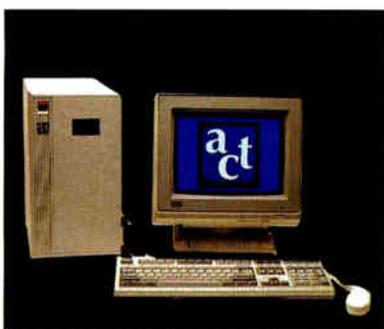


ACT 386SX™-20 CACHE SYSTEM

- Intel 386SX-20MHz CPU
- 32K Cache Memory
- 2MB RAM (exp. to 32MB)
- 1.2MB & 1.44MB Floppy Drives
- 89MB IDE Hard Drive (19ms)
- 2 Serial Ports/1 Parallel Port
- AMI Bios
- Enhanced 101 or 102 Keyboard
- ACT SVGA Monitor (1024x768, .28mm d.p.)
- Super VGA Video Adapter w/512K
- Choice of Tower or Desktop Case
- Microsoft DOS 4.01
- Free Delivery
- Wide Variety of Custom Options



\$2,195



ACT 386™-33 CACHE SYSTEM

- Intel 80386-33MHz CPU
- 64K Cache Memory
- 4MB 80ns RAM
- 1.2MB & 1.44MB Floppy Drives
- 210MB IDE Hard Drive (15ms)
- 2 Serial Ports/1 Parallel Port
- AMI Bios
- Enhanced 101 or 102 Keyboard
- ACT SVGA Monitor (1024x768, .28mm d.p.)
- Super VGA Video Adapter w/1MB
- Choice of Tower or Desktop Case
- Microsoft DOS 4.01
- Microsoft Windows 3.0
- Microsoft Serial Mouse
- Free Delivery
- Wide Variety of Custom Options

"ACT's 33MHz mini-tower is a class act all the way around. The ACT 386-33FC is a well-made machine with easy drive access, good performance, and impressive attention to construction detail. This computer is easy to recommend."
PC MAGAZINE
 December 25, 1990

\$2,995



ACT 486™-33 CACHE SYSTEM

- Intel 80486-33MHz CPU
- Cache: 128K (ISA) 256K (EISA)
- 4MB System RAM
- 1.2MB & 1.44MB Floppy Drives
- 210MB IDE Hard Drive (15ms)
- 2 Serial Ports/1 Parallel Port
- 8 ISA Slots or 8 EISA Slots
- Enhanced 101 or 102 Keyboard
- ACT SVGA Monitor (1024x768, .28mm d.p.)
- Super VGA Video Adapter w/1MB
- Choice of Tower or Desktop Case
- Microsoft DOS 4.01
- Microsoft Windows 3.0
- Microsoft Serial Mouse
- Free Delivery
- Wide Variety of Custom Options

\$4,195

ISA 128K Cache

\$5,295

EISA 256K Cache
Up to 64 MB



386SX™ NOTEBOOK LAPTOP

- Intel 386SX CPU
- 6.9 pounds including battery
- 1MB System RAM (exp. to 5MB)
- 1.44MB Floppy Drive
- 20MB, 40MB, 60MB Conner HD Options
- Backlit VGA Display w/external port
- Microsoft DOS 4.01, Microsoft Windows 3.0
- Logitech Serial Mouse
- Free Carrying Case and Delivery

SX-16 **\$2,495**

20MB Hard Drive

SX-20 **\$3,095**

40MB Hard Drive



Automated Computer Technology Corporation

10849 Kinghurst, Houston, Texas 77099
 Telephone (713) 568-1778 • FAX (713) 568-1779

ACT Now Toll-Free

1-800-521-9237



Lease Terms, Qualified P.O.'s Accepted.
 Dealer and VAR inquiries welcomed.
 International Inquiries Invited.

© 1991 Automated Computer Technology Corporation. All rights reserved. Other product names and trademarks used for comparison may be the property of other companies. Prices and specifications are subject to change without notice. A.C.T. cannot be held responsible for errors in photography or typography. The equipment above is FCC Class A or Class B approved. NOVELL, UNIX, XENIX, OS/2 and TI are all trademarks of their respective corporations. Texas Instruments on-site service is available in most U.S. and Canada locations. The numbers 386 and 486 are trademarks of Intel Corporation. MANLOVE 4402

Circle 32 on Inquiry Card (RESELLERS: 33).

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

Visions of Tomorrow
BY JANE MORRILL TAZELAAR
207

Corporate Connections
BY WAYNE RASH JR.
215

Downsizing: Bane or Boon?
BY BOB RYAN
227

Is America Losing Its Edge?
BY ALAN JOCH
233

Resource Guide: Office Automation Software
245



SEE US AT
INTEROP '2807
NETWORLD '2208
COMDEX '94122

Are LAN cabling problems driving you up the wall?

Is the cost of LAN downtime going through the ceiling? Is your time too valuable to spend hours tracking down LAN problems? Then you need to call Microtest. Since over 50% of LAN crashes are due to cabling problems, Microtest developed a complete family of easy-to-use, hand-held network scanners with a variety of features, functions and prices to meet everyone's needs. Our Cable Scanner was designed to get your network back up and running quickly and easily. When your LAN goes down, simply attach the Scanner to the cabling and in seconds its 32-character display tells you exactly where the fault is—in plain English (i.e. "Short at 320 ft."). Microtest's Pair Scanner is our most sophisticated and feature-packed product. It was designed



to handle the unique challenges of twisted pair networks, where faults are nearly impossible to pinpoint. It even isolates frustrating intermittent problems. Pair Scanner does everything the Cable Scanner does, plus it can tell you if your twisted pair cabling can support 16 Mbit Token Ring or 10Base-T Ethernet networks. Microtest scanners work on all twisted pair and coax cables. You can even monitor network activity and print out hard copy reports. Call Microtest today for more information or the name of the distributor nearest you at 800-526-9675. Or write us at 3519 E. Shea Blvd., Phoenix, AZ 85028. FAX: 602-971-6963. We'll send you our free Network Troubleshooting Guide.

Microtest

Innovative LAN Solutions

800-526-9675

Circle 192 on Inquiry Card (RESELLERS: 193).

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.



DTK 486 drives high-performance software in PC Week Labs test.

When *PC Week's* editors asked PC Week Labs to test Autodesk's® Renderman™ software, a DTK i486™ computer was chosen to run the sophisticated, high-level shading software program. (The drawing shown above is representative of the high quality of Renderman™ output.)

It takes a lot of muscle to get the full benefits of Renderman's™ power; we build that muscle into every DTK i486™ system™.



We begin with Intel's® potent i486™ processor (with its built-in cache and floating-point coprocessor circuitry) and add a second-level 64KByte static Ram cache (expandable to 256KBytes) for even

more impressive productivity levels.

Add to these your choice of hard drives and controllers, a fast graphics card and a post-VGA high definition monitor, and you have a PC screamer that can handle even the toughest of jobs ... while still affordably-priced.

When power and dependability are important, DTK is the computer of choice of people who know. Perhaps it's time you considered a DTK i486™ for your next computer. Call one of the DTK branch offices below for the name of a reseller near you.



The DTK 486 Family ■ 486-33 ISA ■ 486-33 EISA ■ 486-25 ISA ■ 486SX-20 ISA



DTK Computer Inc. A Reputation for Success.

17700 Castleton Street, Suite 300 / City of Industry (Los Angeles), CA 91748 / (818) 810-8880 / FAX (818) 810-5233

Los Angeles
(818) 810-0098

San Jose
(408) 436-6363

Houston
(713) 568-6688

Chicago
(708) 593-3080

New York
(908) 562-8800

Miami
(305) 597-8888

Autodesk is a registered trademark and Renderman is a trademark of Autodesk Inc. The DTK Logo is a registered trademark of DTK Computer Inc. Intel is a registered trademark and the Intel Inside Logo and i486 are trademarks of Intel Corporation. Design and specifications subject to change without notice. ©1991. DTK Computer Inc.

Circle 102 on Inquiry Card.

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."

P E R I S C O P E

Professional Software and Hardware-Assisted Debuggers for 80386 & 80486 Systems



Periscope/EM and 386MAX team up to keep Periscope out of the lower 640K...so you can have both quality memory management and a resident debugger.

New Debugging Tools

If you need a debugger but have no room left in the lower 640K of your 386™ or 486™ system, Periscope now has a new SOFTWARE-ONLY solution for you—Periscope/EM.

- Periscope/EM takes advantage of the extended memory you already have, rather than using any memory in the lower 640K.
- No runaway program can corrupt Periscope/EM because it's write-protected.
- You don't have to use a slot since there's no board to install.
- You can add an optional break-out switch to recover from crashes.
- Periscope/EM costs only \$295, half the cost of Periscope Model I, with most of the same functionality.

Periscope/EM requires 386MAX™ or BlueMAX™, version 5.11 or later; a 386 or 486 system with about 300K of extended memory; 32K of memory between 640K and one megabyte; DOS 3.0 or later.

If you need more than your current software-based debugger gives you, Periscope Model IV, with these advanced NEW features, may be just what you're looking for:

- Supports 386 and 486 systems running up to 33MHz with its ICE-like capabilities.
- Real-time hardware trace buffer holds up to 16K CPU events.
- Enhanced analysis and display of trace buffer makes you more productive.
- Periscope/EM functionality, built-in at no extra cost, saves you money.

Just call toll-free 800/722-7006 for details or to order.

"I needed a means to debug interrupt handlers where I could really see what was going on. The hardware trace buffer is great. I was able to debug code in 3 days that I have been trying to debug for months!"

...writes Peg Sestrich with Prime Computer, on why she chose Periscope Model IV.

The Periscope Company, Inc.

1197 PEACHTREE ST.
PLAZA LEVEL
ATLANTA, GA 30361
404-875-8080
FAX 404-872-1973



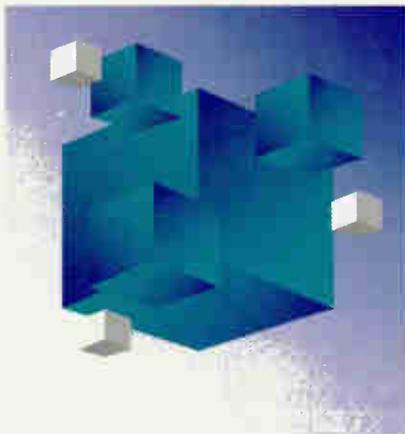
Real-time Periscope Model IV, shown with new 33MHz board and 486 pod.

DBMS NEWS

Announcing The World's First DBMS With An Object-Oriented 4GL

Professional developers agree, DataFlex 3.0 is the ideal application development environment for simple and complex commercial applications.

By combining a flexible, full-featured object-oriented 4GL, WYSIWYG application generator, and a powerful database management system, in a single, integrated package, DataFlex represents a radical improvement in the process of application development. *"Its comprehensive set of built-in productivity tools and utilities make creating large, complex applications much easier, much faster, and much more economical than with any other development system available today."* Jerry Busick, President, DataModes, U.S. Software Development Company. *"I design the forms in the WYSIWYG screen painter and DataFlex automatically generates and compiles the code. I*



DATA FLEX 3.0

can run the finished application in minutes!"

Tony Figueiredo, Systems Analyst, Laurentian General Insurance Company of Canada. *"Reusable procedural and object-oriented command modules including forms, tables, editors, prompts, pull-down menus, action bars, and scrollable selection lists from the built-in library save substantial development time."* Paul Wu, M.I.S. Director, Associated Press. *"DataFlex 2.3b was already a powerful and stable product. DataFlex 3.0 has reduced our development time by more than 25%!"* Craig Bilodeau, Systems Programmer, Raytheon Company. See how you can eliminate time-consuming drudgery and port to all the most popular supported environments,* by calling us now for more information on DataFlex 3.0.

For more information in the U.S., call us at 800/451-FLEX or contact one of the following International distributors:

Switzerland
ABACUS RESEARCH AG
41-71-259-325

Singapore
BIZPOINT SYSTEM PTE. LTD.
65-775-5588

Canada
CANVEGN SYSTEMS
416-226-2181

Germany & BeNeLux
DATA ACCESS EUROPE GmbH
49-6172-75014

United Kingdom
DATA FLEX SERVICES LTD.
44-71-729-4460

Scandinavia
EUROSOFT AB
46-300-195-30

Mexico
INFO-RED
525-545-6327

Brazil
INTERCOMP LTDA.
55-11-672-9266

Italy
LAN SYSTEMS SRL
39-51-437-025

Spain
S.E.I.
341-402-2298

DATA ACCESS
CORPORATION

14000 SW 119 Avenue
Miami, Florida 33186
305/238-0012

* Currently multi-user OOS, and soon to be ported to a variety of other environments including OS/2 and UNIX.
© DataFlex is a registered trademark of Data Access Corporation.

For information via CompuServe: GO DAC

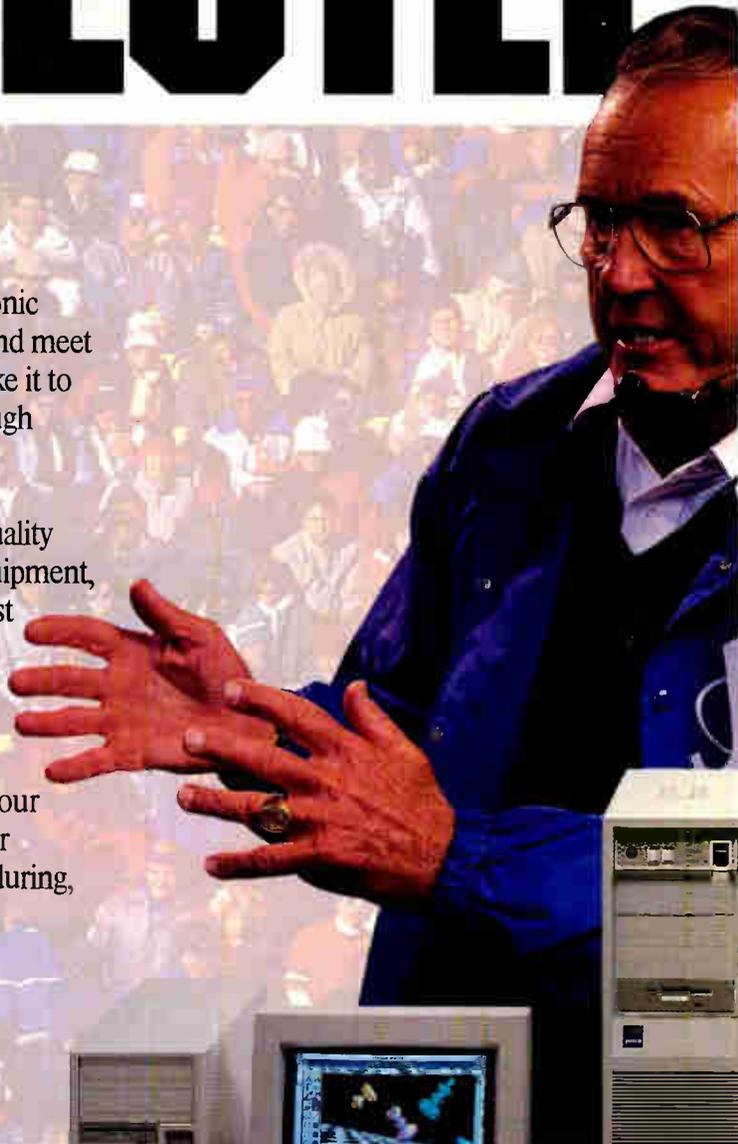
PERFECTLY

Electronic and Computer Products That Score Every Time

It's the fourth quarter, and you need key electronic and computer components! All must be reliable and meet specs head on. Your next call really counts—so make it to Jameco for a strong, balanced product line, thorough customer support, stringent quality controls, and competitive pricing.

Jameco's team has spent 16 years distributing quality electronic components, test and measurement equipment, accessories, and computer systems—from the most advanced, to mid-range, to starter. There are over 4,000 products in the Jameco game plan, all poised for action; order them 24 hours a day!

Our special customer-support team backs you for the long run of the product life, starting with your purchase plan. Our expert technical staff fields your questions by phone to discuss your needs before, during, or after purchase.



**Panasonic
Laser Printer**

**Jameco 16MHz
80386SX Computer Kit**
• 2MB RAM (expandable to 8MB)
• 200 Watt power supply
• 101-key Keyboard • Multi I/O Card
• Toshiba 1.44MB, 3.5" Floppy Drive
• DR DOS 5.0 and AMI diagnostic software
\$849.95/JE3816A
Video monitor/adaptor not included



**Jameco 33MHz 64KB
Cache 80386 Computer Kit**
• AMI Motherboard with 64KB cache,
80486 upgradeable, 4MB RAM
(expandable to 32MB)
• 300 Watt power supply
• 6 half-height drive bays
• 101-key Keyboard • Multi I/O Card
• Toshiba 1.44MB, 3.5" Floppy Drive
• DR DOS 5.0 and AMI diagnostic
software
\$1999.95/JE3833A
Video monitor/adaptor not included

Colorado Memory Systems Tape Back-up



**Jameco 16MHz
80386SX Motherboard**



Please refer to Mail Key 1 when ordering

Terms: Prices are subject to change without notice. Items subject to availability and prior sale. Complete list of terms/warranties is available upon request.

World Radio History

EXECUTED

We scout the world's latest technology for the best quality and value, thoroughly prequalifying each vendor and product. And, our in-house quality assurance group continually tests products received into stock.

Our customers call for Jameco consistent quality, wide selection, latest technology, solid customer support, and competitive prices. Join our large family of loyal fans from big and small businesses, schools and universities, government, and individuals.

When your next electronic or system purchase has to score, check our catalog or stop by our catalog-store/headquarters located in Belmont, CA, serving Silicon Valley and the Stanford technology park area. It's your call. And when it's to Jameco, it will be perfectly executed.

JAMECO[®]
ELECTRONIC COMPONENTS
COMPUTER PRODUCTS

1355 Shoreway Rd.
Belmont, CA 94002
(415) 592-8097
FAX: (415) 592-2503



Books

Weller Soldering Station



Printer Cable & Adapter



UVP EPROM Eraser



Connectors

Jameco 12MHz 80286 Computer Kit

- 512KB RAM (expandable to 4MB)
- 200 Watt power supply
- 101-key Keyboard • Multi I/O Card
- Toshiba 1.44MB, 3.5" Floppy Drive
- DR DOS 5.0 and AMI diagnostic software

\$499.95/JE2812A

Video monitor/adaptor not included

Integrated Circuits



3780Plus for:

Operating Systems

- MS-DOS
- Concurrent DOS
- UNIX System V/386
- XENIX 286/386
- AIX
- 386/ix
- Ultrix
- HP-UX
- NCR UNIX
- DG/UX
- VMS
- FlexOS

Applications

- EDI
- Point-of-Sale
- Mainframe RJE
- Medical Claims Filing
- Check Clearing and Deposits
- Electronic Funds Transfer
- Credit Card Verification
- U.S. Customs Automated Broker Interface
- Electronic Tax Filing
- Stock Market Exchange Data

...and More!

CLEO's 3780Plus® is the preferred 3780/2780 bisynchronous communications solution for applications requiring fast, efficient data transfer.

It provides full IBM 3780/2780 RJE emulation for IBM PCs, PS/2s, and compatibles. It also works with RS/6000, DEC VAX, HP9000, NCR Tower, DG AViiON,

*Easy to install,
easy to use*

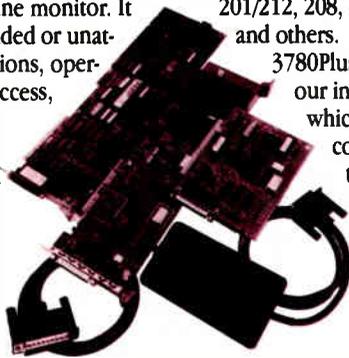
Prime, Pyramid, Sequent, Altos, and other systems.

With 3780Plus, you get a powerful scripting command language, an integrated application program interface, and a communications line monitor. It supports attended or unattended operations, operating system access, and auto-dial/answer. External modem auto-dialing

capabilities include UDS BSC, SADL, AT Command Set, and V.25 bis.

We offer 3780Plus on high-speed modem boards and economical synchronous interface boards. Internal modems supported include 201/212, 208, 208/201/V.22bis, V.32, and others.

3780Plus is also available with our intelligent SYNCcable+, which allows synchronous communications activity through asynchronous ports.



Over 50,000 worldwide installations

To learn more, call us today at 1-800-233-2536. Or write to us at 2652 Eastrock Drive, Rockford, Illinois 61109. Fax: 815/397-6535.

CLEO
CLEO Communications
A Division of Interface Systems, Inc.

AVAILABLE WORLDWIDE!

In Europe, call Sintec Peripherals Ltd. in Slough, England, at +44-753-811888 (fax: +44-753-811666).

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.

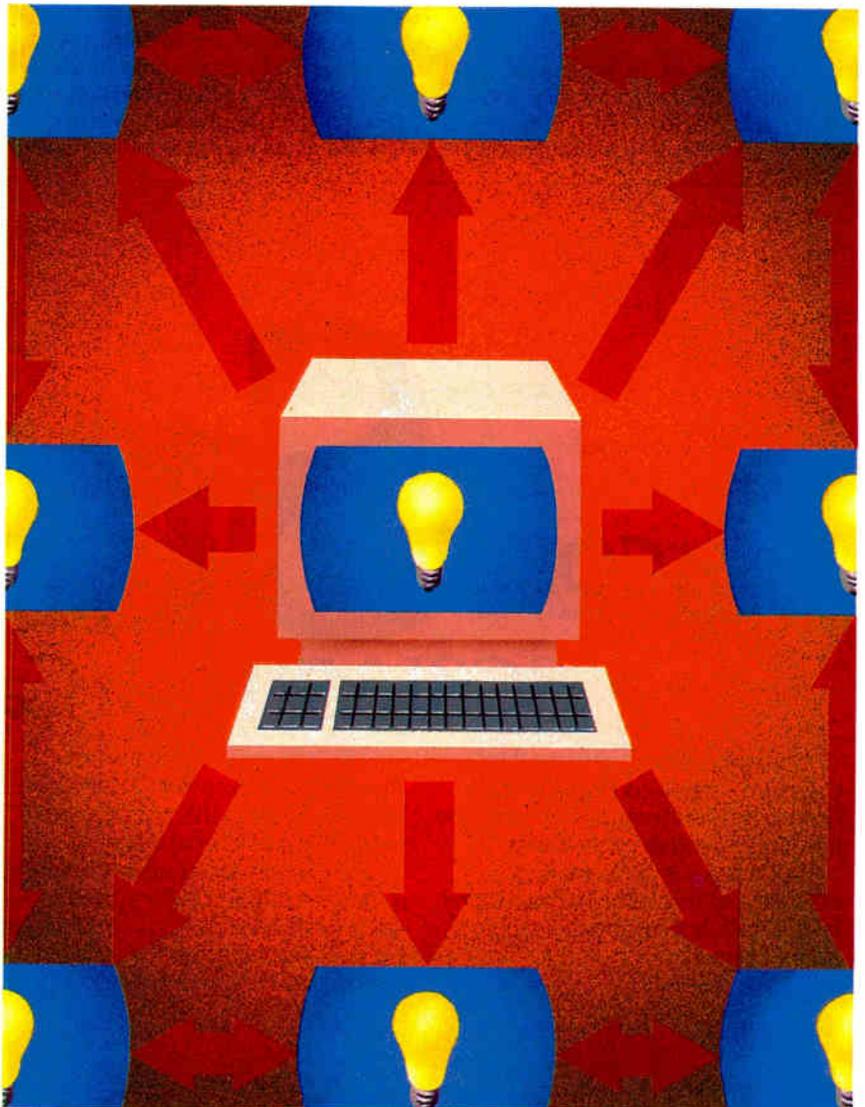
For as long as computers have been used in business, data-processing managers have dreamed of ways to integrate them into a seamless, companywide system. Originally, the vision was that such a system would consist of a gigantic mainframe swapping data with other mainframes elsewhere in the company. As 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



Small

SCSI 3.5" High Capacity Drives

Seems like every time you think you have a pretty good grip on the state-of-the-art in computers, someone introduces another *small wonder*.

But when it is performance, capacity and reliability in mass storage from CORE International, it's more like *no wonder*.

That's because we have been stretching the mass storage envelope since 1981, and in this industry that's more than a few generations.

So, we've made another stretch—a compact solution to the age-old quest to squeeze more and more bytes into smaller and smaller spaces.

The answer comes in our new

series of internal and external High Capacity 3.5" SCSI drives, storing up to to 520MB.

The SCSI interface allows connection of up to seven devices—so you could have as much as 3.6GB of high performance storage *per host adapter*.

Enhanced fault tolerance is easily



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

Wonder.

in 230, 320, 420, & an astounding 520MB.

achieved by installing two of these drives, provided the operating system (such as Novell NetWare®) supports mirroring and/or duplexing.

Looking for speed?

SCSI allows overlapped I/O—that means while one drive is seeking data, the computer is free to perform other tasks, including requests for data

on a second or third drive.

That's performance!

If the 520 is a little too big, we have smaller wonders—a 420, a 320, and a "modest" 230MB model, covering just about every price/capacity point you could ask for.

They're compatible with just about every computer, from IBM® to

Macintosh® to Sun® and everyone else who supports standard SCSI.

Rated at 150,000 hours MTBF, they offer a scorching raw transfer rate of 20MHz, and are backed by a 5 year, full-replacement warranty.

So, you get all that nice big capacity and fast access time for a really small wonder.

Ingram Micro D 800/456-8000 • Merisel 800/637-4735

COREeast 201/348-3330 • COREsouth 407/997-6055 • Mid-Atlantic & Federal Sales 301/258-8818

COREwest 213/595-8966 • CORE International (U.K.) Ltd. 0344 861776 • Headquarters & International Sales 407/997-6055 • Fax 407/997-6009

CORE International and CORE are trademarks of CORE International, Inc. Other trademarks referenced are the property of their owners. Copyright 1991 CORE International Inc.

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

People are talking about us.

F77L-EM/32 & Lahey Ergo OS/386

Port mainframe programs as large as 96MB to 386/486's with this 32-bit DOS-Extender compiler. The Winner of *PC Magazine's* 1988 Technical Excellence Award just got better. New Version 4.0 includes: Programming Tools, Popular Fortran 90 features, Virtual Memory Support, DESQview Support, New Documentation and Free Unlimited Runtime Licenses. F77L-EM/32 \$995 OS/386 \$395

F77L

The fastest real-mode compiler available. F77L can take advantage of your 386 PC by generating 32-bit instructions. New Version 5.0 includes: Fortran 90 features, Weitek support, and Video Graphics. \$595

Lahey Personal Fortran 77

Version 3.0: Full ANSI 77, Editor, Debugger, Linker, Library Manager, Microsoft and Borland C interfaces. A great learning tool at an unbeatable price. \$99



When people talk about **FORTTRAN** the name mentioned most often is



Contact us to discuss our products and your needs. **(800) 548-4778**
 Lahey Computer Systems, Inc. P.O. Box 6091, Incline Village, NV 89450
 Tel: (702) 831-2500 FAX: (702) 831-8123

FORTTRAN IS OUR FORTE

CORPORATE CONNECTIONS

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

Industrial Control Systems
 LAN Terminals
 Diskless Systems

ROMDISK™

For the IBM PC, XT,
 AT PC DOS* or MS DOS*

PCF-1 • New Multi-Megabyte Disk Emulator

- For diskless systems, solid-state reliability and speed
- Flash File System or battery-backed SRAM read/write technology for ISA bus operating under MS DOS.*
- Up to 7MB using 1MB Flash or SRAM—up to 14MB using 2MB Flash SIMMs
- I/O mapped—high performance—write Flash at hard disk speeds—95Kb/sec and erase 4MB/10 sec. Read and write SRAM at I/O bus speed
- Single or Dual mode—to provide Autobooting and Flash File System or SRAM read/write
- PCF-1 with one 1MB SIMM, \$895 with one 1MB SRAM, \$995, 1MB Flash SIMMs \$395, 1MB SRAM SIMMs, \$495, 2MB Flash SIMMs \$695
- Other ROMDISK models provide up to 1.44MB capacity with autobooting in EPROM, Flash and SRAM technologies

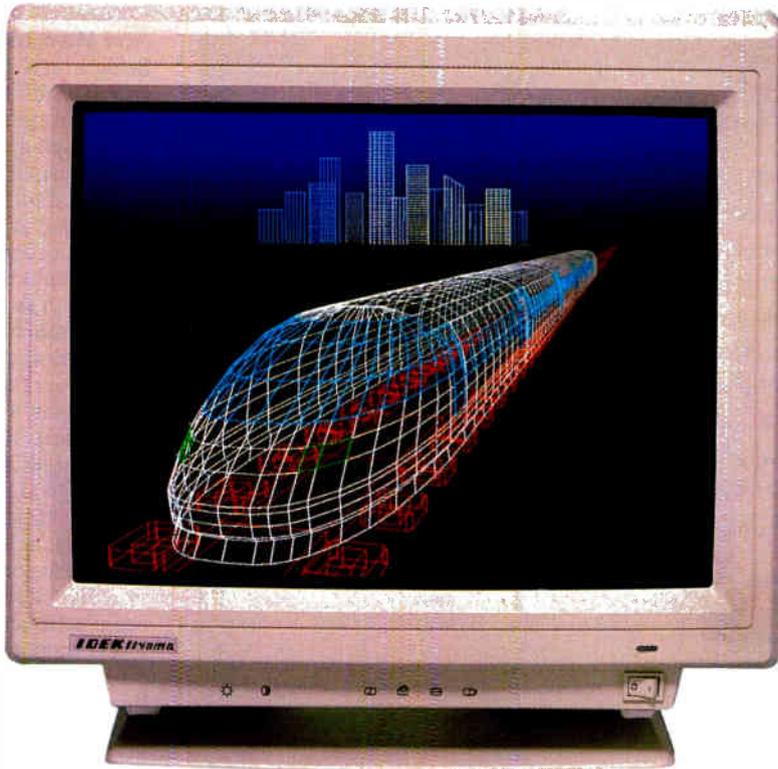
CURTIS, INC.
 2837 North Fairview Ave. • St. Paul, MN 55113
 612/631-9512 • Fax 612/631-9508

* IBM PC, XT, AT, PS/2 and PC DOS are trademarks of IBM; MS DOS is a trademark of Microsoft

**PC MAGAZINE
EDITORS' CHOICE AWARD**

IDEK

**IDEK — THE FIRST COMPLETE FAMILY
OF FST COLOR MONITORS**



March 26, 1991
Idek MF-5117

IDEK's MULTIFLAT Series of 17-Inch Color Monitors

IDEK's MULTIFLAT Series of 17-inch Color Monitors take full advantage of the remarkable properties of their Flat Square Tubes (FST) to deliver superior resolution and a sharper image that is easier on your eyes. A glimpse at our 17" Color Monitors reveals their matchless over-scanning capability that delivers a crisp, distortion-free display across the entire screen.

In addition, Automatic Frequency Scanning realizes outstanding performance for business graphics, CAD/CAM applications as well as desktop publishing on your Mac or IBM compatible system.

As you can see below, whether your requirements are simple or complex, IDEK has the Flat Screen Color Monitor that's just right for you. And priced right, too! See for yourself what a difference a Flat Screen Monitor from IDEK can make.

IDEK also offers its MULTIFLAT Series of 21-inch Flat Screen Color Monitors that deliver the same superior resolution and performance as the other members of the IDEK lineup.



**IDEK
Iiyama**

MULTIFLAT Series (17" Flat CRT Monitors)

Model	H. Frequency	Dot	Resolution
MF-5117	20 to 50kHz	0.28	1024 x 768
MF-5217	30 to 57kHz	0.28	1024 x 768
MF-5317 (Coming soon)	30 to 80kHz	0.28	1280 x 1280

MULTIFLAT Series (21" Flat CRT Monitors)

Model	H. Frequency	Dot	Resolution
MF-5021	15 to 38kHz	0.31	1024 x 768
MF-5121	21 to 50kHz	0.31	1024 x 768
MF-5221	30 to 80kHz	0.31	1280 x 1280
MF-5321 (A.R.Panel)	30 to 80kHz	0.31	1280 x 1280
MF-5421 (A.R.Panel)	30 to 80kHz	0.26	1600 x 1280

IYAMA ELECTRIC CO., LTD.

Overseas Division

7th Fl., US Hanzomon Bldg., 2-13, Hayabusa-cho, Chiyoda-ku
Tokyo 102, Japan
Phone: (81) 3-3265-6081 Fax: (81) 3-3265-6083

IDEK Europe (Germany)

Neumannstrasse 38, 6000 Frankfurt a.M. 50, Germany
Phone: (49) 69-521 922 Fax: (49) 69-521 927

IYAMA North America Inc

650 Louis Drive, Suite 120, Warminster, PA 18974 U.S.A.
Phone: (1) 215-957-6543 Fax: (1) 215-957-6551

PS/2[®] MEMORY

Introducing OS/RAM32™ for the Micro Channel™

- ✓ Provides from 2 to 8 Mbytes of fast memory.
- ✓ Works in 16 or 32 bit mode to meet your needs.
- ✓ Provides extended and expanded memory.
- ✓ Fast software for LIM 4.0 included.
- ✓ Automatic configuration for DOS, OS/2 and UNIX.
- ✓ Easy to install. Risk free guarantee. Two year warranty.
- ✓ Add a disk cache and RAM disk using OS/RAM32 to get maximum performance from your computer.
- ✓ Guaranteed compatibility with all of your programs.
- ✓ "Best price performance", says PC Week .

Call today 617-273-1818 or 1-800-234-4CEC

cec Capital Equipment Corp.
Burlington, MA. 01803

PS/2 and Micro Channel are trademarks of IBM

CORPORATE CONNECTIONS

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.

PS/2® MEMORY

Introducing OS/RAM32plus™ for the Micro Channel™

- ✓ Provides from 2 to 128 Mbytes of fast memory.
- ✓ Works in 16 or 32 bit mode to meet your needs.
- ✓ Provides extended and expanded memory.
- ✓ Fast software and hardware for LIM 4.0 included.
- ✓ Automatic configuration for DOS, OS/2 and UNIX.
- ✓ Easy to install. Risk free guarantee. Two year warranty.
- ✓ Add a disk cache and RAM disk using OS/RAM32plus to get maximum performance from your computer.
- ✓ Free up low memory by moving your drivers and TSR's to OS/RAM32plus. We guarantee compatibility!

Call today 617-273-1818 or 1-800-234-4CEC

cec Capital Equipment Corp.
Burlington, MA. 01803

PS/2 and Micro Channel are trademarks of IBM

Technical support at 3 a.m. is just one reason why...



Northgate® makes it safe to buy business computers direct.

A 24-hour business hotline service for your 24-hour business. Many companies don't realize the importance of round the clock technical support... until they need it. But, chances are, you or someone you know has had questions about computing after normal office hours. If you purchased your systems from one of our competitors, you probably had to wait to get help. Time-wasting. Inefficient. Costly.

Northgate treats you right! Across town or around the world, Northgate's business customers have a special hotline that gives immediate 24-hour access to Northgate's team of technical experts. Compare this with our competitors. Many have limited hours (like 9 a.m. to 2 p.m. on Saturdays; closed Sundays), some won't answer the phone during lunch hour and close up shop at night. While others offer little or no support at all.

You're never far from prompt, on-site service. When a quick phone call to our 24-hour hotline doesn't resolve the problem, we'll dispatch a service technician to your office... at Northgate's expense for one year. To make our service even better, we recently signed a contract with the nation's largest provider of on-site computer service and repair. With over 5000 trained technicians at over 400 service locations, we can get help to your door faster than you ever thought possible.

Northgate's commitment to customer service and support caught the attention of the 1990 Microcomputer Marketing Council who selected Northgate as the first winner of the Association's Service and Support Award. When you buy from Northgate, rest assured we're here to serve you — in person — all day, every day. And the call's always on us.

From our spectacular SlimLine 386SX to our our powerful Elegance 486™

file servers, Northgate backs them all with quality in every respect.

You'll see this quality in our award-winning products. For instance, Elegance 486/33 was recently voted "Desktop Computer of the Year" by readers of both *InfoWorld* and *BYTE!* Seven "Editors' Choice" awards from *PC Magazine*, eight *Computer Shopper* "Best Buy" awards and three *InfoWorld* recognitions are additional proof that our systems are as good as the service that stands behind them.

Quality systems through manufacturing and testing. As a manufacturer, Northgate does not subscribe to the industry trend of taking shortcuts in technology to boost performance gains and keep prices down. Rather, we thoroughly test components for compatibility, performance and value. In fact, if you were to order a hundred of our machines with the same configuration, every one would have the exact same performance. From hard drives all the way to our ALPS keyboard switches. And every stop in between. No "parts of the month" surprises or compatibility problems. We stake our reputation on it.

Unparalleled compatibility with your current industry standard systems and software. We've invested hundreds of thousands of dollars to make sure our systems are compatible with MS-DOS, OS/2, Novell®, Banyan, UNIX, SCO and other software. It's no wonder why many major software developers use Northgate to design, develop and "debug" their new software.

Dollar for dollar, Northgate is your smartest business decision. No doubt you can pay less for computers. And you can certainly pay more. But you won't get the product, performance, service and support that has

positioned Northgate as the new industry leader. No matter what the price, you just can't buy better than Northgate.



Free pre-purchase consultation. Nobody spends thousands of dollars on systems during the first phone call. You know it, we know it. Instead, we offer a no-obligation pre-purchase consultation with one of our highly-trained Technical Consultants. You won't get high-pressure tactics or commission-hungry salespeople. Just friendly assistance in matching your business needs with the appropriate Northgate solution.

CALL TOLL-FREE
800-345-8709

IN U.S.A. AND CANADA

Major corporations, volume purchasers and government agencies call
National Business Accounts: **800-545-6059**

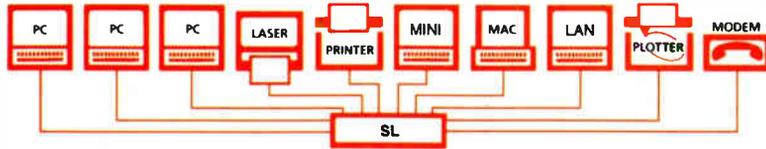
Notice to the hearing impaired:
Northgate has TDD capability. Dial 800-535-0602.



"Smart Tools For Business"™

7075 Flying Cloud Drive,
Eden Prairie, Minnesota 55344

Big Business Productivity For Small Workgroups



- * Pop-up Menu & Windows Option
- * Easy to Install and Use
- * Rapid Data Transfer
- * User Upgradable Memory
- * Reliable Automatic Switching
- * No PC RAM Memory Required
- * Toll-Free Technical Support
- * 45-Day Money-Back Guarantee



Printer Sharing Solutions

Model Name	Total Ports	PCs/ Printers	Memory Available	Printer Selection	Price \$ / Buffer
SL	10 6 Ser., 4 Par.	Any Combination	256KB - 4MB	Pop-up Menu	\$495 / 256KB \$595 / 1MB
SLP	10 8 Par., 2 Ser.	Any Combination	256KB - 4MB	Pop-up Menu	\$495 / 256KB \$595 / 1MB
HXM	4 2 Ser., 2 Par.	Any Combination	256KB - 16MB	Pop-up or Buttons	\$295 / 256KB \$395 / 1MB
HXS	4 Serial	Any Combination	256KB - 16MB	Pop-up or Buttons	\$295 / 256KB \$395 / 1MB
HWP	5 Parallel	3/2 4/1	256KB - 16MB	Pop-up or Buttons	\$295 / 256KB \$395 / 1MB
HXP	4 Parallel	2/2 3/1	256KB - 16MB	Pop-up or Buttons	\$245 / 256KB \$345 / 1MB
HCP	2 Parallel	1/1	256KB - 16MB	One Printer	\$225 / 256KB \$325 / 1MB
AS-41	5 Parallel	4/1	None	One Printer	\$195
AS-31	4 Parallel	3/1	None	One Printer	\$175

Save Money by Sharing Office Resources:

Printers and other expensive peripherals are idle the vast majority of the time. Buffalo boxes facilitate efficient utilization of these devices, and reduce the need to purchase more of them.

Buffalo boxes further improve productivity by allowing easy user access to all shared peripherals. With a buffer, all users can simultaneously send print data and quickly release their PCs to continue working.

BUFFALO

US and Canada Toll-Free:
(800) 345-2356

Fax (503) 585-4505

Buffalo Products, Inc.

2805 19th St. SE, Salem, OR 97302-1520

Circle 399 on Inquiry Card.

World Radio History

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!"

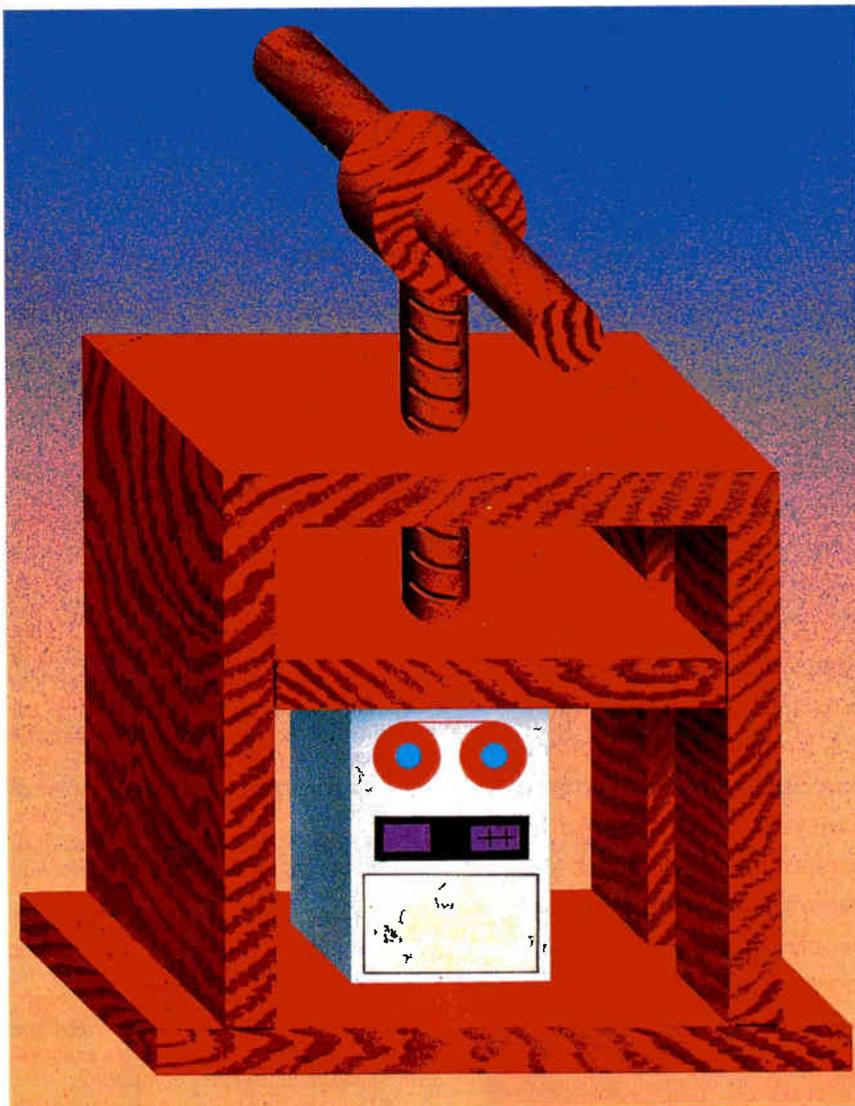
Like *multimedia* and *object-oriented*, *downsizing* has quickly established itself as a buzzword of the 1990s. It also shares with these terms the property of being pregnant with meaning and almost meaningless at the same time. Nevertheless, many people think that it is the most important trend in 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."

continued

THE POWERFUL PRODUCT WITH THE POWERFUL RISK-FREE OFFER

	1	Qtr 2	Qtr 3	Qtr 4
SALES TOTAL	389,688	384,788	433,388	
High Limit	479,184	487,588	487,588	
Low Limit	481,288	482,388	483,878	
Field Limit	471,288	485,588		
Alarm Output	298,688	458,388	488,585	

SOLA MICRO UPS.
IT'LL SHED LIGHT ON YOUR POWER PROBLEMS.

Sola Micro UPS is the economical power protection product that'll make light of even the most serious blackout. State-of-the-art design keeps your sensitive electronic equipment fully functional through every type of power line disturbance. That means no more loss of valuable data, or damage to your system's components. Micro UPS is one of many Sola products designed to communicate your system's power status.

NOVELL. 3Com. GANYAN. Microsoft.

1717 Busse Rd., Elk Grove Village, IL 60007
800/TRY-SOLA ext. 1006

A UNIT OF GENERAL SIGNAL
SOLA

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

Give Us Your Toughest Peripheral Sharing Problem

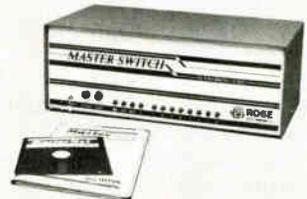
...or your simplest! Master Switch, the intelligent data switch from Rose Electronics, can handle it. The Master Switch series is so versatile and sophisticated, peripheral sharing becomes easy.

Anyone who appreciates ease-of-operation and technologically-advanced capabilities knows the Master Switch is the right choice...for sharing printers, plotters, modems, and any device with a serial or parallel port. Here's why:

- Any combination of serial or parallel ports
- Easy selection of peripherals
- User-expandable memory up to 4 megabytes
- Simultaneous access to all devices
- Rated 'fastest switch' by PC Magazine
- Advanced features include job queue, port contention, data collection, job control menu, initialization strings, pop-up menus, and many more
 - Complete technical support;
 - one-year warranty

The Low-Cost LAN Alternative
With our MasterNet software, the Master Switch provides many convenient LAN functions, such as E-mail, file transfer, and directory access.

Designed and manufactured in the USA. Field-proven in thousands of applications. The Master Switch answers any peripheral sharing challenge. Choose the intelligent data switch that handles your most complex needs, yet is easy to set up and operate... choose Master Switch.



(800) 333-9343

FAX (713) 933-0044 • (713) 933-7673
P.O. Box 742571 • Houston, Texas 77274

Call for complete information and our catalog of Switching and Sharing Solutions. Dealer inquiries welcome.

SmartCache™ Plus: the grow-as-you-go approach to SCSI controllers

START WITH THE BEST ...

DPT's entry level SmartCache Plus board offers unrivaled price/performance for single-user systems. It features ISA or EISA bus mastering, and universal SCSI disk compatibility for all PC operating systems. SmartDriver software supports SCSI-2 peripherals like tape and optical drives.

NOW ADD CACHING!

Get DPT's award-winning caching technology in a plug-in module! Move up to disk caching speed without investing in a new controller. With an integral 512K cache, the module provides up to 5X performance gains for workstations, power users, and small multiuser systems.

ADD MORE USERS, ADD MORE CACHE!

Plug in a 2 MB or 4 MB memory module and accommodate up to 18 users from a single card slot. Ideal for medium-sized networks or multiuser systems.

HOW ABOUT DISK MIRRORING?

DPT's SmartCache mirroring module provides 100% disk fault tolerance by simultaneously writing all data to a second "mirrored" drive. No more data loss or costly system down-time due to disk failures. And unlike software mirroring schemes, fault tolerance is achieved with no performance penalties.

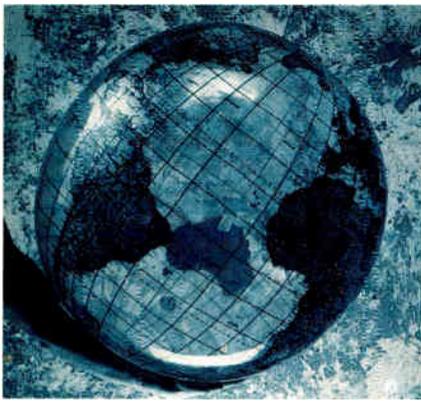
PLUS STILL MORE CACHE, AND THEN SOME ...

Cable over to DPT's 4 MB Cache Expansion Card, then grow your system to 16 MB by adding more plug-in memory modules—enough power for 64-plus users!

DPT has your solution—no matter how you grow. Performance, compatibility and upgradability make SmartCache Plus the only SCSI controller you'll ever need. For details, contact Distributed Processing Technology, 140 Candace Drive, Maitland, FL 32751. Phone (407) 830-5522; FAX (407) 260-5366. In Europe (UK) phone 44 04 884 718 FAX 44 04 884 8892.

 **DPT**

Circle 98 on Inquiry Card (RESELLERS: 99).



Introducing your new Sales Person.

Territory: Global, 80 + countries.
Hours: 24 per day, 365 days per year.

Product and Services: Unlimited
total recall of your information.
Processes your orders and invoices
accurately and instantly.
Salary: US \$200 per month.

Tradelink meets these requirements and allows **MERCHANTS** to list details of Company Services and products plus Payment and Shipping terms for prospective customers around the world.

Prospective buyers simply access the **Tradelink** systems to locate and purchase precisely what they want. An end at last to the time consuming and costly frustration of product and service location, and purchasing. The Buyers pay no subscription and can access and use this unique system from US \$36 per year. Call now for more information and for a **FREE** look around **TradeLink**.

Call (FREE) 0800 181 555 for your local dialplus or Tymnet access number. Tymnet users should enter letter O when connected. Tymnet will respond "please log in", enter Infoindex and if requested enter the password Indexed. You may also call direct on: +44 (0)71 224 9791, set your modem to 2400 N81.

THE INDUSTRIAL INFORMATION INDEX

213-215 Gloucester Place, London NW1 6BU, UK
Voice: +44 (0)71 224 9990 Fax: +44 (0)71 706 0536
Four weeks free trial for UK Merchant Members
signing up in June or July.

232 B Y T E • SEPTEMBER 1991

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

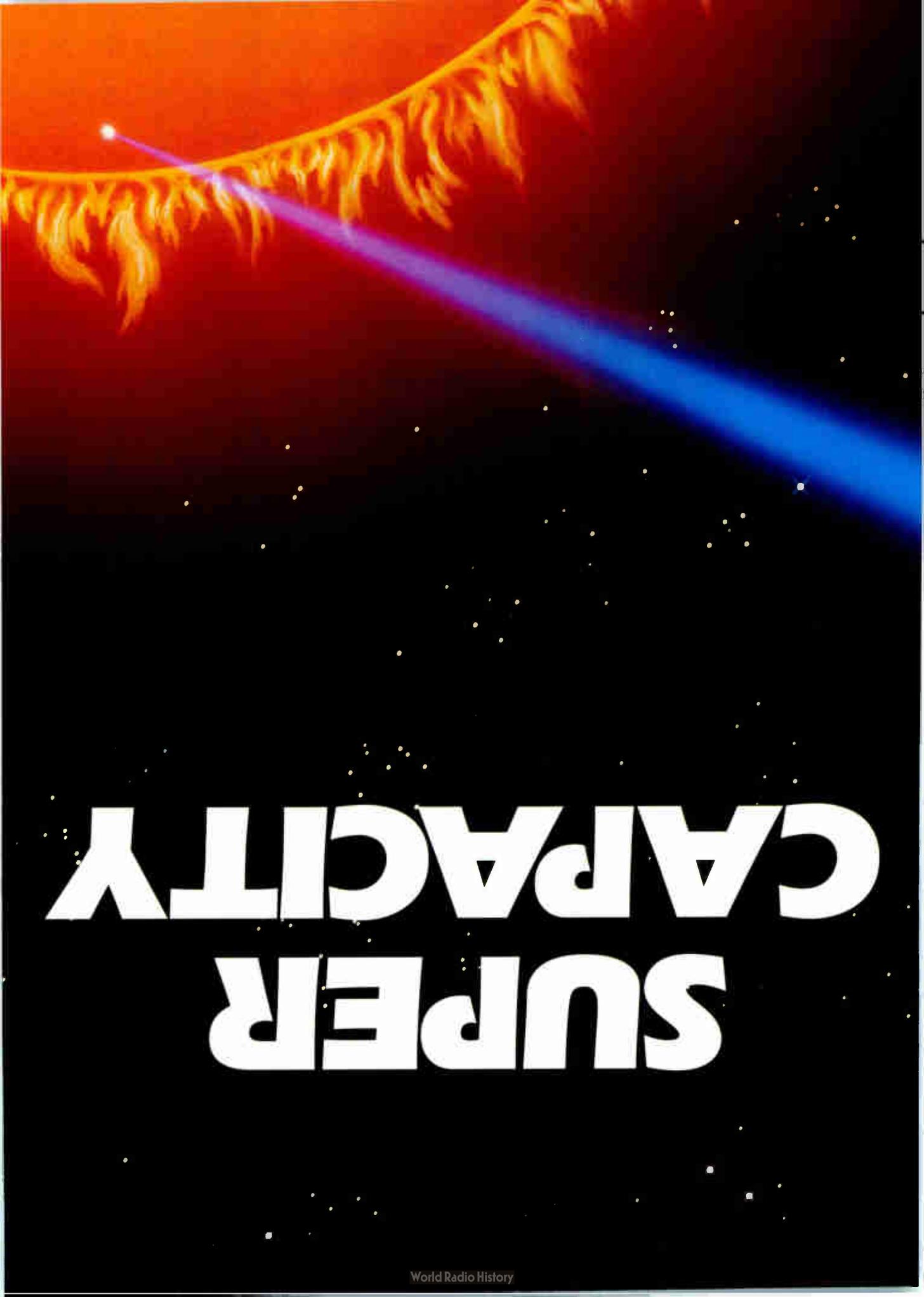
Putting a number on the downsizing phenomenon is impossible at this date. As Zorfass puts it, "there are no good numbers." DeRiggi thinks that companies actively downsizing are "still a very small minority, primarily because the world tends to resist change."

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. ■

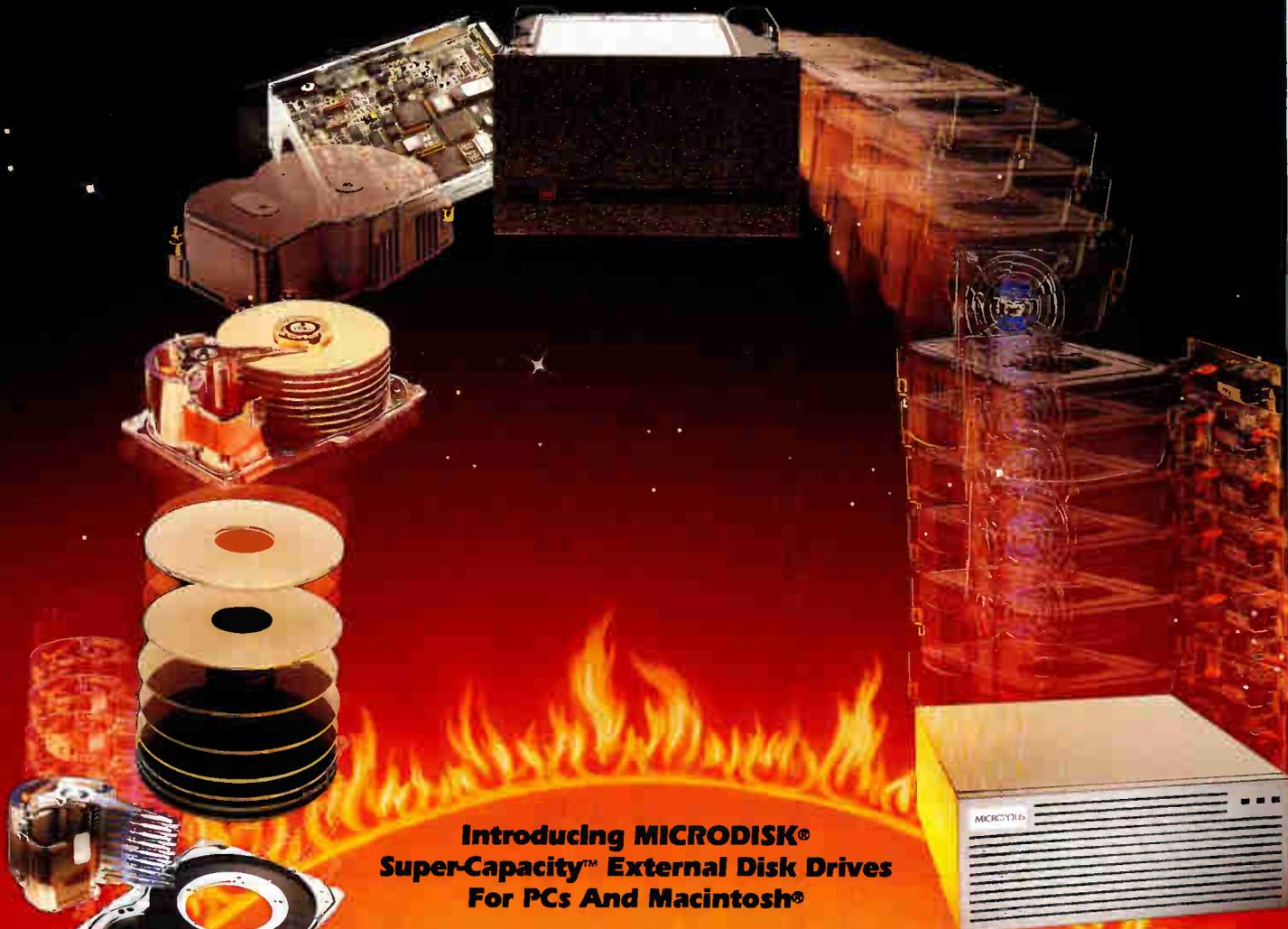
Bob Ryan is a technical editor for BYTE's State of the Art section. You can contact him on BIX as "b.ryan."

Circle 189 on Inquiry Card. —



SUPER CAPACITY

Externalized By Micropolis.



Introducing MICRODISK® Super-Capacity™ External Disk Drives For PCs And Macintosh®

Your criteria for choosing a Super-Capacity disk drive (over 300 MB) are vastly different than for a 40 MB IDE drive.

FACT: High capacity storage demands a higher level of technology in the disk drive, and greater reliability in the subsystem components (i.e. power supply & fan).

Minimizing down-time risk requires that all subsystem components be as reliable as the drive itself.

FACT: Only one company actually builds internal disk drives and delivers Super-Capacity subsystems. Only one: Micropolis.

FACT: For over a decade, Micropolis has designed and built disk drives for the biggest names in the computer business. Now we've applied the same advanced technology that made us a leader in internal drives to our new line of MICRODISK Super-Capacity subsystems.

Quality And Performance From The Inside Out

The heart of every MICRODISK subsystem is a Micropolis HS (High Speed) internal SCSI disk drive, among the world's fastest and most reliable, with effective access times as low as 3.9 milliseconds and an MTBF rating of 17+ years. All MICRODISK drives are UL, CSA & TUV certified and FCC & VDE approved.

MICRODISK Super-Capacity drives are available in formatted capacities of 340 MB, 670 MB, 1.0 GB, 1.34 GB and 1.75 GB. All come complete with a rugged metal enclosure, external SCSI terminator, all necessary SCSI cables, DOS or Mac disk partitioning & formatting software, and easy-to-follow user documentation.

Novell® NetWare Ready™

Our 340 MB and 670 MB (and soon our gigabyte-plus) drives are 100% NetWare Ready, right out of the box!

Super-Capacity Super Warranty

While many companies charge more to extend a warranty past two years, MICRODISK drives come with a full five-year warranty*. Of course, if you ever need help, you'll find a dedicated team of experts ready to solve any application problem pronto! When you need Super-Capacity external storage, remember the one company that builds them from the ground up: Micropolis. The Super-Capacity Experts.

For an authorized reseller near you, call:

1-800-395-3748

MICROPOLIS

21211 Nordhoff Street, Chatsworth, CA 91311
(FAX 818-709-3396)

Pacific HQs VOX-011 886 27608115 FAX-7631654
Europe HQs VOX-011 44-734 751315 FAX-868168

* Limited warranty, restrictions apply. All trademarks and registered trademarks are the property of their respective owners.

IS AMERICA LOSING ITS EDGE?

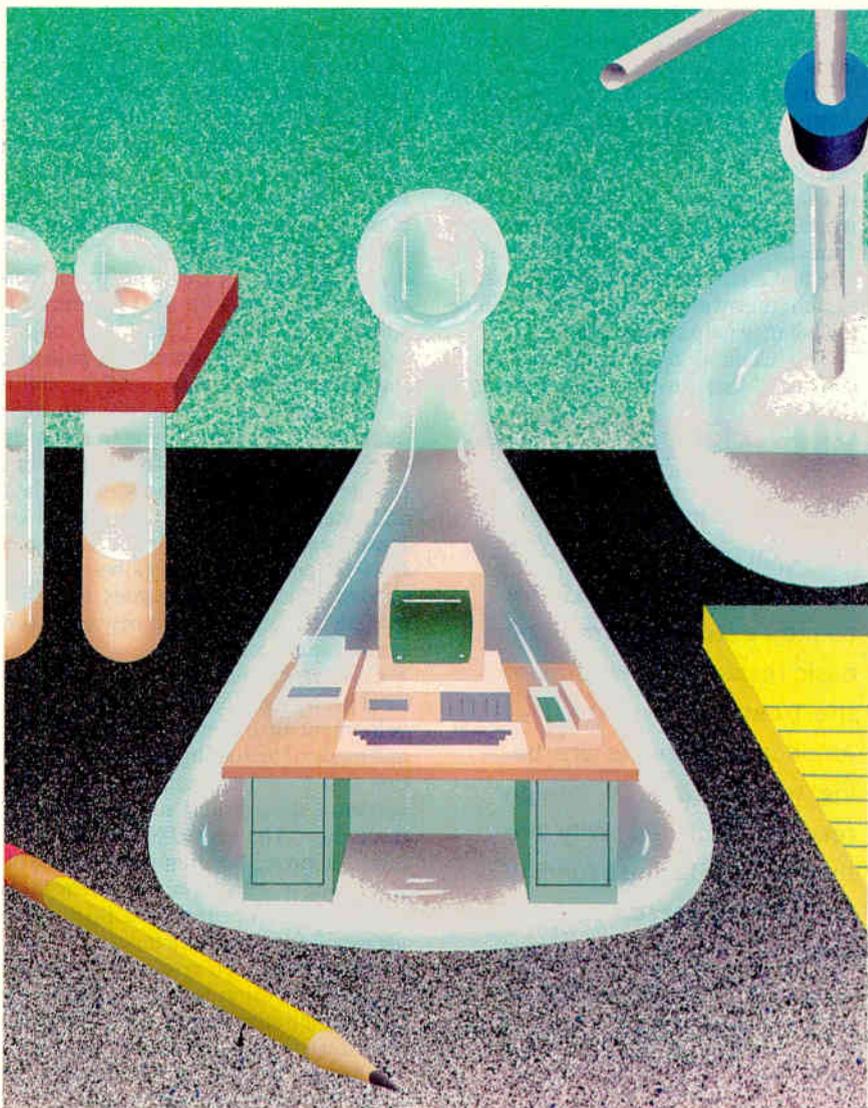
Basic-research labs, long a strong suit for the U.S., are becoming scenes for international competition

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

BYTE ACTION SUMMARY

Even as market leadership in some commercial areas has moved out of the U.S., this country’s strong suit remains basic research. Now some of the best and brightest of America’s scientists are being wooed away by foreign research facilities. Why are they going? Because funding for basic research is available, while U.S. companies lose sight of tomorrow in their quest for today’s dollar.

PC-MOS

The Multiuser DOS Platform For The '90s

The 386 and now the 486 microprocessors have focused a lot of attention on the multiuser, multitasking possibilities of advanced PCs. A myriad of software and hardware manufacturers are promising a new age of multiuser options in the '90s.

But when you take a closer look, only one solution focuses on the features you want and anticipates the capabilities you need to use your PCs to their greatest potential. That solution is PC-MOS™ from The Software Link, the first DOS-compatible, multiuser, multitasking operating system.

A Network Alternative

The advantage to the PC-MOS shared processing solution is its ability to maximize the available memory on your PC, taking full advantage of extended memory and sharing it with up to 25 users on inexpensive terminals or monitors. You can share data with the same speed and integrity of a network solution without the expense of network cards and the waste of under-utilized PCs. And no additional investment is required to get the multitasking capabilities inherent in PC-MOS.

A Network Enhancer

For affordable network expansion, PC-MOS servers can be connected to other servers with The Software Link's LANLink or with the PC-MOS

GATEWAY™ to Novell's NetWare®. This connectivity lets a business configure its automation systems for departmental efficiency and expand affordably as needs grow with LANs or even WANs.

DOS Compatible

The PC-MOS alternative is clear: DOS compatibility means your users can continue to use all the popular software packages. And that means no investment loss, no retraining and no limitations in available applications.

An Unbeatable Solution

The next decade of shared processing will be clouded with choices. Only one operating system was first to offer you DOS-compatible, multiuser, multitasking solutions. Only one operating system continues to provide unbeatable multiuser solutions for over 150,000 users. PC-MOS from The Software Link. Call today and set your computing sights on a more productive horizon.



THE SOFTWARE LINK

1-800-766-LINK

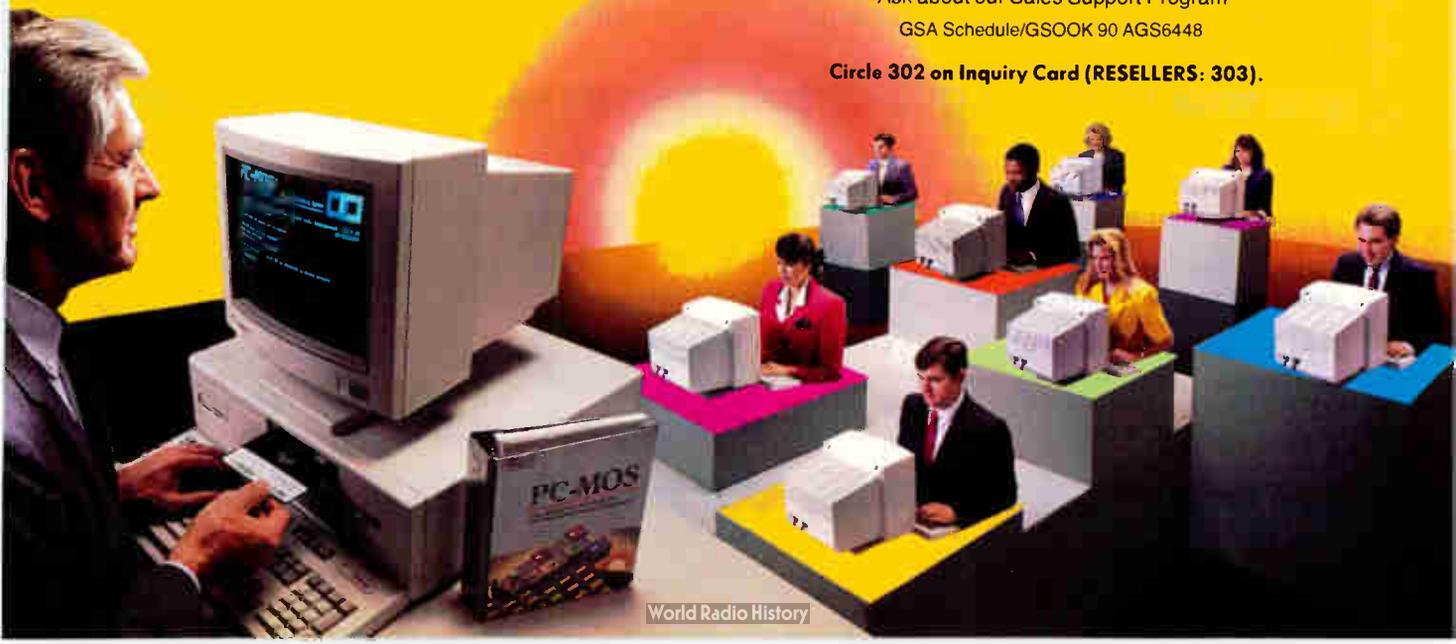
3577 Parkway Lane, Norcross, GA 30092
(404) 448-5465 FAX: (404) 263-6474 TELEX: 4996147 SWLINK

VARS and RESELLERS:
Ask about our Sales Support Program

GSA Schedule/GSOOK 90 AGS6448

Circle 302 on Inquiry Card (RESELLERS: 303).

PC-MOS is a trademark of The Software Link. All other products referenced are trademarks of their respective companies. Prices, policies and specifications subject to change without notice.



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

DATA COMPRESSION LIBRARIES™

PKWARE's® Data Compression Libraries™ allow software developers to add data compression technology to software applications. The application program controls all the input and output of data allowing data to be compressed or extracted to or from any device or area of memory.

- All Purpose Data Compression Algorithm Compresses Ascii or Binary Data Quickly with similar compression achieved by the popular **PKZIP** software, however the format used by the compression routine is completely generic and not specific to the PKZIP file format.
- Application Controlled I/O and memory allocation for extreme flexibility.
- Adjustable Dictionary Size allows software to be fine tuned for Maximum Size or Speed.
- Approximately 35K memory needed for Compression, 12K memory needed for Extraction.
- Compatible with most popular Languages: C, C++, Pascal, Assembly, Basic, Clipper, Etc.
- Works with any 80x86 family CPU in real or protected mode. \$295.00
- No runtime royalties.

RUNNING OUT OF EXPENSIVE DISK SPACE?

PKZIP can help! **PKZIP** compresses your files to free up disk space and reduce modem transfer time. You can compress a single file or entire directory structures with a single command. Compressed files can be quickly returned to their normal size with **PKUNZIP**.

Software developers can reduce the number of diskettes needed to distribute their product by using **PKZIP**. Call for Distribution License information.

The included **PKZIP** utility lets you store compressed files as a single self-extracting .EXE files that automatically uncompresses when run. Only \$47.00



9025 N. Deerwood Dr.
Brown Deer, WI 53223
(414) 354-8699
Fax (414) 354-8559

LET'S MAKE A DEAL

Get Your Quote From
**Zeos • Northgate • Austin
Gateway**



Over the past ten years, 700 agencies and Government contractors bought high quality Iverson computers.

THEN CALL
IVERSON
FOR BETTER

PRICE • SERVICE • QUALITY

Call Today **1-800-444-PC90**

Huge PC product line: 286-386-486

★ ★ ★ **AWARDS** ★ ★ ★

Computer Buyer's Guide & Handbook · Aug '91 · Named the Iverson 286/12 a **BEST BUY**: This machine was typical of the Iversons we've encountered in its overall high quality of construction and glitch-free operation.

PC Sources · Feb '91 · Iverson 486/25: An excellent buy thanks to name-brand components. The documentation is friendly and helpful.

Computer Shopper · July '91 · Iverson 486/25: In operation, Iverson's 486 ran flawlessly [with] good all-around performance.

PC Sources · Dec '90 · Iverson 386SX/20: Iverson offers the right mix of technical and sales advice, a wealth of options, and after-sale support. **Circle 156 on Inquiry Card (RESELLERS: 157).**

**EXPERIENCED
SUPPORT**

**SINCE
1978**

**FINANCIAL
STRENGTH**

**NET
WORTH
(3/31/91)
\$14 million**

P.O. Box 6250 • McLean, Virginia 22106-6250
(703)749-1200 • FAX (703)883-0722

IVERSON COMPUTER CORPORATION

A Subsidiary of

IVERSON TECH

Traded on the AMEX (IVT)

"The research may be theoretical, but it still pursues incremental advances in old, well-established theoretical problems. That can be the easiest way to get funded, because you take fewer risks. All too often, we create our own communities to support our own ideas. We create journals and research groups. And it's easy to conclude we're doing great things because we have this community behind us," Brown explains.

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

Write better programs by doing less

GUI_Master (Program Constructor for C++) now available for MS Windows and for OS/2

If you have to build sophisticated C++ applications for MS Windows or OS/2 PM you can considerably improve your programming throughput both in quantity and in quality by using GUI_Master. This set of tools lessens the burden of writing graphical user interface programs so that you, the developer, can focus on the application parts

• Generate the GUI parts

With the Interface Builder you specify the properties of the visual objects of your program. The Interface Builder then generates the necessary source code, the resource specifications and the make file

• Reuse existing know-how

The Class Tree with over 85 classes contains a wide range of GUI building blocks. Anything that could be accomplished through "normal" programming can be done if you use GUI_Master. It's just a lot easier

• Add functionality

There are features you didn't use to include in your application because they were too complex or time-consuming to program. By using the standard GUI_Master classes you can now easily implement things like color dialogs, font dialogs and multiple level undo/redo facilities

• Stay in control

With the Class Browser you can cross-reference, examine and edit all the code of your applications

• Prerequisites

To use GUI_Master (Program Constructor for C++) you must have a C++2.x compiler and an SDK for the appropriate operating system

• Documentation

Over 1200 pages of detailed, fully indexed class descriptions, method reference etc. are included

• Free code

Seven functional example programs are supplied with code. They give you a head start in building your own Windows or PM programs

• Free support

The first full year support is free for registered users

• Upgrade from CommonView or XVT

Special discount available for current CommonView or XVT users. Write or fax for details

Vleermuis Software Research bv

P.O. Box 2584
3500 GN Utrecht
The Netherlands

Fax: Intl. +31 30 31 04 26
Phone: Intl. +31 30 32 49 44

Name

Company name

Street

City State Zip

Country

Pay by certified cheque or  

Cardno. Exp.date

OS/2 PM US \$ 495.= MS-Windows US \$ 545.=

Zortech 2.1x Glockenspiel 2.x Borland C++

All product names are registered trademarks of their respective manufacturers

More Computing Know How

Get the most from your computer—our books show you how.

DOS 5.0

An encyclopedia of practical information for every computer user. Highly detailed explanations make this the most authoritative DOS reference book available. The friendly, easy to understand writing style insures that even beginners will grasp the fundamentals quickly and easily. The valuable companion disk contains dozens of practical batch files, detailed explanations and powerful tips and tricks to help you get the most out of MS-DOS 5.0. 864 pages with companion disk.

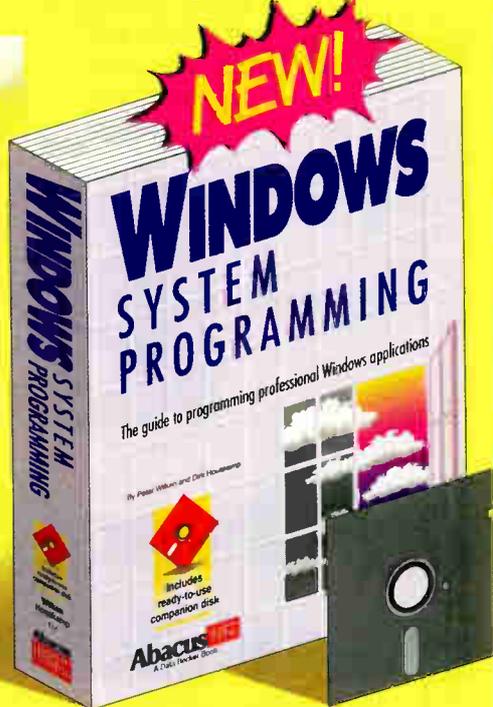
#B109 ISBN 1-55755-109-X \$34.95*



Windows System Programming

The bible for Windows programmers. Includes the tools you need to program professional applications for operation under Windows. Contains sample applications with exhaustive documentation and background information with programming examples in C. Topics include: Using GDI, bitmaps and the color palette manager; using DDE (Dynamic Data Exchange) between applications; Windows memory management; the DDL (Dynamic Link Libraries) concept and much more. 800 pages with companion diskette.

#B116 ISBN 1-55755-116-2 \$39.95*



PC Assembly Language: Step by Step

Teaches you PC assembly and machine language from the ground up. You'll learn at your own pace using the unique simulator which shows you how each instruction works as the PC executes it. 420 pages with 2 companion disks. Also includes evaluation versions of A86 Assembler and D86 Debugger.

#B096 ISBN 1-55755-096-4 \$34.95



PC System Programming

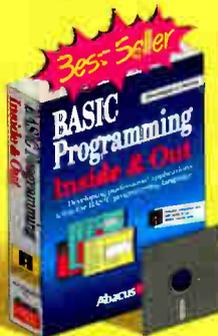
An encyclopedia of PC technical and programming knowledge. Features parallel working examples written in Pascal, C, Assembly and BASIC. Explains how to use extended and expanded memory, hard disks, PC ports, mouse drivers, graphics and sound. Also explains memory layout, DOS operations, fundamentals of BIOS and TSR programs. Includes complete appendices. 920 pages and 2 companion disks with over 1 mb of programs.

#B036 ISBN 1-55755-036-0 \$59.95*

BASIC Programming: Inside & Out

In-depth coverage for all BASIC. QuickBASIC, GW-BASIC and Turbo BASIC programmers. Explains how to use sound and graphics; create help screens and pulldown menus; manage windows in BASIC; use ML with BASIC; create business presentation graphics; print multiple columns and side-ways for professional results and program serial and parallel interfaces. Has dozens of demo programs and routines you can easily adapt to your own programs. 600 pages with companion disk.

#B084 ISBN 1-55755-084-0 \$34.95



In US & Canada Order Toll Free 1-800-451-4319 EXT. 29

For fast delivery Order Toll Free 1-800-451-4319 ext. 29, or FAX (616) 698-0325

Yes, please rush the following items Yes, please rush your free PC catalog
Apply to my: Visa Master Card Am. Express / I have enclosed a check / M.O.

___ PC Assembly Language Step by Step \$34.95 ___ PC System Programming \$59.95
___ BASIC Programming Inside & Out 34.95 ___ Windows System Programming 39.95
___ DOS 5.0 Complete 34.95

In US and Canada add \$5.00 Postage and Handling. Foreign orders add \$13.00 postage per book.

*Foreign orders outside North America add \$30.00 per book.

Card#: _____ Expires: _____

Signature: _____

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone#: _____

Available at B Dalton Booksellers, Waldensoftware, and Software Etc. and at other bookstores nationwide.
In the UK contact Computer Bookshops 021-706-1188.

Abacus

Dept. B9, 5370 52nd Street SE, Grand Rapids, MI 49512

Orders: 1-800-451-4319 • Phone: (616) 698-0330 • Fax: (616) 698-0325

In US and Canada add \$5.00 Postage and Handling. Foreign orders add \$13.00 postage per book.
We accept Visa, Master Card or American Express. Call or write for your free catalog of PC Books.

Circle 10 on Inquiry Card (RESSELLERS: 11)

World Radio History

Dept B9

NETWORKING WITHOUT THE COST OF CABLES

Let us show you how CarrierNET can make printer sharing, file transfer and E-mail, fast, affordable and best of all "cableless." Don't pay for unnecessary cables in your walls and ceilings. Call us today!

- Installs in minutes
- Moveable in seconds
- Perfect for portables
- "Pop-up" menus
- Toll free technical support

Only **\$199**

CARRIER CURRENT
TECHNOLOGIES INC
6505 Pharr Mill Rd.
Harrisburg, NC 28217
1-800-222-0377

DEALER INQUIRIES WELCOME

CARRIERNET

30 DAY MONEY BACK GUARANTEE

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."

PUT dBASE® ON TOP

Dr. Switch-ASE puts dBASE on top. On top of the charts, spreadsheets, word processors or on top of DOS. Right where it belongs, on top of any graphics or text program when you need it. Neatly tucked away when you don't. Dr. Switch-ASE turns any dBASE language program into a 16-20K RAM resident program. So now you can have dBASE power at the touch of a key, anywhere, anytime and from any program.

dBASE TSR's, easy as ASE

With Dr. Switch-ASE you don't have to be an Assembly language whiz or a C code maven to create TSR's. The Doctor includes an integrated cut & paste feature for transferring data between programs. It also supports both Expanded and Extended memory and is fully network compatible.

The doctor speaks your language

Dr. Switch-ASE supports all of the dBASE dialects. So it works directly from Clipper, dBASE III PLUS, dBASE IV, FoxBASE + and FoxPro. No need to learn a new dBASE syntax and no new environments to wrestle with.

When the doctor's in, dBASE is on top.

Call and place your order today!
212-787-6633

DR. SWITCH-ASE
\$179.95*



Black & White International Inc.
PO Box 1040
Planetarium Station
New York, NY 10024-0541

Dr. Switch, Dr. Switch-ASE, Dr. Switch OnCall and Dr. Switch TSMR are trademarks of Black & White International, Inc. All others are trademarks or registered trademarks of their respective holders.

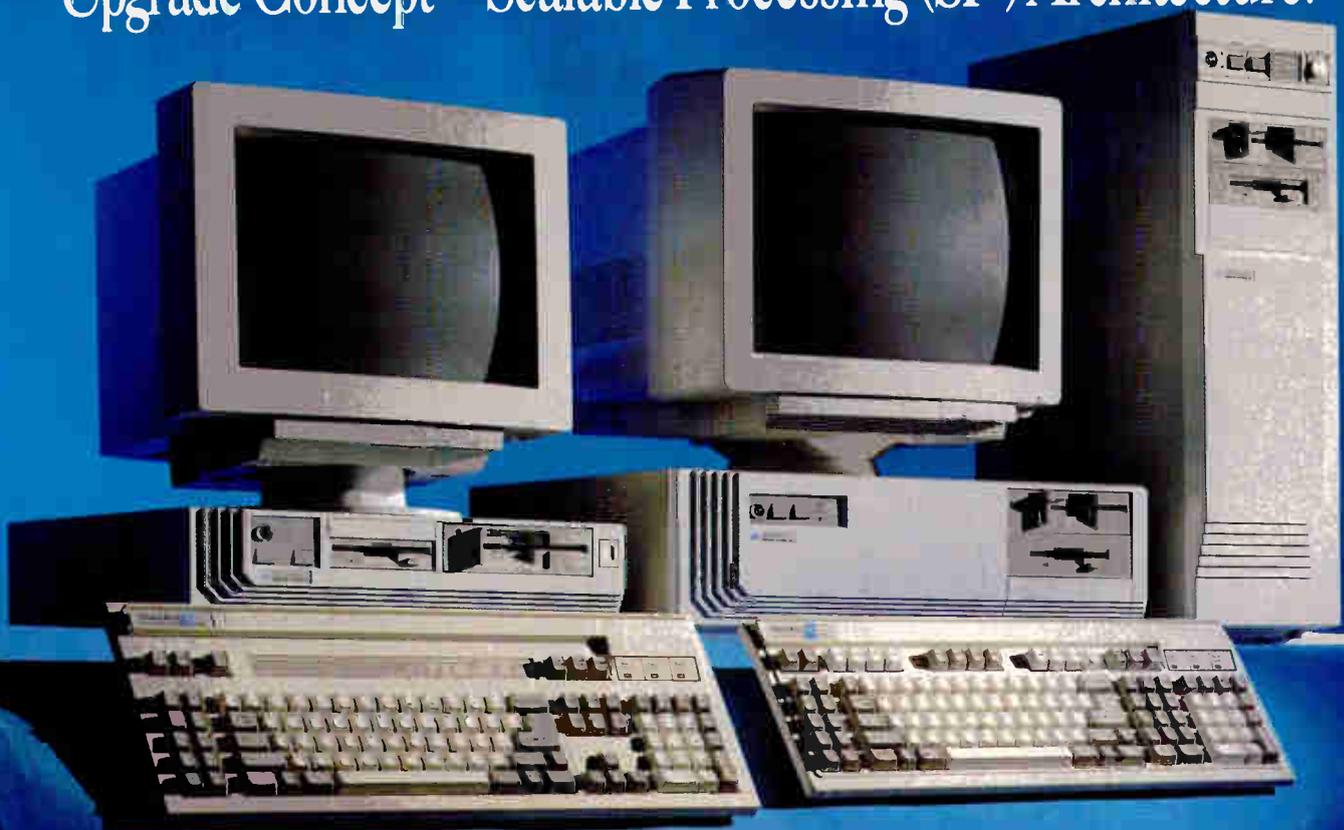
*E-tus Shipping/Handling: U.S. orders add \$6.00 for 2nd Day Air, \$3.00 for Ground. Canadian and Foreign orders add \$8.00. COD add \$3.50. NY residents add sales tax. All payments U.S. funds/U.S. Banks only!

† Includes royalty-free runtime version.



Suddenly, Obsolescence Is Obsolete!

Now! Northgate® Brings You The Only Affordable Upgrade Concept – Scalable Processing (SP™) Architecture!



How many computers do you see here? Three? Guess again.

These platforms represent FIFTEEN new high-performance Northgate SP systems! Every one of these systems is field upgradable to faster processing speeds by simply replacing one power module. It's easy — you can even do it yourself!

Northgate brings you this technology for a fraction of the price others charge for upgrades. Skeptical? Look!



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

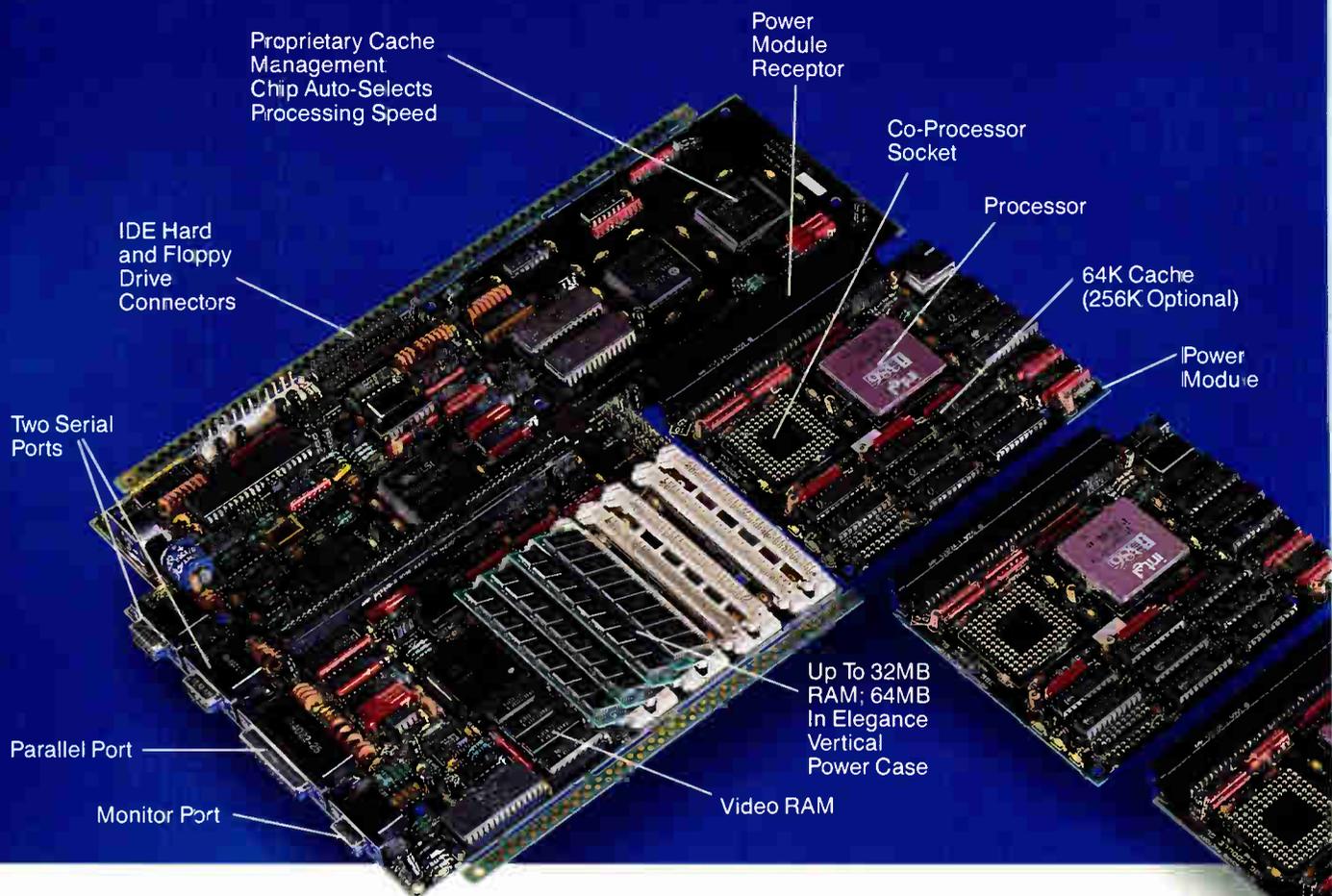


Upgrade to 486SX/20:
send us your 386/25
module and ONLY \$749⁰⁰



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

SlimLine SP Platform..... **\$1899.00**

Elegance Desktop SP Platform..... **\$2199.00**

Elegance Vertical Power SP Platform..... **\$2349.00**

Charge it to your Big 'N' Credit Card Or Lease It At Low Monthly Rates!

CALL TOLL-FREE 24 HOURS EVERY DAY 800-345-8709

Major corporations, volume purchasers and government agencies call **National Business Accounts: 800-545-6059**

Fax your order! **800-323-7182**

Notice to Hearing Impaired: Northgate has TDD capability. Dial 800-535-0602.



"Smart Tools For Business"™
7075 Flying Cloud Drive, Eden Prairie, MN 55344

See Us At
Fall Comdex!
Booth #S2286
At The Sands

Two Main System Boards... Three Cabinet Styles... Five Power Modules. Northgate Gives You The Choice Of 15 Upgradable New Systems!

© Copyright Northgate Computer Systems, Inc. 1991. All rights reserved. Northgate, SlimLine, OmniKey and the Northgate TV logo are trademarks or registered trademarks of Northgate Computer Systems. 80496 is a trademark of Intel. All other products and brand names are trademarks or registered trademarks of their respective companies. Prices and specifications subject to change without notice. Northgate reserves the right to substitute components of equal or greater quality or performance. All items subject to availability. We support the ethical use of software. To report software copyright violations, call the Software Publishers Association Anti-Piracy Hotline at 1-800-386-9881. * ALR, AST and Dell prices quoted May 14, 1991. † Price dependent on market conditions and price at time of upgrade.

Developers: Lock Up Your Profits

Windows 3.0
Support Available

We have the key for protecting your software profits and your copyright.

Software piracy's a crime! What it can do to a developer's profit margin is shameful. The cost of development and marketing products demands you receive the revenue you are entitled to.

We have the solution.

- Custom hardware and software for each developer
- Encrypted interrogation routines and debug disablers. Over 140 language interfaces available.
- Available active read/write memory and on-board microprocessor provide the ultimate protection
- Keys for PC "compatibles," Macintosh, UNIX and RS-232C standard
- Total compatibility, reliability and end user satisfaction

We have the key.
Call us for more information
or a demonstration package.

1-800-843-0413



In EUROPE:
MICROPHAR, 122 Ave. Ch. De Gaulle 92200,
Neuilly-Sur-Seine, FRANCE, Tel: 33-1-47-38-21-21 Fax: 33-1-46-24-76-91

For Distributors in:

- * BELGIUM, E2S (091 21 11 17)
- * GERMANY, AUSTRIA: Microphar Gmbh (06223 - 73730)
- * HUNGARY, Polyware Kit (76-22-307)
- * ITALY, Siosistemi (030 24 21 074)
- * PORTUGAL, HCR (1 56 18 65)
- * SCANDINAVIA, Microphar Nordic (45 53 51 70 33)
- * SPAIN, Hal 2000 (032 37 31 05)
- * SWITZERLAND, SAFE (024 21 53 86)
- * THE NETHERLANDS, Infotic (015 15 88 37)
- * UNITED KINGDOM, Clearsoft (091 378 91 91)

PROTECH
MARKETING, INC

9600-J Southern Pine Blvd.
Charlotte, NC 28217

Tel: 704-523-9500 FAX: 704-523-7651

Hours: Mon-Thurs: 8:30-7:00, Fri: 8:30-5:30 ET

Open late to better serve our west coast clients.

Se Habla Español

For Europe, circle 256 on Inquiry Card.

For America & Pacific, circle 257 on Inquiry Card.

Office Automation Software

The office of the future will be driven by software that lets people work together efficiently and effectively. The following companies provide office automation software for a variety of platforms, including MS-DOS, Macintosh, and Unix.

AFCAD Systems, Inc.

51 Cragwood Rd.
South Plainfield, NJ 07080
(908) 769-7400
fax: (908) 769-7403
Circle 1168 on Inquiry Card.

Applied Digital Data Systems, Inc.

100 Marcus Blvd.
P.O. Box 18001
Hauppauge, NY 11788
(800) 388-2337
(516) 231-5400
fax: (516) 231-7378
Circle 1169 on Inquiry Card.

Applix, Inc.

112 Turnpike Rd.
Westborough, MA 01581
(508) 870-0300
fax: (508) 366-9313
Circle 1170 on Inquiry Card.

AT&T Computer Systems

100 Southgate Pk wy.
Morristown, NJ 07960
(800) 247-1212
(201) 898-8000
fax: (201) 644-9768
Circle 1171 on Inquiry Card.

Blake Technologies, Inc.

10 Park Place
P.O. Box 440
Butler, NJ 07405
(201) 492-5060
fax: (201) 492-2740
Circle 1172 on Inquiry Card.

Bull HN Information Systems, Inc.

2 Wall St.
Technology Park
Billerica, MA 01821
(508) 294-6000
fax: (508) 671-3635
Circle 1173 on Inquiry Card.

Computron Technologies Corp.

301 Route 17 N
Rutherford, NJ 07070
(800) 828-7660
(201) 935-3400
fax: (201) 935-6355
Circle 1174 on Inquiry Card.

Customized Software Support

5839 Willow Crest Dr.
Pinson, AL 35126
(205) 681-2115
Circle 1175 on Inquiry Card.

DataBased

15 Donore Sq.
San Antonio, TX 78229
(512) 342-8687
fax: (512) 342-1710
Circle 1176 on Inquiry Card.

Data General Corp.

4400 Computer Dr.
Westborough, MA 01580
(800) 328-2436
(508) 366-8911
fax: (508) 366-1299
Circle 1177 on Inquiry Card.

Datapoint Corp.

8400 Datapoint Dr.
San Antonio, TX 78229
(800) 334-9968
(512) 699-7000
fax: (512) 699-7920
Circle 1178 on Inquiry Card.

Decathlon Data Systems

P.O. Box 17940
Boulder, CO 80308
(303) 440-9000
fax: (303) 440-9099
Circle 1179 on Inquiry Card.

Deerfield Systems, Inc.

221 Elizabeth St.
Utica, NY 13501
(800) 356-8170
(315) 797-1805
fax: (315) 733-7494
Circle 1180 on Inquiry Card.

Digital Equipment Corp.

146 Main St.
Maynard, MA 01754
(508) 493-5111
fax: (508) 493-8780
Circle 1181 on Inquiry Card.

DPEC, Inc.

1679 Old Henderson Rd.
Columbus, OH 43220
(800) 223-3732
(614) 457-0577
fax: (614) 457-1105
Circle 1182 on Inquiry Card.

East Hampton Industries, Inc.

81 Newtown Lane
P.O. Box 5069
East Hampton, NY 11937
(800) 645-1188
(516) 324-2224
fax: (516) 324-2248
Circle 1183 on Inquiry Card.

EDP System Services, Inc.

19905 Scriber Lake Rd.
Lynnwood, WA 98036
(800) 827-4055
(206) 771-3796
fax: (206) 778-3702
Circle 1184 on Inquiry Card.

Enable Software, Inc.

Northway 10 Executive Park
Ballston Lake, NY 12019
(800) 888-0684
(518) 877-8600
fax: (518) 877-5225
Circle 1185 on Inquiry Card.

Evolution 1, Inc.

6727 North Black Canyon Hwy.
Phoenix, AZ 85015
(602) 433-2600
fax: (602) 433-2603
Circle 1186 on Inquiry Card.

Financial Technologies, Inc.

555 Willow Ave.
Cedarhurst, NY 11516
(516) 569-5767
fax: (516) 295-0348
Circle 1187 on Inquiry Card.

Gilbert & Associates, Inc.

875 Via de la Paz
Pacific Palisades, CA 90272
(213) 454-7679
fax: (213) 459-3544
Circle 1189 on Inquiry Card.

Hewlett-Packard Co.

3000 Hanover St.
Palo Alto, CA 94304
(800) 752-0900
(415) 857-1501
Circle 1190 on Inquiry Card.

IBM Corp.

Old Orchard Rd.
Armonk, NY 10504
(800) 426-2468
(914) 765-1900
Circle 1191 on Inquiry Card.

ICL Business Systems

9801 Muirlands Blvd.
Irvine, CA 92718
(714) 458-7282
fax: (714) 458-6257
Circle 1192 on Inquiry Card.

IIS Technologies, Inc.

275 Matheson Blvd. E
Mississauga, Ontario,
Canada L4Z 1X8
(800) 263-9673
(416) 890-2773
fax: (416) 890-6789
Circle 1193 on Inquiry Card.

Impact Software

12140 Central Ave., Suite 133
Chino, CA 91710
(714) 590-8522
fax: (714) 590-7161
Circle 1194 on Inquiry Card.

Information Management Consultants, Inc.

7915 Westpark Dr.
McLean, VA 22102
(703) 893-3100
fax: (703) 893-3489
Circle 1195 on Inquiry Card.

Inner Media, Inc.

60 Plain Rd.
Hollis, NH 03049
(800) 962-2949
(603) 465-3216
fax: (603) 465-7195
Circle 1196 on Inquiry Card.

Inteck, Inc.

720 South Colorado Blvd.,
Suite 820
Denver, CO 80222
(303) 759-5511
fax: (303) 758-8011
Circle 1197 on Inquiry Card.

JAM Software USA

P.O. Box 4036
Meridien, CT 06450
(203) 630-0055
Circle 1198 on Inquiry Card.

LANshark Systems, Inc.

6502 East Main St.
Reynoldsburg, OH 43068
(614) 866-5553
fax: (614) 866-4877
Circle 1199 on Inquiry Card.

Lodestar Systems, Inc.

1420 North Claremont Blvd.,
Suite 102A
Claremont, CA 91711
(714) 625-7961
fax: (714) 625-7968
Circle 1200 on Inquiry Card.

RESOURCE GUIDE

Logical Technology, Inc.
P.O. Box 3655
5113 North Executive Dr.
Peoria, IL 61614
(800) 373-6742
(309) 689-2900
fax: (309) 689-2911
Circle 1201 on Inquiry Card.

Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
(617) 577-8500
fax: (617) 693-1299
Circle 1202 on Inquiry Card.

MarketCorp Systems
285 Riverside Ave.
Westport, CT 06880
(203) 222-6677
fax: (203) 222-5872
Circle 1203 on Inquiry Card.

Mediline Service Corp.
1736 East Sunshine, Suite 215
Springfield, MO 65804
(417) 882-5516
fax: (417) 883-2711
Circle 1204 on Inquiry Card.

Metz Software
4018 148th Ave. NE
Redmond, WA 98052
(800) 767-6292
(206) 641-4525
fax: (206) 867-9089
Circle 1205 on Inquiry Card.

Micro Perfect Corp.
225 West 34th St.
New York, NY 10122
(212) 629-6082
fax: (212) 629-8578
Circle 1206 on Inquiry Card.

Mitratech, Inc.
9763 West Pico Blvd., Suite 300
Los Angeles, CA 90035
(213) 785-0081
fax: (213) 785-6644
Circle 1207 on Inquiry Card.

**Mitsubishi Electronics
America, Inc.**
Office Automation Division
5757 Plaza Dr.
P.O. Box 6007
Cypress, CA 90630
(714) 220-2500
fax: (714) 220-2731
Circle 1208 on Inquiry Card.

Motorola Commercial Systems
10700 North De Anza Blvd.
Cupertino, CA 95014
(800) 556-1234, ext. 165
(408) 366-4000
fax: (408) 366-4402
Circle 1209 on Inquiry Card.

**Myrick Computer
Services, Inc.**
1250 Tower Lane
Erie, PA 16505
(800) 854-3709
(814) 455-6610
fax: (814) 455-7701
Circle 1210 on Inquiry Card.

NEC America, Inc.
Data and Video Communication
Systems Division
110 Rio Robles
San Jose, CA 95134
(800) 222-4632
(408) 433-1250
Circle 1211 on Inquiry Card.

**Office Automation
Systems, Inc.**
9940 Barnes Canyon Rd.
San Diego, CA 92121
(619) 452-9400
fax: (619) 452-2427
Circle 1213 on Inquiry Card.

On Technology, Inc.
155 Second St.
Cambridge, MA 02141
(617) 876-0900
fax: (617) 876-0391
Circle 1214 on Inquiry Card.

Palsoft
4455 South Padre Island Dr.,
Suite 43
Corpus Christi, TX 78411
(512) 854-8788
fax: (512) 853-1541
Circle 1215 on Inquiry Card.

Power Up Software Corp.
2929 Campus Dr.
P.O. Box 7600
San Mateo, CA 94403
(800) 851-2917
(415) 345-5900
fax: (415) 349-1356
Circle 1216 on Inquiry Card.

Prime Computer, Inc.
Prime Pkwy.
Natick, MA 01760
(508) 655-8000
Circle 1217 on Inquiry Card.

**Russell Information
Sciences, Inc.**
25201 Paseo de Alicia, Suite 111
Laguna Hills, CA 92653
(714) 768-5000
fax: (714) 768-3120
Circle 1218 on Inquiry Card.

Sandata, Inc.
48 Harbor Park Dr.
Port Washington, NY 11050
(800) 544-7263
(516) 484-0700
fax: (516) 484-6084
Circle 1219 on Inquiry Card.

Sidereal Corp., Inc.
2200 Wilson Blvd., Suite 307
Arlington, VA 22201
(703) 525-6200
fax: (703) 525-6308
Circle 1220 on Inquiry Card.

**Software Business
Applications, Inc.**
2137 South Lombard Ave.
Chicago, IL 60650
(708) 863-4020
fax: (708) 863-0044
Circle 1250 on Inquiry Card.

Software Design & Consulting
10012 West Capital Dr.,
Suite 209
Milwaukee, WI 53222
(414) 461-1222
fax: (414) 461-9917
Circle 1251 on Inquiry Card.

Software Solutions, Inc.
1688 Hwy. 29 S
Lawrenceville, GA 30244
(404) 418-2000
fax: (404) 962-0778
Circle 1252 on Inquiry Card.

SOLVEware Systems, Inc.
2323 West Fifth Ave.
Columbus, OH 43204
(614) 488-1891
fax: (614) 488-4686
Circle 1253 on Inquiry Card.

SouthWare Innovations, Inc.
555 Stage Rd.
P.O. Box 2797
Auburn, AL 36831
(800) 547-4179
(205) 821-1108
fax: (205) 821-1146
Circle 1254 on Inquiry Card.

Stained Glass Software, Inc.
750 Sylvan Ave., Suite 34
Mountain View, CA 94041
(415) 968-5000
fax: (415) 968-0113
Circle 1255 on Inquiry Card.

Supermicro Business Systems
P.O. Box 802251
Houston, TX 77280
(713) 465-6375
Circle 1256 on Inquiry Card.

Supertime, Inc.
2025 Sheppard Ave. E.,
Suite 2206
Willowdale, Ontario,
Canada M2J 1V7
(416) 499-3288
fax: (416) 492-9192
Circle 1257 on Inquiry Card.

Systems Solutions, Inc.
2001 West Camelback Rd.,
Suite 400
Phoenix, AZ 85015
(800) 232-0026
(602) 242-2929
fax: (602) 242-4747
Circle 1258 on Inquiry Card.

Target Systems Corp.
33 Boston Post Rd. W
Marlborough, MA 01752
(800) 232-3493
(508) 460-9206
fax: (508) 481-9187
Circle 1259 on Inquiry Card.

Unisys Corp.
P.O. Box 500
Blue Bell, PA 19424
(215) 542-2239
Circle 1260 on Inquiry Card.

Voyager Systems, Inc.
35 Constitution Dr.
Bedford, NH 03102
(800) 634-1966
(603) 472-5172
fax: (603) 472-8897
Circle 1261 on Inquiry Card.

Wang Laboratories, Inc.
1 Industrial Way
Lowell, MA 01851
(800) 835-9264
(508) 459-5000
Circle 1262 on Inquiry Card.

WordPerfect Corp.
1555 North Technology Way
Orem, UT 84057
(800) 321-4566
(801) 225-5000
fax: (801) 222-4477
Circle 1263 on Inquiry Card.

Inclusion in the resource guide should not be taken as a BYTE endorsement or recommendation. Likewise, omission from the guide should not be taken negatively. The information here was believed to be accurate at the time of writing, but BYTE cannot be responsible for omissions, errors, or changes that occur after compilation.

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

USA: 125-127 North 4th Street Philadelphia, PA 19106 USA Tel 800/536-ELEX Fax 215/627-2342
EUROPE: 65, Rue de Lausanne 1202 Geneva Switzerland Tel + 41-22-738.11.88 Fax + 41-22-738.11.90

Trademarks: DOS, OS/2, Microsoft Corp; NetWare, Novell, Inc.; UNIX, SCO Corp; AS/400, IBM Corp; VAX/VMS, Digital Equip. Corp.

Circle 108 on Inquiry Card.

InfoWorld And *BYTE* Readers Go To The "Polls." Both Agree...

Northgate® Elegance™ 486/33 Voted "Desktop Computer Of The Year"!



See Us At
Fall Comdex!
Booth #S2286
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"!

"A sure winner in its class," raved *PC Magazine*. The editors just couldn't say enough great things: "Clear documentation, excellent service policies, top name components and fine performance."††



When Industry Experts And Users Speak Out, Northgate Gets The Vote!

There are two different kinds of Northgate buyers: (1) The repeat customer who knows he'll receive first rate treatment from Northgate and doesn't hesitate buying again and again; (2) The first time buyer who calls Northgate because he just hasn't found the right vendor despite all his shopping and comparing.

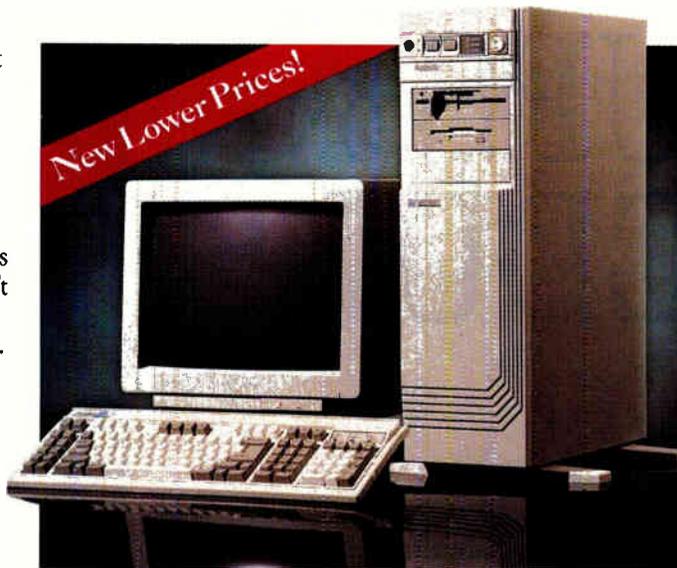
At Northgate, the search ends. And it ends with the buyer finding what he truly wants. A company that cares for him. Who won't let him down no matter what. When Northgate makes a commitment, you can count on it. We deliver!

"Northgate stops at nothing to please its customers."* Sounds like a company slogan, doesn't it? But we didn't say it; *PC Magazine* did! In their "Service and Reliability Survey," the editors also said: "Northgate is the hands-down winner when it comes to customer loyalty."*

We don't just build computers, we build trust. To earn your business, we work harder. Smarter. Longer. In fact, our 24-hour, 7-day-a-week toll-free technical support inspired Dr. Jerry Pournelle to call it: "the standard other mail order computer companies must match."**

We were the first to offer free overnight shipment of replacement parts — more proof that your needs come first at Northgate. Of course, our systems are backed by a full one-year parts/labor warranty; 5 years on *OmniKey*® keyboards.

The nation's largest computer repair service company with 5,000 technicians now serve you from over 400 locations. On site service is FREE for one year!



Elegance 486/33
4MB Base System Prices Start From Only:
\$394900 Or as low as \$120⁰⁰ per month †

Elegance 486/25
4MB Base System Prices Start From Only:
\$324900 Or as low as \$100⁰⁰ per month †

Elegance 386/33
1MB Base System Prices Start From Only:
\$189900 Or as low as \$60⁰⁰ per month †

Elegance 386/25
1MB Base System Prices Start From Only:
\$169900 Or as low as \$55⁰⁰ per month †

From your very first phone call to Northgate ... you'll know you're dealing with a company that forever puts you first!

Use Elegance RISK FREE for 30 days! If your Northgate doesn't get your vote, we'll buy it back at full price. No questions asked!

Northgate Elegance Base System Features:

- ◆ Intel® 486/33 MHz processor
- ◆ 64K SRAM read/write-back cache
- ◆ 4MB RAM (1MB RAM on 386 Base System); expands to 8MB on motherboard; 16MB total RAM with 32-bit memory card
- ◆ 1.44MB 3.5" floppy drive (1.2MB 5.25" optional)
- ◆ Weitek® coprocessor support
- ◆ One 32-bit, six 16-bit and one 8-bit slots
- ◆ One parallel and two serial ports
- ◆ Desktop case with 200 watt power supply OR optional Vertical Power case with 220 watt power supply
- ◆ Award-winning *OmniKey* keyboard
- ◆ Hercules compatible monochrome video adapter
- ◆ MS-DOS 3.3 or 4.01 with GW-BASIC or MS-DOS Version 5 with QUICKBasic installed
- ◆ Microsoft® Windows™ and mouse on systems with 2MB RAM or more
- ◆ FCC Class B certified; Novell certified

Design your own configuration! Northgate's award-winning 486/33 and 25 MHz systems come in a wide range of configurations to suit your particular needs. Add hard drives — 40MB, 80MB, 100MB, 200MB, 300MB, 600MB, 1.2GB. Monitors — 14" VGA Mono or Color, 14" SVGA, 16" SVGA, 19" VGA. Also available is our Award-Winning Elegance line of 386/33 and 25 MHz systems. Call Northgate for specifics!

Call Toll-Free 24 Hours Every Day
800-345-8709

Major corporations, volume purchasers and government agencies call **800-545-6059**
National Business Accounts:
FAX your order! 800-323-7182

Notice to the hearing impaired: Northgate has TDD capability. Dial 800-535-0602.

Call For More Information On Our 486/33 And 486/25 EISA Systems!



"Smart Tools For Business"™
7075 Flying Cloud Drive, Eden Prairie, MN 55344

© Copyright Northgate Computer Systems, Inc. 1991. All rights reserved. Northgate, OmniKey, Elegance and the Northgate "N" logo are registered trademarks of Northgate Computer Systems. 80486 is a trademark of Intel. All other products and brand names are trademarks and registered trademarks of their respective companies. Prices and specifications subject to change without notice. Northgate reserves the right to substitute components of equal or greater quality or performance. All items subject to availability. We support the ethical use of software. To report software copyright violations, call the Software Publishers Association's Anti-Piracy Hotline at 1-800-388-3838. † When charged to your Northgate Big "N" card: 18% A.P.R. * PC Magazine, September 25, 1990. ** Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also owns a considerable living writing about computers present and future. BT7E magazine, July, 1989. † PC Magazine, February 12, 1991.

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.

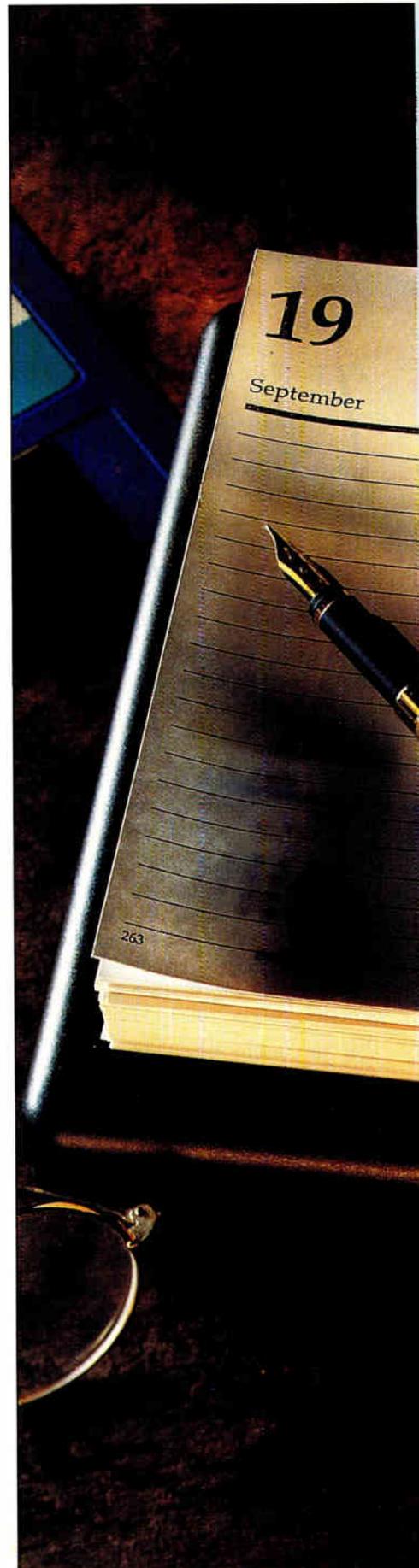
This month, the BYTE Lab examines group-meeting schedulers for Macintosh, PC, and Unix clients. These packages help resolve scheduling conflicts for both people and resources. (See the table for a list of key features.)

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

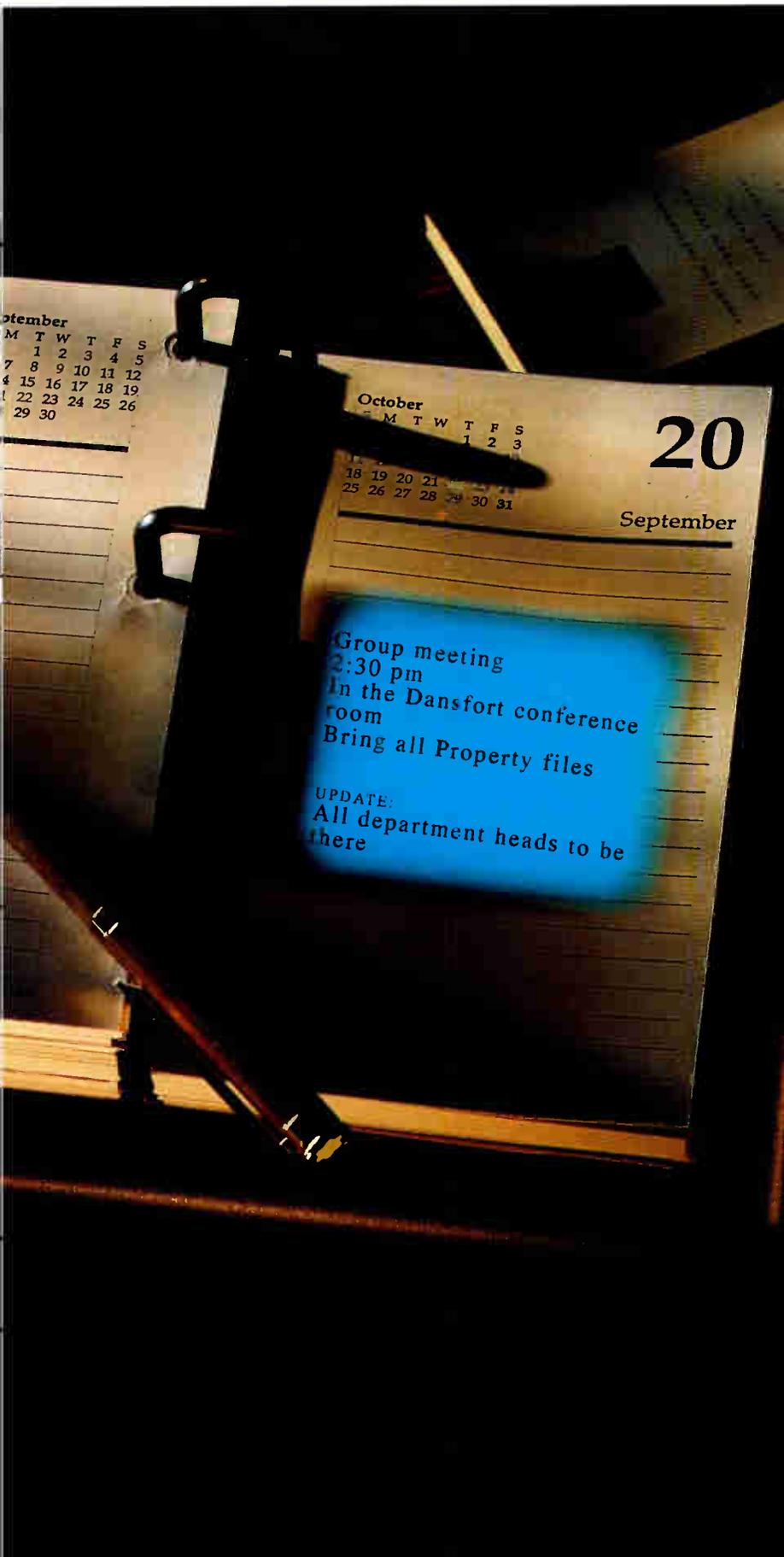
Planisoft is the only choice if you have Mac and PC clients. For PC LANs, CaLANdar, Higgins, and Right Hand Man II are all good choices. We recommend Meeting Maker for Mac-only LANs.

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

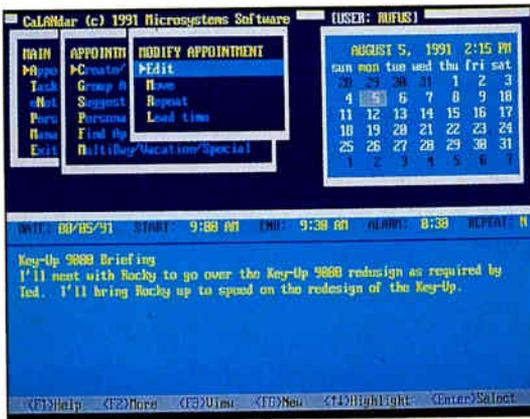
Unix systems, which already have some built-in multiuser applications, including E-mail and a calendar program that lets you send yourself E-mail reminders. Programs like the calendar manager included with Sun's Open Windows Desktop applications bundle carry forward this idea. For *true* group-scheduling 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.

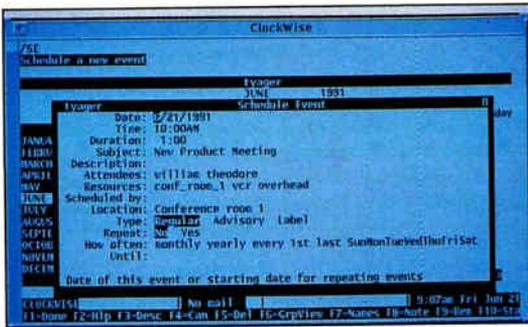
CaLANdar suggests times for group meetings. You choose the participants, resources, meeting length, and range of acceptable dates. CaLANdar then looks through everyone's schedule until it

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

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

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-

WHY SOFTWARE COMPANIES ARE CHOOSING HARDLOCK™

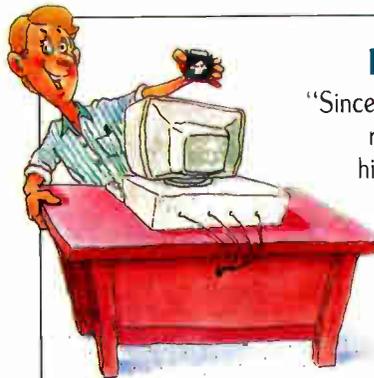


Actual size shown.

Hardlock — programmable, algorithmic response and memory option — all in one

GLENCO ENGINEERING INC.
SERVING THE SOFTWARE INDUSTRY SINCE 1979

270 Lexington Drive
Buffalo Grove, Illinois 60089-6930
(708) 808-0300 FAX 808-0313
1-800-562-2543

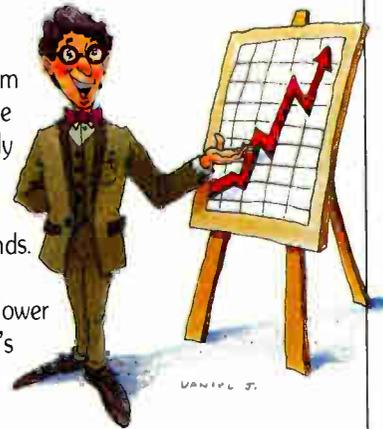


Developers Say . . .

"Since the Hardlock uses an algorithmic response chip, I am assured of the highest level of protection. Also, the optional programmable memory means I can keep custom configurations in Hardlock rather than in a file. I can protect my .EXE or .COM files directly and/or incorporate Glenco's high level language interface routines into my software. And, I feel confident I'll have Glenco's support if I use other programming languages."

Accountants Say . . .

"Hardlock provides our company with a healthier bottom line. Since our software can't be copied, our revenue has steadily increased. The unique programming board allows us to program the Hardlock in seconds. This ensures optimum delivery schedules from Glenco and a lower inventory cost for us. Hardlock's field programmable feature means a single Hardlock can protect more than one product."



End Users Say . . .

"Hardlock allows me to backup my software investment. I just plugged Hardlock into the printer card, connected the printer cable, and forgot about it. Since Hardlock doesn't require a battery, I am assured of reliability and no down time."



HARDLOCK™
The Preferred Protection System!

1-800-562-2543

H A R D L O C K

For a distributor in Europe contact, FAST Electronic GmbH 49-89-539800-20 FAX 49-89-539800-40

Circle 122 on Inquiry Card.

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

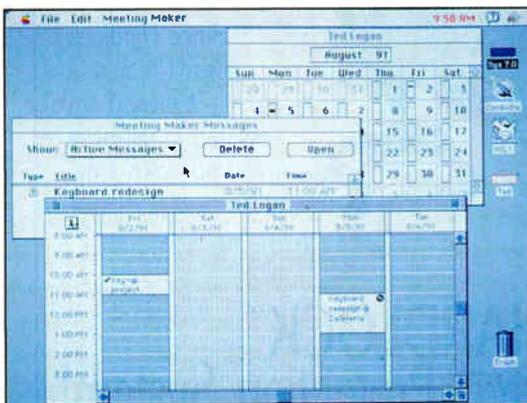
makes a best-effort guess at times that fulfill your criteria. If you don't like the times Higgins has picked, you can change them. Meeting attendees can then vote on which time they prefer. The

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.

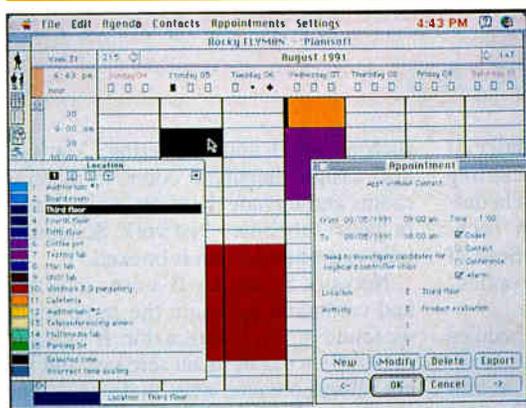
As a group scheduler, OnTime simply doesn't make the cut. Users can share their personal calendars with others in their group, but if someone adds an appointment to your calendar, OnTime does not tell you until the next time you run the package. It also doesn't let you book resources, such as a conference

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.

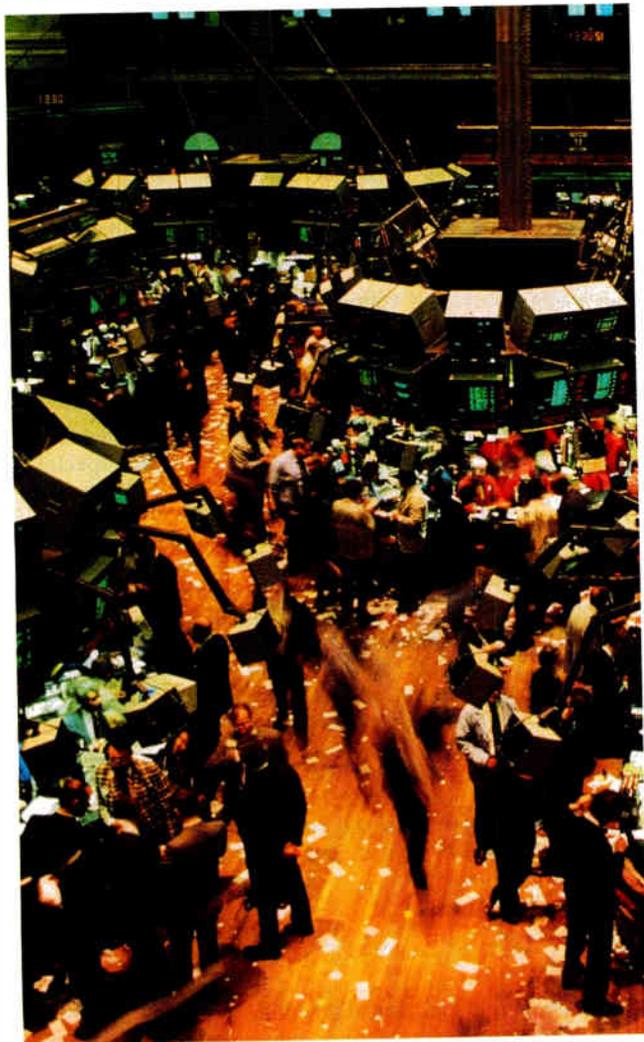
The Mac version handles meeting notification by running Planisoft in the background under MultiFinder or System 7.0. You get an alert when the information changes, and you also get audible alerts 15, 10, and 5 minutes before a

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.

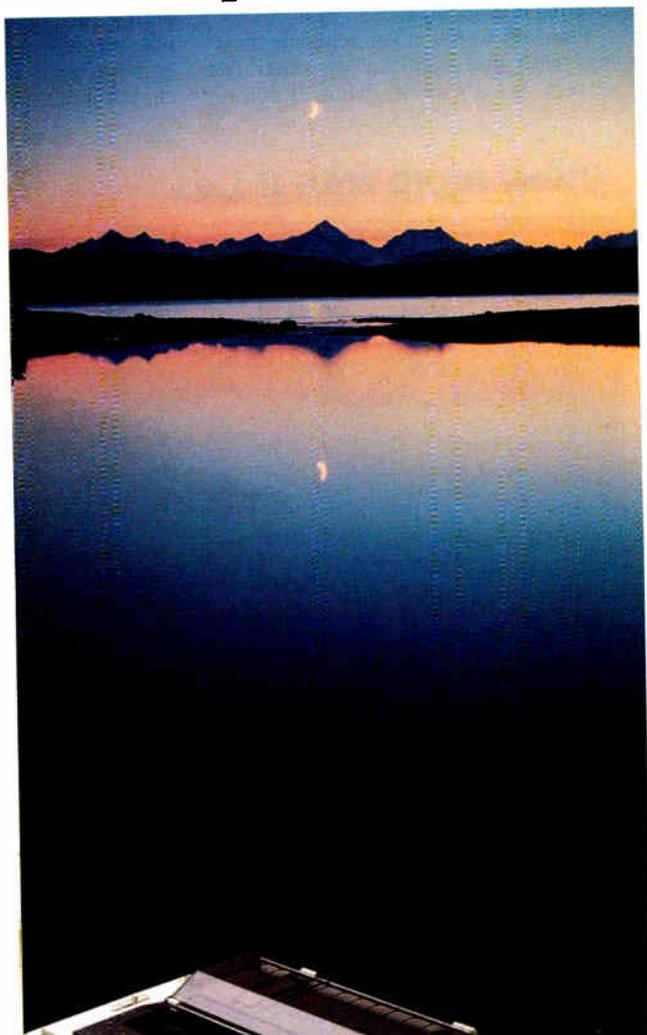
You can sign into Planisoft as a user or

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,

This is your dot matrix,
printing.



This is our new quiet 2624,
printing.



This is the one you've been waiting for. Panasonic® presents the first of a new generation of quiet dot matrix printers.

The KX-P2624 wide-carriage.

It doesn't scream, it whispers. Through multi-part forms, those 'industrial strength' spreadsheets, and your customer correspondence. And does them all with ease, speed and the superb reliability we've built a reputation on. It has all the features you've come to expect from the leader in dot matrix printing. And then some. One super letter-quality and seven letter-quality fonts. Multiple paper paths. An LCD display. A top speed of 300 cps in draft mode, 100 cps in letter quality. A two-year limited warranty on parts and labor.* And serene quiet.

For more information call us toll-free: 1-800-742-8086. Or, better yet, see your Panasonic dealer.

You'll like what you don't hear.

*Printers, Computers, Peripherals,
Copiers, Typewriters & Facsimiles*

Panasonic
Office Automation 

Circle 219 on Inquiry Card.

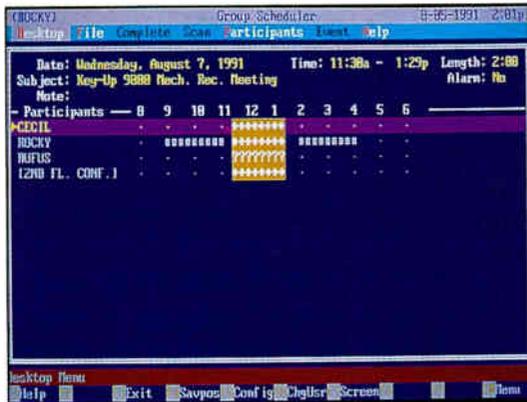
meeting is scheduled.

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.

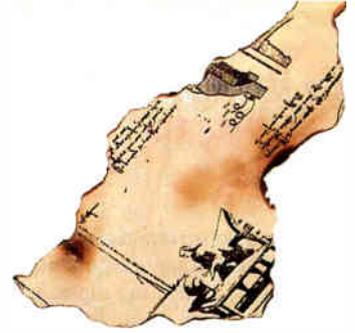
Shoebox runs as a 150-KB TSR and

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



See the Future.

The ideal 16-inch ergonomic monitor for professional graphics and business applications.

Maximum performance for CAD/CAM, spreadsheets, databases, WYSIWYG word processors and desktop publishing. Designed for PCs and Macintosh II.

1024 × 768 resolutions. Supporting the new, higher refresh rate of 70Hz and above for a flicker-free display. No distortion. Sharply focused. Bright images across the entire screen.

An anti-static, non-glare screen. Low magnetic radiation. No interference between two monitors separated by a mere six inches, for dual-display applications.

Microprocessor-controlled configuration for your applications, memorizing size and position of the screen settings you prefer.

Other monitors compete against the standards.
FLEXSCAN® sets them.

NANAO®

NANAO USA CORP.

23510 Telo Ave., Suite 5
Torrance, CA 90505 USA
Phone (213)325-5202
Fax (213)530-1679

Circle 197 on Inquiry Card (RESELLERS: 198).

FLEXSCAN 9080i

16" (15V), 0.28mm-dot pitch CRT
1024 × 768 Super high resolution with 70Hz
high refresh rate
Scan Frequency: Automatic Adjustment
H: 30-64kHz V: 50-90Hz
VGA, 8514/A and Mac II Compatible

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

After Thousands of Hours Working With CD-ROM Drives, I Knew The Best When I Saw It.

Scholar, pianist and university professor Robert Winter is the author of the best-selling CD-ROM music software ever marketed—the Voyager CD Companion to Beethoven's 9th Symphony.



"Over the last two years I have spent more than 3,000 hours working with CD-ROM drives. I have used at least a half dozen drives, including those from all of the major manufacturers. Through hard experience I came to have very specific desires for the ideal drive — one I thought I would never see.

When I found the Chinon drive at a trade show, I couldn't believe my eyes — or ears. All the things I was looking for were there: a small (but elegant!) footprint for easy portability; a separate power supply to eliminate cooling fans and overheating; a fast 350 ms access time; direct RCA audio outputs; a headphone jack with full-range volume control; rugged construction to withstand heavy use and travel; and a great price. It's the drive I recommend to anyone who asks — with only raves from those who have

purchased it. Those who claim that CD-ROM is a slow, stodgy technology haven't tried a Chinon drive."

Chinon drives are available in external versions for both IBM-compatible and Macintosh computers, and a half-height internal version for IBM compatibles.

Experience Chinon's exciting CD-ROM/Audio drives for yourself. Call TOLL-FREE for the reseller nearest you. Whether for work or play, data or audio, it'll be music to your ears.

CHINON

Chinon America, Inc., 660 Maple Avenue, Torrance CA 90503

Toll-Free (800) 441-0222

In California (213) 533-0274 Fax: (213) 533-1727

IBM is a registered trademark of International Business Machines Corporation. Macintosh is a registered trademark of Apple Computer, Inc.

Circle 358 on Inquiry Card.

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.

COMPANY INFORMATION

Action Technologies, Inc.
(The Coordinator II)
1145 Atlantic Ave.
Alameda, CA 94501
(415) 521-6190
fax: (415) 769-0596
Circle 1400 on Inquiry Card.

ASD Software, Inc.
(Planisoft 1.21)
4650 Arrow Hwy., Suite E-6
Montclair, CA 91763
(714) 624-2594
fax: (714) 624-9574
Circle 1401 on Inquiry Card.

Campbell Services, Inc.
(OnTime 1.46)
21700 Northwestern Hwy.,
Suite 1070
Southfield, MI 48075
(313) 559-5955
fax: (313) 559-1034
Circle 1402 on Inquiry Card.

Chronos Software
(Who-What-When
Enterprise 1.0)
555 De Haro St., Suite 240
San Francisco, CA 94107
(800) 999-1023
(415) 626-4244
fax: (415) 626-5393
Circle 1403 on Inquiry Card.

CrossWind Technologies, Inc.
(Synchronize 1.1)
6630 Hwy. 9, Suite 201
Felton, CA 95018
(408) 335-4988
fax: (408) 335-1086
Circle 1404 on Inquiry Card.

Data Access Corp.
(OfficeWorks 2.0a)
14000 Southwest 119 Ave.
Miami, FL 33186
(800) 451-3539
(305) 238-0012
fax: (305) 238-0017
Circle 1405 on Inquiry Card.

Enable Software, Higgins Group
(Higgins 2.4)
1150 Marina Village Pkwy.,
Suite 101
Alameda, CA 94501
(800) 854-2807
(415) 865-9805
fax: (415) 521-9779
Circle 1406 on Inquiry Card.

Futurus, Inc.
(Right Hand Man II 1.01)
3131 North I-10 Service Rd.,
Suite 401
Metairie, LA 70002
(800) 327-8296
(504) 837-1554
fax: (504) 837-3429
Circle 1407 on Inquiry Card.

Microsoft Corp.
(Schedule + 1.00a)
1 Microsoft Way
Redmond, WA 98052
(800) 426-9400
(206) 882-8080
fax: (206) 883-8101
Circle 1408 on Inquiry Card.

Microsystems Software, Inc.
(CaLANdar 1.29)
600 Worcester Rd.
Framingham, MA 01701
(508) 626-8511
fax: (508) 626-8515
Circle 1409 on Inquiry Card.

On Technology, Inc.
(Meeting Maker 1.0)
155 Second St.
Cambridge, MA 02141
(617) 876-0900
fax: (617) 876-0391
Circle 1410 on Inquiry Card.

Phase II Software Corp.
(ClockWise 1.3)
444 Washington St.,
Suite 407
Woburn, MA 01801
(800) 735-2557
(617) 937-0256
fax: (617) 937-0098
Circle 1411 on Inquiry Card.

PowerCore, Inc.
(Network Scheduler II)
1 Diversatech Dr.
Manteno, IL 60950
(800) 237-4754
(815) 468-3737
fax: (815) 468-3867
Circle 1412 on Inquiry Card.

R + R Associates, Inc.
(Shoobox 2.3)
39 Carwall Ave.
Mount Vernon, NY 10552
(914) 668-4057
fax: (914) 668-9277
Circle 1413 on Inquiry Card.

SuperTime, Inc.
(SuperTime 1.0)
2025 Sheppard Ave. E,
Suite 2206
Willowdale,
Toronto, Ontario,
Canada M2J 1V7
(416) 499-3288
fax: (416) 492-9192
Circle 1414 on Inquiry Card.

WordPerfect Corp.
(WordPerfect Office
LAN 3.01)
1555 North Technology Way
Orem, UT 84057
(800) 451-5151
(801) 225-5000
fax: (801) 222-5077
Circle 1415 on Inquiry Card.

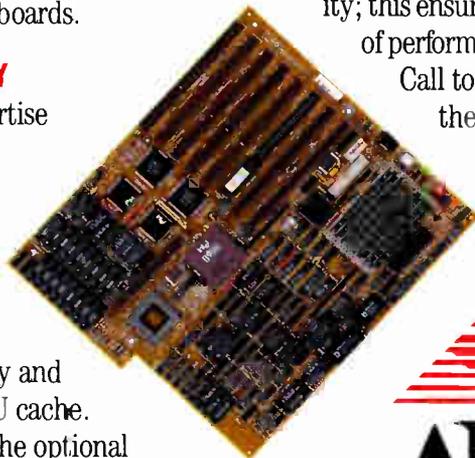
Are you playing board games?

Choosing a board is serious business. The quality of the motherboard will determine the performance and reliability of your machine, and the success of your company.

That is why more OEMs and Integrators are using American Megatrends, Inc. for their motherboard needs. Already the industry leader in 386 and 486 BIOS, AMI has now established the standard for EISA and ISA boards.

EISA TECHNOLOGY

AMI has the expertise to provide you with premium 486 EISA boards. These 33 MHz systems can support up to 96 meg of memory and up to 256K of CPU cache. Used along with the optional SCSI Host Adapter, it creates a terrific high performance network server or UNIX hub.



ISA SOLUTIONS

If EISA is not required, the AMI 486 ISA boards are the answer. Operating at 33 MHz and possessing the fastest video speeds in the industry, they provide the perfect platform for graphic intensive applications.

THE AMI DIFFERENCE

Unlike any other motherboard, AMI boards provide total BIOS compatibility; this ensures the highest levels of performance and reliability.

Call today and see how the team at AMI will put you ahead of the game.



SINGLE SOURCE TECHNOLOGY

AMERICAN MEGATRENDS, INC.
800-U-BUY-AMI or 800-828-9264, 404-263-8181, fax 404-263-9381
 Circle 18 on Inquiry Card (RESELLERS: 19).



Cheap boards forces Bankruptcy

NOBODY WILL VISIT YOU HERE

Imported board proves unreliable

GO BACK 1 SPACE

Use AMI for reliable network file server

MOVE AHEAD 2 SPACES

Cheap board ruins reputation

GO BACK 3 SPACES



Use highly compatible AMI motherboards

PROFITABLE PARKING

Discount boards have high failure rate

GO BACK 3 SPACES

Discount board has slow video speed

LOSE TURN

GO

Imported board has no tech support
 START OVER

Discount board has compatibility problems
 GO BACK 1 SPACE

START HERE

Cheap board fails in UNIX system

Select dependable AMI Motherboards

Imports ship late

Discount boards not worth the savings

GO TO BANKRUPTCY

Northgate® SlimLine™ 386/33 MHz

Computer For The 90's That Gives You More!

Northgate
Announces
New Lower
Prices!

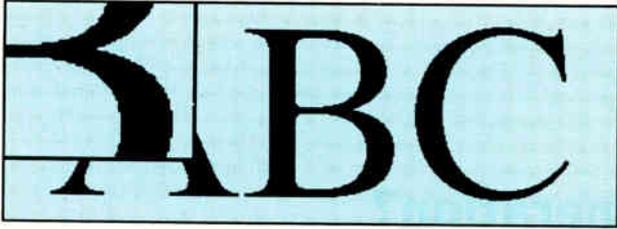
- More Power!
- More Performance!
- More Features!
- More Quality!
- More Service!
- More Support!
- Simply More Computer Than Your Money Can Buy From Any Source!
- Ideal As A Network Workstation, Too!

Actual Unretouched Photo!

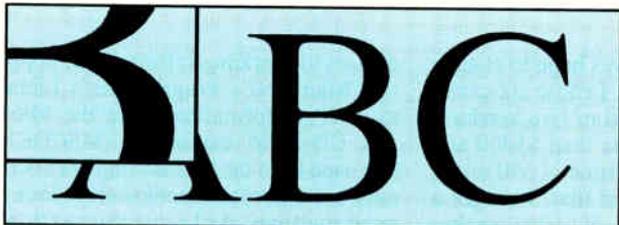
Just
\$2099⁰⁰*

Base System
Including Edsun
CEG Graphics!

Now! Northgate Puts Revolutionary Edsun CEG Graphics On Your Screen!



Until now, standard VGA images left lots of room for improvement. Jagged edges ... wrinkled lines that should be straight ... and just "ho-hum" clarity. (Actual photo)



Same image with Edsun RAM DAC chip technology! Smooth curves and edges. Razor-sharp clarity. Techies call this "anti-aliasing." You'll call it "Incredible!" (Actual photo)

More power, less space! Northgate enhanced the power of Intel's 386/33 chip with 64K of SRAM cache to make quick work of the toughest tasks you can create. All in a package that barely peeks over a 3.5" disk!

SlimLine's "space miser" secret lies in our unique motherboard. We've integrated the works. A 16-bit VGA adapter with 512K video memory, IDE hard drive interface and up to 16MB of 32-bit DRAM. *And we still had room for five internal expansion slots.*

Say goodbye to "jagged" graphics ... Northgate is first to bring CEG technology to the computer industry! We engineered SlimLine 386/33 with the revolutionary Edsun RAM DAC chip. This ingenious device emulates 24-bit color and 2048 x 2048 resolution. The days of standard VGA monitors displaying 16 colors from a palette of 256 are gone for good!

Same monitor with Edsun technology will display over three-quarters of a million colors!

Northgate "extra mile" service and support!
You get a full one-year warranty on system parts and labor. Toll-free technical support — around the clock, every day. Plus FREE field repairs for one year by the nation's largest computer service company.

And our "ace in the hole" ... grab the nearest phone and call us now. We'll send SlimLine 386/33 to you risk free for 30 days. If SlimLine isn't everything we say it is — and more — we'll buy it back. No questions asked.

SlimLine 386/33 **\$2099⁰⁰*** Or as low as \$65⁰⁰ per month†

Northgate SlimLine™ Features:

- 33 MHz 80386 Processor (Not An SX!)
- 64K Of 20NS RAM Cache
- Edsun CEG Graphics
- 1MB RAM On Motherboard; Expandable To 16MB
- SlimLine "Space Miser" Case — Only 15" x 15" x 4.25"!
- World-Famous OmniKey/101 Keyboard
- 1.44MB Floppy Drive (1.2MB Optional)
- Five Internal Expansion Slots
- Integrated 16-Bit SVGA Adapter With Up To 1024 x 768 Resolution; 512K Video Memory
- MS-DOS 3.3 Or 4.01 And GW-BASIC Or MS-DOS Version 5 And QUICKBasic Installed
- One Year Parts/Labor Warranty; 5 Years On Keyboard
- Award-Winning Northgate Documentation
- FCC Class B Certified

* Design Your Own Configuration!

Start with the base price shown and add your choice of drives, memory, cache, keyboard and video options. Your Northgate sales rep will work with you to create the system to precisely match your applications.

CALL TOLL-FREE 24 HOURS EVERY DAY 800-345-8709

Major corporations, volume purchasers and government agencies call **800-545-6059**

Notice to Hearing Impaired: Northgate has TDD capability. Dial 800-535-0602.



7075 Flying Cloud Drive, Eden Prairie, MN 55344

See Us At Fall Comdex!
Booth #S2286
At The Sands

© Copyright Northgate Computer Systems, Inc., 1990. All rights reserved. Northgate, SlimLine, OmniKey and the Northgate "N" logo are registered trademarks of Northgate Computer Systems. All other products and brand names are trademarks and registered trademarks of their respective companies. Prices and specifications subject to change without notice. Limited offer subject to change without notice. Northgate reserves the right to substitute components of equal or greater quality or performance. We support the ethical use of software. To report software copyright violations, call the Software Publishers Association's Anti-Piracy Hotline at 1-800-388-PIR8. †When charged to your Big 'N' Card. 10% A.P.R.

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



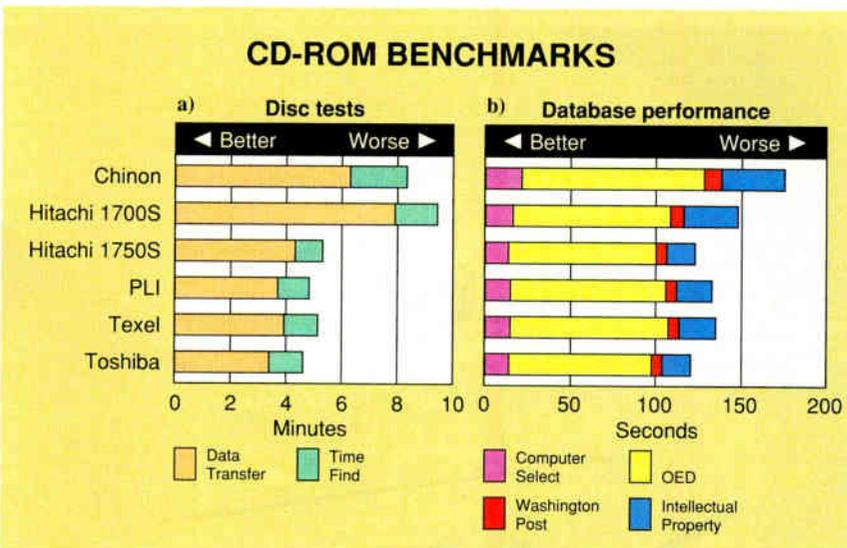
Third-generation CD-ROM drives offer data-access times of 350 ms or better and entrance to an ever-widening world of databases. The six drives tested are built by (from top) Chinon, Texel, Toshiba, PLI, and Hitachi.

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.

continued

EXTEND THE REACH OF CD ROM THROUGH LANs

Everyone wants access to your CD ROMs.

And you can solve this dilemma through Meridian Data's CD Net, a system that places your CD ROM-based information on a Novell, 3Com, Ungermann-Bass or IBM PC LAN. Like sharing a laser printer among several people, the CD Net approach significantly lowers your per user cost.

Instead of relegating CD ROMs to one PC, CD Net enables the same information to be shared by every user on the LAN.

PLACE GIGABYTES OF CD ROM-BASED INFORMATION ON YOUR NETWORK

There's virtually no limit to the number of CD Net units (and CD ROMs) that can be merged into your network. And each CD Net unit can hold up to 14 CD ROM drives (9.3 gigabytes of information).

Equally important, installing CD Net is a snap with our installation procedure. You just plug the system into the LAN like any other node and it's ready to go.

UNMATCHED RELIABILITY AND SPEED

CD Net reflects Meridian Data's commitment to system reliability. In fact, some say this commitment borders on the fanatical.

For example, CD Net incorporates a proprietary "positive air flow design". This prevents dust particles from reaching the sensitive optics of the CD ROM drives, eliminating the most common cause of drive failure.

At a sheer performance level, CD Net again leaves the competition in the dust with speeds 2 to 4 times faster.

WE WROTE THE BOOK ON NETWORKING CD ROMS

Meridian introduced the first CD ROM network-based server in 1987. Since then, we have added CD Net Software, a software-only networking

solution, and access from UNIX, VAX, and other systems through gateways and WAN solutions. The EPA, MCI, Ohio State University, Price Waterhouse, Westinghouse Corp., and Dunn & Bradstreet are a few of the organizations depending on CD Net today.

Of course, the best reason to select CD Net can be summed up in one sentence. No other CD ROM networking system can match CD Net's performance, ease-of-use, and reliability.

CALL MERIDIAN DATA FOR THE RIGHT CONNECTION

Regardless of your computing environment, Meridian Data has the CD ROM networking solution to meet your requirements. Call us today at 408-438-3100 and ask for Dept. CD Net.



MERIDIAN DATA, INC.

Worldwide Headquarters
5615 Scotts Valley Drive
Scotts Valley, CA 95066
Phone: 408-438-3100
FAX: 408-438-6816

European Headquarters
Phone: 31-40-863082
FAX: 31-40-859455

Circle 183 on Inquiry Card.



**NOW AVAILABLE . . .
SOFTWARE-ONLY CD ROM NETWORKING**

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

PHILIPS CD-ROM

Model CM 202 1/2 Height INTERNAL DRIVE

Full Laser Beam Reading (Not Split Beam)

350 MS AVG ACCESS TIME RATING

COMPLETE KIT ONLY **\$499***

ADD \$100 FOR EXTERNAL MODEL

PLUS Your Choice of One of the Following:

BIBLE LIBRARY 9 Translations 29 References

FAMILY DOCTOR A Complete Family Medical Reference

LIBRARY of the FUTURE 450 Great Literary Works

LANGUAGES of the WORLD Equivalent of 132 Bilingual Dictionaries

● **Special Grab TEN Pack \$99**

(TEN CD-ROM DISCS) - CIA WORLD FACTBOOK - FRONT PAGE NEWS - SHERLOCK HOLMES - ATLAS SHAREWARE - CD-SAMPLER - CD-GUIDE - RETRIEVAL - MOVIES + MORE

● **Space Package (12 Discs) \$119**

2 SPACE SAMPLER + 10 VOYAGER SPACE IMAGES

Specify MAC or IBM IMAGES OF THE PLANETS *Quantity Limited

PETER J PHETHEAN, LTD 213/691-8248

1640 East Brookdale Ave, La Habra, California 90631

fax 213/694-2112

ORDER DESK (Outside Southern California) 800-362-3766

AccSys™ for Paradox.

Because you shouldn't
be stuck
pulling the engine.

- 100% compatibility guaranteed
- Support for ALL popular C & C++ compilers
- Twice the speed and half the size (DBA, May '91)
- C Source available for all memory models
- Trade up to AccSys:
get credit for your
current engine

Ideal
for
Windows 3.0

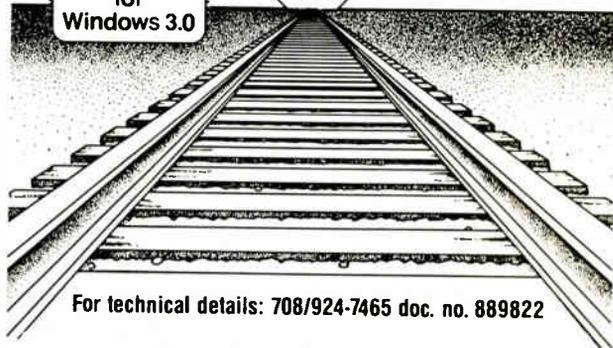
C

VOICE 708/682-8898

FAX 708/665-9841

Wheaton, Illinois 60187

Copia International Ltd.



For technical details: 708/924-7465 doc. no. 889822

CORELDRAW!

Breakthrough

CD-ROM Graphics Package



Reg. Price

Corel CD-ROM package includes:

- \$ 795 • CorelDRAW on CD-ROM
- \$1895 • 3000+ ArtRight clipart on CD-ROM
- \$ 796 • Sony CDU 6211 CD-ROM Drive
- \$ 199 • CorelDRIVER PC Interface kit
- \$ 149 • Corel ArtShow CD-ROM



~~\$3834~~

(high quality images from the CorelDRAW International Design Contest)



Now \$1295

limited time offer

Use your new drive to discover other exciting opportunities now available on CD-ROM:

multimedia encyclopedias; a years worth of computer magazine articles; multilingual directories; medical references; clipart libraries; statistical information; parts catalogues; chemical, biological, geographical, medical databases; font libraries; literature; programming libraries and tools...

And if that isn't enough, create your own CD database!

Also from Corel:

Rewritable drives, WORM drives,
Multifunction drives and CD-ROM drives

Available in stand-alone or Netware versions.

Individual component prices available.

Call our Optical Sales Division now to order your Corel CD-ROM package!

The Leader in Optical Performance



TEL: (613)728-8200
FAX: (613)761-9177

Circle 77 on Inquiry Card (RESELLERS: 78).

World Radio History

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



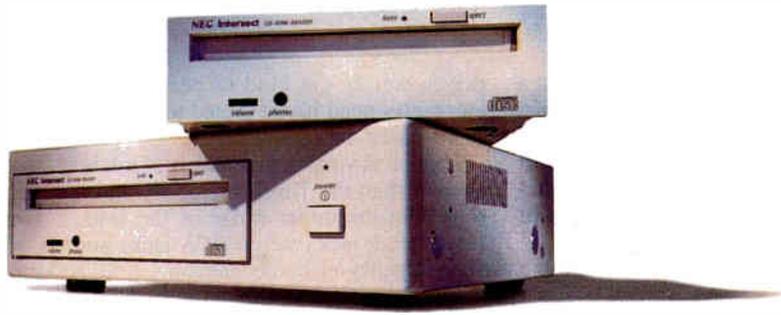
The Toshiba TXM-3201A1 was a leader in many of the benchmark tests. However, it was also the most feature-poor of the drives. It has a standard SCSI adapter and came bundled with a Future Domain TMC-840 card, which allows you to configure among four base addresses and two interrupts and set the time-out 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



Being the best at CD-ROM takes a big commitment.



Not to mention a little one.

Whether we're coming up with big ideas, or small ones, NEC is always leading the way in CD-ROM. ● Take our readers. We have a complete line. With everything from high performance desktop models to the first truly portable* CD-ROM reader. The Intersect™ CDR-35. A product PC Magazine called one of the best of 1990. And a finalist for Systems Integration product of the year. A piece of CD-ROM technology topped only by our portable CDR-36. ● What's more, our Intersect CDR-73 and CDR-83 drives have the fastest** data access rates in the business. In fact, with speeds of up to 300 milliseconds you might even be inclined to call them speed readers. ● All this from NEC. Whose CD-ROM products are known for their high quality and reliability. So high, in fact, that we're offering a two-year limited warranty on every new reader. ● For product literature, or the nearest dealer location, call 1-800-NEC-INFO. ● CD-ROM from NEC. Our commitment to excellence is big. No matter what size the product.

*Battery powered. Introduced 8/89. **Based on published specifications of available drives from major manufacturers, 4/91. © 1991 NEC Technologies, Inc. Intersect is a trademark of NEC Technologies. PC Magazine is a registered trademark of Ziff Communications Co. PC Magazine, 1/15/91 issue, page 208, reprinted with permission.

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."

3 in 1 TI 34020, SuperVGA, 8514/A
at 1/3 the price
\$1194 USD

Meet NDI's Volante AT1000, the sizzling new videographics subsystem that delivers:

- the dynamic power of 34020, plus 8514/A and SuperVGA – all on one compact card
- blazing response times 15 to 50 times faster than 34010 cards
- instant connectivity to all of your software, including X Windows
- high-resolution 1024x768 graphics with 256 active colors out of 16.7 million
- the reliability of NDI's custom ASICs
- an unprecedented lifetime warranty

All this. And more. For only \$1194 USD. To learn more about the Volante AT1000 and other 34020-based subsystems, call 1-512-343-5055.

NDI NATIONAL DESIGN, INC.
 9171 CAPITAL OF TEXAS HIGHWAY
 AUSTIN, TEXAS, 78759

COMPANY INFORMATION

- Chinon America, Inc.**
 Information Equipment Division
 660 Maple Ave.
 Torrance, CA 90503
 (800) 441-0222
 (213) 533-0274
 fax: (213) 533-1727
Circle 1231 on Inquiry Card.
- Hitachi Home Electronics, Inc.**
 Multimedia Systems
 401 West Artesia Blvd.
 Compton, CA 90220
 (800) 369-0422
 fax: (213) 515-6223
Circle 1232 on Inquiry Card.
- Peripheral Land, Inc.**
 47421 Bayside Pkwy.
 Fremont, CA 94538
 (800) 288-8754
 fax: (415) 683-9713
Circle 1233 on Inquiry Card.
- Texel America, Inc.**
 1080-C East Duane Ave.
 Sunnyvale, CA 94086
 (800) 886-3935
 fax: (408) 736-1378
Circle 1234 on Inquiry Card.
- Toshiba America Information Systems, Inc.**
 Disk Products Division
 9740 Irvine Blvd.
 Irvine, CA 92718
 (714) 583-3000
 fax: (714) 583-3133
Circle 1235 on Inquiry Card.



Even This Is More Confining Than Clipper.

Just as the vast expanse of the American West gave its settlers a new perspective on opportunity, Clipper's open architecture lends unprecedented freedom to application development.

Unlike fixed systems, Clipper never forces you to "make do". Its language is fully extensible with user-defined functions and new user-defined commands. You can extend the language with routines written in Clipper itself, or integrate code from other languages like C, Assembler, dBASE® and Pascal. Odds are, you already have knowledge you can use with Clipper!

But if a customizable language isn't enough, there's even more elbow room. Database and I/O drivers can be supplemented or replaced. Even Clipper's linker knocks down barriers by allowing you to develop applications larger than available memory, without defining overlays. And when you're done, Clipper's compiler generates stand-alone, executable files for cost-free, unrestricted distribution.

So, don't let the bounds of fixed systems fence you in. Unleash your imagination in the wide-open spaces of Clipper. To find out more, give us a call today.

Clipper® 5.0

The Application Development Standard

213/390-7923

Ask For Department-A

 **Nantucket®**

Circle 199 on Inquiry Card.

Nantucket Corporation, 12555 West Jefferson Boulevard, Los Angeles, CA 90066. 213/390-7923 FAX: 213/397-5469 TELEX: 650-2574125. Nantucket, the Nantucket logo and Clipper are registered trademarks of Nantucket Corporation. Other brand and product names are used for identification purposes only and may be trademarks or registered trademarks of their respective holders. Entire contents copyright © 1990 Nantucket Corporation.

World Radio History



MCS-COMPUTERS

MCS

LOW PRICING

5 YEAR WARRANTY ON ALL SYSTEMS

CALL US WITH YOUR BEST QUOTE

QUALITY PRODUCT

MONTHLY SALES

CALL TODAY

CALL FOR YOUR OWN CONFIGURATION

COMPUTER SYSTEMS

WE CONFIGURE SYSTEMS

MCS 286-12 MH2	MCS 386-16SX MH2	MCS 386-25 MH2	386-33 MH2
<ul style="list-style-type: none"> • 1 MB RAM • 40 MB HARD DRIVE • AMI BIOS • MATH CO-PROCESSOR SOCKET • 1.2 MB FLOPPY DRIVE 5.25 • 1.44 MB 3.5 DISKET DRIVE • 16 BIT VGA CARD • 14" VGA COLOR MONITOR • 1 PAR 2-SER 1-GAME PORT • 101 KEYBOARD • MS DOS 3.3 OR 4.01 	<ul style="list-style-type: none"> • 1 MB RAM • 40 MB HARD DRIVE • AMI BIOS • MATH CO-PROCESSOR SOCKET • 1.2 MB FLOPPY DRIVE 5.25 • 1.44 MB 3.5 DISKET DRIVE • 16 BIT VGA CARD • 14" VGA COLOR MONITOR • 1 PAR 2-SER 1-GAME PORT • 101 KEYBOARD • MS DOS 3.3 OR 4.01 	<ul style="list-style-type: none"> • 1 MB RAM • 80 MB HARD DRIVE • AMI BIOS • MATH CO-PROCESSOR SOCKET • 1.2 MB FLOPPY DRIVE 5.25 • 1.44 MB 3.5 DISKET DRIVE • 16 BIT VGA CARD • 14" VGA COLOR MONITOR • 1 PAR 2-SER 1-GAME PORT • 101 KEYBOARD • MS DOS 3.3 OR 4.01 	<ul style="list-style-type: none"> • 4 MB RAM • AMI BIOS • 125 MB 19 MS HARD DRIVE • MATH CO-PROCESSOR SOCKET • 1.2 FLOPPY DRIVE 5.25 • 1.44 MB 3.5 DISKET DRIVE • 16 BIT VGA CARD • 14" SUPER VGA COLOR MONITOR • 1 PAR 2-SER 1-GAME PORT • 101 KEYBOARD • MS DOS 3.3 OR 4.01
\$999	\$1,420	\$1,800	\$2,300

MONITORS

LAP TOPS

ACCESSORIES

SOFTWARE

SAMSUNG

MA-2565 12" MONO	\$75
CJ-4681 14" COLOR VGA	\$346
CM 4592 14" COLOR VGA SUPER	\$370
RGB 14" COLOR MONITOR ..	\$220
EGA 14" COLOR MONITOR ..	\$300

NEC

MULTISYNC 2A	LOW	CALL
MULTISYNC 3D	PRICES	CALL
MULTISYNC 4D		CALL
MULTISYNC 5D		CALL

SONY

1320	\$46
1302	\$505
1304	\$630
GVM 2000	\$1450

TOSHIBA

TOSHIBA T1000	CALL
T1000 SE NOTEBOOK	CALL
T1000 XE 1200 XE NOTEBOOK	CALL
T1000 LE	CALL
T1200 HB 20 MB	CALL
T1200 XE 20/40 MB	CALL
T1600 286 20 MB	CALL
T1600 286 40 MB	CALL
T3100 E 286 40 MB	CALL
T3100 SX 40 MB/80 MB	CALL
T3200 SX 40 MB/120 MB	CALL
T5100 386 100 MB	CALL
T5200 386 100/200 MB	CALL
TS200	CALL

150/165 POWER SUPPLIES	\$38
200 WATT BABY AT	\$43
230 WATT FULL SIZE	\$46

KEYBOARDS

101 KEYBOARD ENHANCED	\$42
84 KEYBOARD	\$26

HARD/FLOPPY DISK CON

360K DISK CONTROLLER	\$21
UNIVERSAL F/D CONTROLLER FOR 4 DRIVES	\$30
WD-27X HD CONTROLLER RLLXT CARD	\$49
XT GEN CARD MFM HD CONTROLLER XT	\$44
IDE 1:1 HD/FD CNT	\$27
IDE 2-SP/1-PAR PORT 1-GAME	\$36
WA6 1:1 MFM HD/FD CONTROLLER	\$51
DTC 7287 RLL 1:1 HD/FD CONTROLLER CARD	\$81

MODEMS

ZOLTRIX 2400 INT	\$63
SMART ONE 2400 EXT	\$103

CASES

CARRY ALL SIZE CASES, CALL FOR PRICING

WORD PERFECT 5.1

MICROSOFT WORD

LOTUS 123 2.3-3.1 VU

VENTURA DESKTOP PUBL. D BASE III + D BASE IV

HARVARD GRAPHICS

CALL FOR ADDITIONAL SOFTWARE & PRICING

HARD DRIVES

SEAGATE: 1-YEAR WARRANTY

ST157-44MB.28MS.IDE	\$220
ST251-142MB.28MS.MFM	\$229
ST177-60MB.24MS.SCSI	CALL
ST296N-85MB.28MS.SCSI	CALL
ST1096N-84MB.24MS.SCSI	CALL
STNO2A-84MB.20MS.IDE	\$429
ST4086-80MB.28MS.MFM	\$529
ST4144K-122MB.28MS.RLL	CALL
ST1144A-125MB.20MS.IDE	\$489

WE CARRY ALL SEAGATES UP TO 600MB HARD DRIVES

CONNER I.D.E. HARD DRIVES

40 MB - 28MS. IDE	\$255
80 MB - 28MS. IDE	\$437
100 MB - 28MS. IDE	\$497
200 MB - 19MS. IDE	\$785

PRINTERS

Low PRICING

HP DESKJET 500	CALL
HP LASERJET II P	CALL
HP LASERJET II	CALL
HP LASERJET 2D	CALL
HP LASERJET 3D	CALL
HP LASERJET III	CALL
HP PAINT JET	CALL
HP PAINT JET XL	CALL
HP SCAN JET	CALL
CALL FOR UPGRADES	CALL
PANASONIC 1180	\$189
PANASONIC 1191	\$226
PANASONIC 1124	\$280
PANASONIC 1624	\$257
PANASONIC 1695	\$396
PANASONIC 1524	CALL
PANASONIC 4420 LASER	CALL
EPSON LX 810	\$176
EPSON FX 850	\$290
EPSON LQ 1010	\$365
EPSON FX 1050	\$347
EPSON LQ 510	\$260
EPSON LQ 850	\$550
EPSON LQ 1050	\$578
EPSON LQ 2550	\$869

MOTHER BOARDS

386-33 MH2, FULL SIZE W/64K CACHE W/33 CPU	CALL
386-25 MH2, FULL SIZE W/64K CACHE W/25 CPU	CALL
386-25 MH2 BABY W/25 CPU	\$377
386 SX 16 MH2 & 20 MH2 W/16 CPU	\$245
W/20 CPU	\$320
286-12 MH2 BABY W/12 CPU	\$108
8088 10 MH2 BABY XT, UP TO 640K MEMORY, 8 SLOTS	\$71

MULTI I/O CARDS

AT CARD, 2-SER, 1-PAR PORT, 1-GAME	\$20
XT CARD, 1-SER, 1-PAR PORT, 1 GAME	\$22

VIDEO CARDS

MONOGRAPHIC W/PRINTER PORT	\$21
MONO CGA W/PRINTER PORT	\$27
EGA CARD	\$61
EGA CARD PRINTER PORT	\$67
SUPER VGA 1024x768 W/512K	\$75
VGA CARD 8/16 BIT W/256K	\$58

FLOPPY DRIVES

TEAC & TOSHIBAS

1.44 MB. 3.5 HT	\$69
1.2 MB. 5.25 HT	\$69
360K. 5.25 HT	\$55

HOURS: MONDAY-FRIDAY 8-6
ORDERS: 1-800-724-8865
FAX 716-423-9978



• 5 YEAR WARRANTY ON ALL SYSTEMS
 • 30 DAY MONEY BACK GUARANTEE
 • IN HOUSE SERVICE
 • CALL FOR CATALOG (WE CAN FAX CATALOGS)

TERMS:

1. We accept P.O.'s from universities, government agencies & qualified firms.
2. MC, VISA, COD, prepaid and approved P.O.'s only.
3. We accept international orders.
4. We accept orders through the Fax.
5. 15% restocking fee on returns within 30 days. No refunds after 30 days.
6. No software return.
7. No surcharge on VISA/MC.
8. Prices subject to change.

Circle 176 on Inquiry Card.

APPLICATION

Quattro Pro 3.0 vs. Lotus 1-2-3 Release 2.3

JON PEPPER

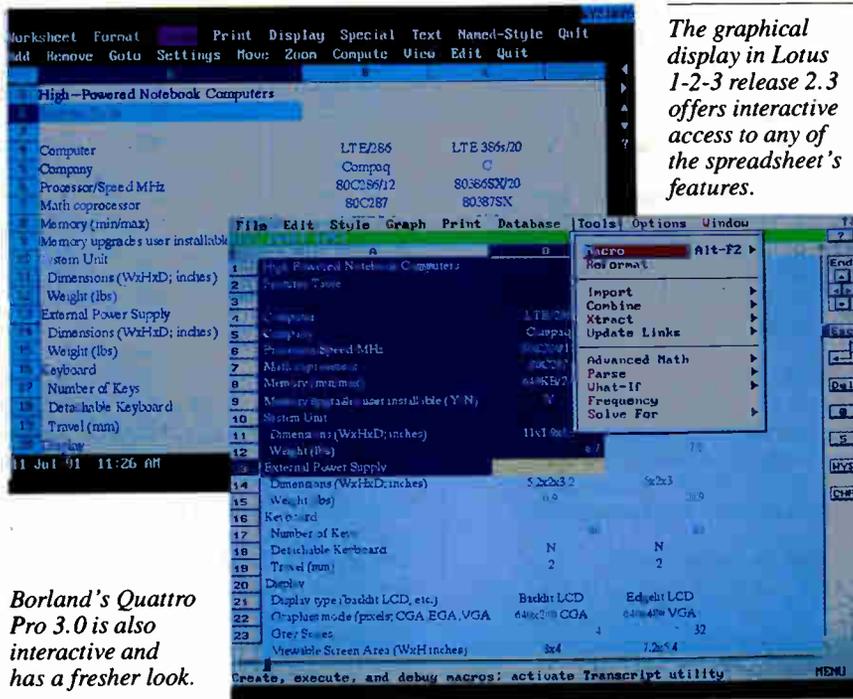
If you're a die-hard DOS user laboring with a 286- or even an 8088-based machine, at least two worthy spreadsheets have now been redesigned with you in mind. Lotus 1-2-3 release 2.3 and Borland's Quattro Pro 3.0 are aimed at spreadsheet users who happen to be low on hardware but high on expectations. 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.
Scotts Valley, CA 95066
(408) 438-8400
Circle 1228 on Inquiry Card.

Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
(617) 577-8500

Circle 1229 on Inquiry Card.

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

Up to date. Down to earth.

Changing the world. UNIX is changing the world of computers, the world of business — quite simply, changing the world. It's revolutionizing office automation. It's required for U.S. government computer contracts. It's the backbone of information strategies worldwide.

The information you need. That's why you need *UNIXWORLD* — the magazine that keeps you up to date on the rapidly changing world of open systems computing. Each issue brings you the latest product trends and technical advances that can affect your business. The inside story on some of the world's

biggest high-tech companies. Easy-to-understand programming tips and tutorials that can help you and your company use UNIX to its fullest. And unbiased hardware and software reviews to help you invest wisely when you buy.

The whole UNIX-verse.

UNIXWORLD's in-depth features go beyond dry technical facts, to show how the pieces fit together — to tell you what's important about the advances and the strategies that are changing your world. And *UNIXWORLD* consistently offers the freshest, most down-to-earth writing you'll find in any computer publication.

Subscribe and Save. Subscribe today, and receive the next 12 issues of *UNIXWORLD* for just half the regular newsstand price. Save even more by ordering for two or three years. You can't lose — every subscription to *UNIXWORLD* comes with a no-risk guarantee.*

1 year \$18.00 (save 50%)
2 years \$32.00 (save 55%)
3 years \$42.00 (save 60%)

**Subscribe now! Call toll-free:
1-800-257-9402 Ext. 29**

UNIXWORLD
MCGRAW-HILL'S MAGAZINE OF OPEN SYSTEMS COMPUTING

If you're into UNIX, you need *UNIXWORLD* MAGAZINE.

UNIX® is a registered trademark of AT&T. UNIX WORLD is not affiliated with AT&T.
*UNIXWORLD's no-risk guarantee: If not satisfied, cancel and receive a full refund for the balance of year subscription.
A McGraw-Hill publication

World Radio History

NOW VERSION 4

Full-featured scientific word processing

ChiWriter gives you all the features of an advanced scientific word processor and more! The WYSIWYG screen display lets you enter and edit text and scientific notation exactly as you want it on your printout. Add easy math editing, font design, multiple undo and redo, automatic formatting, macros, foreign language capability, spell checker, and support for dot-matrix and laser printers—all for only \$349.95 plus shipping and handling.*

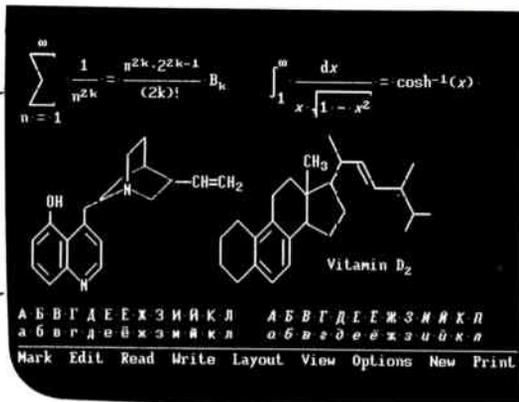
Call today to order your ChiWriter package. Full 30-day money back guarantee. Bankcards welcome.

* Chemistry Fonts \$59.95,
Russian Fonts \$29.95

20% educational discount.

To order, call toll free

1-800-736-8886



ChiWriter

horstmann software

FEATURES

- True WYSIWYG—no encoding or preview mode.
- Easy formula editing is fully integrated into the program
- Multiple Undo and Redo
- Automatic text and formula formatting
- Simultaneous editing of up to 10 documents
- All standard math and scientific symbols included
- Font designer—modify symbols or design your own
- For IBM® PC or compatible systems with 512K memory

HORSTMANN SOFTWARE DESIGN CORPORATION

4 N. 2nd. St., Ste. 500 P.O. Box 1807 San Jose, CA 95109-1807, USA
Phone (408) 298-0828 Fax (408) 298-6157

IBM is a registered trademark of International Business Machines Corporation.

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."

QuickTrace™

Vector Based
Graphics

The Automatic Tracing Program

TIFF Bit Map

QuickTrace is an automatic tracing tool which converts scanned "dot" images into vector based graphics. Instead of drawing by hand, try QuickTrace. It will help you to easily and quickly enter graphics like logos, maps and clip art, which would otherwise be difficult and time-consuming on your PC.

■ for DTP (Illustrator, PageMaker, Harvard) Graphics, DrawPerfect
Convert into EPSF, CGM, Micrograph PIC, DRW \$245

■ for AutoCAD DXF \$295

■ for Lotus Freelance Plus \$245

PLEASE CONTACT: 212-605-2339
OR SEE EGGHEAD NEAREST YOU IN U.S.
CONTACT REFLEX IN U.K.: 0734-314611

Developed by
Information & Control Lab. Co.
Nakajima Bldg., 5F, 11-22, Shinjuku 5-chome,
Shinjuku-ku, Tokyo 160, Japan
Phone: 3-5379-7470 / Fax: 3-5379-7471

Mitsubishi International Corporation
Technology Affairs Dept.
520 Madison Avenue, New York, NY 10022
Phone: 212-605-2339 / Fax: 212-605-1847

● DrawPerfect of WordPerfect Corporation, Micrograph of Micrograph Inc., AutoCAD of Autodesk Inc., Lotus and Freelance of Lotus Development Corporation, Illustrator of Adobe Systems Incorporated, PageMaker of Aldus Corporation, harvard Graphics of Software Publishing corporation are registered trademark of each company.

● Quicktrace can input images scanned by Niscan, Logitech ScanMan and etc. ● OEM inquiry welcome

SPEED. GUARANTEED.



Here's a chance to buy our \$89 Math Coprocessor at no risk whatsoever! It's fully guaranteed to at least double the math performance of your software.

If you want to unlock the full power of your PC, pick up the phone and order an AMD 80C287 math coprocessor. Without it, your PC just isn't really complete. You see, our math coprocessor can *dramatically* increase the performance of 1-2-3,[®] dBASE,[®] Excel, and hundreds of your other favorite business applications! It actually runs calculations *two to ten times faster* than your PC can *without* a math coprocessor. Which means your graphs will draw incredibly fast and your spreadsheets will recalculate at truly blazing speeds. (And that's just for starters!)

High speed at a low price.

Don't think you have to pay over \$200 for a math coprocessor. Now you can get ours for just \$89 when you order direct from AMD! The AMD 80C287 is fully compatible with your 80286-based PC and the hundreds of commercially available software packages written for it. Our coprocessor is also compatible with the Intel NMOS 80287.

Installation is a snap.

The AMD 80C287 plugs easily into a socket that's already inside your 80286-based PC. In fact, you can be up and running in just five minutes. Simply plug the chip into the socket and watch the dazzling improvement in performance! The AMD 80C287 comes with easy-to-follow installation instructions, a free utilities disk (which includes diagnostics and test software), and free color computer games.

Advanced Micro Devices, Inc.

9020-11 Capital of Texas Hwy N., Suite 400
Austin, TX 78759-9797

Volume or dealer inquiries welcome. 1-2-3 is a registered trademark of Lotus Development Corporation. dBASE is a trademark of Ashton-Tate Corporation. Intel is a registered trademark of Intel Corporation.

Circle 363 on Inquiry Card.

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

Our Triple Guarantee

Guarantee #1: If the AMD 80C287 doesn't do everything we promise, or if you are unsatisfied for any reason, return the product within 30 days of purchase and AMD will happily refund your money.

Guarantee #2: If your AMD 80C287 Math Coprocessor ever fails to perform for any reason, AMD will replace it free of charge, no questions asked. Limited to two lifetime replacements per person.

Guarantee #3: AMD guarantees that the AMD 80C287 is fully compatible with your 80286-based hardware and software. If you have any compatibility problems with the AMD 80C287 during the first year, return the product and we will gladly refund the purchase price.



To Order Call Now
1-800-888-5590 ext. 2600

Outside of USA call (512) 345-1728

Yes. I want to double or triple the calculation speed of software running on my 286-based PC. Send me an AMD 80C287 Math Coprocessor, risk free, for only \$89 plus tax, shipping and handling. I understand that I can return the AMD 80C287 for a full refund within the first 30 days if I am not completely satisfied.

NAME _____
 ADDRESS _____
 CITY STATE ZIP _____
 Visa MC# _____
 Type of PC _____

Only ONE Fortran

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.
410 East Plumeria Dr.
San Jose, CA 95134
(408) 432-1160
Circle 1225 on Inquiry Card.

Everex Systems, Inc.
48431 Milmont Dr.
Fremont, CA 94538
(800) 821-0806
Circle 1226 on Inquiry Card.

IBM Corp.
U.S. Marketing & Services
Department ZW1
1133 Westchester Ave.
White Plains, NY 10604
(800) 426-2468
Circle 1227 on Inquiry Card.

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.

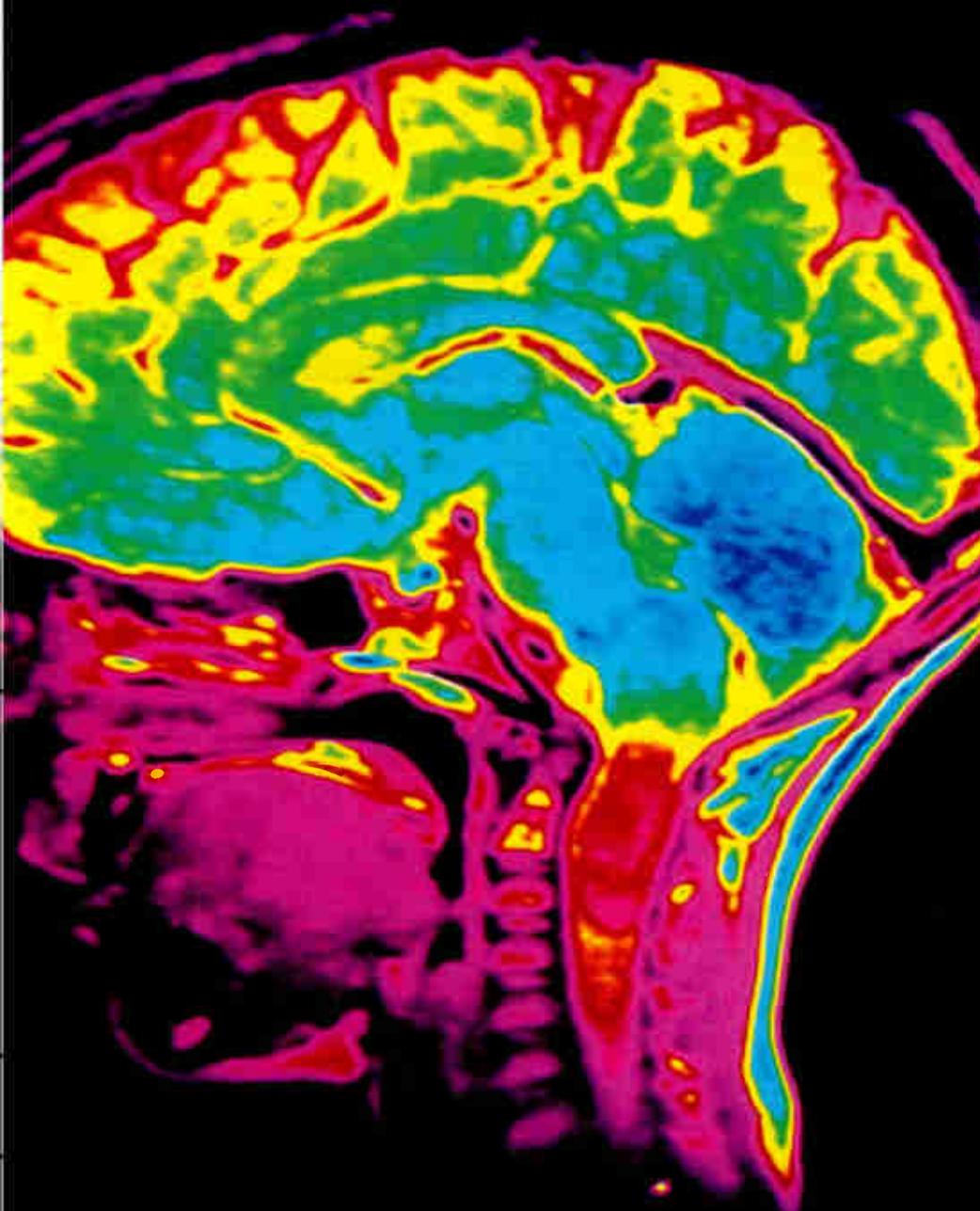
The chassis includes two standard 5¼-inch half-height drive bays and one low-profile 3½-inch drive bay. My machine had one of each type available. The chassis also includes a mounting area for another 3½-inch hard disk drive. The video monitor is adequate, but not as bright or consistent as the Evervision 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

At Mount Sinai Hospital,
some of the best brains in the
country rely on Sony.



Fortunately, critical patient data
is tucked into the safest place of all.
A Sony data cartridge.

In fact, hundreds of detailed files
can be accessed from one, single,
solitary data cartridge.

Which is how the renowned
doctors at Mount Sinai Hospital
in New York City store patient
diagnostic data.

Not one byte can be lost.

That's why Sony produces, with
exacting care, a range of mini and
ultra-high capacity data cartridges
up to 525 megabytes.

And if Sony data cartridges can
do all of this, they can also back up
another vitally important life force
with the utmost integrity.

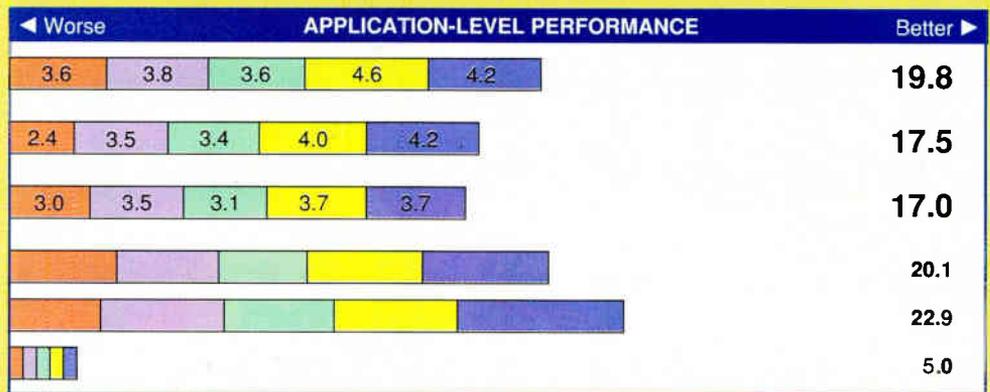
Your business operations.



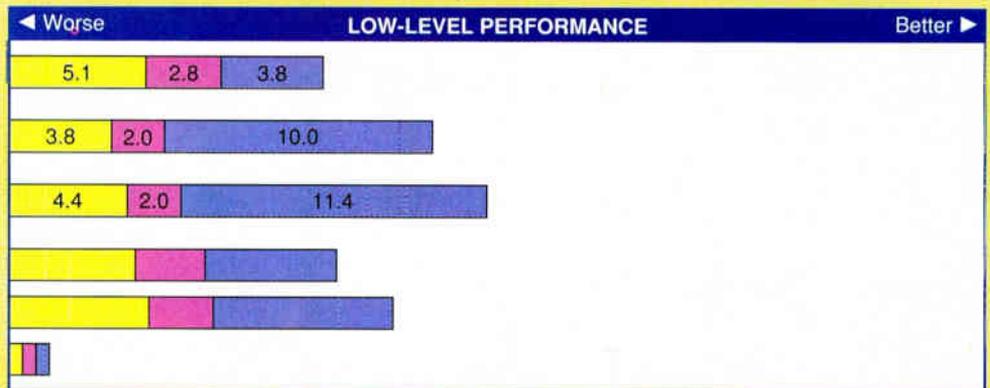
SONY.

Circle 281 on Inquiry Card.

DOS BENCHMARKS



Word Processing Desktop Publishing Database Compilers Spreadsheet



CPU Disk Video

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

Bend Us. Shape Us. Any Way You Want To.

NOW ON
GSA SCHEDULE
GS00K91AGS5022

As long as you love us, it's all right. And love us you will. Statistical software from SPSS is designed to work the way you work. By giving you the power to enter, edit, manage, analyze and present data on virtually every type of PC, workstation, minicomputer and mainframe. By giving you better decision-making ability through the most comprehensive set of statistical procedures available. And by giving you a choice of options to meet your specific data analysis needs. So if you're thinking about statistical software, think about flexibility. Because flexibility means value. And when it comes to value, we top the charts.

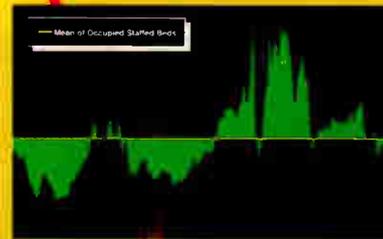
The Accessibility of SPSS makes it ideal for beginners and advanced users alike. With its straightforward menus and context-sensitive help and statistical glossary, SPSS gets you started fast. And with the help of our time-saving programming facilities, including macros and a matrix language, you'll have the power to go deeper even faster. And regardless of your experience with statistics, you'll be supported by the documentation and training that's set the industry standard for over 25 years. Documentation that INFOWORLD calls "The Best in the Business."



The Statistical Procedures in SPSS give you the power to examine data more thoroughly, revealing patterns that might otherwise go unnoticed. We offer the most in-depth group of statistical procedures available including univariate and multivariate descriptives, model building, hypothesis testing, clustering and classification, survival analysis, time series and perceptual mapping. No matter what your question, SPSS provides the flexibility to find the answer.

The Data and File Management capabilities of SPSS give you unparalleled flexibility when preparing data for analysis. With SPSS, information can be quickly reorganized, cleaned and transformed, regardless of size or structure. Multiple missing values for nonresponses can be defined and labeled according to your specifications, while built-in controls easily manage information stored in complex file formats, including custom file formats. Self-documenting portable files give you the freedom to move your analysis from one computing environment to the next, saving time and resources. And because SPSS supports most popular microcomputer file types including Lotus[®], DBF and SYLK, and offers free interfaces to such leading SQL-based database management systems as Informix[™], ORACLE[®] and Sybase[™], there's no need to re-enter data or write out intermediate files.

The Choice of Options offered by SPSS provide the flexibility to meet both your immediate and future data analysis needs. Unlike other statistical packages, we give you more than just the ability to choose between the options you may or may not need. We give you a choice of options designed to work together. Options that work as a system, providing the best possible software solution. Options for data entry and editing. Or producing publication-ready tables and reports. Options to analyze the past and help predict the future. Or to present your results with over 40 high-impact color displays including a variety of charts and maps. No matter what you do, SPSS can help you do it better.



So if you're in the market for statistical software, keep an open mind. Go with the value of SPSS, suppliers of statistical solutions to over 2 million users worldwide. Because when you have the advantage of flexibility, the chances are you'll still be a hit tomorrow.

Call 1(800)543-5835 or FAX (312)329-3668.



SPSS We're Making It Easier To Decide.



Statistical Software For All Leading Computing Environments. Offices in Chicago - Washington, DC - Chertsey, UK - Gorinchem, The Netherlands - Munich - Singapore - Stockholm - Sydney - Tokyo - And Distributors Worldwide

Circle 283 on Inquiry Card.
World Radio History

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

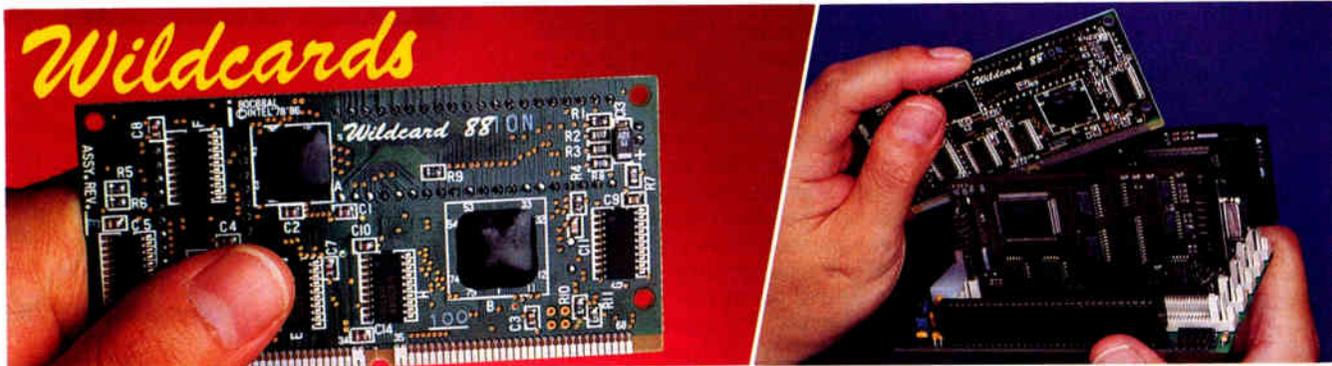
Technologically, 486SX systems don't currently provide any real advantages over existing 386DX and 486DX de-

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."

2" x 4" EMBEDDED PC



Microcontroller.

Microcomputer.

"Megatel Wildcards provide PC functionality in a flexible, small format."

Wildcard 88™

- CPU clock to 10 MHz
- Replaces full PC motherboard
- Co-processor and BIOS socket
- DMA, Bus, DRAM, Keyboard controllers

Multi/10

- On-board SCSI Host Adapter (supports up to 7 devices)
- Floppy Controller (1.44M, 1.2M)
- 2 RS-232, 1 Parallel, 1 RS-485 multi-protocol serial port

Vid/Mem:

- 640Kb User memory
- Video/Colour LCD controls CGA, Hercules®, IBM® Mono; (runs LCD Panels)

All Wildcards are low power single +5 volt operation.

125 Wendell Ave., Weston, Ont. M9N 3K9 Fax: (416) 245-6505

For information on our representatives please contact our head office at the number below.

(416) 245-3324

Wildcard 88 and Megatel are trademarks of Megatel Computer Corp. Hercules is a trademark of Hercules Corp. IBM is a trademark of IBM Corp.

megatel®

The Big Screen

Coming to an
Office Near You.



20"

These two new 1280 x 1024 ultra high resolution monitors will soon be in offices all over the world. That's because they're so *powerful!*

Consider this: Our 17" and 20" non-interlaced microprocessor-enhanced monitors will automatically adjust the image the way you want. Eight of the 16 settings can actually be defined by the operator, the other 8 are programmed at the factory. With built-in memory, these monitors do what you want...and they don't forget. Plus the crystal clarity and sharp focus on the non-glare, anti-static screen are simply unbeatable. NO distortion and low radiation. The ViewSonic 7 even has a flat/square screen.

The ViewSonic 7 (17") and ViewSonic 8 (20") feature a new level of high performance for desktop publishing, CAD/CAM and other graphics-intensive applications. They are designed for PCs, Mac II and Sun systems.



17"

Visit your dealer TODAY and see for yourself why ViewSonic monitors, from the 14" to the 20", are becoming a standard in offices throughout the world.

ViewSonic®

12130 Mora Drive
Santa Fe Springs, CA 90670
(213) 946-0711 (800) 888-8583 Fax: (213) 946-1618

All products and brand names are trademarks of their respective companies.

International Distributors: Australia (02-476-4777, Fax: 02-477-7561); Austria (04252-2700, Fax: 0452-3177); Canada (416-479-5525, Fax: 416-479-1834 and 604-270-8561, Fax: 604-270-1953); Germany (0431-548030, Fax: 0431-5480366 and 05732-101932, Fax: 05732-101937); Hong Kong (389-8252, Fax: 343-6479); Italy (02-82442156, Fax: 02-8256993); Korea (02-784-2915, Fax: 02-784-2549); Poland (39-120314, Fax: 39-120314); Singapore (65-434-1923, Fax: 65-434-192322, Fax: 93-419-1178); Taiwan (02-248-4072, Fax: 02-240-8238)

Circle 326 on Inquiry Card (RESSELLERS: 327).

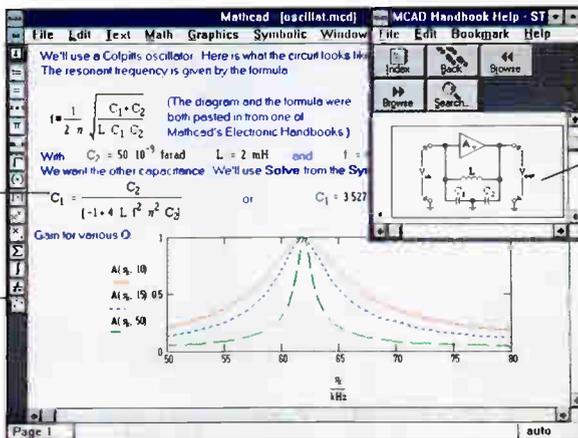
World Radio History

How to spend less time thumbing through books and more time thumbing through results.

New Mathcad 3.0

New Mathcad 3.0 crunches, graphs, updates, and documents your work in real math notation. Automatically.

New symbolic capabilities are available with a simple menu pick.



New Windows 3.0 interface makes calculation fast and effortless.

New Electronic Handbooks give instant access to hundreds of standard formulas. Just click 'n' paste.

It's the fast, efficient, comprehensive way to do technical calculations.

Move those reference texts off your desk. Put that calculator back in your pocket. And save that cryptic spreadsheet for your budgets and bookkeeping.

It's time to get problems out of the way and make room for answers. With new Mathcad 3.0, the major new upgrade to the world's best-selling math software.

It's the all-in-one solution with a singular purpose: to put results in your hands as quickly and thoroughly as possible.

New Mathcad is a workhorse that handles everything from simple sums to matrix manipulation. Effortlessly, naturally.

Simply type your calculations into the live document, just like you'd write them on a scratch pad. And let Mathcad do the work for you. It performs the calculations. Graphs in 2-D or 3-D. Automatically updates results each time you change a variable. And prints out presentation-quality documents, complete with equations in real math notation, even scanned-in graphics.

Newly upgraded Mathcad 3.0 now has Electronic Handbooks for instant access to

hundreds of standard formulas, useful data, even entire calculations. Just click 'n' paste them from a hypertext window into your documents, ready to use.

When you need to simplify a formula, Mathcad's symbolic calculation capabilities are available with a simple menu pick.

There's no arcane programming language to learn, so you can do integrals, Taylor series, infinite sums, and more—all with point 'n' click simplicity. The symbolic answer can be used

for both numerical calculations or further symbolic transformation.

You'll also find improved equation editing, enhanced graphing features, and more documentation options. So why waste time working with problems? Join the 120,000 users that get results—with Mathcad.

- New easy to learn and use Microsoft Windows 3.0 interface
- New easy to use symbolic calculations
- New Electronic Handbooks with hundreds of built-in solutions
- Optional Applications Packs with adaptable templates for Electrical, Mechanical,

Civil and Chemical Engineering, Statistics, Advanced Math, and Numerical Methods

- Differentials, cubic splines, FFTs, matrices and more
- Enhanced 2-D and 3-D graphics
- Improved presentation-quality documentation

• PC DOS, Macintosh®, and Unix® versions also available

For a FREE Mathcad demo disk, or upgrade information*, call 1-800-MATHCAD (or 617-577-1017, Fax 617-577-8829). Or see your software dealer.

Available for IBM® compatibles, Macintosh computers, and UNIX workstations.

TM and ® signify manufacturer's trademark or registered trademark respectively.

1-800-MATHCAD

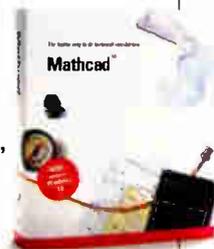
*Free upgrades available for those who purchase Mathcad 2.5 for DOS from 5/1/91-6/30/91. Call for details.

The answer is Mathcad®

MathSoft, Inc.
201 Broadway, Cambridge, MA 02139 USA



Mathcad 2.5
3-14-89 issue.
Best of '88
Best of '87



SOFTWARE

New NetWare Versions, Options Broaden Appeal

BARRY NANCE

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.

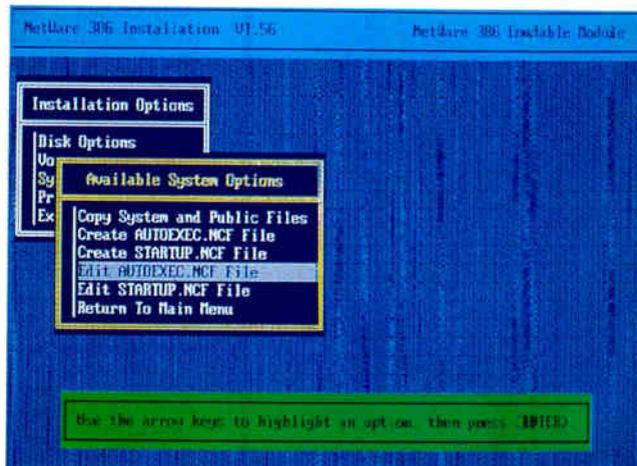
At work I've got four NetWare 3.11 servers, about 70 286 and 386 workstations, and a mixture of IBM, Western Digital, Gateway Microsystems, and Thomas-Conrad 4-Mbps Token Ring cards. I used an IBM RISC System/6000 PowerServer 320 at the office to test NetWare's TCP/IP connectivity.

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



EXTERNAL PARALLEL TO SCSI CD-ROM Optical Disk Subsystem



A 683 MB SCSI removable read-only optical disk subsystem that connects to your computer via its IBM standard parallel port.

Allows online access to large static databases. Enjoy the power of SCSI peripherals, even if your computer does not have a SCSI port.

- High performance 683MB compact disk drive.
- One easy interface to any IBM compatible computer.
- Multiplies the power of notebook and laptop computers.
- Includes audio interface as well as SCSI data interface.
- Additional printer port provided.

Introductory Special
(Regularly \$1,249)

Thru Sept. 30

\$995.00

2500 W. COUNTY RD. 42 • #5
BURNSVILLE, MN 55337
612/894-0595

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

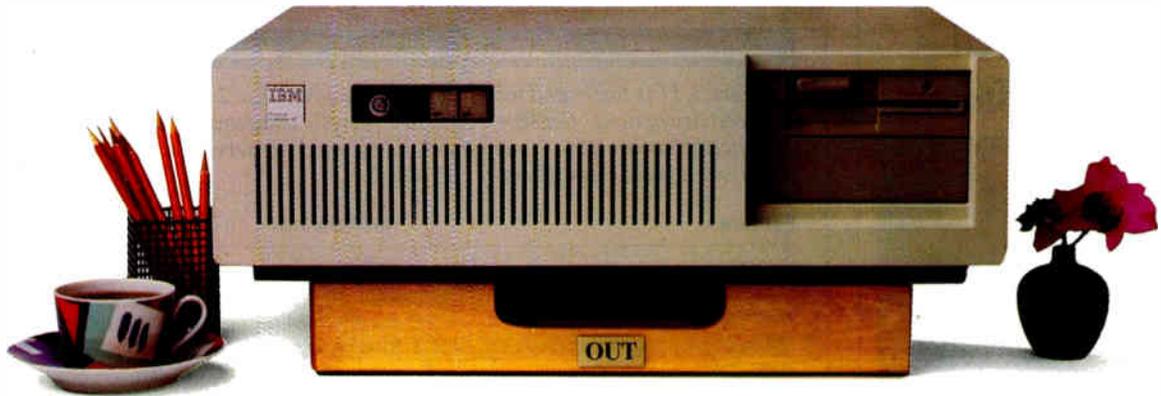
- **WHAT NETWARE DOES**
This network operating system offers file and printer sharing and other connectivity options for Mac, PC, and Unix clients.
- **LIKES**
NetWare 2.2 is now easier to install. NetWare 3.11 options allow connection of Mac, OSI, and Unix clients. Both offer strong security and reliability.
- **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
- **FOR MORE INFORMATION**
Novell, Inc.
122 East 1700 South
Provo, UT 84606
(800) 346-7177
(801) 429-5900
Circle 1221 on Inquiry Card.

subtopic name. Then you press the Enter key to get help for that subtopic.

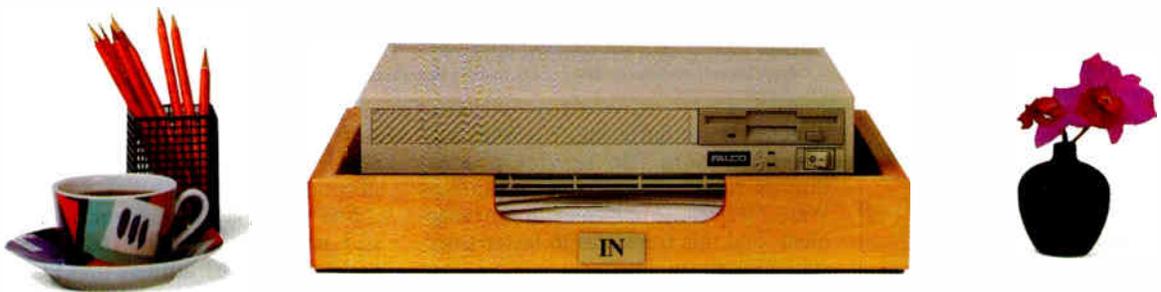
Performance is better with NetWare 3.11, due in part to the new Turbo file allocation table. Each volume contains a FAT—an index to one or more disk allocation blocks in which a file resides. NetWare keeps the entire FAT in server memory and creates a Turbo FAT for files larger than 64 entries. This 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.

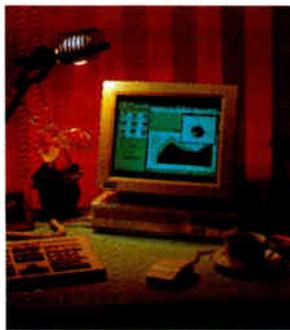


Introducing the Falco Infinity Desktop Computer. The Smallest 386SX Desktop.

If you're sizing up desktop computers, you'll immediately see the advantage of the Falco Infinity™ Desktop. It gives you 386™SX power and performance without dominating your deskpace.

Half the size of a standard PC, the Infinity Desktop has everything you need on-board: Peripheral interfaces like disk controllers. Memory expansion. Communication ports. And VGA® level graphics up to 1024 x 768 resolution. Plus, two AT® compatible, 16-bit expansion slots.

It runs DOS™ 4.0, UNIX™, OS/2™ and Microsoft®



Windows 3.0. What's more, you can choose from four configurations, including a diskless network node and a full-featured model with 1.44MB floppy and the option of 40, 100 or 200 MB hard drive.

The only thing we left out is the noise. The Infinity Desktop runs so quietly, you'll hardly know it's on.

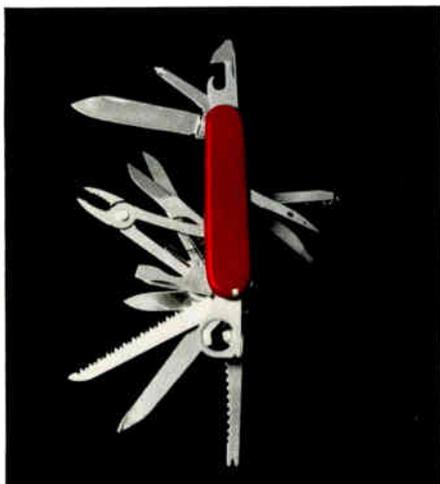
Whether you work in close quarters or spacious surroundings, the Falco Infinity Desktop covers all your needs. Without covering your desk. And that's about the size of it. To get one for your desk, call us today.

1-800-FALCO4U



ASCII EXPRESS®

The right tool
at the right time.



You don't always know what you'll need...so ASCII EXPRESS anticipates your needs with over 140 line editing and word processing features in one powerful package!

With ASCII format, file transfers from other software packages and mainframes are a snap. And ASCII EXPRESS' extensive form processing and merge capabilities finally make data entry and merge processing easy.

Serving your everyday needs:

- Word Wrap and Automatic Paragraph Reformatting
- Headers and Footers
- Centered Typing
- Vertical Typing
- Box and Line Drawing
- Dictionary
- Character and Line Blocking
- Autosave...and more

...plus a host of Special Features:

- Locate Text in a group of files
- 8 special Find and Extract Operations
- Full Columnar Text Manipulation
- Import/Export Files
- Add and Sort Columns
- Formula Calculator
- Normal or relative Line Numbering
- Split/Join Files...and more

Only **\$169.95**

\$189.95 with Dictionary/Spellchecker

VISION SYSTEMS, INC.

502 Bloomfield Avenue
Bloomfield, CT 06002
(203) 247-4747/Fax (203) 243-9150
Site Licenses available

NEW NETWARE VERSIONS

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

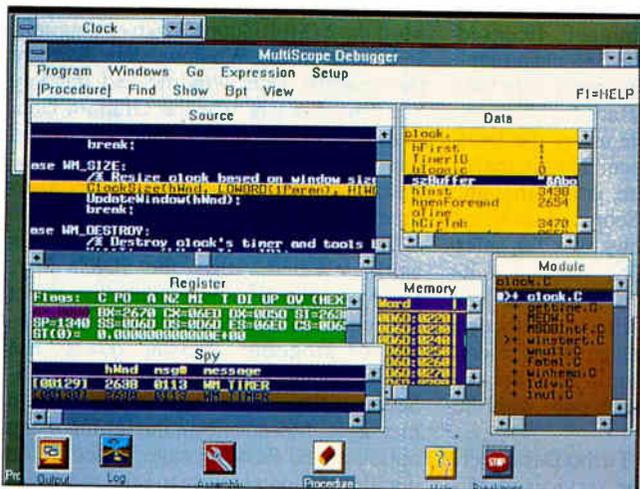
Versions 2.2 and 3.11 of NetWare offer excellent security and reliability. Both are easy to install, and NetWare 3.11 finally delivers long-awaited connectivity options to Novell customers who have DOS, OS/2, Mac, and Unix computers. NetWare 2.2 is an expensive solution if you are creating a small, entry-level 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

MultiScope, Inc.
1235 Pear Ave.
Mountain View, CA 94043
(415) 968-4892
fax: (415) 968-4622

Circle 1224 on Inquiry Card.

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

I THOUGHT THIS WAS
QUALITY SOFTWARE-NOW MY SYSTEM'S
JUST
HANGING!



Don't leave
your customers
HANGING. . .



BEFORE YOU SHIP ANY PROGRAM, CHECK IT WITH



BOUNDS-CHECKER™

WINNER
PC MAGAZINE
BEST OF 1990

JANUARY 15, 1991

PAGE 168

**FINDS OUT-OF-BOUNDS MEMORY ACCESSES
AUTOMATICALLY**

Your program may have 10,000 to a million lines of code. It may occasionally hang mysteriously or it may appear to run flawlessly every time. But under DOS, how can you ever be sure that your program is not corrupting memory it does not own? The only way to be 100% sure is to BOUNDS-CHECK before you ship.

To use BOUNDS-CHECKER you build your program with debugging information (we support most compilers including Microsoft, Borland & JPI). Then you just type <BC file-name>. BOUNDS-CHECKER sets up the 386™/486 for protection and lets your program fly. If your program accesses memory it does not own or overwrites its own code, BOUNDS-CHECKER pops up displaying the offending SOURCE-LINE or instruction.

Programming under DOS is a gamble, so why not stack the odds in your favor--CALL TODAY.

(603) 888-2386

Call by 4:00 PM EST TODAY and ask us to EXPRESS you an info packet. In most cases you will receive it by 10:30 AM tomorrow. (USA only)

All Nu-Mega products require a 386, 386SX or 486. MS-DOS and Codeview are trademarks of Microsoft Corp. 386 is a registered trademark of Intel Corp. Nu-Mega, BOUNDS-CHECKER, Soft-ICE and CV/1 are trademarks of Nu-Mega Technologies, Inc.

OTHER FINE NU-MEGA PRODUCTS. . .

The ultimate systems debugger.

Debug:

- Interrupt routines
- Device drivers
- T&SRs
- ROMS
- Applications
- Overlays



Features:

- Break out of a hung program
- Real time Break-Points
- Back-Trace history
- Works with other debuggers

COMING SOON

Soft-ICE for Windows

Get inside Windows with the first REAL Windows system level debugger. \$386.

1 9 8 8



BYTE
AWARD OF
DISTINCTION

Run CODEVIEW for Windows on a single monitor
CV/1.....\$129

- Runs in a window • No annoying flash •
- Runs on any display that supports windows •



P.O. Box 7780 • Nashua, NH • 03060-7780 U.S.A.
(603) 888-2386 • Fax (603) 888-2465

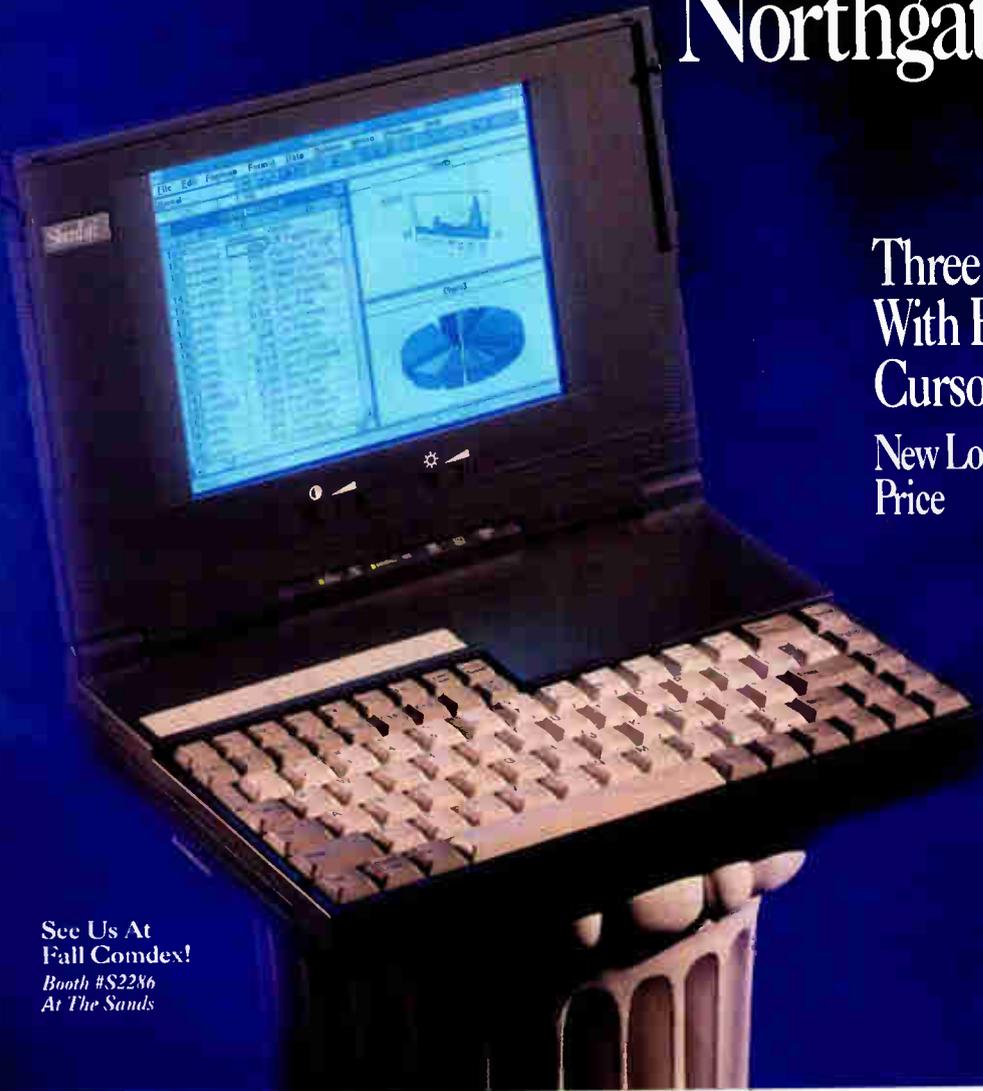
Circle 214 on Inquiry Card.

BOUNDS-CHECKER \$249
Soft-ICE \$386

Special Offer
Buy BC & S-ICE Save \$100

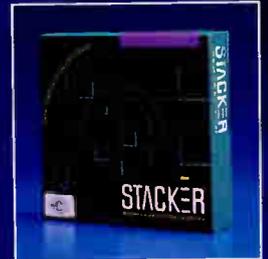
30 Day
Money Back Guarantee

Now! Get 80MB Storage Capacity With Northgate® SlimLite™!



Three SX™/20MHz Systems
With Free Stacker™ And
Cursor Enhancer Software

New Low Price **\$2799⁰⁰!**



Stacker compresses data to give SlimLite 80MB of storage capacity!
A \$149.00 value FREE!

See Us At
Fall Comdex!
Booth #S2286
At The Sands

Get 80MB of storage for the price of 40MB! How to make the best value in notebook computers even better? Put in a fast 40MB hard drive, double SlimLite's storage capacity with FREE Stacker data compression software. Then include ...

Free \$49.95 value cursor enhancing software! Now, SlimLite comes with your choice of Magic Cursor for Windows or No-Squint™ II for DOS at no extra charge! Both programs let you select from a variety of cursor options — let you set cursor "blink" rate, too. Your cursor will "pop" off SlimLite's screen.

Choose from 3 packages! Northgate brings you specially configured 1, 3 and 5MB systems. Take your pick, then call us toll free to order!

SlimLite 1MB Package

- 80386SX™/20MHz Processor
- 1MB RAM
- 40MB Hard Drive
- 3.5" Floppy Drive
- Free Stacker Software
- Free Magic Cursor for Windows or No-Squint II for DOS

Only \$2799⁰⁰ Or as low as \$85⁰⁰ per month**

SlimLite 3MB Package

- 80386SX/20MHz Processor
- 3MB RAM
- 40MB Hard Drive
- 3.5" Floppy Drive
- Free Stacker Software
- Free Magic Cursor for Windows or No-Squint II for DOS

Only \$2999⁰⁰ Or as low as \$90⁰⁰ per month**

SlimLite 5MB Power Package

Everything you need to communicate with business associates the world over. Includes a 2400 baud internal modem, 5MB memory PLUS FREE Crosstalk™. This software features pull-down menus to make modem communications a breeze! Includes:

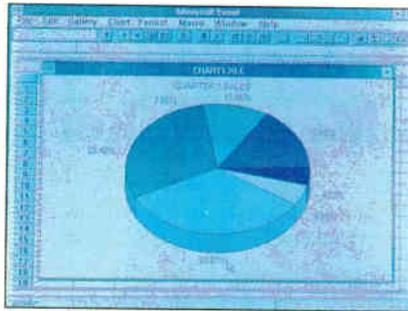
- 80386SX/20MHz Processor
- 5MB RAM
- 40MB Hard Drive
- 3.5" Floppy Drive
- Internal 2400 Baud MNP-5 Modem and Free Crosstalk Software
- Free Stacker Software
- Free Magic Cursor for Windows or No-Squint II for DOS

Only \$3499⁰⁰ Or as low as \$105⁰⁰ per month**

Only Northgate Brings You All This In A 6 Lb. System!

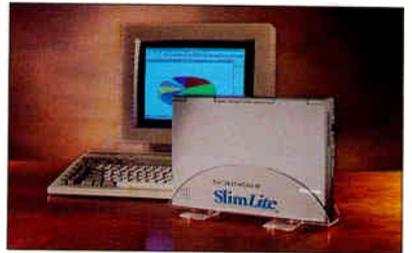
COMPACT POWER! SlimLite is a nifty 11.7" x 8.25" x 1.9" — tucks easily in your briefcase. Plenty of room to spare for extra batteries, AC adapter, a mouse and all your other

business essentials, too. And at only 6.1 lbs. — including battery — it won't bog you down. With the AC adapter (included with your SlimLite) the whole system weighs only 6.9 lbs. Incredible? You bet it is. And you get this only from Northgate!



RAZOR SHARP READABILITY! Sparkling bright sidelit LCD display — VGA 640 x 480 — and you'll see a true 32 shades of gray (Windows solitaire addicts, you'll actually see differences between red and black suits). Other systems claim 32 shades, but just don't measure up to SlimLite. Compare before you buy!

SLIMLITE DOUBLES AS A DESKTOP! Unique Northgate holder lets you set up SlimLite as a desktop "mini-tower". Slide it into the optional stand, connect your full size keyboard and monitor and printer. Presto! You have a powerful desktop computer. You can even communicate around the world with an optional 2400 baud internal modem.



TEST SLIMLITE RISK FREE! Order SlimLite now and give it a workout for 30 days. If SlimLite doesn't deliver everything you expect, return it. We'll buy it back for every penny you paid.



Northgate SlimLite Features:

- System dimensions: 11.7" x 8.25" x 1.9"; battery 4.87" x 2.73" x 0.68"; AC adapter 5.32" x 2.71" x 1.75"
- System weight: 6.1 lbs with battery; AC adapter 0.8 lb.; battery 1.05 lbs.
- 84-key keyboard emulating 101; only one FN function
- 8.5" diagonal LCD screen; supports 32 shades of gray; VGA 640 x 480
- 386SX/20MHz processor; 80387SX coprocessor support
- Up to 5MB RAM
- 40MB hard drive with auto parking
- 1.44MB 3.5" floppy drive
- External VGA monitor and keyboard ports
- Parallel and 9-pin serial ports
- Supports internal 2400 baud MNP-5 modem (optional)
- AC battery charger (optional)
- MS-DOS 4.01 or Version 5 installed
- QA Plus Diagnostic and Utilities software
- Free Stacker software and cursor enhancer software
- One-year parts/labor warranty
- Award-winning toll-free technical support — 24 hours a day, seven days a week

FAST, RESPONSIVE TYPING— ONLY ONE FN KEY FUNCTION!

Before you buy a notebook, check out the keyboard. Beware of those that have lots of FN key functions. Many systems require using these in conjunction with other keys to substitute for separate keys. *Excessive FN key use slows down your typing, can be confusing and downright aggravating.*

SlimLite has separate PG UP, PG DN, HOME and END keys ... and independent inverted "T" cursor keys. You'll feel like you're typing on your office desktop!

The typing keycaps are full size and comfortable. Keyboard quality you expect only of a Northgate.



TOP: Rechargeable Ni-Cad battery weighs 1.05 lbs.
BOTTOM: Compact "AC Pack" weighs well under a pound.

UP TO 2 HOURS OF REAL TIME WORK! SlimLite gives you up to 2 hours of on-the-go computing power. Ingenious power-down feature saves energy, lets you resume working where you stopped. Rechargeable battery is one of the smallest, lightest ever made. Two of them will get you through a coast-to-coast flight. SlimLite recharges WHEN in use with AC adapter.

CALL TOLL-FREE
24 HOURS EVERY DAY

800-345-8709 **800-545-6059**

Fax your order! 800-323-7182

Notice to the Hearing Impaired: Northgate has TDD capability. Dial 800-535-0602.

Major corporations, volume purchases and government agencies call National Business Accounts:



7075 Flying Cloud Drive, Eden Prairie, MN 55344

Circle 212 on Inquiry Card.

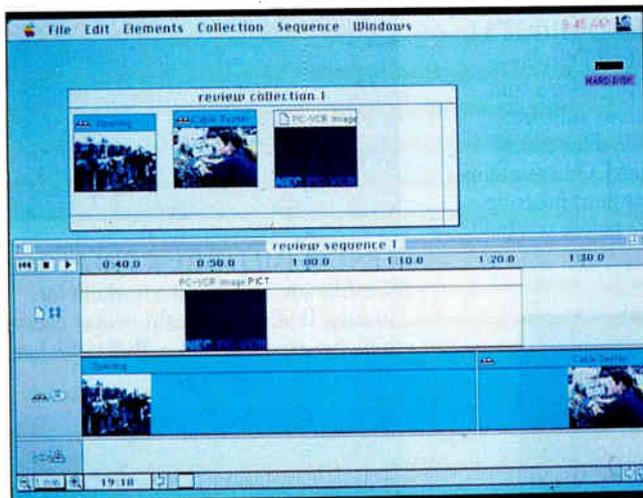
World Radio History

CODE B0109

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

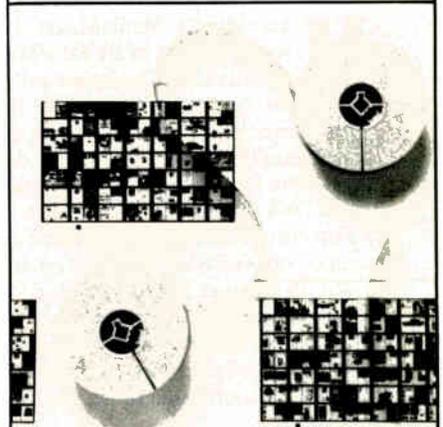
■ FOR MORE INFORMATION

MacroMind, Inc.
410 Townsend, Suite 408
San Francisco, CA 94107
(415) 442-0200
fax: (415) 442-0190

Circle 980 on Inquiry Card.

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

This publication is available in microform.



UMI reproduces this publication in microform: microfiche and 16 or 35mm microfilm. For information about this publication or any of the more than 16,000 periodicals and 7,000 newspapers we offer, complete and mail this coupon to UMI, 300 North Zeeb Road, Ann Arbor, MI 48106 USA. Or call us toll-free for an immediate response: 800-521-0600. From Alaska and Michigan call collect 313-761-4700. From Canada call toll-free 800-343-5299.

Please send me information about the titles I've listed below:

Name _____
Title _____
Company/Institution _____
Address _____
City/State/Zip _____
Phone (_____) _____

U·M·I

A Bell & Howell Company
300 North Zeeb Road
Ann Arbor, MI 48106 USA
800-521-0600 toll-free
313-761-4700 collect from Alaska
and Michigan
800-343-5299 toll-free from Canada

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.

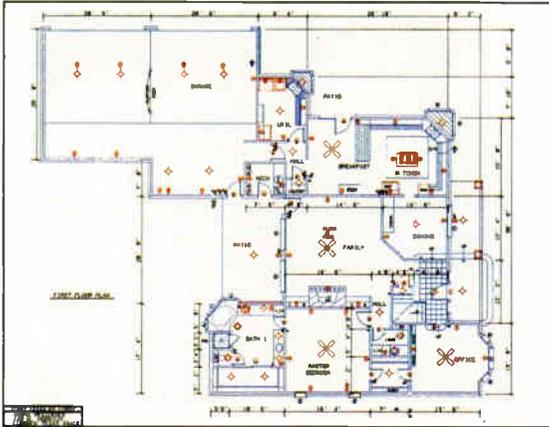
Finally, MediaMaker lacks interactive control. It should be possible to mark segments of a presentation and jump be-

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.

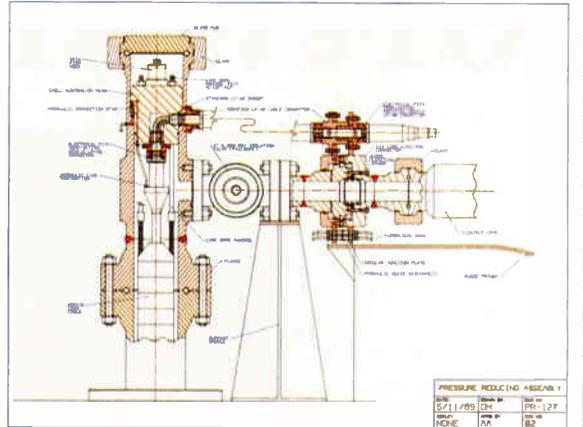
The system requirements for MediaMaker aren't much, considering what the application can do. However, you shouldn't underestimate the time it will take to create your first presentation. Most of the learning process lies in getting used to the applications that create the presentation's raw materials. 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."

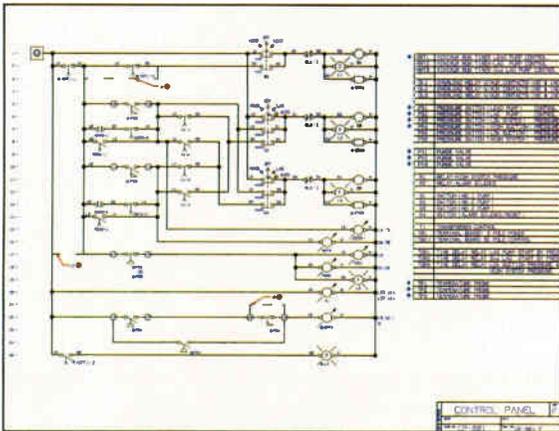
WHAT MAKES A BEST SELLER A BEST SELLER?



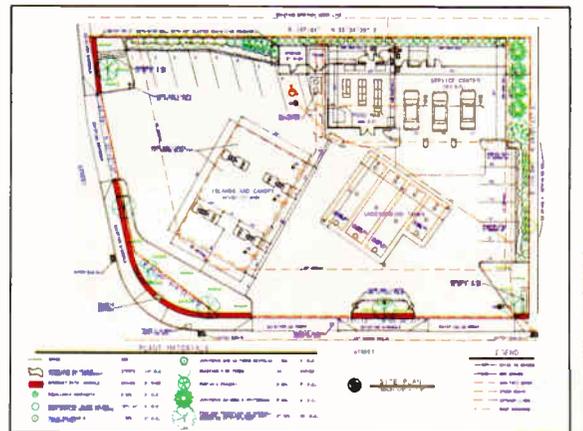
A great plot begins with a great idea, easily translated through every phase of design with Generic CADD 5.0.



Deadline pressure is a thing of the past. Designs can be quickly edited and annotated to produce final working drawings.



No matter the complexity, symbols keep your work flowing uninterrupted. Tap our professional libraries or create your own symbols.



Need to fit a conventional design in a nonconventional space? Revise and improvise in less time with Generic CADD's one-stop convenience.

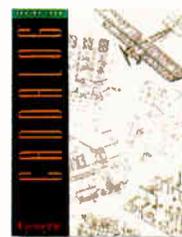
A GREAT PLOT.

Ask any of over 250,000 users of Generic CADD.™ They've discovered CADD that's powerful without being complicated. And professional without being pricey.

Our latest version, Generic CADD 5.0, is just \$495. It's a complete design and drafting program backed by a support team that's drawing rave reviews.

Call us at 1-800-228-3601 for our free full-color CADDalog® and portfolio of CADD drawings.

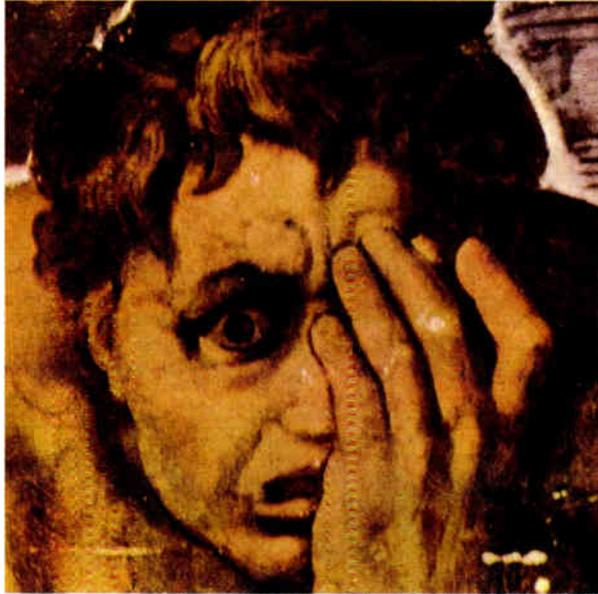
You'll see every plot has a great ending.



Generic
SOFTWARE
An Autodesk Company

IT DOESN'T GET ANY EASIER.

Death Taxes Software Piracy



We can save you from one of them.

Sorry. Death we can't do anything about. As for taxes, when you use our product you'll probably wind up paying more. But software piracy: there we offer some help. Our family of software protection devices (dongles) have improved unit sales for over 2,000 companies around the world. Our products can be used in the MS-DOS, OS/2 and Macintosh environments.

Build Your Own Custom Protection Environment

Use our patented "dual-locking" ASIC chip as the basic building platform. Next, add options like: on-the-fly read/write memory, write-once or multiple-write locking codes, and encryption shells. Then add your

own programming creativity to build a protection environment best suited to your product.

Users attach the device to their parallel port, and programs won't run without it. Back-up copies, hard disk and LAN operation are not interfered with.



Your Intellectual Property Belongs To You

And if you don't protect it, who will? Our products offer the most equitable way to protect your interests without sacrificing the rights of your customers. Call us today for information and demonstration units.

Software Security

1011 High Ridge Road
Stamford, CT 06905
203-329-8870



Fax 203-329-7428
BBS 203-329-7253
AppleLink™ D2379

1-800-333-0407 ext. 102

AUSTRALIA 619 316 2873 • EUROPE 44 932 821 230 • FINLAND 358 0 505 33 55
ITALY 39 2 21 30 450 • NETHERLANDS 31 34 026 77 77 • NORWAY 47 2 44 88 55
SWITZERLAND 41 1 341 9550 • UK 44 784 430 060 • USSR 71 70 50

Macintosh is a trade mark of Apple Computer Inc.,
Activator, Mactivator are trade marks of Software
Security, Inc. illustration: detail from
Michelangelo's Last Judgement

Circle 276 on Inquiry Card.

World Radio History

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.

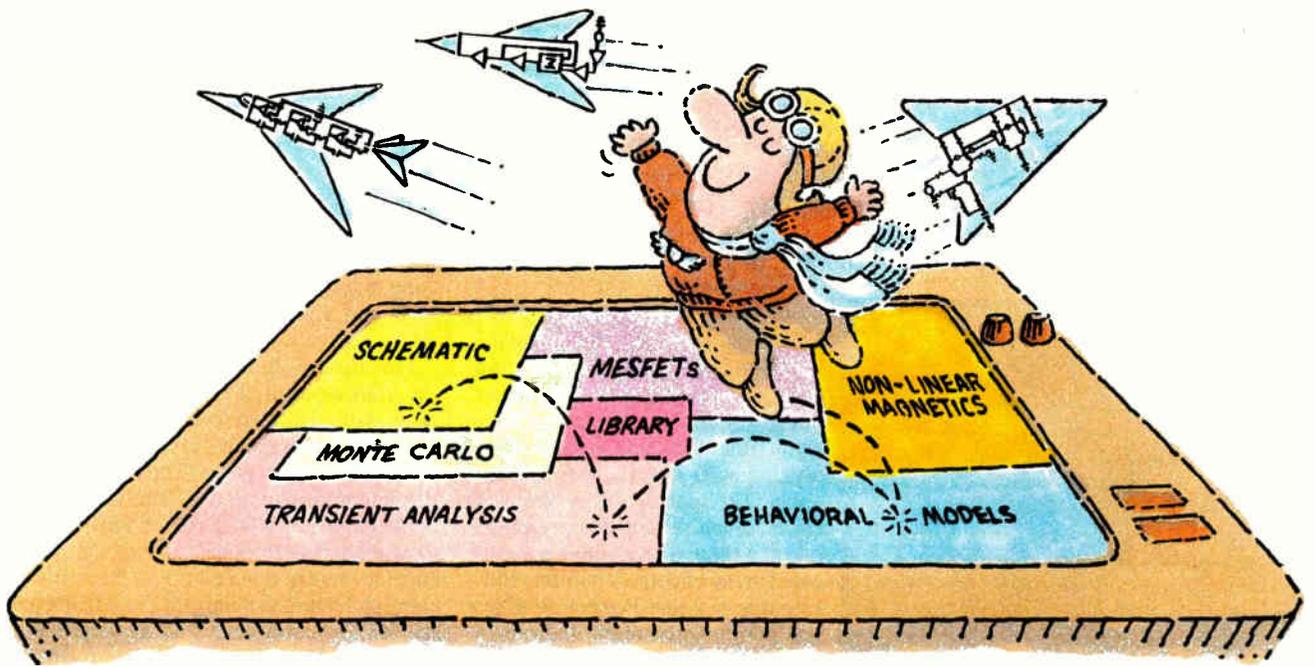
Addresses are recorded separately from the audio and video. A set of input and output connectors on the back lets you copy the address data, along with the audio and video, from one PC-VCR to another. With this, tapes can be distributed along with software that expects certain passages to be located 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



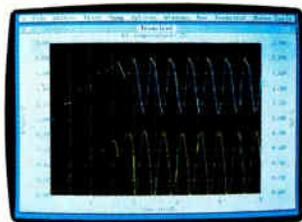
THE NEW MICRO-CAP III.™ SO YOU CAN TEST-FLY EVEN MORE MODELS.

It wasn't easy. But we did it. Made the long-time best-selling IBM® PC-based interactive CAE tool even better.

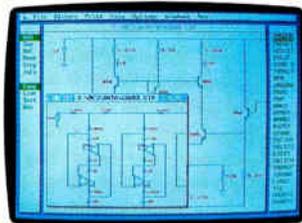
Take modeling power. We've significantly expanded math expression capabilities to permit comprehensive analog behavioral modeling. And, beyond Gummel Poon BJT and Level 3 MOS, you're now ready for nonlinear magnetics modeling. Even MESFET modeling.

Analysis and simulation is faster, too. Because the program's now in "C" and assembly language. That also means more capacity — for simulating even larger circuits.

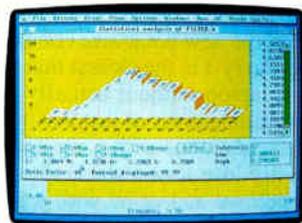
As always, count on fast circuit creation, thanks to window-based operation and a schematic editor. Rapid, right-from-schematics analysis — AC, DC, Fourier and transient — via SPICE-like routines. The ability to combine digital/analog circuit simulations using integrated switch



Transient analysis



Schematic editor



Monte Carlo analysis

models and parameterized macros. And stepped component values that streamline multiple-plot generation.

And don't forget MICRO-CAP III's extended routine list — from impedance, Nyquist diagrams and BH plots to Monte Carlo for statistical analysis of production yield. The algebraic formula parsers for plotting virtually any function. The support for Hercules, CGA, MCGA, EGA and VGA displays. Output for plotters and laser printers.

Cost? Still only \$1495. Evaluation versions still only \$150. Brochure and demo disk still free for the asking. Call or write for yours today. And see how easily you can get ideas up and flying.

spectrum

1021 S. Wolfe Road
Sunnyvale, CA 94086
(408) 738-4387

Circle 282 on Inquiry Card.

World Radio History

Improvements In Grammar Checking



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

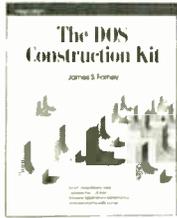
Circle 786 on Inquiry Card.

Reader 1.10 \$79
Langsoft, Ltd.
5 Rosemont Rd.
London W3 9LT, U.K.
44-081-992-2056

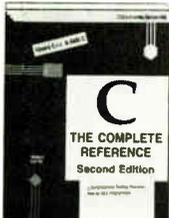
Circle 787 on Inquiry Card.

The two most comprehensive
to bring you the largest selection of business & personal computing

SELECT 5 BOOKS for only \$4⁹⁵



3563P \$22.95



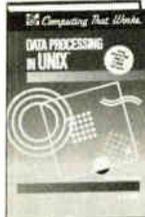
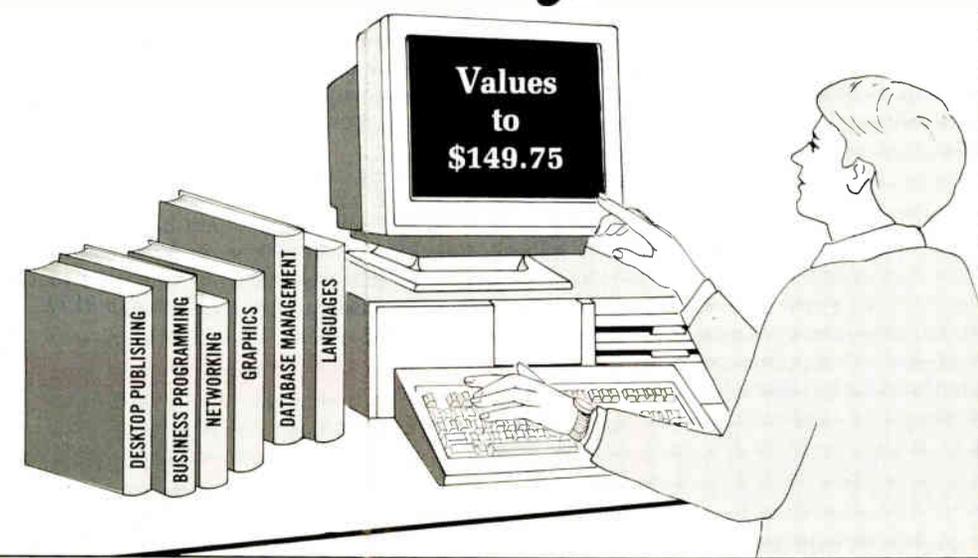
9309P \$28.95
Counts as 2



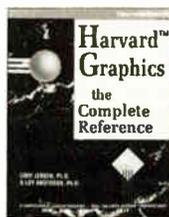
3279 \$36.95
Counts as 2



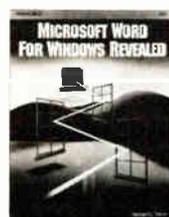
3617P \$29.95
Counts as 2



062885-8 \$39.95
Counts as 2



881621-1P \$27.95
Counts as 2



3799P \$24.95
Counts as 2



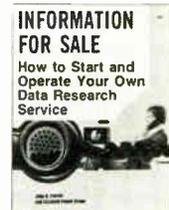
054594-4 \$44.95
Counts as 2



3679P \$22.95



3578P \$16.95



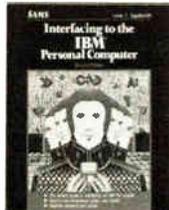
3057P \$15.95



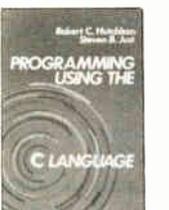
15057P \$39.95
Counts as 2



3170P \$26.95
Counts as 2



9372P \$21.95
Counts as 2



031541-8 \$32.95
Counts as 2



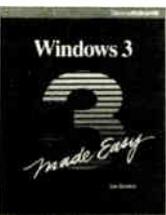
3564P \$19.95



10035 \$49.95
Counts as 2



056565-1P \$29.95



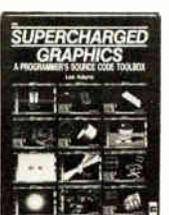
15037P \$19.95



3382P \$29.95



3738 \$26.95



2959 \$31.95
Counts as 2



3418P \$26.95



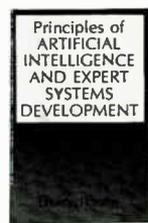
881711-0P \$19.95



046455-3 \$34.95
Counts as 2

computer clubs have joined forces

references available . . . at savings up to 50% off publishers' prices!



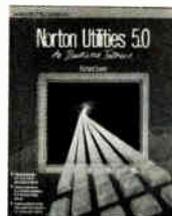
053614-7 \$49.95
Counts as 2



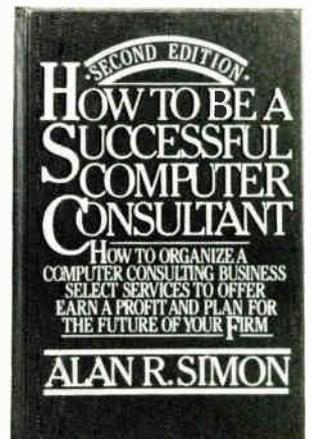
15003P \$22.95



881693-9P \$29.95



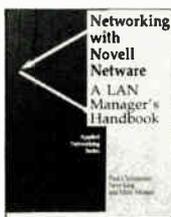
881307-7P \$22.95



9339 \$29.95
Counts as 2



3989P \$16.95



3283 \$29.95



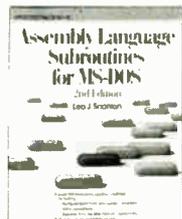
15018P \$19.95
Counts as 2



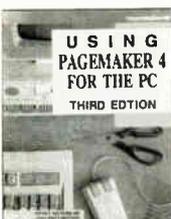
2951P \$18.95



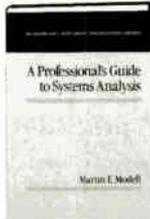
044118-9 \$49.95
Counts as 2



3649P \$24.95
Counts as 2



881629-7P \$26.95
Counts as 2



042632-5 \$39.95
Counts as 2



881736-6P \$27.95
Counts as 2



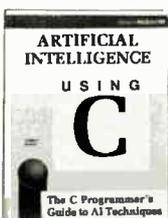
3541P \$24.95
Counts as 2



3828P \$19.95



3683P \$24.95
Counts as 2



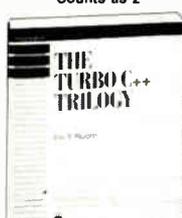
881255-0P \$24.95



15064P \$22.95



3628 \$26.95



3300P \$24.95

Membership Benefits

The Computer Book Club and the BYTE Book Club have joined forces to bring you the largest selection of business and personal computing titles available today.

- Big Savings** In addition to this introductory offer, you keep saving substantially with members' prices of up to 50% off the publishers' prices.
- Bonus Books** Starting immediately, you will be eligible for our Bonus Book Plan, with savings of up to 80% off publishers' prices.
- Club News Bulletins** 15 times per year you will receive the Book Club News, describing all the current selections—mains, alternates, extras—plus bonus offers and special sales, with scores of titles to choose from.
- Automatic Order** If you want the Main Selection, do nothing and it will be sent to you automatically. If you prefer another selection, or no book at all, simply indicate your choice on the reply form provided. You will have at least 10 days to decide. As a member, you agree to purchase at least 3 books within the next 2 years and may resign at any time thereafter.
- Ironclad No-Risk Guarantee** If not satisfied with your books, return them within 10 days without obligation!
- Exceptional Quality** All books are quality publishers' editions especially selected by our Editorial Board.

All books are hardcover unless number is followed by a "P" for paperback. (Publishers' Prices Shown)
©1991 THE COMPUTER BOOK CLUB, Blue Ridge Summit, PA 17294-0820

The Computer Book ClubSM with the BYTE Book Club[®]

Blue Ridge Summit, PA 17294-0820

Please accept my membership in The Computer Book Club with the BYTE Book Club and send the 5 volumes listed below, billing me \$4.95. If not satisfied, I may return the books within 10 days without obligation and have my membership cancelled. I agree to purchase at least 3 books at regular Club prices during the next 2 years and may resign any time thereafter. A shipping/handling charge and sales tax will be added to all orders.

Name _____

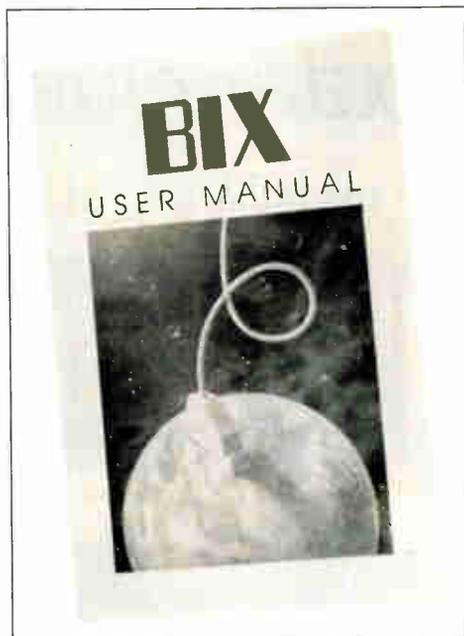
Address _____

City _____

State _____ Zip _____ Phone _____

Valid for new members only. Foreign applicants will receive special ordering instructions. Canada must remit in U.S. currency. This order subject to acceptance by The Computer Book Club. BY991

Where do you go for help when you're more than just an Amiga user?



BIX—the online service for people who know Amiga.

- ◆ *Get quick answers to tough coding questions*
- ◆ *Interact with other Amiga Developers*
- ◆ *Download source code, utilities and other programs for the Amiga*
- ◆ *Keep up with the latest Amiga developments*
- ◆ *Send and receive private e-mail with binary attachments*
- ◆ *Chat with other Amiga users in real time*

All for just \$39 for three months plus \$3 per connect hour weeknights and weekends or \$6 per connect hour weekdays.*

Subscribe to BIX—just set your telecommunications program for full duplex, 2400 or 1200 baud, 7 bits, even parity, 1 stop bit or 8 bits no parity, one stop bit. Have your Visa, MasterCard or American Express card ready. With your modem, dial your local BT Tymnet number, at “xxx[x]” enter “A.” Then at “Please log in” enter “bix”—at “Name?” enter “bix.amiga” and complete on-line registration, you’ll be on BIX immediately.

*Connect fees are for access via BT Tymnet and are subject to change. Call 800-336-0149 for your local access number. BIX handles billing for BT Tymnet connect fees.

Subscribe Today!

BIX

One Phoenix Mill Lane
Peterborough, NH 03458
800-227-2983 or 603-924-7681

JEFFREY H. LUBECK
AND BRUCE D.
SCHATZMAN

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

**You can use
type managers to print
complex documents
on any output device
supported by
Windows 3.0**

ILLUSTRATION: DAVE CUTLER © 1991

SEPTEMBER 1991 • BYTE 315

...ing problem you encounter. Unlike Turbo Pascal, we produce standard Microsoft® objects, support all memory models, and give you complete control over procedure-calling and parameter passing conventions.

INSTANTLY LINK TO OTHER LANGUAGES

With Pascal+ it's easy to interface with code written in any other language. This means, for instance, that you can have immediate access to millions of lines of commercial library code written by and for C programmers.

Turbo Pascal and Turbo C are registered trademarks of Borland International, Inc. Microsoft and Windows are registered trademarks of the Microsoft Corporation. Stony Brook Software and Pascal+ are trademarks of Gogesch Micro Systems, Inc.

SOFTWARE

187 E. Wilbur Rd., Suite 9, Thousand Oaks, CA 91360
Makers of Stony Brook Professional Modula-2 and QuickMod

SAVE \$100! WITH OUR SPECIAL
INTRODUCTORY OFFER!

Buy directly from us by 12/31/91 and pay only:

\$295	plus shipping, U.S. & Canada	\$395	after offer expires
\$375	Incl. shipping, outside U.S. & Canada	\$475	after offer expires

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

MORE THAN YOU ASKED FOR?

Contact Us To Stop Unwanted Advertising Mail.

Most folks like advertising mail. They get special offers, sweepstakes chances, free gifts, good prices on things they can't find anywhere else. And shopping by mail or phone is quick and simple.

But if you're one of those people who would rather not receive advertising mail, we can help.

Send us your name and full address and we'll tell participating national mailers to remove your name from their mailing lists.

After all, they want to talk to people who want to listen.



Mail Preference Service
Direct Marketing Association
11 West 42nd Street
P.O. Box 3861
New York, NY 10163-3861

Name _____

Street _____ Apt. _____

City _____

State _____ Zip _____

Variation of my name _____

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 About
 Since the publication of the *Microsoft* become available. This document contains a section, use the table below. At the end of the document, refer to pages in the *User's Reference*

Additional Information About
 Since the publication of the *Micro* become available. This document contains a section, use the table below. At the end of the document, refer to pages in the *User's Reference*

Additional Information About
 Since the publication of the *Micro* become available. This document contains a section, use the table below. At the end of the document, refer to pages in the *User's Reference*

Text only

For a list of
Information About New Features

For a list of
Information About New Features

For a list of
Information About New Features

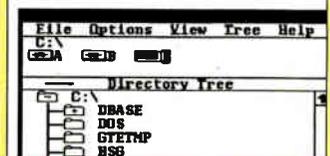
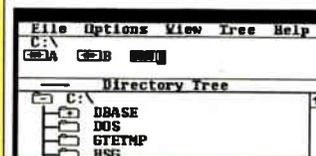
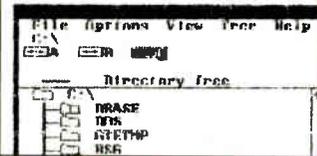
PageMaker 3.01

When started, the MS-DOS Shell will display the disk drive (usually C:\) that holds the Shell. In order to work with the Shell, you must select another drive. As shown in the screenshot, the drive is displayed below the menu bar, with the following files:

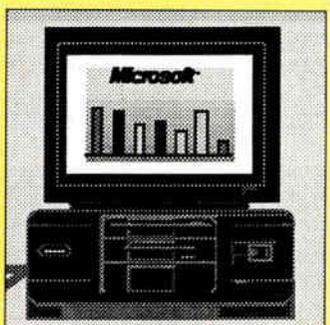
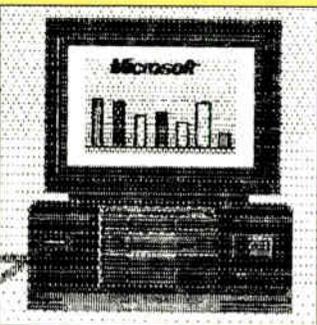
When started, the MS-DOS Shell will display the disk drive (usually C:\) that holds the Shell. In order to work with the Shell, you must select another drive. As shown in the screenshot, the drive is displayed below the menu bar, with the following files:

When started, the MS-DOS Shell will display the disk drive (usually C:\) that holds the Shell. In order to work with the Shell, you must select another drive. As shown in the screenshot, the drive is displayed below the menu bar, with the following files:

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:

SlimLine™ 386SX/20... "Fastest In Its Class!"

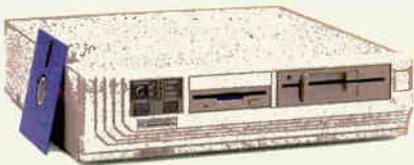
Northgate Outpaces Compaq, AST, ALR, Dell, CompuAdd And A Half Dozen More!



When *InfoWorld's* tough testers rounded up 386SX/20's for an exhaustive battery of head-to-head comparisons, there was no doubt about the leader. SlimLine cruised to an incredible 8.5 rating. Eleven other companies sent their best. None scored higher than 7.9. A few barely broke 6.5.*

"Northgate packs a lot of speed into SlimLine 386/20SX," they reported, "fastest in its class!"*

How did Northgate beat the competition? By following our corporate philosophy: "Every system we sell must be a winner." Before we entered the SX race, we designed our own motherboard with a full 64K RAM cache into both our 16 AND 20MHz entries. And, this incredible speed comes in a space-saving case only 4.25" high!



InfoWorld says: "Exceptional support policies!"* No wonder. Northgate gives you toll-free 24 hour technical support, one year parts and labor warranty and overnight shipment of replacement parts. And now, you get a FREE year of on-site service from the nation's largest computer service company.

There you have it. Right on the heels of Northgate Elegance™ 486™/33 being voted *InfoWorld's* "Desktop Computer of the Year" and *BYTE's* Reader's Choice Award for "Desktop Computer of the Year," another Northgate system (backed by the same legendary support) thrashes the competition in the SX20 arena.

Prove it to yourself... use SlimLine 386SX RISK FREE for 30 days! If it isn't everything you expect, we'll buy it back. No questions asked!

SlimLine 386SX Features:

- Intel® 80386SX/20 or 16 MHz processor
- 2MB of RAM on motherboard
- 64K SRAM read/write-back cache
- 1.44MB floppy disk drive
- Small footprint (16.5" x 16.5" x 4.25" high)
- SlimLine case with room for two exposed and one internal half-height devices
- Integrated 16-bit SVGA with up to 1024 x 768 resolution; 512K video memory
- Intel math coprocessor support
- 150 watt power supply
- Front mounted reset and high/low speed controls
- OmniKey® keyboard
- MS-DOS 3.3 or 4.01 with GW-BASIC or MS-DOS Version 5 with QUICKBasic installed
- Microsoft® Windows™ and mouse
- On-line user's guide to MS-DOS
- QA Plus diagnostic and utility software
- FCC Class B certified

Northgate
Announces New
Lower Prices!

Design Your Own System!

Northgate will custom build your system to meet your most demanding needs. Add hard drives — 40, 80, 100 and 200MB available. Monitor options include 12" VGA monochrome, 14" VGA and SVGA and 16" SVGA. More memory, floppies, a modem... it's up to you! Call for details!

SlimLine 386SX/20

\$1599⁰⁰ Or as low as \$50⁰⁰ per month†

386SX/16 as configured above:

\$1499⁰⁰ Or as low as \$45⁰⁰ per month†

EASY FINANCING: Use your Northgate Big 'N', VISA, MasterCard. Or, lease it — up to five-year terms available.

CALL TOLL-FREE
24 HOURS EVERY DAY **800-345-8709**

Major corporations, volume purchasers and government agencies call
National Business Accounts: **800-545-6059**

Notice to the hearing impaired: Northgate has TDD capability. Dial 800-535-0602.



"Smart Tools For Business"™
7075 Flying Cloud Drive, Eden Prairie, MN 55344

See Us At
Fall Comdex!
Booth #S2286
At The Sands

© Copyright Northgate Computer Systems, Inc. 1991. All rights reserved. Northgate, OmniKey, SlimLine and the Northgate 'N' logo are registered trademarks of Northgate Computer Systems. 80386SX and 80486 are registered trademarks of Intel. All other products and brand names are trademarks and registered trademarks of their respective companies. Prices and specifications subject to change without notice. Northgate reserves the right to substitute components of equal or greater quality or performance. All items subject to availability. We support the ethical use of software. To report software copyright violations, call the Software Publishers Association's Anti-Piracy Hotline at 1-800-388-PIRB. *InfoWorld, February 25, 1991. †When charged to your Northgate Big 'N' card. 19% A.P.R.

Circle 213 on Inquiry Card.
World Radio History

CODE B0209

Some days you have all the time in the world.



When the pressure is on, pour on the speed. With Hewlett-Packard's new LaserJet III Si printer. A powerhouse that delivers at a throughput speed of 17 pages per minute.

With the LaserJet III Si, you're up to speed the moment you give the "print" command. HP's RISC-based formatter and the PCL5 printer language, with vector graphics and on-the-fly typeface scaling, yield fast

results. This printer also represents a new standard for I/O performance with optional Network Printer Interface cards for either Ethernet or Token Ring.

The LaserJet III Si is specifically designed for shared-use environments. Its high-volume paper handling features include two 500-sheet input trays and a monthly duty cycle of 50,000 pages. HP offers software-selectable language switching

between PCL5 and optional Adobe® PostScript®. For added versatility, your options include

Adobe and PostScript are registered trademarks of Adobe Systems Inc. in the U.S. and other countries.

World Radio History



And some days you need the new 17ppm LaserJet III Si.



an envelope feeder and two-sided printing.

Beyond speed and efficiency, the LaserJet III Si delivers the sharpest 300 dpi print quality yet. In fact, HP's revolutionary combination of Resolution Enhancement technology and new microfine toner challenges the print quality of many 600 dpi printers.

The price of the new LaserJet III Si, just \$5,495*, is as impressive

as the work load it handles. If you're ready to pick up the pace, call **1-800-752-0900, Ext. 2067** for more information on the fastest LaserJet printer and the name of your nearest authorized HP dealer.

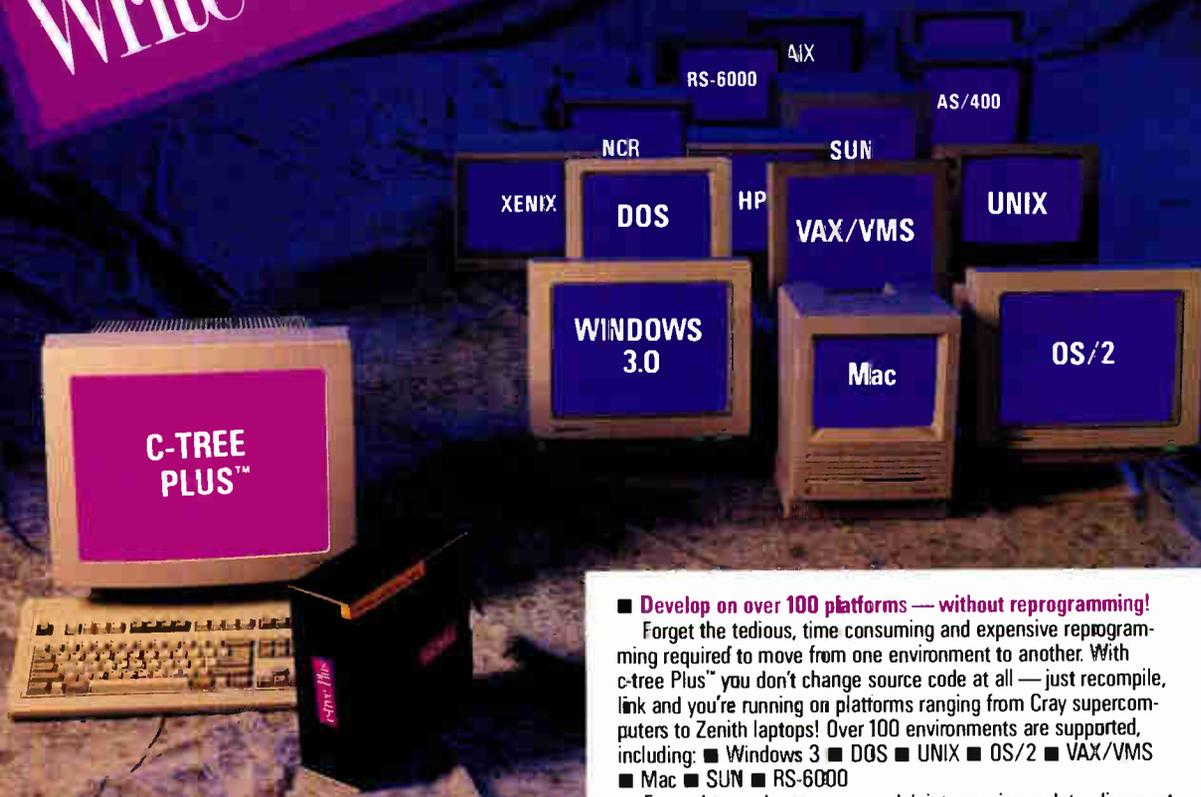


**HEWLETT
PACKARD**

*Suggested U.S. list price. © 1991 Hewlett-Packard Company PE12101

Circle 131 on Inquiry Card.

Write Once, Port Many.



With new c-tree Plus™
when you've written
for one platform you've
written for them all.

■ **Develop on over 100 platforms — without reprogramming!**

Forget the tedious, time consuming and expensive reprogramming required to move from one environment to another. With c-tree Plus™ you don't change source code at all — just recompile, link and you're running on platforms ranging from Cray supercomputers to Zenith laptops! Over 100 environments are supported, including: ■ Windows 3 ■ DOS ■ UNIX ■ OS/2 ■ VAX/VMS ■ Mac ■ SUN ■ RS-6000

Forget byte order, memory model, integer size or data alignment hassles — c-tree Plus manages it all automatically, regardless of processor architecture. And c-tree Plus even provides a utility to port your pre-existing data files *in place*.

■ **Whether you need single, multi-user, client/server or LAN configurations, c-tree Plus supports them all!**

Now you don't have to make a choice between configurations — c-tree Plus supports them all. The same application can use c-tree Plus as a powerful data management engine or as a client front-end to the FairCom Servers.

■ **Put the latest data management technology to work in your applications!**

Outstanding new features make c-tree Plus the developer's "product of choice." Features include: ■ True transaction processing* ■ Superfiles ■ Resources ■ Full ANSI-standard SQL functionality* ■ Batched operations ■ Ultra-high speed data & index cache ■ Row & key level locking ■ FREE FairCom® Server (Developer's Version) ■ No run-time royalties ■ Full source code ■ Extensive tech support.

■ **Order your copy of c-tree plus today!**

Start putting the power of new c-tree Plus to work in your applications right now — call FairCom today!

(800) 234-8180, Ext. 1

* — when used in conjunction with the FairCom Servers



4006 WEST BROADWAY
COLUMBIA, MO 65203
PHONE 314.445.6833

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.

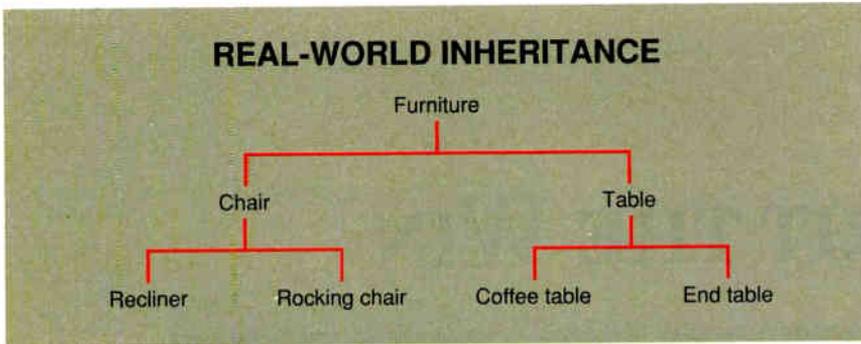


Figure 1: An inheritance tree for Furniture.

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.

continued

OOP Async Tools for Turbo Pascal 6.0 with ZMODEM and Data Decompression

Async Professional is a full-featured object-oriented communications toolkit that enables you to build powerful async applications faster and easier. Async Professional has all the standard features you'd expect of an async toolbox. Plus the robust ZMODEM transfer protocol, data decompression tools, and both object-oriented and procedural calling interfaces.

You get ■ interrupt driven buffered I/O to 115K baud ■ ZMODEM, Kermit, XMODEM, YMODEM protocols ■ ZIP and LZH data decompression ■ automatic flow control—XON/XOFF, CTS/RTS, DTR/DTS ■ COM1- COM8 support with up to 4

ports open at once ■ 16550 buffered UART support ■ hardware interrupt sharing on PS/2 ■ ANSI terminal emulation ■ modem control including Hayes, V.32, V.42, and MNP5.

Hot Example Programs Too!

Demo programs include a powerful multi-window comm program with menus, text editor, and mouse support, built using Object Professional, and a simple comm program that depends on no other products.

Powerful Async Debugging

Event logging and tracing options create a time-stamped audit trail of all async interrupts and characters sent or received. You'll debug your

application faster without the need for special debugging hardware.

Full Source, Documentation

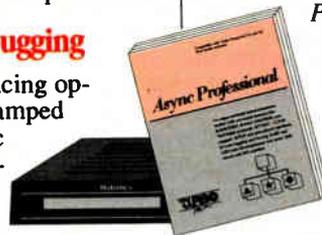
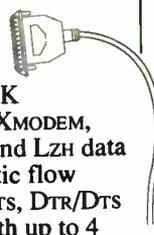
Async Professional includes complete documentation, pop-up help, free technical support on CompuServe and by telephone direct from the authors. You get full source code and pay no royalties.

"Async Professional is an excellent series of routines...and very complete. It's better than anything I've seen in Pascal, C or assembler."

Richard Wilkes, Author, TAPCIS

Async Professional, only \$139.

Call toll-free to order. 1-800-333-4160



Satisfaction guaranteed or your money back within 30 days. Add \$5 per order for standard shipping in U.S./Canada. Inquire about other shipping options. Includes both 5.25" and 3.5" disks. Registered LiteComm owners call for special upgrade offer. OOP units require Turbo 5.5 or 6.0; non-OOP units require Turbo 5.0 or later.



9AM-5PM MST Monday through Friday, USA & Canada. For more information call (719) 260-6641, fax to (719) 260-7151, or send mail to CompuServe ID 76004,2611 TurboPower Software PO Box 49009 Colorado Springs, CO 80949-9009 © TurboPower Software 1991



\$19.95

"Power C is a heavy-weight contender - at a bantamweight price"

Stephen Davis
- PC Magazine

"On sheer audacity for price-performance ratio, we loved Mix's products"

Tim Parker - Computer Language



\$19.95

"The Ctrace debugger is where Mix really shines. It is magnificent."

David Weinberger
- Computer Shopper



Power C

combines a high-performance C compiler with superb documentation, at a price that brings chuckles from over 50,000 satisfied customers. That's because Power C performs favorably against compilers costing 10 times as much. And you can't buy a compiler that's more reliable or easier to use - at any price. Perhaps that's why Power C has won Computer Shopper's Best Buy award for three years running.

- compatible with ANSI C standard
- integrated Make utility
- library of over 450 functions
- IEEE software floating point
- supports 8088/286/386/486 CPU
- memory resident program support
- supports 8087/287/387 math chips
- small/medium/large memory models
- mixed model with near/far/huge
- allows arrays larger than 64K
- CGA, EGA, VGA & Hercules graphics
- 650 page manual with tutorial

\$10.00

Power C Library Source

includes our Power C assembler, plus the C and assembly language source code to over 450 functions in the Power C library. Unlike our competitors, who charge \$150.00 or more for library source code, we've made ours very affordable.

\$10.00

Power C BCD Business Math

includes binary coded decimal floating point routines and financial functions to calculate interest, depreciation, etc.. BCD routines are used for dollars and cents calculations to eliminate inaccuracies caused by rounding.

Power C requires DOS 2.0 or later, 320K memory, 720K disk space. Master C requires DOS 3.0 or later, 384K memory, hard disk.

Power Ctrace

combines state-of-the-art technology with a friendly interface, making it very easy to find and correct your programming mistakes. No time consuming edit/compile cycles are needed to track down bugs. Simply compile your program once with the trace option, and Power Ctrace does the rest. Multiple windows display your C source code, the values of all your program variables, program output, watch points, and assembly instructions. Put Power Ctrace to work for you, and we guarantee that you'll be a more productive C programmer.

Order line:

1-800-333-0330

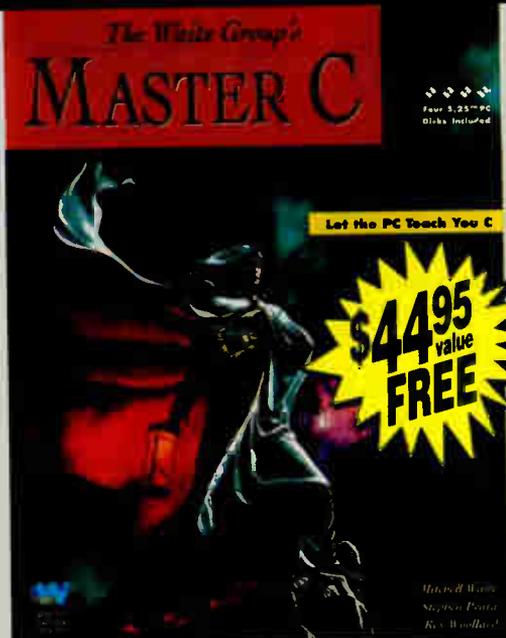
Technical Support:

1-214-783-6001

Fax: 1-214-783-1404

Mix Software, 1132 Commerce Drive,
Richardson, TX 75081

Get a FREE copy of Master C (limited time offer)



Published by the highly acclaimed Waite Group, Master C is a revolutionary book/disk package that turns your PC into a C instructor. Master C teaches you, quizzes you, notices problems you are having, and recommends action. In a pilot study at IBM, students using Master C retained 19% more knowledge than students who learned from a lecturer. Now you can receive this \$44.95 package absolutely FREE when you purchase all four Power C products described above. Just ask for the Master Pack.

"Master C eschews flash for elegant competence, and it works!"

Jeff Duntzman - PC Techniques

60 day money back guarantee

Name _____
Street _____
City _____
State _____ Zip _____
Telephone _____

Please send me a free brochure

Paying by: Check Money Order
 MC Visa Amex Discover
Card # _____ Exp _____

Disk Size: 5 1/4" 3 1/2"

Product(s) (Not Copy Protected)

Power C (\$19.95) \$ _____
 Power Ctrace (\$19.95) \$ _____
 Power C Library Source (\$10) \$ _____
 Power C BCD Business Math (\$10) \$ _____
 Master Pack (\$59.90) \$ _____
(includes all of the above plus Master C)
Add Shipping \$ _____
(\$5 USA - \$10 Canada - \$30 Foreign)
Texas Residents add 8.25% Sales Tax \$ _____
Total amount of your order \$ _____

Circle 196 on Inquiry Card.

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.

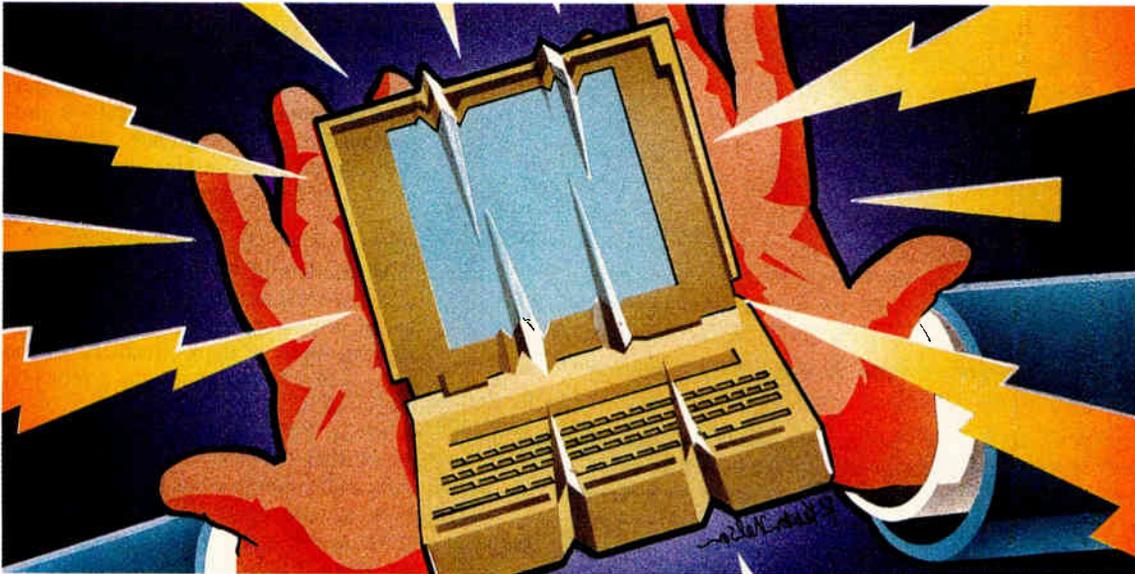
A Technique

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.

continued on page 388

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:

$$P = V^2/R$$

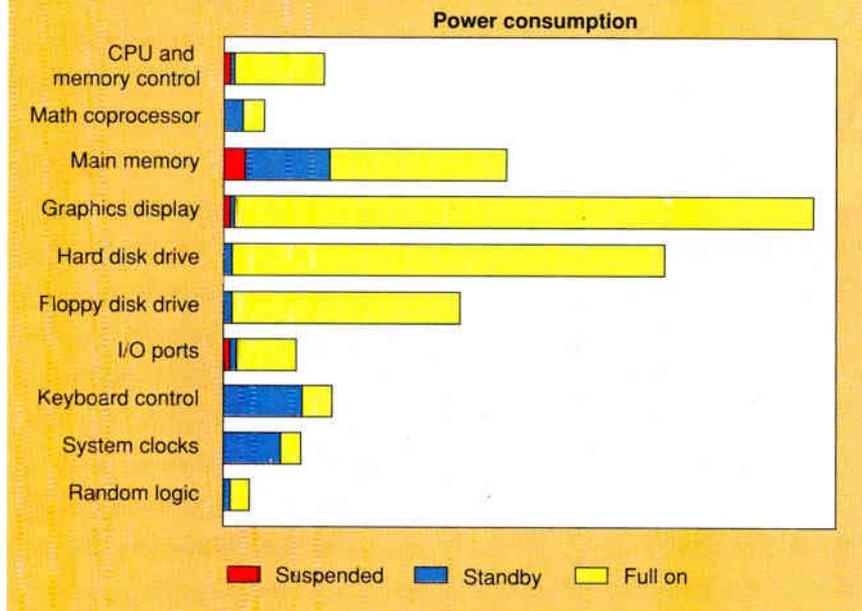
In other words, power is equal to the square of the voltage across a device divided by the resistance of that device. The second equation applies when an AC signal—a clock—drives a capacitive load:

$$P = CV^2f$$

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.

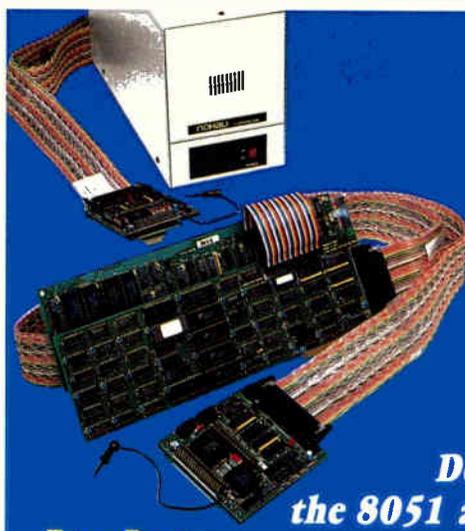
The size of the display has a dramatic effect on power consumption. Given a constant scan rate (generally no slower than 50 Hz to avoid flicker), the frequencies of the clocks that drive the display must go up in proportion to the number of lines. What's more, the time available to charge the capacitance 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



8051 & 68HC11

PC-Based
In-Circuit Emulators

Nohau
Covers All Your
Development Needs for
the 8051 and 68HC11 Families!

Free Demo

You can start your debugging with this FREE demo simulator. You can load up to 512 bytes of code, assembler, C, or PL/M and do full debugging/simulation in assembly and source level. A great way to get started for FREE. Fantastic for schools! Just call and we'll send it!

Full Simulator

The full-blown simulator is an extension of the DEMO. You can load up to 64K of code and use 64K of XDATA space. You can program an "external environment" to interact with your code to simulate your target system. The emulator is the hardware extension of the simulator!

In-Circuit Emulation

The 24MHz real-time emulator has been the industry standard for years. With its complex breakpoint logic and advanced trace, nobody can beat it for performance. Plug-in or RS-232 configuration. All 8051 derivatives are supported!



NOHAU

CORPORATION

51 E. Campbell Avenue, Campbell, CA 95008
(408) 866-1820 • FAX (408) 378-7869

Australia (02) 654 1873, Austria (0222) 38 76 38, Benelux +31 1858-16133, Canada (514) 689-5889, Czechoslovakia 0202-2683, Denmark (42) 65 81 11, Finland 90-452 1255, France (01)-69 41 28 01, Germany 08131-25083, Great Britain 0962-73 31 40, Greece 01-862-9901, Hungary (1) 117 6576, Israel (03) 48 48 32, Italy (011) 771 00 10, Korea (02) 784 784 1, New Zealand (09) 392-464, Portugal 01-80 9518, Norway 02-649050, Singapore (065) 284-6077, Spain (93) 217 2340, Sweden 040-9224 25, Switzerland (01) 740 41 05, Taiwan (02) 7640215, Thailand (02) 281-9596, Yugoslavia 061 621066.

Circle 209 on Inquiry Card.

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



Smart-UPS 600

NOVELL PASS AUTHORIZED TESTED APPROVED



COMPAQ SYSTEMPRO

The Smart-UPS™

by American Power Conversion



APC Uninterruptible Power Supplies keep more LANs up, running, and reliable than any other brand of UPS. Call for your free power protection handbook and find out why.

800-541-8896, Dpt. P4

33-1-60078500 in Europe

Advanced features

- Tracks power quality data for analysis (software required)
- Interface for Novell, LAN Manager, LAN Server, Unix, Banyan, etc.
- Smart Guard™ brownout correction
- Full-wave multi-stage surge suppression, EMI/RFI filters
- Battery replacement LED, load and voltmeters
- 400 to 2000VA in both 117V and 230/240V models

Unmatched reliability

1985, 1990 PC Magazine Editors' Choice

1985, 1990 Novell Manager News "Best to Sell 1985"

1989, 1991 LAN Times, Editors' Choice

1989 PC Week "All Annual Reliability Index"

1990 International Yearbook "Lexus"

1990 Computer International, Product of the Year

1991 Best Computer Power

Circle 21 on Inquiry Card (RESELLERS: 22).

WorldRadioHistory.com

Graphical User Interface CLEARING HOUSE

Specializing in products for Microsoft Windows and OS/2 graphical environments

G.U.I. CLEARING HOUSE - PM / Windows Catalog

File Edit Search Order!

WINDOWS APPLICATIONS

Development Tools	
ACTOR 3.1 Professional.....	429
ADEPT Expert Application Builder.....	595
ICEWorks Pro (Icon Editor).....	129
Borland C++.....	339
Borland ObjectVision.....	99
Borland Turbo Pascal/Windows.....	199
Bridge 2.0 Tool Kit.....	629
C-TRIEVE Windows (Coromandel).....	349
C++ Views.....	469
CASE:W 3.0.....	459
CASE:W Corporate Edition.....	895
Graphics Server SDK.....	399
Knowledge Pro Windows.....	629
Lasertalk PC.....	309
Microsoft SDK for Windows 3.0.....	349
Multiscope for Windows 3.....	299
ObjectGraphics (WhiteWater).....	call
Personal Case.....	179
PowerLibW.....	265
ProtoView.....	585
ProtoGen.....	409
Pubtech BatchWorks.....	89
SmallTalk V/Windows.....	369
SpeedEdit for Windows.....	255
ToolBox (Drover).....	249
The Whitewater Resource Toolkit.....	179
WindowsMAKER Professional.....	795
WinTrieve.....	369
VZ Programmer Windows.....	535
Zortech C++ Developers Edition.....	399
Database/Forms	
Access SQL (SPI).....	1279
dBFast/Windows.....	319
ERwin ver 1.5.....	849
FormWorx Forms Publisher.....	169
INTEGRA SQL.....	609
JetForm.....	399
MARVIN Image Database.....	2395
Omnis 5/Windows.....	759
PerForm Pro.....	299
Q+E ver 2.6, (standard or server).....	call
Superbase 2 ver 1.2.....	249
Superbase 4 ver 1.2.....	469
Chart Builder for Superbase.....	169
Thinx.....	399
Engineering/Planning	
ABC Flowcharter.....	249
Braniceal (Neural Net).....	229
Design/IDEF.....	2795
DesignView.....	749
DRAFIX Windows CAD.....	459
MathType.....	199
MetaDesign, diagramming tool.....	329
Milestones, Etc.....	129
Project for Windows.....	469
PUMP-FLO, pump analysis.....	179
RFFlow, flowcharting.....	119
SPACETEK-Facility Planner.....	call
Topdown Project Planner.....	249

1-800-522-4624

International, call (203) 268-4400 Fax (203)261-4636
Monday - Friday 9:00am to 8:00pm EST

GUI Clearing House is the only national reseller specializing exclusively in Windows and OS/2 Presentation Manager environments. This specialization is necessary in order to properly serve you, our customer, in this rapidly evolving market. Our goal is to provide you with the finest customer service in the industry and to ensure that the products you select are the correct ones for your application.

When you call GUI Clearing House, you will be greeted by one of our friendly, knowledgeable sales staff who will take the time to talk with you to understand your specific requirements. To further assist you, we maintain a staff of technical consultants available to answer in-depth technical questions on products; and to help customers in identifying applications to meet their needs.

Please Note: The applications listed in this ad represent only a small sample of the Windows and OS/2 Presentation Manager products available through GUI Clearing House. Call us for pricing on any Windows or OS/2 applications. We'll promptly get pricing and availability for you. **CALL TODAY!**

>> HOT NEW PRODUCTS <<

Aldus Type Align.....	79	Realizer.....	299
Braniceal.....	229	Remotely Possible.....	call
Clip & Save for Windows.....	129	Sitback.....	119
File Shuttle XPRESS.....	129	VentanaDRAW.....	149
ICEWorks Professional.....	129	Virus Secure.....	85
PFS: Window Works.....	149	Visual BASIC.....	159
Photo Styler.....	699	Whiskers.....	25

Connectivity

Business Session for Windows.....	269	PubTech Text Editor.....	69
cc:MAIL for Windows.....	449	SmarText (Samna).....	409
DaVinci eMAIL for Windows.....	call	Straight Line.....	89
DynaComm (Sync or Async).....	259	WideAngle/Windows.....	119
DynaComm Elite.....	399	Windows/On The World.....	409
EXTRA! for Windows.....	379	Windows Shopper's Guide.....	16
Faxit! for Windows ver 2.0.....	139	Publishing/Graphics	
MicroPhone II.....	259	Adonis Clip-Art Window Shopper.....	42
Net Magic (US version).....	609	Aldus PageMaker.....	499
Network Courier.....	509	Ami' Professional ver 1.2.....	319
Remotely Possible.....	249	Archetype DESIGNER.....	795
TERM for Windows.....	179	Arts & Letters Graphics Editor.....	509
Windows Workstation.....	559	Corel DRAW! 2.0.....	399
WinTerm.....	409	DoDOT! (capture/convert).....	139

General/Productivity/Utilities

Adobe Type Manager.....	69	Image-In Full Pak.....	679
Asymetrix ToolBook.....	309	Image-In Scan & Paint.....	139
BeckerTools 2.0.....	99	Image Prep.....	269
Distinct Back-up.....	119	Instant ORGcharting.....	NEW
File Shuttle XPRESS.....	129	Micrografx Charisma.....	349
File FIX.....	119	Micrografx Designer 3.01.....	469
HP New Wave.....	call	Microsoft Office for Windows.....	699
ICEWorks Personal.....	79	Picture Publisher.....	489
Icon Pak II.....	89	PowerPoint for Windows.....	329
Intermission.....	42	Publisher's PaintBrush.....	359
More Windows.....	89	PubTech Multi-Tack.....	139
PackRat 3.0 for Windows.....	call	Scrapbook+ 2.1 (Eikon).....	99
Personal Librarian.....	859	Ventura Gold Series.....	559
PLUS for Windows.....	179	WordScan Plus.....	795
Publisher's Powerpak.....	69	Word for Windows.....	329
PubTech File Organizer.....	159	Financial/Accounting	
		Accounting Software for Windows.....	call

PM APPLICATIONS

Active Life for OS/2.....	135
Aldus PageMaker for OS/2.....	579
Asymetrix ToolBook for OS/2.....	329
CASE:PM for C or C++.....	1875
CASE:PM for MicroFocus Cobol.....	2375
ChipChat (Cawthon).....	279
Clip & Save for OS/2.....	129
Collage PM.....	179
Core! Draw! for OS/2.....	call
DeScribe.....	529
Excel for OS/2.....	349
FreeLance for OS/2.....	499
HyperACCESS/5 for OS 2.....	169
Lotus 1-2-3/G.....	579
Micrografx Designer.....	509
Multiscope for OS/2.....	349
Nexpert Object, PM Runtime.....	929
Object-1/PM (MDBS).....	895
OS/2 PM Softset (Microsoft).....	129
OS/2 PM Toolkit (Microsoft).....	409
PackRat for PM.....	339
PackRat PM Network (3 User).....	579
Print Screen for OS/2 PM.....	72
Perspective for OS/2.....	259
Q+E/PM ver 2.6 Standard Edition.....	call
Q+E/PM ver 2.6 Server Edition.....	call
Relish.....	139
RT-Graphics (FSI).....	959
Sidekick for PM.....	169
SmallTalk/V PM.....	339
SpeedEdit for OS/2.....	255
SpeedEdit for PM.....	255
Sytos Plus/PM (Sytro).....	259
Ventura Gold for OS/2.....	559
VZ Programmer/PM.....	1225
WideAngle for PM.....	119
Wingz.....	359
Word for OS/2.....	call
WordPerfect 5.0 for OS/2.....	339
WinPRO/PM (Xian).....	379
Zortech C++ OS/2 Compiler Option.....	139
Zortech C++ OS/2 Dev Edition.....	489

HARDWARE, etc.

Image Scanners

Logitech ScanMan 256/PC-AT.....	399
Microtek scanners.....	call

Boards

ATI 8514 Ultra.....	call
Intel SatisFAXtion board.....	call

MultiMedia Products

Guide 3 (Owl Int'l).....	439
IconAuthor (AimTech).....	call
Super VideoWindows.....	599
VideoLinX:FRAMEBUFFER.....	1119
Erasable Optical Drives.....	call

GUI Clearing House offers a full line of hardware items selected to augment the Windows, Presentation Manager, and MultiMedia based platforms. If you don't see a particular item, just ask..... we will promptly obtain pricing and availability for you. **Call us TODAY!**



PAYMENT - Visa, MasterCard, Diners Club and Carte Blanche accepted. Personal and company checks accepted. Please allow 2 weeks for processing. Corporate and institutional purchase orders subject to credit approval and a minimum initial purchase \$500, paid via C.O.D. or in advance. C.O.D. minimum purchase is \$100, maximum \$1,000 payable by cash, cashier's check, or money order. CT residents add 8% sales tax.
SHIPPING - Shipping/handling charge is 3% or \$6 minimum; \$5 extra for C.O.D. Larger shipments may require additional charges. Call for information for shipments to Alaska, Hawaii, and points outside the United States.
TERMS - All products carry manufacturer's warranties only. Product warranties, guarantees, rebates, trial period privileges, or other promotional programs are handled by the manufacturer. Defective items replaced or repaired at our discretion. All returned items must be accompanied by a return material authorization (RMA) number. There is a 15% restocking fee on non-defective merchandise. Shipping is non-refundable. Opened software and other consumables are non-refundable. We can not guarantee compatibility. Item availability, price, terms, and policies subject to change without notice. Graphical User Interface CLEARING HOUSE is not liable for damage due to omissions or typographical errors. Mailing address is Graphical User Interface CLEARING HOUSE, P.O. Box 10, Sandy Hook, CT 06482. (203) 268-4400. Copyright © 1990, 1991 GUI CLEARING HOUSE. All rights reserved. 199-250

TYPICAL IDLE TIMES FOR DOS-BASED COMPUTING

*There's no shortage of idle cycles, but the trick is to exploit them safely.
(Statistics courtesy of Digital Research)*

Application	Action	Percent Idle time
COMMAND.COM	Waiting for input	99.4
	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. ■

ACKNOWLEDGMENT

Many thanks to John Wobber of Digital Research, Charlotte Bryant and Dave Ryan of Intel, Lucy Honig and Howard Honig of HP, Maureen O'Connell and David Frink of AMD, John Fairbanks of Poqet, and Carl Snedaker of Phoenix for their help in preparing this article.

Brett Glass is a freelance programmer, author, and hardware designer residing in Palo Alto, California. He can be contacted on BIX as “glass.”

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

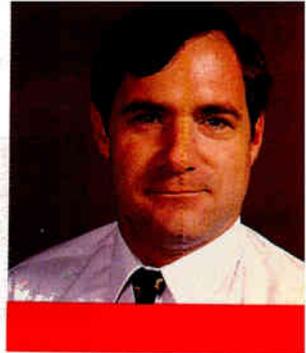
Fancy Patches

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





Build your own i486 AT multiprocessor under UNIX. Introducing the APD Bipro: as easy as plugging a second chip!

Up to 1.9 times faster than single i486 AT (standard benchmarks). Today's most reliable biprocessor architecture (2 x i486 33 Mhz) running ATT UNIX SVR4.0. Simple structure: 100% AT compatible. The CPU board includes 2 x i486 sockets and up to 64 MB. shared memory. Also start with one processor (no extra cost compared against standard i486 AT motherboards) for later upgrading (just plug the second chip). AT standard size, 7 slots (ISA bus), 100% tested, professional reliability systems. Immediate delivery.

Basic platforms:.....From 1.749 \$

Complete system :.....From 4.749 \$

Parallel O.S.: APDX[®] biprocessor version (derived & full compatible UNIX SVR4.0): 999 US \$

Payment by. Visa / American Express



C/ Castelló, 63. 28001. Madrid. Spain.

Or fax to Peter Howarth. Fax nº.: 34--1- 575 88 16.

i 486[™], AT, UNIX, VGA are trademarks of their respective companies APD Bipros and APDX are registered of APD S.A.

A MESSAGE TO OUR SUBSCRIBERS

FROM TIME TO TIME WE MAKE THE BYTE SUBSCRIBER list available to other companies who wish to send our subscribers material about their products. We take great care to screen these companies, choosing only those who are reputable, and whose products, services, or information we feel would be of interest to you. Direct mail is an efficient medium for presenting the latest personal computer goods and services to our subscribers.

Many BYTE subscribers appreciate this controlled use of our mailing list, and look forward to finding information of interest to them in the mail. Used are our subscribers' names and addresses only (no other information we may have is ever given).

While we believe the distribution of this information is of benefit to our subscribers, we firmly respect the wishes of any subscriber who does not want to receive such promotional literature. Should you wish to restrict the use of your name, simply send your request to the following address.

BYTE MAGAZINE

ATTN: SUBSCRIBER SERVICE

P.O. Box 555

HIGHTSTOWN, NJ 08520



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
Ray Dream, Inc.
1804 North Shoreline Blvd.
Mountain View, CA 94043
(415) 960-0765
fax: (415) 960-1198
Circle 1147 on Inquiry Card.

MacCon + IIE\$379
Asanté Technologies, Inc.
404 Tasman Dr.
Sunnyvale, CA 94089
(408) 752-8388
fax: (408) 734-4864
Circle 1148 on Inquiry Card.

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

SEKISUI

MULTI-PROTOCOL ANALYZER
LE-3000

Monitors high-speed communication of 72Kbps. A high-end analyzer capable of program simulation

■ MAJOR FUNCTIONS

- Statistical analysis
- Idle time measurement
- Automatic configuration
- Data extend with 128KB/256KB S-RAM cards
- Protocol translation display capability
- Powerful trigger function
- Timer/counter capability
- Off-line analysis
- BERT function
- 192Kbyte buffer memory

MULTI-PROTOCOL ANALYZER
LE-2000

Multi-function analyzer that supports high-speed communications network of 64Kbps.

RS-232C
MULTI-PROTOCOL ANALYZER

New **LINE EYE**



LE-3000

COMPACT PROTOCOL ANALYZER
LE-1000

High-performance RS-232C line monitor capable of monitoring high-speed asynchronous communication of 38.4Kbps.

New

COMPACT LOGIC ANALYZER

You can't expect a higher cost performance from machines of this compact body: A-4 size weighing 1.4kg with advanced functions of high-class machines enabled through the adoption of custom components (ASIC).

COMPACT LOGIC ANALYZER
CA-1000

- Simultaneous sampling of 16 channels at a rate of 100MHz.
- Large capacity memory: 32Kbits/CH

COMPACT LOGIC ANALYZER
CA-500

- Simultaneous sampling of 16 channels at a rate of 50MHz.
- Large capacity memory: 32Kbits/CH

FEATURES

- File management
- Glitch detection
- Data comparison/display
- Frequency counting
- Display interchange

SCSI ANALYZER SC/2

SC/2 has the SCSI simulation capability. A high-performance analyzer for professional use that is capable of simulating both the initiator and the target.

• This product is controlled under Foreign Exchange and Foreign Trade Control Law as one of the strategic products.
• In the case of exporting this product, it is requested that you take necessary procedures to obtain prior approval from the Japanese government.

SEKISUI CHEMICAL CO., LTD.
Computer Applied Equipment Division

4-4 Nishitemma, 2-chome, Kita-ku, Osaka, 530 Japan
PHONE: OSAKA (06) 365-4504 FAX: OSAKA (06) 365-4375
TELEX: 5236943 SEKIOS J

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."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.



**The brand new "FAScinator"®
Make You be a "Image-master"**



We'll bundle in "A4000C" Color Flat-bed Scanner.



OEM WELCOME!

ULTIMA ELECTRONICS CORP.

MAIN OFFICE
9F, NO. 18, ALLEY 1, LANE 768, SEC. 4, PA TE ROAD, TAIPEI, TAIWAN, R.O.C.
TEL: 886-2-7885470 (REP.) FAX: 886-2-7885657 • 7885655

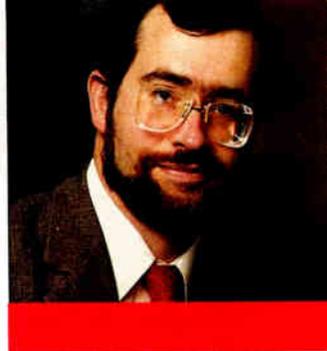
USA BRANCH
1156 ASTER AVENUE, SUITE A SUNNYVALE CA 94087 U.S.A.
TEL: 408-246-9208 FAX: 408-246-9207

DENMARK:
UNIPRO SCANDINAVIA BIRKEMOSEVEJ 32, 8361 HASSELAGER, DENMARK.
TEL: 4586286366 FAX: 4586286870

HOLLAND:
SOECOMA COMPUTERS NED. BV DOMMELSTRAAT-ZUID 23-25 5503-NA VELDHOVEN
The Netherlands. TEL: 31-40-533515 FAX: 31-40-544535

Circle 315 on Inquiry Card.

BELGIUM:
T.C.T. COMPUTER N.V. 95 3545 HALEN BELGIUM
TEL: (32)13444777 FAX: (32)13444780



DAVID
FIEDLER

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:

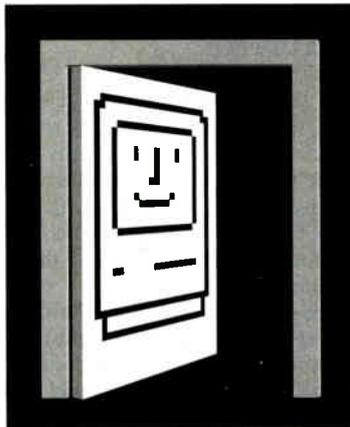
```
SE1d:23:respawn:/usr/lib/
uucp/uugetty -t 60 tty1C TB19200
```

HERE'S YOUR AFP-TO-NFS GATEWAY!

Announcing Helios' EtherShare™ 2.0, our enhanced Mac/Unix file server that's fully System 7.0 compatible. It's the one, remember, that lets you do system administration from any Macintosh on your network. Now anyone running any of the standard flavors of DEC Ultrix, Sony NEWS OS, AIX RS-6000 or Sun OS can take advantage of these newly added features:

- AFP-to-NFS Gateway
- Easy Macintosh system administration
- Integrated Unix mail and terminal services
- Enhanced file and printing accounting systems
- Printer load balancing, including unlimited spooling queues

... All for about \$100 per session!



What used to be extra-cost options are now standard in EtherShare 2.0. These include File, Print, Mail, and Apple-Talk™ Phase II. And now we're including Helios Terminal with VT100 and VT320 emulation along with our Unix terminal services program.

Two new options are also available: AppleTalk Tunnel and a Developers' Toolkit with sample source code.

We've prepared a full e-mail package of information about EtherShare 2.0 for you. Just dial up our CompuServe® number

74730, 1004 and we'll get it to you.

Contact our National Sales Manager, Paul Lucero at 998 West Lynn Way, Suite 4, Cupertino, CA 95014. Phone 408-255-2503; AppleLink: Helios, USA; or send him e-mail on Internet: lucero@apple.com.



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

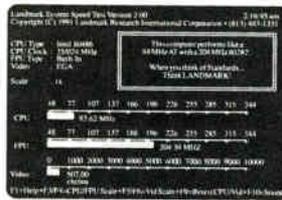
mean laser printer), what did people do for fancy troff output? It seems that someone came up with a way, involving solenoids, code translation tables, and other kludges, to hook up an IBM Selectric typewriter to a computer. Based on the maximum speed the Selectric could run without turning its insides 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."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

PC DIAGNOSTICS

SPEED TEST YOUR PC!



Accurately measure CPU, math, and video speeds to make an informed purchasing decision, determine the best PC for the job or maybe just win some bets in the office on whose PC is really faster! Includes the Landmark AT CMOS RAM Setup program to update your system configuration on-the-fly. **CALL FOR CURRENT PRICING.**

HARD CORE PC TESTING!

Landmark Service Diagnostics™ is ideal for professionals requiring the most exhaustive diagnostic test capabilities. Each module is CPU specific, including PC, XT, AT, 386/486, and PS/2. Since 1981 major manufacturers like Wang, Xerox, Prime, Sony, DEC, NEC, and NCR have relied on Service Diagnostics to tackle their toughest operating problems.

Intended for professional service and repair technicians, Service Diagnostics is also easy to use for the novice. Clear, concise on-line help and intuitive menus make finding system problems a breeze. Tests all CPUs, math chips, all memory, floppy, fixed and non-standard disk drives, standard/non-standard printers, system board, video, communication ports and all keyboards. Utilities include low-level reformat, log bad sectors, edit bad sector table; the partition editor allows you to set up multiple partitions; back-up program transfers hard disk image on unformatted floppies and allows for restore after reformat.

Ideal for UNIX and other operating systems, the self-booting version doesn't require DOS. The manual offers troubleshooting tips to the component level. Also available in a complete Kit including; all CPU specific software, dual size floppy alignment software, and PC/XT & AT ROM POSTS. Not copy protected. **CALL FOR CURRENT PRICING.**

"Service Diagnostics: The Kit is a technicians dream, with all the tools necessary to accurately analyze all phases of computer operations... it is well worth its performance potential." Bill O'Brien, PC Magazine



First in PC Testing... Since 1981



Copyright © 1991 Landmark, System Speed Test, KickStart, JumpStart and Service Diagnostics are trademarks of Landmark Research International Corporation. All Rights Reserved. Other names are the trademarks of their associated owners.

PC WON'T BOOT? THEN JUST KICKSTART IT!

Don't replace your motherboard, don't call service, use KickStart 2™. When serious hardware problems occur, nothing gets you up and running as fast. KickStart 2 measures power within 2.5% on all four voltages, shows Power-On Self-Test (POST) failure codes, and features on-board ROM-based diagnostics allowing you to determine and remedy the problem quickly, easily, and inexpensively!

Built-in serial and parallel I/O allows for testing via modem, or simply logging results to a remote terminal, printer or laptop. You can configure your own test routines and store them in KickStart 2's battery backed-up CMOS RAM saving valuable setup time. Includes serial and parallel loopback plugs and Landmark JumpStart™ AT ROM BIOS for testing PCs that don't issue POST codes. KickStart 2 tests your system regardless of O/S (even UNIX).



On-board switches, LEDs, and digital displays allow complete control over testing in systems lacking video or disk (ideal for motherboard or system burn-in).

KickStart 2 is the ultimate SECURITY CARD too! With both supervisor and user levels of password protection, you can prevent unauthorized use of your PC and accidental running of destructive tests. **CALL FOR CURRENT PRICING.**

Ask about our other diagnostic products:

- PC Probe - Diagnostics, Utilities & more
- PC Probe Jr. - No fancy package, save \$\$\$
- KickStart 1 - Low cost debugger
- AlignIt - The 5 minute floppy solution

CALL (800) 683-6696

Fax (813) 443-6603 • Voice (813) 443-1331
CA, WA, NV, HI, OR, AK use (800) 275-9933

Dealer Inquiries Welcome



703 Grand Central St. • Clearwater, Florida • 34616

Statistics

“...my worst fears were realized...”

JMP® for your Apple Macintosh® combines classical statistics with today's most dynamic graphics...to give you a way to discover more, interact more, and understand more about your hard-earned data.

Version 2 Now Available.

New tools in JMP include quality control charts, nonlinear regression, multiple comparisons, multivariate analysis of variance with repeated measures, random effects, and power calculations. All easy to use...and to understand!

Yours from SAS Institute Inc., the most respected name in data analysis software.

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.

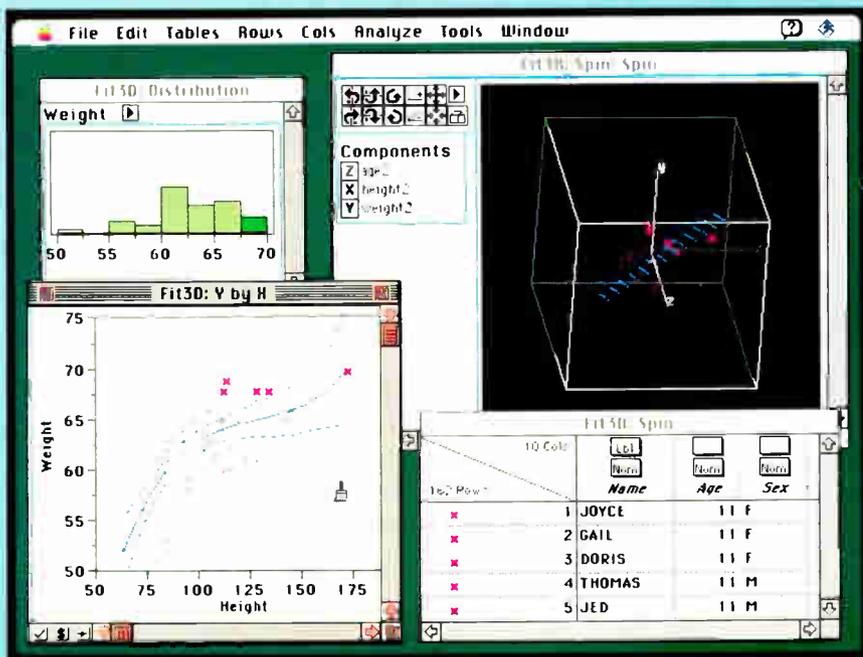
As the demonstration progressed, however, I became fascinated with the number of things JMP offered that, judging from the reactions of the more knowledgeable members of the group, were absent in other statistical graphics packages. Even more amazing was the fact that I found myself understanding the 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

Free Demo Disk. Just Call Today.

For details about JMP, including a free demo disk, give our JMP Sales Team a call at 919-677-8000. Or write us at:



SAS Institute Inc.
Attention: JMP Sales
SAS Campus Drive
Cary, NC 27513
Phone 919-677-8000
Fax 919-677-8166

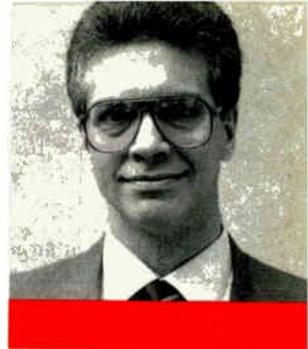


BYTE Free Demo Download
DEMO LINK 617-861-9767*

JMP is a registered trademark of SAS Institute Inc.
Macintosh is a registered trademark of Apple Computer, Inc.

Copyright © 1991 by SAS Institute Inc.
Printed in the USA.

Circle 271 on Inquiry Card.
World Radio History



LOUIS J.
CUTRONA JR.

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 uncongenial, 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).

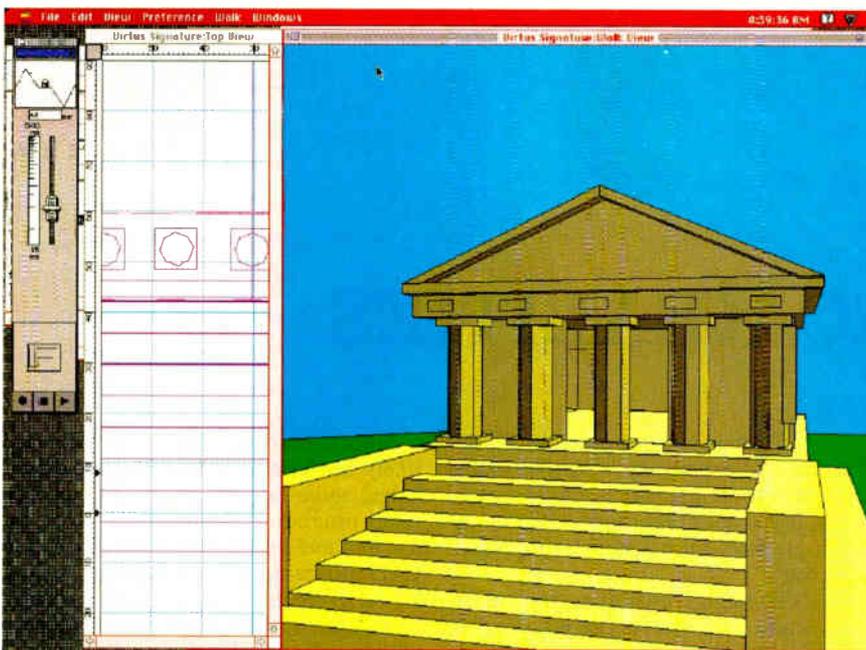
The program supports Design View (2-D) and Walk View (3-D) modes. In the Design View mode, you get good planar and 2-D solids tools for creating your designs. Walk View lets you control the 3-D color display and walk-through of your design.

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

System 7.0

Personal Upgrade Kit..... \$99
Group Upgrade Kit\$349

Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010

Circle 1151 on Inquiry Card.

Virtus WalkThrough 1.03\$895

Virtus Corp.
117 Edinburgh S, Suite 204
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

BIOS SOURCE CODE

The AT BiosKit gives you a complete Bios with source code in C you can modify for your own applications! The BiosKit includes a Bios on diskette ready for programming Eproms, and includes the utilities you need to Rom the sources Code. The Bios also has a Rom Monitor/Debug and Setup. At last you have control over the core of your system. Over 380 pages, with diskette, \$199. The XT BiosKit is only \$99. The Intel Wildcard Supplement for the XT BiosKit is \$49. Software tools: You need MS C and MASM 5.1 for modifying the Bios.

FREE We'll include a free copy of the pocket-sized XT-AT Handbook by Choisser and Foster with each BiosKit if you mention this ad when you order. Of course, this \$9.95 value is also available by itself. Or buy five or more for only \$5.00 each.



800-462-1042
619-271-9526



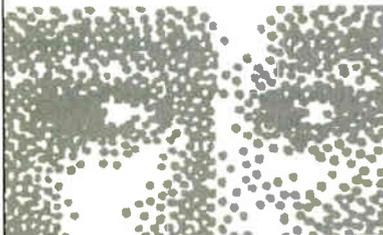
Annabooks

12145 Alta Carmel Ct., Suite 250
San Diego, CA 92128

FAX 619-592-0061

Money-back guarantee

RealTime.



New, affordable video frame grabber for IBM computers. ComputerEyes/RT includes everything you need to capture high-resolution 8- or 24-bit color (or 8-bit gray scale) images from any standard composite or S-video source in real time.

VGA and Super-VGA compatible. All popular file formats are supported.

Call today for more information and free demo disk.

Other versions available for IBM PC and Macintosh from under \$250.

Digital Vision, Inc.
270 Bridge St., Dedham, MA 02026
(617) 329-5400
To order call (800) 346-0090

New

24-Bit

Color Video

Frame

Grabber

For Under

\$ 600.

Digital Vision

C O M P U T E R E Y E S TM

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 if 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.
220 Grande Allee E, Suite 960
Quebec City, Quebec,
Canada G1R 2J1
(800) 463-2686
(418) 529-9676
fax: (418) 529-1159

—S. W. ■

ECLIN CONNECT.

IF YOU DON'T THINK IT'S THE EASIEST FULL FUNCTION COMMUNICATIONS PROGRAM YOU'VE EVER USED, WE'LL GIVE YOU A FULL REFUND!

ECLIN CONNECT establishes a new standard in easy-to-use communications software. It allows users of any experience level to communicate with on-line services, bulletin boards and other PC's — without cryptic menus, technical jargon or complex keystrokes.

ECLIN CONNECT's outstanding user interface, superb on-line help and solid performance make it the best choice for general purpose telecommunications. *New Version 2.0!*

\$49 ORDER TODAY!
Call: (609) 393-0577
Fax: (609) 393-1990

VISA, MASTERCARD, CHECK OR COD ACCEPTED

ECLIN 172 W. State Street
TECHNOLOGY Trenton, NJ 08607

- "Point-and-shoot" interface with comprehensive mouse support
- Background file transfers in less than 45K of RAM using EMS or disk space
- Integrated Usage Record includes calls, file transfers (with file-names) and user comments
- Plain English script commands and undemanding syntax. Script Watch helps identify script errors during playback
- Script Recorder creates reliable scripts that don't need editing
- Built-in text editor
- Xmodem, Ymodem, Zmodem and other popular protocols
- COM1 to COM4 and 16550 UART support
- Free technical support and 30-day money back guarantee
- For IBM PC/compatibles

Protects
while you
type!



- Remains in Place while you use your computer.
- Avoids Costly Repairs. Protects delicate electronics from dust, spills, smoke, ashes, staples.
- Soft, Flexible, retains normal keyboard feel.
- Washable, Durable High-Tech Polymer lasts years.
- Hundreds of Models. SafeSkin is available for most PCs, laptops, workstations and clone keyboards.
- Office • Home • Factory • Classroom • Laboratory
List Price \$29.95. Please call or write for free color brochure. Dealer inquiries encouraged.

SafeSkin[®]
KEYBOARD PROTECTOR

Merritt Computer Products, Inc.

5565 Red Bird Center Dr., Suite 150 • Dallas, Texas 75237
(214) 339-0753 • FAX (214) 339-1313

2 parallel, 2 serial, 1 board

Quatech DSDP-402 for PC-AT has two parallel ports, and two serial ports for any combination of RS-232, 422, and 485 communication. DSDP-100, two parallel and two RS-232 ports, available at lower cost.

For order info, call:
1-800-553-1170



662 Wolf Ledges Parkway, Akron, OH 44311



See us at Booth #S4667

Circle 240 on Inquiry Card.

Eight Serial Ports One Board

Quatech's ES-100 provides eight RS/232 serial ports in a single AT slot. RJ-11 modular connectors. 16450 UARTS are standard. Optional buffered 16550 UARTS. PC-AT, ISA, or EISA compatible. Priced below \$500! Quantity Pricing Available!

Call for our PC Interface Handbook:
1-800-553-1170



662 Wolf Ledges Parkway, Akron, OH 44311

PC-AT is a trademark or registered trademark of IBM Corp.

Circle 241 on Inquiry Card.

RS-422/RS-485 Boards for AT, Micro Channel

RS-422/RS-485 asynchronous serial communication boards from Quatech available in 1 to 4 ports for PC-AT and compatibles and 1 to 4 ports for PS/2 Micro Channel.

Call for our free
PC Interface Handbook:
1-800-553-1170



662 Wolf Ledges Parkway, Akron, OH 44311

PC-AT, Micro Channel, and PS/2 are trademarks or registered trademarks of IBM Corp.

Circle 242 on Inquiry Card.

Synchronous Communication Boards for AT

Quatech synchronous/asynchronous serial boards for PC-AT and compatibles support RS-232, RS-422, and RS-485 communication.

Call for our free
PC Interface Handbook:
1-800-553-1170



662 Wolf Ledges Parkway, Akron, OH 44311

PC-AT and PC are registered trademarks of IBM Corp.

Circle 243 on Inquiry Card.

Communications Data Acquisition



"PC-AT (ISA) Interfaces"



"PS/2 Micro Channel Interfaces"



Phone: (216) 434-3154 • FAX: (216) 434-1409

TELEX: 510-101-2726

PC-AT, PS/2 and Micro Channel are registered trademarks of IBM Corporation.

Circle 244 on Inquiry Card.

Digital I/O Board

Single-slot Quatech PXB-721 for PC-AT has 72 digital I/O lines. Connect three choices of data acquisition modules. Supports Labtech Notebook™

Call for our free
PC Interface Handbook:
1-800-553-1170



662 Wolf Ledges Parkway, Akron, OH 44311

LabTech Notebook is a trademark of Laboratories Technologies Corp.

Circle 245 on Inquiry Card.

PXB-160 16-BIT TRUE PARALLEL DIGITAL I/O

- Two eight bit ports
- Latched I/O
- DMA and I/O Modes
- Handshakes for 16 Bit I/O Transfer
- Programmable timer for Interrupt or DMA Transfer
- External interrupt and data transfer request inputs
- List Price Below \$400.00

Call the Order Line
1-800-553-1170



662 Wolf Ledges Parkway, Akron, OH 44311

Circle 246 on Inquiry Card.

100KHz - 16 Bit Data Acquisition



DAQ-16!! Complete 16 bit data acquisition system on a card! Converts 286/386/486 personal computers into full featured high performance data acquisition systems for laboratory and plant floor applications.



662 Wolf Ledges Parkway, Akron, OH 44311

To order call **1-800-553-1170**

PC and Micro Channel are registered trademarks of IBM

Circle 247 on Inquiry Card.

Wave Form 20MHz - 32K \$1290

The WSB-100 Wave Form Synthesizer Board from Quatech has the best set of numbers in the market. With speed to 20MHz and a 32K memory at \$1290, it's making waves in more ways than one. The WSB-100 is also a star performer as a digital pulse/word generator with the optional digital module.

Call for our free
PC Interface Handbook
1-800-553-1170

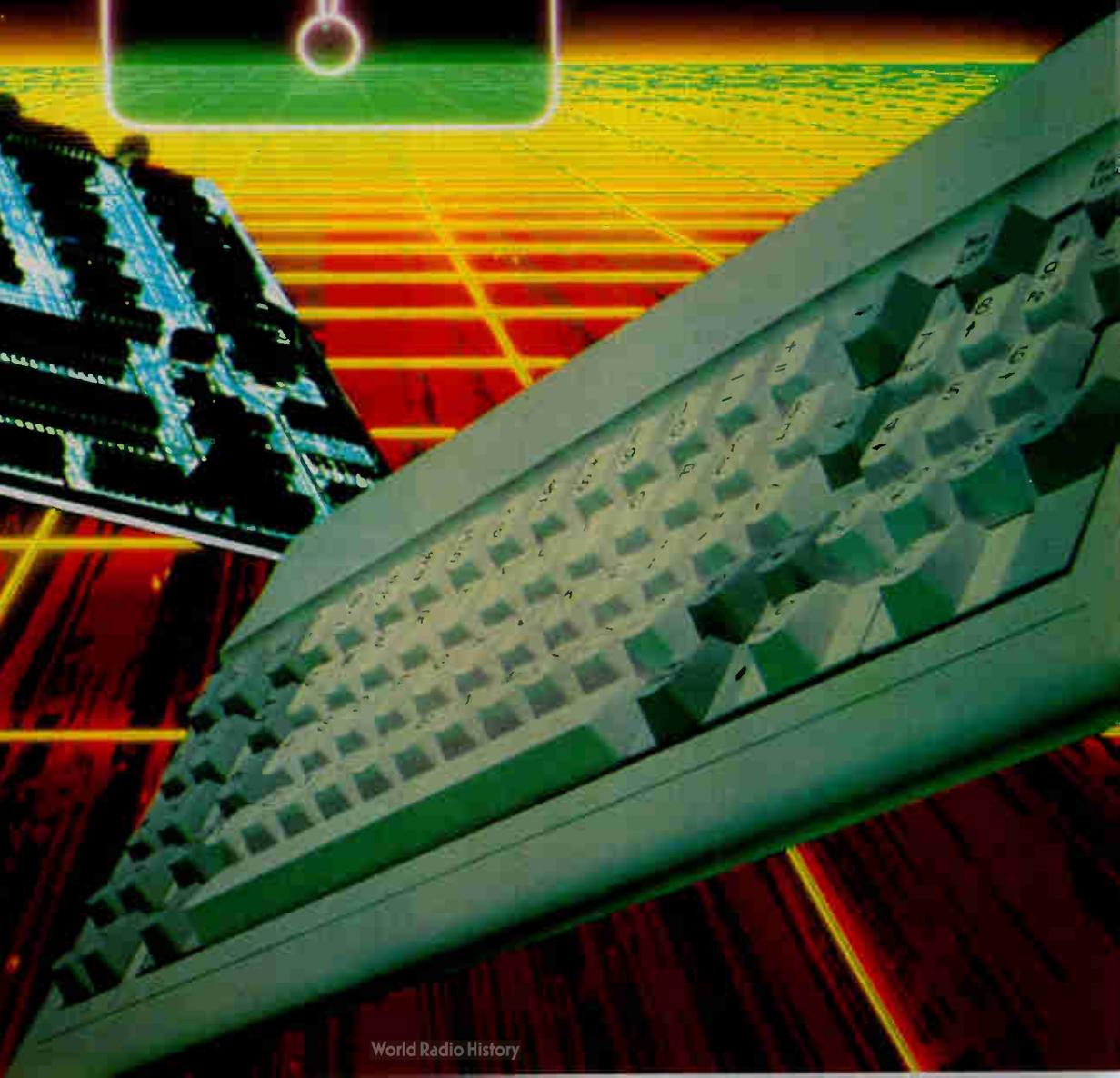
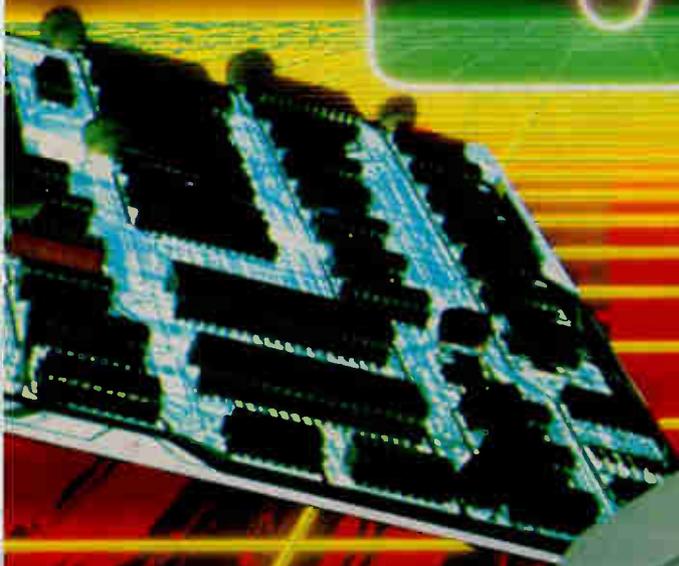
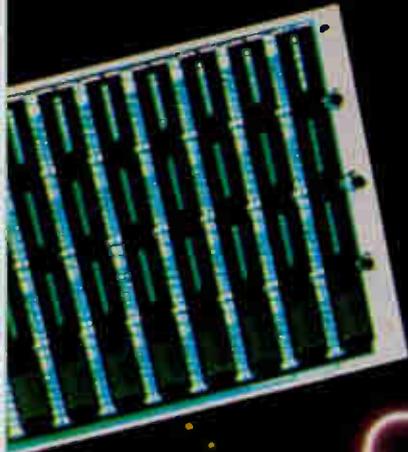
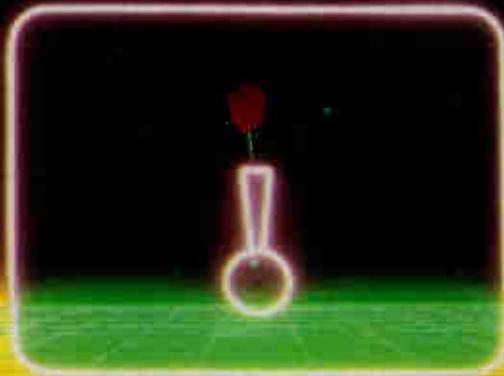


662 Wolf Ledges Parkway, Akron, OH 44311

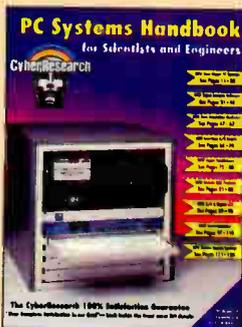
Circle 248 on Inquiry Card.

BYTE

PRODUCT SHOWCASE



CyberResearch, Inc.



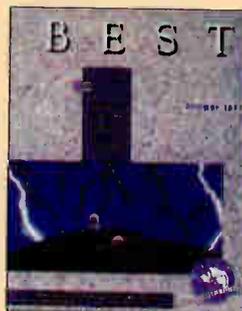
Catalog/Tutorial for Scientists & Engineers
The new 1991 edition of the **PC Systems Handbook** is bigger and better than ever. More than twice as large as the 1990 edition, it includes reference material, "Tech Notes," and diagrams as well as the broadest range of scientific and engineering products for PCs.

CyberResearch offers toll-free applications engineering and a 30-day satisfaction guarantee on all products. Send for your **FREE Handbook** today, or call our toll-free applications line for immediate assistance.

Toll Free: 1-800-341-2525
CT & Int'l: 203-483-8815
Fax: 203-483-9024

Circle 84 on Inquiry Card

Best Power Technology, Inc.

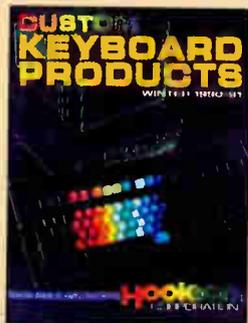


HOW TO PROTECT YOUR COMPUTER
And Make It Last Longer

FREE, money-saving literature tells you how to protect your computer from power problems such as surges, sags, spikes, noise, brownouts, blackouts and lightning. These power line problems can damage delicate equipment and cause loss of valuable data. Learn how Best Power Technology's uninterruptible power systems, ranging from 500 VA to 18 KVA, can protect your computer. Contact: Best Power Technology, Inc.; P.O. Box 280; Necedah, WI 54646.

(608) 565-7200, ext. 2191
Toll-free: (800) 356-5794, ext. 2191
Circle 41 on Inquiry Card

HooLeon



CUSTOM KEYBOARD PRODUCTS

Improve productivity and reduce training time by having your software commands color-coded and imprinted on your keyboard. Custom keys, SnapCap™ Keycaps, custom imprinted keytop and keyfront labels, templates, plus new macro devices and custom keyboards. WordPerfect and 5250 Emulation KeyCaps for IBM 101-keyboard; relegendable keys for IBM®, Cherry®, Wyse® and KeyTronic®; Keytop Label kits for WordPerfect™, DisplayWrite™, Data Entry and language conversions. Call for **FREE** catalog.

1-602-634-7515 FAX 612-634-4620
Order Hotline 1-800-937-1337
Circle 133 on Inquiry Card

Lyben Computer Systems



Computer Supplies and Accessories at Discount Prices

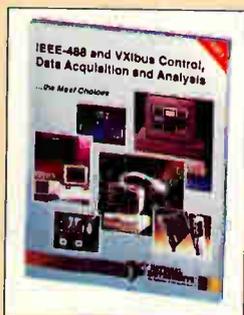
Over 4000 Items
93% of Orders Shipped Same Day
Many Hard-to-Find Items
30-Day Return Policy

A Unique catalog company with a personal touch. Circle inquiry number to receive a free 100-page Introductory Catalog with special offers. Our regular catalog is 228 pages.

1-313-649-4500 FAX 313-649-2500
1150 Maplelawn • Troy, MI 48084

Circle 174 on Inquiry Card

National Instruments

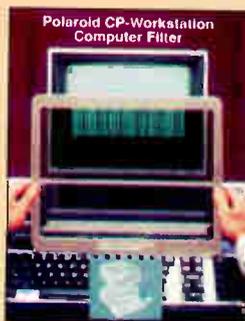


Free 488-page full-color catalog describing instrumentation hardware and software products for personal computers and workstations. Application software for data analysis and presentation and for collecting data using instruments and plug-in boards. Features GPIB interfaces, data acquisition and DSP boards, driver level software, signal conditioning and VXI controllers.

1-512-794-0100 Fax 512-794-8411

Circle 202 on Inquiry Card

Polaroid



Polaroid Corporation introduces a new product to its family of **Circular Polarizer Filters** for computer monitors. The Polaroid CP-Workstation Filter is a high-quality circular polarizing glass filter which reduces glare and improves contrast. The CP-Workstation filter also features a transparent conductive coating that reduces up to 98% Electromagnetic Radiation and eliminates static.

Polaroid produces a full range of anti-glare filters in glass and triacetate to fit most monitors.

Polaroid Corporation, Polarizer Division,
N2, 1 Upland Road, Norwood, MA 02062
1-800-225-2770 Fax 617-446-4600

Circle 251 on Inquiry Card

Intel Development Tools



Choosing the right architecture for your embedded design is one of the most important decisions you face today. For successful embedded microcontroller development, Intel offers you a complete line of emulators, compilers, debuggers and much more for the MCS®-51, MCS®-96, i960™, x86, Intel386™, and Intel486™ families of Intel architectures.

Call or write us for your free copy of our Development Tools Catalog.

Intel Corporation, Development Tools,
5200 N.E. Elam Young Parkway, JF1-15,
Hillsboro, OR 97124.

1-800-874-6835 or Fax 503-696-4633

Circle 151 on Inquiry Card

Alpha Products



Open this **FREE** catalog from Alpha Products to the world of low-cost, high-quality data acquisition and control devices. Our catalog features everything from high speed A/D converters to stepper motors to sensors. We also provide custom design and systems integration services.

Whatever the application, factory, laboratory, classroom, office or home, our products can do the job.

Call or write for your **FREE** color catalog.
ALPHA PRODUCTS, 303 Linwood Avenue, Fairfield, CT 06430

(203) 259-7713 Fax (203) 254-0169

THE BUYER'S MART

A DIRECTORY OF PRODUCTS AND SERVICES

THE BUYER'S MART is a monthly advertising section which enables readers to easily locate suppliers by product category. As a unique feature, each BUYER'S MART ad includes a Reader Service number to assist interested readers in requesting information from participating advertisers.

Effective January 1, 1991.

RATES: 1 issue—\$675 3 issues—\$625 6 issues—\$600 12 issues—\$525
Prepayment must accompany each insertion. VISA/MC Accepted.

AD FORMAT: Each ad will be designed and typeset by BYTE. Advertisers must

furnish typewritten copy. Ads can include headline (23 characters maximum), descriptive text (250 characters is recommended, but up to 350 characters can be accommodated), plus company name, address and telephone number. Do not send logos or camera-ready artwork.

DEADLINE: Ad copy is due approximately 2 months prior to issue date. For example: November issue closes on September 8. Send your copy and payment to THE BUYER'S MART, BYTE Magazine, 1 Phoenix Mill Lane, Peterborough, NH 03458. For more information call Joseph Mabe at 603-924-2656. FAX: 603-924-2683.

ACADEMIC COMPUTING

Transputer Education Kit

For the student, Professional or hobbyist
ONLY \$398.
Includes ready-to-use PC add-in board with 20-MHz 32-bit T400 transputer, 1MB of RAM, PC interface (PC, XT, AT, or 386 compatible), and an 8-bit parallel I/O port (for optional hardware experiments). Also includes: Occam2 and C compilers (and assembler); demo, example, and diagnostic programs; and 1500 pages of documentation (including schematics). Can be interconnected with other Kit boards or with less expensive Add-On-Processor boards.

Computer System Architects

950 N. University Ave., Provo UT 84604
(800) 753-4CSA (801) 374-2300 FAX (801) 374-2306

Inquiry 701.

ACCESSORIES

RADIOACTIVE?

Plot it on your PC with The RM-60 RADIATION MONITOR. Serial or printer port. Detects: ALPHA • BETA • GAMMA • X-RAY. MicroR, 1000 times the resolution of standard geiger counters. Excellent for tracking RADON GAS. Find sources. New: Version 2.5
Plot: • Background • Cosmic Rays • Clouds • Foods
Call/Write for PC MAGAZINE review. • TSR • GM Tube
VISA/MC/EURO Phone orders. Not satisfied? Full refund.

Tel/Fax: (302) 655-3800

Aware Electronics Corp.

P.O. Box 4299, Wilmington, DE 19807 \$149.50

Inquiry 702.

CUT RIBBON COSTS!

Re-ink your printer ribbons quickly and easily. Do all cartridge ribbons with just one inker! For crisp, black professional print since 1982. You can choose from 3 models:
Manual E-Zee Inker — \$39.50
Electric E-Zee Inker — \$94.50
Ink Master (Electric) — \$189.00
1000s of satisfied users. Money-back guarantee.

BORG INDUSTRIES

525 MAIN ST., JANESVILLE, IA 50647
1-800-553-2404 In IA: 319-987-2976

Inquiry 703.

KEYBOARD, VIDEO, MOUSE

Extension with **EXTENDER**
Splitting with **COMPANION**
Switching with **COMMANDER**
Boosts signals up to 600 feet. Control up to 96 PCs with one keyboard and monitor.

CYBEX CORPORATION

2800H Bob Wallace Ave., Huntsville, AL 35805
Phone 205-534-0011 Fax 205-534-0010
See our ad on page 226

Inquiry 704.

HEWLETT PACKARD

Buy — Sell — Trade

Laser Jet II/III Color Pro (7440)
Laser 2000 2 Meg/4 Meg upgrades HP-7550A
Desk Jet Draft Pro DXL/EXL
Rugged Writer Draftmaster III
Electrostatic Plotters C1600 (D Size)/C1601 (E Size)
Science Accessories Corporation Sonic Digitizers
36" x 48" (2750) 60" x 72" (3175)

T. E. Dasher & Associates

4117 Second Ave. S., Birmingham, AL 35222
Phone: (205) 591-4747 Fax: (205) 591-1108
(800) 638-4833

Inquiry 705.

ARRAY PROCESSORS

SCIENTIFIC ACCELERATOR

25 MegaFLOP Floating Point Array Processor with 256K+ static memory. Easily programmed by calling 598 routines from your C, FORTRAN, or Pascal PC programs. 512x512 FFT 1.18 secs. Single slot board with software: \$2,495.00.

EIGHTEEN EIGHT LABORATORIES

1247 Tamarisk, Boulder City, NV 89005
Tel: 800-888-1119, Fax: 702-294-2611

Inquiry 706.

ARTIFICIAL INTELLIGENCE

NeuralWorks Explorer

NeuralWorks Explorer is a neural net tutorial that provides the novice user with a method of learning neural net theory as well as an environment in which to build practical real time applications such as targeted marketing, stock prediction, process control and more. PC and MAC. Price \$99.00. Visa/MC accepted. University discounts available.

NeuralWare, Inc.

412-787-8222

Inquiry 707.

Software Engineer Do Your Own Windows!

At last a LISP programming environment which takes advantage of a GUI and protected mode on the PC. Software Engineer™ for Windows™ 3.0 is a complete programming environment. It includes a LISP-aware text editor, allowing quick, easy and interactive Windows development. Software Engineer supports DDE, GDI, the clipboard, dialog boxes and menus. Software Engineer is priced at \$249.95

Raindrop Software Corporation
845 E. Arapaho, Suite 105, Richardson, Texas 75081
(214) 234-2611 Fax (214) 234-2674

Inquiry 708.

BAR CODE

LABELING SOFTWARE

On EPSON, IBM, OKI dot matrix or LaserJet. Flexible design on one easy screen. Any format/size. Up to 120 fields/label. 18 text sizes to 3" readable at 100'. AIAG, MIL-STD, 2 of 5, 128, UPC/EAN, Code 39. File Input & Scanned logos/symbols (PCX)—\$279. Other programs from \$49. 30-day \$5 back.

Worthington Data Solutions

417A Ingalls St., Santa Cruz, CA 95060
(408) 458-9938 (800) 345-4220

BAR CODE

PORTABLE READER

Battery-operated, handheld reader with 64K static RAM, 2x16 LCD display, 32-key keyboard, Real-Time-Clock. Wand or laser scanner. Program prompts and data checking through its own keyboard. Easy data transfer by RS-232 port or PC, PS/2 keyboard. Doubles as On-Line Reader. 30-day \$5 back.

Worthington Data Solutions

417A Ingalls St., Santa Cruz, CA 95060
(408) 458-9938 (800) 345-4220

PRINT BAR CODES/BIG TEXT FROM YOUR PROGRAM

Add bar codes and big graphics characters to your program. Print from ANY MS-DOS language. Bar codes: UPC, EAN, 2 of 5, MSI, Code 39. Epson, OKI, IBM dot matrix text up to 1/2". LaserJet up to 2". Font cartridges not required. \$179-\$239. 30-day \$5 back.

Worthington Data Solutions

417A Ingalls St., Santa Cruz, CA 95060
(408) 458-9938 (800) 345-4220

BAR CODE READERS

Keyboard emulation for PC/XT/AT & PS/2's, all clones and any RS-232 Terminal. Transparent to your operating system. Available with Steel wands, Lasers, Slot & Magstripe Readers. Same day shipping, 30-day money-back guarantee. One-year warranty. Reseller discounts available.

AMERICAN MICROSYSTEMS

2190 A Regal Parkway, Euless, TX 76040
(800) 648-4452 (817) 571-9015 FAX (817) 685-6232

BAR CODE PRINTING SOFTWARE

- MS/PC DOS SYSTEMS
- 9 & 24 PIN DOT MATRIX
- H-P LASER JET/PLUS/SERIES II
- MENU-DRIVEN or MEMORY RESIDENT
- CODE 39, I 2/5, UPC A/E, EAN 8/13
- BIG TEXT & BAR CODE SOFTONTS

AMERICAN MICROSYSTEMS

2190 A Regal Parkway, Euless, TX 76040
(800) 648-4452 (817) 571-9015 FAX (817) 685-6232

BAR CODE READING SOFTWARE

KNOW-WEDGE eliminates the need for cumbersome and costly hardware wedges. Simply plug a wand, laser, or CCD into a game port and scan. Works with any program and is available for UPC, EAN, and CODE 39. A serial port version is available for Laptops and Notebooks! OEM and reseller inquiries invited.

COMPUTER RESOURCES GROUP

629 Silverdale Dr., Claremont, CA 91711
VOICE: (714) 624-8734 BBS: (714) 626-1054

Inquiry 709.

THE BUYER'S MART

BAR CODE

Ultra-Portable Reader

The OmniWand 100 requires no batteries, external power, or boards. Plugs into serial port of any IBM compatible (laptop to desktop) and scans Code 39, I-2/5, Codabar, MSI, UPC, and EAN-13. Uses power directly from computer, but with very little effect on a laptop's charge-life. Setup and keyboard emulation software included. \$439.

Digital Dynamics

2335 Lois Ct., Sparks, NV 89434
(702) 331-7581

Inquiry 710.

PC-Wand Bar Code Solutions

Bar codes are easy using our FULL line of readers & printers. They plug & play with your existing CPU/printer/terminals/software systems in your office, store, truck, factory or warehouse. ITS' bar code DOS programs print on matrix or laser printers. 30 day refund, 1 year warranty. OEM/VAR/ Dealer discounts.

International Technologies & Systems Corp.

655-K North Berry St., Brea, CA 92621-Western USA
13 Welwyn Court, Richmond, VA 23229-Eastern USA
(800)228-9487 (714)990-1880 (804)741-6725 (FAX)990-2503

Inquiry 711.

PC BAR CODE SPECIALISTS

Bar code readers designed for fast, reliable, cost-effective data entry. They emulate your keyboard, so scanned data looks just like it was typed! Choose from stainless steel wand, laser gun, card slot reader, and magnetic stripe scanner. Also, powerful Bar Code and Text printing software. Great warranty. Generous dealer discounts.

Seagull Scientific Systems

15127 N.E. 24th, Suite 333, Redmond, WA 98052
206-451-8966

Inquiry 712.

DATA INPUT DEVICES

Bar Code, Magnetic Stripe Readers & SmartCard Encoder/Reader for microcomputers & terminals, including IBM PS/2 & others, DEC, Macintosh, AT&T, CT, Wyse, Wang. All readers connect on the keyboard cable & are transparent to all software. UPC & 39 print programs, magnetic encoders, & portable readers are also available.

TPS Electronics

4047 Transport, Palo Alto, CA 94303
415-856-6833 Telex 371-9097 TPS PLA
1-800-526-5920 FAX: 415-856-3843

Inquiry 712.

VARIANT MICROSYSTEMS BAR CODE READERS DELIVER

WAND/LASER/MAGNETIC CARD CONNECTIVITY
• Keyboard wedges (Internal/External) for IBM PC/XT/AT, PS/2 and portables.
• RS232 wedges for WYSE, Link, Kimtron terminals
• Bar code and label printing software
• Full two-year warranty
• 30-Day Money-Back Guarantee
• Extensive VAR/Dealer Discounts
3140 De La Cruz Blvd., Suite 200/Santa Clara, CA 95054/(408) 980-1880
800-666-4BAR FAX: (415) 623-1372

Inquiry 713.

BAR CODE EQUIPMENT

MS-DOS Bar Code Decoder

The FlexScan™ I Bar Code Decoder for MS-DOS Based PCs has been proving itself in industrial, point-of-sale, and office environments since 1989 and is being used by Fortune 500 companies. List price for PC card and wand is \$265.00
• HIGH PERFORMANCE
• RUGGED
• EASY TO USE
• RESALEABILITY DISCOUNTS
• MADE IN THE U.S.A. AND BACKED BY A ONE-YEAR WARRANTY

ADAPTIVE TECHNOLOGIES

1651 S. JUNIPER, STE. 188
ESCONDIDO, CA 92025 (619) 746-0468

Inquiry 714.

356 BYTE • SEPTEMBER 1991

CAD

PCB & SCHEMATIC CAD—£195

"EASY-PC" for single-sided and multilayer boards to 17" x 17" with up to 1500 ICs including surface mount. Phenomenally fast and easy to use. Over 9000 copies sold. Needs PC/XT/286/386 HERC/CGA/EGA/VGA. Output to laserjet/inkjet/dot matrix printer, pen-plotter, photo-plotter and NC Drill. Not copy protected. VISA/MC/AMEX welcome. For full info circle inquiry # or contact us direct.

NUMBER ONE SYSTEMS LTD.

Harding Way, St. Ives, Huntingdon, Cambs, England, PE17 4WR
Tel 011-44-480-61778 Fax 011-44-48-494042

Inquiry 715.

VIEW CAD DRAWINGS

SirlinVIEW Allows non-CAD users to view AutoCAD DWG, DXF & IPLG files on PCs. Print, Plot, attach notes and hyper-link between files. Change views and layers. Accurate! Query databases to locate & highlight objects on the screen.
Also, linkable Sirlin VIEW/LIB allows developers to add viewing capabilities to their own applications.

Sirlin Computer Corporation

225 Lowell Road, Hudson, NH 03051
(603) 595-0420 Fax (603) 595-7779

Inquiry 716.

CAD MAPPING/GIS

Custom Line Types

"Universal C-Line" is for all DXF files: imbed text, blocks, shapes; "flow" patterns along the path of all types of polylines (2D, 3D, arcad, splined, etc.); weed dense polylines.

(800) 663-8045 (604) 266-5380

M. Silnn Engineering

315B W. 32nd Ave., Vancouver BC V6L 2C1

Inquiry 717.

CAD/CAM

STEPPER MOTOR CONTROL FROM A PRINTER PORT

NEW Indexer LPT software \$249
VERSION 2.0 VISA/MC

• Controls up to six motors simultaneously
• Linear and Circular Interpolation.
• New features to accommodate machine control.
• Easy-to-use DOS device driver. Super Manual.
• CAD-CAM interface available.
Corporation, 1422 Arnold Ave.
Roslyn, PA 19001 (215) 657-4338
FAX (215) 657-7815

Ability Systems

Inquiry 718.

If you've been muttering...

DXF SUX

...here's the solution!

The "CAD/CAM Developer's Kit/DXF" has all the C Functions you need for programs that read and write DXF files
Full Release 10 support... unlimited file size...
...insert explosion... ALL entity types!

CALL (617) 628-5217 FOR INFO

Building Block Software, PO Box 1373, Somerville, MA 02144

Inquiry 719.

CD-ROM

CD ROM, Inc.

RETAIL/WHOLESALE

CD-ROM • WORM • MO • CDD DRIVES

IBM/MAC CD-ROM & CDD DISCS

QUALITY PRODUCTS AND SERVICES AT COMPETITIVE PRICES

FREE CATALOG

TEL. 303-231-9373

1667 COLE BLVD., SUITE 400, GOLDEN, CO 80401

FAX: 303-231-9581, CIS: 72007,544

VISA/MC/AMEX/GOV'T. Pds

Inquiry 720.

CD-ROM

NIMBUS

Your complete source for CD-ROM implementation including disc replication, search and retrieval software and application design. Find out just how easy it is to put your data into the media of the '90s

Nimbus Information Systems

1-804-985-1100

Box 7427, Charlottesville, VA 22906

Inquiry 721.

COMMUNICATIONS

RS232 PROBLEMS ???

Turn your PC/XT/AT into an RS232 Bus Analyzer — Monitor 2-way communications in real time — Capture at 19200 (XT) 57600 (AT+) — 500,000 byte data buffer — Monitor HW signals — Search for ASCII text/hex bytes — Write data to disk — Data file processing utilities included. Great value, ONLY \$150!

RING DEVELOPMENT (612) 425-7807

P.O. Box 560, Osseo, MN 55369-0560

Inquiry 722.

SDLC OR X.25 SUPPORT

Use Sangoma hardware and software to provide cost effective, robust and easy-to-use SDLC or X.25 links from MS-DOS, UNIX, PC-MOS, etc.

All real time communication functions performed by intelligent co-processor card.

Full function SNA emulation packages also available.

Sangoma Technologies Inc.
(416) 474-1990

Inquiry 723.

COMPUTER INSURANCE

INSURE YOUR COMPUTER

SAFWARE Computeroowners coverage provides replacement of hardware, media and purchased software. As little as \$49 a year covers accidents, theft, power surges and more. One call does it all. Call 8 am-10 pm ET. (Sat. 9 to 5)

TOLL FREE 1-800-848-3469

(Local 614-262-0559)

SAFWARE, The Insurance Agency Inc.

Inquiry 724.

CROSS ASSEMBLERS

CROSS ASSEMBLERS

Universal Linker, Librarian
Targets for 42 Microprocessors
Hosts: MS-DOS, UNIX, VAX VMS

ENERTEC, INC.

BOX 1312, 811 W. Fifth St.

Lansdale, PA 19446

Tel: 215-362-0966 Fax: 215-362-2404

Inquiry 725.

CROSS ASSEMBLERS/SIMULATORS

New unique full-function simulators for the 8096 and 80C196 controllers, featuring ALL MODES of interrupts, plus the HSI, HSO, and A/D functions.

We also support the 804849, 8080/85, 8051/52, and Z80 controllers with excellent, reasonably priced Cross Assemblers and Simulators.

Lear Com Company

2440 Kipling St., Ste. 206, Lakewood, CO 80215

(303) 232-2226 FAX: (303) 232-8721

Inquiry 726.

CROSS DISASSEMBLERS

PROFESSIONAL PC SOFTWARE
NEW: 8096/80196 CROSS-DISASSEMBLER
* ANALYTIC CROSS-DISASSEMBLERS W/AUTO LABEL GENERATION
* RELOCATABLE MACRO CROSS-ASSEMBLERS
SUPPORT FOR SPARC, 8051, 8048, 8080/5, Z80/180, Z8000, 6800,
6805, 6809, 68HC11, 68000, 6301, 6305, 1800, 6500, 6502C, 9900,
OTHERS
* Z80-8086-8088 SOURCE TRANSLATION UTILITIES
ORDER TODAY: (408) 773-8465
LOGISOFT PO BOX 61929, SUNNYVALE, CA 94086
FAX: (408) 773-8466

Inquiry 727.

DATA CONVERSION

MEDIA CONVERSION/DATA TRANSLATION
More than just a straight dump or ASCII transfer!
Word Processing, DBMS, and Spreadsheet data on Disks
or Tapes transferred directly into applications running on
Mainframes, Minis, Micros, Dedicated Word Processors,
Typesetters, and Electronic Publishing systems.
IBM PS/2 & Macintosh supported
#1 in the translation industry!
CompuData Translators, Inc.
3345 Wilshire Blvd., Suite 407, Los Angeles, CA 90010
(213) 387-4477 1-800-825-8251

Inquiry 728.

DATA RECOVERY

CRASHED?
Your valuable data can be recovered!
• 95% success rate • Fast turnaround
• Priority service available
• Servicing Novell, DOS, Macintosh, Unix,
Xenix, OS/2, Bernoulli, Sun and more!
ONTRACK DATA RECOVERY, INC.
6321 Bury Drive, Eden Prairie, MN 55346
1-800-872-2599 • 612-937-5161

Inquiry 729.

DATA RECOVERY

Data lost from 1/4" cartridges or 1/2" tape can be
recovered almost every time. We have helped Banks, In-
surance Companies, Telephone Companies, Commodity
Dealers, Hospitals, Software Houses, Government Depart-
ments. *The list is endless.*
We charge a small fixed fee for investigation and then on a
time and materials basis.
The QICPAK Cartridge Interchange People
Vogon Enterprises Ltd.
94 Easthamstead Road, Wokingham, Berkshire RG11 2JQ ENGLAND
Tel 44 + (0)734-784511 or -890042 Fax 44 + (0)734-890040

Inquiry 730.

DATA/DISK CONVERSION

CONVERTING YOUR DISKETTES?
ENTRUST THEM TO US!
2500 Word Processor & Computer formats, 3 1/4", 5 1/4", 8"
Disks, Mag Tapes, Mag Cards, Cartridges & Cassettes, Custom
Conversions, Programming & Applications Development
DISK DUPLICATION
OCR SCANNING SERVICES
HIGH VOLUME LASER PRINTING
Call us for Quality, Best Prices and Quickest Turnaround Time.
COMPANY COMPENDIA, INC., 55 E Washington St.,
#237, Chicago, IL 60602 TEL: 312-419-8771 FAX: 312-419-1390

Inquiry 731.

INCOMPATIBLE COMPUTERS?

We transfer files between incompatible computers,
dedicated word processors and 9-track tape. Thousands
of formats are supported, including cartridge tapes.
We're committed to customer satisfaction and quality
conversions at affordable prices. Call for a free quote
today!
• 24-hour turnaround available •
Disk Interchange Service Company
2 Park Drive • Westford, MA 01886 • (508) 692-0050

Inquiry 732.

DATA/DISK CONVERSION

THE #1 CHOICE
In disk & tape conversion
for many leading corporations, government agencies,
law firms, and companies in every industry—world-wide.
Free test • Satisfaction guaranteed
Graphics Unlimited Inc.
3000 Second St. North, Minneapolis, MN 55411
(612) 588-7571 or (612) 520-2345
FAX: (612) 588-8783

Inquiry 733.

IBM PC ◀ TO ▶ HP FILE COPY
FASTER EASIER TO USE
Update version uses windows: Call for free demo! IBM
PC <to> HP File Copy allows IBM PCs, PS/2,
compatibles to interchange files with Hewlett-
Packard Series 70, 80, 200, 300, 1000, 9000s.
Oswego Software
Box 310 708/554-3567
Oswego, IL 60543 FAX 708/554-3573

Inquiry 734.

CONVERSION SERVICES

Convert any 9-track magnetic tape to or from over
3000 formats including 3 1/2", 5 1/4", 8" disk formats &
word processors. Disk-to-disk conversions also
available. Call for more info. Introducing OCR Scan-
ning Services.
Pivar Computing Services, Inc.
165 Arlington Hgts. Rd., Dept. #B
Buffalo Grove, IL 60089 **(800) Convert**

DATABASE MGMT SYSTEMS

SQL DBMS FOR DEVELOPERS
OCELOT2—THE SQL is a DBMS library and precompiler
for writing 3GL applications with embedded SQL. It's like hav-
ing IBM's DB2 on your PCI OUR GUARANTEE: This is the
fastest, most powerful micro DBMS you can get anywhere
at any price or your money back. Get referential integrity, get
dynamic SQL, get OCELOT2 — THE SQL!
• Requires 320KB RAM, DOS 3.1 & up, compatible BASIC/PASCAL/COBOL compiler
• Windows compatible version available
ORDER YOURS TODAY!—Prices start at \$195.00
OCELOT COMPUTER SERVICES INC.
#1502, 10025 — 106 Street, Edmonton, AB, Canada, T5J 1G7
(403) 421-4187

Inquiry 735.

dBASE file Access from C
C programmers use CodeBase to build multi-
user, dBASE/Clipper compatible applications.
Create popup windows, pulldown menus, and
data entry screens. Port between Unix,
Microsoft Windows and OS/2.
FREE Demo Disk Call (403) 448-0313
Fax (403) 448-0315
Sequitur Software Inc.
#209, 9644-54 Ave, Edmonton, AB, Canada, T6E 5V1
See our ad on page 181.

Inquiry 736.

DESKTOP PUBLISHING

Make Ventura Writing Easy
VenEdit makes editing Ventura Publisher files easy:
• Clear, code-free display
• Code-ignoring spelling checker
• Strips codes
• 50 Ventura commands
• Powerful editor. Much more
QPlus Inc. 1-800-76-PLUS-6
Act now — only \$139 — 60-day guarantee

Inquiry 737.

DISK DRIVES

IBM PS/2 HARD DRIVES

30MB	MOO 30, 30-286	\$350
30MB	MOO 50Z, 55SX	450
60MB	MOO 50Z, 55SX, 70	695
120MB	MOO 50Z, 55SX, 70	795

New, genuine Big Blue Product with 1 yr. Warranty.
Call for Model 60/80 drives. Terms: COO/MC/Visa
COMPUTER TECHNIQUES
Merritt Island, FL 32953-3484
Phone/Fax (407) 453-8783

Inquiry 738.

DUPLICATION

SOFTWARE DUPLICATION

- DISKETTE & TAPE
- DOCUMENTATION PRINTING
- CUSTOM PACKAGING
- FULFILLMENT

MEGASOFT, INC.
P.O. Box 6609, Freehold, NJ 07728
(800) 222-0490 (908) 462-7628

Inquiry 739.

EDUCATION

B.S. & M.S. In COMPUTER SCIENCE
The American Institute for Computer Sciences offers an in-
depth correspondence program to earn your Bachelor of
Science and Master of Science degrees in Computer Science
at home. B.S. subjects covered are: MS/DOS, BASIC,
PASCAL, C, Data File Processing, Data Structures &
Operating systems. M.S. program includes subjects in Soft-
ware Engineering and Artificial Intelligence
AMERICAN INST. FOR COMPUTER SCIENCES
2101-BY Magnolia Ave. South, Ste. 200, Birmingham, AL 35205
800-767-2427 205-323-6191

Inquiry 740.

EDUCATIONAL TRAINERS

MICROPROCESSOR TRAINING SYSTEMS
Learn how to program and troubleshoot microprocessor
systems the easy way. EMAC offers stand alone and PC/Ter-
minal based systems. Uses simple 8085 architecture. Monitor
Operating System allows single step, breakpoints, register
modification & more. Upload/download programs from PC
and store in battery backed RAM. Intel devices include 8255,
8253, 8251, 8259, 8279, A/D & D/A. Manuals, Lab books, and
Cross assemblers available. Prices start at \$449.00
(618) 529-4525 EMAC INC. (618) 457-0110 FAX
P.O. Box 2042, Carbondale, IL 62902

Inquiry 741.

ENTERTAINMENT

WIN \$10,000
THE GRIN-GO CHALLENGE
Grin-Go is a PC-based game that the average 7-yr. old can learn in
five minutes. The Challenge: write a program that will allow an individual
to play against the computer. Grin-Go Inc. doesn't think you can do
it and will pay \$10,000 for the rights to such a program. The Challenge
registration fee is \$44.00. Registration package includes rules and source
code. (GW Basic, Turbo Pascal, MS C)
Grin-Go Inc. P.O. Box 6295 Alexandria VA 22306
(703) 329-1717 Visa & MC accepted
Contest rules and description of Grin-Go—\$5.00
(No Charges. \$4.00 applicable to future registration)

Inquiry 742.

Go, NEMESIS, Go

Go — a Zen game. So appealing, it has endured 4,000
years. So useful, governments study it.
NEMESIS Go Junior entices novices of any age.
NEMESIS Go Master Delux satiates the addicted.
Chaos Manor User's Choice Award (BYTE/1990)
Toyogo, Inc. (800) 869-6469
PO Box 25460-Y, Honolulu, HI 96825-0460
(808) 396-5526 fax: (808) 396-4126

Inquiry 743.

THE BUYER'S MART

EPROM EMULATION

EPROM EMULATORS

An EPROM emulator takes the place of an actual EPROM and allows you to download code to your target system instead of programming and erasing parts. In seconds, you see results!

Model I (2764-27256, 8-bit, \$199)

Model II (2764-27010, chainable for 16/32-bit, \$349)

PARALLAX, INC.

6200 Desimone Lane, #69A • Citrus Heights, CA 95621
(916) 721-8217

Inquiry 744.

FILE COMPARISON

A Difference That Must be Seen! *Diff. It!*

△ Faster resync algorithms. △ Multiple wildcard filename parsing. △ Mouse support. △ Mixed file difference output. △ Unlimited file sizes. △ Scrollable split screen display. △ Configurable compare algorithms. △ Command line interface. △ Pop-up menu interface. △ Line, Word and Hex compare. △ Fast terse modes. △ Batch file drive-able.

Requires IBM PC or 100% compatible, 256KB memory, DOS 2.0 or higher, floppy or hard disk. 30-day money-back guarantee. \$129.95 (215) 666-8104

Double R Software, Inc.

Rd 1 Fifth Ave., Valley Forge Manor, Phoenixville, PA 19460

Inquiry 745.

FINANCIAL SOFTWARE

BrainMaker:

"The most fascinating computer software I've ever seen... learn about this stuff." *John Dvorak, PC Mag.* Predicts stocks, bonds, sales, inventories. Comprehensive manual. Menus. Only \$195!

Mac version now available

Free Brochure: 916/477-7481

California Scientific Software

Inquiry 746.

FLOW CHARTS

WINDOWS FLOWCHARTER \$129

RFFFlow 2.0 is a professional drawing tool for flowcharts & org charts. Requires Microsoft Windows 3.0. 100 shapes auto adjust in size. Diagonal lines and curves. Auto line routing and re-routing. Click on a shape to bring up a sub-chart. Move charts to other apps. via the Clipboard. Call for free trial disk.

RFF ELECTRONICS

1053 Banyan Court, Loveland, CO 80538
Phone: (303) 663-5767 FAX: (303) 669-4889

Inquiry 747.

HARD DRIVE REPAIR

HARD DRIVE REPAIR

ALSO

DATA RECOVERY

FAST TURN!! CALL FOR DETAILS

H&W micro labs, inc.

528-C Forest Parkway, Forest Park, GA 30050

404-366-1600

Inquiry 748.

CAPACITY	MFM/RLL	ESDI/SCSI	LOWEST DISK DRIVE REPAIR PRICES
10-19Mb	\$75	N.A.	JB TECHNOLOGIES, INC. 5105 Maureen Lane Moorpark, CA 93021 Phone: (800) 688-0908 FAX: (805) 529-7712
20-29	95	105	
30-39	110	125	
40-49	135	155	
50-85	175	195	
86-120	275	295	
121-160	325	345	
161-340	CALL	CALL	

Inquiry 749.

358 B Y T E • SEPTEMBER 1991

HARDWARE

COMPLETE COMPUTER SYSTEMS

1 Year Warranty • Components also at Reasonable Prices
Standard System Features Include: 1Meg of Ram, 1.2 Floppy, Case, Power Supply, Monitor, Keyboard, 2 Serial Ports, 1 Parallel port, Floppy and Hard Drive Controller, Mono-Graphics Card, And, if ordered by 03/09/91, Get MS-DOS 4.01 free! 286-12MHz System \$625, 386sx-16MHz System \$1025, 386-25MHz System (No-Cache) \$1325, 286-16MHz System \$675, 386sx-20MHz System \$1125, 386-33MHz System (64K Cache) \$1525, 486-25MHz System (256K Cache) only \$2275; System Upgrades Add: VGA Mono \$75, VGA Color \$275, Hard Drives Add: 45 Meg \$209, 89 Meg \$379, 130 Meg \$479, 200 Meg \$769. We feature a LANDMARK Diagnostics Products. Call for Prices.

Blackburn & Wright • 42257 6th Street West, Suite 302 • Lancaster, CA 93534
Phone (805) 940-5200 (800) 235-8533 Fax (805) 940-5202

Inquiry 750.

PRE-OWNED ELECTRONICS, INC.

THE Independent Provider, serving the Dealer, Professional, Corporate, Government, and Educational Buyer since 1985.

APPLE® II & MACINTOSH® SYSTEMS • PARTS • EXCHANGE REPAIRS

Call for a Catalog... 800-274-5343

Int'l: 617-275-4600 • Fax: 617-275-4848
205 BURLINGTON ROAD • BEDFORD, MA 01730

Inquiry 751.

IBM® & Macintosh®

Parts • Systems • Add-ons

Shreve Systems

3804 Karen Lane
Bossier City, LA 71112

800-227-3971

Export our Specialty!

We Ship Worldwide

Call for catalog!

International 318-742-2700
FAX 318-742-2799

Inquiry 752.

HARDWARE/COMPUTERS

SC/FOX™ EMBEDDED COMPUTERS

PC Parallel Coprocessor Plug-In Boards: 15 MIPS avg 50 MIPS burst using the SC32 32-bit CPU or the 16-bit Harris RTX 2000*
VME Master/Slave System Controller SBC: 16 MIPS avg 70 MIPS burst, uses RTX 2000 cpu, SCSI, 2 ser, 1 ptr ports, to 640K bytes.
Stand-Alone Single Board Computers: 16 MIPS avg 60 MIPS burst. 3U or 100x100mm Euro-card-size using either SC32 or RTX 2000. Ideal for embedded real-time control, data acquisition, robotics, and signal processing. OEM software development system included.

SILICON COMPOSERS INC (415) 322-8763
208 California Avenue, Palo Alto, CA 94306

Inquiry 753.

Everything you want...

... to make life easier. TDS2020 is an ideal way to save time and money designing equipment. Use as a High Performance 16-bit Control Computer or 500uA Data Collection Module. Attach LCD & keyboard. Use internal 10-bit multichannel A to D converter. D to A, 4 counter-timers, multitasking, interrupts, parallel & serial I/O, non-volatile clock and up to 512K bytes NV-RAM/EEPROM/FLASH memory. \$299 and its TDS9092 brother \$179 (25 qty). Call or fax for details.

The Saellg Company

1193 Moseley Road, Victor, NY 14564
Phone (716) 425-3753 Fax (716) 425-3835

Inquiry 754.

SDK-386™ *

*386 is a trademark of Intel Corporation. Used by permission.
BRAND NEW AND AVAILABLE ONLY FROM URDA, INC. along with the URDA SDK-85 and SDK-86 educational trainers and microprocessor development systems. The URDA SDK-51 will be available next year. Other 8, 16, and 32 bit systems are available.

Phone URDA, Inc.

1-800-338-0517 or 412-683-8732

Inquiry 755.

World Radio History

HARDWARE/CONTROLLERS

STEPPER

3 MOTOR CONTROL FROM SERIAL PORT

3 Channels of Stepper/DC motor/2.4A PWM per card. Half step, S curve accel. to 5000 steps/sec. RS232 3 wire or RS485 2 wire. Simple, powerful ascii command set. 4 cards (12 motors/port). On board switcher provides power for logic from motor supply of 7-30 vdc. High output I/O and A/D converters also available. All boards 4" x 5 1/2" \$245 single qty. \$21010+

STRADA AUTOTECH INC. P.O. Box 188, Elgin, Ont. Canada K0G 1E0 TEL: (613) 359-1029

Inquiry 756.

HARDWARE/COPROCESSOR

DIGITAL SIGNAL PROCESSOR

DSP products for the IBM PC/XT/AT. Our TMS320C25 based Model 250, with extensive software, features 250 KHz multi-channel A/D and D/A, up to 192 Kwords RAM, very high throughput to PC RAM and disk, and is priced competitively with traditional Analog I/O boards. Call us about your applications.

DALANCO SPRY

89 Westland Ave., Rochester, NY 14618
(716) 473-3610

Inquiry 757.

INVENTORY MANAGEMENT

dFELLER Inventory

Business inventory programs written in modifiable dBASE source code

dFELLER Inventory \$150.00

Requires dBASE II or III, PC-DOS/CPM

dFELLER Plus \$200.00

with History and Purchase Orders

Requires dBASE III or dBASE III Plus (For Stockrooms)

Feller Associates

550 CR PPA, Route 3, Ishpeming, MI 49849

(906) 486-6024

Inquiry 757.

LANS

The \$25 Network

Try the 1st truly low-cost LAN

- Connect 2 or 3 PCs, XTs, ATs
- Uses serial ports and 5-wire cable
- Runs at 115K baud
- Runs in background, totally transparent
- Share any device, any file, any time
- Needs only 14K of RAM

Skeptical? We make believers!

Information Modes

P.O. Drawer F, Denton, TX 76202
817-387-3339 Orders 800-628-7992

Inquiry 758.

LANS/SOFTWARE

NETRUNNER

the low cost remote control program

- Control remote computer across LAN or WAN.
- Running on NetBIOS, IPX/SPX, RS-232, and modem.
- All in one package.
- Background file transfer.
- Selective keyboard locking.
- Remote execution.
- \$19.95 per user, \$24.95 Starter's Kit (2 users)
\$99.95 unlimited users.

Crystal Computing Corporation

3140 De La Cruz Blvd, Suite 200, Santa Clara, CA 95054
Tel: (408) 748-0685 (408) 748-0125 Fax (408) 748-0879

Inquiry 759.

LAPTOP COMPUTERS

SAVE! LAPTOPS/NOTEBOOKS SAVE!

TOSHIBA • EVEREX • ZENITH • AT & T • TANDON
AST • SANYO • SHARP • BONDWELL • ALR • LIBREX
PANASONIC • ALTIMA • LEADING EDGE • FORA
PACKARD BELL • SAMSUNG • NEC • TI • COMPAQ
• We ALSO carry a full line of accessories •
Computer Options Unlimited

12 Maiden Lane, Bound Brook, NJ 08805
CALL: (800) 424-7678 Need Help?: 908-469-7678
9-9 M-F 9-5 Sat. 6 days Worldwide Sales

Inquiry 760.

LAPTOP COMPUTERS

IBM CONVERTIBLE

MEMORY-128K \$79 256K \$225 384K \$295
MODEMS-Standard \$75 Enhanced \$175
CRT ADAPTER-for monitors \$99
SERIAL/PARALLEL ADAPTER-\$120
MONITORS-Monochrome \$115 Color \$349
COMPACT Carrying Case \$39
ENHANCED LCD-\$79 BATTERY -\$89
HARD DRIVES-20 Meg-\$495 40 Meg-\$695

MORE ACCESSORIES AVAILABLE

COMPUTER RESET

P.O. Box 461782, Garland, TX 75046
Phone (214) 276-8072 BBS & FAX (214) 272-7920

Inquiry 761.

LAPTOP PERIPHERALS

LAPTOP POWER ADAPTERS

AC and DC input

TOSHIBA INTERNAL CARDS

Fax/modems: 9600/2400bps, software, acoustic port
Modems, exp: 2400 bps, acoustic or serial port Modem,
dedicated: 2400 bps (notebooks, T31&3200SX) Serial IO
cards: RS232, RS422, SCSI, HPIL, barcode

Contact us for more information:

PRODUCT R&D Corporation (Callf.)
805/546-9713 Fax 805/546-9716

Inquiry 762.

PRINTER DIAGNOSTIC

NEW!! PC PRINTER DIAGNOSTIC

The first software-based Printer Diagnostic targeting PC printers.
PRINTER-Technician™ currently tests over 275 different models of dot
matrix, laser, ink jet, thermal & daisywheel printers from 8 of the largest
manufacturers. Includes parallel & serial interface tests. Provides •
Reduced mean time to diagnose printer problems • Quick identifica-
tion when software (not hardware) is the issue • Greatly improved first-
time-fix rate • Rapid printer installation certification. If you are trouble-
shooting and repairing printers, you need **PRINTER-Technician**. ORDER
TODAY! \$244. Plus S&H and CA Sales Tax where applicable

Call (415) 456-2200 or fax (415) 456-2244

Windsor Technologies, Inc., 130 Alto St., San Rafael, CA 94901

Inquiry 763.

PRODUCT MANAGEMENT

Keep Track of Bug Reports

New tool gives instant access to information about pending
bug reports/suggestions on the products you maintain
or support. Eases planning of new releases. No
more paperwork, lost reports or hunting for customers'
example files. Multiple users (development, marketing,
QA) can independently categorize, prioritize, and re-
arrange records.

KeyTrack \$495 (£495 non-US)

C Street Software (805) 486-7807 Fax (805) 485-1197
3L Ltd (UK) +44 506 41 59 59 Fax +44 506 41 59 44

Inquiry 764.

PROGRAMMERS TOOLS

HYPERINTERFACE™ II

Menu Creator™ — An interactive WYSIWYG editor to
generate a menu-driven user interface for your software.
Screen Creator™ — An interactive WYSIWYG editor for
quick and easy screen design and a screen database
manager for your software. **Advanced Library** — Ex-
tended capability for data entry for your programs. FOR-
TRAN, Pascal, C, BASIC supported.

Avanpro Corp.

P.O. Box 969, Pacific Palisades, CA 90272
(213) 454-3866

Inquiry 765.

COMPILE N TIMES FASTER!

N=number of PCs on your network
SIMULTI utilizes idle PCs connected to a network in
order to parallel-process and linearly speed up your
compile jobs. Runs under DOS & WINDOWS. Compati-
ble with any compiler, any network OS. No TSRs, no
device drivers. \$195 per network (until Oct. 1st 1991).
60 days Money Back Guarantee.

Parallex Software

12021 Wilshire Blvd., Suite 892, L.A., CA 90025
(213) 207-6051

Inquiry 766.

PUBLIC DOMAIN

FREE IBM 5 1/4" Disk with FREE GAMES, UTILITIES and CATALOG

Just to get acquainted
with our shareware.

1-800-845-8902
L.A. Software

Inquiry 767.

\$1.00 PER DISK NO MINIMUM ORDER!

Free Catalog of 700+ Programs
Many Unique, Hard to Find Titles.

(Watch For Our On-Line BBS -Coming Soon!)

Northern Micro Systems

16 Main St. Absarokee, MT 59001
(406) 328-4343

Inquiry 768.

FREE SOFTWARE FOR IBM®/clones

TRY US! GET 15/5.25" or 6/3.5" Disks full
of our best selling software—**FREE**. Great
games, programmer's utilities, business,
educational, and desktop publishing. Pay
only \$5.00 shipping/handling. Credit cards
only. Call Today!

SMC SOFTWARE PUBLISHERS
619-931-8111

Inquiry 769.

FREE CATALOG FOR IBM PD AND SHAREWARE SELECTED PROGRAMS LATEST VERSIONS Low as \$1.50

SOFTSHOPPE, INC.

TEL: 800-829-2378 • 313-761-7638

FAX: 313-761-7639

P.O. Box 3678, ANN ARBOR, MI 48106

Inquiry 770.

SECURITY

FIGHT PIRACY!

Since 1986, companies worldwide have been choosing **Az-Tech**
security products. If you demand the strongest protection available,
why not choose one of these "proven leaders":

- EVERLOCK Copy Protection
- EVERTRAK Software Security
- EVERKEY II "The Lock"

For IBM and Compatibles. 30 day money back guarantee. Free info
and demo disk available.

Az-Tech Software, Inc.

201 East Franklin, Richmond, MO 64085

(800) 227-0644 Fax: (616) 776-8398

Inquiry 771.

THE ULTIMATE COPY PROTECTION

- Completely Menu Driven *Quite Simply*
- Defeats all Hardware/Software Copiers *The Best*
- No Source Code Changes *Ways To*
- Multiple Layering *Protect Your Valuable*
- No Damaged Media *Software Investment*
- Full Hard Disk & LAN Support
- Unlimited Metering, FREE Demo Disk

STOPVIEW™ STOPCOPY PLUS™ (800) 879-2224

BBI COMPUTER SYSTEMS, INC. (301) 871-1094

14105 Heritage Lane, Silver Spring, MD 20906 FAX: (301) 480-7545

Canadian residents call: (800) 867-5657

Inquiry 772.

SECURITY

HYPER-LOCK

If you search for a powerful copy protection system,
you also can have privileges of HYPER-LOCK.

- Protects on standard diskettes • Machine And/Or Hard disk
install • LAN support • Cannot be copied by any device
- No source code required • And/Or password protection
- Cost effective • FREE demo disk and info

GUVEN COMPUTER LTD.

Talimyeri sk. 7/3 Macks/Istanbul TURKEY
(90) 1-136 10 07 Fax: (90) 1-160 36 46

Inquiry 773.

Are you concerned with data security and integrity?

Then **SECURE** your data by encrypting it using our data
security products. Data encryption is a proven method to pre-
vent highly confidential data from getting into the wrong
hands. Don't wait until a catastrophe occurs and your highly
sensitive data gets into the wrong hands. Order now by call-
ing 1-800-274-3007.

Price range: \$149—\$495.00

Information Systems To Increase Profits Inc.

P.O. Box 4529, Middletown, New York 10916
Fax: 1-914-496-3504

Inquiry 774.

Cop's CopyLock II

The professional software protection with
TRUE Machine Install. Option Board safe.
Supports OS/2, Windows and Trace.

LINK Computer

Int'l: +45 31232350 Fax +45 31238448
US/CAN: 800-344-2545 Fax 408-923-7061

Inquiry 775.

BIT-LOCK® SECURITY

Piracy **SURVIVAL** 8 YEARS proves effectiveness of
powerful multilayered security. Rapid decryption
algorithms. PARALLEL or SERIAL port-transparent
security device. Complemented by economical **KEY-
LOK™** and multifeatured **COMPU-LOCK™** including
countdown, timeout, data encryption, and multiproduct
protection. (Dos/Unix/Mac). Also, access control.

MICROCOMPUTER APPLICATIONS

3167 E. Otero Circle, Littleton, CO 80122
(303) 770-1917

Inquiry 776.

HANDS OFF THE PROGRAM® OPERATING SYSTEM SECURITY

Secures subdirectories, files, printers and floppies
Keyboard/Mouse lock — automatic or manual
Log PC boot, program exec, file opens, login/logout
Prevents DOS FORMAT and most viruses
Drive A: Boot Protection / Hard Disk Lock
IBM PC or 100% comp. —DOS V 3.0+ —\$89.95 + \$5.00 S/H

SYSTEMS CONSULTING INC.

PO BOX 111209, Pittsburgh, PA 15238
(412) 781-5280

Inquiry 777.

SHAREWARE

FREE KIDS SOFTWARE FOR IBM®

TRY US! GET 15/5.25" or 6/3.5" Disks full
of our best selling software for kids—**FREE**.
Great games, puzzles, tutorials, and educa-
tional programming. Pay only \$5.00 ship-
ping/handling. Credit cards only. Call Today!

SMC SOFTWARE PUBLISHERS
619-931-8111

Inquiry 778.

THE BUYER'S MART

SOFTWARE

DecisionTrack for Windows 3.0

A *MUST* for all decision makers. Structures, records and analyses your daily decision-making processes. Make your best decision today and order now! Just \$99 plus \$3 post and packing. Includes the best seller "The Business Oracle" by Guy Damion Knight. Order online from the Business Network by calling a local Tymnet number. No subscription needed, and there's no charge for connection. Log-in id: INFOINDEX
 Or Fax: +44-71-7060536 / Tel. +44-71-2249990.
 VISA and MC accepted.

Inquiry 779.

SOFTWARE/ACCOUNTING

Solomon III Software

Integrated Accounting Software
 Top rated last 6 years
 No down time — No lost data
 Unmatched Security System
 Major Account discounts available
 Call **Debra J. Tucker**
 Authorized Dealer, CBM Consultants
 4420 Hotel Circle Ct. #350, San Diego CA 92108
 619-224-9916 Fax 619-299-6169

Inquiry 780.

dbase BUSINESS TOOLS

- GENERAL LEDGER
- ORDER ENTRY
- JOB COSTING
- BILL OF MATLS
- PAYROLL
- PURCH ORD/INVENTORY
- ACCOUNTS REC/VABLE
- JOB ESTIMATING
- SALES ANALYSIS
- ACCOUNTS PAYABLE

\$99 ea. + S&H

dATAMAR SYSTEMS Cred. Card-Check-COD
 8586 Miramar Place
 San Diego, CA 92121 (619) 452-0044

Inquiry 781.

Network Multi User

Integrated Accounting Systems Complete office management for non accountants. Behaves in Windows. Easy install, easy setup, easy use. Applications for homes, professionals, retailers and manufacturing firms. Starting from \$149 + \$50 each workstation. Call for orders, demos or brochures.

IDEA Computers, Inc. (Since 1982)
 300 Jackson Street, Richmond, TX 77469
 (713) 342-5846

Inquiry 782.

SOFTWARE/ATHLETIC

ATHLETIC SOFTWARE

For IBM PC/XT/AT and compatibles with CGA, EGA or VGA. Requires DOS 2.0 or higher. Tracks 1-50 athletes with up to 46 events each. This is a computerized exercise log. It can help you set goals, find weak spots, and organize your workouts. \$60 ck/mo

DALY SOFTWARE

28 Pembroke Terrace, Oak Grove, KY 42262

Inquiry 783.

SOFTWARE/BUSINESS

DATA ENTRY SOFTWARE

Full featured, heads-down data entry with two-pass verification, edit language, operator stats, much more! Designed for the PS/2®, PC, XT, AT or compatibles.

PC's from \$395 LAN version available
FREE 30 day trial

Computer Keys Tel: 206/776/6443
 21929 Makah Rd., Fax: 206/776-7210
 Woodway, WA 98020 USA: 800/356-0203

SOFTWARE/BUSINESS

HYPERTEXT STATISTICAL ENCYCLOPEDIA

Statistical Navigator Professional provides descriptions, definitions, and examples of over 200 statistical analysis techniques plus hundreds more terms all within a mouse-driven hypertext environment. Also offers statistical advice, pull-down menus, detailed report, natural language interface. Money-back guarantee. (VISA, MC, AMEX, PO, check)

1-800-537-8866

The Idea Works, Inc.

607 Jackson, Columbia, MO 65203

FAX: 1-314-875-5812 Outside USA: 1-314-875-5827

Inquiry 784.

SOFTWARE CONTRACTS

Worried about contracts or handling rights in software? The two volume looseleaf **Software Legal Book** text and forms can help—from employee agreements through VAR distribution. \$170

For brochure use reply card or call.

Safer Books 914-271-6919

Inquiry 785.

SOFTWARE/CHEMISTRY

Software For Chemists

- PERIODIC PLUS™ chemical database reference
- Chemical/Thermo properties of 105 elements
- 2D, 3D color graphics, Structures, History
- Organic Spectroscopic Data, Conversion Tables
- Environmental & more. Dos, 30 day Guar \$99.95

SPECTRAL INTELLIGENCE CORPORATION

30 E. Swedesford Road, Malvern, PA 19355

215-889-1349 FAX 215-889-1630

Inquiry 786.

SOFTWARE/ENGINEERING

MATFOR

BEST VALUE FOR NUMERICAL COMPUTING

An interpreter with a comprehensive set of functions for Applied Mathematics, Engineering Analysis, Statistics, and Graphics. IEEE Software says that "there is clearly significant scientific work embodied in the interpreter—the program is no lightweight." Use it risk-free under 30-day unconditional guarantee. Lowest priced mathematical toolbox. From \$150. Protected Mode versions also available.

Computational Engineering Associates

3525 Del Mar Heights Road, Suite 183, San Diego CA 92130

(619) 259-8863

Inquiry 787.

Analog Circuit Simulation

- PC and Macintosh CAE
- Schematic Entry
- SPICE Simulator
- Model Libraries
- Monte Carlo Analysis
- Plotting/Graphics Output

Intusoft

The leader in low cost. P. O. Box 710, San Pedro, CA 90733-0710
 full featured CAE tools (213) 833-0710 FAX (213) 833-9658

Inquiry 788.

CIRCUITS: SPICE for PCs

Non-linear DC & Transient, Linear AC Analyses

- Version 3C1 with BJT, MOSFET, JFET, diode, etc. models. NUTMEG postprocessor with Screen Graphics, Operating Shell, Hypertext Help & circuit file Editor included.
- Version 2G6 now includes Operating Shell, circuit file Editor & NUTMEG compatibility.

Northern Valley Software

28327 Rothrock Dr., Rancho Palos Verdes, CA 90274

(213) 541-3677

Inquiry 789.

SOFTWARE/ENGINEERING

Interactive Design/Simulation Analog Circuit Simulation

ECA-2 Electronic Circuit Analysis with all the best Monte Carlo and Worst-Case analyses with this and MORE included:

- AC, DC, Transient
- Fourier Temperature
- Sine, Pulse, PWL, SFFM, and Exponential Generators
- Full Nonlinear Simulator
- On Line, Real Time Graphics
- Multiple Plots
- FREE Demo

Tatum Labs, Inc.

3917 Research Park Dr., B-1, Ann Arbor, MI 48108 (313) 663-8810

Inquiry 790.

SOFTWARE/GRAPHICS

PostScript from C

c_...pslib function library

Order today for \$149.00

and receive FREE source code!

Barton Creek Software

2222 Western Trails Ste 106, Austin, TX 78745
512-441-8354

Inquiry 791.

FRACTAL REALISM FOR CAD AND DTP

"Fractal Graphics" lets you design dazzling images and realistic models interactively with your mouse, or use the 200+ examples. Supports .DXF and .PCX files. Herc to Super-VGA. On-line tutorial & 160-page Guidebook teach Chaos and fractals. Only \$79. With C source and PROGRAMMER'S TUTORIAL: \$109.

Cedar Software

R1, Box 5140, Morrisville, VT 05661

(802) 888-5275

Inquiry 792.

NEW VERSION!

"The Ultimate CAD/CAM/CAE Engine"

TurboGeometry Library 4.0. The most complete toolbox of 2D & 3D routines available today! Now over 600 routines including NURBS, DXF, Graphics, Surfacing, Hidden Line, Volumes, Areas, Transforms, Perspectives, Polygon (In/Union/Diff), Clipping, Tangents & more. Includes source. 30 day guarantee. Priced from \$300.00. Call or FAX for additional information.

Disk Software, Inc.

2116 E. Arapaho Rd., Suite 487, Richardson, TX USA 75081

Phone: 214-423-7288 — 800-635-7760 — FAX: 214-423-7288

Inquiry 793.

RAINDROP™

FAST, compact PntScrn Utility for end users AND developers. Hardcopy as fast as 10 secs. Average binary size - 6 kbyte. 14 video graphic standards. Scale, rotate, colorize and more. 'CALL' from user-written programs. Complete 9- & 24-pin dot-matrix, inkjet, and laserjet library \$44.95+\$3 s/h.

ECLECTIC SYSTEMS

8106 St. David Ct., Springfield, VA 22153

(703) 440-0064 Fax (703) 455-8965

Inquiry 794.

PEN PLOTTER EMULATOR

FPLOTT turns your printer into an HP pen plotter. Fast hi-res output, no jagged lines. Vary line width, color. Screen preview with zoom and pan. Stand-alone, background, and device driver modes. Works with most CAD and graphics programs. Supports most printers. New version 3. \$119+\$3 S&H. 30 day money back. VISA/MC/Check/MO.

FPLOTT Corporation

24-16 Steinway St., Suite 605, Astoria, NY 11103
718-545-3505

Inquiry 795.

SOFTWARE/GRAPHICS

EGraph for ENGINEERS \$69

Pulldown menus for XY, Bar, Needle, Double Pie, Contour, 3D-Surface, HiLoClose, Value-Range, Triangle %, & Polar graphs using 2Y Linear, Log, PROBABILITY, Time Series & Vector scaling. 32,000 points from ASCII, Lotus WK1 or editor, Outputs Epson FX&LQ, HP LaserJet, HP plotter, HPGL & Lotus PLOT files. Stats, Histogram, Cumulative, Moving Avg, Spline, 6 Regressions, Pearson III, Interpolation & MORE! CGA, EGA, VGA, MCGA, Hercules, 256K, DOS 2.1+

Great Basin Associates

653 Ave M, Boulder City, NV 89005 702-293-5908

Inquiry 796.

GOBS

GRAPHICAL OBJECTS USER INTERFACE TOOLKIT

Small, power-packed GUI toolkit library supports: • moveable, resizable windows • dialog boxes • conventional RAM, EMS, XMS or disk back up memories • drop-down & pop up menus • scrollable lists • button & icon menus. Contains an interactive, "FORMS DESIGNER", "ICON EDITOR" & manuals. Versions available for Turbo Pascal 6.0, Turbo C 2.0 & Borland C++ 2.0 w/ support for BGI or METAWINDOW graphics libraries.

NOW ONLY \$145.00

(Special Offer — Source code for Forms Designer/Icon Editor \$25.00)
ISI - Identification Solutions Inc.
1-800-668-2700 (US) 1-613-228-2700 (CAN) Fax: 1-613-228-2702

Inquiry 797.

GRAPHICS PRINTER SUPPORT

AT LAST! Use the PrtSc key to make quality scaled B&W or color reproductions of your display on any dot matrix, laser, or inkjet printer (incl. Postscript) in up to 64 shades of gray or 256 colors. GRAFFLUS also creates PCX & TIFF files. Supports Windows 3.0 or DOS application graphics - EGA, VGA, Super VGA, Hercules screens. Linkable/OEM versions available.

Jewell Technologies, Inc.

130 Nickerson St., Suite 105, Seattle, WA 98109
1 (800) 284-2574 (206) 285-6860

Inquiry 798.

FORTRAN GRAPHICS

GRAFATIC - FORTRAN callable graphics Library for creating 2-D and 3-D graphics, contour plots and solid models. PRINTMATIC and PLOTMATIC provide high resolution FORTRAN callable printer and plotter drivers for your graphics. NO ROYALTIES. \$249.95 ea.
Supports Microsoft/Lahey/RM FORTRAN compilers.

Jewell Technologies, Inc.

130 Nickerson St., Suite 105, Seattle, WA 98109
1 (800) 284-2574

Inquiry 799.

SOFTWARE/LANGUAGES

IntegrAda

Standard Air Force PC Ada Compilers & environments for MS-DOS and UNIX. Integrated programming systems include validated Ada compilers, language sensitive editors, complete libraries and other Ada programming tools. FREE demo.

AETECH, Inc. From \$495

380 Stevens Ave., Ste. 212 Solana Beach, CA 92075
(619) 755-1277 Fax: (619) 755-7540

Inquiry 800.

DRUMA FORTH-83

Break the 64K barrier without speed/size penalty. Powerful, attractively priced. *3 Standard.

- 1Mb+ automated memory management
- Full OS interface, extensive utilities
- On-line documentation, ASCII/block files
- Other products: windows, modules, profiler
- IBM PC/XT/AT including 386 compatibles

FREE learn/utility disks with purchase

DRUMA INC.

6448 Hwy. 290 East E103, Austin, TX 78723
Orders: 512-323-5411 Fax: 512-323-0403

Inquiry 801.

SOFTWARE/LANGUAGES

MAGIC II

Looking for Magic Developers to form a Magician's Group and compile a Comprehensive Encyclopedia of Magic Applications. Promote your programming investment. Learn more about what has been and can be done with Magic. Please send your Press Release, up to 500 words to:

Ellex Information Systems, Inc.

125-127 N. 4th Street, Philadelphia, PA 19106
Phone: 215/627-7202 Fax: 215/627-2342

Inquiry 802.

SOFTWARE/MATHEMATICS

OPERATIONS RESEARCH @ \$149 for your IBM or Compatible

LP88—Linear programs up to 3000 rows by 15000 columns.
BLP88—Bounded LPs up to 2500 rows by 12500 columns.
MLP88—Mixed-integer linear programs up to 800 by 4000.
TS488—Transportation problems up to 1200 sources/sinks.
NLP88—Nonlinear programs up to 800 by 4000.
TPRO88—Shortest path and travelling salesman problems.
Student/Demo Package—Reduced capacity versions for students. Manual on diskette. No site license required.
Turbo Pascal Units—Compiled ORMS procedures for developers.

Eastern Software Products, Inc.

P.O. Box 15328, Alexandria, VA 22309, (703) 360-7600, Fax (703) 360-7654

Inquiry 803.

MATH EDITING FOR THE PC

$$x^2 = \sum_{k=0}^{\infty} [x_k^{2k} (\frac{1}{x})] + (\frac{1}{x} \int F ds)$$

- MathEdit constructs math equations to be inserted into WordPerfect, Word, WordStar, and others.
- WYSIWYG interface—no codes need to be learned.
- MathEdit—\$199

K-TALK COMMUNICATIONS

30 West First Avenue, Suite 100
Columbus, Ohio 43201
(614) 294-3535

Inquiry 804.

MATHEMATICIANS—ENGINEERS

Have you ever seen functions of a complex variable? Would you like to really understand differential operators like div, grad and curl? How about a peek into the fourth dimension? Call or write for information on our latest PC and Macintosh software.

Lascaux Graphics

7601 N. Calle Sin Envidia, Tucson, AZ 85718
(602) 544-4229 — 1-800-338-0993

Inquiry 805.

SOFTWARE/PACKAGING

SAVE SAVE SAVE SAVE LET'S TALK LABELS

We do disk labels (5¼" & 3½")
• Better • Faster • Cheaper •
Because we specialize in disk labels... Let's Talk

We also have Tyvek Sleeves
Mailers • Binders • Vinyl Pages
We are a complete software packaging service.
Free Catalog

Hice & Associates

8586 Monticello Dr., West Chester, OH 45069
513-777-8586

Inquiry 805.

ONE STOP FOR ALL OF YOUR SOFTWARE PACKAGING NEEDS

The only place in the world that you can find everything you need to label — mail — package your software. From diskettes to manuals — mailers to binders — boxes to index tabs. EVERYTHING including complete design and turnkey assembly. WE DO CABLES

FREE CATALOG of services — products — prices

SPS SUPPLIES, INC.

YOUR SOFTWARE PACKAGING SOLUTION
9464 Hunters Creek Drive, Cincinnati, OH 45242
(513) 984-9938

Inquiry 806.

SOFTWARE/SCIENTIFIC

BIBLIOGRAPHIC CIRCUITS DATABASE

Provides you with references to 13,000 papers containing practical electronic circuit designs; Sources from over 300 technical and scientific periodicals; Access references by keywords and device numbers; Easy installation; Requires 7Mbytes on hard drive; Semi-annual updates; Hard copy by FAX or mail.

Package US \$375 / Demo Disk \$7

CIRCUIT SEARCH

P.O. Box 268, Breslau, Ontario, Canada N0B 1M0
TEL (519) 241-1252 FAX (519) 742-4594
US DISTRIBUTORS WANTED

Inquiry 807.

Perform engineering and scientific calculations faster... and with fewer errors!

MathCAD combines equations, text, and graphics on your PC, Macintosh, or UNIX workstation. Over 120 built-in functions handle formulas, exponentials, differentials, cubic splines, FFTs and matrices for virtually any application—special offer \$395. Call for a free demo disk.

1-800-MATHCAD

FAX 617-577-8829

MathSoft, Inc., 201 Broadway, Cambridge, MA 02139

Inquiry 808.

FREE CATALOG

A great selection of scientific software products for plotting, non-linear curve fitting, chemical equilibrium, simulation, statistics, symbolic algebra, and more. Prices from \$150. Call:

1-800-942-MATH

MicroMath, Salt Lake City, UT 84121-0550

Inquiry 809.

VT_EX: Scientific Desktop Publishing

• Equations • Tables • Graphics • Scalable Fonts • Supports most printers • WYSIWYG previewer • Foreign Languages • Special Symbols • Font Effects • Indices • Only \$299
"TeX of Tomorrow"—Notices of AMS, March 1991.

MicroPress, Inc.

68-30 Harrow Street, Forest Hills, NY
Tel (718) 575-1816 Fax (718) 575-8038

Inquiry 810.

HI-SPEED DATA ACQUISITION FOR WINDOWS 3.0

DRIVERLINX™

- Real-time, multitasking, multiuser DLL device driver
- Language - and hardware-independent data-acq. interface to all OEM supported hardware
- Includes C source to a digital oscilloscope application

SCIENTIFIC SOFTWARE TOOLS, INC.

30 E. SWEDSFORD RD., MALVERN, PA 19355
(215) 889-1354 FAX: (215) 889-1630

Inquiry 811.

SOFTWARE/SORT

OPT-TECH SORT/MERGE

Extremely fast Sort/Merge/Select utility. Run as an MS-DOS command or CALL as a subroutine. Supports most languages and file types including Btrieve and dBASE. Unlimited file sizes, multiple keys and much more! MS-DOS \$149. OS/2, XENIX, UNIX \$249.

(702) 588-3737

Opt-Tech Data Processing

P.O. Box 678 — Zephyr Cove, NV 89448

Inquiry 812.

SOFTWARE/VOICE/FAX

MULTI-VOICE® TOOLS

Multi-Voice Tools is a complete development Toolkit for Pascal or "C" to access all the features for most speech processing boards available today. It helps you write MULTI-LINE VOICE APPLICATION systems in minutes. A number of programming examples are provided. All programs and libraries are delivered with source code.

Dialogic, Rhetorex, Pika, VBX: \$599. Watson (Single Line): \$99. ALSO AVAILABLE: FAX Programmer's Toolkit (\$199). Based on CAS specifications. Visa/MC accepted.

ITI Logiciel

4263 Cristophe-Colomb, Montreal, Quebec, Can. H2J 3G2
TEL (514) 597-1692 FAX (514) 526-2362

YOUR SALES MESSAGE

about the special computer product or service that you provide belongs in print.

THE BUYER'S MART

can help you reach computer professionals and produce valuable inquiries for your company!
Call Joseph Mabe for more information

603-924-2656

or

Fax: 603-924-2683

Inquiry 813.

STATISTICS

NCSS 5.x Series — \$125

Easy-to-use menus & spread sheet. Multiple regression. T-tests. ANOVA (up to 10 factors, rep. measures, covariance). Forecasting. Factor, cluster, & discriminant analysis. Nonparametrics. Cross Tabulation. Graphics: histograms, box, scatter, etc. Reads ASCII/Lotus. Many new add-on modules.

NCSS

329 North 1000 East, Kaysville, UT 84037

Phone: 801-546-0445 Fax: 801-546-3907

Inquiry 814.

MODDE — Modeling and Design

is a PC program for the generation and evaluation of statistical experimental designs. MODDE is a user-friendly software which provides a powerful methodology for the investigation and optimization of any product system or process from laboratory to full industrial scale. MODDE supports statistical experimental designs both for screening and response surface modeling. Full support for the analysis of results. Graphical visualization of the results. Demo for complete program test available for \$70.

Umetri AB

P.O. Box 1456, S-90124 Umeå, Sweden
Telefax: +46-90-197685

Inquiry 815.

TOUR SYSTEMS

PICTOURBASE QIKTOUR SINGAPORE VER. 1.0

The world's first graphics database tour system. See the world from the comfort of your very own computer screen. View scenes of Singapore's lourest attractions with accompanying explanatory notes on VGA screens of up to 320x200x256 colors. Package contains eight 5 1/4" diskettes, requires 3.3 Mb of hard disk space, EGA/VGA display. Contains over fifty screens of favorite tourist hotspots. Only US \$35. Dealer enquiries welcome.

SIGMUND-CAI DATABASES (S) PTE LTD
5 KAKI BUKIT RD 2, #03-12 SINGAPORE 1441
TEL: 748-7148 FAX: 748-7712

Inquiry 816.

TRANSLATION

Tradoc translates and localizes your software and hardware documentation into the following languages:

+ French + Russian
+ Spanish + Arabic
+ German + Italian

Turnkey service: Desktop Publishing, typesetting and printing of your brochures and manuals.

205 Gibson Rd., Annapolis, MD 21401
(301) 267-8655

Inquiry 817.

362 B Y T E • SEPTEMBER 1991

UNINTERRUPTIBLE POWER

HOW TO PROTECT YOUR COMPUTER And Make It Last Longer

FREE money-saving literature tells you how to protect your computer and make it last longer with an uninterruptible power supply. 500VA through 18KVA models from the world's largest manufacturer of single-phase UPS.

Best Power Technology, Inc.

P.O. Box 280, Necedah, WI 54646

Toll-Free (800) 356-5794, Ext. 2151

Telephone: (608) 565-7200, Ext. 2151

UTILITIES

Recover deleted files fast!

Disk Explorer now includes automatic file recovery. You type in the deleted file's name, Disk Explorer finds and restores it. Disk Explorer also shows what's really on disk; view, change or create formats, change a file's status, change data in any sector. MS-DOS \$75 U.S. Check/Credit card welcome.

QUAID SOFTWARE LIMITED

45 Charles St. E. 3rd Fl.

Toronto, Ontario, Canada M4Y 1S2

(416) 961-8243

Inquiry 818.

Why You Want BATCOM!

BATCOM is a batch file compiler that transforms your .bat files to .exe files to make them faster. BATCOM extends DOS with many new commands so you can read keyboard input, use subroutines, and much more. In addition, BATCOM protects your source code. No royalties! Only \$59.95. Order today!

Wenham Software Company

5 Burley St., Wenham, MA 01984

(508) 774-7036

Inquiry 819.

WORD PROCESSING

Replace Proofreading

Key, edit, or proof any file on your PC with Word-Proof™, then import to your application. **New** two-pass proofing is faster, more accurate than proofreading or document comparators. Single \$295. Multi-copy discounts. Network version.

Computer Keys

21929 Makah Rd.
Woodway, WA 98020

800/356-0203

206/776-6443

Fax: 206/776-7210

FARSI / GREEK / ARABIC / RUSSIAN

Hebrew, all European, Scandinavian, plus either Hindi, Punjabi, Bengali, Gujarati, Tamil, Thai, Korean, Viet, or IPA. Full-featured multi-language word processor supports on-screen foreign characters and NLQ printing with no hardware modifications. Includes Font Editor \$355 dot matrix; \$150 add'l for laser; \$19 demo. S/H in U.S. incl'd. Req. PC, 640K, graphics. 30-day Guarantee. MCVIS/A/AMEX

GAMMA PRODUCTIONS, INC.

710 Wilshire Blvd., Suite 609, Santa Monica, CA 90401
213/394-8622 Tlx: 5106008273 Gamma Pro SNN

Inquiry 821.

YOUR SALES MESSAGE

about the special computer product or service that you provide belongs in print.

THE BUYER'S MART

can help you reach computer professionals and produce valuable inquiries for your company!
Call Joseph Mabe for more information

603-924-2656

or

Fax: 603-924-2683

Inquiry 822.

Global ReLeaf comes in all shapes and sizes.



Planting trees is one of the best and easiest ways to help reduce global warming and other environmental problems. You can make a difference right now by calling our special Action Line —
1-900-420-4545.

The \$5.00 charge actually pays for planting a tree and we'll also rush you detailed information on Global ReLeaf. Take action now.

1-900-420-4545

GLOBAL RELEAF

A program of The American Forestry Association
Citizens caring for
trees & forests since 1875
P.O. Box 2000, Washington, DC 20013



UNIVERSAL

MEMORY PRODUCTS

NATIONAL LEADER IN EXPANSION MEMORY!!
INTERNATIONAL ORDERS ACCEPTED!!

BLOWOUT SPECIALS

NEW!!!
BOCA RESEARCH
 2-8MB
 EXPANSION BOARD FOR PS/2
 MODELS 50, 50Z, 55SX, 60
 W/2MB \$285 W/4MB \$395

MICRON COMPAQ
 2-8MB
 EXPANSION BOARD FOR
 COMPAQ DESKPRO 386-16
 W/2MB \$310 W/4MB \$415

COMPAQ
 LTE 386S/20
 4MB MODULE
 \$649

NEW!!!
PROCOM TECHNOLOGY
 CD-ROM FOR PC/AT
 AND COMPATIBLES
 650MB
 STEREO OUTPUT AUDIO & DATA
 WITH OPTIONAL CD PACK
 INTERNAL \$499 W/O CD PACK \$420
 EXTERNAL \$590 W/O CD PACK \$520

ORCHID
 TINY TURBO 286
 PC/XT ACCELERATOR
 \$159

CANON
 BJ10E
 BUBBLE JET PRINTER
 \$375

ATI
 GRAPHICS VANTAGE
 COMBINED SUPER VGA
 AND 8514/A GRAPHICS
 W/512KB \$389 W/1MB \$429

EXPANSION BOARDS

ORCHID TECHNOLOGY
 RAMQUEST 8/16
 UP TO 32MB LIM 4.0 HARDWARE & SOFTWARE
 FOR PC/XT/AT USES 256KB, 1 OR 4MB SIMM
 0KB \$189 W/2MB \$297
 RAMQUEST 16/32
 2-8 MB FOR PS/2
 LIM 4.0 HARDWARE & SOFTWARE WITH SER & PAR PORT
 FOR MOD 50, 50Z, 55SX, 60, 70, 80
 FULLY SUPPORTS 16 & 32 BIT MEMORY
 PRINT SPOOLER/RAM DISK/DISK CACHE
 0KB \$289 W/2MB \$389

BOCA RESEARCH
 BOCARAM AT PLUS
 \$119 W/2MB \$227
 2-8MB USING 1X1 DRAM OR 1MB SIMM
 BOCARAM AT IO PLUS
 \$159 W/2MB \$269
 UP TO 4MB W/SER & PAR PORT
 BOCARAM 30 \$129
 UP TO 2MB FOR PS/2 MOD 25 & 30
 BOCARAM XT \$119
 UP TO 2MB EXPANSION FOR PC/XT

AST RESEARCH
 6 PAK 286 \$119 W/2MB \$227 W/4MB \$335
 INCLUDES HEADROOM SOFTWARE
 RAMPAGE PLUS 286 \$339 W/4MB \$550
 UP TO 8MB FOR AT'S LIM 4.0 HARDWARE & SOFTWARE
 RAMVANTAGE \$49 W/128KB
 BACKFILLS AT'S TO 640KB & UP TO 3MB EXT. MEMORY

MICRON TECHNOLOGY
 2-8MB EXPANSION BOARD
 FOR PS/2 50, 50Z, 55SX, 60
 W/2MB \$295 W/4MB \$405

EVEREX
 RAM 3000 \$ 99 UP TO 3MB FOR AT'S
 RAM 8000 \$225 UP TO 8MB FOR AT'S
 LIM 4.0 HARDWARE & SOFTWARE

INTEL
 FOR PC/XT/AT
 ABOVE BOARD PLUS8 W/2MB \$559
 ABOVE BOARD PLUS W/512 \$390
 FOR PS/2
 ABOVE BOARD 2 PLUS \$349
 FOR MOD 50, 50Z, 55SX, 60, 65SX
 ABOVE BOARD MC32 \$449
 FOR MOD 70 & 80

COMPAQ
 DESKPRO 386 20/25 20E/25E 386S
 1MB MODULE \$109 4MB MODULE \$299
 4MB EXPANSION BOARD \$425
 NEW LTE 386 S/20 4MB \$890
 PORT. 386/20 4MB \$710
 1.44 & 1.2 MB 1/3 HEIGHT FDD
 FOR DESKPRO \$129

LASER PRINTERS

HP LASERJET
 HP II & IID, HP & III
 1MB \$ 89 2MB \$149 4MB \$245

PACIFIC DATA
 POSTSCRIPT CARTRIDGE \$385

IBM
 4019 & 4019E
 1MB \$139 2MB \$189 3.5MB \$269

PANASONIC
 4420 & 44501
 1MB \$109 2MB \$169 4MB \$279

CANON
 LBP 4
 1MB \$189 2MB \$229 4MB \$319
 LBP 8
 1MB \$119 2MB \$159 4MB \$259

EPSON EPL 6000
 1MB \$119 2MB \$159 4MB \$259

MEMORY

PS/2 MODULES
 6450604 2MB MOD 50Z, 55SX, 70E611/21 \$129
 6450608 2MB MOD 70A21 \$139
 6450603 1MB PS/2 SIMM \$69
 6450372 2MB FOR 6450367 \$249
 6450375 1MB FOR MOD 80-041 \$135
 6450379 2MB MOD 80-111/311 \$209
 34F2933 4MB PS/2 SIMM \$390
 30F5360 2MB KIT MOD 30-286 \$149
 6451060 4MB MOD 80-A21/31 \$495
 6450128 4MB MOD 90 & 95 \$399
 6450902 2MB MOD 90 & 95 \$195

PS/2 EXPANSION BOARDS
 6450609 W/2MB 2-8MB MOD 50, 50Z, 55SX, 60 \$460
 6450605 W/2MB 2-8MB MOD 70 & 80 \$460
 34F3077 W/2MB 2-14MB MOD 70 & 80 \$485
 34F3011 W/4MB 4-16MB MOD 70 & 80 \$690
 6450185 W/1MB 1-13MB MOD 50, 55SX, 60 \$425

PROCOM PS/2 DRIVES
 200MB MDL 50/50Z \$1375 320MB SCSI EXT \$2500
 80MB SCSI EXT \$745 1.2MB EXT FDD \$269
 100MB SCSI EXT \$985 MC SCSI ADAPTER \$269
 200MG SCSI EXT \$1457 650MB EXT CD-ROM \$747

MATH CO-PROCESSORS

NEW!!! ULSI
 FASTER, LOWER COST LIFETIME WARRANTY
 30 DAY MONEY BACK GUARANTEE
 US83C87-16 \$199 US83C87-33 \$199
 US83C87-20 \$199 US83C87-16SX \$129
 US83C87-25 \$199 US83C87-20SX \$149

CYRIX
 83D87-16 \$209 83D87-33 \$219
 83D87-20 \$209 83S87-16 \$159
 83D87-25 \$209 83S87-20 \$169

INTEL
 80387-16 \$249 80387-33 \$249
 80387-20 \$249 80387-16SX \$199
 80387-25 \$249 80387-20SX \$209

VIDEO GRAPHICS CARDS

ORCHID TECHNOLOGY
 PRODESIGNER IIS 512KB \$299 1MB \$339
 PRODESIGNER IIMC FOR PS/2 1MB \$399

ATI
 8514 ULTRA PS/2 OR ISA BUS 512KB \$469
 8514 ULTRA PLUS VGA W/1MB \$599
 VGA WONDER W/IMOUSE 512KB \$239
 VGA INTEGRA W/256KB \$129
 BASIC VGA 640 X 480 \$99

BOCA RESEARCH
 BOCA SUPER VGA 512K \$139 1MB \$179
 BOCA VGA 600 X 800 \$119

LAPTOPS

TOSHIBA LAPTOP
 T1200SE/XE, T1600, T3100E, T3100SX, T3200SX, T5100, T5200 2MB \$169
 T1000SE/XE/LE, T2000SX 2MB \$289
 T100LE, T2000SX 4MB \$699
 T3100SX, T3200SX 4MB \$467

MEGAHERTZ
 LAPTOP MODEMS TOSHIBA/COMPAQ/OTHERS
 2400BAUD \$149 W/IMP \$209
 2400 MODEM/9600 FAX FOR TOSHIBA \$407
 TOSHIBA LAPTOP ETHERNET ADAPTER \$290

SINGLE MEMORY

SIMM/SIPP MEMORY
 1X9-70NS \$59 256X9-70NS \$23
 1X9-80NS \$55 256X9-80NS \$19
 1X9-100NS \$53 256X9-100NS \$17
 4X9-80NS \$275 256X9-120NS \$15
 4X9-70NS \$295

DRAM MEMORY
 1MBX1-70NS \$5.70 256X1-100NS \$1.85
 1MBX1-80NS \$5.50 256X1-120NS \$1.60
 1MBX1-100NS \$5.25 256X1-150NS \$1.40
 256X4-80NS \$5.50 64X4-80NS \$3.00
 256X4-100NS \$5.25 64X4-100NS \$2.75
 256X4-120NS \$5.00 64X1-120NS \$1.50
 256X1-80NS \$2.05 64X1-150NS \$1.10

HOURS MON - FRI 7AM-5PM SAT 8AM-2PM

800 678-8648 5 YEAR WARRANTY ON PARTS 714 258-2818 FAX

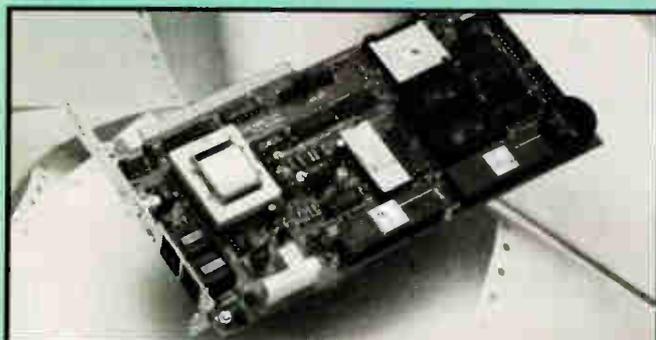
UNIVERSAL MEMORY PRODUCTS 15411 RED HILL AVENUE SUITE B TUSTIN, CA 92680 714 258-2018

NO SURCHARGE ON VISA/MASTERCARD, AMEX ADD 4% PURCHASE ORDERS ACCEPTED FROM QUALIFIED FIRMS 20% RESTOCKING FEE ON ALL NON-DEFECTIVE RETURNS PRICES SUBJECT TO CHANGE



Circle 318 on Inquiry Card (RESELLERS: 319).

SEPTEMBER 1991 • B Y T E 363



COMPUCOM

9,600-38,400 bps MODEM...\$169

NOW you can afford a **SPEEDMODEM™**. The **CHAMP™** has a raw speed of 300 - 9600 bps and 4:1 data compression for throughput up to 38,400 bps. Dynamic Impedance Stabilization™ provides robust performance on noisy telephone circuits. The **COMBO™** adds 9600 bps send/receive, full-featured **FAX with VOICE MAIL** upgrade...total communications capability—only \$279. Both come with a 30-day money back guarantee, 5-year warranty and made in USA. **BYTE** magazine said our 2400bps modem was "a real deal"....well we've done it again! See for yourself... *3/89p.102

408732-4500 **CALL NOW 800 228 6648** Fax 408732-4570

A TRULY ECONOMICAL 9-TRACK SUBSYSTEM DOESN'T JUST COME WITH A LOW PRICE.



To really be economical, a 9-track subsystem must be easy to use, durable, powerful, and reliable. It should:

- ✓ Require no controller card
- ✓ Be easily shared among multiple PCs at no additional cost
- ✓ Average **25,000 hours** without fail
- ✓ Have a full 1 MB cache buffer for unimpeded data transfer performance
- ✓ Come with powerful, easy-to-use software for interchange and backup
- ✓ Make mounting tapes a one-step process
- ✓ Be warranted for 2 years
- ✓ Come with toll-free customer support

Fortunately, there is such a subsystem: the TL3201, manufactured by Overland Data. Its low weight (32 lb) and **PC parallel port interface** make it easy to share among all kinds of PCs. And, like all of our value-packed subsystems, the TL3201 is backed by OSSP, the most comprehensive service and support system in the industry. All to keep your subsystem economical long after the purchase. Finding out more is economical too; the call is free.

1-800-PC9-TRAK

1-800-729-8725 • Bus. Phone: 1-419-571-5555 • FAX: 1-419-571-0982

OVERLAND DATA
San Diego, CA

PS/2 & AT DISKS

Novell Compsurfed Subsystems

Flawless Performance

Perisol's subsystems offer failsafe performance without stretching your budget. We support DOS, OS/2, Xenix, Unix, Netware 286 & 386 for both AT & PS/2s. No compatibility issues. No problems. It's that simple.

- ✓ Caching Controllers ✓ Disk Mirroring & Duplexing
- ✓ Torture-Tested Drives with 24-hour Burn-in
- ✓ Lifetime Toll-Free Tech Support

**Upgrade
Any PS/2
50/70/90
with 340 MB
SCSI II
Subsystem
\$1742**

Plug & Play Solutions from Perisol

Enhance Any
PS/2 With

**1GB
SCSI II
Drive**

We Back Our
5.25" Drives
for 5 Years!

System	Capacity	Access	Interface	Price
PS/2	110 MB	18 ms	SCSI	\$787
PS/2	149 MB	14 ms	ESDI	\$1269
PS/2	213 MB	15 ms	SCSI	\$1172
PS/2	320 MB	16 ms	ESDI	\$1736
PS/2	535 MB	12 ms	SCSI	\$2549
AT	120 MB	18 ms	IDE	\$495
AT	213 MB	15 ms	SCSI/IDE	\$926
AT	338 MB	16 ms	SCSI/ESDI	\$1443
AT	670 MB	16 ms	SCSI/ESDI	\$1897
AT	1020 MB	13 ms	SCSI	\$2677
AT	1500 MB	13 ms	SCSI	\$3337

Maxtor

□ Drive, Controller, Cables and Software included with Subsystems.



Call for Perisol's Complete Product Catalog

800-447-8226

Fax: 408-988-4431
International Tel: 408-988-2232

VOICE MASTER KEY® SYSTEM II VOICE RECOGNITION & SPEECH RESPONSE FOR IBM PC/XT/AT/386, PS/2, LAPTOPS, COMPATIBLES



FOR PRODUCTIVITY, PRESENTATIONS, SOFTWARE DESIGN, ENTERTAINMENT, LANGUAGE TRAINING, EDUCATION, MORE...

SPEECH/SOUND RECORDING AND PLAYBACK. Desktop Audio sound editing allows you to create custom sound applications. Variable sample rate (to 20 KHz) and compression levels. A four-voice music synthesizer is included also!

VOICE RECOGNITION TSR utility allows you to add voice command keyboard macros to your CAD, desktop publishing, word processing, spread sheet, or entertainment programs. Up to 64 voice commands in RAM at once—more from disk.

HARDWARE SYSTEM contains built-in speaker with separate volume and tone controls, external speaker and headphone jacks. Enclosure made of sturdy vinyl-clad steel. Attaches to parallel printer port without affecting normal printer operation (U.S. Patent 4,812,847). Headset microphone, printer cable, 9 volt AC adapter (110 volt UL/CSA listed), and comprehensive user manual included.

QUALITY THROUGHOUT. MADE IN USA. ONLY \$219.95

ORDER HOTLINE: (503) 342-1271 Mon-Fri, 8 AM to 5 PM PST

Visa/MasterCard, company checks, money orders, CODs (with prior approval) accepted. Personal checks subject to 3 week shipping delay. Specify computer type when ordering. Add \$5 shipping charge for delivery in USA and Canada. Foreign inquiries contact Covox for C&F/CIF quotes. OEM configurations available.

30 DAY MONEY BACK GUARANTEE IF NOT COMPLETELY SATISFIED.

CALL OR WRITE FOR FREE PRODUCT CATALOG



COVOX INC.
675 Conger Street
Eugene, Oregon 97402

TEL (503) 342-1271
FAX (503) 342-1283
BBS (503) 342-4135

We Dare The Competition To Beat Our Prices!

TOLL FREE 1-800-678-5913

★ LAPTOPS ★

TOSHIBA

Toshiba 1000SE	\$ 995
Toshiba 1000XE	\$1,240
Toshiba 1200XE 20/40	\$1,845/2,015
Toshiba 2000SX 20/40	\$2,650/2,925
Toshiba 3100SX 80	\$3,199
Toshiba 3100E 40	CALL
Toshiba 3200/3200SX	CALL
Toshiba 5200 40/100	CALL

NEC

UltraLite 286V-20MB/40MB	CALL
ProSpeed 286-40MB	\$3,099
286-100MB	\$3,110
386SX-40MB	\$2,895
386SX-100MB	\$3,410
386-40MB	\$3,399
386-100MB	\$3,945
386CSX Color: 40MB/100MB	CALL

ZENITH

Supersport 286E-20	CALL
Supersport 286E-40	CALL
386SX-40	CALL
386SX-100	CALL
All Other Models	CALL

30 Day Money Back Guarantee 1 Year Parts and Labor

★ LAPTOPS ★

PANASONIC

Panasonic CF-150	CALL
Panasonic CF-170	CALL
Panasonic CF-270	CALL

AST

Premium Exec 386SX 20MB	CALL
Premium Exec 286/12	CALL
All Other Models Available	CALL

TEXAS INSTRUMENTS

TM2000 Notebook 286/20MB VGA 3.5"/1.44MB Floppy	CALL
LT286 VGA: 20MB/40MB	CALL

★ LAPTOPS ★

EPSON

286E 20MB Removable	CALL
286E 40MB Removable	CALL
386SX 20MB Removable	CALL
386SX 40MB Removable	CALL
386SX Notebook	CALL

COMPAQ

Compaq LTE-20	\$1,799
Compaq LTE-286/20	CALL
Compaq LTE-286/40	CALL
Compaq SLT-286/20	CALL
Compaq SLT-286/40	CALL
All other models	CALL

★ LAPTOP MEMORY ★

T1000SE/XE .. 1MB	\$225	
T2000	2MB	\$225
T3100SX	2MB	\$125
All Toshiba/Compaq memory available		

★ LAPTOP PRINTERS ★

BJ10e	\$325
BJ300	\$440
BJ330	\$365

★ HARD DRIVES ★

SEAGATE

ST157A IDE 28ms 44MB 3.5"	\$225
ST1102A IDE 19ms 89MB 3.5"	\$325
ST1144A IDE 19ms 125MB 3.5"	\$425
ST1239A IDE 15ms 210MB 3.5"	\$725

CONNER

CP3024 IDE 27ms 21MB 3.5"	\$325
CP3000 IDE 25ms 42MB 3.5"	\$260
CP3184 IDE 25ms 84MB 3.5"	\$415
CP3104 IDE 25ms 104MB 3.5"	CALL

★ HARD DRIVE CARDS ★

IDE	CALL
ESDI	CALL
AT MFM 2:1 Controller	\$79
AT MFM 1:1 Controller	\$99
AT RLL 1:1 Controller	CALL

★ FLOPPY DISK DRIVES ★

TEAC

360K 5.25" HH Black	\$59
720K 3.5" HH w/5.25 Mount	\$64
1.2MB 5.25" HH Grey	\$69
1.44MB 3.5" HH Grey w/5.25" Mount	\$69

★ VIDEO CARDS ★

PC BRAND

Mono Graphics w/ Printer Port	\$ 30
Color Graphics w/ Printer Port	\$ 30
EGA (640x480) Autoswitch	\$ 85
VGA 16 Bit	\$149



★ 386SX 16/20 Mhz ★

- 1 Megabyte of Memory
 - 3.5" 1.44MB & 5.25" 1.2MB Floppy Drives
 - 80MB Hard Disk Drive
 - 16 bit VGA Video Card
 - 14" VGA Color Monitor
 - Clock/Calendar
 - 101 AT Keyboard
 - 2 Serial, 1 Parallel Port
- 386SX-16Mhz \$1,495**
- 386SX-20Mhz \$1,615**

★ HARDWARE ★

AT 12 Mhz (exp. 4 meg 0 wait)	\$108
XT 10 Mhz Turbo (exp. 0 wait)	\$69
Power Supply 200 Watt	\$50
Power Supply 150 Watt	\$40
XT Case (w/ hardware)	\$37
Baby AT Case (w/ hardware)	\$52
AT Case (Full Size)	\$54
Keyboard 101 Key (tactile touch)	\$50
Multi I/O Card	\$34
Floppy Controller Card	\$21
FHDC (1.44/1.2/720K/360K)	\$40
AT I/O	\$25

★ PRINTER SPECIALS ★

CITIZEN

120D/180D	CALL
GSX-140/200GX	CALL
HSP-500/550	CALL
GSX 145	CALL

HEWLETT-PACKARD

Laserjet IIIP	\$995
Laserjet Series III	CALL
Laserjet IIID	CALL
Laserjet IIP	CALL
Deskjet 500	CALL
Memory Prices	CALL

PANASONIC

KXP 1180 192cps, 80 col, 9-pin	\$164
KXP 1124 192cps, 24-pin	\$275
KXP 1624 192cps, 132col, 24-pin	CALL
KXP 1695 330cps, 132 col, 9-pin	CALL
KXP 4420 Laser, 8 page per minute	CALL

EPSON

LX810 180/30, 9-pin	\$175
LQ510 180/60, 24-pin	\$265
LQ1050 330/88, 9-pin	\$620
LQ2550 400/108, 24-pin	CALL

★ MONITORS ★

NEC

MultiSync 2A 14" (800x600) VGA	\$460
MultiSync GS 14" Mono	CALL
MultiSync 3D 14" (1024x768) EGA/VGA	\$580
MultiSync 4D 16" (1024x768) .28DP	CALL
MultiSync 5D 20" (2180x1024) .31DP	CALL



TERMS & CONDITIONS: VISA, MC, UPS, COD OR PREPAYMENT, CODs: Additional \$4.75 per shipping carton, cash or cashier's check. A.C.T. is now serving the continental U.S. and Europe. Prices and availability subject to change. Net 30. P.O.s accepted from local, state, and federal gov't agencies, all other net 30 requests are subject to approval.



American Computer Technology

**HOURS: Monday - Friday
7:30-5:00 (PST)
(714)534-5144 Fax (714)534-5803
12492 GALWAY #E,
GARDEN GROVE, CA 92466**

THE FASTEST 80486 & 80386/40 MHz 15 Mips, FASTER THAN EVEREX STEP & ALR

15 Mips! 1895 Qty 1



80486 40MHz AVAILABLE
NEW BABY SIZE

SYSTEM BOARD

MODEL	CACHE	MIPS	OK	4M
486/33	64K	15.2	1295	1495
486/25	64K	11.4	1195	1395
386/40	64K	9.8	695	895
386/33	64K	8.3	625	825
386/25	64K	6.2	525	725

*256K Cache Available

SUPER TOWER



\$335
Qty. 1

- 5 Half Ht. Drive Bay
- 2 Full Ht. Drive Bay
- 250 Watt UL/Power Supply
- Dual Fans
- Double Security Lock
- Wheels / Caster
- Front Display Panel
- Excellence For UNIX & NOVELL Server
- UPS Optional

TECHNOLOGY POWER ENT., INC.

FEATURES

- 64256K Write Back Cache
- Burst Mode Design
- Shadow Ram on Video & Bios
- 64MB 32 Bit Memory Expansion
- Baby size with Eight Expansion Slot
- Unix, OS/2 & Novell 100% Compatible
- One Year Full Warranty
- Made in USA

Complete Desktop System with
1.2 MB Floppy, HD/Floppy Controller,
101 Keyboard and 4MB Memory.

MODEL	BASE	MONO	VGA
486/33	1895	2070	2345
486/25	1795	1970	2245
386/40	1295	1470	1745
386/33	1225	1400	1675
386/25	1125	1300	1575

*FCC, UL & CSA Approval
*Tower Add \$200 & Hard Disk Available

MONITOR

VGA	315.00
MULTISCAN	415.00
SUPER VGA	345.00

UNIVERSAL 3 1/2-5 1/4 KIT

FLOPPY	5.00
HARD DISK	5.00

MATH-CO	INTEL	MATHCO
80387-25	199	159.00
80387-33	205	165.00
80387-40		215.00

DRAM

4M x 9 - 80	300.00
1M x 9 - 80	59.00
1M x 9 - 70	69.00

HARD DRIVE

QUANTUM IDE 52MB	215.00
QUANTUM IDE 105MB	339.00
MAXTOR IDE 200MB	699.00

47273 Fremont Blvd., Fremont, CA 94539
Tel: 415-623-3818 Fax: 415-623-3840

Don't Move! without telling BYTE

Clip out form below
and mail to:

BYTE Magazine
P.O. Box 555
Hightstown, NJ 08520

At least 8 weeks before you move, please give us your
new address and/or name change

(Please Print)

New address, name _____
Name _____
Address _____ Apt. _____
City _____
State _____ Zip _____

Print current name and address
(or affix the mailing label from your current issue of BYTE here)

Current address, name _____
Name _____
Address _____ Apt. _____
City _____
State _____ Zip _____

AMT INTERNATIONAL

(408) 432-0552 • (408) 432-1790

LOWEST PRICES
SAME DAY SHIPPING
Fax: (408) 944-9801

COMPAQ MEMORY

DeskPro 286-E, 386-20/20E/25

1MB	113131-001	\$125.00
4MB	113132-001	\$330.00

DeskPro 286N, 386N and 386SX

2MB	118689-001	\$200.00
4MB	118690-001	\$545.00

DeskPro 386S

1MB	113646-001	\$125.00
4MB	112534-001	\$315.00

DeskPro 386-33, 486-33 & SystemPro

2MB	115144-001	\$200.00
-----	------------	----------

AST MEMORY

Bravo-286, Workstation

512K KR500510-010	\$59.00
2MB KR 500510-002	\$150.00

Premium 386-16/20C

1MB KR 500510-007	\$95.00
4MB KR 500510-008	\$275.00

Premium 386-20

1MB KR 500510-003	\$150.00
4MB KR 500510-004	\$350.00

Bravo-386SX

4MB KR 500510-008	\$369.00
-------------------	----------

Premium 386-SX/25/33 & 486-25

1MB	500718-002	\$80.00
-----	------------	---------

HEWLETT-PACKARD MEMORY

Vectra QS/16S

1MB	D1540A	\$112.00
4MB	D1542A	\$325.00

Vectra QS/20PC, RS/25PC and 20C

1MB	D1640A	\$126.00
4MB	D1642A	\$365.00

Vectra 486PC

1MB	D2150A	\$115.00
4MB	D2151A	\$390.00

IBM PS/2 MEMORY

Models 30-286, Exp. Board 1497259

512 K Kit	30F5348	\$54.00
2MB Kit	30F5360	\$175.00

Models 70-E61/121, 55SX, 65SX

1MB	6450603	\$95.00
-----	---------	---------

Models 70-E61/121, 50Z, 55SX, 65SX

2MB	6450604	\$179.00
-----	---------	----------

Models 55SX, 65SX, 34F3077 & 34F3011

4MB	34F2933	\$370.00
-----	---------	----------

Models 70-A21

2MB	6450608	\$150.00
-----	---------	----------

Models 80-141

1MB	6450375	\$145.00
-----	---------	----------

Models 80-111/311

2MB	6450379	\$220.00
-----	---------	----------

All Models 70 and 80

2-8MB w/2M	6450605	\$489.00
2-14MB w/2M	34F3077	\$500.00
2-16MB w/4M	34F3077	\$925.00

Models 50, 50Z, 55 SX & 60

2-8MB	1497259	\$599.00
-------	---------	----------

LASER PRINTER MEMORY

Hewlett-Packard Laser Jet IIP, III & IIID	1MB	33474B	\$110.00
-------------------------------------------	-----	--------	----------

2MB 33475B \$150.00

4MB	33477B	\$215.00
-----	--------	----------

Hewlett-Packard Laser Jet IIP & IID

1MB	33443B	\$110.00
2MB	33444B	\$150.00
4MB	33445B	\$215.00

IBM Laser 4019 and 4019e

2MB	1039137	\$369.00
3.5MB	1038675	\$469.00

Canon LBP-III, IIIr, IIII

2MB	S63-1880	\$225.00
4MB	Part #N/A	\$439.00

LAPTOP AND PORTABLE MEMORY

TOSHIBA MEMORY

1MB	Model 1000SE/XE	\$265.00
2MB	Model 1000SE/XE	\$325.00
2MB	Model T1200XE	\$230.00
2MB	Model T1600	\$230.00
2MB	Model T3100E	\$175.00
2MB	Model T3100SX	\$175.00
4MB	Model T3100SX	\$395.00
2MB	Model T3200SX	\$175.00
4MB	Model T3200SX	\$395.00
2MB	Model 5100	\$215.00
2MB	Model T5200, T8400	\$185.00
8MB	Model T5200, T8400	\$950.00

ZENITH MEMORY

1MB	SuperSport 286 & 286E	\$199.00
2MB	SuperSport 286 & 286E	\$350.00
2MB	SuperSport SX/Alpha	\$350.00
4MB	SuperSport SX/Beta	\$350.00

COMPAQ MEMORY

1MB	Portable LTE 286	\$175.00
2MB	Portable LTE 286	\$225.00
1MB	SLT-286	\$225.00
4MB	SLT-286	\$775.00

NEC MEMORY

1MB	Prospect 286	\$270.00
2MB	Prospect 386	\$450.00

ZENITH MEMORY

Zenith Z-386/20/25/33 & 33E

1MB	ZA36-3800ME	\$100.00
4MB	ZA3800MK	\$525.00

Zenith Z-386/20/25 & 33

2MB	ZA3600MG	\$199.00
-----	----------	----------

Zenith Z-386 SX

2MB	Z-605-1	\$225.00
-----	---------	----------

MATH COPROCESSORS

INTEL

8087-5MHz	\$80.00
8087-2 8MHz	\$116.00
8087-1 10MHz	\$155.00
80287-6 6MHz	\$89.00
80287-8 8MHz	\$89.00
80287XL 8/10MHz	\$99.00
80287XTL 12 MHz (Laptop)	\$105.00
80287-10 10MHz	\$89.00
80C287-12 12MHz	\$109.00
80387SX-16	\$135.00
80387SX-20	\$145.00
80387DX-20	\$215.00
80387DX-25	\$225.00

80387DX-33 \$235.00

3167-20 20MHz	\$300.00
3167-25 25MHz	\$450.00
3167-33 33MHz	\$500.00
4167-25MHz	\$600.00
4167-33MHz	\$750.00

WEITEK

83087-16 16MHz	\$175.00
83087-20 20MHz	\$175.00
83087-25 25MHz	\$175.00
83087-33 33MHz	\$185.00
83SX87-16 16MHz	\$120.00
83SX87-20 20MHz	\$125.00

CYRIX

8C87-8	\$69.00
8C287-10	\$79.00
8C287-12	\$89.00
8C287-20	\$99.00
8C387-20	\$175.00
8C387-25	\$175.00
8C387-33	\$200.00

IIT

80C287-10	\$89.00
80C287-12	\$110.00

AMD

80C287-10	\$89.00
80C287-12	\$110.00

SIMM MODULES

IBM TYPE

Add \$2.00 for Supps

4Mx9-80	\$190.00
1Mx9-60	60.00
1Mx9-10	45.00
1Mx9-30	49.00
1Mx9-70	51.00
256x9-70	18.00
256x9-10	14.00
256x9-60	16.00
256x9-80	18.00

APPLE-MAC

1Mx8-70	\$50.00
1Mx8-10	\$40.00
1Mx8-80	\$45.00
4x8-80	\$190.00

DRAM - DRAM - DRAM

DRAM 1MGX1	DRAM 64X1	DRAM 64X4	DRAM 256X4
------------	-----------	-----------	------------

The savings begin here!



Make the call!
800-950-4487

12 MHz 80286

- 640K RAM
- 1.2 Mb Floppy
- 40 Mb Drive
- VGA Card
- 14" VGA Monitor
- Parallel + Serial Ports
- 101 Key Keyboard
- Battery Backed Clock

\$999.00

MONTHLY SPECIALS:

- ★ Hewlett Packard IIIp **\$ 989**
- ★ DOS 5.0 **Call**
- ★ Wordperfect 5.1 **Best Price**
- ★ Teac 1.44 Floppy Drive **\$64**
- ★ Genius Serial Mouse **\$21**
- ★ MS Windows **Call**
- ★ 101-key Keyboard **\$49**
- ★ VGA Monitor/Card **\$299**

16 MHz 386SX

- 1 Mb RAM
- 1.2 Mb Floppy
- 40 Mb Drive
- VGA Card
- 14" VGA Monitor
- Parallel + Serial Ports
- 101 Key Keyboard
- Battery Backed Clock

\$1,385.00

20 MHz 386SX

- 2 Mb RAM
- 1.2 Mb 5-1/4" Floppy
- 1.44 Mb 3-1/2" Floppy
- 125 Mb Drive 19 MS
- 16-Bit VGA Card with 512Kb
- 14" 1024 x 768 Color VGA Monitor
- 1 Parallel + 2 Serial Ports, 1 Game
- 101 Key Keyboard
- Battery Backed Clock
- MS DOS 4.01 + GW-Basic
- 3 Button Mouse

\$1,599.00

25 MHz 386

- 4 Mb RAM
- 1.2 Mb 5-1/4" Floppy
- 1.44 Mb 3-1/2" Floppy
- 125 Mb Drive 19 MS
- 16 Bit VGA Card with 512Kb
- 14" 1024 x 768 Color VGA Monitor .28 DP
- 1 Parallel + 2 Serial Ports, 1 Game
- 101 Key Keyboard
- Battery Backed Clock
- MS DOS 4.01 + GW-Basic
- 3 Button Mouse

\$1,885.00

33 MHz 386

- 64Kb Cache
- 4 Mb RAM
- 1.2 Mb 5-1/4" Floppy
- 1.44 Mb 3-1/2" Floppy
- 125 Mb Drive 19 MS
- 16 Bit VGA Card with 512Kb
- 14" 1024 x 768 Color VGA Monitor .28 DP
- 1 Parallel + 2 Serial Ports, 1 Game
- 101 Key Keyboard
- Battery Backed Clock
- MS DOS 4.01 + GW-Basic
- 3 Button Mouse

\$1,935.00

DISK CONTROLLERS

2 Hard/2 Floppy IDE	\$ 29
2 Hard/4 Floppy IDE	39
2 Hard/2 Floppy w/ 1 Parallel, 2 Serial and 1 Game	45
XT/AT High Density Floppy Controller Up to 4 Hi-Density Floppies!	32
XT/AT High Density Floppy Controller Up to 2 Hi-Density Floppies!	28

MULTI I/O

AT Card 2 Serial, 1 Parallel, 1 Game ...	\$ 21
XT Card 1 Serial, 1 Parallel, 1 Game, Clock, Calendar, and Battery	28
XT Plus 1 Serial Port, 1 Parallel Port, 1 Game Port, Clock, Calendar, w/ Battery, Built in High Density FDC does 2 Floppies (Any Combo)	32
Modem External 2400 Baud	78

HARD DISKS

Seagate

157A 45MB IDE 28ms	\$ 180
1102A 84MB IDE 19ms	280
1144A 125MB IDE 19ms	375
1239A 210MB IDE 15ms	675
Other models	Call

Conner

CP3044 42MB IDE 25ms	\$ 280
CP3184 80MB IDE 25ms	360
CP3104 100MB IDE 25ms	380
CP3204 200MB IDE 19ms	635

MONITORS

Sony (Color VGA Trinitron)

1320 .25mm VGA only	\$ 467
1302 .25mm 900x560 Multiscan	550
1304 .25mm 1024 x 768 w/VGA cable	695
GVM 1300 13" Multisync/Multiscan	Call
GVM 2000 20" Multisync/scan	Call

NEC

2A 14" 800x600 MultiSync	\$ 450
3D 14" 1024x768 MultiSync	580
3Ds Low Radiation	590
4D 16" 1024x768 .28mm	Call
5D 20" 1280x1024 .31mm	Call

PRINTERS

Panasonic

1124/1180	\$ 264/170
1123/1654	239/Call
1624/1695	380/415
4420	820
4450/4155	1195/Call

Hewlett-Packard

Laser Series III/Laser III D	Call
★ Laser HP/III	Call
Desk Jet 500	\$ 510

Pacific Data

1MB/2MB	\$ 130/180
25-N-1	285

CHIPS

Intel

80287-10	Call
80386-SX16	Call
80387-20	Call
80387-25	Call
80387-33	Call

VIDEO CARDS

16-Bit VGA 1024 x 768	
1 MB RAM, 256 Color	
Trident Chip Set	\$ 135

LAPTOPS

Toshiba

1000SE	Call
1000XL	Call
1200XE	Call
2000SX 20MB/40MB	Call
3100SX	Call
3100E 20MB/40MB	Call
3200SX	Call
6800 40MB/100MB	Call

Toshiba Memory Low, low prices

FLOPPY DRIVES

Teac

1.44MB 3.5"	\$ 69
1.2MB 5.25"	69
720KB 3.5"	58
360K	58

MOTHERBOARDS

12 MHz 286	\$ 65
16 MHz 286	75
16 MHz 386SX	Call
25 MHz 386 w/o CPU	Call
25 MHz 386 w/ Cache	Call
33 MHz 386 w/ Cache	Call

Corporate P.O.s welcomed. All packages shipped UPS and FedEx. COD add \$3.95. Mastercard and VISA accepted. All returns must have R.M.A.s. Price/terms/conditions subject to change without notice.

CALL NOW!
800-950-4487

3937 S. Sepulveda Blvd
Culver City, CA 90230
Store Hours 8:00 - 5:00PM
(213) 572-4471 Fax
(213) 390-2380



Desktop Super VGA Color System

- PCI 386SX-20MHz **\$1,595**
- PCI 386-25MHz **\$1,695**
- 2MB RAM • 85MB IDE HD (19ms)
- 1.2 & 1.44MB FD • 16 bit Super VGA Card with 1MB RAM
- 14" Super VGA Color Monitor
- 2 Serial, parallel and game ports • 101-key keyboard
- Case & power supply • DOS 4.01 or 3.3
- Windows 3.0 with mouse • 30 days money back guarantee
- PCI 386-33 **\$2,095**
- same as above configuration • 64K Cache memory
- 4MB RAM • 120MB HD
- PCI 486-25 **\$3,095**
- PCI 486-33 **\$3,395**
- same as above configuration • 256K Cache memory
- 200 MB IDE HD (14.5MS) • 4MB RAM

Notebook 386sx .. \$2,095

- 2MB RAM • 1.44MB FD
 - 40MB HD • Serial or parallel
 - Built-in mouse & scanner ports
 - Ext. keyboard port
 - Ext. monitor port
 - Carrying Case
- Fortune 1000 companies,
Universities and
Governments purchase
orders welcome.
- All systems come with 2
years labor + 1 year
parts warranty.
Free lifetime toll free
technical support.

LCD VGA Portable

- 386SX-20MHz **\$1,595**
- 386-25MHz **\$1,795**
- 386-33MHz **\$1,945**
- 1MB RAM • 1.2MB & 1.44MB FD
- 42MB hard disk
- LCD 640x480 screen
- LCD VGA display
- Serial and parallel
- 86 key detachable keyboard
- 200W power supply
- 9.1" (H) x 7.5" (D) x 16.1" (W)
- 486-25 MHz **\$2,995**
- 486-33 MHz **\$3,295**
- 256K Cache Memory
- 4MB RAM
- 200 MB IDE HD (14.5MS)

Plasma VGA Portable

- 386SX-20MHz **\$1,795**
- 386-25MHz **\$1,995**
- 386-33MHz **\$2,145**
- 1MB RAM • 1.2MB & 1.44MB FD
- 42MB hard disk
- Plasma VGA 640x480 screen
- Plasma VGA card
- Serial and Parallel
- 86 key detachable keyboard
- 200W power supply
- 9.1" (H) x 7.5" (D) x 16.1" (W)
- 486-25 MHz **\$3,195**
- 486-33 MHz **\$3,495**
- 256K Cache Memory
- 4MB RAM
- 200 MB IDE HD (14.5MS)

OFFICE HOURS: MON-SAT 8:30AM-5:30PM PST

Price Subject To Change Without Notice

PACIFIC COMPUTERS



9945 LOWER AZUSA, TEMPLE CITY, CA. 91780
TOLL FREE 800/346-7207 • FAX: 818/442-9112

BYTE BACK ISSUES FOR SALE

	1990	1991
January	<input type="checkbox"/>	<input type="checkbox"/>
February	<input type="checkbox"/>	<input type="checkbox"/>
March	<input type="checkbox"/>	<input type="checkbox"/>
April	<input type="checkbox"/>	<input type="checkbox"/>
May	<input type="checkbox"/>	<input type="checkbox"/>
June	<input type="checkbox"/>	<input type="checkbox"/>
July	<input type="checkbox"/>	<input type="checkbox"/>
August	<input type="checkbox"/>	<input type="checkbox"/>
September	<input type="checkbox"/>	<input type="checkbox"/>
October	<input type="checkbox"/>	<input type="checkbox"/>
November	<input type="checkbox"/>	<input type="checkbox"/>
December	<input type="checkbox"/>	<input type="checkbox"/>
Inside the IBM PCs	<input type="checkbox"/>	<input type="checkbox"/>

Issues Available

1990-'91 BYTE Issues \$6.00*

The above prices include postage in the US. *Please add \$.50 per copy for Canada and Mexico; and \$2.00 per copy to foreign countries (surface delivery). European customers please refer to Back Issue order form in International Advertising section of book.

Please indicate which issues you would like by checking (✓) the boxes. Send requests with payment to:

BYTE Back Issues, One Phoenix Mill Lane, Peterborough, NH 03458
(603) 924-9281

Check enclosed Charge: VISA MasterCard

Card # _____

Exp. Date _____

Signature _____

Name _____

Address _____

City _____

State _____ Zip _____

All orders must be prepaid. Please allow four weeks for delivery.

CO AUTHORITATIVE*

*you can take advantage of the knowledge and insights from the world's leading computer hardware and software experts . . .

YES! I want BYTE for:

- 1 year for \$24.95 (12 issues plus Bonus Annual)
- 2 years for \$44.95 (24 issues plus 2 Bonus Annuals)
- Payment enclosed Bill me

SAVE UP TO

46%

off the newsstand cost!

BYTE

Plus-
Get the
BYTE Annual
Special Issue
FREE!

with BYTE, you maximize the productivity of the products you already have, and . . .

Name _____ Title _____

Company _____

Address _____

City/State/Zip _____

Your satisfaction is **GUARANTEED!**
If you are dissatisfied, cancel anytime for a refund on all unmailed issues.

Single copy \$3.50. The basic annual subscription rate is \$29.95.
Mexican subscribers: One year rate US\$29.95, two year rate US\$56.95.
Your subscription will start in 6-8 weeks.

IB19049

YES! I want BYTE for:

- 1 year for \$24.95 (12 issues plus Bonus Annual)
- 2 years for \$44.95 (24 issues plus 2 Bonus Annuals)
- Payment enclosed Bill me

SAVE UP TO

46%

off the newsstand cost!

BYTE

Plus-
Get the
BYTE Annual
Special Issue
FREE!

get the information you need to make smart decisions for the future.

Name _____ Title _____

Company _____

Address _____

City/State/Zip _____

Your satisfaction is **GUARANTEED!**
If you are dissatisfied, cancel anytime for a refund on all unmailed issues.

Single copy \$3.50. The basic annual subscription rate is \$29.95.
Mexican subscribers: One year rate US\$29.95, two year rate US\$56.95.
Your subscription will start in 6-8 weeks.

IB19049

WEFTB

BYTE IS

* you get in-depth coverage of the systems, products, and trends of today - and what you can expect from the products of tomorrow.

COMPREHENSIVE



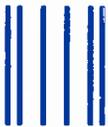
NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 42 HIGHTSTOWN, NJ

POSTAGE WILL BE PAID BY ADDRESSEE:

BYTE

Subscription Department
P.O. Box 558
Hightstown, N.J. 08520-9409



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 42 HIGHTSTOWN, NJ

POSTAGE WILL BE PAID BY ADDRESSEE:

BYTE

Subscription Department
P.O. Box 558
Hightstown, N.J. 08520-9409



Lowest Prices!
Large Selection!
Fast Service!

COMPUTER SPECTRUM

Call our toll-free order line:
1-800-388-8550

We offer the lowest LaserJet prices in the industry!
Free 6' cable with every LaserJet order.

HEWLETT-PACKARD

LaserJet Blowout!

LaserJet IIISI	.....Call
LaserJet IIIP	.....\$ 959
LaserJet IIP	.....Call
LaserJet III	.....1,510
LaserJet IIID	.....Call
DeskJet 500	.....490
ScanJet	.....Call
ScanJet +	.....1,400
PaintJet XL	.....1,595
LaserJet Toner	.....75
Lower Cassette Tray	.....250
1MEG Upgrade	.....108
2 MEG Upgrade	.....195
4 MEG Upgrade	.....245

PACIFIC DATA

Laser Accessories

Pacific Data 1 Mb/2MB	.....\$ 120/170
Pacific Data 25-N-1	.....275
Pacific Bar Code	.....326
Pacific Outlines	.....199
Pacific Page PE	.....Call
Pacific Page XL	.....745
Pacific Type	.....259
Plotter in a Cartridge	.....245
Headlines in a Cartridge	.....215
Pacific Print	.....219
Pacific Connect 256K	.....259
Complete Font Library	.....259
Super Set Plus 425	.....Call

OKIDATA PRINTERS

ML390	.....\$ 435
ML391	.....615
ML393	.....919
ML320	.....310
ML321	.....425
ML380	.....279
OLC 400	.....Call
OLC 800	.....Call
OLC 820	.....Call

PANASONIC

1123	.....\$ 225
1124I	.....254
1180	.....149
1191	.....205
1624	.....368
1654	.....Call
1695	.....405
4420	.....810
4450I	.....1175
4455	.....Call

EPSON PRINTERS

LX810	.....\$ 165
FX850	.....279
FX1050	.....388
LQ200	.....Call
LQ510	.....249
LQ850	.....430
LQ860	.....539
LQ1010	.....370
LQ1050	.....589
LQ2550	.....865
EPL7000	.....Call
EPL7000	.....Call

CITIZEN

Prices Too Low List!

GSX140	GSX145
GSX200	HSP500

I/O CARD

XT I/C 1S, 1P, 1G, FDC, CLK	.....\$ 24
2S, 1P, 1G XT M/10	.....28
720K/1.2MB/1.44 MB FOC	.....30

HARD DISK CONTROLLER

XT-GEN MFM HDC	.....\$ 47
XT-27X RLL HDC	.....47
AT-(1:1) MFM HDC	.....49

HARD DRIVES

Seagate Hard Disks

ST157A IDE 40 MB 25ms	.....\$ 205
ST1102A IDE 89 MB 19ms	.....310
ST1144 IDE 125 MB 20ms	.....405
ST1239A IDE 210 MB 15ms	.....689
ST251-1 MFM 40 MB 28ms	.....225

CP3000 IDE 42MB 25ms 3-1/2 ...	\$ 235
CP3184 IDE 84MB 25ms 3-1/2	.....405
CP3104 IDE 104MB 19ms 3-1/2	.....399
CP3204 IDE 209MB 19ms 3-1/2	.....675

FLOPPY DRIVES

Teac

1.2MB	.....\$ 65
1.44MB	.....65
720KB	.....59
360KB	.....59

VIDEO CARDS

VGA 16-bit 1MB 1024x768	.....\$ 128
VGA 16-bit 512KB 1024x768	.....75
VGA 16-bit 256KB 1024x768	.....70
Color Graphic Card w/ PP	.....25
Monochrome Graphic Card w/ PP	.....25

MONITORS

Nec

Multisync 2A	.....\$ 460
Multisync 3D	.....575
Multisync 4D	.....980
Multisync 5D	.....Call

Samsung

14" VGA SyncMaster 4 .28	.....\$ 810
14" VGA SyncMaster 2 .28	.....370
14" VGA Multi-Sync 800x600 .31	.....335
14" VGA 640x480 .31	.....285
12" Monochrome Monitor	.....75

TERMS: VISA, MC accepted.
COD add \$3.75. P.O.s must be
mailed in. All products shipped
via UPS/Federal Express/DHL.
Overseas orders welcome. No
surcharge on VISA/MC.

Circle 71 on Inquiry Card.

ORDER TODAY

1-800-388-8550

Computer Spectrum
201 Pacific Coast Hwy.
Wilmington, CA 90744
(213) 518-2321
FAX (213) 518-3123



PS/2 model 55SX-60 meg	2595
PS/2 model 70-60 meg	3195
PS/2 model 65SX-60 meg	3325
PS/2 model 70-A21	4725
PS/2 model 95-320 meg	14950
*** Monitor Extra ***	



DeskPro Models

286E-40/120 meg	1775/1895
386S-20 MHz 120 meg	2375
386/20E-120 meg	2795
386/25E-120 meg	4085
386/33L-320 meg	7885
*Call for other models - Monitor Extra *	

NOVELL SPECIALS

Netware Version 2.2	
5 users	595
10 users	1395
50 users	CALL
100 users	CALL
Netware 386 V.3.11	
20 users	2195
100 users	CALL
250 users	CALL

WE STOCK AST

CITIZEN
OKIDATA
EPSON

HITACHI
TALLGRASS
ARCHIVE

NEC
ALR
WYSE

HOUSTON INSTRUMENTS
MICROSOFT
SUMMAGRAPHIC

INTEL
PC MOUSE
CALCOMP

HARD DISKS

CONNER	
CP3044 40 meg	Call
CP3104 100 meg	Call
CP30104 120 meg	Call
CP3204F 220 meg	Call

MAXTOR	
XT8760E 676 meg	1895
XT8760S 676 meg	2150

Call for Optical and
W.O.R.M. Drives

Call for other brands

SOFTWARE SPECIAL

dBase IV	455
Wordperfect 5.1	260
Aldus Pagemaker	495
Ventura Publisher	525
Clipper	535
WordStar 6.0	190
EasyExtra	40

PACIFIC DATA PRODUCTS

P. Page II	345
P. Page IIP	355
P. 1-2-4 Mem II	140
P. One Meg IIP	145
P. 25 in One	250
P. Headlines	245



**NOVELL
Authorized
Dealer**

LAN BOARDS

8 bit Arcnet	110
16 bit Arcnet	220
8 bit Ethernet	190
16 bit Ethernet	275
8 port Active Hub	325
Token Ring Card	399
Tokenhub 4-port	355
Call for other LAN Accessories	

SPECIALS

HP Scan Jet+	1325
Hp Paint Jet	965
Lotus Ver. 3.1	365
Kodak 150P	345
Canon BJ 10	345
Intel Satisfaction	425
Okidata 391	615
Epson LQ 1050	625
HP-7475 Plotter	1495
IBM Token-Ring	655
Panasonic 1124	299
Intel 80387-33	205

LASER PRINTERS

HP Laser IID	2550
HP Laser 3P	1025
HP Laser III	1575
Panasonic 4450	1395
NEC 2 Model 90	1695
NEC 2 Model 290	2675
TI PS17	1595

VGA BOARDS

BOCA Super VGA 1 meg	210
Paradise	CALL
Vega VGA	CALL
AT Wonder	CALL
Other VGA Video boards available	

Corporate Accounts
Welcome
**Call for Volume
Discounts**
Consultants Call
for Pricing
**Exports
Available**

Computerlane inc.

Outside California: 1-800-526-3482

Inside California: 818-884-8644 • FAX: 818-884-8253

22107 Roscoe Blvd., Canoga Park, CA 91304 • 1/2 Block west of Topanga

Hours: Monday - Friday 9 - 6

Compaq is a Registered Trademark of Compaq. IBM is a Registered Trademark of International Business Machines.

LOW PRICES SINCE 1983

International Orders

**We Honor Manufacturer's
Warranties**

Call for details

LAPTOP

Texas Instruments TM2000	1995
Texas Instruments TM3000	2995
Compaq LTE/286-40 meg	2750
Compaq LTE/386-60 meg	4995
Sharp 6220-20 meg	1995

CALL FOR OTHER BRANDS

LAPTOP MEMORY

2 meg Toshiba 3100SX	160
2 meg Toshiba 5200	165
2 meg Toshiba 3200SX	165
1 meg Compaq SLT/LTE	180



MEGACUBE ISA BUS

486-33 System	
8 meg 128K Cache ESDI	
16 meg 128K Cache ESDI	CALL

Step 386-20 MHz System

1 meg RAM, 64K Cache, 1.2 & 40 meg Drive, 640x480 VGA Combo	CALL
----------------------------------------------------------------------	------

Step 386-25 MHz System

1 meg RAM, 64K Cache, 1.2 & 40 meg Drive, 640x480 VGA Combo	CALL
----------------------------------------------------------------------	------

Step 386-33 MHz System

2 meg RAM, 64K Cache, 1.2 & 150 meg Drive 1024x768 VGA Combo	CALL
-----------------------------------------------------------------------	------

TOSHIBA

T1200 XE 40 meg	call
T2000 SX 40 meg HDD	call
T3200 SXC	call
T5200C	call

Call for all models and pricing

INTEL COPROCESSORS

80387 XL	\$99.00	80387-20	\$205.00
80387 SX-16	\$135.00	80387-25	\$205.00
80387 SX-20	\$149.00	80387-33	\$205.00
80387-16	\$205.00		

DEVELOPERS' TOOLS

The Total Solution Programmer.
The best-selling Programmer since 1985
Appreciated by over 50,000 users worldwide

TUP-300
Universal Programmer
& Tester (PC based)
from \$695.00



- 40-Pin ZIF socket can be expanded up to 68 Pin for 8 to 68 Pins DIP or PLCC chips
- Programs 20 to 68 Pin PLO (PAL, CPAL, FL, GAL, PEEL, EPLO, EEPLO), EPROM up to 16 Mbit, EEPROM, Serial PROM, Special PROM, Bipolar: PROM & MPU (8741/42/48/49, 8051/51FA, FB, FC/521/541/252/751/752/52/451, 8796/97, 68705, 286E11/21, TMS7742, TMS77C82, 8755A, ...)
- Tests TTL (74/54), CMOS (40/45), SRAM, DRAM, SDRAM and SIM DRAM
- Full screen edit, HEX to OBJ, 2 way or 4 way Binary File Splitter and Shuffler, 6 MPU Disassemblers
- 34 various adapters (4 sockets, ROM-RAM, PLCC, ...) from \$95.
- Other high quality programmer cards at low cost available from \$119.
- UV Eraser (UV-32) for 32 pcs at \$95.
- Call us today for complete product line
- 1 year warranty, 30 days money back guarantee
- 1 year free software updates and Customer Support

TRIBAL MICROSYSTEMS

Tel: (415)623-8859 Fax: (415)623-9925
44388 S. Grimmer Blvd. Fremont CA 94538

Circle 308 on Inquiry Card
(RESELLERS: 309).

DOS IN ROM!

ALWAYS WAITING
FOR A PROMPT?
SPEED UP WITH
MVS ROM DRIVE!
-BOOT 0.1 SEC
-1/2 SIZE CARD
-ANY PGMS, ODS
-LANS, CONTROL
64K... \$95
360K... 200
1.44M... 300
M V S
(508) 792 9507



8088 SINGLE BOARD COMPUTER

PC ON A CARD!
1. DEBUG ON PC
2. TEST SBC RAM
3. BURN EPROM
-BATTERY, SOLAR
-5YR WARRANTY
-52 PIN PC BUS
-2PAR, 3SER, RTC
-LCD/KBO PORTS
MVSBC1... \$95
MVBIO5... 60
PC CABLE... 50
PC CARD... 85



Circle 184 on Inquiry Card.

Complete VOICE MAIL TURNKEY SYSTEMS!

We Have The Competitive Edge
**BEST BUY! BEST VALUE!
BEST INVESTMENT!**
THE BEST PRICED BEST QUALITY
VOICE MAIL SYSTEM IN THE
INDUSTRY TODAY.

As Low as
\$2349.00
(2 lines easily expanded to 16 lines)

FOR SALES AND INFO:
415 655-6953

OR WRITE:

UNVOICE TECHNOLOGY
43 MONTE VISTA, STE: 2
OAKLAND, CA 94611

Circle 361 on Inquiry Card.

DEVELOPER'S TOOLS

NICE-51 satisfies you, who expects excellent functions, attractive price and easy to use. What a surprise, now you have it!

**8051 IN-CIRCUIT
EMULATOR NICE-51**
PC BASED FROM \$950



- Up to 12 MHz Real-Time without intruding Interrupt, Serial Channel, I/O or Code Space
- Built-in programmer for EPROM & 8751
- Handles Binary, Hex, & Symbol file and down-loads data to external RAM
- With full screen editor, SPF, Code, External data, Internal data and Bit address can be directly viewed and edited
- Complete menu-driven software without any tedious commands
- 16 K trace buffer, 48 Bit wide with ADDR, DATA, P1, P3 and status signals
- 64 K H/W breakpoint
- Extra 10 function keys operate routine tasks
- Call us today for complete product line
- Immediate technical support upon your phone call
- 1-year warranty and 30 days money-back guarantee

TRIBAL MICROSYSTEMS

Tel: (415) 623-8859 Fax: (415) 623-9925
44388 S. Grimmer Blvd. Fremont CA 94538

Circle 310 on Inquiry Card
(RESELLERS: 311).

Intelligent Universal Programmer & IC Tester
Full Software Support
Window screen, PIN OUT diagram, PAL fuse map,
IC pin error indication

DEVICES APPLICABLE:

EPROM series: 2716-27512.
1M, 2M, 4M (8M); EEPROM series: 2804-28256; EPROM series: 29C256; MCS-48 series: 8741, 8742, 8748, 8749, 8750, 8755; MCS-51 series: 8744, 8751, 87C52, 8753H, 87C252, 87C541; Z8 series: Z86E11, Z86E21; PLD series: EPLO, PAL, GAL, PEEL, CPL, MMI (A, B, C type); AMD, NS, Cypress, Samsung, Signetic, TI, SGS, VLSI etc.; SERIAL series: 93C06-93C66, 93C506-93C566; BPRDM series: AMD, MMI, NS, TI, Signetic, Cypress; High Speed EPROM series: Atmel, Cypress; TTL, 54/74 series: 7400, 7401, etc.; CMOS 40/45 series: 4000, 4500, etc.; DRIVER series: 2003, 2004, 75, etc.; OPTO series: PC817, PC17TL etc.; SRAM series: 6116-2256; DRAM series: 4164-41000



— Programming Adaptors available —
— New Devices supported through disk update —
— One-year warranty — \$45 —

KUSTEM DATA SERVICES, INC.

4 Hudson Court, Cranbury, NJ 08512
Tel: (609) 799-2963 Fax: (609) 799-5416

Circle 165 on Inquiry Card.

NEW FREE 272 PAGE DATA ACQUISITION
& CONTROL HANDBOOK FOR IBM PC/XT/
AT, PS/2 AND COMPATIBLE COMPUTERS



- A/D BOARDS
- SIGNAL CONDITIONING
- COMMUNICATION
- INDUSTRIAL CONTROL
- PC INSTRUMENTS
- SCIENTIFIC SOFTWARE

*SEND TODAY FOR YOUR FREE 272 PAGE METRABYTE
DATA ACQUISITION & CONTROL HANDBOOK

KEITHLEY METRABYTE

440 Myles Standish Blvd., Taunton, MA 02780
(508) 880-3000 TLX: 503989 FAX: (508) 880-0179

Circle 161 on Inquiry Card.
World Radio History

Circle 54 on Inquiry Card.

LOW COST
INTERFACE
AND DATA
ACQUISITION
/ CONTROL
CARDS
FOR PC/XT/AT



RS-485/422 Card [PC485] \$95/125

- Serial Async. Communication up to 4,000ft; 2 or 4 wires; NSI6450 UART;
- Can be configured as COM1-COM4; Maximum Baud Rate 56KB.
- Flexible configuration options. RTS or DTR control of transmission direction.
- Full/Half duplex operation. Supports hardware handshaking (RTS,CTS).
- Dual drivers/receivers; Handles 64 devices; Compatible with most comm. software.
- High speed version available (supports baud rates up to 256KB) - \$165

Dual-Port RS-485/422 [PCL743] \$175

- Two independent channels/UARTs; 2 or 4 wire operation. Max. Baud 56KB.
- Dipswitch configurable as COM1-4 (IRQ2-7). On board terminator resistor.

IEEE-488 Card [PC488A/C] \$145/445

- Includes DOS Device Driver and sample Communication program in BASIC.
- Additional sample programs in C, Pascal & Assembly - \$50.
- IRQ (4-8). DMA channel 1 or 2. Up to 4 boards per computer.
- Compatible with most IEEE-488 Software packages for IBM-PC.
- I/O Addresses and Control Registers compatible with NI's GPIB-PCII.
- PC-888C card version with Built-In Bus Analyzer hardware and software.
- (Allows Real Time 488 Bus Data Capture in background operation mode.)

Digital I/O & Counter [PCL720] \$175

- 32 Digital Input and 32 Digital Output Channels, 3 channel programmable counter/timer. User configurable clock source. Bread board area.

144 Bit Digital I/O [PCL722] \$345

- 144 lines (24 bits x 6 ports) of TTL compatible digital I/O. Output buffers sink 24mA, source 15mA. Interrupt handling capability. Opto-22 module compatible.

Relay & Isolated D/I [PCL725] \$240

- 8 Relay actuator outputs; 8 Opto-isolated digital inputs. Relay driver circuits.
- LED indicators for activated relays. On board signal conditioning.

10 Channel Counter [PCL830] \$345

- 10 Independent 16 bit up/down counters. Programmable frequency output.
- 16 bit TTL input and 16 bit TTL output ports. Selectable interrupt channel.

6 Channel 12 bit D/A [PCL726] \$495

- Output Ranges: 0 to +5V, 0 to +10V, ±5V, ±10V or sink 4-20mA.
- Settling time: 70µs. Linearity: ±1/20LS. Voltage output driving capacity: ±5mA
- Digital I/O: 16 digital inputs and 16 digital outputs; TTL compatible.

12 Bit A/D & D/A [PCL711s] \$295

- A/D converter: 8 single-ended channels; Device: AD574; Conversion time less than 25µsec; Input range: ±5V; Software Trigger Mode only.
- D/A converter: 1 channel; 12 bit resolution; 0 to +5V/10V Output Range.
- Digital I/O: 16 Input / 16 Output channels; All I/Os TTL compatible.
- External Wiring Terminal Board with mounting accessories included.
- Utility Routines and Demo/Sample Programs for BASIC and Quick-BASIC.

12 Bit A/D & D/A [PCL812] \$395

- A/D converter: 16 single ended inputs; Device: AD574; Conversion time less than 25 µsec; Built-in programmable pacer; Input ranges: ±10V, ±5V, ±1V.
- D/A converter: 2 channels; 12 bit resolution; Output Range 0-5V.
- Digital I/O: 16 Input / 16 Output channels; All I/Os TTL compatible.
- Counter: 1 channel programmable interval counter/timer; Uses Intel 8254.
- DMA and interrupt capability. Utility software for Basic included.

12 Bit w/ Pgm Gain [PCL812pg] \$450

- A/D converter: 16 single ended inputs; Device: HAD574; Conversion time less than 25 µsec; Built-in programmable pacer;
- Software Programmable Multiple Input Ranges: ±10V, ±5V, ±2.5V, ±1.25V, ±0.625V, ±0.3125V.
- D/A converter: 2 channels; 12 bit resolution; Output Range 0-5V.
- Digital I/O: 16 Input / 16 Output channels; All I/Os TTL compatible.
- Counter: 1 channel programmable interval counter/timer; Uses Intel 8254.
- DMA and interrupt capability. Utility software for Basic included.

Fast 12 Bit A/D/A [PCL718] \$785

- A/D converter: 16 single ended or 8 differential channels; 12 bit resolution; Programmable scan rate; Built-in Interrupt and DMA control circuitry. Conversion speed 60,000 samples/sec (standard), 100,000 samples/sec (optional).
- Input ranges: Bipolar ±10V, ±5V, ±2.5V, ±1V, ±0.5V; Unipolar 10.5, 2.1, 1V.
- D/A converter: 2 channels; 12 bit resolution; Output Range 0-5V.
- Digital I/O: 16 OUT; 16 IN; TTL compatible; All I/Os TTL compatible.
- Counter: 16 bit prog. interval counter/timer; Uses Intel 8254; Pacer clock.
- Software: Utility software for BASIC and QuickBASIC included. Supported by LabDAS (\$195/495), ASYST, LABTECH1, UnikelScope

Fast 12 Bit w/ Pgm Gain [818] \$875

- A/D converter: 16 single ended or 8 differential channels; 12 bit resolution; Programmable scan rate; Built-in Interrupt and DMA control circuitry. Conversion speed 100,000 samples per second.
- Software Programmable Input ranges: Bipolar ±10V, ±5V, ±2.5V, ±1V, ±0.5V; Unipolar 10.5, 2.1, 1V.
- D/A converter: 2 channels; Resolution: 12 bits res; Settling time: 5µsec; ±5V
- Digital I/O: 16 OUT; 16 IN; TTL compatible; All I/Os TTL compatible.
- Counter: 16 bit prog. interval counter/timer; Uses Intel 8254; Pacer clock.
- Software: Utility software for BASIC and QuickBASIC included. Supported by LabDAS, ASYST, LABTECH1, UnikelScope

Stepper Motor Card [PCL838] \$395

- Capable of independent and simultaneous control of up to 3 stepper motors.
- Programmable speed from 1 to 10,000 pps; Steps per command 1 to 65535.
- DIP switch selectable I/O port base address. 24 bit TTL I/O ports.
- Crystal based timing. All control signals opto-isolated.

Circle 55 on Inquiry Card.

MC / VISA / AMEX

Call today for datasheets!



B&C MICROSYSTEMS INC.

750 N. PASTORIA AVE., SUNNYVALE, CA 94086 USA
TEL: (408) 730-5511 FAX: (408) 730-5521 BBS: (408) 730-2317

9 Track Tape Subsystem for PC/XT/AT/386/PS2



Best Quality • Lowest Prices

800/1600/3200/6250 BPI
CALL 1-800-266-4827

Laguna Data Systems

26941 Cabot Road
Laguna Hills, CA 92653
Tel: 714-367-0497, Fax: 714-367-0508

Circle 166 on Inquiry Card.

Cross-Assemblers from \$50.00
Simulators from \$100.00
Cross-Disassemblers from \$100.00
Developer Packages
from \$200.00 (a \$50.00 Savings)

Make Programming Easy

Our Macro Cross-assemblers are easy to use. With powerful conditional assembly and unlimited include files.

Get It Debugged--FAST

Don't wait until the hardware is finished. Debug your software with our Simulators.

Recover Lost Source!

Our line of disassemblers can help you re-create the original assembly language source.

Thousands Of Satisfied Customers Worldwide

PseudoCorp has been providing quality solutions for microprocessor problems since 1985.

Processors

Intel 80486	PCA 1802/05	Intel 8051	Intel 8096, 196kc
Motorola 6800	Motorola 6801	Motorola 6811	Motorola 6805
Hitachi 6301	Motorola 6809	MOS Tech 6502	WDC 65C02
Rockwell 65C02	Intel 8080/85	Zilog Z80	NSC 800
Hitachi HD64180	Mot 68k, 8, 10	Zilog Z8	Zilog Super 8

* All products require an IBM PC or compatible.

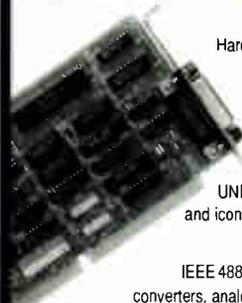
For Information Or To Order Call:

PseudoCorp

716 Thimble Shoals Blvd, Suite E
Newport News, VA 23606
(804) 873-1947 FAX: (804) 873-2154

Circle 258 on Inquiry Card.

IEEE 488.2



Hardware for IBM PC/AT,
Micro Channel, Sun,
Macintosh, DEC,
and NeXT.

Software for DOS,
UNIX, VMS, menu-driven
and icon-driven environments.

IEEE 488 extenders, analyzers,
converters, analog I/O, and digital I/O.

Call for your free IEEE catalog

Otech

Otech, Inc. • 25971 Cannon Road
Cleveland, Ohio 44146 • (216) 439-4091

Circle 153 on Inquiry Card.

New SUPERPRO™ UNIVERSAL PROGRAMMER



WITH
FREE
MULTIMETER
ONLY \$795

- programs • PAL, EPLD, GAL, PEEL, FPL (up to 68 pin PLCC)
- E(E) PROM, Flash EPROM up to 4 Mbits (40 pins)
- Microcontroller, Bipolar PROM.
- Tests TTL/CMOS Logic, D/S Memory Device.
- High speed parallel interface card to PC/XT/AT/386
- Pull-down Menu driven, Library Operating software.
- Fast Device update on user's request
- 40-pin Gold ZIF Socket
- Lifetime Free Updates (BBS)
- User Device Library Generator (optional)

TOLL FREE 1-800-541-1975 764 San Aleso Ave.
Sunnyvale, CA 94086
XELTEK TEL (408) 745-7974
FAX (408) 745-1401

Circle 338 on Inquiry Card.

E/EPROM \$180

Buy your
E/EPROM
programmer from a
company with over
12 years experience
in providing both
hardware and
software tools.

Order today,
call 800-
448-8500

AVOCET SYSTEMS, INC.

120 Union St., Rockport, ME 04856
Outside US 207-236-9055 • FAX 207-236-6713
The source for quality embedded-system tools



- Expert technical support
- HEX file utilities included
- Supports EPROM and EEPROMs to 32 pins
- NMOS and CMOS devices to 1 Mbit
- 4, 8, and 16 socket models available
- IBM PC/XT/AT/386 compatible
- 1 year warranty

Circle 36 on Inquiry Card.

16-BIT RESOLUTION ANALOG-TO-DIGITAL CONVERTER 12,000 SAMPLES/SEC for IBM PC, XT & AT SINGLE PIECE PRICE \$475

We manufacture a broad line
of data acquisition and control
hardware and software for Apple
and IBM computers.
Call for quotes on custom
hardware or complete systems.

LAWSON LABS, INC.

74 4th AVE. W.N.
KALISPELL, MT 59901
800 321-5355 or 406 257-5355
FAX 406 257-5572



Circle 168 on Inquiry Card.

SuperSound™

LOW-COST, EASY



Digital Audio
Authoring
Workstation
Stereo / Mono Hardware
only \$179 / \$149

Developers: for Windows 3.0 / DOS
Create SoundBlaster, Covox, Disney
Sounds, Import Mac, Amiga Sounds

IBM-PC DIGITAL VOICE / SOUND
from only \$20 User's Player \$239 - \$640 Developer's Kits

Pro Quality Software / Hardware

- in use worldwide, even Japan!
- 30 Day Money-Back Guarantee if not Satisfied
- JUST LIKE HAVING A CASSETTE TAPE RECORDER IN A PC.
- Fastest, easiest Editors with the most features for the price.
- Quick, simple hardware / software installation.
- Use for Foreign Language training / communications.
- For Business: Training, Slide Shows - with Grasp, ShowPartner, FFX ...
- For Engineering: Function Gen., Clear Voce Alarms, Storage Scope...
- For Fun: Create Your Own Sounds For Games, Alter Your Voice...
By Silicon Shack. Ph: 408-446-6521 FAX: 408-374-4412

5120 Campbell Ave. #112, San Jose, CA 95130.
Technical Info./Orders: 800-969-4411
Ask for FREE PRODUCT CATALOG.

In Far East: Bayware Japan, Inc. Tel: (03) 972-5391 FAX: (03) 959-1214
OEM Developers: Add QUALITY audio hardware to your product

Circle 274 on Inquiry Card.

9-Track Tape Subsystem for the IBM PC/XT/AT



Now you can exchange data files between
your IBM PC and any mainframe or mini-
computer using IBM compatible 1600 or 6250
BPI 9-Track tape. System can also be used for
disk backup. Transfer rate is up to 4
megabytes per minute on PCs and com-
patibles. Subsystems include 7" or 10 1/2"
streaming tape drive, tape coupler card and
DOS compatible software. For more informa-
tion, call us today!

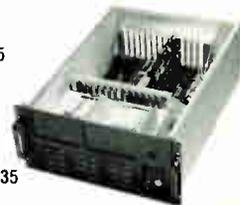
QUALSTAR®

9621 Irondale Ave., Chatsworth, CA 91311
Telephone: (818) 882-5822

Circle 261 on Inquiry Card.

286/386/486 RACKMOUNT SYSTEMS

RMS286 \$549
RMS386SX \$895



RMS386-33 \$1435
RMS486 \$2070

Rackmount Motherboard Systems Include:

Rackmount Enclosure • IDE, FDC, 2-Ser, Par
200W PS - 275W Optional • 1.2MB or 1.44 MB FDD
Motherboard with 1.0MB Memory • 1 year warranty

Also available

15 Models of Rackmount Enclosures
20, 18, 14, 12 or 8 Slot Passive Backplane Boards
486, 386, 386SX or 286 Slot CPU Boards
Rackmount Monitors - Super VGA, VGA, Amber, B & W
Rackmount Keyboard Drawer with narrow 101 Keyboard

VALLEY TECHNOLOGY INC.

2468 Armstrong St. • Livermore, CA 94550
Tel (415) 447-2030 • Fax (415) 447-4559

Circle 307 on Inquiry Card.

MEMORY!



FIRST SOURCE INTERNATIONAL, INC.

"The Only Source for Computer Memory!"

WE ACCEPT INTERNATIONAL ORDERS AND PURCHASE ORDERS!
3 DAY INTERNATIONAL DELIVERY VIA FEDERAL EXPRESS, UPS, OR DHL!



YOUR CHOICE OF QUALITY MEMORY PRODUCTS MANUFACTURED BY: KINGSTON, PARAGON, AND APRICORN.

- ALL USER INSTALLABLE
- SUPERIOR SERVICE
- FREE TECHNICAL SUPPORT
- QUALITY PRODUCTS
- UNLIMITED SELECTION
- FLEXIBLE PAYMENT OPTIONS
- GREAT PRICES
- EXCEPTIONAL WARRANTY

FAX: 714-588-9872 or CALL: 714-588-9866

IBM MEMORY

PS/1	512K Kit	1057036	\$59.00
	2MB	IBM P/N/A	\$189.00
PS/2 30-286, Exp. Board 1497259			
	512K Kit	30F5348	\$39.00
	2MB Kit	30F5350	\$119.00
PS/2 70-E6/121,502,555X,655X			
	1MB	6450603	\$69.00
	2MB	6450604	\$129.00
PS/2 70-A21			
	2MB	6450603	\$139.00
PS/2 55SX/LS, 655X/LS, 34F3077 & 34F4011			
	4MB	34F2933	\$299.00
PS/2 80-141			
	1MB	6450375	\$89.00
PS/2 80-111/311			
	2MB	6450377	\$139.00
PS/2 80-A21/A31			
	4MB	6451060	\$269.00
PS/2 90, 95 and P75			
	2MB	6450902	\$179.00
	4MB	6450128	\$369.00
Expansion boards for all models 50 and 60			
	2 8MB w/2M	1497259	\$379.00
	2 16MB w/2M	6450603	\$439.00
Expansion boards for all models 70 and 80			
	2 14MB w/2M	34F3077	\$389.00
	4 16MB w/4M	34F3011	\$499.00

COMPAQ MEMORY

DeskPro 286-E, 386-20/20E/25			
	1MB	113131-001	\$99.00
	4MB	113132-00	\$289.00
DeskPro 386S/16			
	1MB	113646-00	\$99.00
	4MB	112534-00	\$299.00
DeskPro 286N, and 386N			
	OK Board	118700-00	\$109.00
DeskPro 286N, 386N, 386SX/20			
	1MB	118688-00	\$79.00
	4MB	118690-00	\$339.00
DeskPro 386N, 386SX/20			
	2MB	118689-00	\$139.00
DeskPro 386-33, 486-33 & SystemPro			
	2MB	115144-00	\$149.00
	8MB	116561-00	\$849.00
DeskPro 386-20e and 25e			
	1MB Board	113644-00	\$159.00
	4MB Board	113645-00	\$359.00
DeskPro 386S			
	1MB Board	113633-00	\$159.00
	4MB Board	113634-00	\$359.00
DeskPro 386/16			
	1MB Board	108069-00	\$249.00
	4MB Board	108070-00	\$499.00

LAPTOP MEMORY

COMPAQ	
Portable 386/20	1MB \$189.00
	4MB \$499.00
Portable LTE 286	1MB \$119.00
	4MB \$669.00
SLT-286	1MB \$149.00
	4MB \$679.00
SLT-386	1MB \$139.00
	4MB \$629.00
	4MB \$499.00
TOSHIBA	
1000SE, XE, LE, 2000SX	1MB \$139.00
	2MB \$259.00
1000LE, 2000SX	4MB \$439.00
	8MB \$1079.00
T1200XE	2MB \$65.00
T1600	2MB \$165.00
T3100E	2MB \$165.00
T3100SX	2MB \$165.00
	4MB \$349.00
	4MB \$65.00
T3200SX	4MB \$349.00

BRAND NEW!

IBM PS/2 1405X Laptop			
	2MB		\$289.00
	4MB		\$579.00
	8MB		\$999.00
Hewlett-Packard LaserJet IIIsi			
	1MB		\$89.00
	4MB		\$329.00
Compaq LTE386/20			
	1MB		\$249.00
	4MB		\$579.00
AT & T Safari N5X/20			
	1MB		\$649.00
	4MB		\$999.00
NEC UltraLite 286F			
	1MB		\$259.00
	4MB		\$699.00
Toshiba T3200iXC			
	2MB		\$179.00
	4MB		\$399.00

MEMORY DIAGNOSTIC SOFTWARE FREE WITH EVERY PURCHASE!

PRINTER MEMORY

Hewlett Packard LaserJet IIP, III, IIIP and IID				
	2MB	334754	\$139.00	
	4MB	334776	\$239.00	
Hewlett Packard LaserJet II and IID				
	2MB	334439	\$119.00	
	4MB	334459	\$229.00	
BM Laser 4019 and 4019e				
	2MB	103917	\$159.00	
	3.5MB	103865	\$229.00	
Canon LBP 8II, 8IIR, 8IIT				
	2MB	S63 18B0	\$129.00	
	4MB	PN N/A	\$229.00	
Panasonic 4450I and 4420				
	2MB	KX P44-1	\$165.00	
	4MB	PN N/A	\$249.00	
Toshiba Page Laser 6				
	2MB	LS6-NE3090	\$159.00	
OkLaser 800 and 820				
	2MB	OKI P/N/A	\$229.00	
Laser printer memory also available for:				
	Texas Inst	QMS	Ep-on	Canon
	Apple	Brother	ATI*	TEC
	Kanica	Star	Ok*	Many others!

AST MEMORY

Premium 386C, 386/16			
	1MB Kit	500510-007	\$69.00
Premium 386C, 386/16, FastRAM, Fastboard			
	4MB Kit	500510-008	\$219.00
Premium 386			
	1MB Kit	500510-003	\$89.00
	4MB Kit	500510-004	\$269.00
Premium WS/386SX, WS/286, Brava 286, 386SX			
	2MB Kit	500510-002	\$109.00
Premium 386iX, 16, 25, 33, 486 models			
	1MB	500718-002	\$69.00
Erava 486/25			
	2MB	500718-004	\$179.00
Premium II 386SX/20, SX/16, Cupid 32 card			
	1MB	500790-002	\$79.00
	4MB	500790-004	\$399.00
Premium 386, 33T, 486/25, Brava 486/25			
	8MB	500790-001	\$779.00

HEWLETT-PACKARD MEMORY

Vectra QS/16S & ES/12PC			
	2MB Kit	D1354A	\$109.00
Vectra QS/16S and RS/20PC			
	1MB Kit	D1540A	\$69.00
	4MB Kit	D1542A	\$219.00
Vectra QS/20PC, RS/25PC, 20C and 25C			
	1MB Kit	D1640A	\$69.00
	4MB Kit	D1642A	\$219.00
Vectra 486 PC			
	1MB Kit	D2150A	\$69.00
	4MB Kit	D2151A	\$339.00
Vectra 486PC and 386/25 PC			
	8MB Kit	D2152A	\$569.00
Vectra 386/25 PC			
	2MB Kit	D2381A	\$129.00

T3200SX	2MB	\$169.00
	4MB	\$359.00
T3200	3MB	\$249.00
T5100	2MB	\$165.00
T5200, 5200C, 8500	2MB	\$165.00
	8MB	\$459.00

ZENITH

SlimsPart	1MB	\$199.00
Slims, SupersPart SX, 286E	2MB	\$219.00
Slims, SupersPart 286E	4MB	\$499.00
SupersPart 286, 286E	1MB Kit	\$129.00
SupersPart SX	2MB A or B	\$199.00

NEC

ProSpeed 286, 386SX/16	1MB	\$219.00
	4MB	\$569.00
ProSpeed SX/20	1MB	\$219.00
	4MB	\$529.00
ProSpeed 386	2MB	\$279.00
	8MB	\$1079.00
Powermate Portable SX	2MB	\$429.00
	8MB	\$1469.00

Many other brand name laptop and notebook memories available!

Panasonic	Sharp	Everex
Texas Inst.	Packard Bell	Sony
Leading Edge	Hewlett Packard	AST

ZENITH MEMORY

Zenith Z-386/20/25/33 & 33T			
	1MB	ZA367/386DME	\$69.00
	4MB	ZA3800MK	\$339.00
Zenith Z-386/20/25 & 33			
	2MB	ZA3600MG	\$139.00
Zenith Z-386 SX and Z-386SX/10			
	2MB Kit	Z-605-5	\$119.00
Zenith TurboPart 386e			
	1MB	ZA-3034 ME	\$199.00
	4MB	PN N/A	\$569.00

EXPANSION BOARDS

Everex RAM 3000 Deluxe

Up to 8MB of basic, expandable, enhanced memory. EMS 4.0 compatible with no wait states. Uses 256Kx1 Dram.

with 512K: \$139.00

BocaRam/AT Plus

Up to 8MB for any AT or 16 bit compatible machines running up to 33MHz. 256K of special memory, provides a maximum of 5MB LMT (MS-2.0 Uses 1x1 Drams or 2 8Mx1 modules)

2MB with DRAM's: \$219.00

2MB with SIMM's: \$239.00

NEC MEMORY

Powermate SX	
2MB Brd	APC-HB55 \$569.00
4-8MB Brd	APC-HB53 \$849.00
8MB Brd	NEC PN N/A \$1429.00
Powermate SX Plus	
1-2MB Brd	APC-HB50E \$239.00
2MB Brd	NEC PN N/A \$399.00
4-8MB Brd	APC-BS2E \$659.00
Powermate SX/20	
2MB CPU	OP 410-6101 \$239.00
2MB CPU/3K	OP 410-6100 \$299.00
2MB Brd	OP 410-6102 \$239.00
2MB Kit	OP 410-6102 \$179.00
Powermate 386/20	
2MB	APC-HB55E \$429.00
Powermate 386/25	
2MB	APC-HB65X \$429.00
8MB	APC-HB66X \$1329.00
8MB Base	APC-HB67X \$1329.00
Powermate 386, 255	
2MB Kit	OP 410-520T \$239.00
8MB Kit	OP 410-520Z \$759.00
Powermate 386, 33E and 486, 25E	
2MB	OP 41-51C1 \$299.00

TOLL FREE FROM ANYWHERE IN THE U.S. OR CANADA
ORDER NOW! 1-800-535-5892



WE ACCEPT VISA, MASTERCARD AND AMERICAN EXPRESS!

- No surcharge on Visa or Mastercard. AmEx add 4%.
- Terms: AMEX, Visa, Mastercard, C.O.D., P.O.s.
- Return Policy: 20% Restocking fee on all nondefective returns and refund orders. All items must be returned within 15 days with original documentation and package. Return Merchandise Authorization # required.
- Manufacturers part numbers are for your convenience. All products are third party 100% compatible or full refund!
- Prices and availability subject to change.

INT'L 011-714-588-9866
U.S. 800-535-5892
FAX 714-588-9872

MAIL ORDERS TO:
FIRST SOURCE INT'L INC.
36 ARGONAUT, STE 140
ALISO VIEJO, CA 92656

FOLLOW YOUR PACKAGE EVERY STEP OF THE WAY!

FEDERAL EXPRESS **DHL** **ups**
WORLDWIDE EXPRESS

FAST, INEXPENSIVE AND DEPENDABLE DELIVERY ANYWHERE IN THE WORLD! CHOOSE THE CARRIER TO FIT YOUR DELIVERY NEEDS AT LOW RATES. INFORMATION FOR TRACKING SHIPMENTS IS READY AVAILABLE AT YOUR REQUEST!



Call: (800) 654-7762

OVERSTOCKED SALE 30% TO 80% OFF

WORDSTAR 6.0 & WORDSTAR 2000 REL. 3.5

This is not a misprint! These are the exact same ones selling for over \$300.00 from our competitors. We have thousands in stock FOR SALE BELOW DISTRIBUTOR COST! LIST \$495.00 ea.

YOUR CHOICE 99.00 ea.
FAST TRAX

THE BEST DISK OPTIMIZER. Speeds up Hard Disk Performance * Extends Hard Disk Life * Allows Flexible File Placement * Batch File Operation & Works on Floppies too!

YOUR COST 19.00
PS/2 50/60 BOARD

AST ADVANTAGE/2
 Comes with 2Meg expandable to 8Meg using SIMMS. SuperPak utility software.
 OK - 49.00
 2MEG - 149.00 4MEG - 249.00 8MEG - 449.00
AST ADVANTAGE
 For PC/AT, 128K exp 3MB, 2 serial, 1 parallel & SuperPak software. FREE SideKick.
 LIST \$399.00 YOUR COST 79.00

10 MEG HARD DRIVE
 Half height - 80 MSEC - 6 Month Warranty

List 149.00 Your Cost **69.00**

FAX CARD W/ 2400 BAUD MODEM
 Automatic group III digital FAX, background operation, send and receive text, screen images, scan pages, Hayes compatible, modem built-in. FAX 9600/7200/4800/2400. Software, telephone cord.
 LIST 695.00 YOUR COST 129.00

MODEMS
 Fully Hayes compatible, monitor speaker w/ volume control, 2400/300 Baud transmission rate, addressable COM 1,2,3,4, Compatible w/ IBM PC, XT, AT & Compatibles. 2year Manuf. Warranty. Full Duplex operation, complete with software. Auto dial, Auto answer.
INTERNAL 69.00 EXTERNAL 89.00

SEAGATE HARD DRIVES

MODEL	SIZE	ACCESS TIME	INTERFACE	DRIVE	W/CONTROLLER
ST157A	44MB	28MSEC	IDE	219.00	259.00
ST251-1	42MB	24MSEC	MFM	229.00	299.00
ST177N	60MB	24MSEC	SCSI	339.00	469.00
ST264A	85MB	28MSEC	SCSI	319.00	459.00
ST1096N	84MB	24MSEC	SCSI	379.00	509.00
ST1102A	84MB	20MSEC	IDE	369.00	499.00
ST4096	80MB	28MSEC	MFM	499.00	579.00
ST4144R	122MB	28MSEC	RL	579.00	679.00
ST1144A	125MB	20MSEC	IDE	459.00	499.00
ST1162N	142MB	15MSEC	SCS	709.00	819.00
ST1239A	211MB	15MSEC	IDE	699.00	739.00
ST2383A	338MB	16MSEC	IDE	1279.00	1339.00

CONTROLLERS
 IDEHD/Floppy 39.00, 16BitWD 2:1 109.00, 8BitHDonly 59.00
 FOR FLOPPYS: Super Floppy Controls 1, 2, 360K, 720K & 1.44 Drives 69.00

FLOPPY DRIVES
 360K-5 1/4 * 54.00, 720-3 1/2 * 54.00, 1.2 MEG-79.00,
 1.44MEG-3 1/2 * 79.00

84KEY KEYBOARD
 New 1 year Warranty, works on XT, AT & 386's. Low cost, high quality by Mitsumi.
 LIST \$79.00 YOUR COST 19.00 101 KEY 49.00

LOTUS METRO

Memory resident desktop manager. Accessories include Appointment Book, Calculator, Clipboard, DOS Filemanager, Editor, Kaleidoscope, List Manager, Macros, Notepad, Phone Book & Watch.
 LIST \$85.00

YOUR COST 19.00

MINISCRIBE HARD DRIVE
 * 3180E 5 1/4 * 154 MEG * ESDI - 18MSEC Access Time * New Factory Packed!
 LIST \$1295.00 YOUR COST 499.00
 (71MEG MFM, 20MSEC, 1/2 HT 5 1/4 * YOUR COST 349.00)

INTEL COPROCESSOR

5 YEAR WARRANTY!
 8088 BASED MACHINES: 80286 BASED MACHINES: 80386 BASED MACHINES:
 8087-5MHz 49.00 80287-6.6MHz 49.00 80387-16 16MHz 185.00
 8087-28MHz 79.00 80287-8MHz 59.00 80387-20 20MHz 199.00
 8087-110MHz 139.00 80287-10 10MHz 89.00 80387-25 25MHz 209.00
 80287-XL 99.00 80387-SX16 129.00

150 MEG TAPE BACKUP
 Mfg. by Wangtek Part #5150PK, compatible with MS Dos, Novell, SCO Xenix, Pick systems. Complete kit w/ controller, cables and manual. 附贈 SY-TOS Software...
 LIST \$1495.00 YOUR COST 499.00 (60 MEG KIT 399.00)

200 WATT POWER SUPPLY
 Direct AT replacement, UL Appr., 110/220V, 4 Drive Connectors. LIST \$99.00
 YOUR COST 39.00 (150 WATT for XT 49.00)

WE WILL BEAT ALL COMPETITION ON MEMORY

COMPAQ MEMORY

MODEL	MEMORY ADDED	COMPAQ EQUIV. PART#	YOUR COST
DESKPRO 286	512K KIT	113012-001	59.00
DESKPRO	1MB MODULE	118688-001	79.00
284X, 386N	2MB MODULE	118689-001	149.00
386SX/20	4MB MODULE	118690-001	309.00
DESKPRO	1MB BOARD	108069-001	279.00
386/16	2MB BOARD	108069W71	349.00
	1MB KIT	108071-001	149.00
	4MB BOARD	108070-001	599.00
DESKPRO	4MB KIT	108072-001	319.00
386S	1MB BOARD	113633-001	159.00
	4MB BOARD	113634-001	359.00
	1MB MODULE	113646-001	104.00
	4MB MODULE	112534-001	279.00
DESKPRO	1MB MODULE	113131-001	99.00
386/20, 25, 286E	4MB MODULE	113132-001	239.00
DESKPRO	1MB BOARD	113644-001	139.00
386/20E/25E	4MB BOARD	113645-001	349.00
DESKPRO	2MB MODULE	115144-001	149.00
386/33, 486/25	8MB MODULE	116561-001	899.00
SYSTEMPRO	32MB MODULE	116568-001	3499.00

PORTABLES

MODEL	MEMORY ADDED	COMPAQ EQUIV. PART#	YOUR COST
PORTABLE III	512K KIT	107331-001	38.00
	INTFC 8D	107808-001	99.00
	EXP 8D	107811-001	199.00
	2MB KIT	107332-001	129.00
SLT/286	1MB MODULE	110235-001	159.00
	4MB MODULE	110237-001	449.00
LTE/286	512K BOARD	117077-001	199.00
	1MB BOARD	117081-001	129.00
PORTABLE	2MB BOARD	117081-002	179.00
386/20	1MB KIT	107551-001	129.00
	INTFC 8D	107707-001	189.00
	4MB BOARD	107653-001	699.00
	4MB EXT BRD	107654-001	799.00
SLT/386S	1MB MODULE	108303-001	194.00
	2MB MODULE	108304-001	324.00

RAM CHIPS (DIPS)

DESCRIPTION	150NS	120NS	100NS	80NS	70NS
64X1	1.20	1.80	1.95		
64X4	1.95	2.25	2.45	3.95	
256X1	1.50	1.65	1.95	1.99	2.95
256X4		3.95	4.45	5.95	6.95
1MEG X1		4.75	4.95	5.45	

TOSHIBA MEMORY

TOSHIBA MODEL	MEMORY ADDED	TOSHIBA EQUIV. PART #	YOUR COST
PORTABLE 2000SX	1MB BD	PC14-PA8311U	189.00
T1000SE & IE/LE	2MB BD	PC14-PA8312U	279.00
PORTABLE T1200XE	2MB BD	PC13-PA8306U	169.00
PORTABLE T1100E	2MB BD	PC8-PA8302U	159.00
PORTABLE T3100E	2MB KIT	1PC9-PA8341U	159.00
PORTABLE T3100SX	2MB BD	PC15-PA8308U	159.00
	4MB BD	PC15-PA8310U	309.00
PORTABLE T3200	3MB BD	PC6-PA7137U	279.00
PORTABLE T3200SX	2MB KIT	PC12-PA8307U	159.00
	4MB KIT	PC12-PA8309U	399.00
PORTABLE T5100	2MB BD	PC7-PA8301U	169.00
DESKTOP T8500 OR	2MB KIT	PC10-PA8304U	169.00
PORTABLE T5200	8MB KIT	PC10-PA8313U	999.00

ZENITH MEMORY

ZENITH MODEL	MEMORY ADDED	ZENITH EQUIV. PART #	YOUR COST
Z386/33/37E/25/20	1MB MOD	ZA3800ME	79.00
	4MB MOD	ZA3800MK	389.00
Z386/25/33	1MB MOD	ZA3600ME	79.00
	2MB MOD	ZA3800MG	149.00
Z248, Z286LP, Z386SX	2MB MOD	Z-6051	149.00
TURBO SPRT 386, 386E	1MB KIT	ZA3034ME	259.00
	4MB KIT	ZA3034MK	569.00
SUPER SPRT	2MB KIT	ZA180-64	199.00
SK	2MB KIT	ZA180-86	199.00
	2MB KIT	ZA180-87	279.00
SUPER SPRT 286	1MB KIT	ZA180-66	129.00
286E, SX	2MB KIT	ZA180-64	199.00

BOCA MEMORY BOARDS

BOCARAH XT 0-2 MEG BOARD. USES 256K D-RAM. OK 99.00 * 2MEG 219.00
 BOCARAH 502 0-2MEG BOARD. WORKS WITH PS2/250, 502 & 60 Q WAIT STATE RAM. USES 1MEG D-RAM. OK 99.00 * 2MEG 199.00
BOCA AT PLUS (BRAT 80) OK-8MEG BD. 4.0 LM COMPATIBLE. NEW 5 YEAR WARR. CONVENTIONAL, EXPANDED & EXTENDED MEMORY. SUPPORTS DOS, OS/2, LIM/EMS & EEMS
 OK-112.00 2MEG-219.00 4MEG-319.00 8MEG-499.00

IBM PS/2 MEMORY

IBM PS/2 MODEL	MEMORY ADDED	IBM EQUIV. PART#	YOUR COST
PS/225/286	512K KIT	30F5348	39.00
30-286, 502 & 55-SX, 65SX	2MB KIT	30F5360	129.00
PS/2 502 & 55SX, 65SX	1MB SIMM	6450603	59.00
	2MB SIMM	6450604	109.00
55SX & 65SX	4MB MODULE	34F2933/87F9977	299.00
50, 502, 55SX & 60, 65SX	2-8MB BOARD	1497259/6450609	349.00
PS/2	1MB SIMM	6450603	59.00
70-E61, 061, 121	2MB SIMM	6450604	109.00
PS/270-A21 AX1, BX1	2MB SIMM	6450608	119.00
PS/280-041	1MB MODULE	6450375	99.00
PS/280-111, 121, 311, 321	2MB MODULE	6450379	149.00
80-A21, A31	4MB MODULE	6451060	279.00
PS/2	2-8MB BOARD	6450605 OR	379.00
ALL70s & 80s	2-14MB BOARD	34F3077 OR	389.00
	4-16MB BOARD	34F3011	519.00
90, 95 & P75	1MB	6450902	189.00
	4MB	6450128	419.00

SIMM MODULES

DESCRIPTION	120NS	100NS	80NS	70NS	60NS
256X9 IBM	9.00	14.00	19.00	26.00	39.00
1MEG X 8 APPLE		87.00	59.00	71.00	79.00
1MEG X 9 IBM		39.00	49.00	59.00	74.00
4MEG X 9 IBM			219.00	249.00	319.00

LASER JET MEMORY

MODEL	MEMORY ADDED	H.P. EQUIV. PART#	YOUR COST
HP41 & HD	2MB MODULE	33444B	139.00
	4MB MODULE	33445B	229.00
HP3 & HD	1MB MODULE	33474A/B	99.00
HP4P	2MB MODULE	33475A/B	139.00
	4MB MODULE	N/A	239.00
CANON LBP4	1MB MODULE	N/A	199.00
CANON LBP	1MB MODULE	N/A	199.00
8II, 8II, 8II	2MB MODULE	563-1880	129.00
	4MB MODULE	N/A	239.00

ORDERS ONLY
800-654-7762
 TECHNICAL/CUSTOMER SERVICE/ORDER STATUS:
 (702) 294-0204 FAX (702) 294-1168
 HOURS: M-F 8:00-6:00 PST, SAT 9:00-3:00 PST

Manufacturer part #'s for convenience only. All products 3rd party.
WE ACCEPT INTERNATIONAL ORDERS
WE ALSO PURCHASE EXCESS INVENTORY! FAX OR CALL.
NO SOFTWARE RETURNS
ALL PRICES FINAL.
 Trademarks are registered with their respective Co.'s.
 386, 387, 287, SX, are trademarks of Intel Corp.

NO SURCHARGE FOR MC/VISA TERMS:
 MC, VISA, AE, COD CASH, NET
 Purchase orders from Universities
 Fortune 1000 & Government Agencies
 Personal Checks, COD add \$5.00
 20% Restocking Fee on returns within 30 days
 No refunds after 30 days - EXCHANGES ONLY

SE HABLE ESPANOL
 *ADVERTISING IN THIS MAGAZINE UNDER SAME TERMS.

 PRICES SUBJECT TO CHANGE. SHIPPING: UPS (Min. \$8.25)
684 Wells Road, Boulder City, Nevada 89005

QLLC X.25
ADCCP SDLC
TCP/IP HDLC
3270 BSC PAD

- C source code
- ROM-able
- Full porting provided
- No OS required



GCOM, Inc.
 1776 E. Washington
 Urbana, IL 61801
 (217) 337-4471

Specialists in Computer Communications
 FAX 217-337-4470

Circle 119 on Inquiry Card.

UNIVERSAL PROGRAMMER



\$475

PAL EPROM
GAL 8748/49
PROM 87C51...
EEPROM 87C751

5ns PALS
4 Meg EPROMs
16 bit EPROMs

Parts added at your request.

FREE software updates on BBS.
 Powerful menu driven software.

Call - (201) 994-6669



Link Computer Graphics, Inc.
 4 Sparrow Dr., Livingston, NJ 07039
 FAX:(201) 994-0730

Circle 169 on Inquiry Card.

ROM Based AT Systems



Single Board Computer

- Run DOS and AT object code from ROM. Use standard PC/AT cards on passive backplane.
- KS6: NEC V53 uP, runs AT Code, 12mHz, AT Bus 4M RAM, 2M ROM, 512K SRAM (battery backed), 5 Serial, 2 Parallel Ports, Clock, Watchdog. \$ 399 q1.
- KS7: V40 uP, PC compatible, 8 mHz, PC bus 512K RAM, 512K ROM, 384K SRAM, flop, 3 serial, parallel, keyboard, Clock, Watchdog. \$ 245 q1.

303-444-7737 KILA

Fax 303-786-9983 655 Hawthorn Ave Boulder CO 80304

Circle 162 on Inquiry Card.

386 POWER

286 to 386SX UPGRADE!



Affordable! Slotless! The Evergreen 386 SuperChip II can convert your 286 IBM, Compaq, or AT compatible to a 386. Run Windows 3.0 in the enhanced 386 mode, utilize MS DOS 5.0's Loadhigh and Devicehigh programs. Speed up your processor (increase on an AST Premium 286 using Norton SI version 4.5 goes from 11.2 to 15.6!). Math accelerator board also available for your 287 Math Coprocessor.

1-800-733-0934

Evergreen

Technologies

1325 N.W. Ninth Street
 Corvallis, OR 97330-4508
 (503) 757-0934
 FAX: (503) 757-7350



Circle 111 on Inquiry Card.

ICs PROMPT DELIVERY!!!

SAME DAY SHIPPING (USUALLY)
 QUANTITY ONE PRICES SHOWN FOR JULY 21, 1991

Memory for almost ALL computers

DYNAMIC RAM

4M Board for hp LJ's w/2MB			\$125.00
SIMM	4Mx9	80 ns	185.00
SIMM	1Mx9	60 ns	57.00
SIMM	1Mx9	80 ns	46.00
4 Mbit	4Mx1	80 ns	25.00
4 Mbit	1Mx4	80 ns	34.00
1 Mbit	1Mx1	80 ns	4.95
41256	256Kx1	100 ns	1.90
41256	256Kx1	120 ns	1.60
44256	256Kx4	80 ns	5.75
4464	64Kx4	100 ns	1.75
EPROM			
27C4001	512Kx8	150 ns	\$48.00
D28F010	128Kx8	150 ns	24.00
27C1000	128Kx8	150 ns	13.95
27C512	64Kx8	120 ns	7.25
27128	16Kx8	250 ns	3.40
STATIC RAM			
1 Mbit	128Kx8	100 ns	\$13.00
62256LP	32Kx8	100 ns	6.50

OPEN 6 1/2 DAYS, 7:30 AM-8 PM. SHIP VIA FED-EX ON SAT.

SAT DEL ON FED-EX ORDERS RECEIVED BY: **NOV 22 08:25 PM '91**
 MasterCard VISA or UPS CASH COO
MICROPROCESSORS UNLIMITED, INC.
 24,000 S. Peoria Ave., (918) 267-4961
 BEGGS, OK, 74421
 No minimum order. \$1 for packing materials.
 Shipping and Insurance extra.

Circle 190 on Inquiry Card.

Precision Data Products

CARLISLE Sale

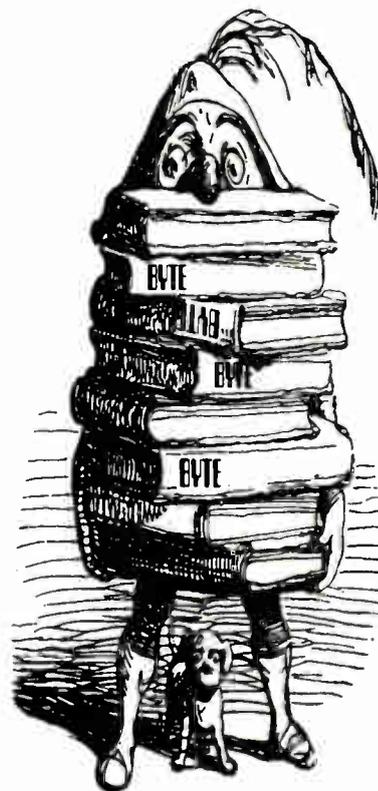
Item	Price
DC2000	\$ 14.40
DC2000 XL	\$ 17.55
DC300 XLP	\$ 17.70
DC300 XLP-555	\$ 18.70
DC300 XLP-600	\$ 19.15
DC600A	\$ 19.65
DC6150	\$ 21.15
DC6525	\$ 29.10

Terms to well-rated. Min. order \$25.00. S&H: FOB Grand Rapids, MI. COD: addt \$5.50. MI residents + 4% tax. Prices subject to change. Visa, Mastercard accepted.

616-698-2242 • FAX 616-698-9047
 P.O. Box 8367 Grand Rapids, MI 49518
U.S.A. & Canada 800-968-0888
In MI, IN, & OH 800-968-2468

Circle 254 on Inquiry Card.

Subscription Problems?



We want to help!

If you have a problem with your **BYTE** subscription, write us with the details. We'll do our best to set it right. But we must have the name, address, and zip of the subscription (new and old address, if it's a change of address). If the problem involves a payment, be sure to include copies of the credit card statement, or front and back of cancelled checks. Include a "business hours" phone number if possible.

BYTE Magazine

Attn. Subscriber Service
 P.O. Box 555
 Hightstown, HJ 08520

**PERSONAL E/EPPROM PROGRAMMERS
with BUILT-IN UV ERASER**



Stand-alone
and PC remote
operation.

Model: 9850
\$395.00

- Simple function key operations
- Full LCD display message
- Programs 2716 to 27513 EPROMs and 2804 to 28256 EEPROMs
- Programming algorithms: STANDARD, INTELLIGENT, INTERACTIVE and QUICK PULSE.
- Data file formats: INTEL HEX, BINARY, MOTOROLA S and TEKTRONIX HEX
- Programming functions: READ, PROGRAM, AUTO, BLANK CHECK, VERIFY
- Built-in UV Eraser (9850 UV)

For more information please call:
AMERICAN RELIANCE INC.
1 (800) 654-9838 Fax: (818) 575-0801

FREE CATALOG

**RS-232C INTERFACE & MONITORING
EQUIPMENT CATALOG**

WRITE or CALL for YOUR **FREE**
COMPREHENSIVE B & B
ELECTRONICS CATALOG TODAY!

Pages and pages of photographs and illustrated, descriptive text for B&B's complete line of RS-232C converters, RS-422 converters, current loop converters, adapters, break-out boxes, data switches, data splitters, short haul modems, surge protectors, and much, much more. Most products meet FCC Part 15J. Your RS-232 needs for quality, service and competitive prices will be more than met by B&B ELECTRONICS. **Manufacturer to you, no middleman!** Money-back guarantee! Same-day shipment! One-year warranty on products! Technical support is available.



Order direct
from manufacturer
TODAY & SAVE!

Write For Your **FREE** Catalog Today!

B & B electronics
MANUFACTURING COMPANY

4000 Baker Road P.O. Box 1040 • Ottawa, IL 61350

Phone: 815-434-0846

A MUST for Computers

**VIZIFLEX
SEELS**



The Ideal Keyboard Cover!

Protect your computer and **eliminate** downtime caused by liquid spills, contaminants, environmental hazards, etc. with VIZIFLEX SEELS - the **only** keyboard cover that:

- **Remains securely in-place** during the operation of the keyboard and will not interfere with computer performance in any way.
 - **Is designed to "form-fit"** to the exact contours of the keyboard to provide superior tactile sensitivity & feel for individual keys.
 - **Consists of Ultraflex™ material, a transparent, flexible "film"** which allows all "markings" to be clearly visible.
- VIZIFLEX SEELS are the **only** keyboard covers for your computer!

VIZIFLEX SEELS, INC.
16 E. Lafayette St., Hackensack, NJ 07601 (201) 487-8080

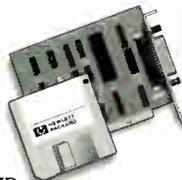
Circle 23 on Inquiry Card.

Circle 53 on Inquiry Card.

Circle 333 on Inquiry Card.

**Simplify IEEE 488.2
control.**

The HP 82335A is a simple solution. It's IEEE 488.2 and SCPI compatible.



Powerful, common sense commands (HP-type calls) make programming easy. Comprehensive examples get you started fast. And support for the most popular languages and automatic software installation are included. All for \$525.* To order, simply call **HP DIRECT** 1-800-538-8787, Ext. TX12.

*U.S. list price



**HEWLETT
PACKARD**

© 1991 Hewlett-Packard Co. TMMSC0120

Circle 129 on Inquiry Card.

**QICPAK
Cartridge & Tape Conversion**

Vogon's QIC-02 and SCSI PC-based solutions provide access to the widest range of Micro, Mini, Mid-Range and Mainframe Cartridge and Tape Data, with options for user developed software.

- Cartridge/Tape Formats**
- 1/4" - (QIC-11 to QIC-525) DOS/UNIX (TAR, RBAK), S/3X, AS/400 (**READ and WRITE**)
 - 1/2" - IBM/ANSI Labelled/Unlabelled
 - 3480 - IBM Labelled
 - DAT - IBM formats and UNIX Systems.

Interchange Facilities

Conversion from one type of cartridge or tape to another, Media duplication, DOS Data to IBM or UNIX Systems, IBM or UNIX Systems to DOS. Used by Accountants/Auditors, COM Bureaus, Conversion Companies, Software Houses, PCB Manufacturers and Many Others Worldwide.

In the USA contact **Computer Peripherals Unlimited** on 602-774-3101 or FAX 602-773-9183.



VOGON ENTERPRISES LIMITED
94 Easthampstead Road, Wokingham,
Berkshire RG11 2JD England
Tel: 44 +(0) 734 784511/890042 • FAX: 44 +(0) 734 890040



Circle 335 on Inquiry Card.

**Monitor & Control
Environmental Quality
Using WeatherNet™
& Your PC!**

Powerful and versatile stand-alone system of hardware, menu-driven software, and weather instrumentation.

- Datalog, store, retrieve, record, manipulate 8,000 records
- Interface up to 27 instruments, display live action on graphical screens
- Control output devices, auto-upload data to host PC
- Only \$3,595



Call for complete information:
Solus Systems, Inc., Lake Oswego, OR
(800) 247-5712 FAX (503) 635-3004

Circle 280 on Inquiry Card.

DATA ACQUISITION

- Systems for Lab, Factory & Field
 - PC Software Included
 - Serial, Modem, & Bus
 - Stand Alone Ability
 - Laptop & Handheld
 - PC & MAC Cards
 - Inexpensive
 - OEM & VAR
 - RTU's

FREE CATALOG & DEMO DISK!

Manufacturers of Measurement & Control systems for Laboratory, Industrial, & Field applications. Specialists in Battery-Powered systems.



Call for applications info: (201) 299-1615
P.O. Box 246: Morris Plains, NJ 07950 U.S.A.



MEASUREMENT TO GO

Circle 109 on Inquiry Card.

IMAGING CARDS



- Complete software
- Real time grab/display
- PC/XT/AT/386 compatible

CV-512 Advanced 8 bit board. 512 x 480 or 256 x 240 (4 images), in/out LUTS. 4 inputs, "ping pong" buffers, 24 bit RGB output \$795

CV-02 256 x 240 x 8 bits, 2 inputs, cursor. 24 bit RGB output \$495

CV-03 6 bit CV-02, 8 bit output \$395

Control Vision
P.O. Box 596, Pittsburg, Kansas 66762
800/292-1160, 316/231-6647

Circle 74 on Inquiry Card.

World's most popular, expandable, flexible
**Multi-User Online
Bulletin Board
System**

\$59

The Major BBS®

STARTER SYSTEM FOR 2 LINES
*Includes electronic mail,
teleconferencing, file upload/download,
SIG messaging & file areas,
classified ads, and much more!*

**CALL NOW
(305) 583-5990**



VISA / MasterCard / American Express

Circle 118 on Inquiry Card.

Save BIG on Computer Products



DRIVES AND BACKUPS

Conner Hard Drives	
3000 42MB 3.5" IDE 28ms	\$199
3100 104MB 3.5" w/SCSI 25ms	399
3104 104MB 3.5" IDE 25ms	399
3200 209MB 3.5" SCSI 19ms	699
3204 209MB 3.5" IDE 19ms	699
Seagate Hard Drives	
ST225 20MB 65 MS	189
ST225KIT 20MB w/Cont. XT	229
ST238 RLL 30MB RLL XT w/Cont.	239
ST251-1 40MB 28 MS 1/2 HT	259
ST4096 80MB 28 MS*	499
* 2 Year Warranty	
Seagate Swift & Wren Drives	
CALL	
Micropolis	
1355 159MB ESDI FH 28MS	499
1558 338MB ESDI FH 18MS	1299
1568 676MB ESDI FH 16MS	1599

Plus Development Hard Drive Cords	
20MB/40MB Hard Cord	499 / 529.99
80MB Hard Cord II	469.99
Hard Cord III	
50MB / 105MB	349 / 589

Optical Drives

Worm External 5.25" 940MB Drive	2299
Worm Internal 5.25" 940MB Drive	2099
External 5.25" 1GB Drive	2799
Internal 5.25" 1GB Drive	2599

Mountain Internal Tape Backups	
40MB XT or AT	259
80/150MB AT	499
150/250MB AT	1099
Archive Tape Back-up	
40MB Internal XT or AT	249
80MB Internal AT	359
150MB Internal AT	899
Toshiba	
CD ROM 600MB AT External	699
CD ROM 600MB PS/2 MCA	899

FLOPPY DRIVES

Toshiba Disk Drive Kits	
ND 04D 1/2 HT 360K (PC/XT)	\$59
ND 08DEG 1.2MB (PC/AT)	75
ND 356T 3.5" 1.44MB AT Kit	75
Sony Disk Drives	
3.5" 720K (PC/XT/AT)	59
3.5" 1.44MB Slimline	59
3.5" 1.44MB	65

MOUSE DEVICES

Logitech Mouseman Serial	
Right Handed	\$69.99
Logitech Trackman Serial	79.99
Microsoft	
Bus or Serial w/Paintbrush	95.99
Microsoft Mouse Serial	79.99
Mouse System	
White Mouse Bus/Ser.	59.99/49.99
Omnimouse II	
w/Paint Bus/Ser.	49.99/35.99
PC Trackball Bus/Ser/w/Designer DOS	59.99/44.99

SCANNERS

Logitech Scanman 256	\$299
Niscan True Gray Scale	209.99
Complete Page Scanner	575
Panasonic Flatbed I, II, and III	CALL
Epson Desktop Color Scanner	1099

SOFTWARE

Direct Access V5.0	59.99
Fastback Plus	116.99
Formtool Gold V3.0	55.99
Harvard Graphics V2.3	239.99
Laplinc III	69.99
LetterPerfect	129.99
MS Excel V3.0 for Windows	299.99
Objection for Windows	79.99
ProCom Plus V2.0	65.99
ProWrite/ProFile/Free Video	149.99
Quicken V4.0	36.99
SoundBlaster	155.99
Word Perfect 5.1	235.99

MATH COPROCESSORS

Intel Math Coprocessors	
8087 (5MHz)	\$85
80872 (6/8 MHz)	119
80871 (10MHz)	149
80287XL(6,8,10MHz)	
and 80C287 (12MHz)	79.99
80287XLT Compaq LTE/286, and Tandy 2800	79.99
80387SX (16MHz)	119.99
80387SX (20MHz)	129.99
8038716 (16MHz)	199
8038720 (20MHz)	199
8038725 (25MHz)	199
8038733 (33MHz)	199
80487SX (20 MHz)	475
Cyrix Math Coprocessors	
83D87-16 (16MHz 80386)	199
83D87-20 (20MHz 80386)	199
83D87-25 (25MHz 80386)	199
83D87-33 (33MHz 80386)	209
83S87-16 (16MHz 80386SX)	125
83S87-20 (20MHz 80386SX)	135

CHIPS AND SIMMS

256K (all speeds)	CALL
1MB (all speeds)	CALL
Simms Modules (all speeds)	CALL

ACCELERATOR/UPGRADE BOARDS

Sota	
286i Accelerator	\$209
386Si Accelerator	359
Express 386SX 16MHz Upgrade	359
Express 386SX 20MHz Upgrade	475

MEMORY UPGRADES FOR IBM

Legend IBM™ Compatible PS/2 Memory Upgrades	
529795 512K 30-286	\$49
529802 2MB 30-286	125
529810 1MB 70-E61, 70-121	79
529828 2MB 70-E61, 70-121	129
529836 2MB 70-A21	129
529844 1MB 80-041	99
529852 2MB 80-111, 80-311	159
Legend Memory available for Toshiba Laptops, AST, HP, Moc & Others. CALL	

BOARDS

Intel Aboveboard	
Above Board Plus w/512K	\$289
Above Board Plus w/2MB	399
Above Board 2 Plus for PS/2 models 50, 50Z & 60 w/512K	
325	
AST Boards	
SixPak Plus w/384K	225
SixPak 286 w/512K	175
Boca Boards	
Boca I/O 2 Ser., 1Par.	49
Boca AT Plus 2 K	109
Boca AT Plus 2MB	225
Boca VGA Basic	79
Inchip Expanz Board	149

NETWORKING PRODUCTS

NE1000 Anthem 8-bit Ethernet	134.99
NE2000 Anthem 16-bit Ethernet	169.99
3COM 3C503 Etherlink II PC/XT/AT	219
SMC Arcnet PC-130 8-bit board	99.00
SMC Arcnet PC-130E 8-bit board	119.99
Lantastic 10 MBPS Starter Kit	499

PACKARD BELL EASIER THAN EVER TO USE!
New Packard Bell Computers include PB Desktop, an easy-to-use Window type environment offering quick access to programs. Built-in tutorial.

FULL YEAR ON-SITE WARRANTY*

PB FORCE 820 SERIES		PB FORCE SX16	
• 80386SX, 20 MHz	• 2MB RAM Exp. to 16MB	• 80386SX, 16MHz	• 44MB Hard Drive
• 16K Cache memory exp. to 32K	• 4 Exp. Slots (3 16-bit, 1 8-bit)	• 1MB RAM exp. to 5MB	• 3.5" 1.44MB FDD
• 4 Mass Storage	• 3.5" 1.44MB & 5.25" 1.2MB FDD	• 800 x 600 Super VGA built-in	• Enhanced 101 KB
• 16-bit Extended VGA with 1024 x 768 res. & 512K mem.	• I/O Ports: 2 Ser., 1 Par., 1 Mouse, 1 VGA, & 1 PS/2 Kb.	• 2400 B Modem built-in	• Incl: Mouse & Keyboard
• Enhanced 101 Keyboard	• Built-in 2400B Internal Modem included (model 820H & 820HF) & FaxBoard (model 820HF)	• Sfwr: MS-DOS 4.01, GW-Basic, PB Desktop, LotusWorks w/templates and Prodigy**	• LotusWorks & Prodigy
• Includes: Mouse & Keyboard			
• Sfwr: MS-DOS 4.01, GW-Basic, PB Desktop, LotusWorks w/templates and Prodigy**			
** Included in 820H & 820HF only			

TRONICS MODEMS		2400 Baud Internal w/software	\$79
▲ 100% Hayes Compatible		2400 Baud Internal w/V.42 & software	115
▲ 2 year warranty		2400 Baud External no software	99
		2400 Baud External w/V.42 no software	139

DISKETTES		ELK-TEK	maxell.	SONY.	3M	Verbatim.
3 1/2" DSDD	6.50	7.99	7.50	7.99	7.99*	7.99*
3 1/2" DSDD	12.99	14.99	14.99	15.99	15.99*	15.99*
5 1/4" DSDD	3.99	5.50	5.50	5.99	5.99*	5.99*
5 1/4" DSDD (IBM AT)	7.50	9.99	9.99	9.99	9.99*	9.99*

* Preformatted at no extra charge.
In addition to the above, we stock preformatted & color diskettes.

DATA CARTRIDGES		Pre-formatted 3M	
Regular		DC600 HC/lotomat™	\$25.50
DC100A(Mini)	\$14.99	DC6150/Zetamat™	28.00
DC300X/P	20.00	DC1000/Dellamat™	16.99
DC600A	21.00	DC2000/Kappomat™	19.00
DC6150	22.00	DC2000/Thelamat™	19.00
DC6250	26.99	DC2080/Rhomat™	20.99
DC6320	29.00	DC2120/Rhomat™	25.50
DC6525	34.00	DC2120/Ximat™	25.50

Call for Large Quantity Pricing. Call for Wholesale Pricing on 3M Computer Tape.

LASER PRINTERS

Okidata Laser 400*	\$625
Epson	
EPL 7000** (with FREE 65-in-1 font)	799
EPL 7500** PostScript	1999
Panasonic	
4420* 8pgs/min.	799
4450* / 4455* 11pgs/min.	1099/1999

DOT MATRIX PRINTERS

EPSON	
LQ2000*	225
LX810**	159
LG570** NEW /1010**	CALL/369
FX850**/1050**	289/399
LG870** NEW /1170** NEW	CALL
LG860** (Color) /2550 (Color)	549/849
DFX5000/8000	1289/2199

Panasonic Office Automation

1180** / 1695**	159 / 379
1123** / 1624**	219 / 349
1124** / 1654**	289 / 569
2624** NEW Superquiet	449

OKIDATA

320* / 321*	319 / 459
390* / 391*	459 / 639
393* / 393C*	979 / 1049

Diconix Ink Jet Printers

150+ Parallel / Serial*	329 / 339
-------------------------	-----------

* 1 Yr. Warranty ** 2 Year Warranty

HP LASERJET ENHANCEMENTS

25-IN-1 Font Cartridge	\$259
1MB Memory Board IIP/III/IIID	109
2MB Memory Board IIP/III/IIID	159
PacificPage XL PostScript	799
Postscript Cartridge for IIP/III/IIID	349
Postscript Cartridge w/2MB Memory Board for LaserJet II	349

MODEMS AND FAX BOARDS

Hayes and Hayes Compatible	
Hayes Internal	
2400 Baud No Software	\$239
2400 Baud with Software	299
9600 Baud V.42 w/Software	499
Compatible (including software)	
Practical Peripherals 2400 Baud	119
Practical Peripherals 2400 V.42	169
Practical Peripherals 2400 IBM PS/2	199
Practical Peripherals 9600 Baud	379
Hayes External (no software incl.)	
2400 Baud	329
2400 Baud Pocket Edition	129
9600 Baud V.42/V.42 Ultra	499/649
External Compatibles	
Practical Peripherals 2400SA	169
Practical Peripherals 2400SA V.42	199
Practical Peripherals 9600SA	459
Practical Peripherals 2400BPS	
Pocket Modem, "Credit Card Size"	99
Intel 9600 Baud with Software	499
All U.S. Robotics High Speed Models	CALL
Fax Boards	
Freecom Fax 96 Board	119
Freecom Fax 1-Liner Board	179
Intel SatisFAXtion Fax Board	379
Internal Practical Peripherals	
2400 Send/FAX	139

MONITORS

Panasonic 14" Color	
C1381 SVGA 1024 x 768 (.28mm)	\$349
C1395 SVGA 1024 x 768 (.28mm)	549
Packard Bell 14" Color	
8541VG VGA 640 x 480 (.41mm)	239
8539VG VGA 640 x 480 (.39mm)	269
8509VG VGA 640 x 480 (.28mm)	299
8538SV SVGA 1024 x 768 (.39mm)	299
8528SV SVGA 1024 x 768 (.28mm)	349
NEC Multisync Color	
2A 800 x 600/3D 1024 x 768	449/599
4D 1024x768/5D 1280x1024	999/2275
Sony 14" Color	
1304HG 1024 x 768 Multiscan	629
1320 640 x 480 VGA	449

Write for free catalog.
Prices subject to change; products subject to availability.
Not responsible for printing or typesetting errors.

RETURN POLICY—All sales are final except defectives which will be replaced with identical merchandise only. Computers and large peripherals—3 work days after delivery; most small items, 30 calendar days, after which manufacturer's warranty applies. No returns will be accepted without an RMA number. Unauthorized returns and refused shipments subject to 15% restocking charge. ALL ELEK-TEK MERCHANDISE IS BRAND NEW, FIRST QUALITY AND COMPLETE.

CORPORATE CUSTOMERS INVITED
We offer large bid opportunities. DUNS # 09-718-0517
OPEN ACCOUNTS—Net 30 terms available to D&B accounts rated 2A1 or better, actual freight charges; FOB Skokie, IL. Phone (as above) fax orders to Major Accounts 708-677-1168, mail P.O.'s (as above) to Dept. C1132.
PREPAID ACCOUNTS—Use Visa, MasterCard, check, money order (no cash or c.o.d.'s please). When ordering by mail please call in advance for shipping and handling charges. Shipments to IL add 7% tax. Minimum order \$15.00.



7350 North Linder Avenue, Skokie, Illinois 60077
800-395-1000 In IL: 708-677-7660
ET Valuline is the telemarketing and mail order department of Elek-Tek, inc.

Circle 107 on Inquiry Card.
World Radio History

Industrial PC Solutions

Reliable, Affordable and Flexible

Rack Mountable PC-Bus Chassis



- 19" chassis, 12-slot passive backplane
- Up to 4 drives, 200W UL power supply
- Dual-fan cooling with removable filter
- Security door, vibration proof hold-down clamp, dual keyboard connectors, 0 - 50° C
- Slide rail option, heavy duty steel, 19"x22"x7"

286/386/486 All-in-One CPU Cards



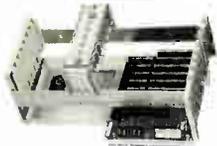
- All-in-one design: 2 serial, 1 parallel, IDE/Floppy control, 80x87 socket, speaker
- Keyboard/video enable and disable option
- 286-16: 360K ROM disk, watch dog timer
- 386-33: watch dog timer, 486DX or 486SX

Solid State SRAM/EPROM Disks



- Two drives per card, 1.44 MB per drive
- Auto bootable, DOS compatible
- On-board EPROM programming circuitry
- SRAM backed up by rechargeable battery

Card Cage, Backplane and more ...



- 8-Slot card cage with hold-down clamp
- For PC or industrial power supply
- 5-slot node chassis, 150W power supply, space for 5.25" and 3.5" drives
- 19" rack mountable monitor kit

Free 120-page reference guide for your system & OEM needs

Industrial & Lab Automation with PCs

ADVANTECH

1310 Tully Rd., San Jose, CA 95122, USA
USA & Canada: (408) 293-6786, FAX 293-4697
Other Countries: FAX 886-2-918-4566



REMOTE ACCESS

Office & Home Computers
Network/Servers • Remote Booting

- Call-in & activate computer On or Off with touch-tone code.
- 1-10 Selectable rings with answer machine compatibility.
- Increase security. Save energy. Extend hardware/disk life.
- Compatible w/all communications & remote control software.
- Additional Multi-Unit Remote Control options available.
- U.L. listed - FCC Registered - Fully Guaranteed.

\$129.95-\$4.00 9/H
24 Hour Ordering **1-800-266-1733 EXT. 140**
FAX ORDERS TO: **1-818-879-2643**
Vant Systems, Inc. 5210 Lewis Rd., Bldg. 8, Agoura Hills, CA 91301

Circle 321 on Inquiry Card.

Communications Problems?

The compact Protocol Switch™ is designed to solve special communications problems. There are 4 serial ports configurable in different ways: RS485 ports for long distance, synchronous ports for high speed and RS232 ports for IBM-PC interface. 2 parallel ports (32 bits) provide high speed bidirectional communications with the IBM-PC or standard PC printers. The Protocol Switch is easy to program with our low cost, interactive C development system. Battery backed memory, time of day clock, EEPROM. Use our box or embed the PC board in your product. Off-load PC communications using 80,000 byte per second transfer via parallel port. Applications: Change serial / parallel protocols. Implement another layer of security. Use for industrial control with our Opto 22 software support. From \$295.



4-Serial Ports
RS232 / 485

Z-World Engineering

1340 E. Covell Blvd.
Davis, CA 95616
Tel: (916) 753-3722 Fax: (916) 753-5141
Automatic Fax: (916) 753-0618
(Call from your fax, request data sheet #19.)

Circle 347 on Inquiry Card.

DEC/TEK Terminal Emulation

EM4105

- Tektronix 4105/4010/4014
- DEC VT320, VT220, VT102
- 16 color VGA/EGA support
- PostScript, HP Laserjet, plotter high resolution hardcopy
- Pan/Zoom, mouse support
- Extensive network support

EM320

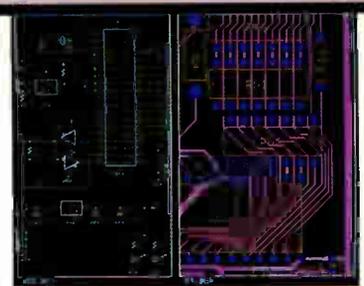
- DEC VT320, VT220, VT102
- True 132 column display
- Remappable keyboard
- KERMIT, Xmodem file transfer
- DOS hot key (only 170 Kbit)
- Extensive network support

Diversified Computer Systems, Inc.

3775 Ins Avenue, Suite 1B
Boulder, CO 80301 (303) 447-9251
FAX 303-447-1406

All Trademarks Acknowledged

Circle 100 on Inquiry Card.



New Schematic and PCB Software

With support for extended and expanded memory, HiWIRE II can handle your most demanding schematic and PCB designs quickly and easily. The unique HiWIRE editor allows you to display and edit schematics and PCBs simultaneously, using the same commands for each. HiWIRE II is \$995, and is guaranteed.



Corporation

1801 South Street, Lafayette, IN 47904
(800) 742-6809 or (317) 448-1903

Circle 337 on Inquiry Card.

Instant Microcontroller



Instant C Programming

Don't use a microprocessor, use a SmartBlock™ microcontroller module to build your custom controller. Our low cost Dynamic C™ makes programming a snap. 3.5 x 2.5 inch module includes microprocessor, memory, time/date clock, eeprom, watchdog, serial ports and more. As low as \$59 in quantity. The efficiency of a custom design without the headaches.

Z-World Engineering

1340 Covell Blvd., Davis, CA 95616 USA
Tel: (916) 753-3722
Regular Fax: (916) 753-5141
Automatic Fax: (916)-753-0618
(Call from your fax, hear computer voice, use touchtone dial to request desired data sheets.)

Circle 348 on Inquiry Card.

Data Acquisition Processor™



- Onboard Intelligence For IBM PC/XT/AT/386
- 16 MHz 80C186 for general processing
 - 20 MHz DSP56001 for digital signal processing
 - Sustained digital signal processing of 10 MIPS
 - FFT and FIR filtering without programming
 - Acquires analog and digital inputs to 235K s/s
 - Buffers and processes input data as required
 - Updates analog or digital outputs to 250K s/s
 - Over 100 commands without programming
 - Custom commands may be written in C

Call for FREE Demo Diskette

MICROSTAR
LABORATORIES™

(206) 453-2345
2265 116th Ave. N.E.
Bellevue, WA 98004
FAX (206) 453-3199

Circle 191 on Inquiry Card.

BLAST YOUR MESSAGE THRU!

VOICE SOLUTION ... \$995
(Developer, OEM Packages Available)
VISA • MC • AMEX • COD
For Sales and Information:
1 (800) 688-TALK (8255)
For Technical Assistance:
(415) 522-3800
FAX: (415) 522-5556

TALKING TECHNOLOGY, INC.
1125 ATLANTIC AVE., ALAMEDA, CA 94501

© 1990 TALKING TECHNOLOGIES INC.

Circle 362 on Inquiry Card.

MEMORY - SIMMS

FAX MODEMS

ROBOFAX

MEMORY COMPUTERS Apple, AST, AT&T, Compaq, Data General, DEC, Epson, HP, IBM, NEC, Silicon Graphics, Sun
LAPTOPS Compaq, Toshiba, Zenith
NOTEBOOKS AST, Compaq, Everex, Zenith, Panasonic, Sharp, T.I., Toshiba
PRINTERS Apple, Canon, Epson, H.P., IBM, Okidata, Panasonic

FAX MODEMS 9600bps/2400bps/Group III
External, Half-Card, & Portable
for: IBM, Macintosh, Compaq, Toshiba, Zenith

ROBOFAX FAX-ON-DEMAND SYSTEM KIT FOR PC
For Instant Price and Product Information Via
ROBOFAX
Day or Night
CALL: 1-800-424-FAXX
(Have your FAX # ready)
To Order CALL: 1-800-292-7771

ADD★ON™
AMERICA
A DIVISION OF RHYM CORPORATION
433 N. Mathilda Ave., Sunnyvale, CA 94086
Phone: (408) 746-1590 FAX: (408) 746-1593

Circle 12 on Inquiry Card.

40+ MHz Operation!

BSB486

486 Single-Board Computer

for passive backplane systems

Qty 2: \$695/ea. US (Without CPU or memory)
(Pricing includes soldered-on SIMM/SIPP sockets)

On-board features include:

- 80486 processor (DX & SX) • up to 32MB DRAM
- IDE hard disk controller • floppy disk controller
- real-time clock • 1 parallel port
- 2 serial ports • keyboard port

Inquire about our new products:

- 486SBC with added on-board VGA controller and Ethernet
- 1280 X1024 high-resolution video ctrlr with Ethernet ctrlr and optional SCSI
- EISABUS Backplanes

BECTERM
5336, Boul. de la Rive-Sud
Lévis, Qc CN G6V 4Z2
Tel: (418) 835-1551
Fax: (418) 837-4068

Circle 38 on Inquiry Card.

Version 3!

8051/8052 BASIC COMPILER

Saves Time And Money

- Compatible with all 8051 variants.
- Supports floating point, integer, byte and bit data types.
- Code runs 50 times faster than BASIC-52 interpreter.
- Flexible memory mapping options.
- Trace command for debugging.
- Improved error reporting.

\$295.00

Upgrades: Vers. 1 to Vers. 3—\$125.
Vers. 2 to Vers. 3—\$75.

603-469-3232 • FAX: 603-469-3530

Binary Technology, Inc.
Main Street • P.O. Box 62 • Meriden, NH 03770

Circle 42 on Inquiry Card.

VIDEO FRAME GRABBERS

MODEL	RESOLUTION		
HRT 256-4	256 x 256 x 4	495	
HRT 256-8	256 x 256 x 8	795	
HRT 512-8	512 x 512 x 8	995	
HRT 512-24	512 x 512 x 24	1995	

- IBM PC/XT/AT COMPATIBLE
- DIGITALIZE IN REAL TIME
- COMPOSITE VIDEO IN
- 24 BIT RGB OUT except model HRT 256-4
16 level gray scale out
- SOFTWARE LIBRARY OF IMAGE ANALYSIS ROUTINES
- FREE SOFTWARE UPGRADES TO REGISTERED OWNERS
- FULL CREDIT ON UPGRADE PURCHASE IN FIRST YEAR
RETURN OLD BOARD AND JUST PAY DIFFERENCE

HRT HIGH RES TECHNOLOGIES
P.O. BOX 76
LEWISTON, N.Y. 14092
PHONE 416-497-6493 FAX 416-497-1636

Circle 132 on Inquiry Card.

Workstations

External SCSI Drives

286/386/486, Macintosh, Silicon Graphics, Sun, IBM RS6000, VAX, NeXT...

Half Shell size 1.4"x5.5"x7.5" weight 2.5 lb
Hard Drives 20MB to 120MB

Hermit Crab size 2.8"x5.5"x7.5" weight 4 lb
with additional shock mount
Hard Drives 20MB to 120MB

A-Hive Jr size 2.2"x7.1"x7.1" weight 6 lb
Hard Drives 20MB to 400MB
Tape Drives 50MB to 600MB
Floppy Drives 720K to 3MB

A-Hive size 4.3"x9.6"x9.9" weight 11 lb
Hard Drives 20MB to 1GB
Cartridge Drive 44MB
Tape Drives 50MB to 1.3GB

Tulin Corporation Tel: 408-432-9025
2156H O'Toole Ave., San Jose, CA 95131 Fax: 408-943-0782

Circle 313 on Inquiry Card.

Lifetime FREE software updates via BBS/US Mail
Unlimited toll-free technical support in USA

CP-1128 Combination Programmer

\$1295.00

- Supports over 2,000 devices
- Manufacturer approved algorithms
- Recommended by AMD, Signetics, National, Lattice, TI
- MACH 110/210/130 • PALCE/4 EPLDs • ECL PLDs
- All 4ns and 5ns TTL standard PALs • MAPL 128
- 7ns & 10ns 22V10, 22VP10 • 7ns GALs • BiCMOS devices
- Bipolar PROMs • 8-pin serial E/EPROMs • I²C
- Microwire
- E/EPROMs and high-speed CMOS PROMs
- PIC & DSP microcontrollers
- Works under Windows • Parallel Interface • Single Executable file

Call 1-800-225-2102 for information.

BP MICROSYSTEMS
BP Microsystems, Houston, TX 77043-3239
Phone: (713) 461-9436 Fax: (713) 461-7413

Circle 48 on Inquiry Card.

SPOTLIGHT: DESIGN & DEVELOPMENT ■

Finally, attendees determined the most impressive product of the show was CAD Software's PADS.

Each vendor presented a bench... PE 81 News 6/90 on CAD Showroom Results

PADS SETS THE STANDARD

for CAE/CAD design on Personal Computers

Complete thru-put logic capture and board design functionality including:

- A true multi-sheet database for Schematic capture with hierarchical design capability
- Both automatic and interactive PCB layout tools
- Most complete set of autorouters for Analog, Digital and SMD designs
- Cam outputs including database ASCII II and ASCII Out format
- **NEW!** PADS-2000, board designs with no system limits. 1 micron database, copper pouring, T-routing. Workstation capability at PC prices!

Call today for a free demonstration package, and for your local Authorized PADS Reseller.

CAD Software, Inc. *Call today!* Inside MA: (508) 486-8929
Outside MA: (800) 255-7814
118 Russell Street, Littleton, MA 01460

Circle 57 on Inquiry Card.

Network testers now cost only \$ 179 to \$ 479

Get rid of trial and error! Now, any user and any professional can buy attractively priced testers which will find many faults in the shortest possible time. They are so easy to use, you can't fail - even if you don't use them every day.
Ask for Catalogue no. 90.

Now you can get PC interface cards with optical isolation

This is always important where high reliability and protection against varying potential levels and distant lightning strikes are required. W&T cards are compatible with normal ones, and are available for RS232, RS422 and 20mA.
Ask for Catalogue no. 50.

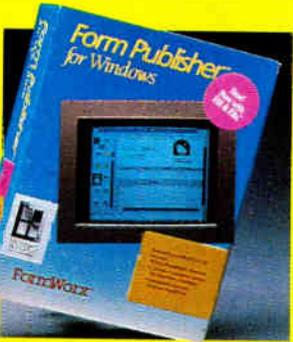
Fax enquiries to 1-305-351-9099

W&T Products Corp.
2209 NE 54th Street
Ft. Lauderdale, FL 33308
Phone 1-800-628-2086
Fax 1-305-351-9099

W&T PRODUCTS

Circle 336 on Inquiry Card.

JOIN THE COMPUTER BUYER'S CLUB™...



The Most Complete Forms Software for Windows!

Form Publisher with Fill & File combines forms design, forms fill in, and database management all in one complete package. Get the forms you want the way you

want them quickly and easily. Unique "object-oriented" design tools let you create professional quality forms fast. Just piece together ready-made form parts like address labels, lists, and grids. Powerful test features allow you to place text of any type style or size anywhere on your form. Advanced graphics and scanning features let you add logos and signatures to your form. You can even generate bar codes.

You may never again have to design your own forms from scratch, because the forms you need may already be included in Forms-on-Demand (FOND)™. Included with Form Publisher with Fill & File, FOND™ is a collection of over 600 forms on disk, ready for you to print or modify with the click of a mouse.

Fill in the forms you create with Form Publisher or any pre-printed form you already have. Simply tab from blank to blank and type in your information. Even better, use multiple data files simultaneously to enter information for you. For example, type in a part number and the description and price will automatically be entered. There are also many validation and math features to guarantee accurate completion of your forms. Best of all, your information is being stored to a standard database file that's directly read/write compatible with dBASE. And with many powerful built-in relational database base management features, you'll be able

to manage your data more conveniently than ever before!

Form Publisher with Fill & File

by *Form Worx*

LIST: \$195
CLUB: \$109 MEMBERS ONLY

MAX Finds Additional Memory When You Need it Most

Running Windows, TSRs, LANs, even Lotus stretches the limits of your machine's memory. 386MAX and BlueMAX automatically free up space to run big applications by relocating memory-resident software into unused regions of address space in high DOS. MAX intelligently calculates the thousands of ways to put your network shells, pop-up utilities and device drivers into high DOS, and then arranges them for the best possible fit.

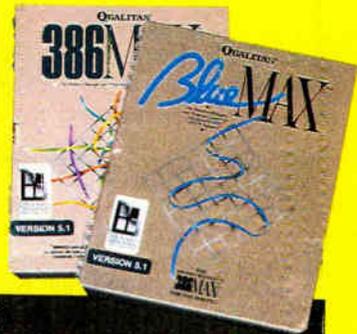
386MAX serves 386 and 486 machines, while BlueMAX serves 386- and 486-based PS/2 systems. BlueMAX recovers an additional 80-84K of contiguous high DOS memory space using exclusive BIOS compression technology. Order MAX now and we'll include a copy of ASQ, Qualitas' memory management tutorial and system analyzer, free of charge!

386MAX BlueMAX

by *Qualitas*

386MAX/BlueMAX

LIST: \$130/\$155
CLUB: \$65/\$78 MEMBERS ONLY



Create Flow-Charts, Data-Flow Diagrams, and Organization Charts..With Ease!

In any business there are processes and procedures that must be documented.

EasyFlow is a powerful program dedicated to the fast creation of flowcharts, data-flow diagrams and organization charts. EasyFlow 7.0 offers full-color support, global search and replace, automatic line routing, 3-D charting, and supports Novell as well as over 270 output devices.

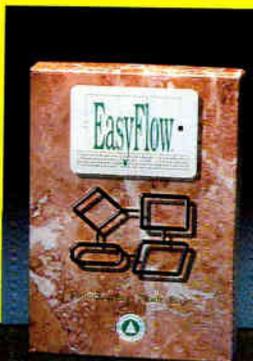
EasyFlow's wide range of supported products allows for easy integration of charts into larger documentation.

Alternate shape libraries for accounting diagrams, networking diagrams, and fault-tree diagrams expand the usefulness of the program and are also available.

EasyFlow

by *HavenTree*

LIST: \$230
CLUB: \$162 MEMBERS ONLY



SAVE MONEY, SAVE COMPUTER BUYER'S





\$450 OFF!

Develop Database Applications in Minutes... For Just \$99

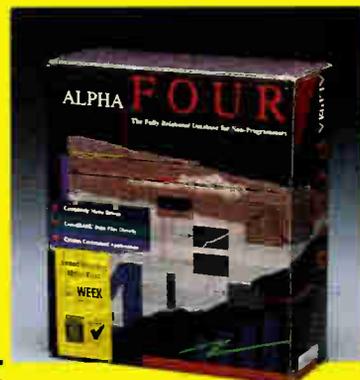
Creating custom database applications is an intimidating task to most users. But sooner or later every user discovers the overwhelming need to tap into the potential of a powerful database system. With Alpha FOUR users at every skill level can develop applications in minutes.

The key to Alpha FOUR's ease of use is its menu-driven interface, arranged in an intuitive and logical manner. Alpha FOUR lets you create custom help screens and lookup tables so that data entry is a breeze. You can design custom forms, reports and labels with a WYSIWYG (what you see is what you get) layout editor. And Alpha FOUR's report writer helps you produce sophisticated reports everyone can understand.

Because Alpha FOUR is a relational database, you have the power to link up to 10 related databases in a relational set. Each database in the set can have multiple relationships and automatically handle one-to-many links.

With sets, you can solve any data management problem easily.

Alpha FOUR uses the identical file structure as dBase and FoxBase, and imports/exports a multitude of other formats, such as Lotus 1-2-3. Sharing data is a snap! Imagine a non-programmer writing custom database applications that read, link and report dBase files! Become the database expert you always wanted to be with Alpha FOUR.



Alpha FOUR

by Alpha Software

LIST: \$549
CLUB: \$99* MEMBERS ONLY

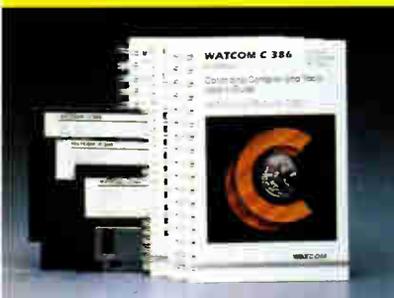
*This is a competitive upgrade offer. To qualify you must have any database software, integrated package, mail list manager or spreadsheet used as a data manager. Call for complete list of packages that qualify you for this upgrade. Regular Club price is just \$295.

Unleash 386 Power on Your Microsoft C Code with WATCOM C8.0/386!

WATCOM's C compilers for 386 Extended DOS has won high praise from industry's experts. According to *Computer Language*, "WATCOM is definitely the leader in object-level optimization... for flat-out speed WATCOM C showed shining performance."

"If You're Writing Applications in Microsoft C, You'll Love This Compiler!" That's how J. Richard Hines described

WATCOM C/386 in *Electronic Test* magazine. WATCOM C8.0/386 offers interactive source-level debugger, generates high-performance code for 32-bit protected mode, and is 100% ANSI C and SAA compatible.



WATCOM C8.0/386

by WATCOM

LIST: \$1295
CLUB: \$975 MEMBERS ONLY

WHAT IS THE COMPUTER BUYER'S CLUB?
 The Computer Buyer's Club offers members an incredible selection of PC products at wholesale prices. We don't mark up prices. Club members get the same low prices that a reseller gets. And if we don't have it at the lowest price we'll tell you who does. Join the Computer Buyer's Club now and enjoy wholesale prices today!

TIME, SAVE THIS AD. THE CLUB™ HAS THE LOWEST PRICES. ANYWHERE.

GET IT AT OUR LOW WHOLESALE PRICES. JOIN THE COMPUTER BUYER'S CLUB.™ CALL 1-800-732-3698

.RTPatch Lets You Update Any Type of Software File by Sending Only the Changes

Updating files or systems to new versions of a program takes time. Instead of replacing whole programs or systems, .RTPatch updates files or entire systems by sending *only* the changes. By comparing the old version of a file (or set of files) to the new version, .RTPatch creates a small patch file that contains just the differences. This patch file is then sent to the end user to change their old version into the new one... quickly and easily.

Patches typically are very small and therefore use a minimum of disk media or bulletin board time. Patches are also very easy to create and apply, thus taking the hassle out of updating. Also, by posting patches on public bulletin boards you don't have to fear theft, since the patch is useless if the user doesn't have an original copy of the program.

.RTPatch works with MSDOS, OS/2 and Windows, and comes with a full 45-day, no-risk, money-back guarantee direct from PocketSoft.



.RTPatch

by PocketSoft

LIST: \$495
CLUB: \$295 MEMBERS ONLY

THE
 COMPUTER BUYER'S CLUB

MEMBERSHIP GUARANTEE

If you are dissatisfied for any reason, your membership dues will be completely refunded within the first 90 days.

No questions asked.

Computer Buyer's Club

70 Walnut Street

Wellesley, MA 02181.

• For International FAX inquiries: 617-739-7412

• Visa, Mastercard and AMEX accepted.

• Your credit card will not be charged until your order is shipped.

• Purchase orders subject to credit approval.

• All sales final. Defective software replaced immediately. Returns subject to restocking fee.

• MA residents add 5% sales tax.

• Item availability and price subject to change without notice.

• \$35 annual membership fee.

• International memberships available.

• \$11 shipping and handling charge on all orders within continental US. Call for express and international freight charges.

• Actual freight charges apply for hardware.

• COD - \$5 per order.

• Please indicate disk size.

© 1991, Computer Buyer's Club Inc.

1
 800
 732-3698

GET A **FREE TRIAL** MEMBERSHIP



Look What Club Members Pay!

	LIST	CLUB
Pagemaker 4.0/Win	795	468
dBase IV	795	452
Toolbook	395	279
Paradox 3.5	795	459
CorelDRAW 2.0	695	368
Procomm Plus 2.0	119	59
Fastback Plus	189	165
IBM Current	395	212
Lotus 1-2-3 3.1	595	390
Excel for Windows	495	285
MS Compiler 6.0	495	285
Word for Windows	495	285
Clipper 5.0	795	468
QEMM 386 5.11	100	55
Norton Utilities 5.0	179	105
WordPerfect 5.1	495	237

CLUB MEMBERSHIP BENEFITS:

1. Low wholesale prices - the same prices that a computer reseller gets without the retail markup.
2. **FREE**, unlimited access to the Computer Buyer's Club's state-of-the-art *PriceLine* shopping database. We track the prices of over 500 of the most popular PC products.
3. 24 hour/day automated ordering service.
4. **FREE** pricing information available via fax or Compuserve.
5. **FREE** directory of over 5,000 hardware and software products.
6. **FREE** demo programs.
7. **FREE** discount coupons to software, magazines, journals, newsletters, training seminars, trade shows, and more!
8. **FREE** *HotSheet* of competitive upgrades, special offers and discounted products mailed to members throughout the year.
9. A money-back guarantee if you are not satisfied with the Club at anytime within the first 90 days. No questions asked!

9 REASONS TO JOIN THE COMPUTER BUYER'S CLUB™

EDITORIAL INDEX BY COMPANY

Index of companies covered in articles, columns, or news stories in this issue
Each reference is to the first page of the article or section in which the company name appears

Company, Page # Inquiry #

A

A.R.C. Software, 88 1307
Abacus Software, 153, 349 1473
Abooft, 78 1300
Access Softek, 153 1474
ACE, 117
Acar America, 48 1284
Action Technologies, 250 1400
Ad Lib, 349
Adobe Systems, 52, 153, 315 1286
1452
Advanced Micro Devices, 25
AFCAD Systems, 245 1168
AimTech, 88 1313
Alia Systems, 153 1069
Aldus, 153 1453
American Magnetics, 349
American Mitac, 25, 285 1225
Apple Computer, 25, 38, 117, 207, 293, 315, 337, 347 1149
Applied Digital Data Systems, 245
Applix, 245 1170
Aquarius Systems, 25
Aquiline, 60 1274
Artificial Linguistics, 310
Artisoft, 74, 110 786

Asanté Technologies, 337
ASD Software, 250 1223
Ashton-Tate, 25 1294
Asia Communications, 89 1148
ASP Computer Products, 70 1401
AST Research, 117 1186
AT&T Computer Systems, 227, 245
AT&T's Bell Laboratories, 233 1171
Atari, 329
ATI Technologies, 62 1280
Attachmate, 153 1467
Avatar, 25
Axia, 349

B

Banyan Systems, 227
Barco, 207
Bell Atlantic, 89, 215 1184
Bell Atlantic Software Systems, 153
Bitstream, 279, 315 1446
Blake Technologies, 245 1221
BLOC Publishing, 153 1172
Blyth Software, 153 1451
1438
Borland International, 25, 153, 279 1228
1447
British Standards Institute, 147
Brown-Wagh Publishing, 349
Bull HN Information Systems, 245 1173

C

Cabletron Systems, 215
Cadence Design Systems, 25
Cadre Technologies, 25 1402
Campbell Services, 250 1475
Central Point Software, 153
Centrex, 215
Centronics, 40
Chinon America, 268 1231
Chips & Technologies, 25
Chronos Software, 250 1403
Cirrus Logic, 25
Citizen America, 81 1275
Claris, 82, 117, 347 1306
Clarity Software, 25
CMS Enhancements, 81 1279
CNS, 345
COM1 Data Communication, 74 1297
Compaq Computer, 117, 227
Computer Associates
International, 153 1456
1457

Computer Elektronik Infosys
of America, 62 1282
Computer Support, 153 1455
Computron Technologies, 245 1174
Cornell, 82 1304
Corel Systems, 89, 153, 268 1155
1459
Coromandel Industries, 153 1439
CoStar, 349
Crescent Software, 89 1157
Cross Communications, 310 783
Crosstalk Communications/DCA, 153 1468
CrossWind Technologies, 250 1404
Cubix, 310 782
Cumulus Computer, 60 1271
Customized Software Support, 245 1175
Cyma, 78 1302
Cynix, 25

D

Data Access, 250 1405
DataBased, 245 1178
Data General, 245 1177
Datapoint, 245 1178
DEC, 117, 135, 147, 207, 215, 227, 233, 245 1181
Decathlon Data Systems, 245 1179
Deerfield Systems, 245 1180
Defense Advanced Research
Projects Agency, 233
Dell Computer, 117, 227
Denon, 349
Department of Defense, 147
DeScribe, 153 1431
Digital Communications
Associates, 25, 153 1469
1470
Digital Research, 329
Dimensional Reasoner, 78 1303
DMA, 310 785
Doctor Design, 88 1309
DPEC, 245 1182
DRI/McGraw-Hill, 25

E

East Hampton Industries, 245 1183
Editor's Choice Software, 349
EDP System Services, 245 1184
Educational Computer Services, 89 1182
Eighteen Eight Laboratories, 62 1283
Electric Image, 302
Enable Software, 245, 250 1185
1406
Epoch Systems, 215
Epson, 315, 349
Everex Systems, 285 1226
Evolution 1, 245 1186
Exxon, 117

F

Farallon Computing, 337 1150
Fifth Generation Systems, 88 1311
Financial Technologies, 245 1187
Frame Technology, 54 1287
Future Soft Engineering, 25, 153 1466
Futurus, 250 1407

G

Gates Rubber, 227
Gateway Microsystems, 293
Generic Software, 110 1222
Genesis Development, 345
GenSoft Development, 153 1440
GetC Software, 153 1073
Gibson Research, 89 1163
GigaTrend, 74 1285
Gilbert & Associates, 245 1189
Go, 25
Gupta Technologies, 227

H

Hammerlab, 349
hDC Computer, 153 1070
1476
1477
1478
Hewlett-Packard, 25, 38, 70, 135, 245, 268, 315, 329, 349 1190
1292
1232
Hitachi Home Electronics, 268
Honeywell, 215

I

IBM, 25, 38, 117, 135, 147, 153, 207, 215, 227, 233, 245, 285, 293 1191
1227
1430
1460

J

ICL Business Systems, 245 1192
IIS Technologies, 245 1193
ImageSoft, 345
Impact Software, 245 1194
Imai, 88 1310
Information Management
Consultants, 245 1195
Informix Software, 153 1448
Inner Media, 245 1196
Inteck, 245 1197
Intel, 25, 135, 227, 329
InterActive, 74 1296
Interactive Development
Environments, 25

K

JAM Software USA, 245 1198
JVC, 349
King Phoenix, 25 1264
Kingston Technology, 62

L

Langsoft, 310 787
LANshark Systems, 245 1199
LaserMaster, 61 1278

Lodestar Systems, 245 1200
Logical Technology, 245 1201
Long Shine Electronics, 25
Lotus Development, 25, 82, 153, 245, 279 1202
1229
1305
1432
1449

M

MacroMind, 302, 347 980
MarketCorp Systems, 245 1203
Matsushita Electric, 25, 233
Maxell, 349
Maxtor, 89 1187
MCI, 122
MDBA, 153 1442
Medline Service, 245 1204
Merasoft, 153 1071
Metaphor Computer Systems, 25
Metz Software, 153, 245 1072
1205
1479
1206
1454
1148
1293
1458
1461
1308
Micro Perfect, 245
Micro Synergy International, 153
Microcom, 70, 337
Micrografx, 153
MicroSim, 86
Microsoft, 25, 38, 89, 117, 147, 153, 250, 268, 315, 325 1185
1289
1408
1433
1450
1482
1409
784

Microsystems Software, 250
Microtest, 310
Mips Computer Systems, 135, 233
MIT, 122
Mitratch, 245 1207
Mitsubishi, 207
Mitsubishi Electronics
America, 81, 245 1206
1276
1277
1298
781
1209
1224
1210

Mitsubishi International, 81
Mobius Computer, 74
Motorola, 25, 40, 135, 227, 310
Motorola Commercial Systems, 245
MultiScope, 297
Myrick Computer Services, 245 1210

N

National Computer Security
Association, 349
National Science Foundation, 233
NBI, 153 1434
NCR, 25
NEC, 233, 302, 329
NEC America, 245 1211
1211
1230
1230
1221
Office Automation Systems, 245 1213
1214
1410
1289
Onset Computer, 66
Oracle, 227

O

On Technology, 245, 250
Onset Computer, 66
Oracle, 227

P

Pacific Data Products, 66 1267
Packard Bell, 60 1273
Palfsoft, 245 1215
Panasonic, 25, 349
Parascomp, 302
Parallan Computer, 227
Peat Marwick, 227
Perceptive Solutions, 89 1159
Peripheral Land, 268 1233
Phase II Software, 250 1411
Phoenix Technologies, 329
Pioneer Communications of
America, 89, 268 1156
Pixar, 25
PK Partners, 122
Poquet Computer, 329
Power Up Software, 245 1216
PowerCore, 250 1412
Prime Computer, 245 1217
Princeton University, 233

Q

QMS, 25
Qualitas, 10
Quantum Leap, 62 1281
Quarterdeck Office Systems, 10

R

R + R Associates, 250 1413
Raima, 153 1444
Ramus from Beyond, 207
Ray Dream, 337 1147
RCA, 268
Revelation Technologies, 227
RIX SoftWorks, 153 1465
Russell Information, 245 1200

S

Sabre Software, 25
Sandata, 245 1219
Seagate, 25
Shiva, 70 1291
Skidereal, 245 1220
SIIG, 60 1272
Silicon Graphics, 40, 135 1270
Software Business Applications, 245 1250
Software Design & Consulting, 245 1251
Software Products International, 153 1445
Software Publishing, 153 1435
1443
1205
1479
1206
1454
1148
1293
1458
1461
1308
Sun Microsystems, 25, 135, 268
SunSoft, 25 1185
Supermicro Business Systems, 245 1256
SuperTime, 245, 250 1257
1414
1450
1482
1409
784

Symantec, 50
Synoptics, 215
Systems Solutions, 245 1258

T

T/Maker, 89 1154
Target Systems, 245 1259
TDK, 349
Technion, 122
Technologia Systems, 66 1285
Tecmar, 349
Teletit, 341
Taxal America, 268 1234
32 Bit Software, 78 1301
Thomas-Conrad, 293
Three-Sixty, 89 1158
Tidemark, 349
Toshiba, 25, 268
Toshiba America Information, 268 1235
Traveling Software, 43, 153 1074
1153

Tricord, 227
Truvision, 302
Turner Construction, 227

U

UMI, 268
Unisys, 245 1260
University of California
at Berkeley, 233
University of Illinois, 233
UserLand Software, 56 1266

V

V Communications, 10
Valid, 25
VentanaWorks, 153 1484
Vertex Industries, 349
VideoLogic, 302
Virtus, 347
Voyager Systems, 245 1261

W

Wall Data, 153 1472
Walt Disney Studios, 25
Wang Laboratories, 245 1262
Western Digital, 293
Wilson WindowWare, 153 1068
Within Technologies, 78, 89 1160
1299
WordPerfect, 153, 245, 250 1263
1415
1436

WordStar International,
153, 349 1437

X

Xerox, 122
Xerox Palo Alto Research
Center, 207, 233

Z

Ziff-Davis, 268
Zihua Software, 88 1312
ZSoft, 153 1463

READER SERVICE

ALPHABETICAL INDEX TO ADVERTISERS

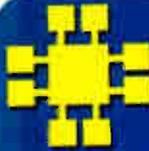
Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.
402	35T-USA	8818-85	429	DAN TECHNOLOGIES	8818-8	290	LANDMARK RESEARCH
8	3M COMPANY	35	67-88	DATA ACCESS	211	480	INT'L CORP
10-11	3M COMPANY	181	691-592	DATACARD	8818-7	158	LANTECH
360	ACER (INT'L)	344	583-594	DATATRANS SYSTEMS	8818-23	563-564	LAWSON LABS
12	ADD ON AMERICA	379	660-670	DATATRANS SYSTEMS	8818-19	590-600	LIANT SOFTWARE CORP
363	ADVANCED MICRO DEVICES	283	430	DATATRONS TECHNOLOGY	8818-89	635-636	LIANT SOFTWARE CORP
403	AGC	8818-77	89	DCA	159	675-676	LIANT SOFTWARE CORP
	ALADDIN KNOWLEDGE SYS	8818-1000-H	90-91	DELL COMPUTERS (N.A.)	CMI	350	LIFEBOAT SOFTWARE
404	ALADDIN KNOWLEDGE SYS	8818-43		DELL COMPUTERS (N.A.)	CIV	169	LINK COMPUTER GRAPHICS
27	ALPHA PRODUCTS	354	92	DELL COMPUTERS	392A-B	170	LITTON
13-14	ALR	2	92	DELTA TECHNOLOGY INC	179	461-462	LONGSHINE ELECTRONICS
405	AMDS LTD	8818-82	359	DELTA ELECTRONICS (INT'L)	111	172	LOTUS DEVELOPMENT CORP
15	AMERICAN ADVANTECH	378	557-558	DERBYTECH COMPUTERS	8818M-24	565-566	LUCKY COMPUTER
18-17	AMERICAN COMP TECH	366	671-672	DERBYTECH COMPUTERS	8818-24	602-603	LUCKY COMPUTER
18-19	AMERICAN MEGATRENDS	285	93	DESCRIBE, INC	185	638-639	LUCKY COMPUTER
20	AMERICAN MITAC	134	94-95	DESIGN SCIENCE	180	677-678	LUCKY COMPUTER
21-22	AMERICAN POWER CONV	202, 232		DEXPO/FALL	8818-12	174	LYBRO SOLUTIONS
23	AMERICAN RELIANCE, INC	378	431	DIGITAL	8818-28	604	MANCHESTER EQUIP
24	AMERICAN SMALL BUSINESS	143	98	DIGITAL VISION	98		MARK WILLIAMS
25	AMT INT'L	366	432	DIGITALX	148	356-357	MATHEMATICA, INC
26	ANNABOOKS	350	98-99	DISTRIBUTED PROCESSING	231	177	MATHSOFT
	ANTHRO CORP (N.A.)	106	100	DIVERSIFIED COMPUTER	378	640-641	MAXIMUM STORAGE
406	ASC INT'L GROUP	8818-47	101	DOLCH COMPUTERS	51	160	MCS COMPUTERS
27	ADP	338	433	DORR COMMUNICATIONS	8818-5	181-182	MERASOFT
622-623	APPLE COMPUTER	8, 9		DSI INNOVATIVE ELECTRONIC	8818-84	183	MERRIDIAN DATA, INC
	SIMULATION	8818-20	102	DTK COMPUTER, INC	209	184	MERRIMACK VALLEY SYSTEMS
28	ARTISOFT	104	103-104	DYNALINK TECHNOLOGIES	201	185	MERRITT COMPUTER PROD
29-30	ASHTON-TATE	76, 77	105-106	ECLIN TECHNOLOGY	351	642	METAWARE
31	ASP COMPUTER PRODUCTS	44	107	ELEK-TEK (N.A.)	377	693	MH-HEALTH LETTER (INT)
407	ATICO	8818-52, 53	108	ELEX INTERNATIONAL	8818-22	561	MICRO LETTER (INT)
32-33	AUTOMATED COMP TECH	322	436	ELEX INTERNATIONAL	8818-22	618	MICRO SOLUTIONS
663-664	AUTOSOF	8818-18	109	ELEXOR, INC	378		COMPUTER PROD
34-35	AVIEW TECHNOLOGY	160	110	ELOGRAPHICS	201	618	MICRO SOLUTIONS
38	AVOCET SYSTEMS	372	595-596	EMPOWER MICRO	8818-12		COMPUTER PROD
53	B&B ELECTRONICS	378	437	ESIX COMPUTER, INC	8818-25	650	MICRO SOLUTIONS
54-55	B&B MICROSYSTEMS	371	438	EUTRON	8818-40	693	MICRO SOLUTIONS
56	B&B MICROSYSTEMS	373	439	EVERGREEN TECH, INC	8818-40	187	MICRO SOLUTIONS
57	BAER SOFTWARE	379	112	FAIRCUM	324		COMPUTER PROD
38	BECTERM, INC	63	113	FALCO DATA PRODUCTS	295	188	MICROGRAFX, INC
39	BERKELEY SYSTEMS, INC	172	430	FAST ELECTRONIC GMBH	8818-67	189	MICROPOLIS
40	BEST DATA PRODUCTS	175	440	FIRST INT'L COMP	8818-45	190	MICROPROCESSORS UNLTD
41	BEST POWER TECH	354	114-115	FIRST SOURCE INTERNATIONAL	373		MICROSOFT
	BEST POWER TECH	8818-1000-C	116	FLYTECH TECHNOLOGY	71	191	MICROSTAR SYS JOUR
42	BINARY TECHNOLOGY	379	117	FRONTIER TECHNOLOGIES	187	192-193	MICROSTAR LABS
410	BISOFT	8818-90	351-352	FTP SOFTWARE (INT'L)	287	349	MICROTECH
450	BIX	168, 167	650-660	FUJIKAMA USA, INC	8818M-16		MICROWAY
	BIX	314	441-442	GAIN SYSTEMS	8818-86		MICROWAY
450	BIX (INT'L)	112, 113	116	GALACTICOMM	378		MICROWAY
43	BLACK & WHITE INT'L	240		GATEWAY 2000	88A-D		MICROWAY
411	BLUE CHIP	8818-85		GATEWAY 2000 (INT'L)	CMI, CIV	454	MINOLTA INTERNATIONAL
44-45	BOFFIN LTD	294		GATEWAY 2000	8818-32, 33	194-195	MITSUBISHI
46-47	BORLAND INT'L	11	119	GCOM, INC	372	196	MIX SOFTWARE
48	BP MICROSYSTEMS	379	120	GENERIC SOFTWARE	305	465-467	MYOTOLAUDS
412-413	BTC	8818-37	121	GFA SW TECH	162	587	MYODA, INC
414-415	BTC	8818-39	443	GFK HAMBURG GERMANY	8818-31	679-680	MYODA, INC
399	BUFFALO PRODUCTS (N.A.)	226	631-632	GIT CO, LTD	8818-23	197-198	NAJAO
40-50	BUREAU OF ELECTRONIC PUBL	90	122	GLENCO ENGINEERING	285	199	NANTUCKET
	BUYERS MESSAGE	36	123	GLOBAL ELECTRONICS	387	200-201	NATIONAL DESIGN
	BYTE BACK ISSUES	8818-78	444	GROUP MATTER	8818-69		NATIONAL INSTRUMENTS
	BYTE BACK ISSUES	368	597-598	GROUP 1 SOFTWARE	8818-16	202	NATIONAL INSTRUMENTS
416	BYTE BITS	8818-88	633-634	GROUP 1 SOFTWARE	8818-16	203	NATIONAL INSTRUMENTS
	BYTE PUBLICATIONS	8818-41	125-126	GTEK, INC	108	204	NATIONAL INSTRUMENTS
52	BYTE PUBL/DEMOLINK (INT'L)	115	127	GUI CLEARING HOUSE	333	205	NATIONAL INSTRUMENTS
	BYTE SUB MESSAGE	8818-80	448	HANTARE	8818-17	206	NATIONAL INSTRUMENTS
	BYTE SUB MESSAGE	338	128	HAUPTPAUGE COMPUTER	57	207-208	NEC TECHNOLOGIES
	BYTEWEK/NEWSLETTER	114	353	HELIOS USA	342	209	NEC TECHNOLOGIES
	C GAZETTE MAGAZINE	8818-1000-D	129	HEWLETT-PACKARD	378	210	NEC TECHNOLOGIES
	C USERS JOURNAL	8818-1000-H		HEWLETT-PACKARD NETWORKED PRODUCTS	191	211	NEC TECHNOLOGIES
57	CAD SOFTWARE, INC	379	130	HEWLETT-PACKARD PERIPHERALS GR	46, 47	212	NEC TECHNOLOGIES
58	CAPITAL EQUIPMENT	222	131	HEWLETT-PACKARD PERIPHERALS GR	322, 323	213	NEC TECHNOLOGIES
59	CAPITAL EQUIPMENT	223	132	HIGH RES TECHNOLOGIES	379	214	NEC TECHNOLOGIES
60-61	CARRIER CURRENT TECH	240	673-674	HI-COMPUTER	8818-16	215-216	NEC TECHNOLOGIES
416	CATHAY COMP & TECH	8818-94	133	HOOLEON	354	217	NEC TECHNOLOGIES
62	CENTRAL POINT SOFTWARE	98	134	HORSTMANN S/W DESIGN	282	218	NEC TECHNOLOGIES
63	CENTRAL POINT SOFTWARE	84, 85	446	H.R. BOYNTON CO, INC	8818-97	219	NEC TECHNOLOGIES
64-65	CHI PRODUCTS	177	449	IBC DATA	8818-73	220	NEC TECHNOLOGIES
358	CHINON AMERICA, INC	263	135	IBM PS/2 386	28, 29	221	NEC TECHNOLOGIES
419-420	CLARION SOFTWARE	8818-11	136	IBM - HOLLYWOOD	23	222	NEC TECHNOLOGIES
	CLEARING HOUSE	364	137	ICL	282	223	NEC TECHNOLOGIES
67	COMP ASSOC (SUPER CALC)	31	446	IDIOMA / I-COM	8818-85	224	NEC TECHNOLOGIES
68	COMP ASSOC (SUPER PROJECT)	49	138	IYAMA	221	225	NEC TECHNOLOGIES
	COMPAQ COMPUTER	12, 13	139	INDUSTRIAL INFO INDEX	232	226	NEC TECHNOLOGIES
421-422	COMPEX	8818-65	140-141	INEX TECHNOLOGY INT'L	8818-38	227	NEC TECHNOLOGIES
423	COMPEX INTERNATIONAL	8818-87	142	INFINITE POSSIBILITIES	201	228	NEC TECHNOLOGIES
424	COMPUCLASSICS	8818-14	143-144	INTEGRATED INFO TECH	53	229	NEC TECHNOLOGIES
48	COMPUCLUB	364	145-146	INTEL	101	230	NEC TECHNOLOGIES
425	COMPUSAVE	8818-63	147-148	INTEL	38, 37	231	NEC TECHNOLOGIES
69	COMPUTER BUYERS CLUB	380-382	149-150	INTEL	80, 81	232	NEC TECHNOLOGIES
70	COMPUTER FRIENDS, INC	316	151	INTEL CORP	8818-59	233	NEC TECHNOLOGIES
426	COMPUTER QUICK	8818-8	451-452	INTERSYS	8818-61	234	NEC TECHNOLOGIES
	COMPUTER SOLUTIONS NW	8818-1000-F	152	IN-FOCUS SYSTEMS	129	235	NEC TECHNOLOGIES
71	COMPUTER SPECTRUM	369	153	IO TECH	372	236	NEC TECHNOLOGIES
	COMP SUPPORT CORP	164A-B	154-155	IOMEGA	188, 187	237	NEC TECHNOLOGIES
72	COMPUTER SUPPORT CORP	160	156-157	IVERSON TECH	237	238	NEC TECHNOLOGIES
73	COMPUTERLANE	370	453	IXI LTD	8818-48	239	NEC TECHNOLOGIES
	COMP/BYTE BOOK CLUB	312, 313	454	JAMCO	8818-13	240	NEC TECHNOLOGIES
	COMP/BYTE BOOK CLUB	312A-B	455	JANDEL SCIENTIFIC	8818-17	241	NEC TECHNOLOGIES
554-555	COMTRADE	8818M-15	456	JC INFO SYSTEMS	8818-17	242	NEC TECHNOLOGIES
558-589	COMTRADE	8818-5	6-7	JDR MICRODEVICES	367	243	NEC TECHNOLOGIES
625-626	COMTRADE	8818-19	457	JEAN'S KINGDOM	8818-10	244	NEC TECHNOLOGIES
668-669	COMTRADE	8818-3	458	JEN ELECTRONICA	8818-57	245	NEC TECHNOLOGIES
428	CONTROL TELEMETRY	8818-94	480	JOAN DENT CO	8818-54	246	NEC TECHNOLOGIES
74	CONTROL VISION	378	486	KEDWELL S/W EUROPE	8818-58	247	NEC TECHNOLOGIES
	COPIA INTERNATIONAL LTD.	272	161	KEITHLEY METRABYTE	371	248	NEC TECHNOLOGIES
78-78	CORE INTERNATIONAL	218, 217	162	KILA	376	249	NEC TECHNOLOGIES
77-78	COREL SYSTEMS	273	163-164	KINGSTON	180	250	NEC TECHNOLOGIES
79-80	COREL SYSTEMS	189	459	KUO FENG CORPORATION	8818-96	251	NEC TECHNOLOGIES
81-82	CORTIS, INC	220	185	KUSTEM DATA SERVICES, INC	371	252	NEC TECHNOLOGIES
83	CURTIS, INC	220	186	LAGUNA DATA SYSTEMS	372	253	NEC TECHNOLOGIES
84	CYBER RESEARCH	354	167	LAHEY	220	254	NEC TECHNOLOGIES
556	CYBEX CORP	8818M-4					
590	CYBEX CORP	8818-4					
627	CYBEX CORP	8818-4					
668	CYBEX CORP	8818-8					
85	CYBEX CORPORATION (INT'L)	226					
88	CYRIX	21					

To get further information on the products advertised in BYTE, fill out the reader service card by circling the numbers on the card that correspond to the inquiry number listed with the advertiser. This index is provided as an additional service by the publisher, who assumes no liability for errors or omissions.

*Correspond directly with company.

INDEX TO ADVERTISERS BY PRODUCT CATEGORY

Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.
HARDWARE							
926	ADD-INS	659	MICRO SOLUTIONS COMPUTER PRODUCTS 88PC-17	90	DELL COMPUTERS (N.A.)	181	KEITHLEY METRABYTE 371
12	ADD ON AMERICA 379	693	MICRO SOLUTIONS COMPUTER PRODUCTS 88SO-9	91	DELL COMPUTERS (N.A.) CIV	290	LANDMARK RESEARCH INTERNATIONAL CORP 343
15	AMERICAN ADVANTECH 378	189	MICROPOLIS 232A-B	857-858	DERBYTECH COMPUTERS 88MW-4	465	MKS 88IS-2
16-19	AMERICAN MEGATRENDS 285	215-216	ONLINE COMP SYS 110	871-872	DERTECH COMPUTERS 88SO-24	203	NATIONAL INSTRUMENTS 15
38	BECTERM, INC 379	217	OVERLAND DATA 364	51	DOLCH COMPUTERS 51	214	NU-MEGA TECHNOLOGIES 299
58	B&C MICROSYSTEMS 83	261	QUALSTAR CORPORATION 372	102	DTK COMPUTER, INC 209	222	PATTON & PATTON 399
54-55	B&C MICROSYSTEMS 371	281	SONY (N.A.) 287	595-596	EMPOWER MICRO 88NE-12	282	SPECTRUM SOFTWARE 389
58	CAPITAL EQUIPMENT 222	215-216	OVERLAND DATA 364	113	FALCON DATA PRODUCTS 88IS-45	283	SPSS, INC 289
59	CAPITAL EQUIPMENT 223	217	OVERLAND DATA 364	44	FIRST INT'L COMP 88IS-45	284	STATSOFT 119
74	CONTROL VISION 378	261	QUALSTAR CORPORATION 372	116	FLYTECH TECHNOLOGY 71	291-293	SYSTAT, INC 151
88	CYRIX 21	281	SONY (N.A.) 287	559-560	FUJIKAMA USA, INC 88MW-16	334	VLEERMUIS SFTW RSCH BV 238
431	DIGICOM 88IS-88	281	SONY (N.A.) 287	441-442	GAIN SYSTEMS 88IS-86	337	WATCOM PRODUCTS, INC 87
96	DIGITAL VISION 350	281	SONY (N.A.) 287	442	GATEWAY 2000 (INT'L) CH, CIV		WINTEK CORPORATION 378
98-99	DISTRIBUTED PROCESSING 231	281	SONY (N.A.) 287	442	GATEWAY 2000 88A-D	945	IBM/MSDOS APPLICATIONS— Miscellaneous
443	GFK HAMBURG GERMANY 88IS-31	281	SONY (N.A.) 287	673-674	HI-COMPUTER 88SO-16	49-50	BUREAU OF ELECTRONIC PUBL 90
631-632	GIT CO, LTD 88PC-23	281	SONY (N.A.) 287	135	IBM PS/2 386 28, 29	110	LOGGRAPHICS 201
125-126	GTEK, INC 108	281	SONY (N.A.) 287	487	INTERQUAD 88IS-75	145-148	INTEL 101
128	HAURPAUGE COMPUTER 57	281	SONY (N.A.) 287	451-452	INTERSYS 88IS-81	842	METAWARE 88PC-5
132	HIGH RES TECHNOLOGIES 379	281	SONY (N.A.) 287	156-157	IVERSON TECH 237	270	ROYKORE 168
143-144	INTEGRATED INFO TECH 53	281	SONY (N.A.) 287	457	JEN ELECTRONICA 88IS-57	277-278	SOFTWARE WORKSHOP 190
149-150	INTEL 80-81	281	SONY (N.A.) 287	162	KILA 375	289	STRATEGIC MAPPING 55
153	IO TECH 372	281	SONY (N.A.) 287	604	MANCHESTER EQUIP 88NE-16A-B	948	IBM/MSDOS APPLICATIONS— Word Processing
485	JC INFO SYSTEMS 88IS-17	281	SONY (N.A.) 287	587	MANCHESTER EQUIP 88NE-17	328-329	VISION SYSTEMS 296
487	JEN ELECTRONICA 88IS-57	281	SONY (N.A.) 287	604	MYODA, INC 88SO-6	947	IBM/MSDOS — CAD
163-164	KINGSTON 169	281	SONY (N.A.) 287	679-680	NORTHGATE 224, 225	57	CAD SOFTWARE, INC 379
481-482	LONGSHINE ELECTRONICS 88IS-85	281	SONY (N.A.) 287	210	NORTHGATE 241, 243	120	GENERIC SOFTWARE 305
180	MEGATEL COMPUTER TECH 290	281	SONY (N.A.) 287	210	NORTHGATE 248, 249	312	TRI-STAR COMPUTER 7
184	MERRIMACK VALLEY SYSTEMS 371	281	SONY (N.A.) 287	211	NORTHGATE 266, 267	948	IBM/MSDOS — COMMUNICATIONS
190	MICROPROCESSORS UNLTD 375	281	SONY (N.A.) 287	211	NORTHGATE 266, 267	80-81	CARRIER CURRENT TECH 240
	MICROWAY 42	281	SONY (N.A.) 287	212	ORBITAL CO LTD 300, 301	591-592	DELACINA 88NE-7
	MICROWAY 179	281	SONY (N.A.) 287	213	NORTHGATE 321	89	DCI 159
	MICROWAY 284	281	SONY (N.A.) 287	213	NORTHGATE 321	92	DARINA TECHNOLOGY, INC 170
200-201	NATIONAL DESIGN 278	281	SONY (N.A.) 287	213	NORTHGATE 321	100	DIVERSIFIED COMPUTER 378
207-208	NEWER TECHNOLOGY 376	281	SONY (N.A.) 287	213	NORTHGATE 321	106-106	ECLIN TECHNOLOGY 351
228-229	PC POWER & COOLING 127	281	SONY (N.A.) 287	213	NORTHGATE 321	117	FRONTIER TECHNOLOGIES 188
233-234	PERISCOPE CO., THE 210	281	SONY (N.A.) 287	213	NORTHGATE 321	118	GALACTICOMM 378
240-248	QUATECH 382	281	SONY (N.A.) 287	213	NORTHGATE 321	118	GCON, INC 375
274	SILICON SHACK 372	281	SONY (N.A.) 287	213	NORTHGATE 321	160	SEA SYSTEMS LTD 271
294	TECHNOLOGY POWER ENT 366	281	SONY (N.A.) 287	213	NORTHGATE 321	314	TURBO POWER 328
296	TRI VALLEY TECHNOLOGY, INC 375	281	SONY (N.A.) 287	213	NORTHGATE 321	964	IBM/MSDOS — DATABASE
313	TULIN CORP 379	281	SONY (N.A.) 287	213	NORTHGATE 321	43	BLACK & WHITE INT'L 240
481	UNITED HIGHTECH UNIAIR 88IS-73	281	SONY (N.A.) 287	213	NORTHGATE 321	949	IBM/MSDOS — GRAPHICS
318-319	UNIVERSAL MEMORY 363	281	SONY (N.A.) 287	213	NORTHGATE 321	72	COMPUTER SUPPORT CORP 185
330	VISTA MICROSYSTEMS 180	281	SONY (N.A.) 287	213	NORTHGATE 321	79-80	COREL SYSTEMS 89
484	V.D.S. 88IS-8	281	SONY (N.A.) 287	213	NORTHGATE 321	77-78	COREL SYSTEMS 273
336	WIESMANN & THEIS GMBH 379	281	SONY (N.A.) 287	213	NORTHGATE 321	108	ELEX INTERNATIONAL 247
348	Z-WORLD 378	281	SONY (N.A.) 287	213	NORTHGATE 321	138	IBM - HOLLYWOOD 23
927	DRIVES	281	SONY (N.A.) 287	213	NORTHGATE 321	137	ICL 282
18-19	AMERICAN MEGATRENDS 285	281	SONY (N.A.) 287	213	NORTHGATE 321	358-357	MATHEMATICA, INC 157
49-50	BUREAU OF ELECTRONIC PUBL 90	281	SONY (N.A.) 287	213	NORTHGATE 321	158	MICROGRAFX, INC 152B
75-76	CORE INTERNATIONAL 216, 217	281	SONY (N.A.) 287	213	NORTHGATE 321	270	ROYKORE 168
83	CURTIS, INC 220	281	SONY (N.A.) 287	213	NORTHGATE 321	289	STRATEGIC MAPPING 55
154-155	IOEMGA 186, 187	281	SONY (N.A.) 287	213	NORTHGATE 321	322	VERMONT CREATIVE SOFTWARE 33
188	LAGUNA DATA SYSTEMS 372	281	SONY (N.A.) 287	213	NORTHGATE 321	950	IBM/MSDOS — LAN
187	MICRO COMPUTER PRODUCTS 306	281	SONY (N.A.) 287	213	NORTHGATE 321	28	ARTISOFT 104
568	NATIONAL SERV BUREAU 88MW-3	281	SONY (N.A.) 287	213	NORTHGATE 321	951	IBM/MSDOS — LANGUAGES
605	NATIONAL SERV BUREAU 88NE-3	281	SONY (N.A.) 287	213	NORTHGATE 321	97	DIGITAL 148
643	NATIONAL SERV BUREAU 88PC-3	281	SONY (N.A.) 287	213	NORTHGATE 321	167	LAHE 220
681	NATIONAL SERV BUREAU 88SO-3	281	SONY (N.A.) 287	213	NORTHGATE 321	563-564	LIANT SOFTWARE CORP 88MW-19
235	PERISOL TECHNOLOGY 384	281	SONY (N.A.) 287	213	NORTHGATE 321	599-600	LIANT SOFTWARE CORP 88NE-19
237-238	PETER J. PHETHEAN LTD 272	281	SONY (N.A.) 287	213	NORTHGATE 321	635-636	LIANT SOFTWARE CORP 88PC-28
250	PLUS DEVELOPMENT 157	281	SONY (N.A.) 287	213	NORTHGATE 321	675-676	LIANT SOFTWARE CORP 88SO-28
477	TEAC CORP 88IS-68	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROSOFT 19
928	HARDWARE PROGRAMMERS	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
23	AMERICAN RELIANCE, INC 376	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
38	AVOCET SYSTEMS 379	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
48	BP MICROSYSTEMS 372	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
54-55	B&C MICROSYSTEMS 371	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
58	B&C MICROSYSTEMS 83	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
129	HEWLETT-PACKARD 376	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
185	KUMESTER DATA SERVICES, INC 371	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
189	LINK COMPUTER GRAPHICS 375	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
209	NOMAU CORP 375	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
308-311	TRIBAL MICROSYSTEMS 371	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
338	XELTEK 372	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
929	INSTRUMENTATION	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
54-55	B&C MICROSYSTEMS 371	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
58	B&C MICROSYSTEMS 83	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
109	ELEXOR, INC 378	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
188	LAWSON LABS 372	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
191	MICROSTAR LABORATORIES 378	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
	NATIONAL INSTR 88IS-100E-F	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
178-179	SIMPLICITY COMPUTING 180	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
480	TRIANGLE DIGITAL SERV 88IS-87	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
930	KEYBOARDS/MICE	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
412-413	BTC 88IS-37	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
64-65	CH PRODUCTS 177	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
432	DIGITURST 88IS-46	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
488	JOW DIAN 88IS-54	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
	ENTERPRISE CO, LTD 88IS-54	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
170-171	LOGITECH 75	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
349	MICRO TOUCH 108	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
	NORTHGATE 224-225	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
210	NORTHGATE 248-249	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
	NORTHGATE 248-249	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
211	NORTHGATE 266-267	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
212	NORTHGATE 300-301	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
342-343	ZNIX 199	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
931	MASS STORAGE	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
8	3M COMPANY 35	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
9	3M COMPANY 181	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
15	AMERICAN ADVANTECH 378	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
18-19	AMERICAN MEGATRENDS 285	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
44-45	BOFFIN LTD 294	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
49-50	BUREAU OF ELECTRONIC PUBL 90	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
388	CHINOM AMERICA, INC 263	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
439	FAST ELECTRONIC GMBH 88IS-83	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
154-155	IOEMGA 186-187	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
640-641	MAXIMUM STORAGE 88PC-21	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
581	MICRO SOLUTIONS	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
	COMPUTER PRODUCTS 88MW-13	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
618	MICRO SOLUTIONS	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
	COMPUTER PRODUCTS 88NE-13	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
	COMPUTER PRODUCTS 88PC-17	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
	COMPUTER PRODUCTS 88SO-9	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
	COMPUTER PRODUCTS 232A-B	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
	ONLINE COMP SYS 110	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
	OVERLAND DATA 364	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
	QUALSTAR CORPORATION 372	281	SONY (N.A.) 287	213	NORTHGATE 321		MICROWAY 284
	SONY (N.A.) 287	281	SONY (N.A.) 287	213	NORTHGATE 321		M



JDR Microdevices®

2233 Samaritan Drive, San Jose, CA 95124

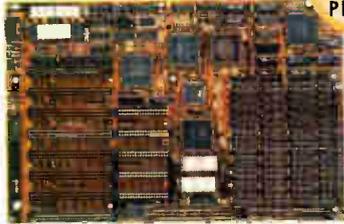
Serving you since 1979

BUY WITH CONFIDENCE FROM JDR!

- 30-DAY MONEY BACK GUARANTEE
- 1 YEAR WARRANTY
- TOLL-FREE TECH SUPPORT



MOTHERBOARDS



NEW LOWER PRICES

16MHz MINI 386-SX \$349.95

• NORTON SI 15.3 • LANDMARK AT SPEED 20.8

- EXPANDABLE TO 8MB CN-BOARD • AMI BIOS • CHOOSE 0 OR 1 WAIT STATE FOR USE WITH SLOWER RAM • FIVE 16-BIT AND THREE 8-BIT SLOTS • CHIPS & TECHNOLOGY "NEAT" CHIPSET • SOCKET FOR 80387-SX CO-PROCESSOR • 8.5" X 13" SIZE FITS MINI-286 & FULL-SIZE 286 CASES

MCT-386SX		\$349.95
MCT-386SX-20	20MHZ MINI 386-SX	\$399.95
MCT-M386-25	25MHZ MINI 386	\$699.00
MCT-386MBC-33	FULL-SIZE 33MHZ CACHE 386	\$949.00
MCT-386MBC-25	25MHZ VERSION	\$899.00
MCT-486MB33	33MHZ CACHE 486	\$1895.00
MCT-486MB25	25MHZ CACHE 486	\$1495.00
MCT-M286-20N	20MHZ 286 W/NEAT	\$389.95
MCT-M286-16N	16MHZ 286 W/NEAT	\$289.95
MCT-M286-16	16MHZ 286	\$199.95
MCT-M286-12	12MHZ 286	\$179.95

INTERFACE CARDS

16-BIT IDE MULTI I/O \$69.95

- 286/386/486 COMPATIBLE
- SUPPORTS 2 IDE HARD DRIVES & 2 FLOPPIES (360K, 720K, 1.2MB & 1.44MB)
- TWO SERIAL, ONE PARALLEL & ONE GAME PORT
- SUPPORTS COM1 THRU 4, LPT1, 2, & 3
- ALL FUNCTIONS CAN BE INDIVIDUALLY DISABLED

MCT-IDEIO		\$69.95
MCT-FDC-HD	1.44MB FLOPPY(2X) CARD	\$49.95
MCT-FDC-HD4	4 FLOPPY VERSION	\$59.95
MCT-HDC	HARD DISK CARD	\$79.95
MCT-RLL	RLL HARD DISK CARD	\$89.95
MCT-FAFH	16-BIT 1:1 MFM F/H CARD	\$149.95
MCT-AFH-RLL	16-BIT 1:1 RLL F/H CARD	\$199.95
MCT-ESDI	16-BIT 1:1 ESDI CARD	\$149.95
MCT-IDEFH	IDE FLOPPY/HARD CARD	\$29.95
MCT-IO	MULTI I/O CARD FOR 8088 SYSTEMS	\$59.95
MCT-AIO	286/386/486 MULTI I/O CARD	\$49.95
MCT-AEMS	16-BIT EMS CARD	\$129.95
MCT-EEMS	16-BIT EEMS CARD	\$149.95
MCT-VGA	8/16-BIT VGA CARD	\$149.95
MCT-VGA-1024	1024 X 768 VGA	\$169.95
MCT-VGA-1024+	1024 X 768/256 COLORS	\$199.95



CALL FOR OUR FREE 100 PG CATALOG!

FOR PC'S, MONITORS, DISK DRIVES, KEYBOARDS, MODEMS, LAPTOPS, CABLES, CONNECTORS, SOFTWARE, PROGRAMMING PRODUCTS, TEST EQUIPMENT, ICS & MORE!



DISPLAY CARD \$49.95 DIAGNOSES SYSTEM ERRORS

PLUG INTO SLOT, READ DISPLAY AND CHECK MANUAL FOR POWER-ON SELF-TEST CODE

- 286/386/486 COMPATIBLE
 - WORKS WHEN SOFTWARE WON'T EVEN BOOT PC
 - PLACE DISPLAYS ON-BOARD OR ON BACK PANEL
- | | | |
|----------------------------------|--|---------|
| PCODE | | \$49.95 |
| PCODE+ WITH OA PLUS VERSION 3.12 | | \$69.95 |



UNIVERSAL PROGRAMMER/TESTER

- PROGRAMS EPROMS, EEPROMS, PALS, BI-POLAR PROMS, 8748 & 8751 SERIES, 16V8 & 20V8 GALS • TESTS TTL, CMOS, DYNAMIC & STATIC RAMS
- LOAD DISK, SAVE DISK, EDIT, BLANK CHECK, PROGRAM, AUTO, READ MASTER, VERIFY & COMPARE • ACCEPTS 3" TO .6" WIDE IC'S (8-40 PINS)
- MOD-MUP REQUIRES HOST ADAPTOR CARD \$499.95



EPROM PROGRAMMING MODULES

- PROGRAMS 24-32 PIN EPROMS, CMOS EPROMS & EEPROMS, 16K TO 1024K • HEX TO OBJ CONVERTER
 - AUTO, BLANK CHECK/PROGRAM/VERIFY
- | | | |
|-----------|--------------------------|----------|
| MOD-MEP | | \$119.95 |
| MOD-MEP-4 | 4-EPROM UNIT | \$169.95 |
| MOD-MAC | COMMON HOST ADAPTOR CARD | \$29.95 |

BREADBOARD ON-CARD

- INCLUDES ADDRESS DECODING LOGIC, DATA BUFFERING, 2 LSI CIRCUITS FOR PROGRAMMABLE DIGITAL I/O & COUNTER TIMING FUNCTIONS • ACCEPTS UP TO 24 14-PIN IC'S • ACCEPTS 9.15, 25, OR 37-PIN D-SUBS
- | | | |
|---------|-----------------------------|---------|
| PDS-601 | 8-BIT CARD | \$79.95 |
| PDS-611 | 16-BIT CARD WITH I/O DECODE | \$89.95 |



PROTOTYPE CARDS

- JDR'S CARDS INCLUDE FR-4 EPOXY LAMINATE WITH GOLD-PLATED EDGE CARD FINGERS & SILK-SCREENED LEGENDS
- | | | |
|----------|-------------------------------|---------|
| JDR-PR2 | 8-BIT WITH I/O DECODE LAYOUT | \$89.95 |
| JDR-PR10 | 16-BIT WITH I/O DECODE LAYOUT | \$79.95 |

3-BUTTON MOUSE \$14.95

- SELECTABLE ACCURACY 290 - 1450 DPI
 - SWITCH SELECTABLE MICROSOFT OR MOUSE SYSTEMS COMPATIBILITY MODE
 - OPTO-MECHANICAL DESIGN
 - WINDOWS 3.0 COMPATIBLE
- | | | |
|-------------|--|---------|
| JDR-MOUSE-3 | | \$14.95 |
|-------------|--|---------|

\$14.95



HARD DRIVES 45MB \$219

5-1/4"	ST-251-1	42.8 MB	MFM	28MS	\$249
3-1/2"	ST-157A	44.7 MB	IDE	28MS	\$219
5-1/4"	ST-277-1	65.5 MB	RLL	28MS	\$289
3-1/2"	ST-1102A	89.1 MB	IDE	19MS	\$399
3-1/2"	ST-1144A	131 MB	IDE	19MS	\$499
3-1/2"	ST-1201A	177 MB	IDE	15MS	\$749
5-1/4"	ST-2283A	338 MB	IDE	16MS	\$1295
5-1/4"	1654	161 MB	ESDI	16MS	\$899
5-1/4"	1664	345 MB	ESDI	14MS	\$1449
5-1/4"FH	1568	676 MB	ESDI	16MS	\$2195

FLOPPY DRIVES

FDD-1.44X	1.44MB 3.5" FLOPPY - BLACK	\$79.95
FDD-1.44A	1.44MB 3.5" FLOPPY - BEIGE	\$79.95
FD-55GFV	5.25" TAP DOUBLE-SIDED HD 1.2MB	\$99.95
FDD-1.2	5.25" DOUBLE-SIDED HD 1.2MB	\$89.95
FD-55B	5.25" TAP DOUBLE-SIDED DD 360K	\$89.95
FDD-360	5.25" DOUBLE-SIDED DD 360K	\$69.95

UPRIGHT CASE \$249.95

- FOR STANDARD, FULL SIZE AND MINI-MOTHERBOARDS
 - 250 WATT POWER SUPPLY (110/220V)
 - MOUNTS FOR 3 FLOPPY AND 4 HARD DRIVES
 - TURBO AND RESET SWITCHES
 - SPEED DISPLAY, POWER, DISK LEDS
 - MOUNTING HARDWARE, FACEPLATES AND SPEAKER INCL.
- | | | |
|----------|--|----------|
| CASE-100 | | \$249.95 |
|----------|--|----------|



MORE CASES...

CASE-200	UPRIGHT HOLDS 11 DRIVES	\$499.95
CASE-120	MINI-UPRIGHT W/200 WATT PS	\$199.95
CASE-70	FULL-SIZE 286 STYLE CASE	\$89.95
CASE-50	MINI-SIZE 286 STYLE CASE	\$59.95

POWER SUPPLIES

PS-135	8088 135 WATT	\$59.95
PS-150	8088 150 WATT	\$69.95
PS-200X	8088 200 WATT	\$89.95
PS-200	286/386/486 200 WATT	\$89.95
PS-250	286/386/486 250 WATT	\$129.95



1024 x 768 \$499.95 VGA PACKAGE

- 8088 & 286/386/486 COMPATIBLE CARD & 1024 X 768 INTERLACED MONITOR
 - 1:1 ASPECT RATIO; 0.28 DOT PITCH
 - 256 COLORS FROM 262,000
 - 8/16-BIT CARD HAS 512K VIDEO RAM EXPANDABLE TO 1MB
- | | | |
|---------------|-----------------------|----------|
| VGA-PKG-1024+ | | \$499.95 |
| VGA-PKG | 640 X 480 VGA PACKAGE | \$399.95 |



MORE MONITORS...

NEC-MULTI-3D	14" MULTISYNCH MONITOR	\$649.00
VGA-MONITOR	VGA MONITOR	\$379.95
MONO-VGA	PAPERWHITE VGA MONITOR	\$139.95

2400 BAUD MODEM \$79.95

- 2400/1200/300 BPS INTERNAL DATA MODEM • FULL HAYES AT COMPATIBILITY • INCLUDES PROCOMM SOFTWARE
- | | | |
|------------|------------------------------|----------|
| MCT-241 | | \$79.95 |
| MCT-FAXM | AS ABOVE W/4800 BPS FAX SEND | \$89.95 |
| PCEM7296 | INTEL 9600 BPS EXTERNAL | \$549.00 |
| PCCB6201 | INTEL SATISFACTION FAX/MODEM | \$449.95 |
| VIVA-24MNP | 2400 BPS EXT MODEM W/MNP | \$149.95 |

\$79.95

DYNAMIC RAM

PART #	SIZE	SPEED	PINS	PRICE
TMS4464-12	65536x4	120ns	1k	3.49
41256-100	262144x1	100ns	1k	1.99
41256-80	262144x1	80ns	1k	2.19
414256-100	262144x4	100ns	2k	6.95
414256-80	262144x4	80ns	2k	7.95
1MB-100	1048576x1	100ns	1k	6.95
1MB-80	1048576x1	80ns	1k	7.95
1MB-60	1048576x1	60ns	1k	9.95

SIMMS

PART #	SIZE	SPEED	FOR	PRICE
41256A9B-80	256K x 9	80ns	SIMM/PC	21.95
421000A8B-10	1MB x 8	100ns	SIMM/PC	64.95
421000A9B-10	1MB x 9	100ns	SIMM/PC	64.95
421000A9B-80	1MB x 9	80ns	SIMM/PC	69.95
421000A9B-60	1MB x 9	60ns	SIMM/PC	89.95

MATH CO-PROCESSORS

MANUAL, SOFTWARE GUIDE & 5 YEAR WARRANTY

	PART #	SPEED	PRICE	PART #	SPEED	PRICE
INTEL	8087	5 MHz	89.95	80387-20	20 MHz	209.95
	8087-2	8 MHz	129.95	80387-25	25 MHz	219.95
	8087-1	10 MHz	169.95	80387-33	33 MHz	229.95
	80287-XL	12 MHz	94.95	80387-SX	16 MHz	129.95
CYRIX	83D87-16	16 MHz	199.95	83D87-40	40 MHz	239.95
	83D87-20	20 MHz	209.95	83S87-16(SX)	16 MHz	129.95
	83D87-25	25 MHz	219.95	83S87-20(SX)	20 MHz	149.95
IIT	2C87-8	8 MHz	79.95	2C87-12	12 MHz	99.95
	2C87-10	10 MHz	89.95	2C87-20	20 MHz	139.95

MAXIMIZE CO-PROCESSOR SPEED

OUR "2ND STAGE" ALLOWS 20MHZ CO-PROCESSORS TO RUN AT FULL SPEED IN THE SLOWEST 286 SYSTEMS

2ND-STAGE FOR 10/20 MHZ 80287'S \$49.95

OTHER VERSIONS FOR 8, 12 OR 16 MHZ 80287'S



SALES 800-538-5000

Customer Service 800-538-5001 Local/Int'l 408-559-1200
Technical Support 800-538-5002 Fax 408-559-0250

TERMS: For shipping & handling include \$5.00 for ground and \$7.50 for air. Orders over 1 lb. and foreign orders may require additional shipping charges—contact our Sales Dept. for the amount. CA residents must include applicable sales tax. Prices subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturer. All merchandise subject to prior sales. A full copy of our terms is available upon request. Items pictured may only be representative. JDR, the JDR logo, JDR Microdevices, and the MCT logo are registered trademarks of JDR MICRODEVICES, INC. Modular Circuit Technology, are trademarks of JDR MICRODEVICES, INC. Copyright 1991 JDR MICRODEVICES.



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		
<code>hab</code>	PM	A handle to the calling application's anchor block.
<code>pszSuperClass</code>		A NULL-terminated string containing the name of the super class.
<code>pszRegisterClass</code>		A NULL-terminated string containing the name of a new class to register that will inherit the super class.
<code>pfnwpRegister</code>		A pointer to the window procedure of the new class.
<code>styleExclude</code>		Class style flags that can be set in the super class but must not be set in the new window class.
<code>styleInclude</code>		Class style flags that must be set in the new window class regardless of whether or not they are set in the super class.
<code>cbWinExtra</code>		Extra bytes of window storage data required by the new window class. This is added to the window data required for the super class.
<code>pcbQwOffset</code>		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.
<code>hInstSuperClass</code>	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.
<code>hInstApplication</code>	W	A handle to the instance of the application or DLL that is registering the new window class.
Output		
<code>*pcbQwOffset</code>		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);
```

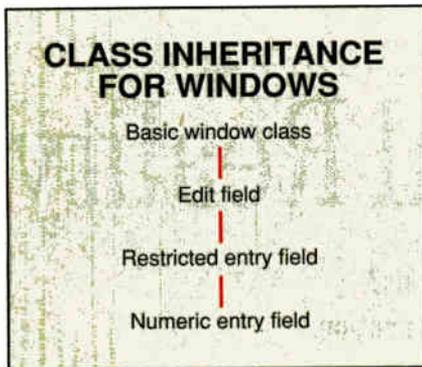


Figure 2: The inheritance tree for the sample program.

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."

HUGH KENNER

Dreams of Artificial Reality

Does technology imprison us, or empower us?
Two new books examine the mind-machine connection.

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.

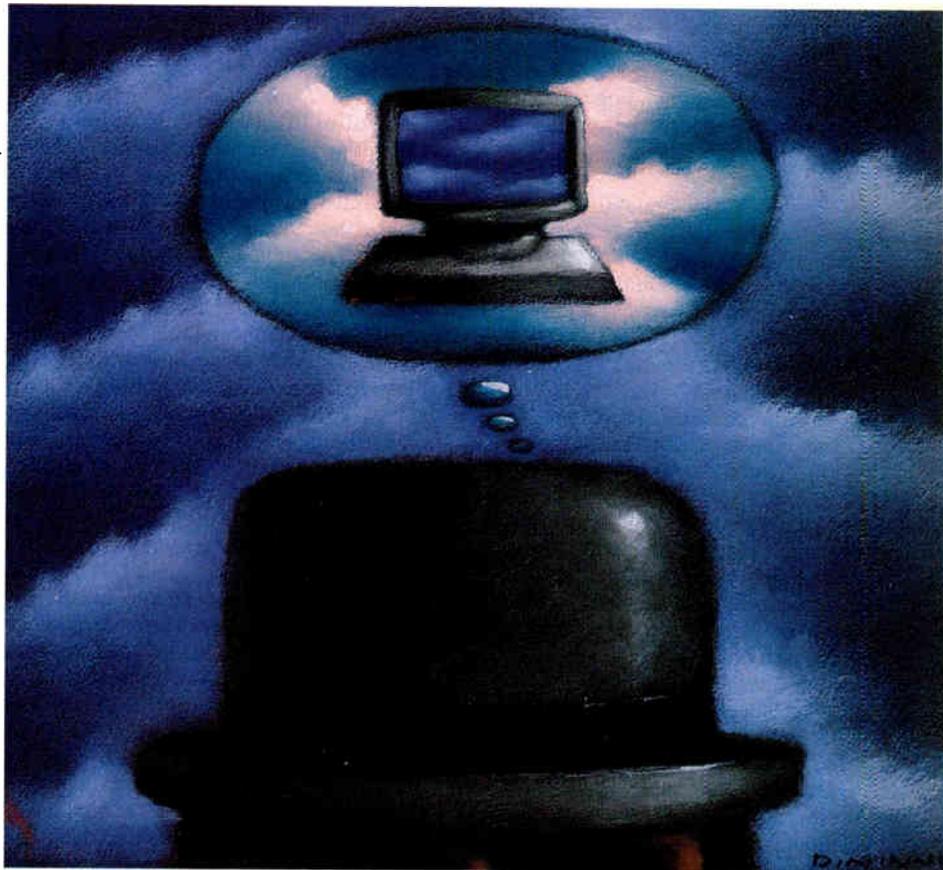
But Hollywood had followed the new-fangled sound track clear out of Paradise. For now *talk* was expected, and whenever someone spoke, a mike needed to be right above the clown's head, just high enough to elude the camera's view. To position that mike, the crew (becoming more numerous than the clowns) 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.

Hugh Kenner is Franklin and Callaway Professor of English at the University of Georgia. He writes for publications ranging from the New York Times to Art & Antiques. His recent books include Mazes and Historical Fictions. He can be contacted on BIX as "hkenner."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Krueger has
wilder visions, like
cars expressing
the driver's feelings.





STOP BIT

BONNIE J.
DJOUADI

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.

This nagging recession has persisted for some time but now relief is finally in sight.

Because Dell has just reduced the prices on various 286, i386™ SX, i386 and i486 desktops and i386SX laptops up to \$900. And although our prices are now extraordinarily low, our quality and reliability remain extraordinarily high.

Our service and support program isn't hard to swallow either. Dell's toll-free

technical support hotline solves 90% of reported problems over the phone usually in 6 minutes or less. You can also get system information 24 hours a day via our innovative TechFaxSM line. Or log on to our electronic bulletin board that

HERE'S THE SUPPORT YOU'LL GET.

- ~ Toll-free technical support hotline for the life of your system.
- ~ One full year of on-site service included in the system price[△]
- ~ Self-diagnostic software.
- ~ Toll-free 24-hour TechFax line for instant access to Dell technical information.
- ~ On-line Bulletin Board to communicate with Dell technical staff and other Dell users.

lets you see other users' questions. And, better yet, Dell's answers.

If this still doesn't clear up the problem, a trained technician will be at your desk-side usually by the next business day.[△]

This is all pretty easy to take when you consider Dell phone support is always free and the system price includes a one year on-site service contract.

Perhaps this is why we come so highly

recommended. Dell has won *PC Week's* Corporate Satisfaction Poll for PCs, laptops and servers an unprecedented eight times.

You deserve credit. Back to

this recession issue. If you don't want to buy a Dell computer outright even at these prices, just lease[°] one for as little as \$51 a month. We make available a variety of financial products that can

TO ORDER, CALL PLEASE REFERENCE #11EJ1.
800-545-1580
 HOURS: 7AM-9PM CT MON-FRI 8AM-4PM CT SAT
 IN CANADA 1-800-668-3021. IN MEXICO 95-800-010-0664.

be tailored to your business needs.

There's even a Dell Direct Advantage MasterCard with a credit limit of up to \$15,000 and a way to earn points toward Dell

products with everything you buy.

When you just can't take any more

high prices, call us. If you've had your dose of high computer costs, this is a perfect time to buy or lease one.

Just describe what you need and we'll help you configure the right system. Which we'll custom build, test and ship to you with a 30-day no-questions asked money



back guarantee and one-year limited warranty.

So, call us today.

Because a deal like this is nothing to sneeze at.

COUGHING UP TOO MUCH? TAKE ONE OF THESE.



DELL SYSTEM® 433P.
 WAS \$5,199
NOW ONLY \$4,299
 Lease: \$156/month.**
 • Intel 486 microprocessor running at 33 MHz.
 100 MB VGA Color Plus System \$4,299
 Price listed includes 4 MB of RAM* 200 and 320 MB hard drive configurations also available.



DELL SYSTEM 333D.
 WAS \$3,399
NOW ONLY \$3,299
 Lease: \$123/month.**
 • Intel® 80386 microprocessor running at 33 MHz.
 40 MB VGA Color Plus System \$3,299
 Price listed includes 1 MB of RAM* 80, 100, 200, 330 and 650 MB hard drive configurations also available. 25 MHz systems also available starting at \$2,699



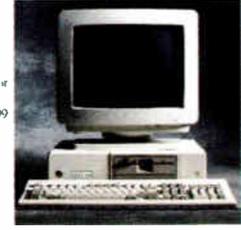
DELL SYSTEM 325P.
 WAS \$2,499
NOW ONLY \$2,299
 Lease: \$66/month.**
 • Intel 80386 microprocessor running at 25 MHz.
 40 MB VGA Color Plus System \$2,299
 Price listed includes 1 MB of RAM* 80, 100, 200 and 320 MB hard drive configurations also available. 33 MHz systems also available starting at \$2,499



DELL SYSTEM 316SX.
 WAS \$1,999
NOW ONLY \$1,799
 Lease: \$64/month.**
 • Intel 80386SX microprocessor running at 16 MHz.
 40 MB VGA Color Plus System \$1,799
 Price listed includes 1 MB of RAM* 20, 80, 100 and 200 MB hard drive configurations also available.



DELL SYSTEM 320LT.
 WAS \$3,699
NOW ONLY \$3,199
 Lease: \$119/month.**
 • Intel 80386SX microprocessor running at 20 MHz.
 40 MB, 1 MB RAM* \$3,199
 20 and 120 MB hard drive configurations also available.



DELL SYSTEM 210.
 WAS \$1,549
NOW ONLY \$1,349
 Lease: \$51/month.**
 • Intel 80286 microprocessor running at 12.5 MHz.
 20 MB VGA Monochrome System \$1,349
 Price listed includes 1 MB of RAM* 40, 80 and 100 MB hard drive configurations also available.

Circle 90 on Inquiry Card.

*Performance Enhancements: Within the first megabyte of memory, 384 KB (433DE), 128 KB (316SX, 320LT and 210), 96 KB (433P, 333D, 325D, 333P and 325P) of memory is reserved for use by the system to enhance performance. Can be optionally disabled on all except 320LT. All prices and specifications are subject to change without notice. Dell cannot be responsible for errors in typography or photography. **Payment based on a 36-month, open-end lease. ° Leasing arranged by Leasing Group, Inc. In Canada and Mexico, configurations and prices may vary. Dell and Dell System are registered trademarks. SmartVu and PowerLine are trademarks and TechFax is a service mark of Dell Computer Corporation. Intel is a registered trademark and 386 and 486 are trademarks of Intel Corporation. Other trademarks and trade names are used to identify entities claiming the marks and names of their products. Dell Computer Corporation disclaims any proprietary interest in trademarks and trade names other than its own. ° Service provided by Third Party Provider. On-site service may not be available in certain remote locations. Shipping, handling and applicable sales tax not included in the price. For information on a copy of Dell's 30-Day Total Satisfaction Guarantee, limited warranty, and Third Party Provider Service Contract, please write to Dell USA Corporation, 9505 Arboretum Boulevard, Austin, Texas 78759-7299, ATTN: Warranty ©1991 Dell Computer Corporation. All rights reserved.

VGA graphics. Non-interlaced 256-color at 800 x 600 or 16-color at 1024 x 768 resolution, built into the system board. No video cards. No flicker.

BIOS is on Flash EPROM. Upgrade or modify from floppy without removing chips.

Custom memory controller ASICs deliver higher performance and reliability than standard PAL.

Upgrade easily to a 50 MHz i486 processor.

SmartVu Diagnostic Display troubleshoots even if the monitor is not working.

Behind the SmartVu™ module lies industry standard SIMMs so extra memory can be added easily and inexpensively.

NOBODY ELSE HAS THE GUTS TO SAY THIS.

Dell's ingenious i486 system innovations not only help you outwit your competition, they help us outwit ours.

Our high-powered i486 PC is the Dell PowerLine 433DE, running at 33 MHz, and our 420DE is based on Intel's 20 MHz i486SX microprocessor. Built on the EISA

include a full range of upgrade and expansion capabilities.

Now that we've poured our guts out, it's your turn.

Just describe your needs and we'll help you configure the ultimate powerhouse. Which we'll custom build, test, and ship to you with a 30-day no questions asked money back guarantee, and a one-year limited warranty.

All this, plus the fact that the Dell PowerLine 433DE costs so much less than many i486 systems, may make those others a little hard to stomach.

bus, they have unique features that give them plenty of muscle for CAD, CAE, animation, 3D, solids modeling and applications where maximum performance is required.

Furthermore, we've designed the system to



SEE INSIDE FOR DETAILS.

For more information on the new Dell®PowerLine™ 433DE 33 MHz i486™ System turn the page.

TO ORDER, CALL PLEASE REFERENCE #11EJ1.
800-545-1580
 HOURS: 7AM-9PM CT MON-FRI 8AM-4PM CT SAT
 IN CANADA 1-800-668-3021. IN MEXICO 95-800-010-0664.



TO ORDER, CALL PLEASE REFERENCE #11EJ1.
800-545-1580
 HOURS: 7AM-9PM CT MON-FRI 8AM-4PM CT SAT
 IN CANADA 1-800-668-3021. IN MEXICO 95-800-010-0664.

