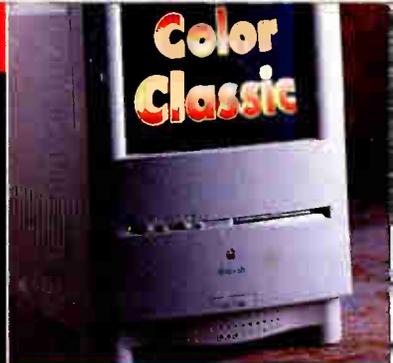


# BYTE

THE WORLDWIDE COMPUTING AUTHORITY



**6 New Macs** Page 40

# Smarter E-Mail



## Intelligent E-Mail will change the way you work

See page 90

**PLUS**

**SPECIAL REPORT**

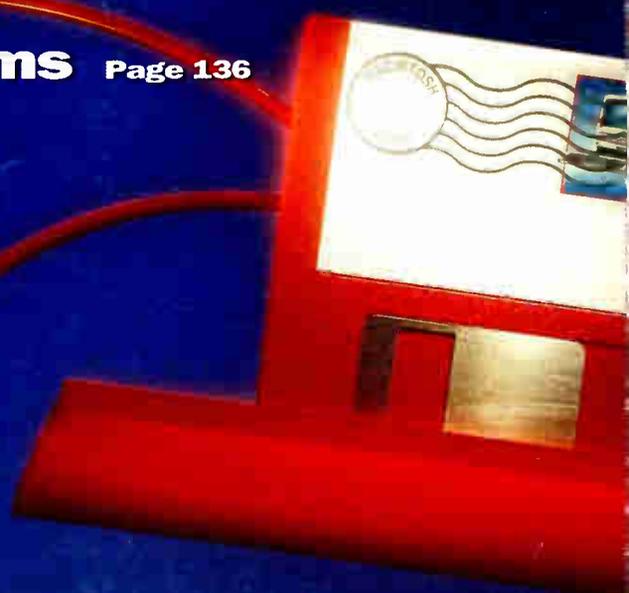
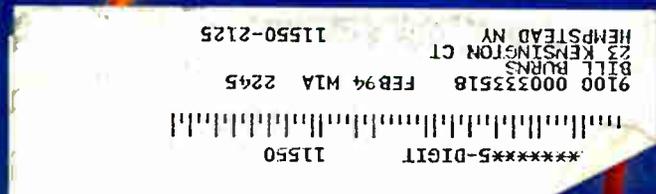
- **Where groupware is headed** Page 112

**EXCLUSIVE RATINGS**

- **The best E-Mail programs** Page 136

**5 New 600-dpi Laser Printers**

**Beyond DOS: Next-Generation OLE**



# Command!

"I wish I could be sure I'm buying from a PC company that will provide excellent service and support - a company that will be around for me." Your wish is our command!

Twice in 1992, Gateway was honored for outstanding service. *PC World* readers ranked Gateway number one in service and support. And *PC Magazine* readers gave Gateway the best overall scores in the 1992 Service and Reliability Survey.

Just as important is our strength as a company. Warranties and assurances of lifetime technical support don't mean anything unless a company survives to honor them, which is a serious consideration in the shifting sands of today's PC marketplace.

Gateway is among the few financially robust companies in the industry. Our 1992 revenues exceeded \$1 billion and our earnings are among the strongest in the industry. The company is virtually debt-free. At a time when other companies have been forced to lay off employees, we added 300 people to our staff. You now have 1,800 friends in the business. Rest assured Gateway is your oasis that will never leave you high and dry. We'll be here for you!

"I wish I could find the combination of features I need in a portable PC - at the right price." Your wish is our command!

No matter what you need in a portable, you'll find it in one of our Nomad notebooks. Gateway customers selected Nomads as the winners in 386 and 486 notebook categories of *Computer Shopper's* 1992 Best Buy Awards.



"There are faster laptops, there are cheaper laptops, there are color laptops, but there is no better laptop ...

Weighing in at only 5.6 pounds, the Nomad combines the powerful punch of a 25MHz i486DX with a working battery life of more than six hours. At long last, we have a laptop that can really go the distance when there's no power outlet in sight."

- *Computer Shopper*, 1992 Readers' Best Buy Awards

*PC Sources* echoed *Computer Shopper's* conclusions. "The Nomad 425DXL packs an awful lot of computing into a case that's just 1.7 inches high. Its excellent 79-key keyboard has a great typing feel ... The fine video system includes a large backlit black-on-white LCD ..."

New this month is the Nomad 450DXL including Intel's 50MHz 486DX2L processor for blazing performance.



# What Do You Wish For In A PC?



# Your Wish Is Our Co

 "I wish I could get a great PC at a great price without sacrificing performance and features." Your wish is our command!

You'll be spellbound by Gateway's ferociously competitive prices on systems that are unequalled in powerful performance, impressive features and graceful integration of components. When readers and editors of the most popular PC magazines are asked which company delivers on its promises, their overwhelming response is Gateway 2000.



"Gateway has gone far beyond conventional ideas of price and performance ... it has created new rules that other PC makers will have to follow if they want to remain players."

– *PC Computing*, 1992 MVP Awards



"Gateway 2000 was the big 1992 Best Buy winner, sweeping not only the desktop awards as it did last year, but the newly expanded notebook categories as well ... Altogether, Gateway won five Best Buy awards this year, including Best

Overall System Vendor ... It's no surprise that Gateway is consistently the people's choice when it comes to systems.

– *Computer Shopper*, 1992 Readers' Best Buy Awards



**Your wish** is our command at

Gateway 2000! We can grant you the three most universal PC wishes in the wink of an eye. As a fringe benefit, we won't limit you to three wishes here. Most anything your heart desires in computers (sorry, we can't grant wishes for romance or riches), you can get from Gateway.

That's because we built our business by listening to our customers' wishes and doing everything in our power to make their dreams come true. At Gateway, we believe you should be able to *have it all*: the latest technology, glittering performance, quality construction, enchanting service and the fairest prices in the land. All this from a financially healthy company that won't run dry and leave you stranded in the desert.

You don't have to settle for less. With Gateway 2000, you can have it all. Draw up your wish list and give us a call. We'll make some truly magical values materialize for you.

 **GATEWAY2000**  
8 0 0 - 8 4 6 - 2 0 0 0

# Our Caravan Of Extras.

## Software Selections

Your every software need is our command! With mini desktop, desktop and tower systems that include "choice of application software," select one of the following applications, all latest versions:

- Microsoft® Excel for Windows™
- Microsoft Word for Windows™
- Microsoft Word and Bookshelf 92,® CD-ROM Edition
- Microsoft PowerPoint for Windows™
- Microsoft Project for Windows™
- The MS Entrepreneur Pack (Works,™ Publisher,™ Money,™ TurboTax for Windows® from ChipSoft, and games)
- Borland Paradox® or dBASE IV®
- The Windows Programmer Pack (MS Quick C,™ Visual Basic and more)
- Upgrade to Microsoft Office™ for \$175

If the system you want comes with Works for Windows,™ you can upgrade to one of the software choices above for only \$150.

## Utilities Included, Too

Cool Tools for DOS, a diagnostic and utilities package, comes with all Gateway desktop systems and includes: QA Plus™ from Diagsoft,™ Central Point® Anti-Virus, RAM Boost, Defrag and Emergency Disk.

## Microsoft Windows™ for Workgroups

Windows for Workgroups is ideal for e-mail, group scheduling and resource sharing, and includes an Ethernet adapter and software. Hardware and software are factory-installed. You can see Windows for Workgroups running on Gateway systems in any of over 200 Egghead Software® stores in the U.S. Stop by for a demonstration! With the purchase of a system, Windows for Workgroups is specially priced at just **\$159!**

## Microsoft Windows Sound System™

This sound system designed especially for business use lets you speak to your PC for hands-free operation. It even reads numbers back to you for proofing. You can also embed audio messages in all your Windows OLE applications. Package includes soundboard, microphone, headset and software. You pay only **\$149** with the purchase of a system.

## CD-ROM Kit

Includes CD-ROM, interface card, and everything you need to add MPC-compliant CD-ROM to your PC. With a system purchase, or if you own a Gateway system, you can buy this CD-ROM kit for only **\$225!**

## The TelePath™ Fax/Modem

A 14,400bps modem, V.32bis, with 9,600bps fax capability. Includes WinFax Pro,™ Crosstalk™ for Windows, Qmodem™ and more. **\$195**

## CrystalScan™ 15-Inch Monitor

Non-interlaced 15-inch color monitor with flat, square screen – an upgrade option only at the time of purchase on any Gateway 2000 desktop system for only **\$100.**

## Panasonic Color-Capable Printer

Add color to your documents with this Panasonic KXP2123 24-pin dot matrix printer. Includes Adobe Type Manager.® Printer, **\$259**; Color Option, **\$50**

*Most Gateway peripherals are sold only with the purchase of a Gateway system.*

*For details on our complete line of components, peripherals and software, call direct to our special add-on components division at 800-846-2080.*



# Gateway 2000's Magical Values

## DESKTOP SYSTEMS

### 3SX-33

- 33MHz 386SX Intel® Processor\*
- 4MB RAM
- 5.25" & 3.5" Diskette Drives
- 80MB 17ms IDE Hard Drive
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan™ 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey™ Keyboard
- MS-DOS,® Windows™ & Mouse
- Cool Tools for DOS
- MS Works for Windows™ 2.0

**\$1295**

### 4SX-25

- 25MHz 486SX Intel Processor\*
- 4MB RAM
- 5.25" & 3.5" Diskette Drives
- 170MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- MS Works for Windows 2.0

**\$1495**

### 4SX-33

- 33MHz 486SX Intel Processor\*
- 4MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives \*
- 170MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

**\$1695**

### 4DX-33

- 33MHz 486DX Intel Processor\*
- 4MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 250MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

**\$1995**

### 4SX-33V

- 33MHz 486SX Intel Processor\*
- 8MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 170MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- VESA Local Bus ATI Ultra Pro with 1MB VRAM
- 15" Color CrystalScan 1572FS
- Desktop Case (Tower Upgrade)
- 8 16-Bit ISA Slots, 2 with 32-Bit VESA Local Bus
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

**\$2195**

### 4DX-33V

- 33MHz 486DX Intel Processor\*
- 8MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 250MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- VESA Local Bus ATI Ultra Pro with 1MB VRAM
- 15" Color CrystalScan 1572FS
- Desktop Case (Tower Upgrade)
- 8 16-Bit ISA Slots, 2 with 32-Bit VESA Local Bus
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

**\$2495**

### 4DX2-66V

- 66MHz 486DX2 Intel Processor\*
- 8MB RAM, 256K Cache
- 5.25" & 3.5" Diskette Drives
- 340MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- VESA Local Bus ATI Ultra Pro with 1MB VRAM
- 15" Color CrystalScan 1572FS
- Desktop Case (Tower Upgrade)
- 8 16-Bit ISA Slots, 2 with 32-Bit VESA Local Bus
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

**\$2995**



### 4DX2-66E

- 66MHz 486DX2 Intel Processor\*
- 8MB RAM, 256K Cache
- 5.25" & 3.5" Diskette Drives
- 500MB 11ms SCSI Hard Drive
- 32-Bit EISA SCSI Controller
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024NI
- Tower Case
- 8 32-Bit EISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

**\$3795**

## 486 Notebooks

### NOMAD 425SXL

- 25MHz 486SX Intel Processor\*
- 4MB RAM
- 3.5" Diskette Drive
- 80MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Grays
- Simultaneous Video with 256K
- Size 8.5" x 11" x 1.8", 5.6 Lbs.
- 6-Hr. NiCad Battery & AC Pack
- 1 Parallel/1 Serial Port
- 79-Key Keyboard & FieldMouse™
- MS-DOS 5.0 and Windows 3.1
- MS Works for Windows 2.0

**\$1995**

### NOMAD 425DXL

- 25MHz 486DX Intel Processor\*
- 4MB RAM
- 3.5" Diskette Drive
- 120MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Grays
- Simultaneous Video with 1MB
- Size 8.5" x 11" x 1.8", 5.6 Lbs.
- 6-Hr. NiCad Battery & AC Pack
- 1 Parallel/1 Serial Port
- 79-Key Keyboard & FieldMouse
- MS-DOS 5.0 and Windows 3.1
- MS Works for Windows 2.0

**\$2595**

### NOMAD 450DXL

- 50MHz 486DX2 Intel Processor\*
- 8MB RAM
- 3.5" Diskette Drive
- 200MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Grays
- Simultaneous Video with 1MB
- Size 8.5" x 11" x 1.8". 5.6 Lbs.
- 6-Hr. NiCad Battery & AC Pack
- 1 Parallel/1 Serial Port
- 79-Key Keyboard & FieldMouse
- MS-DOS 5.0 and Windows 3.1
- MS Works for Windows 2.0

**\$3295**



8 0 0 - 8 4 6 - 2 0 0 0

610 Gateway Drive • P.O. Box 2000 • North Sioux City, SD 57049-2000 • 605-232-2000 • Fax 605-232-2023  
Sales Hours: 7am-10pm Weekdays, 9am-4pm Saturdays (CT)



\*Contains an Intel386™ or Intel486™ microprocessor

©1993 Gateway 2000, Inc. AnyKey, HandBook, FieldMouse, CrystalScan and TelePath are trademarks of Gateway 2000, Inc. The Intel Inside Logo is a trademark and Intel is a registered trademark of Intel Corporation. All other brands and product names are trademarks or registered trademarks of their respective companies. Prices and configurations are subject to change without notice. Prices do not include shipping.



INTERACTIVE UNIX<sup>®</sup>  
OPERATING SYSTEM

INTERACTIVE UNIX<sup>™</sup>  
OPERATING SYSTEM



# So Powerful It Can't Be A PC.



## Transform Your PC With The INTERACTIVE UNIX System.

Unleash the 32-bit power in your PC with the INTERACTIVE UNIX System from SunSoft. Charge through applications at record speeds. Use real-world multitasking and networking. Get on the path to a distributed computing future.

### Just Say No To SCO.

Why? The INTERACTIVE UNIX System is easy to use, simple to administer, all at a great price.

*Open Systems Today*\* says the INTERACTIVE UNIX "system management... is easier to use and more comprehensive" than SCO and "is simply a masterpiece of good design."

Looking Glass Professional<sup>®</sup> desktop manager makes the INTERACTIVE UNIX System easy enough for novices, yet powerful enough for experienced UNIX users. And the award winning Easy Windows makes setting up graphic environments infinitely simpler.

You can't afford *not* to take advantage of the already low cost of the INTERACTIVE UNIX System.

And SCO UNIX/XENIX<sup>®</sup> users can save an additional 50% by switching to the INTERACTIVE UNIX System today. That's something to say yes to.

## Everything You Like About Your PC—And A Lot More.

INTERACTIVE UNIX System V/386 Release 3.2 supports hundreds of the most popular Intel-based platforms and peripherals. So getting started is fast, easy, and cost-effective.

Thousands of UNIX and XENIX applications are at your command. And our VP/ix package runs virtually all DOS software.

You get Lotus, WordPerfect, and Oracle. You get SCO applications. You get it all.

### See What Develops.

The INTERACTIVE UNIX System is the environment of choice for 80X86 application development. You get access to a full range of development tools including compilers, debuggers and libraries. And for graphical applications, the X11 INTERACTIVE environment is a revelation.

### Partner With Power.

The INTERACTIVE UNIX System is a powerful business partner for companies who know something about power. Companies like BMW, Goodyear, Leica, and Dunlop to name a few. That power can be yours, too. All from SunSoft, the leading supplier of 32-bit UNIX system software.

Call today and save 50% on UNIX power that's so cost-effective, it can't be anything *but* a PC. 1-800-227-9227.

 **SunSoft**  
A Sun Microsystems, Inc. Business

# BYTE

March 1993 Volume 18, Number 3

## COVER STORY

FEATURE

### Smarter E-Mail Is Coming

PAGE 90

SOLUTIONS FOCUS

### A Review of E-Mail Packages

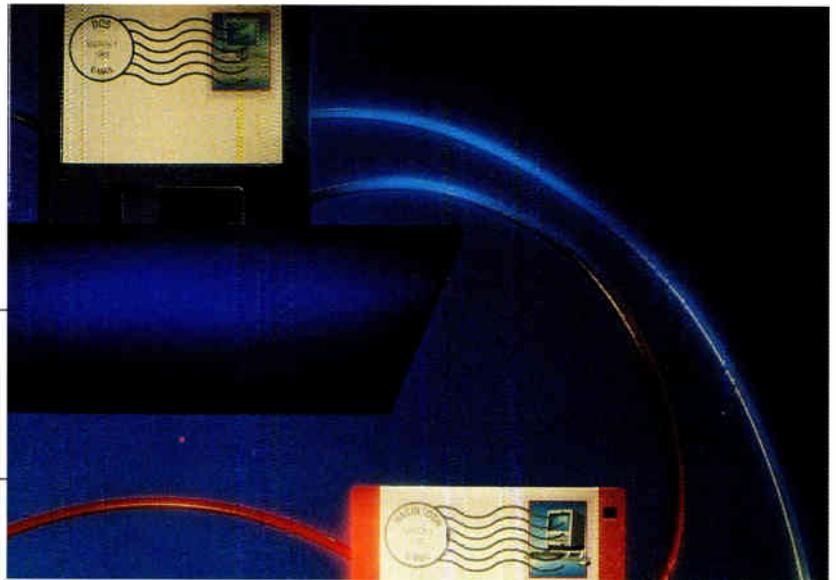
PAGE 136

## NEWS

- 24 MICROBYTES**  
The first HDTV sets are not likely to appear in U.S. homes before 1995, yet companies from Microsoft to HBO are already involved in programming projects.
- 37 REPORT FROM INDIA**  
**High-Tech Opportunities Abound**  
*by Jay Ranade*  
The government is high on growth but down on imports.
- 40 FIRST IMPRESSIONS**  
**A Spring Harvest of Apple Macintoshes**  
*by Tom Thompson and Tom R. Halfhill*  
With street prices of about \$1000 to \$4500, these new Macs are price-conscious and powerful.



- 46 Lotus 1-2-3 for OS/2 2.0 and Lotus Freelance Graphics for OS/2 2.0**, two major applications for IBM's OS
- Sparcstation LX**, Sun's feature-packed little Unix box
- Personal Communicator 440**, start-up EO does it right the first time
- PowerExec EL**, forgoing some notebook frills means big savings
- 58 WHAT'S NEW**  
BriteLite LX puts SPARC power on the road, LANdesk simplifies network management, and more.



## FEATURES

- 90 Smarter E-Mail Is Coming**  
*by Andy Reinhardt*  
Intelligent E-mail delivers more than messages. It will change how your business works by improving communications and automating workflow.
- THE VINES ADVANTAGE**  
*by Jon Udell*

## STATE OF THE ART

### COLLABORATIVE COMPUTING

- 112 Overview: Collaborative Computing**  
*by Jeffrey Hsu and Tony Lockwood*  
Computer technology brings workgroups closer.
- THE PUBLIC REACTS TO GROUP DECISION SUPPORT SYSTEMS**  
*by James D. Gantt and Catherine M. Beise*
- 123 Hitting Warp Speed for LANs**  
*by Mark A. Clarkson*  
Collaborative computing demands faster networks.
- 129 Better Than Being There**  
*by Tom Yager*  
Desktop video conferencing is on its way.
- BEING HERE AND THERE**  
*by David H. Mitchell*



- 136 SOLUTIONS FOCUS** ▷  
**Mixed Messaging**  
*by Howard Eglowstein and Ben Smith*  
 Multiplatform internetwork mail can link diverse clients on widespread networks.

**E-MAIL FROM THE WORKPLACE SHELL**  
*by Jon Udell*

- 156 A New Resolution for Desktop Lasers**  
*by G. Armour Van Horn*  
 A comparison of the latest 600-dpi laser printers.

- 165 How to Deal with Taxing Questions**  
*by Kathleen LaRivière and Stan Miaskowski*  
 Tax-preparation software for DOS, the Mac, and Windows.

- 169 Compaq Stakes Out Both Ends of the Server Spectrum**  
*by Barry Nance*  
 Compaq's new high-end Systempro/XL and low-end ProSignia servers.

- 173 Two PowerBooks Great and Small**  
*by Tom Thompson*  
 The PowerBook 180 and PowerBook Duo 230 show different design directions.

- 177 Visual Basic for Windows Gets a Face-Lift** *by Tom Yager*  
 Microsoft improves its programming package with version 2.0.

- 181 Imagining the World** *by Raymond GA Côté*  
 Macintosh software for simulating systems from the administrative office to the factory floor.

- 183 REVIEWER'S NOTEBOOK**  
**It Worked Fine a Minute Ago** *by Rick Grehan*  
 Reflections on Macintosh compatibility problems.



RICHARD WAHLSTROM © 1993

HANDS ON

- 187 SOME ASSEMBLY REQUIRED**  
**Divide and Conquer**  
*by Thomas Jeffries*  
 Here's how to debug interrupt service routines.

- 197 UNDER THE HOOD**  
**CD-ROM Inside and Out**  
*by Roger C. Alford*  
 Exploring the complexities of CD-ROM drives, discs, and associated standards.

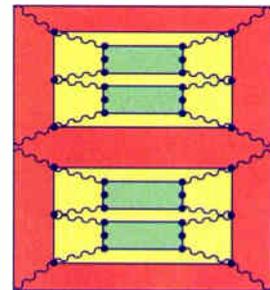
- 208 SOFTWARE CORNER**  
**Automatic NetWare Log-Ins**  
*by Barry Nance, Tom Thompson, and Ben Smith*  
 Let your applications log in to NetWare; a Mac text editor; and a graphics file viewer.

- 209 BEYOND DOS**  
**Next-Generation OLE**  
*by Bruce D. Schatzman*  
 A faster, simpler OLE looms on the horizon.

- 73 USER'S COLUMN**  
**CD-ROM Secrets**  
*by Jerry Pournelle*  
 The trick to integrating CD-ROM and Windows for Workgroups.

- 184 BOOK AND CD-ROM REVIEWS**  
**The AI Debate Revisited**  
*by Hugh Kenner, Dick Pountain, and Raymond GA Côté*  
*What Computers Still Can't Do*, guides to the Internet, an updated Grolier's multimedia encyclopedia, and more.

- 256 STOP BIT**  
**Fractal Fantasies**  
*by Clifford A. Pickover*  
 Fractals add a new dynamic to game design.



- 12 EDITORIAL**  
**The State of BYTE**  
*by Dennis Allen*

- 20 LETTERS**  
 Choosing a CPU; low-cost PCs; BYTE's Windows issue; and other topics.

READER SERVICE

- 254 Editorial Index by Company  
 250 Alphabetical Index to Advertisers  
 252 Index to Advertisers by Product Category  
 Direct Link Cards: 252A

BUYER'S GUIDE

- Mail Order  
 Hardware/Software Showcase  
 Buyer's Mart

PROGRAM LISTINGS

From BIX: Join "listings/frombyte93" and select the appropriate subarea (i.e., "mar93"). From the UUNET: ftp to ftp.uu.net, log on as "anonymous," and enter your user ID as your password. Type "cd/published/byte" and type "DIR." Files appear in subdirectories arranged by month.

From the BYTE BBS at 1200-9600 bps: Dial (603) 924-9820 and follow the instructions at the prompt.

# WIN

## THE BEST OPTICAL HARD DRIVE.

It's not just the drive that's the best. It's the drive that's the best.

Only the best.



The PMD-650 delivers unparalleled performance.

Only the best.



TYPE: 3.5" OPTICAL  
CAPACITY: 1.2 GB  
SIZE: 5.0" (H) x 8.0" (W) x 5.5" (D)  
WEIGHT: 4.11 LB  
MOUNTING: VERTICAL •• HORIZONTAL

| Drive Tested                     | Pinnacle PMD-650™ | Seagate® ST4766N 630MB | Fujitsu M2266SA 1.2GB | Maxtor® XT-8760SH 676MB |
|----------------------------------|-------------------|------------------------|-----------------------|-------------------------|
| Xcopy 20MB Tree to Optical Drive | 135.3             | 210.6                  | 165.5                 | 178.9                   |
| Xcopy 50MB Tree to Optical Drive | 379.5             | 496.8                  | 375.1                 | 428.7                   |

| Drive Tested                     | Pinnacle PMD-650™ | Sony® SMO-E502 | Maxoplix Tahiti™ II | Hewlett-Packard Corsair™ | Ricoh RO-5031E |
|----------------------------------|-------------------|----------------|---------------------|--------------------------|----------------|
| Xcopy 20MB Tree to Optical Drive | 135.3             | 506.5          | 440.6               | 198.1                    | 477.5          |
| Xcopy 50MB Tree to Optical Drive | 379.5             | 1241.2         | 1047.9              | 492.7                    | 1134.8         |

Tested on a Pentium 100MHz system with Windows 95. All tests were performed on a standard 100MHz system with Windows 95. All tests were performed on a standard 100MHz system with Windows 95.

# PEAKS

THE LAST DRIVE YOU'LL NEED.

Experience the PMO-650  
Optical Drive™  
Click, Click, Click™



"The PMO-650 is the first  
essential optical drive  
we've ever tested that can get  
hot and run cool and  
work with hard disks!"

Best Storage  
Choice

TYPE: 5.25" OPTICAL  
CAPACITY: 650/1000 MB  
SIZE: 3" (H) x 3" (W) x 10" (D)  
WEIGHT: 7.4 LBS  
MOUNTING: VERTICAL • HORIZONTAL



Optical technology offers you all the advantages of removability, reliability, maintenance-free operation, and more. The PMO™ series is the only optical drive that registers under the PMO™ series and is the only optical drive that is compatible with hard disks.

There is no other source in the industry. The PMO-650™ is the only optical drive that is compatible with hard disks. The PMO-650™ is the only optical drive that is compatible with hard disks. The PMO-650™ is the only optical drive that is compatible with hard disks.

## COST PER MEGABYTE COMPARISONS

| Drive Type                     | Retail Price | 2 Disks | 5 Disks  | 10 Disks | 50 Disks  |
|--------------------------------|--------------|---------|----------|----------|-----------|
| PMO-650 Optical Drive (1 Disk) | \$4,394      | \$4,593 | \$5,190  | \$6,185  | \$14,145  |
| Magnetic Hard Drive (650 MB)   | \$3,594      | \$6,793 | \$16,390 | \$32,385 | \$160,345 |

1-800-552-7777

THE OPTICAL STORAGE COMPANY

# INSIDE **BYTE**

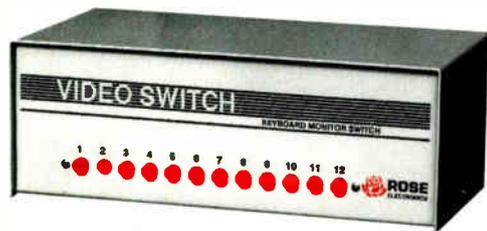
## BYTE Topic Index

*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 254), you can identify articles by type, subject, title, author, or product discussed.*

|  |                                       |  |   |
|--|---------------------------------------|--|---|
| <b>ACCOUNTING</b> 165                        | <b>FDDI</b> 123                       | <b>MULTIMEDIA</b> 73, 184                  | <b>STANDARDS</b> 90, 197                      |
| <b>AI</b> 184                                | <b>FRACTALS</b> 254                   | <b>NETWORKS</b> 73, 90, 112, 123, 136, 171 | <b>SYSTEMS</b> 40, 171                        |
| <b>APPLICATIONS</b> 90, 112, 123, 165        | <b>GAME THEORY</b> 254                | <b>NOTEBOOKS/PORTABLES</b> 46, 58, 173     | <b>TAX SOFTWARE</b> 165                       |
| <b>BASIC</b> 177                             | <b>GROUPWARE</b> 112, 123, 129        | <b>OLE</b> 209                             | <b>U.K.</b> 24                                |
| <b>BOOKS</b> 73, 184                         | <b>HDTV</b> 24                        | <b>OS/2</b> 20, 46                         | <b>UNIX</b> 46, 208                           |
| <b>CD-I</b> 197                              | <b>INDIA</b> 37                       | <b>PEN PCS</b> 46                          | <b>UTILITIES</b> 208                          |
| <b>CD-ROM</b> 73, 184, 197                   | <b>INDUSTRIAL</b> 181                 | <b>PHOTO CD</b> 197                        | <b>VIDEO</b> 58, 129                          |
| <b>COLLABORATIVE COMPUTING</b> 112, 123, 129 | <b>INTERNET</b> 184                   | <b>PRINTERS</b> 156                        | <b>VIDEO CONFERENCING</b> 112, 129            |
| <b>COMMUNICATIONS</b> 136                    | <b>INTEROPERABILITY</b> 90, 136       | <b>PROGRAMMING</b> 37, 177, 187, 209       | <b>VIM (VENDOR-INDEPENDENT MESSAGING)</b> 90  |
| <b>DEVELOPMENT</b> 177                       | <b>INTERRUPT SERVICE ROUTINES</b> 187 | <b>SERVERS</b> 171                         | <b>VINES</b> 90                               |
| <b>DRAMS, 64-MEGABIT</b> 24                  | <b>JAPANESE</b> 73                    | <b>SGML</b> 24                             | <b>WINDOWS</b> 20, 73, 90, 112, 165, 177, 209 |
| <b>DVI (DIGITAL VIDEO INTERACTIVE)</b> 197   | <b>LASER PRINTERS, 800-DPI</b> 156    | <b>SHAREWARE</b> 208                       | <b>WINDOWS NT</b> 24                          |
| <b>ELECTRONIC BOOKS</b> 24                   | <b>MACINTOSH</b> 40, 173, 208         | <b>SIMULATION</b> 181                      | <b>WORKSTATIONS</b> 46                        |
| <b>ELECTRONIC MEETINGS</b> 112               | <b>MANUFACTURING</b> 181              | <b>SOFTWARE PIRACY</b> 24                  | <b>X.400</b> 90                               |
| <b>E-MAIL</b> 90, 136                        | <b>MAPI (MESSAGING API)</b> 90        | <b>SPREADSHEETS</b> 46                     | <b>X.500</b> 90                               |
|  | <b>MOBILE COMPUTING</b> 46            |  |   |

## Your Choice of Keyboard Monitor Switches

*Access multiple computers with a single keyboard and monitor to cut equipment costs, save valuable space, and end clutter*



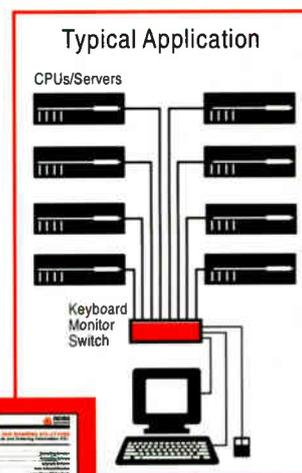
Manually controlled unit

- Simple pushbutton operation for quick selection
- Four, eight, or twelve ports per unit
- Daisy-chaining connects unlimited number of CPUs
- Compatible with EGA, VGA, Macintosh, Sun, and others
- Optional keyboard booting for 286, 386, and 486
- Optional RS232 or PS/2 mouse interface
- PCB construction for high reliability and low crosstalk
- Rack mount, matrix, and customized units available

- Switch by keystroke, from front panel, or RS232 port
- Two or four ports per unit
- Cascade units to support up to 255 CPUs
- Supports monochrome, EGA, and VGA
- Includes keyboard booting for 286, 386, and 486
- Includes RS232 and PS/2 mouse interface
- LEDs display selected CPU and CPU power-on
- Scan function switches among CPUs automatically



Keyboard controlled unit



Call toll-free now for your copy of our Switching and Sharing Solutions catalog.

Other Rose products: Print servers, printer sharing units, print buffers, keyboard monitor extenders, video splitters. All Rose products are US-made and have a 1-year warranty.

## Make the Rose Connection

10850 Wilcrest Drive • Houston, Texas 77099 • Phone (713)933-7673 • Fax (713)933-0044

**ROSE**  
ELECTRONICS

**1-800-333-9343**

# The Software is the Instrument ... You Choose the Computer

LabWindows for DOS

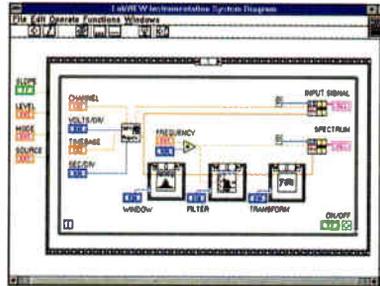
NEW  
NEW  
NEW  
LabVIEW for Windows  
LabVIEW for Sun  
LabVIEW for Macintosh

## ACQUISITION

```

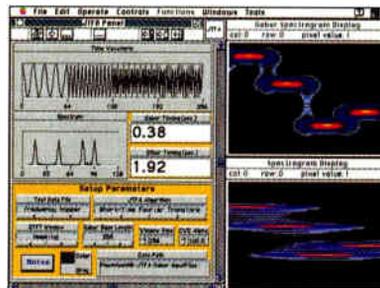
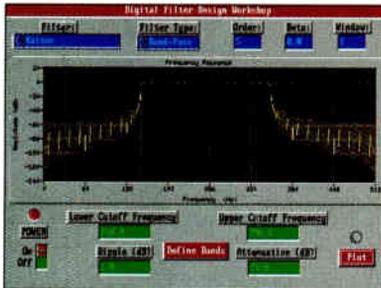
Precision
double wave1[1024], wave2[1024];
double freq1[1024], freq2[1024];
double dc_ta.t1, delta.t2;
double trig_pos1, trig_pos2;

main ()
{
    // Initialize and configure scope
    tek2400_init (1);
    tek2400_set_vertical_mode (2);
    tek2400_set_horizontal (1, 50.00, 1, 0, 0);
    tek2400_set_horizontal (0, 20.0e-9, 20.0e-9, 20.0e-9, 512);
    tek2400_set_trigger (0, 0, 1, 15, 0, 0, 0);
    // Acquire waveforms
    tek2400_read_waveform (1, wave1, dc_ta.t1, &trig_pos1);
    tek2400_read_waveform (2, wave2, dc_ta.t2, &trig_pos2);
}
    
```



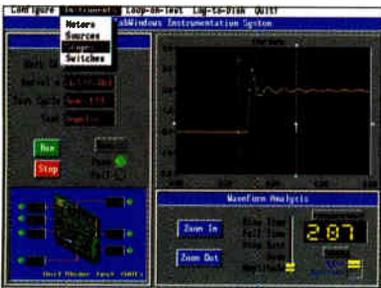
GPIB • Data Acquisition • VXI • RS-232 • Instrument Drivers

## ANALYSIS



DSP • Statistics • Linear Algebra • Filters • Windows

## PRESENTATION



Graphical User Interface • Hard Copy • File I/O

C and BASIC Programming

Graphical Programming

See us at PITTCON, Booth 4207.

Call for FREE demo disks  
(800) 433-3488 (U.S. and Canada)



Branch Offices: Australia 03 879 9422 • Belgium 02 757 00 20 • Canada 519 622 9310  
Denmark 45 76 73 22 • Finland 90 524566 • France 1 48 65 33 70 • Germany 089 714 50 93  
Italy 02 48301892 • Japan 03 3788 1921 • Netherlands 01720 45761 • Norway 03846866  
Spain 91 896 0675 • Sweden 08 984970 • Switzerland 056 27 00 20 • U.K. 0635 523545  
© Copyright 1992 National Instruments Corporation. All rights reserved. Product and company names listed are trademarks or trade names of their respective companies.



6504 Bridge Point Parkway  
Austin, TX 78730-5039  
Tel: (512) 794-0100  
Fax: (512) 794-8411

Circle 116 on Inquiry Card.

World Radio History

LabWindows®

LabVIEW®

**T**alk about poetry in motion.  
Introducing the IBM ThinkPad™ 300.  
Less than six pounds of brilliance and beauty  
that can accompany you hither and yon. And  
won't cost you an outrageous fortune.

## *Introducing* ThinkPad

ThinkPad 300 comes with 4MB of  
memory upgradable to 12MB and 80MB of  
hard disk space, upgradable to 120MB.  
There's even a math co-processor available.

But while ThinkPad is the ultimate tool

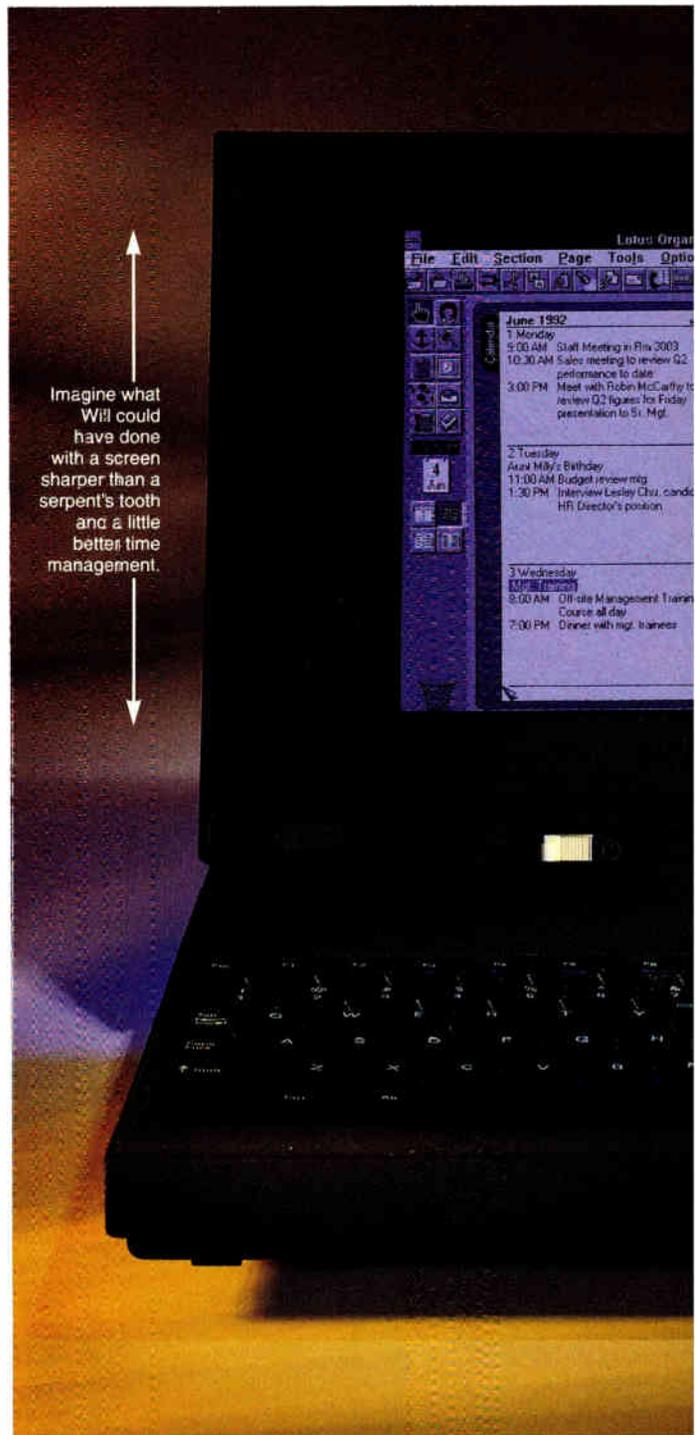


for your mind, we  
didn't forget the  
rest of you. So  
there's a comfort-  
able, ergonomi-  
cally designed  
keyboard with a  
numeric keypad  
built in. And a  
feature that lets  
you take a break

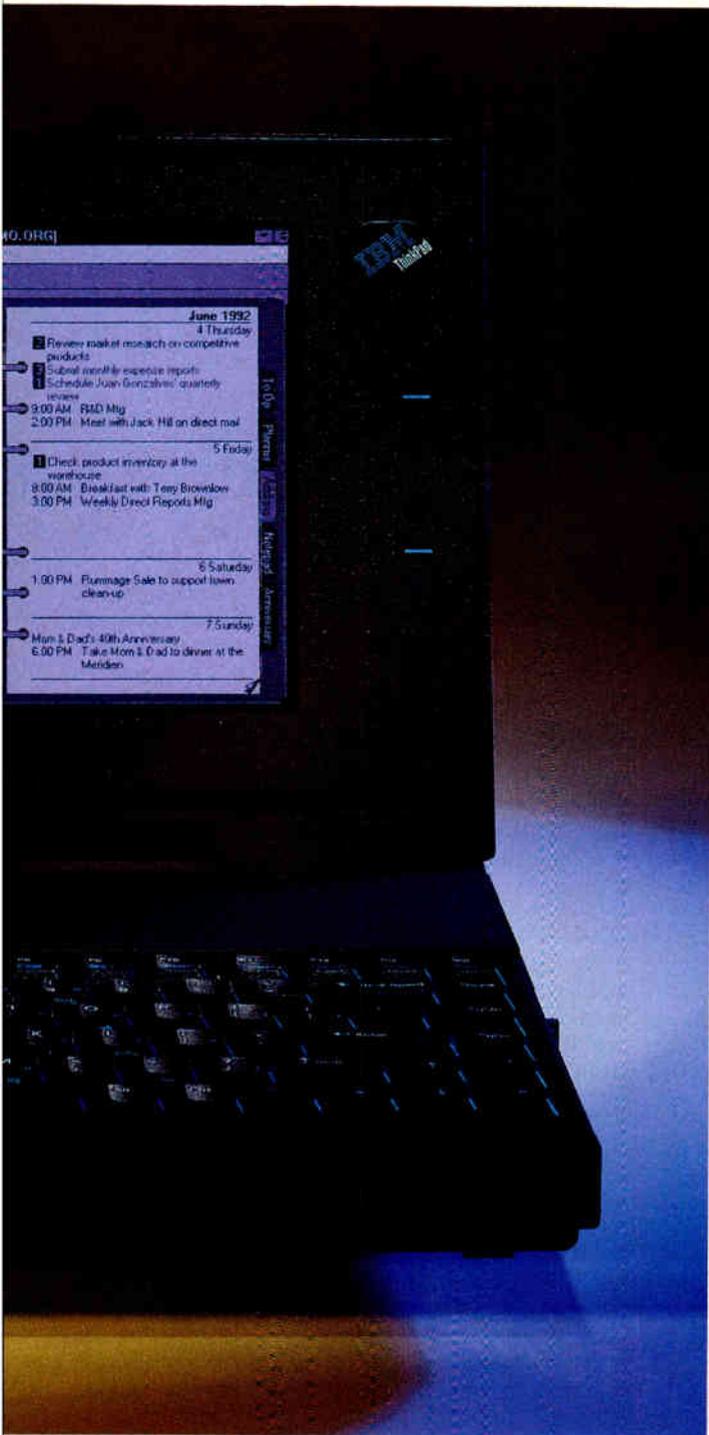
and pick up where you left off. The display is  
a big 9.5" with incredibly sharp 640×480  
VGA resolution. Since complex ideas are  
rarely black and white, ThinkPad displays 64  
dramatic shades of gray—enough to express  
the subtleties of anyone's gray matter.

ThinkPads set you free, with a world-

\*Depending on usage and configuration. \*\*MSRP. Dealer prices may vary. IBM is a registered trademark and ThinkPad, and HelpWare are trademarks of International Business Machines Corporation. The Intel Inside Logo is a trademark of Intel Corporation. © 1992 IBM Corp.



# It's what Shakesp used on a flig



wide AC adapter and a port replicator, so you don't have to detach and reattach peripheral cables when you take your ThinkPad with you. There's an Ethernet LAN port right on the machine, with Data Only (2400 baud) and Data/Fax (2400/9600) modems available, too. The dual VGA connector lets you display on other monitors and keep the control right in your lap.



| ThinkPad      | Model 300                                      |
|---------------|--|
| Processor     | 386SL/25 MHz                                   |
| Display       | 9.5" Monochrome Display<br>64 Grayscale Screen |
| Battery Life* | 4-10 Hours                                     |
| Weight        | 5.9 Lbs.                                       |
| Warranty      | 1 Year   |
| Price**       | \$2,375  |

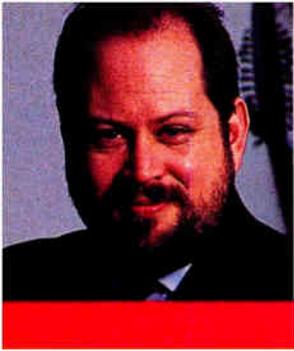
Alas, even great thinkers don't always have all the answers. So ThinkPad comes with HelpWare,<sup>™</sup> an invaluable service package including a one-year international warranty and 24-hour, seven-day-a-week assistance by fax, electronic bulletin board or toll-free phone, as you like it. To learn more about ThinkPad, or to order, call 1 800 IBM-2YOU. Or visit your nearest IBM authorized dealer.

And experience your next flight on a higher plane.



# care would have ht to the coast.

Circle 91 on Inquiry Card.



## EDITORIAL

DENNIS  
ALLEN

# THE STATE OF BYTE

Since I offered my first state-of-BYTE editorial a year ago, BYTE has made some important advances in how it serves you. And this year we have even greater things in store for you. I would like to share a glimpse of what you can expect from BYTE in 1993. First, though, here's a quick review of where we are today.

In 1992, BYTE began doing a new kind of cover story.

**The changes we're making this year are being made for only one reason: to serve you better**

Our approach combines reportorial breadth with technical depth—a combination that no other computer magazine delivers. To accomplish that goal, we literally threw all BYTE's editorial resources at each cover story. We garnered firsthand reports from our bureaus

and staff editors, and, where appropriate, we backed it up with testing from the BYTE Lab. The result has been first-class articles that provide you with information not available elsewhere. Even publications outside the computer field, such as *BusinessWeek* and the *Wall Street Journal*, have quoted from BYTE's cover stories.

Another change came in September 1992 with the globalization of BYTE. Because technology and product developments are not exclusive to North America, BYTE is committed to covering the most important technologies and products from around the world. BYTE also expanded its worldwide position with translations in such places as Brazil, Czechoslovakia, and Croatia.

Additionally, we produced two special issues in 1992: BYTE's *Essential Guide to Windows* and *Essential Guide to Portable Computing*. These issues departed from BYTE's usual technology-centric coverage to provide practical hands-on and buying information for the two fastest growing segments of users.

All these changes were in direct response to your information needs. In 1993, BYTE will continue to respond to your needs. We'll do so by applying the breadth and depth of our cover stories to other feature articles. BYTE will continue and strengthen its commitment to worldwide reporting on technologies and products. We will also continue to provide the two elements of BYTE that you say you like best: our legendary State of the Art articles that focus on a specific technology topic each month, and the wit and wisdom of industry sage and user advocate Jerry Pournelle. And this spring, BYTE will introduce an updated look that will make finding the information you need easier.

In 1993, BYTE is committed to bringing you two bonus issues on using Windows—one in the spring, the other in the fall. We're also going to provide you with information in forms beyond the pages of a magazine.

We will be listening to you more closely than ever before. Don't be surprised if you receive a survey questionnaire—or a phone call—from BYTE editors, because we want to hear from you firsthand.

All this close communication brings me to our most important announcement of the year. In our May issue, we will introduce the most exciting and innovative product coverage ever. We know that you expect BYTE to write about advanced technologies and leading-edge products, and we will continue to fill that need in a way that only BYTE can. However, we have learned that you also need to know about commodity products for your organization. In other words, it's not enough for BYTE to cover leading-edge dye-sublimation printers, for example—you also need to know which personal laser printer is best for the applications in your business.

Therefore, BYTE will provide large-scale exhaustive testing on commodity products every month. The first product-testing report will be on, you guessed it, printers, and we won't cover just a select few. This roundup will encompass virtually every significant printer on the market. But we won't bore you with 80 to 120 pages of endless printer specifications and features lists; instead, BYTE will deliver only the information you need, in a format that will make zeroing in on that information a cinch.

How can we do it? With our 20,000-square-foot state-of-the-art testing facility, the National Software Testing Labs in Philadelphia. No other computer magazine has such a lab, and no other magazine is listening to its readers in the way that BYTE does.

Moreover, at no other magazine on the planet can you find a better qualified group of technical journalists/engineers than at BYTE, BYTE Lab, and NSTL.

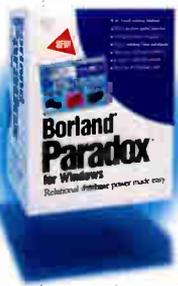
But it is you, BYTE's readers, who make BYTE a success. No other group of readers demands the kind of excellence in technical reporting that you do.

—Dennis Allen  
Editor in Chief

# Introducing Borland's Paradox for Windows



## Experience the magic of easy database power



If you're looking for the easiest-to-use, most powerful, and most reliable Windows database, this is it! With new Paradox® for Windows, there's no limit to what you can do. The graphical interface makes it easy to access, modify, and present your data. Create customer lists in seconds, automatically generate reports with the push of a button, or retrieve data from different sources into a single answer table.

## The best way to manage Paradox and dBASE data

Paradox for Windows makes it easy to work with your Paradox and dBASE® data. You can view, edit, query, and link to all your data, with no limitations. You make your request for data simply by checking off boxes with easy-to-use Query By Example. Then the Paradox for Windows query optimizer automatically

**OBJECT COMPUTING NOW!**



**BEST DATA CONNECTIVITY**

**Paradox is the best Windows database**

|   | Paradox | Access  |
|---|---------|---------|
| <b>Performance</b>                          |         |         |
| Insert 1,000 records*                       | 29 sec  | 147 sec |
| Range selection: 15,000 of 130,000 records* | <1 sec  | 16 sec  |
| Complete Paradox and dBASE file support     | ✓       |         |
| Visual data modeling for forms and reports  | ✓       |         |
| Object-oriented development environment     | ✓       |         |

determines the fastest way to deliver the answer.

Paradox for Windows lets you manage virtually unlimited data types, too. You can store any kind of information, including text, menus, graphics, OLE objects, sound, and even multimedia. You can even mix and match Paradox and dBASE data in queries, forms, and reports.

More people trust their data to Borland than all other database companies combined. That's why Borland is the Data Company. Put the power of Paradox to work for you today. You will be amazed at what you can do.

## Special introductory offer.

Offer expires April 30, 1993.

**\$139<sup>95</sup>**

(regular list price \$795)

**See your dealer or call now, 1-800-336-6464, ext. 5202**

In Canada, call 1-800-461-3327.



**Borland Paradox for Windows**

\*All tests run on IBM® PS/2 Model 70 386/20 mhz, 4Mb RAM, Novell 3.11 NetWare, Ethernet network. Special offer good in the United States and Canada only. Prices in U.S. dollars. Copyright © 1993 Borland International, Inc. All rights reserved. All Borland product names are trademarks of Borland International, Inc. BI 1548

Circle 70 on Inquiry Card (RESELLERS: 71).



# Increased 386 Performance

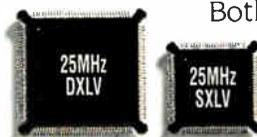
## AMD's 3-Volt 386 Microprocessors Deliver The Longest Battery Life For Portable Computing.

The power struggle continues. While you can get a 386 microprocessor that goes fast, you'll still burn through a battery charge in a hurry. Low-voltage 386 CPUs from AMD are the answer—the Am386™SXLV and Am386DXLV microprocessors.

Here are two CPUs made not only to go fast, but to go the distance with portable computer users. Unlike common power-hungry 386s, these low-voltage CPUs

run on 3 volts. And they automatically slip into a static "sleep" mode to save power whenever the processor is idle. So users depend less on recharge units—and get the longest operational battery life.

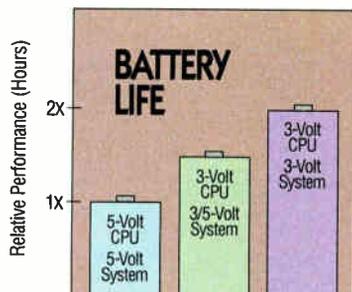
Both Am386 CPUs were designed to fit as comfortably in your budget as they do your portable computers. But you won't compromise on performance because the Am386SXLV and Am386DXLV 3-volt microprocessors both run at 25MHz. So



*The 25MHz DXLV and the 25MHz SXLV are available in PQFP packaging.*



# ance At No Extra Charge.



they're plenty powerful for running Windows.™

Now there's nothing stopping you from charging forth with more efficient 3-volt laptops, notebooks, and palmtops. AMD

also has your memory needs covered with our 3-volt EPROMs. And now that the industry at large has welcomed low-voltage portable computing, you'll find the rest of your components equally easy to come by.

For more information on low-voltage 386 microprocessors and support logic, call **1-800-222-9323** and ask for Literature Pack 15F. And become the current leader in portable computing.



**Advanced Micro Devices**

*Microprocessors For The Masses.™*

# BYTE

**EDITOR IN CHIEF**  
Dennis Allen

**PUBLISHER**  
Ronald W. Evans

## HOW TO CONTACT THE EDITORS

### EXECUTIVE EDITORS

New York: Rich Malloy  
Peterborough: Rich Friedman

### MANAGING EDITOR

D. Barker

### ASSISTANT MANAGING EDITOR

Lauren Stickler Thompson

### NEWS

**Peterborough:**  
Senior Editor: Dan Muse  
News Editors, *What's New*: Martha Hicks, Carol Swartz  
Microbytes: David L. Andrews  
News Assistant: June Sheldon  
**San Mateo/West Coast:**  
Bureau Chief: Andrew Reinhardt  
Senior Editor: Tom Hallhill  
News Editor: Patrick Waurzyniak  
Editorial Assistant: Barbara J. Caravello  
**Los Angeles:**  
Senior Editor: Gene Smarte  
**New York:**  
News Editor: Ed Perratore

### BYTE LAB

Senior Editor & Director: Alan Joch  
Technical Director: Rick Grehan  
Technical Editors:  
Stephen Aphi: systems, networking  
Stanford Diehl: graphics software, add-ins, peripherals  
Tom Yager: multimedia, Unix, operating systems, software development  
Testing Editors/Engineers: Howard Eglowstein, Ben Smith, Stanley Wszola  
Lab Assistant: Selinda Chiquoine

### STATE OF THE ART/FEATURES

Senior Editor: Michael Nadeau  
Technical Editors: Janet J. Barron, Anthony J. Lockwood, Robert M. Ryan

### SENIOR TECHNICAL EDITORS

*At Large*: Tom Thompson, Jon Udell  
Columns: Rob Mitchell

### ASSOCIATE TECHNICAL EDITORS

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

### SENIOR CONTRIBUTING EDITOR

Jerry Pournelle

### CONTRIBUTING EDITORS

Hugh Kenner, Barry Nance

### CONSULTING EDITORS

Roger C. Alford, Jonathan Amsterdam, Nicholas Baran, Raymond GA Côté, Don Crabb, Anne Fischer Lent, Laurence H. Loeb, Trevor Marshall, Dick Pountain, Wayne Rash Jr., Kenneth M. Sheldon, Jane Morrill Tazelaar, Ellen Ullman, Peter Wayner

### EDITORIAL ASSISTANTS

Office Manager: Peggy Dunham  
Assistants: Linda C. Ryan, Janet A. Young

### DESIGN

Director: Nancy Rice  
Associate Director: Joseph A. Gallagher  
Designers: Jan Muller, Sharon Price  
Graphics Manager: Roger Goode

### PRODUCTION AND FINANCE

Director: Claudia Flowers

### PRODUCTION

Director: David M. Cohen  
Production Manager: David R. Anderson  
Advertising Graphics Manager: Susan Kingsbury  
Editorial Graphics Manager: Virginia Reardon  
Graphics Production Coordinators: Barbara Busenbark, Christa Patterson, Donna Sweeney, Lillian J. Wise  
Advertising Services Manager: Linda Fluhr  
Senior Advertising Services Representative: Lyda Clark  
Advertising Services Representatives: Dale J. Christensen, Karen Cilley, Rod Holden  
Quality Control Manager: Wai-Chiu Li  
Operations Assistant: Lisa Jo Steiner

### FINANCE

Senior Financial Analyst: Kenneth A. King  
Financial Analyst: Kathleen Deguise  
Data Processing Coordinator: Diane Henry  
Billings Coordinator: JoAnn Walter  
Production Assistant/Purchaser: Agnes Perry

### MARKETING AND PLANNING

Director: L. Bradley Browne  
Administrative Assistant: Carol Cochran  
Marketing Communications Manager: Pamela Petrakos  
Marketing Art Director: Stephanie Warnesky  
Market Research Manager: Julie Perron  
Copyrights Manager: Faith Kluntz  
Reader Service: Cynthia Sands  
Marketing Assistant: Carol Sanchioni

### CIRCULATION

Director: Glyn Standen  
Subscriptions Manager: Paul Ruess  
Assistant Manager: Pam Wilder  
Subscriptions Assistant: Christine Tourgeon  
Newsstand Manager: Vicki Weston  
Assistant Manager: Karen Desroches  
Back Issues: Louise Menegus  
Direct Accounts Coordinator: Ellen Dunbar

Publisher's Assistant: Donna Nordlund

### ADVERTISING SALES

**NEW ENGLAND**  
Patricia Payne (603) 924-2654

### EAST COAST

Kim Norris (212) 512-2645  
Jonathan Sawyer (603) 924-2665

### SOUTHEAST

Mary Ann Goulding (404) 843-4782  
Barry Echavarría (603) 924-2574

### MIDWEST

Kurt Kelley (312) 616-3328  
Ed Ware (603) 924-2664

### SOUTHWEST, ROCKY MOUNTAIN

Jennifer Walker (214) 701-8496  
Larry Levine (603) 924-2637

### SOUTH PACIFIC

Beth Dudas (714) 753-8140  
Joseph Mabe (603) 924-2662  
Alan El Faye (213) 480-5243  
Larry Levine (603) 924-2637

### NORTH PACIFIC

Bill McAfee (415) 513-6862  
Jonathan Sawyer (603) 924-2665  
Roy J. Kops (415) 513-6861  
Joseph Mabe (603) 924-2662  
Barbara Holmes (415) 513-6945  
Barry Echavarría (603) 924-2574

### INSIDE ADVERTISING SALES

Director: Liz Coyman (603) 924-2518  
Assistants: Susan Monkton, Vivian Bernier

### THE BUYER'S MART (1 x 2)

Margot Gnade (603) 924-2656

### HARDWARE/SOFTWARE SHOWCASE

Ellen Perham (603) 924-2598  
Mark Stone (603) 924-2695

### REGIONAL & BUYER'S GUIDE

Brian Higgins (603) 924-2651

### BYTE DECK

Brad Dixon (603) 924-2596

### EURO-DECK

James Bail (603) 924-2533

### INTERNATIONAL ADVERTISING SALES STAFF

See listing on page 251.

### PERSONNEL

Human Resources Administrator:  
Patricia Burke  
Assistant: Fran Wozniak  
Receptionist: Beverly Goss

We welcome your questions, comments, complaints, kudos, and submissions.

**MAIN OFFICE:** One Phoenix Mill Lane, Peterborough, NH 03458, (603) 924-9281.  
**San Mateo:** 1900 O'Farrell St. #200, San Mateo, CA 94403, (415) 513-6912.

**Los Angeles:** 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.

**U.K./EUROPE:** Wimbledon Bridge House, One Hartfield Rd., Wimbledon, London SW19 3RU, England, +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 unnet, AppleLink, CompuServe, and numerous other services.

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

Advertising: (603) 924-7507

U.K. fax: +44 81 540 3833

### 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.

### ARTICLE REPRINTS:

For price quotations on customized reprints of BYTE articles, contact Faith Kluntz, Reprints Manager, at (603) 924-2525. (Minimum quantity: 500.)

## SUBSCRIPTION CUSTOMER SERVICE

**Inside U.S. (800) 232-BYTE;** outside U.S. +1 609 426 7676. 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, £35 (U.S. \$60) for fast surface delivery, £46 (U.S. \$80) for air delivery. Non-European countries U.S. \$60 for surface mail, or U.S. \$85 for air mail. 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.

### PHOTOCOPY 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, \$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 Faith Kluntz, Copyrights Manager, (603) 924-2525. 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 © 1993 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 Audit Bureau of Circulation

## BIX INTERACTIVE ON-LINE SERVICE

### PRODUCT MANAGER

Kip Bryan

### EXCHANGE EDITORS

*Amiga Exchange:* Joanne Dow  
*Entertainment and Leisure Exchange:* Rich Taylor  
*IBM Exchange:* Barry Nance  
*Programmers Exchange:* Bill Nicholls  
*Professionals Exchange:* David Reed  
*Tojerry Exchange:* Jerry Pournelle  
*WIX Exchange:* Karen Kenworthy  
*Writers Exchange:* Wayne Rash Jr.

### DIRECTOR OF COMPUTER-RELATED SERVICES

Stephen M. Laliberte

### MEMBER SERVICES MANAGER

Kevin Plankey

BIX, owned and operated by General Videotex Corporation, 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) 695-4882 or (617) 491-5410, or make a data call to our Tymnet address: 310690157800. 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) 695-4775 or (617) 354-4137 on voice phone; fax: (617) 491-6642; Internet: bix@genvid.com.

### OFFICERS OF MCGRAW-HILL, INC.:

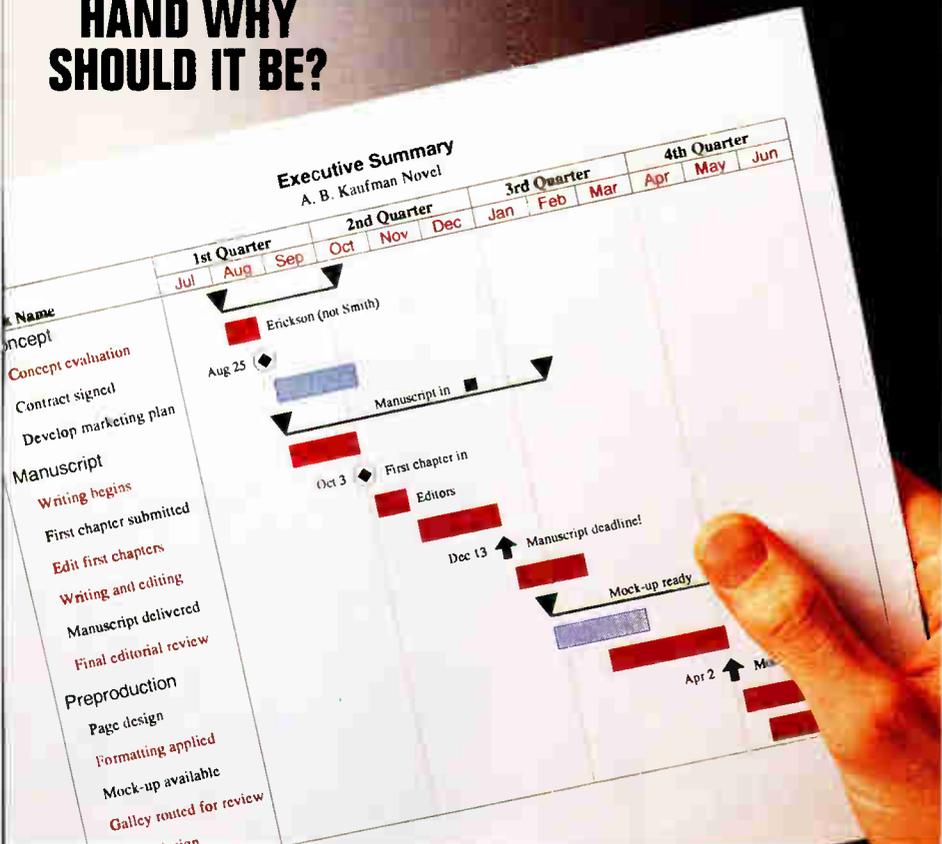
Chairman, President, and Chief Executive Officer: Joseph L. Dionne; Executive Vice President, General Counsel, and Secretary: Robert N. Landes; Executive Vice President: Harold W. McGraw III; Executive Vice President and Chief Financial Officer: Robert J. Bahash; Senior Vice President, Treasury Operations: Frank D. Penglase; Executive Vice President, Publication Services: Norbert Schumacher.

Founder: James H. McGraw (1860-1948).

**ON ONE HAND,  
PROJECT  
MANAGEMENT  
CAN BE A REAL  
HEADACHE.**



**ON THE OTHER  
HAND WHY  
SHOULD IT BE?**



You work hard enough planning your projects; why not let Microsoft® Project 3.0 for Windows™ help you make it easier?

With clear graphs, you'll be able to see and communicate your project even better—from the tiny details to the big picture.

Changes? No problem. For every revision you make, Microsoft Project helps you see how it will affect the entire job.

Assigning a new job? Just click the People button. Want to know who's doing what, when? Microsoft Project can help you keep track of everyone.

And if you need to get off to a fast start, use PlanningWizards to guide you step-by-step. Soon, you'll have great-looking, easy-to-read reports that make all your plans perfectly clear.

You can even exchange files between Project on your PC and your Mac®. Either way, why not plan on the leading project management software? Microsoft Project 3.0 – it takes the pain out of planning.

**Microsoft**  
Making it easier

# The Widest Arra

Fault Tolerant Disk Array Controllers, Subsystems and Servers supporting NetWare, SCO UNIX and OS/2.

## Powerful 1, 2, 3, and 5-Channel Disk Array SCSI Controllers

Mylex now offers a range of disk array controllers, all based on the powerful Intel i960CA™ RISC processor. The controllers feature 4/16/64-Mbytes of cache, an EISA host interface and extensive software support.

RAID levels 0, 1, and 5 are supported, with hot swapping, on-the-fly reconstruction, background rebuild, hot standby, multi-threading, and scatter/gather features.

NetWare 3.11, SCO UNIX 3.2.4 and IBM OS/2 2.0 operating environments are supported. All controllers are offered with user-friendly software utilities.

► **DAC960-1/2:** Single fast and wide SCSI-II channel, which can be upgraded to two channels. Each channel has both 8-bit and 16-bit SCSI-II connectors.

► **DAC960-3:** Three fast SCSI-II channels, which can support up to 21 SCSI drives.

► **DAC960-5:** Five fast and wide SCSI-II channels, with the option to drive 8-bit or 16-bit fast SCSI drives.

### NetWare, UNIX, OS/2

All Mylex disk array products support Novell NetWare 3.11, with optional support for SCO UNIX 3.2.4 and IBM OS/2 2.0.

## Disk Array Subsystem

The disk array subsystem (DAS) features a DAC960 five-channel disk array controller and a flexible enclosure which houses up to five 5.25" or 3.5" SCSI drives. Each drive is powered by its own power supply for improved system reliability. Disk drives are offered as an option. Up to four of these enclosures can be powered by a single DAC960-5 controller, allowing up to 20 drives for each controller.

The DAS can be used in conjunction with any EISA-based computer to build a powerful file server. Up to four controllers can be configured into the system to offer virtually unlimited disk capacity.



# y of Disk Arrays.



## Integrated Disk Array Server: IDAS2000

The Mylex IDAS2000 is a high-performance integrated disk array server, utilizing state-of-the-art disk array technology.

► **CPU Subsystem:** Intel 486™ DX2-66MHz EISA system with 256-Kbytes of cache, 8-Mbytes of system memory upgradable to 256-Mbytes, six bus master EISA slots, built-in I/O, flash BIOS and future CPU upgrades with the ZIF socket.

► **Disk Subsystem:** Features a one-channel disk array controller that is upgradable to two channels for increased performance. The controller utilizes the powerful Intel i960CA RISC processor and includes a standard cache of 4-Mbytes that's upgradable to 64-Mbytes. RAID levels 0, 1, and 5 are supported with fault tolerance, hot replacement, hot sparing and background rebuild capabilities. Both 8- and 16-bit fast and wide SCSI-II drives are supported. Software support for NetWare 3.11 (Novell certified). Optional support for SCO 3.2.4 and IBM OS/2 2.0 operating environments. Extensive user-friendly software utilities included.

► **Enclosure:** Includes three redundant power supplies, five cooling fans, 10 drive bays for 3.5" SCSI drives, and four additional drive bays for tape drives, floppy, etc.

The system includes an EISA LAN adapter and super VGA graphics. Disk drives are optional.

## We've Benchmed the Competition

When Mylex conducted benchmark tests to compare our disk array system's performance to our competitors', we outperformed the competition's RAID 3 and 5 systems, as well as duplexed and spanned systems, by a wide margin.

### Benchmarks: Disk Array Subsystems

|                                | CIPRICO<br>NetArray<br>RAID 3 | CORE<br>IAS<br>RAID 3 | MICROPOLIS<br>RAIDion<br>RAID 5 | ULTRASTOR<br>U124<br>RAID 5 | MYLEX<br>DAC960<br>RAID 5 |
|--------------------------------|-------------------------------|-----------------------|---------------------------------|-----------------------------|---------------------------|
| NCOPY<br>all drives<br>enabled | 13:19                         | 15:00                 | 13:30                           | 10:06                       | 4:25                      |
| NCOPY<br>one drive<br>down     | 14:05                         | 15:00                 | 15:30                           | 10:36                       | 4:30                      |
| NCOPY<br>during<br>rebuild     | 26:32                         | -                     | 20:49                           | 18:30                       | 10:17                     |

► LAN Technology's performance tests for Ciprico, Core and Micropolis consisted of copying 2400 files—totaling about 80-Mbytes—from one directory to another using NetWare's NCOPY. The Mylex and UltraStor test configuration included a 486 DX2-50MHz CPU-based EISA system using five HP 97556-30 796-Mbyte drives. Times are shown in minutes.

Visit us at CeBIT - Hall 8/EG, Stand B40.

World Radio History

## Flexible Purchase Options

Controllers only, a complete system without disk drives, or a complete system with the drives are offered.

For more information on Mylex disk array systems and controllers, call 1-800-MYLEX or 1-510-796-6100. Or, fax us at 1-510-745-8016.

© 1993, Mylex Corporation. Specifications subject to change without notice. All trademarks are the property of their respective holders. © 1992, M&T Publishing, reprinted with the permission of LAN TECHNOLOGY, August, 1992. Novell certification applies to 5-channel disk array products only. The Intel Inside Logo is a trademark of Intel Corporation.



Circle 113 on Inquiry Card.

# LETTERS

## The Truth About OS/2

I want to clarify one point in Jerry Pournelle's comments about OS/2 2.0 ("Pondering OS/2," November 1992). Referring to Windows 3.1 bundled applications like Paintbrush and Write, he states that "if you had a bunch of Windows 3.1 applications on your hard disk, this is probably one of them and you'll get a message that the applications can't be run. Considerable time is wasted to no purpose." But Windows 3.1-compatible programs definitely work under OS/2 2.0. Some people misunderstood the phrase and asked me if OS/2 2.0 can't run *any* Windows 3.1-aware applications. I run Windows applications like Atech's AllType font-conversion program without problems.

Fernando Cassia  
Buenos Aires, Argentina

## Upgrading Made Easier

I appreciated the timeliness of Andy Redfern's article "Make the Right CPU Move" (December 1992). I wanted to upgrade my 386SX/25 to remain more current but was unsure of the best path to take. Since I wanted to realize a major performance improvement but not at an astronomical cost, I had narrowed it down to either the 386DX/40 or the 486DX/33. The article clearly showed that there is not enough difference, performance-wise, to justify the extra cost of the 486 for my applications. I'll upgrade to the 386DX/40 and wait for the P5.

Also, thanks to Jerry for telling the truth about OS/2's installation: If you read the manuals, it's as easy as inserting one disk after another—it is boring, but hardly difficult.

Larry Field  
College Station, TX

## Static Shock

I was shocked when I saw the November 1992 What's New item "Create a New Ion Field" (page 82), which describes a device called the Perfect-Aire 100.

There is no such thing as an ion field. There is also no such thing as ion radiation (except maybe in particle accelerators, and that's stretching it). There is certainly no such thing as electrostatic radiation: By definition, static electricity is *static* and thus cannot radiate anything.

On top of that, I do not think this kind of device has ever been proved to have any beneficial effect in reducing static. Rather, it often uses high voltages, which tend to produce ozone—a poison if the concentration is too high.

Jean-Pierre Weber, Ph.D. in E.E.  
Stockholm, Sweden

WE WANT TO HEAR FROM YOU. Address correspondence to Letters Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458, send BIXmail c/o "editors," or send Internet Mail to letters@bytepb.byte.com. Letters may be edited.



## Investment Credit

While many companies may be trading off long-term R&D against short-term financial gain with the new, low-cost personal computers coming out ("Penny-Pinching PCs: How They Did It," November 1992), not all are cutting back on R&D spending. Apple has *increased* spending on R&D (26 percent from 1991). Also, the construction of Apple's new R&D campus (Cupertino, CA) demonstrates that not all companies coming out with low-cost personal computers are taking a short-term view of their future.

Mark Boudreau  
Toronto, Ontario, Canada

## Windows Rebellion?

It was interesting to contrast the tone of BYTE's *Essential Guide to Windows* (1992) with that of "Penny-Pinching PCs: How They Did It" (November 1992). The former referred to the huge amount of disk storage and RAM required to run Windows applications. The consensus seemed to be a 200-MB hard drive and 8 MB of RAM; a 486 was recommended. In the discussion of the inexpensive PCs (made by Compaq, AST Research, IBM, and so on), the configuration was more like a 40-MB drive, 4 MB of RAM, and a 386SX. Unless there is a wholesale rebellion against Windows applications because of their excessive hardware requirements, I fear that the marketing of low-end PCs by high-end companies will fail.

Henry T. Minden  
Concord, MA

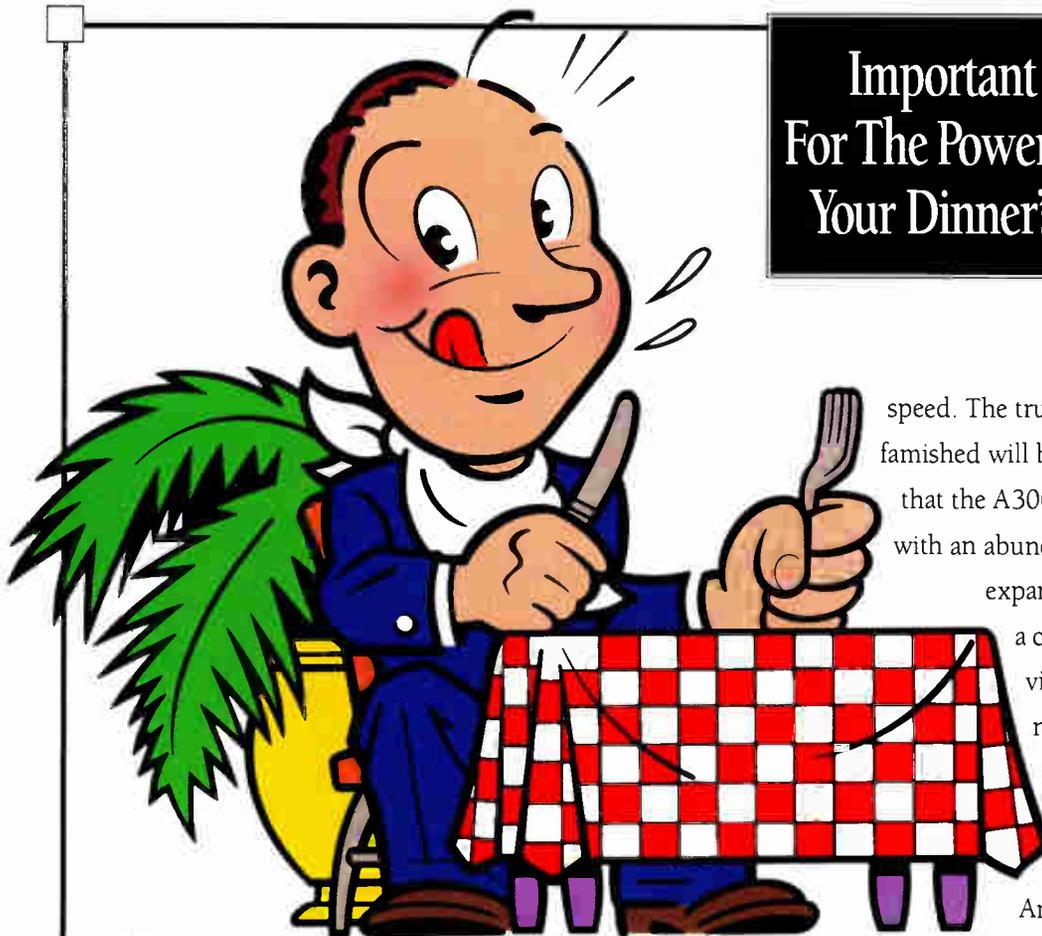
Where are all the Windows enthusiasts your PC journalists cite in BYTE's *Essential Guide to Windows*, 1992? The Windows users I see are usually victims of managers trying to entice computer phobics and novices to the system or of their vendor's greedy deals with the Microsoft juggernaut. Enthusiastic PC users gave up on DOS long ago. Most that I know are using OS/2 2.0 and find it a much better platform for their DOS applications than DOS, and especially better than Windows. OS/2's support for Windows applications is a useful bonus.

Joseph C. Hager  
San Francisco, CA

## FIXES

- In BYTE's *Essential Guide to Portable Computing*, 1992, on page 26 we referred to Mitsuba as a manufacturer of floppy drives as well as notebook computers. Mitsuba does not make floppy drives.
- In "Fast Transit" (October 1992), Henry Quan is identified as president of ATI Technologies. Quan is vice president of marketing. ■

## Important News For The Power Hungry: Your Dinner's Ready.



speed. The truly power famished will be happy to know that the A3000T is stuffed with an abundant selection of expansion slots. There's a co-processor slot. A video slot for internal devices. Up to four PC slots. And up to five Zorro III slots. Every Amiga 3000 series computer comes with

**C**ome and get it. The new Amiga® 3000T multimedia workstation tower—the most expandable, flexible Amiga ever built.

*Now powered by a 25 MHZ Motorola 68040 CPU, the A3000T is faster than ever before. (Current A3000T users can upgrade to a 040-based accelerator card.)*

The A3000T features a 200MB hard disk drive. A 3.5" floppy disk drive. 5MB of RAM, expandable to 18MB. And 32-bit bus architecture to transfer mammoth amounts of information at breakneck

Commodore Express™ Gold Service options.\* And convenient leasing terms are available.

Now, you'd expect a power feast like this to carry a fat price tag. But now with our new low price, you can sit down to an Amiga 3000T for just \$2,875.\*\* Which in itself is a powerful reason for seeing your Commodore dealer today. For a dealer near you, call 1-800-66-AMIGA. In Canada, call 1-800-661-AMIGA. Bon appetit.



**Commodore**  
**AMIGA**

© 1992 Commodore Business Machines Inc. Commodore and the Commodore logo are trademarks of Commodore Electronics Ltd. Amiga is a trademark of Commodore-Amiga, Inc. Products available on GSA schedule GS-00K-91-AGS-5069. \* Available only on systems purchased in the U.S. through an authorized Commodore-Amiga dealer. Customer activation required. Some optional programs include a charge. \*\*MSRP, monitor sold separately.

**Circle 75 on Inquiry Card.**

- ▶ Add more storage.
- ▶ Protect your data.
- ▶ Transport your data.
- ▶ Share your data.



**lomega® 21MB Floptical® Drive.**  
**A standard floppy drive and a 21MB floppy drive in one.**

- Reads/writes to standard floppy diskettes.
- Up to 3 times faster than floppies.
- Holographic Optical Tracking for added reliability and speed.
- New lomega laser-etched media—every one is a master.



**Bernoulli® MultiDisk™ 150.**  
**Handles like a floppy,**  
**performs like a hard disk.**

- 150MB capacity.
- 18-msec effective access time.
- Rugged Bernoulli Technology®
- Disks also available in 1.05, 65, and 35MB capacities.
- Reads/writes 90MB Bernoulli Disks, reads 44MB-Bernoulli Disks.



\*Awards won for products using Bernoulli Technology. ©1993 lomega Corp. lomega, the lomega logo, Bernoulli, and Bernoulli Technology are registered trademarks, and MultiDisk and LaserS... call 1-800-456-5522. In Europe, call 49-761 45040. For worldwide custom...



# NEWS

## MICROBYTES

### Popular 486 Sees High Demand in Europe

**L**ONDON—Europe faces a potential shortage of 486 chips in the first quarter, with vendors saying that Intel has warned that those without a consignment on order should not expect to obtain parts early this year. The processor family is in heavy demand due to a larger-than-expected need for the 486 family and the rush of vendors wanting to deliver low-cost 486-based PCs, said Nick Wood, Intel's technical marketing manager at Intel U.K. Companies that buy 486 chips on the open market—in particular, through the so-called “gray” market from other PC makers—may face a tough time, Wood conceded.

“A significant change in demand for 486s started in Q3 last year, compounded

by the market reaching an overall size of 30 million units [for all PC processors worldwide], compared to a Dataquest forecast of 23 million,” Wood said. “Q1 will be tough, but we should be able to meet all market requirements.” About 60 percent of PCs now shipping are 486-based, Wood added.

Chris Bakolas, Dan Technology's technical director in the U.K., confirmed that Intel was warning vendors about potential 1993 shortages as long ago as October 1992. Michael Spiro, financial director of direct-vendor Elonex, said PC vendors that buy their 486s through the U.K. chip distribution channels may not get enough chips. Chip shortages could recur later this year.

—Dom Pancucci

### IBM No Ostrich in Anticipation of NT, Cairo

**W**hile Microsoft readies Windows NT, IBM is busily preparing OS/2 2.1. John Patrick, vice president of marketing and sales for IBM's Personal Software Products division, said IBM hopes its 5000-site beta test of OS/2 2.1 will help it avoid mistakes made with version 2.0. The haste with which IBM released OS/2 2.0 resulted in about 200 bugs.

Version 2.1 will have seamless support for Windows 3.1 standard mode (with extra drivers for printers and other hardware), the 32-bit graphics engine, and bug fixes. It will also have 256-color XGA and Super VGA drivers, Advanced Power Management support, PCMCIA-card enabling, pen support, a fax send/receive applet, and for Win-OS/2 users, the Windows File Manager and TrueType fonts. What's missing is seamless support for IBM's 8514 graphics standard. “All in all, it's the best beta I've seen to run with all these features,”

said Steve Mastrianni, president of Personal Systems Software (Unionville, CT).

IBM's PSP division is not focusing its development efforts solely on the 32-bit Intel version of OS/2, however. Patrick said the company is targeting a “Workplace Shell-like” GUI-based version of PC-DOS—tentatively called Workplace DOS—at users of 286 and lower-end 386 systems. IBM may come out with pen extensions for this PC-DOS and a ROM version of Workplace DOS. IBM also expects to go into beta test this year with a version of OS/2 running on the Mach microkernel.

Also, Taligent spokeswoman Loretta Stagnetto said that the company hopes this year to announce business and product strategies for the microkernel-based, object-oriented operating system it hopes will win out over Microsoft's upcoming Cairo and other systems.

—Ed Perratore

### Intel Faces Competition on Low and High End

**B**URLINGAME, Calif.—Smaller Intel-clone chip makers AMD (Sunnyvale, CA) and Cyrix (Richardson, TX) are upbeat in their assessments about their ability to compete. At the Technologic Partner's Personal Computer Outlook conference, executives from AMD, Cyrix, Sun Microsystems, and AST Research concluded that despite the massive Intel Inside campaign, most users don't care about processor name brand, provided the chip is 100 percent compatible and performs well.

Cyrix's CEO Jerry Rogers said that as a fabless chip maker, Cyrix has concentrat-

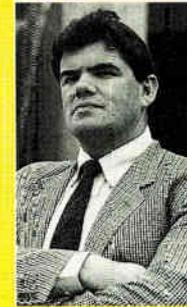
ed on its strengths and enlisted the aid of Texas Instruments. Subodh Taprani, AMD director of marketing and systems, said AMD has seen strong demand for its 386 chips, noting that it set a record for its 386 unit sales during the third quarter of last year. AMD plans to release a 486-compatible chip later this year.

As Intel prepares to unleash the first Pentium processors and move its user base from the 486 to its next-generation processor, it faces competition from the likes of the Mips R4000 and DEC's Alpha microprocessor.

—Patrick Waurzyniak

## NANOBYTES

In an ironic twist of fate, Borland International founder **Philippe Kahn** blames Microsoft for starting a price war that he said forced



Borland to lay off 350 people—15 percent of his company—two weeks before Christmas.

“It's painful, it's no fun, but we have to do it,” said Kahn.

“Microsoft has

been extremely aggressive, and we think there will be more price wars in the future.” Kahn attacked Microsoft's pricing strategy for Access, a Windows database program introduced last November. Kahn said Microsoft mailed literature that advertised Access at \$695 and then slashed the introductory price to \$99. Ironically, Borland used a similar strategy a few years ago when introducing Quattro Pro. Observers said that things would not be so bad for Borland had it not been so late in releasing its Paradox for Windows (which should be released by now) and dBase for Windows (slated for mid-1993 release). □

Microsoft (Redmond, WA) denies that its \$99 introductory offer for Access was a cruel attempt to squash Borland. Charles Stevens, general manager of Microsoft's Database and Programmability Group, told BYTE that Microsoft was only trying to establish a new database program in an entrenched market. Nevertheless, users report that the first version of Access could have benefited from code optimization. One user complained that Microsoft technical support recommended that he upgrade his 40-MHz 386 machine to at least 8 MB of RAM to achieve acceptable performance. This despite the fact that Microsoft's Access box reads that the program runs on a 386SX with 2 MB of RAM; “4 MB [of RAM] recommended.” □

# Finally, full-motion video for your PC.

Now you can create full-motion video and multimedia presentations right on your desktop PC with Video Blaster™ hardware and Microsoft® Video for Windows™ software. Everything you need is right in the Video Blaster box.

**Complete video hardware PLUS full-motion multimedia software...**

Video Blaster lets you capture, freeze, store, manipulate and export fully-scalable digital video images from as many as three sources (both PAL and NTSC).

Video for Windows software adds Windows-compatible, Audio-Video Interleave (AVI) format to your Video Blaster hardware. So you can now capture and store full-motion video and incorporate it into OLE-compatible applications.

Use the two together to produce and edit full-color digital video sequences in a resizable window. Combine still and moving video with computer-generated graphics and animation, or overlay text and graphics onto live video. With just these tools and a video source, you've got an entire multimedia video studio on your desktop.

To add CD-quality 16-bit stereo sound and on-screen digital mixing, just plug in a Sound Blaster™ 16 ASP™ or other Sound Blaster audio card. Your presentations will sound as good as they look.

Included in your Video Blaster package is over \$1500 in software—including Macromind Action!™ and Temptra™ presentation packages for DOS or Windows environments. Plus Creative Labs'



*Microsoft Video for Windows: puts the power of full-motion digital video onto your PC screen.*



Video Kit for special effects and JPEG compression software to store images in a fraction of the disk space required by other PC video systems.

**...all in one package.**

It's the complete multimedia authoring and editing solution. Everything you need to

get rolling with full-motion multimedia video... and all at a price you can afford.

For more information and the name of your nearest dealer, call 1-800-647-9933.

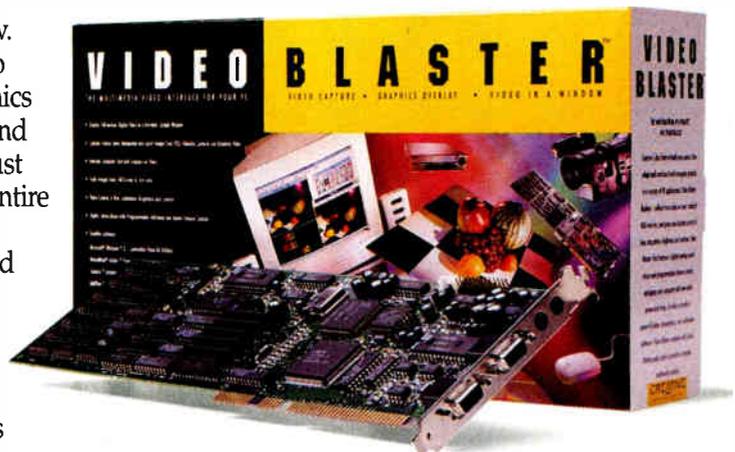


*Special Edition Temptra GIF and SHOW: for DOS.*

## Creative Labs and Microsoft team up to offer state-of-the-art PC video for less than \$500.\*



*Macromind Action! for Windows.*



Microsoft VIDEO FOR WINDOWS

Video BLASTER

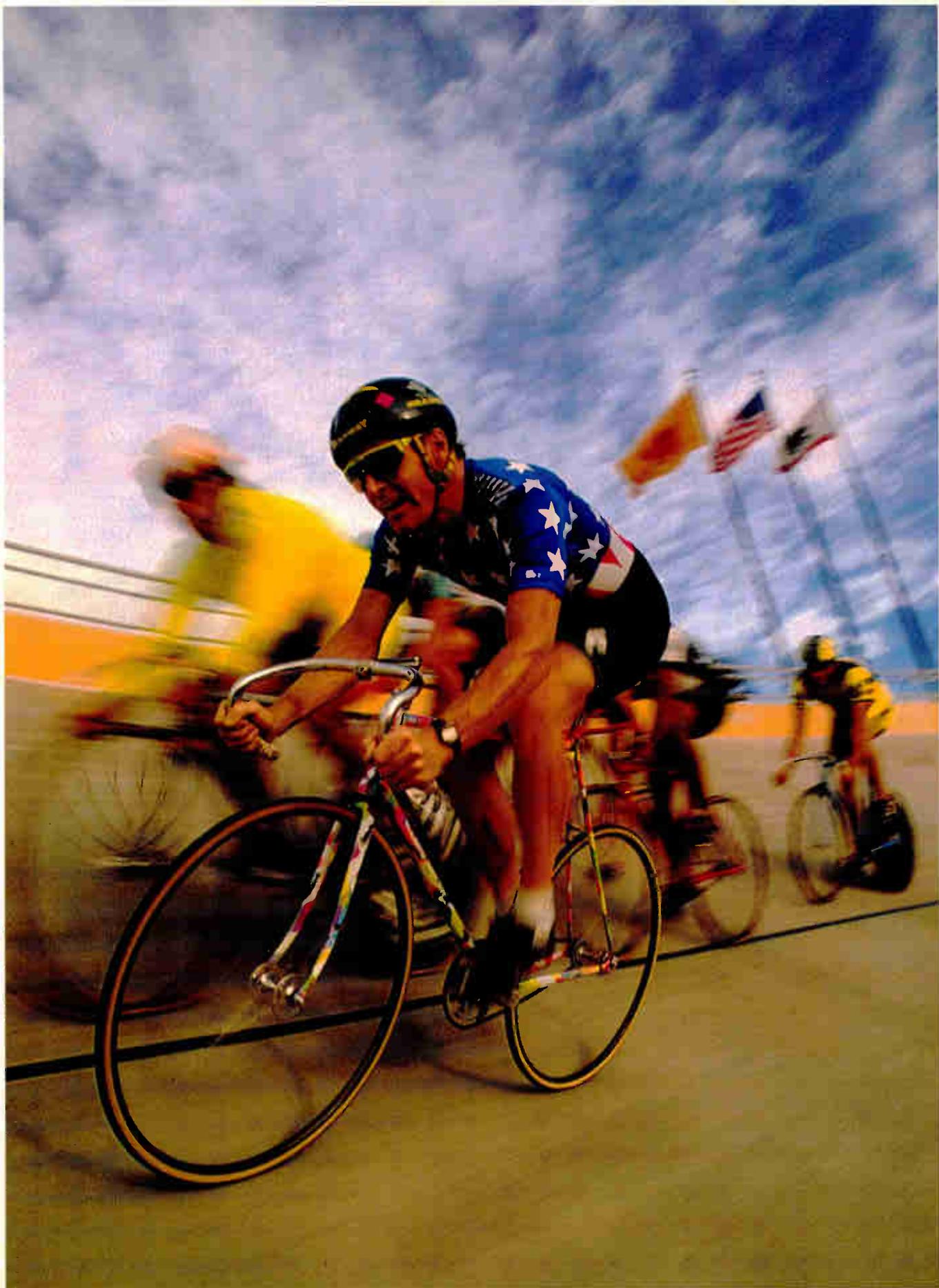
CREATIVE CREATIVE LABS, INC.



\*MSRP \$499.95. If MS Video for Windows is not included in your Video Blaster package, a copy can be sent to you at a special offer price. Call 1-800-647-9933. ©Copyright 1992 Creative Labs, Inc. Video Blaster, Sound Blaster, and ASP are trademarks of Creative Labs, Inc. All other trademarks are owned by their respective companies. International inquiries: Creative Technology, Ltd. Singapore, TEL 65-733-0233 FAX 65-773-0353.

Circle 170 on Inquiry Card.

World Radio History



# Since the beginning of time, people have been obsessed with reaching ever increasing rates of speed. So what else is new with Microsoft FoxPro 2.5?

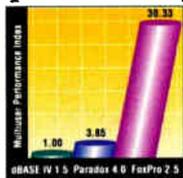


Plenty. For starters, the new Microsoft® FoxPro® 2.5 for Windows™ has a rich and productive environment with an intuitive graphical interface.

So it's never been easier for you to use and develop powerful database applications.

Plus there's a virtual hardware store of tools for both developers and users.

For developers, there are professional tools like Trace and Debug windows, Project Manager, Menu Builder, Screen Builder, and Report Writer. And each one is designed to help you create the most powerful applications possible.



*Microsoft FoxPro version 2.5 is the fastest PC database management system available today.\**

For users, there are lots of handy tools that make it easy to do complex database tasks without programming. Like Relational Query By Example (RQBE), which allows you to build and see queries

instantly. Or the graphical Browse tool, an intuitive way to view data.

And with the arrival of FoxPro 2.5 for both the Windows and MS-DOS® operat-

ing systems (and soon for the Macintosh® and UNIX®), you can have the most powerful and most graphical Xbase applications across all major PC platforms.

And if you are thinking about migrating to Windows in the future, have no fear.

Microsoft FoxPro for Windows will easily run all your FoxPro 2.0 files.

But no matter which platform you choose, you can count on the new Microsoft FoxPro 2.5 to provide you with the fastest PC-based database management system available today.

For additional information, just zip on over to your nearest reseller, or call us at (800) 882-2000, Dept. JF7. We'll be more than happy to tell you all the ways Microsoft FoxPro 2.5 for Windows can get your adrenaline pumping.



*FoxPro 2.5 takes advantage of Windows and allows you to create dazzling applications.*

**Microsoft**  
Making it easier

\*Query test performed by Micro Endeavors, Inc., a third party consulting firm (November 1992). © 1993 Microsoft Corporation. All rights reserved. Printed in the USA. In the 50 United States, call (800) 882-2000, Dept. JF7. Customers in Canada, call (800) 563-9048. Outside the 50 United States and Canada, call (206) 936-8661. Microsoft, MS-DOS and FoxPro are registered trademarks and Windows is a trademark of Microsoft Corporation. Macintosh is a registered trademark of Apple Computer, Inc. UNIX is a registered trademark of UNIX Systems Laboratories.

## First Showing for 64-Mb DRAMs

**M**UNICH—Attendees of the Electronica trade expo were treated to previews of 64-Mb DRAMs. These memory chips will be a major factor in the hardware implementation of bit-hungry digital image-processing and transmission applications, which look set to dominate the computer, telecommunications, and consumer markets into the next century.

The chips were shown by Korea's Samsung Electronics, which claims to have wrested world leadership in DRAM production from its Japanese competitors, and by the partnership comprising Germany's Siemens Nixdorf and U.S.-based IBM.

The Samsung chip is based on 0.35-micron CMOS technology. Improvements in performance and reliability will be carried out through 1994, when engineering sampling will begin, said the firm. Commercial sampling is scheduled for 1995, and volume production is planned for the

same year. Using a price projection of \$600 per chip, Samsung cited a Dataquest forecast that the market for 64-Mb DRAMs would be worth \$7 million in 1995 and \$2.1 billion in 1997 and would then soar to \$7.5 billion in 1998.

More low-key was the decision by IBM and Siemens to show, at the latter's Electronica booth, an 8-inch wafer comprising 64-Mb DRAMs that the two firms manufactured jointly at IBM's East Fishkill (New York) facility. Ulrich Schumacher, memory product manager for the German firm since October 1992, told BYTE that "development work on the 64-Mb DRAM in partnership with IBM is proceeding according to plan. In the meantime, work on the 256-Mb DRAM [by Siemens] has commenced with IBM and Toshiba, with preliminary results not expected until the end of 1994."

—Raymond Boulton

## Europe Struggles with Piracy Definitions

**L**ONDON—Pan-European computer companies are being forced to review their antipiracy procedures across Europe because different EC (European Community) states are implementing the centrally agreed legislation in different ways and at different times.

The deadline for passing the EC directive on copyright protection and building it into national law was January 1, but many countries have missed this target. Despite extensive argument during the drafting of the central directive, each country has since reworked the document to fit their traditional style of statute. "The directive from Brussels was wrought after such heated debate that it was felt it would be wrong for member states to paraphrase it," said Vanessa Marsland, chairwoman of the legal advisory group for the U.K.'s FAST (Federation Against Software Theft). This has already happened, however, leading to slight differences in key definitions such as originality, interoperability, and the restrictions on practices such as decompilation (i.e., reverse engineering).

There are also discrepancies between the directive's and the specific country's definitions of a "computer program" and in the areas of expression versus ideas, which proved such a crucial point in the famous Microsoft/Apple interface battle. These differences will be tempered by the fact that national law has to be interpreted by judges in the spirit of EC law. Neverthe-

less, the different implementations of the EC legislation will require careful study by companies in the U.S. and Japan wishing to do business in Europe.

According to Marsland, certain amendments in the EC directive could inconvenience suppliers more. "A quirk of the wording [paragraph 5.1 of the directive] may mean [current user] agreement licenses need rewriting. There is a question now over whether things which are not prohibited are permitted," she said. The combination of the EC directive and each country's implementation will likely keep international counsels for companies busy.

The U.K. government has received joint complaints from the Software Publishers Association, the Business Software Alliance, and FAST about the proposed form of the U.K. statute.

Neil Goldman, international counsel for Lotus Development, said, "We are hoping that none of the slight variations will compromise the EC standards. But we have delayed bringing legal action in some countries because some are slower than others at putting the law in place." Currently, the Business Software Alliance is pursuing an active campaign against software piracy worldwide. In Europe, the worst offenders are Spain, Italy, and Portugal, according to industry trade associations. Spain is not expected to amend its copyright laws until mid-1993.

—Louise Cole

## NANOBYTES

DEC says that nearly 900 technical and commercial applications from 400 software developers have been announced so far for DEC OSF/1 for AXP, OpenVMS AXP, and Windows NT on Alpha AXP systems. Of the 900 applications, 400 should be released by March, according to **Marion Dancy**, director of the Alpha AXP Applications Program. Sarah Miller, spokeswoman for DEC, said the application breakdown is about 500 for OpenVMS AXP, 300 for the 64-bit OSF/1 for AXP, and 75 or 100 for Windows NT. The numbers do not include DEC's own applications or custom applications being ported to Alpha using DEC's binary translators and compilers. □

Demand for Intel's 486 pushed the company's fourth quarter revenue to a record **\$1.86 billion**. Net income for the quarter was \$429 million, compared to \$189 million for the same quarter in 1991. Vinod Dham, general manager for Intel's microprocessor division, told BYTE that for 1993, Intel's volume processor will be the 486—not the Pentium. □

IBM has recalled two former top executives from retirement to advise the company as it tries to climb out of a slump. **Paul Rizzo** and **Kaspar Cassani**, both formerly vice chairmen of IBM, will advise chairman John F. Akers as counselors and advisers. IBM says it will eliminate 25,000 jobs this year—possibly through its first-ever layoffs. IBM blamed a sharp drop in European sales in recent months for its worsening financial results. □

Computer maker **Everex Systems** (Fremont, CA) has filed for voluntary protection from creditors under Chapter 11 of the Bankruptcy Code. CEO Steve Hui had resigned, and Everex has pared its workforce to less than 900 employees from the 2100 people it employed about a year ago. □

# What a 15" Monitor Should Be

## Our New Generation

ViewSonic 15 monitor features color temperature control and exceptional clarity.

And it boasts of an ultra high 76Hz refresh rate at 1,024 x 768 which exceeds the tough ISO-9241-3 requirements for a flicker-free image. The larger flat square screen provides reduced distortion along with a full edge-to-edge image. For a brighter, crisper image the ViewSonic 15 offers Invar Shadow Mask technology and digital controls with 26 user-programmable modes.

The new ergonomically designed drop-down control panel is as easy to use as a keyboard, which makes it great for adjusting image size, position, color and pin cushioning.

This monitor is compatible with all current video standards from VGA up to 1,280 x 1,024 non-interlaced, and is certified to meet strict Swedish MPR-II low radiation standards.

**The ViewSonic 15 ...  
everything you expect in  
a 15" monitor.**



## The ViewSonic 15

- Color control
- Exceptional clarity
- Larger screen
- Easy and safe to operate
- Flicker-free performance

# ViewSonic®

For Information Call (800) 888-8583

20480 Business Parkway, Walnut, CA 91789, (909) 869-7976, Fax: (909) 869-7958. All products and brand names are registered trademarks of their respective companies.

Circle 161 on Inquiry Card (RESELLERS: 162).

## FTC Ready to Rule on Microsoft

The FTC has completed its antitrust probe into the business practices of Microsoft and concluded that the company engaged in anti-competitive behavior, says a report in *Business Week*; FTC staffers are preparing recommendations that include breaking the company up into smaller pieces and establishing a "wall" between its operating-system and applications divisions.

Microsoft continues to post big profits while other software companies struggle. Although this does not mean that Microsoft's success is due to anticompetitive behavior, competitors say Microsoft can subsidize its applications development with revenues from its operating-system operations, and that its applications people can benefit from early details of an operating system.

"It's always been true the more you knew about the operating system, the better you could make your apps," said Fred Gibbons, CEO of Software Publishing. "There's no

way on God's green Earth that I can believe that Microsoft didn't have an unfair competitive advantage by being in the operating-system and the apps business."

Microsoft argues, however, that a company that is creative and aggressive can succeed in the market and offers companies like Adobe and Intuit (maker of the Quicken personal-finance manager) as examples. "We're competing with Microsoft and doing very well," said Kevin Harvey, president and CEO of Approach Software, makers of a Windows database package.

"Microsoft is a brilliant company run by a brilliant individual. Bill Gates is the Henry Ford of this half century," Gibbons said. But Gibbons added he wished Microsoft would do everything within its power to make sure that its applications division gets the same information at the same time as independent vendors.

—Dave Andrews and  
Patrick Waurzyniak

## Portable Documentation Accelerating SGML

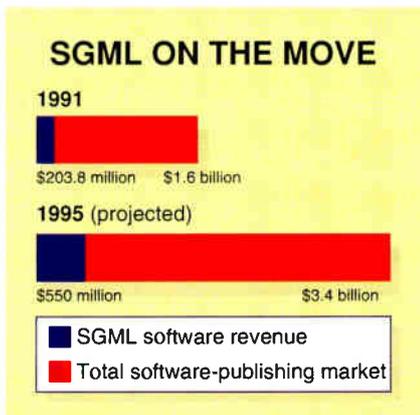
Worldwide revenues for products related to SGML, the Structured Generalized Markup Language established by the ISO in 1986 and adopted by the U.S. Department of Defense, will more than double by 1995, according to InterConsult (Arlington, MA, (617) 646-9600), a market-research firm specializing in the computer-publishing market (see the figure). The study predicts that the steady growth for SGML-based software is due in

part to the shift toward electronic delivery of massive amounts of documentation required in manufacturing, military, telecommunications, and service fields.

Louis R. Reynolds, president and CEO of Electronic Book Technologies (Providence, RI, (401) 421-9550), said SGML offers an open standard that lets users access hypertext documents under multiple operating systems like Windows, DOS, Unix, and the Mac. With the growing acceptance of CD-ROM, companies can put the equivalent of several large, complicated manuals on a single CD. "The hardware technology [for portable computing and remote access] is becoming cost-effective and available," he said. "It's driving the whole industry to electronic delivery."

Control Data Systems announced it will use EBT's DynaText electronic-book publishing and delivery system to convert its paper documentation to electronic manuals, joining Novell and Silicon Graphics as EBT users. Reynolds predicts that within two to three years, applications will be supporting SGML on a wide scale. For example, a word processor's Save options will include SGML as well as options like ASCII. "Electronic books are potentially bigger than spreadsheets," Reynolds said. "Think of it this way, how many people play with spreadsheets and how many people read books or reference manuals?" ■

—Dave Andrews



*InterConsult's worldwide SGML-specific software revenue figures include parsing, composition, auto-tagging, and SGML integration programs for workstations and mainframes.*

## NANOBYTES

Novell has signed a letter of intent to acquire **Unix System Laboratories**, the subsidiary of AT&T that provides the Unix operating system and related software and services. The acquisition is expected to be completed by the end of March. Ray Noorda, president and CEO of Novell, said the acquisition is being done at the "urging of customers" who have asked Novell to "support the Unix system directly and integrate it more fully within the NetWare environment." Analysts said the announcement illustrates the importance of Unix systems in downsizing business applications to computer networks and shows how seriously Novell regards the potential challenge of Microsoft's unreleased Windows NT operating system. □

Users depending on Microsoft for "mission-critical" project management were dismayed to learn last year that a bug in **Microsoft Project 3.0** causes file corruption. Microsoft technical support acknowledges that a serious bug will cause file corruption on large projects using shared resources. If users save often, the software doesn't relinquish memory properly. What the company calls a "memory leak" eventually crashes the program with a protection fault. Microsoft says its developers are aware of the bug. A maintenance release that fixes the problem was due in mid-February. □

WordPerfect is finalizing beta testing on a program called **IntelliTag** that converts WordPerfect documents into SGML (Structured Generalized Markup Language). You can use IntelliTag to convert other word processors' files into WordPerfect 5.1 format and then into SGML. A Unix version (expected price is \$495 for one user) is slated for release for Sun Sparcstations in the February/March time frame. A DOS version is planned for June release, says a WordPerfect representative. ■

“You mean I can order  
from IBM  
over the phone?”



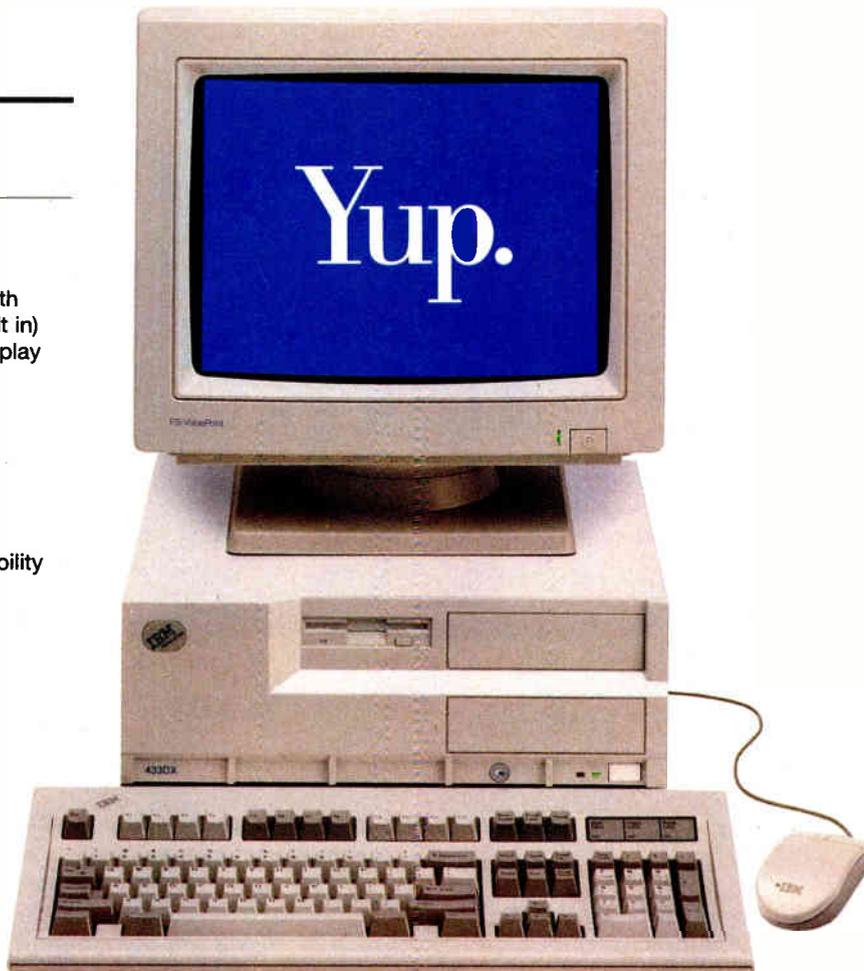
---

**PS/ValuePoint™**  
**433DX**

---

i486™DX/33 MHz  
120MB hard drive  
8MB RAM  
Pre-installed OS/2® 2.0 (with  
DOS and Windows™ built in)  
6312 SVGA NI 14" color display  
3.5" diskette drive  
IBM mouse  
Internal i487™ math  
coprocessor  
128KB L2 cache  
8KB internal cache  
1MB Video DRAM  
Industry standard compatibility  
Networkable  
5 slots/5 bays

**\$1,999\***



**Welcome to IBM Direct.**



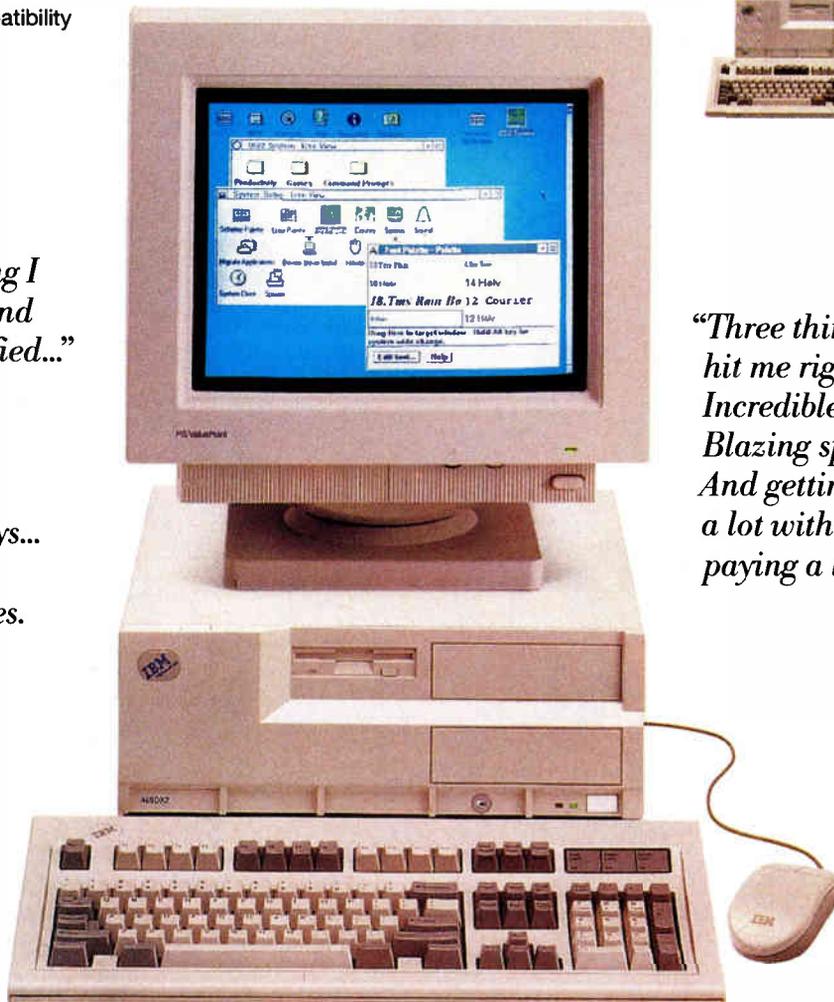
## PS/ValuePoint 466DX2

i486DX2/66 MHz  
 212MB hard drive  
 8MB RAM  
 Pre-installed OS/2 2.0 (with  
 DOS and Windows built in)  
 6319 SVGA NI 15" color display  
 3.5" diskette drive  
 IBM mouse  
 Internal i487 math coprocessor  
 128KB L2 cache  
 8KB internal cache  
 1MB Video DRAM  
 Industry standard compatibility  
 Networkable  
 5 slots/5 bays

**\$3,119\***

*"It's everything I  
need now...and  
Novell®-certified..."*

*"It's not just  
slots and bays...  
It gives me  
lots of choices.  
And that  
feels great."*



## PS/ValuePoint 325T

386SLC™/25 MHz  
 80MB hard drive  
 2MB RAM  
 Pre-installed DOS 5.0  
 PS/2® 8511 VGA color display  
 3.5" diskette drive  
 IBM mouse  
 5 slots/5 bays  
 IBM enhanced keyboard  
 Industry standard compatibility

**\$1,299\***



*"Three things  
hit me right off.  
Incredible power.  
Blazing speed.  
And getting  
a lot without  
paying a lot."*

# Every detail says IBM,



## ThinkPad 300†

386SL/25 MHz  
80MB hard drive  
4MB RAM  
DOS 5.0 pre-installed  
Integrated STN LCD display  
3.5" diskette drive

# \$2,335\*

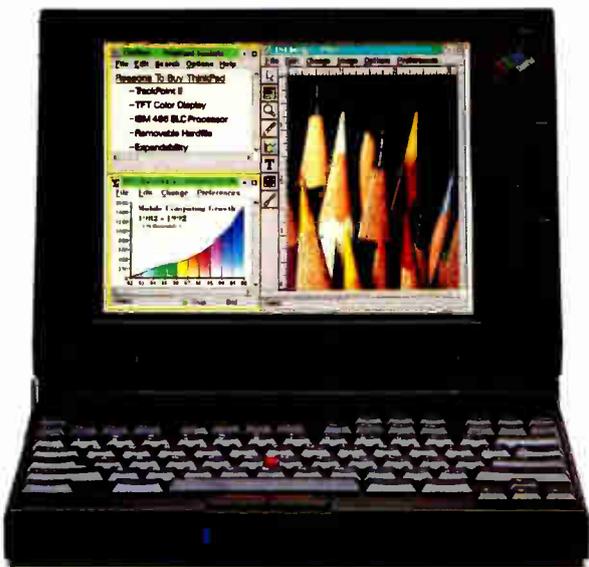


## ThinkPad™ 700C†

486SLC/25 MHz  
120MB hard drive  
4MB RAM  
DOS 5.0 and PRODIGY®††  
pre-installed  
10.4" active matrix  
color display  
3.5" diskette drive  
TrackPoint II,™ an integrated  
pointing device  
Full-size keyboard, 84 keys  
NiMH rechargeable  
battery pack  
Removable hard disks  
Slip-in IC DRAM cards  
for memory  
Up to 16MB memory, system  
maximum

# \$4,139\*

*"No more mice  
scurrying  
around...This  
TrackPoint II  
is one hot  
little button."*



*"Wow! It's the  
biggest color  
screen I've ever  
seen."*

## IBM Direct

### Buy IBM by phone.

Quality, service, selection and price—just call IBM Direct. It's that easy to get IBM PC products delivered right to your door. Or for more information on IBM products, call our automated fax system at 1 800 426-3395.

### Choose the best way to pay.

Easy payment methods—American Express, VISA, MasterCard, Discover card or personal check. Personal checks are subject to credit approval. Purchase order is available for qualifying customers.



### Hundreds of IBM products.

The IBM Direct catalog highlights a broad range of other products such as application software, storage devices, memory options, connectivity adapters and much more. In addition, our 40-page catalog features other IBM PS/ValuePoint and ThinkPad configurations. And if you want a PS/ValuePoint system with DOS and Windows only, that is also available on certain configurations.

### The HelpWare™ Advantage.

- One-year, on-site warranty for PS/ValuePoint products and ThinkPad 300.
- Three-year international warranty for ThinkPad 700 and 700C (in U.S., first year on-site).
- 24-hour 800# assistance, 7 days a week<sup>1</sup>
- 4-hour service response time, on average<sup>2</sup>
- 24-hour Bulletin Board and Automated Fax
- Hassle-free, 30-day money-back guarantee<sup>3</sup>
- Plus 10,000 IBM service representatives at 1,600 locations backed by a \$1 billion parts inventory

<sup>1</sup> At no additional charge during warranty.

<sup>2</sup> Available Monday through Friday 8 am-5 pm in your time zone, when serviced by IBM. If parts are required, this service is provided after receipt of parts shipped overnight. Applies to IBM Direct sales only.

<sup>3</sup> Warranty and 30-day guarantee information available from IBM and IBM authorized dealers. Please call 1 800 426-2968 for details regarding IBM's money-back guarantee and limited warranty. Copies of the terms of IBM's money-back guarantee and limited warranty are available upon request.

\* IBM prices only. The offerings, prices and products are subject to change or withdrawal without prior notice. Products you acquire may not be counted under any existing Volume Purchase Agreement. The same offerings and products may be available through IBM Authorized Remarketers. Remarketer prices may vary. Shipping and handling charges are extra.

† ThinkPad 300 and 700C systems and options are manufactured in Japan. PS/ValuePoint 6312, 6314 and 6319 Color Displays are manufactured in Korea.

†† PRODIGY will not run without a modem. A modem is not included with the ThinkPad 700C. A customer who acquires the ThinkPad 700C and a modem which operates at a speed below 9600 bps may contact Prodigy to obtain a One-Month Free Trial Membership.

When calling, please reference X213BYTE.

# except the price.

World Radio History

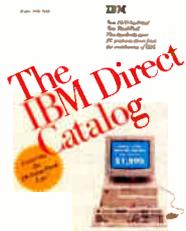
## CALL TO ORDER TODAY 1 800 IBM 2YOU

1 800 426-2968 8am-9pm EST Monday-Friday

Circle 110 on Inquiry Card.

# “And with one phone call I can get all this, too?”

You bet. And much more. This page offers just a sampling of the more than 250 advanced technology products IBM Direct offers to help you keep pace with your changing computer needs. From IBM desktops, ThinkPads and displays to adapters, peripherals, software, network connectors, even multimedia options. Just give us a call. We'll be glad to guide you to the IBM products most appropriate for your needs. We can also provide you with accurate specifications and answer any questions you may have.



## Catalog

For handy reference and comparison shopping, the IBM Direct Catalog is a comprehensive source for a broad range of products available through IBM Direct.

**Free**



## IBM LaserPrinter

An IBM LaserPrinter 6 delivers up to 6-pages-per-minute performance, 300 dpi resolution for sharp images, and a variety of built-in type fonts.

**\$1,510\***



## Expansion Unit (Docking Station)

The 3550 Expansion Unit for ThinkPad 700 and 700C gives you two slots and one bay, and accommodates 5.25-inch or 3.5-inch SCSI devices.

**\$859\***

| ThinkPad 700 and 700C Options   | Price*  |
|---|---------|
| Data/Fax Modem (2400 bps/9600 bps)  | \$285   |
| IBM PS/2 8MB IC DRAM Card   | \$905   |
| IBM ThinkPad 486SLC2 Processor Upgrade  | \$549   |
| ThinkPad 300 Options  |         |
| Data/Fax Modem (2400 bps/9600 bps)  | \$330   |
| Port Replicator   | \$120   |
| Operating Systems and Application Software  |         |
| DOS 5.0, Stacker V2.0 and 386MAX 6.0  | \$135** |
| OS/2 2.0, Upgrade from DOS  | \$ 99   |
| WordPerfect® 5.1 for DOS  | \$355   |
| Lotus® 1-2-3® for DOS   | \$355   |
| Microsoft® Excel™ 4.0 for Windows   | \$335   |
| Lotus Freelance Graphics® for OS/2  | \$425   |
| <small>Non-IBM programs are licensed under the manufacturer's, supplier's or publisher's terms and conditions. **Promotional price. Offer good until 3/31/93. Offer may be modified or withdrawn at any time.</small> |         |
| LAN Communications  |         |
| Token Ring Network 16/4 Adapter for AT Bus  | \$535   |
| EtherCard PLUS Elite 16 Combo™  | \$195   |
| PC LAN Program 1.3  | \$185   |
| NetWare® V3.11 (5 User)   | \$720   |
| IBM OS/2 LAN Server 3.0, Entry  | \$505   |
| Printer and Printer Options   |         |
| IBM Personal Printer Series II, 2390  | \$385   |
| IBM ExecJet® Printer, 4072  | \$775   |
| 500-Sheet Second Drawer for 4019(E), 4029   | \$295   |
| PostScript® Option for 4019(E), 4029  | \$335   |
| <small>Technical support for IBM printers is provided by Lexmark™ International, Inc.</small>   |         |
| PS/ValuePoint Displays  |         |
| IBM 6312 Color Display  | \$405   |
| IBM 6314 Color Display  | \$530   |
| IBM 6319 Color Display  | \$660   |

IBM, OS/2, PS/2 and ExecJet are registered trademarks of International Business Machines Corporation. PS/ValuePoint, SLC, ThinkPad, TrackPoint II and HelpWare are trademarks of International Business Machines Corporation.

The Intel Inside Logo, 486 and 487 are trademarks of Intel Corporation. Lexmark is a trademark of Lexmark International, Inc. Windows and Excel are trademarks of Microsoft Corporation. EtherCard PLUS Elite 16 Combo is a trademark of Standard Microsystems Corporation.

Novell and NetWare are registered trademarks of the Novell Corporation. PRODIGY is a registered service mark and trademark of Prodigy Services Company. WordPerfect is a registered trademark of WordPerfect Corporation. Lotus, 1-2-3 and Freelance Graphics are registered trademarks of Lotus Development Corporation. Microsoft is a registered trademark of Microsoft Corporation. PostScript is a registered trademark of Adobe Systems Incorporated.

©1993 IBM Corp.

When calling, please reference X213BYTE.

# IBM Direct

**CALL TO ORDER TODAY  
1 800 IBM 2YOU**

1 800 426-2968 8am-9pm EST Monday-Friday



Circle 111 on Inquiry Card.

# HIGH-TECH OPPORTUNITIES ABOUND

**N**EW DELHI—India, the country that introduced the world to the decimal system and the use of the numeral 0, is still far from being a serious player in the computer industry. According to *Dataquest*, an Indian computer magazine, total revenue generated by the Indian computer industry passed the US\$1 billion mark for fiscal year 1991–92. This may sound like a staggering figure for a country whose GNP is only \$450 billion, but it is a drop in the bucket compared to the global information-technology market.

To encourage growth, the Indian government has recently adopted a more liberal policy that makes it easier for foreign companies to set up high-tech industries in India. The government is emphasizing domestic manufacturing. It is discouraging imports by imposing a crushing import duty of more than 100 percent for hardware and 70 percent for software. According to many sources, hardware manufactured in India is as robust as any available. However, the most popular operating systems are the U.S.-developed DOS and Unix-on-Intel operating systems, with Microsoft Windows catching up rapidly.

India, with a population of 870 million, is the second most densely populated country in the world, and it presents a huge consumer market. An educated middle class of about 300 million is an unexplored market that will become hungry for PCs if the prices are low enough. A cutthroat competition among Indian vendors has already resulted in price-cutting that saw an average PC drop in price by more than 50 percent. Even with that reduction, a 386 system sells for about \$3300; a 486 system sells for about \$4900.

The Indian government is looking for foreign companies to invest in the capital-hungry computer market and thus create more competition. If U.S. and European hardware vendors are not quick to react to the recently liberalized foreign-investment policy in India, they will lose the opportunity to fill the gap between supply and demand of PCs in India.

A country with more English-speaking people than there are in England, India offers an inexpensive but talented pool of 140,000 software professionals. The South Indian city of Bangalore, also called the Silicon Valley of India, has more than 300 software houses that export software to other countries. Primarily, though, such ventures deal with applications software and turnkey projects only.

Public schools in India follow the “catch them young” philosophy. According to Jaya Narasimhand of the Modern Public School in Delhi, Logo programming is taught

in elementary schools beginning with the fourth grade. Students in the ninth and tenth grades learn BASIC, and eleventh- and twelfth-grade students advance to Pascal.

In a few years, this emerging class of affluent and computer-literate students will create a great demand for computers. These future entrepreneurs, whose parents are already well established in business, will do nothing short of launching a massive computerization of their businesses. But the Indian computer industry is not ready to meet this demand. This creates a hotbed of opportunities for U.S. and European companies that are interested in investing in high-tech industries abroad.

There are hurdles, however. The telecommunications system is still in a primitive state. It takes anywhere from one to two years to get a telephone connection—if you are lucky. In spite of these obstacles, the National Information Center, a department of the Planning Commission of the Indian government, has installed a satellite-based network connecting 470 districts in India using VSAT (very small aperture terminals) technology. According to Dr. N. Vijayaditya, the deputy director general of NIC, “It is the largest satellite-based network outside the U.S.”

Major international hardware and software vendors like Hewlett-Packard, DEC, Olivetti, Intel, Lotus, Honeywell, Unisys, Motorola, and Microsoft already have a presence in India, whether through joint ventures with Indian companies or through local outlets for export purposes. However, India is still largely a market waiting to be discovered. ■

*Jay Ranade is the series editor in chief for McGraw-Hill's books on the subjects of IBM, DEC, computer communications, and workstations. He has written more than 10 books and edited more than 100 books in this series.*

**India's emerging class of computer users will create a great demand for computers**



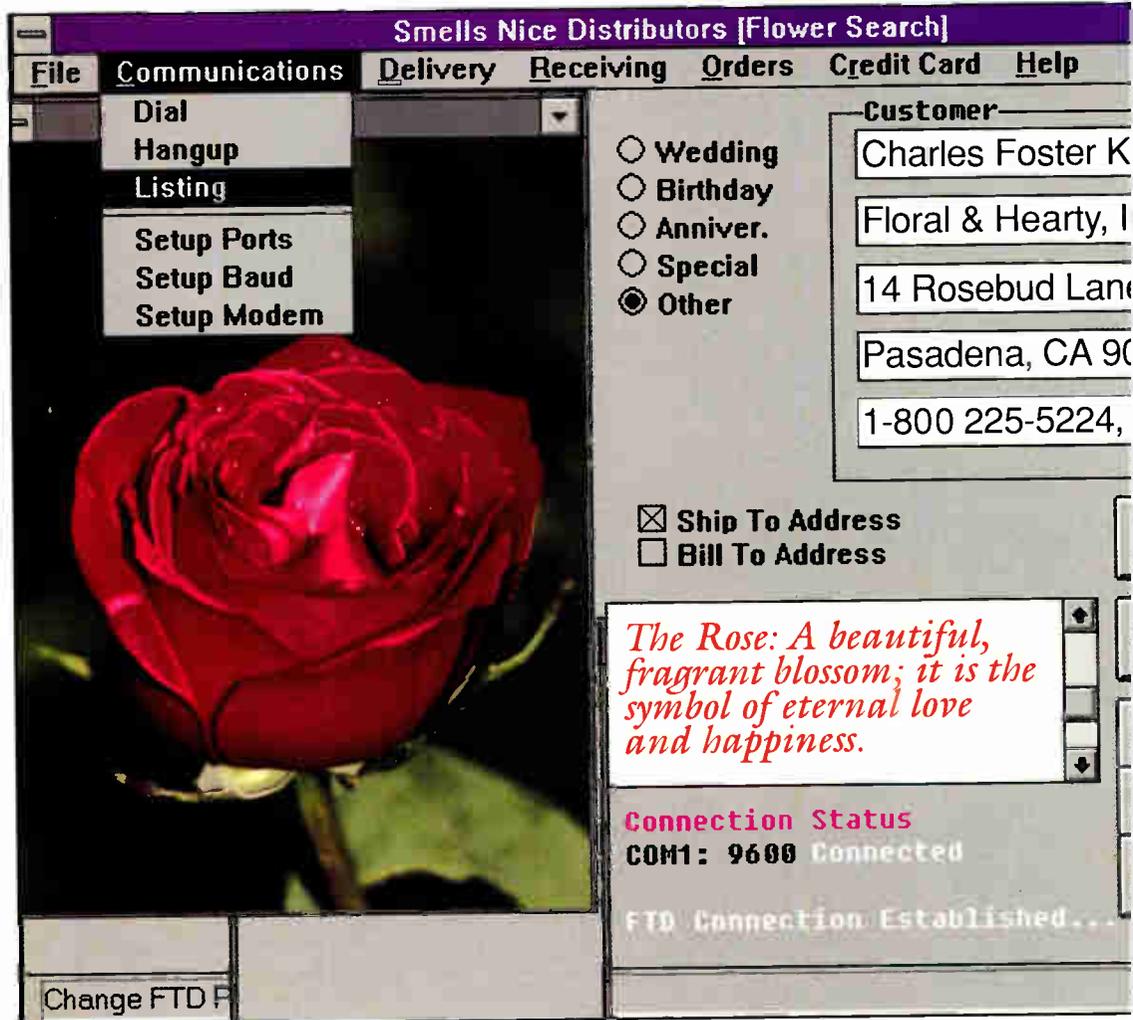
# Hey dBASE U And Smell T

*Adding a GUI to existing dBASE applications is fast and easy with CA-dBFast.*



*CA-dBFast's report writer, CA-RET, lets you mix text, graphics and data to produce great-looking reports in minutes.*

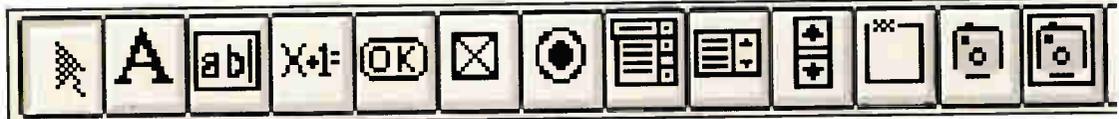
*The Visual Application Designer lets you interactively create and modify the user interface within a graphical environment.*



*CA-dBFast is the first and only way to get graphics, including bit-maps, into Xbase applications.*

*CA-dBFast is a complete Xbase language development system, including an Editor, Compiler, Debugger, Application Designer and Runtime Generator.*

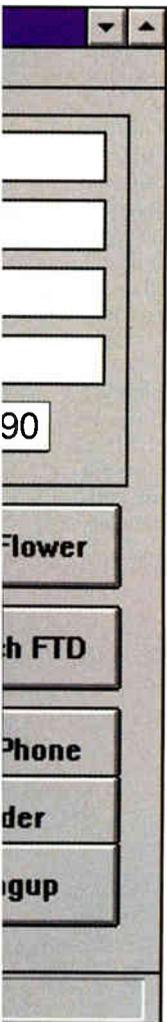
*Integration with other Windows programs is available through Dynamic Data Exchange, Dynamic Link Libraries and the Windows clipboard.*



# sers, Wake Up he Windows.



*CA-dBFast includes Windows interface objects for pull down menus, push buttons, radio buttons, check boxes, scrolling list boxes, bit-mapped graphics and more.*



*The runtime compiler can produce client-server applications that support Novell Netware, LAN Manager, LANtastic and any Net-BIOS compatible LAN system.*

*There's only one database that can take .DBF files into Windows: CA-dBFast.*

*Support for standard Xbase file formats also includes .NTX, .FRM and .LBL files.*

*The Editor can now support up to 10 open documents at once – with the look and feel of Windows word processing.*

*You can set and save personal preferences on Editor fonts, tab settings, colors and indentation.*

A new day is dawning for millions of dBASE developers – thanks to new CA-dBFast 2.0, the first and only dBASE-compatible database and language for Windows.



**NEW UPGRADE 2.0**

CA-dBFast meets two giant needs: moving existing dBASE applications to Windows *and* developing dazzling new applications in record time. It's the one solution that lets you take advantage of Windows while protecting the huge investment you've made in Xbase technology.

With CA-dBFast 2.0, you get a proven, stable environment that's more visual and more intuitive than anything you've ever used. And there's no need for Microsoft's confusing, intimi-

dating SDK, so creating applications with CA-dBFast is, true to its name, fast.

The Visual Application Designer (VAD) makes creating pull-down menus, push buttons, radio buttons, check boxes, scrolling list boxes and other Windows objects as easy as "point and click" or "drag and drop." The VAD generates the required source code, saving you hours of complex programming. You also get a debugger that's so advanced, it lets you watch your source code execute at run time – even Single Step through execution.

CA-dBFast 2.0 also includes CA-RET – an outstanding Windows-based report writer that lets you mix text, graphics and data on the same report in a full WYSIWYG environment. Creating great looking tabular reports, form letters or labels is as easy as using a word processor.

**FOR A FREE DEMO DISK, CALL 1-800 CALL CAI, Ext. 190.** With CA-dBFast applications, there are no license fees, royalties or key diskettes to bother with. And recipients of runtime programs don't need CA-dBFast to run the application – just Windows. CA-dBFast is also compatible with CA-CLIPPER, dBASE III Plus, dBASE IV and FoxBASE.

So whether you want to wake up old applications or build brilliant new ones, you can't afford to sleep through this revolution.

Check out CA-dBFast today.



**COMPUTER ASSOCIATES**  
Software superior by design.

## New CA-dBFast Release 2.0.

© Computer Associates International, Inc., One Computer Associates Plaza, Ispania, NY 11788-7000. All product names referenced herein are trademarks of their respective companies.

Circle 77 on Inquiry Card.

World Radio History

# A Spring Harvest of Apple Macintoshes

TOM THOMPSON AND TOM R. HALFHILL

## Six new computers redefine the Mac product line

In 1990 Apple began its major assault on the microcomputer market with six new machines. No portion of the market was left untouched: The Mac Classic II, with its black-and-white display, targeted the low-cost segment, while two 68040-based Macs, the Quadra 700 and 900, took the high-end, high-performance territory. For the on-the-go office worker, the PowerBooks—three notebook Macs with black-and-white screens—offered many features that PC notebook computers lacked. Since then, Apple has made enhancements to these product lines, such as a faster Quadra (the Quadra 950) and more powerful notebooks with gray-scale displays (the PowerBook 180 and PowerBook Duo 230).

On February 10, Apple unleashed its second wave in the market-share war. As before, the company introduced six Macs that compose a sweeping revision of its product line. Among the changes is the first compact Mac with a color screen, the first PowerBook with a color screen, and a new Quadra with a shorter mini-tower design. A newly introduced Centris series—a set of 68040-based midrange computers—is intended to replace the Mac II line. Also shown was the Mac LC III, a high-powered successor to the LC II.

With street prices likely to range from \$1000 to \$4500, these new Macs address the price-conscious segment of the microcomputer market while delivering processing power. Because low-end Macs now account for the vast majority of Apple's unit sales, we'll start at the bottom of the product line and work our way up. We looked at preproduction units of each model. Note that the prices given here are preliminary and may change by press time.

### Color Classic

Low-cost computing on the Mac traditionally meant sacrificing color capability. This is no longer true. The Color Classic's built-in monitor uses a 76-dot-per-inch, 10-inch-diagonal Sony Trinitron tube that displays a 512- by 384-pixel screen. Previous compact Mac screens—such as the Classic II—are only 512 by 342 pixels, making the Color Classic's screen taller by 42 pixel lines. To accommodate the larger tube, Apple slightly altered the compact case design, using a larger front bezel that also includes a built-in microphone.

As with the Classic II, the Color Classic's main logic board uses a 16-MHz 68030 processor and has 4 MB of RAM standard (the Classic II initially had only 2 MB of RAM, but since mid-1992, Apple has been shipping the unit with 4 MB). RAM is expandable to 10 MB using 30-pin RAM SIMMs. There is 256 KB of 100-nanosecond VRAM (video RAM) that lets



the computer display 256 colors on-screen. You can expand it to 512 KB by adding a VRAM SIMM; the system can then display 32,768 colors.

The Color Classic still uses a 16-bit-wide bus that reduces system costs, but at the expense of throughput. However, the video-frame buffer now resides in VRAM rather than in main memory and thus eliminates a performance hit that hobbled the Classic's design. In the old design, as the video circuits periodically accessed memory to refresh the screen, they blocked the processor's access to the bus, which degrades overall performance. With the video-frame buffer in separate VRAM on the Color Classic, both video and processor operations run unimpeded. The result should be better performance, and the preliminary BYTE low-level benchmark results (see the figure) support this conclusion. The Color Classic is about as fast as a Mac LC II, or about Mac II caliber.

Normally, the compact Mac design offers limited expansion options, but here's where the Color Classic really breaks with tradition. First, there's a socket for a 68882 FPU. Next, there's a 96-pin PDS (Processor Direct Slot) that's electrically and physically compatible with Mac LC and LC II expansion boards. Finally, you can junk the Torx screwdriver and case-cracking tools required to open older compact Macs. Just tug on two tabs at the bottom rear of the computer to remove a panel, and the

main logic board slides out, letting you easily add extra RAM, the FPU, or an LC or LC II expansion board. This arrangement also prevents exposure to the hazardous voltages lurking in the color-video circuitry.

A Color Classic with 4 MB of RAM and a 40-MB hard drive costs \$1300. The 68000-based Classic is being discontinued, with the Classic II taking its place as the lowest-cost Mac. No upgrade path from a Classic II to a Color Classic is offered.

### Mac LC III

As limited as its expansion options are (a single PDS slot and no FPU), the Mac LC II is Apple's best-selling computer. The company asked users what design improvements they'd like to see in the computer. The answers were, allow more memory, add more display options, and make it faster. The LC III does these things—and more. A new controller chip—an enhanced derivative of a Mac LC ASIC (application-specific IC)—enables you to expand RAM to 36 MB (up from 10 MB). The main logic board has 4 MB of 80-ns RAM soldered to it, and a single SIMM socket provides memory expansion using a high-density SIMM. The LC III uses an industry-standard 72-pin SIMM, rather than the 30-pin SIMMs found in other Macs.

The LC III's built-in video supports a bevy of monitors, from Apple's 12-inch RGB display (512 by 384 pixels) to its 16-

inch display (832 by 624 pixels) and VGA monitors. The 512 KB of 80-ns VRAM soldered to the main logic board supports 8-bit pixels (256 colors) on these screens. A single SIMM socket lets you add 256 KB of VRAM (for a total of 768 KB) so that you can view 16-bit images (32,768 colors) on 14-inch monitors (640 by 480 pixels).

The LC III's 68030 processor is clocked at 25 MHz (up from 16 MHz), and there's a socket for a 68882 FPU. More important, the LC III uses a 32-bit-wide bus, whereas the LC II's bus was only 16 bits wide (a cost-cutting move, as in the Classic design). The end result is that the LC III serves up nearly Mac IIci performance, according to the BYTE benchmarks. A notched 114-pin PDS connector accepts existing 96-pin LC II expansion boards, with a maximum power budget of 4 watts. An LC III with 4 MB of RAM and a 40-MB hard drive costs \$1300. Mac LC II owners can rest easy: Through a logic-board swap, they can upgrade their computers for \$599, although they will have to replace the old RAM. The LC II won't be discontinued; instead, its price will be lowered.

### Centris 610

With the market's low end firmly anchored by the Classic II, Color Classic, LC II, LC III, and the Performa line, Apple turned its attention to the aging 68030-based Mac II line. The top performer here has been the 25-MHz Mac IIci, whose design is more than three years old. The new Centris 610 and 650 computers are low-cost 68040-based midrange Macs.

Tight integration of components has reduced the 10 custom ASICs used in the Quadra 950 design to only three, which reduces the cost of the Centris computers and the 33-MHz Quadra 800 (described later). One of these chips, the memory-controller ASIC (MEMC), now lets you mix different-density RAM SIMMs (as long as they are 4 MB or larger) on the main logic board. At boot-up time, the MEMC maps the different-size chunks of RAM into one contiguous memory space.

Throughput wasn't sacrificed while cutting costs. Both Centris computers use the 53C96 SCSI controller, the same one found in the Quadoras. This controller has a maximum transfer rate of 5 Mbps, versus the 53C80 found in other Macs that handles only 1.5 Mbps. The I/O bus in the Quadra design has practically disappeared,



with most I/O signals and controls combined into one ASIC (the IOSB). The IOSB is clocked at CPU speeds, so on the Quadra 800 most I/O operations run at 33 MHz. The exception is the Ethernet controller, which runs at 16 MHz.

The Centris 610 is a low-profile desktop computer similar in design to the Mac LC III. It has room for two internal SCSI devices: a 3½-inch drive and a bay at the front for a 5¼-inch half-height device (typically a CD-ROM drive). An 86-W power supply provides ample power for these peripherals. To reduce costs, the Centris 610 uses a 20-MHz 68LC040, which is essentially a 68040 processor without an FPU (sort of like a 486SX). However, it uses the same socket as a 68040, which offers the possibility of an upgrade.

An Ethernet port, using the AUI (Attachment Unit Interface) connector, is an option. This option is actually a main logic board populated with the Ethernet port and electronics. Like the Mac IIsi, the Centris 610 has a single 68040 PDS expansion slot, which can also be a NuBus slot by using an adapter board. To fit within the computer, these boards must be only 7 inches long (current NuBus boards can be up to 12 inches long) and use a maximum of 10 W.

The Centris 610 starts with a base 4 MB of RAM; two 72-pin SIMM sockets let you expand memory to a maximum of 68

MB. Its 512 KB of 100-ns VRAM supports 8-bit colors on monitors from 12 to 21 inches (1152 by 870 pixels). Two SIMM sockets let you increase VRAM to 1 MB, to support 16-bit-deep screens on monitors as large as 16 inches.

A Centris 610 with 4 MB of RAM and an 80-MB hard drive is expected to cost under \$2000. You get a lot of bang for your buck here: The BYTE low-level benchmarks peg the 20-MHz Centris 610 at better than Mac IIfx performance (the Mac IIfx uses a 40-MHz 68030 and 68882 FPU.) Even with the 68LC040, the Centris 610 did better than the Mac IIfx on floating-point operations.

### Centris 650

If you require more expansion options than are offered by the Centris 610, there's the Centris 650. It uses the same Mac IIfx housing with a bay for a 5¼-inch SCSI device, a 68040 PDS, and three slots that implement a NuBus 90 backplane. The slots accept full-size NuBus boards. A 112-W power supply powers the system, and 15 W is available for each NuBus slot. The processor is a 68LC040 or a 68040 clocked at 25 MHz. As with the Centris 610, the Ethernet interface is an option. The Centris 650's on-board video is identical to the Centris 610's and supports the same monitor sizes and screen depths. But it uses 80-ns VRAM instead of 100-ns hardware.

The main logic board has 4 or 8 MB of 80-ns RAM; four 72-pin SIMM sockets let you expand memory to as much as 136 MB (assuming 8 MB on the main board). The memory subsystem in the Centris 650 and the Quadra 800 has been enhanced to support interleaved memory. The MEMC ASIC arranges RAM in logical banks and then provides a hardware assist by rapidly stepping through the banks during burst-mode accesses. This shaves several clock cycles off these memory operations and improves throughput. The memory on the main logic board is interleaved, and the socketed SIMM RAM must be the same density for memory interleaving to occur.

The BYTE benchmarks show that, on average, the Centris 650's memory operations are faster by about 13 percent than the Quadra 700 (Apple claims 10 percent to 15 percent). While not all memory operations can take advantage of burst mode, the test results do indicate that the memory subsystem uses them when it can. The benchmarks show that the 650 edges out the 25-MHz Quadra 700 in performance.

A Centris 650 with 4 MB of RAM and an 80-MB hard drive sets you back \$3000. It's expected that the Mac IIsi and IIfx will be discontinued, leaving the Mac IIfx as the sole survivor of the Mac II line.

### Quadra 800

The Quadra 800 is a short, squat tower similar to the Quadra 950, but it stands only 14¼ inches high (versus the Quadra's 18½ inches). It uses a 33-MHz 68040 processor and comes with 8 MB of 70-ns RAM on the main logic board. Four 72-pin SIMM sockets let you expand RAM to 136 MB. Memory on the main logic board is interleaved, and so is the socketed RAM if it is all the same density. Ethernet is standard, and three slots implement a NuBus 90 backplane, which handles full-size NuBus boards.

The tower contains three bays at the front that can hold four SCSI devices: a 5¼-inch half-height device (typically a CD-ROM), a 3½-inch half-height device (a hard drive), and either a 3½-inch full-height device (typically a disk array) or two half-height devices. A ribbon cable with SCSI connectors and four power cables at the ready make adding a SCSI peripheral easy. The 200-W power supply provides ample muscle for these peripherals and 15 W per NuBus board.

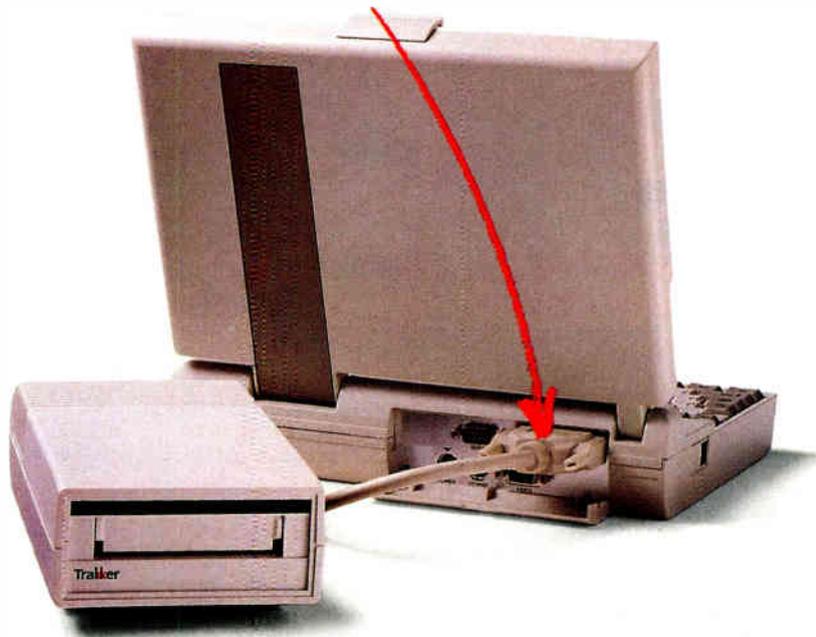
Because the Quadra 800 borrows from the same design used by the Centris 610 and 650, it supports the same monitors and screen depths (up to 16 bits deep on a 16-inch monitor). Video performance on all



The Centris 68040-based Macs make up Apple's new midrange computers. Both are shown with an optional CD-ROM drive.

# Plug and Play Tape Backup.

## The Plug.



## That's it. Go Play.

**N**ow, tape backup is easier than ever. Unpack Trakker and plug it into your computer's parallel printer port. That's it. No assembly, no installation, no problem.

Trakker goes anywhere. It's light and compact, the ideal solution for backing up notebooks and laptops. And Trakker can back up unattended, so you can go anywhere, too. Trakker is available in two models. At \$448, Trakker 120 (120

Megabyte capacity, using data compression) is the price leader. And Trakker 250 (250 MB capacity using data compression) is the fastest in its class at up to 8 MB/minute. Both give you QIC Industry Standard Recording Format, as well as Novell® and LANTastic® certification.

For a FREE 76-page catalog, please call 1-800-451-0897 ext. 227 today.



# Trakker™

*Backup so simple it's advanced.\**

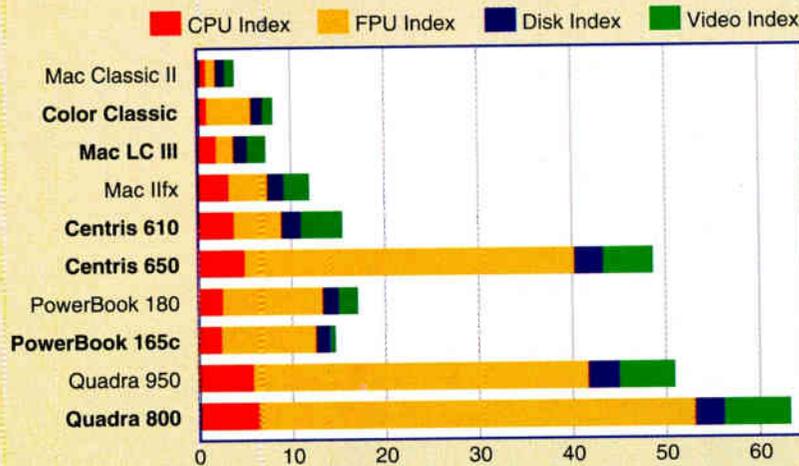


Mini data cartridge sold separately. © 1992 Colorado Memory Systems Inc. All rights reserved. Jumbo, Trakker and Colorado are trademarks of Colorado Memory Systems, Inc. All other trademarks are property of their respective companies. JTB-BYT011593

Circle 73 on Inquiry Card (RESELLERS: 74).

World Radio History

### PRELIMINARY LOW-LEVEL BENCHMARK RESULTS



For all tests, a Classic II = 1. Higher numbers indicate better performance. All Macs ran System 7.1. The Color Classic had an FPU; the Centris 610 did not.

three systems is faster because the IOSB eliminates one wait state from VRAM accesses. Also, certain QuickDraw graphics routines have been modified to take advantage of the 68040's MOVE16 instruction (which burst-transfers 16 bytes), improving the speed of scrolling and filling operations.

The BYTE benchmarks show that the Quadra 800 is slightly faster than the 33-MHz Quadra 950. This results from the improvements in the Quadra design: memory interleaving, the I/O functions merged into the IOSB, and the optimized video.

A Quadra 800 with 8 MB of RAM and a 230-MB hard drive costs \$4700, a most attractive price when you compare it to a similarly equipped Quadra 950 (\$7359). Where the Quadra 800 falls short of its predecessor is in its lack of 24-bit video, fewer slots, and fewer peripheral bays. The features the Quadra 800 packs, however, should attract a flock of buyers.

#### PowerBook 165c

Last but not least, Apple closes the gap in its notebook line with the PowerBook 165c. Essentially a PowerBook 180 (a 33-MHz 68030 processor, 68882 FPU, external video, and 4 MB of RAM), the 165c differs mainly in its color passive-matrix LCD screen that displays 256 colors. The 9-inch-diagonal display is smaller than the PowerBook 180's 77-dpi, 10-inch-diagonal display, but its 85-dpi density packs in the same 640- by 400-pixel screen. The screen uses special filters and polarizer

materials to provide good contrast and a wide viewing angle, while two backlight bulbs and a filter increase its brightness. The screen adds only 1/8 pound to the system's weight (for a total of 7 pounds).

Internally, the engineers moved the 4 MB of RAM and 1 MB of ROM to a "cousin card" to make room for the color display's controller and DRAM. The display consumes more power (about 6 to 7 W). Thus, the PowerBook 165c uses a beefier 2.9-watt-hour nickel-cadmium battery (the PowerBook 140/170 use a 2.7-Wh battery). Also, the power charger now cranks out 24 W (up from 15 W) to recharge the battery faster.

The 165c's screen is brighter than we expected, with rich colors. Scanned color images are a joy to behold. The BYTE benchmarks indicate that the 165c is slightly slower than the PowerBook 180. The video benchmarks were especially slow because the display's frame buffer doesn't use dual-ported VRAM. Although the PowerBook 165c's passive-matrix screen might not match the brisk colors of an active-matrix screen, the trade-off here is for your wallet. A PowerBook 165c with 4 MB of RAM and an 80-MB hard drive costs \$3279. The prices of comparable PC notebooks with active-matrix screens start at about \$4300.

#### A Mac for Every Purpose

This latest generation of Mac spans every part of the microcomputer market. At the low end, there is the affordable Color Clas-

sic with a small desktop footprint. If you need more power, the LC III serves up Mac IIci performance.

The 68030-based midrange Mac II line was in desperate need of an overhaul. The Centris line of Macs brings this section up to date with affordable 68040-based computers that deliver ample horsepower.

The Quadra 800 mini-tower offers leading-edge performance while intelligent design compromises make it the most affordable Quadra ever. And for those who need color on the road, the PowerBook 165c is a powerful 33-MHz color notebook that delivers performance while sparing your budget.

As usual, we admire the Apple engineers who have reused proven technologies where they can (e.g., enhanced versions of the Mac LC components for the LC III) and maximized their design efforts (e.g., by integrating the Quadra design into fewer ASICs and using them in the Centris computers as well as the Quadra 800). The result is better performance at lower cost—a win-win situation for the Mac user. ■

*Tom Thompson is a BYTE senior technical editor at large with a B.S.E.E. from Memphis State University. He is an associate Apple developer. You can reach him on AppleLink as "T.THOMPSON" or on the Internet at tomt@byteph.byte.com. Tom R. Halfhill is a BYTE senior news editor based in San Mateo, California. You can reach him on BIX as "thalfhill."*

### THE FACTS

**Color Classic** (with 4 MB of RAM/40-MB hard drive): \$1300

**Mac LC III** (with 4 MB of RAM/40-MB hard drive): \$1300

**Mac Centris 610** (with 4 MB of RAM/80-MB hard drive): under \$2000

**Mac Centris 650** (with 4 MB of RAM/80-MB hard drive): \$3000

**Mac Quadra 800** (with 8 MB of RAM/230-MB hard drive): \$4700

**Mac PowerBook 165c** (with 4 MB of RAM/80-MB hard drive): \$3279

Apple Computer, Inc.  
20525 Mariani Ave.  
Cupertino, CA 95014  
(408) 996-1010

**Circle 1165 on Inquiry Card.**

Ultimately the Winner in  
**BIG SCREEN**

SCEPTRE 17" Flat Screen High Resolution Digital Color Monitor CL-617,  
 Introduced by Brutus\*, the King of Monitors:



**1280 x 1024**  
 Non-interlaced

**VESA 72 Hz**  
 Refresh Rate,  
 Flicker Free

**Multiscan**  
 Horiz. 30-66KHz  
 & Vert. 50-90Hz

**Advanced  
 Compact & Slim  
 Design**

**Automatic  
 Dynamic  
 Focusing**

**0.26mm**  
 Dot Pitch

**INVAR**  
 Shadow Mask  
 (30% Brighter  
 Screen)

**Mac Compatible**

**Auto & Manual  
 Degaussing**

**90-260 VAC**  
 50/60Hz  
 Auto-input Power

**Front Access  
 Push Button  
 Microprocessor  
 Controls with 31  
 Memory Modes**

Wide Turning Angle

Plus: **Two Year** Limited Warranty, Low Radiation (MPR II) and Anti-Static Options, and many more. For more information, call

**SCEPTRE®**

**1-800-788-2878**

SCEPTRE TECHNOLOGIES, INC. 714-993-9193 FAX 714-993-2997

©1993 Copyright SCEPTRE Technologies, Inc. All Rights Reserved. All products and brand names are trademarks or registered trademarks of their respective companies.

Circle 223 on Inquiry Card (RESELLERS: 224).

## 1-2-3, Freelance for OS/2: Major Applications at Last

The lines "something borrowed, something blue" came to mind while I looked at Lotus's first two applications for OS/2 2.0. **Lotus 1-2-3** and **Lotus Freelance Graphics** for OS/2 2.0 were written for this platform, not ported, yet they borrow from among the best features of their DOS and Windows counterparts while bringing out the best of Big Blue's 32-bit operating system.

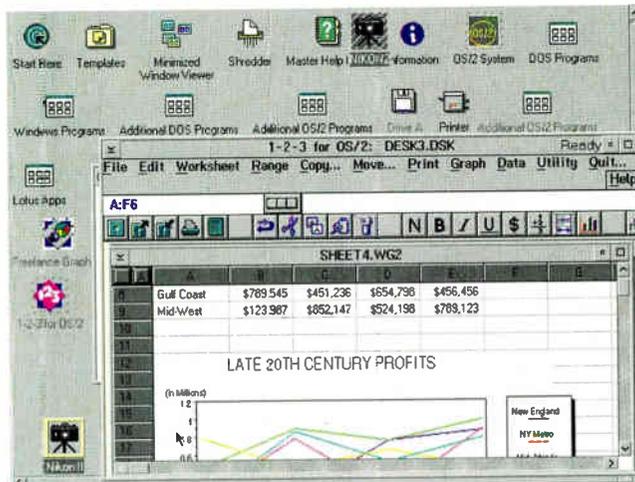
Based on the beta versions that I saw, OS/2 2.0 is worth consideration—or reconsideration—as a platform that is supported by major, and native, applications. The attraction of 1-2-3 for OS/2 2.0 and Freelance Graphics for OS/2 2.0, however, is also their tight integration when both are installed—from file operations to the sharing of resources and an OLE-like method of saving all a project's files under a single desktop (.DSK) filename.

Both products should now be available, and Lotus says that OS/2 2.0 versions of cc:Mail and Ami Pro should follow within a couple of months. Lotus will then have OS/2 2.0 products in all four major applications categories. A 32-bit version of Lotus Notes has been held up. Lotus officials indicated at press time that it may not be ready to ship until the end of the year.

Lotus 1-2-3 for OS/2, formerly called Lotus 1-2-3/G, has improved with OS/2 2.0's functionality in mind. Lotus quietly shed the redundant *G* (for graphical) label around the time it released 1-2-3 for Windows. But true to the form of products maintained across multiple platforms, the newer 1-2-3 for OS/2 has gone beyond the current Windows version.

In addition to a more powerful charting engine based on a DLL shared with Freelance Graphics, 1-2-3 for OS/2 includes SmartIcons—one-click shortcuts to operations such as insert or delete row/column, format currency, add, and undo. One handy icon will resize one or more columns to their maximum widths necessary to display all data contained in each respective column. You can also customize the default SmartIcon set to substitute ones you use more frequently.

Among other enhancements, you can select discontinuous sections (called *collections*) for various operations by using the right mouse button, and you can se-



lect whole rows and columns by clicking on them in the frame. The next version of 1-2-3 for Windows (expected to ship this spring) will support collections. OS/2's Workplace Shell will now let you drop a filename onto the printer, shredder, or 1-2-3 icon (or the Freelance icon if both are installed). The application icon will launch the application and load the file.

Freelance Graphics, developed for OS/2 before DOS and Windows, uses the same process-oriented approach that Lotus first used in the Windows version 1.0. In other words, the program guides you through each step of building a presentation through a succession of templates.

Version 2.0 for Windows shipped early this year, so the OS/2 version gleaned plenty of functionality from its older sibling. SmartIcons let you click on page layouts, select a text block for input and change the font, start a new page, and page in either direction. Some functions (e.g., outlining and organizational charting) present in the new Windows version are missing from Freelance Graphics for OS/2 2.0. Other functions, particularly those related to the OS/2 Workplace Shell, are not in versions written for other platforms.

Individually, 1-2-3 and Freelance Graphics are worth a look; together they may be irresistible. For starters, you save more than 4 MB on your hard disk thanks to code shared between the two applications; you also save RAM, but usage varies too much to provide a concrete figure.

The common charting engine, which saves about 2 MB in itself, represents one less part of either program for new users to learn. And, if you're working on several files grouped under a single desktop file,

all SmartIcons and menus are context-sensitive and change as you move from worksheet to graph to presentation. Lotus expects that if you use cc:Mail for OS/2 when it ships later this year, you'll be able to drag a file icon to the cc:Mail icon to attach a file to an E-mail message.

You've heard the OS/2 trash talk: It has no so-called killer application that will do for Big Blue's platform what the original 1-2-3 did for DOS. No true killer application may surface in a market that is far more segmented and sophisticated today than it was 10 years ago,

but Lotus's first two OS/2 2.0 offerings indicate that adopting the OS/2 platform is now an easier choice to make.

—Ed Perratore

### THE FACTS

**Lotus 1-2-3 for OS/2 2.0**  
single-user standard edition, \$495;  
network server edition, \$595; \$395  
per concurrent network user (not in-  
cluding documentation) above price  
of network server edition

**Lotus Freelance Graphics  
for OS/2 2.0**  
(prices same as for 1-2-3)

*System requirements:*  
386 PC (minimum 20 MHz recom-  
mended) with OS/2 2.0 (equipped  
with Service Pak) or higher; if in-  
stalling both products, 4 MB of  
RAM (7 MB recommended) and  
11½ MB of free disk space; for 1-2-  
3 alone, 4 MB of RAM (8 MB rec-  
ommended) and 9½ MB of free disk  
space; for Freelance alone, 4 MB of  
RAM (8 MB recommended) and 6½  
MB of free disk space; a mouse.

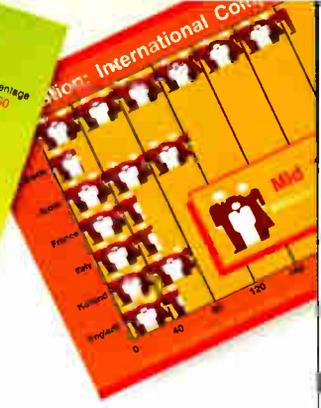
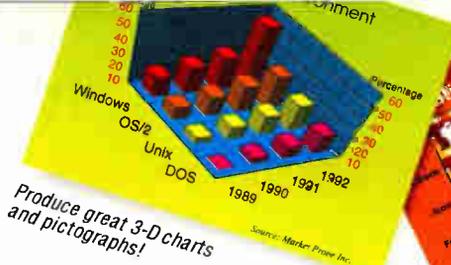
Lotus Development Corp.  
55 Cambridge Pkwy.  
Cambridge, MA 02142  
(800) 343-5414  
(617) 577-8500  
fax: (617) 693-4551  
**Circle 1166 on Inquiry Card.**



3.0 has... There is no... illustration, charting, painting... CorelDRAW 3.0... packages now that CorelDRAW 3.0... all with unmatched power and ease of... Also, as an unprecedented bonus, Corel has... included a CD-ROM with over 14,000 clipart... images and more than 250 fonts!

Yours truly,  
*Philena*  
 Greg Wiens,  
 Corel Corporation

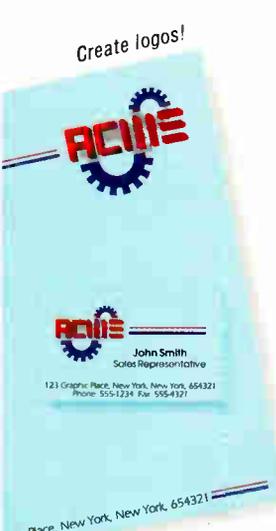
Type letters. Create newsletters,  
 ads, and brochures!



# CorelDRAW 3.0

# ALL-IN-ONE GRAPHICS SOFTWARE

Look at all you can do with CorelDRAW 3.0!



- Create Effective Charts and Pictographs!**  
 Choose from dozens of preset templates or create your own. With over 14,000 clipart images available, you can add power to your message with exciting pictographs!
- Type Letters and Produce Dynamic Newsletters!**  
 With spellcheck and thesaurus, CorelDRAW is a convenient word processor. Incredible type control and many import/export filters let you add flair to your communication.
- Create Inspirational Ads and Brochures!**  
 Easily combine photos, scanned images, text, and graphics. A dazzling array of colors are available with world standard color matching.
- Design Impressive Corporate I.D.s!**  
 Create exciting logos using CorelDRAW's special effects: 3-D, blending, extrusion, and more! You can choose from over 250 fonts.
- Make Powerful Presentations!**  
 With CorelDRAW's import features, transition effects, hundreds of animation sequences, and professionally designed backgrounds, exciting presentations are at your fingertips!
- Touch up Photos and Bitmap Images!**  
 Enhance your photos and bitmap images with impressive paint and retouching capabilities. CorelDRAW has 24-bit color and Kodak Photo CD technology support!



No wonder CorelDRAW is the world's best selling graphics software!

# COREL DRAW!

**1-800-836-DRAW**

**CORELDRAW WORLD DESIGN CONTEST**

OVER \$1,000,000 IN PRIZES TO BE WON!  
 Enter now and win valuable prizes in the monthly contests (from Sept. '92 to April '93). Each monthly winner qualifies as a finalist in the Annual Design Contest in May '93.

## COMPETITIVE UPGRADE OFFER!

Limited time only. **\$199**

You can take advantage of this sensational offer if you own a competing Windows/DOS product. Call Corel for details.

Suggested list price

**\$595**



CorelDRAW is NETWORK READY and is MULTIPLATFORM for corporate standardization: Windows, OS/2, UNIX, CTOS. Soon available for the MAC, and in 20 languages!

Call to get your FREE DEMO DISK and brochure!  
 Free 24-hour technical support.

Circle 79 on Inquiry Card.  
 World Radio History

## Sun's New Unix Box: Short and Sweet

**W**ith its introduction of the Sparcstation IPC, Sun Microsystems started a new packaging trend: small and inexpensive Unix workstations. With their small footprints and like-size expansion cabinets (for external drive, tape, and CD-ROM), Sun's IPC and its descendants took the bulk out of workstations. But Sun's best-performing desktop systems were still found only in the traditional "pizza-box" case. If you wanted a zippy CPU or drive, you had to invest in something other than Sun's squat boxes.

The Sparcstation LX hopes to change all that. As with the IPC, miniaturization abounds, but Sun has found some innovative ways to pack more functions into a case that hasn't gotten any bigger or heavier. The LX addresses many of the wish-list items Sun users have desired.

At the heart of the LX is its MicroSparc CPU, developed by Sun and Texas Instruments and running here at 50 MHz. This CPU rolls the integer, FPU, MMU (memory management unit), and cache into one chip, bringing the chip count down, reducing costs, and making room for more goodies. Those objectives were furthered by Sun's replacement of most of the system's I/O controllers with a pair of ASICs (application-specific ICs). The LX makes fine use of the extra real estate, building in support for basic-rate ISDN, twisted-pair Ethernet, 16-bit digital audio, and accelerated graphics.

Most of the new features built into the LX require outside-world connections, and the back panel of this system is densely packed with connectors. One DB-25 splits out to two serial ports, and another one services a bidirectional parallel port, expanding the range of supported printers. The Ethernet port pops out in two places: a tiny socket into which you plug a thin-wire transceiver or an AUI (Attachment Unit Interface) conversion cable, and a twisted-pair jack that lets you hook directly into a network. You'll also find a jack for connection to an ISDN line and connectors for SCSI and audio I/O.

The LX's standard audio capability is a leap beyond that built into previous Sparcstations. The LX manages 16-bit audio at sampling rates of up to 48 kHz. The system includes a battery-driven condenser microphone with mounting hardware to stick it to the front of your monitor.

The most impressive aspects of this new system relate to performance: CPU, display, and drive performance have all been



enhanced. With the 50-MHz MicroSparc CPU, the LX is faster than Sun's Sparcstation 2, previously its fastest uniprocessor desktop system. But it's not *much* faster—the documentation refers to it as being "1.5 times the speed of a 486." My tests against an Altos System 5000 (33-MHz 486) proved that statement to be true, at least for integer performance. In other areas, the LX positively skunked the 486: The LX was three times faster in floating-point and disk I/O. These results are unreliable because the LX I tested was a pre-production unit, but they at least show that Sun isn't inflating its performance claims.

I'll admit I had hoped that by now Sun would have taken a big leap in single-CPU performance, along the lines of 68030 to 68040 or 386 to 486. That didn't happen: My CPU performance tests showed the 50-MHz MicroSparc to be calculating almost exactly twice as fast as the 25-MHz chip in an IPC unit. It's fine for Sun to quote performance numbers against the 486, but the company is losing ground against IBM, Hewlett-Packard, and Silicon Graphics, all of which have reduced-cost RISC workstations with excellent single-processor performance. The LX will also be competing soon against systems built around Intel's Pentium, which, if you take Intel's vaunted performance figures as truth, could also make the MicroSparc look a little sickly.

If the LX's CPU performance isn't stellar, it's at least adequate, and some of the slack is picked up by the system's other turbocharged features. The GXplus graphics accelerator built onto the LX's motherboard boosts the system's text and graphics performance. The first evidence of this

is in the LX's text mode. Previous Sun systems were practically unusable without the window system running because text was displayed and scrolled so slowly.

Once you fire up OpenWindows, the GXplus really earns its keep. Sun claims the chip enhances everything from window operations to 3-D wireframe and flat shading; I had no complaints with the system's performance in these areas. The LX comes with a 16-inch color monitor that shows the Sun-standard 1152- by 900-pixel resolution, but you can pick up a 21-inch monitor that handles the GXplus's top resolution.

Overall, the Sparcstation LX strikes me as a solid machine. True, it's not at the top of its class in CPU performance, but it certainly makes a capable platform for the majority of applications you'd want on your desktop. The standard accelerated graphics means that whether you run a program locally or reach across the network to some high-performance computer server, your display won't be a bottleneck. The LX's fast SCSI makes quick work of applications I/O and makes the LX valuable in the peer-to-peer world of TCP/IP and NFS (Network File System)—or even as a low-cost file server.

The Sparcstation LX is priced at \$7995 with 16 MB of memory (expandable to 96 MB using 16-MB SIMMs, 24 MB otherwise), a 424-MB hard drive, a 3½-inch 1.44-MB floppy drive, and a 16-inch color monitor. A license for Sun's new Unix System V-based operating system, Solaris 2.1, is included with the system. A CD-ROM drive is not included, but if you plan to buy anything from Sun, you'd better make room for one in your budget. All Sun's software products are shipped exclusively on CD-ROM, and most SPARC applications vendors are following suit.

—Tom Yager

### THE FACTS

**Sparcstation LX**  
\$7995

Sun Microsystems Computer Corp.  
2550 Garcia Ave.  
Mountain View, CA 94043  
(415) 960-1300  
fax: (415) 969-9131  
**Circle 1167 on Inquiry Card.**

# Power Packed Upgrades.

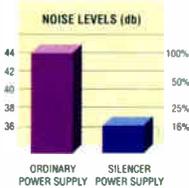
## STANDARD UNITS

These UL/CSA approved, fully-tested power supplies are the best basic units available.

|                             |      |
|-----------------------------|------|
| STANDARD 200 XT .....       | \$69 |
| STANDARD 205 SLIM .....     | \$89 |
| STANDARD 220 BABY .....     | \$89 |
| STANDARD 220 AT/TOWER ..... | \$89 |

## ULTRA-QUIET UNITS

Unrattle your nerves with a Silencer power supply, recognized since 1986 as the industry's quietest. Cooled with efficient, variable-speed fans that are virtually inaudible!



A must for home office or *multimedia* applications.

|                             |       |
|-----------------------------|-------|
| SILENCER 205 SLIM .....     | \$119 |
| SILENCER 220 AT/TOWER ..... | \$129 |
| SILENCER 270 AT/TOWER ..... | \$179 |

## HIGH-PERFORMANCE UNITS



Upgrade your computer with one of our premium Turbo-Cool power supplies—the choice of PC professionals. You'll get 50% - 100% more power, built-in line conditioning, a dual-stage EMI filter, super-tight regulation, ultra-clean DC output, our high-capacity ThermoSense variable-speed fan (300W models), UL/CSA/TUV approvals, and a no-hassle 2-year warranty! Ideal for high-end workstations and network file servers.

|                               |       |
|-------------------------------|-------|
| TURBO-COOL 200 XT .....       | \$159 |
| TURBO-COOL 300 SLIM .....     | \$169 |
| TURBO-COOL 300 BABY .....     | \$169 |
| TURBO-COOL 300 AT/TOWER ..... | \$189 |
| TURBO-COOL 450 AT/TOWER ..... | \$349 |

## REDUNDANT POWER SYSTEM

Eliminate the risk of network downtime or data loss due to power supply failure with the TwinPower 900 redundant power system. It delivers high-capacity, fault-tolerant power to the entire network server. Consists of two Turbo-Cool 450 power supplies in parallel, utilizing a special power-management interface module. A must for mission critical LANs.



■ **Super Server Power.** With 900 watts of peak power, the TwinPower 900 effortlessly runs any array of drives—without the need for sequencing.

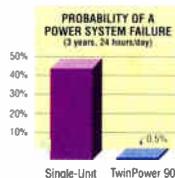
■ **100 Times More Reliable.**

Why gamble with a single-unit system? TwinPower's load-sharing, redundant design lets you take the power system for granted. It's the peace-of-mind a network manager needs!

■ **Hot-Swap Capability.** In the unlikely event that one of its 450s should fail, an alarm sounds, and the other 450 sustains the server while the user simply swaps in a new unit. No downtime!

■ **Optional Enclosures.** We offer "monster" cases that hold TwinPower's two power supplies and the interface. The Standard Tower (51 lbs.) holds 13 drives, while the all-steel Industrial Tower (104 lbs.) allows dual systemboards and holds up to 16 drives. Now, that's expandability!

|                         |        |
|-------------------------|--------|
| TWIN-POWER 900 .....    | \$995  |
| W/STANDARD CASE .....   | \$1695 |
| W/INDUSTRIAL CASE ..... | \$1995 |



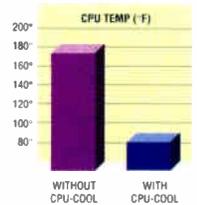
## 486 CPU COOLER



It's a fact. 486 chips run hot, often exceeding 185°F! Now, you can reduce the operating temperature of your 80486 processor to a cool, safe 85°-95°F with our popular CPU-Cool. You'll *prevent random system errors* and add years to the life of your investment. Consists of a

quiet mini-fan embedded in a sculptured heat sink that easily mounts on the CPU. Powered by a spare drive connector. Effective, inexpensive insurance!

CPU-COOL .....



## POWER SUPPLY ADVISOR

1. Even before it fails, an inferior power supply can be trouble. Nasty hard-to-track problems such as rebooting, loss of setup, overheating, and memory errors are often power supply related.
2. You can't have too much power. A power supply delivers only what the PC needs and actually performs best at 25% -75% of its rated capacity.
3. For greater hard drive reliability, use a power supply with independent regulation and extra cooling such as the Turbo-Cool 300/450.
4. Buy from a reputable power supply specialist. You'll get real service, not some runaround like: "Here's a number in Taiwan, give them a call".
5. To save money, PC manufacturers put ordinary power supplies— with limited features— in their systems. To upgrade, call us direct or ask your PC supplier for one of our units by name.

## PC POWER & COOLING, INC.

5995 Avenida Encinas, Carlsbad, CA 92008 • (619) 931-5700 • (800) 722-6555 • Fax (619) 931-6988

Most orders shipped same day. We accept Visa, MC, COD, or PO on approved credit. Turbo-Cool and TwinPower models guaranteed for 2 years. All other products guaranteed for 1 year. Hours: 7 a.m. - 5 p.m. (PT) Mon. - Fri. ©1992 PC Power & Cooling, Inc. Silencer, Turbo-Cool, ThermoSense, TwinPower, and CPU-Cool are trademarks of PC Power & Cooling, Inc. All other brand names are trademarks or registered trademarks of their respective companies.

# NO OTHER PEN HAS THIS KIND OF

The 3.3-pound machine is considerably lighter than many competitors' machines. Its black-and-white screen uses a back light,

which will allow customers to use the computer in difficult lighting situations.

—Los Angeles Times, Nov. 2, 1992

...tunes for w.  
connections, they said.

One problem we've had is seeing the screens [of other pen computers] in various lighting environments...[Toshiba is] using new backlit reflective technology; you can see it in any lighting.

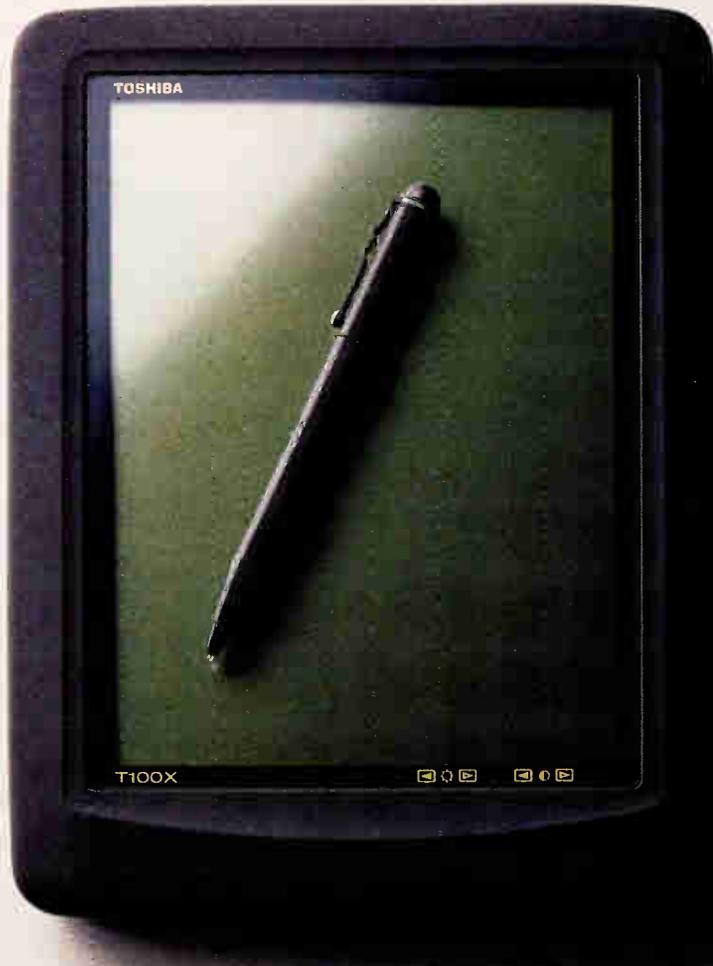
—Reprinted from PC Week, Sept. 14, 1992

...s, an  
and corporate users said.

[Toshiba has] done an exceptional job in the industrial design of the system, and going beyond that, looking at specific vertical solutions.

See TOSHIBA page 10

—Stella Kelly, InfoCorp Senior Analyst  
Infoworld, Nov. 2, 1992



The Toshiba Dynapad makes most of its predecessors look clunky by comparison. Packed into this sleek, little 3.3-pound tablet is a 9.5" transreflective-sidelit display, 40MB hard drive and two PCMCIA 2.0 slots. Clearly a 3rd-generation pen computer, the innovative engineering in the pen market has

—Portia Isaacson, Dream IT, Inc.

## INTRODUCING THE TOSHIBA DYNA

# INK.

[Toshiba has] a much better infrastructure for providing support than some other pen computer companies.

— Tim Bajarin, President/Creative Strategies Research International Inc. *Infoworld*, Nov. 2, 1992

[The Dynapad is] a nice system, has a good feel and [Personal Computer Memory Card International Association] cards, and at that low weight, it's much more the kind of thing people are going to need in the field than something like the ThinkPad.

— Janet Cole, Dataquest Analyst *Computerworld*, Nov. 2, 1992

I've been saying that [a pen computer] needs to be small, rugged, and able to run 386 or better.

— Mel Hinton, Senior Engineer/Public Service Electric and Gas Co. *Infoworld*, Nov. 2, 1992

## PAD T100X



Amazingly, we've even been able to incorporate two PCMCIA slots for expandability.



We took pains to ensure our Dynapad is perfectly balanced. Thus making it easy to hold in either arm and in a variety of positions.



At 3.3 pounds, it's truly one of the few pen computers where employees won't get fatigued carrying it.



We gave our pen a transreflective display screen so it can be used in a variety of different locations and lighting conditions (underground, at night, in broad daylight).

Leave it to Toshiba engineers to create a pen computer that has left an indelible impression on the computer world.

Presenting the acclaimed Dynapad™ T100X.

It's almost as if, for the first time, someone actually considered how people would use a pen computer. And designed it from there.

For starters, it's phenomenally light, weighing in at 3.3 pounds. So you can carry it for extended periods in the field without your arm falling off.

But don't be fooled into thinking that it's a lightweight. Because it boasts a 25 MHz Am386™ low-voltage processor. Offers 4MB RAM—expandable to 20MB. And comes with a 40MB hard disk.

The screen is equally impressive. We purposely designed a large 9.5-inch transreflective screen so it's easy to view whether you're in a pitch-black tunnel or out in the field in the blinding sunlight.

We were no less painstaking with the ergonomics. At 10.6" x 8.3" x 1.5", the T100X is very easy to hold. The weight is well balanced. There are no sharp corners. And we've given you both a top-view silo, so you can see if you have your pen, and the option of tethering the pen.

And like every computer we make, our T100X offers a variety of Toshiba innovations. Like our MaxTime™ power management system, which offers such features as AutoResume and AutoSave. So you get the maximum out of every battery charge.

To learn more, call the toll-free number below for the location of your nearest Toshiba reseller.

Because as you can see from the quotes to the left, this is one pen that's already made its mark.

In Touch with Tomorrow  
**TOSHIBA**

1 - 8 0 0 - 4 5 7 - 7 7 7 7

© 1993 Toshiba America Information Systems, Inc. All products indicated by trademark symbol are trademarked and/or registered by their respective manufacturers. PC Week quote copyright © 1992 Ziff Communications Company.

Circle 156 on Inquiry Card.

World Radio History

## EO's Personal Communicator Ushers In a New Era

**M**uch as the Macintosh represented a conceptual leap forward for personal computers, so too does the **Personal Communicator 440** from start-up EO. EO has changed the definition of a mobile computer, uniting the functions of a handheld organizer with a cellular telephone, both running under an intuitive pen-based user interface (see "Communications Gets Personal," February BYTE).

In BYTE's first hands-on evaluation of the Personal Communicator 440, I looked at a machine that breaks with the past in more than just conception: It is the first system built on the AT&T Hobbit RISC chip, a 3.3-volt CPU that offers fast performance with low power consumption. It also runs Go Corp.'s PenPoint operating system, ported to the Hobbit. EO has guts to eschew compatibility with the Intel/Microsoft and Mac standards, but the company sees communicators as a separate market from portable PCs.

Available this spring, the 440 sports a unique design with no keyboard and a distinctive set of "ears" on either side of the screen. These ears contain I/O ports, a speaker, and a microphone. The 1-inch-thick unit measures 11 by 7 inches without the ears; with one 4-hour nickel-cadmium battery, it weighs 2½ pounds.

The system uses a 20-MHz Hobbit chip and ships with 8 MB of ROM (containing PenPoint and 10 bundled applications) and 4 MB of RAM. Using standard 88-pin JEDEC memory modules, you can expand the RAM to 8 or 12 MB through a small door on the front; the preproduction unit I evaluated was loaded with 12 MB. Another door on the front contains a PCMCIA slot (Type 2, Level 2), which you can use for nonvolatile removable storage or other peripherals. My evaluation model also



included the optional fax modem and \$800 cellular-phone handset.

The 440 makes a nice pen-based personal organizer with a built-in PIM (personal information manager) and note taker, but the system doesn't come into its own without the phone. The 440 diverges from earlier pen-based systems in its tight integration of communications. The bundled GoFax, GoMail, and address book make it easy to send documents from within any program, and the built-in sound lets you attach voice annotations to documents.

Much of this capability comes from PenPoint, whose notebook metaphor and gesture interface make the 440 remarkably easy to use. The object orientation of PenPoint allows transparent sharing of data between applications.

The software I ran was a beta release, but it had few bugs and the performance was perky. The bundled programs and applets—which include MiniNote (for writing in digital ink), MiniText (for entering text via handwriting recognition), EO Calc

(a paper-tape calculator), and Pensoft's Personal Perspective (a scaled-down version of the company's PIM)—were powerful yet amazingly easy to use.

In fact, the 440's intuitiveness demonstrates how far user-interface design has come. I had only a few minutes of training on the basic gestures, yet I barely cracked a manual to use the system. I wasn't able to try the tutorial because it wasn't ready, but I liked being able to get context-sensitive help simply by writing a question mark over the area in question.

The Personal Communicator 440 is well designed and feels solidly built, and I found the nonreflective LCD screen easy to read. Perhaps for the first time in pen computing, a company has got the details right. AT&T has even gotten into the act. As a major investor in EO, AT&T will sell the 440 and 880 under its own name.

EO is only the first player in an expected wave of mobile devices that integrate computing and telephony. Over the next year, you can expect competition for EO and AT&T, but all new arrivals will have to be judged against the high standard set by the Personal Communicator 440.

—Andy Reinhardt

### THE FACTS

**Personal Communicator 440**  
(price not available at press time)

EO, Inc.  
800A East Middlefield Rd.  
Mountain View, CA 94043  
(415) 903-8100  
fax: (415) 903-8190

Circle 1168 on Inquiry Card.

## PowerExec EL Notebook: More for Less

**I**f our review of the AST PowerExec notebook ("AST's PowerExec Goes Modular," January BYTE) caught your eye, but you found the price a bit steep, AST has something new for you—the **PowerExec EL**. The *EL* stands for "entry level," and with a list price of \$1745, it may appeal to cost-conscious notebook users. That's what AST is hoping for, anyway. Philip Osako, AST portable systems marketing product manager, says that the EL is targeted at small businesses and peo-

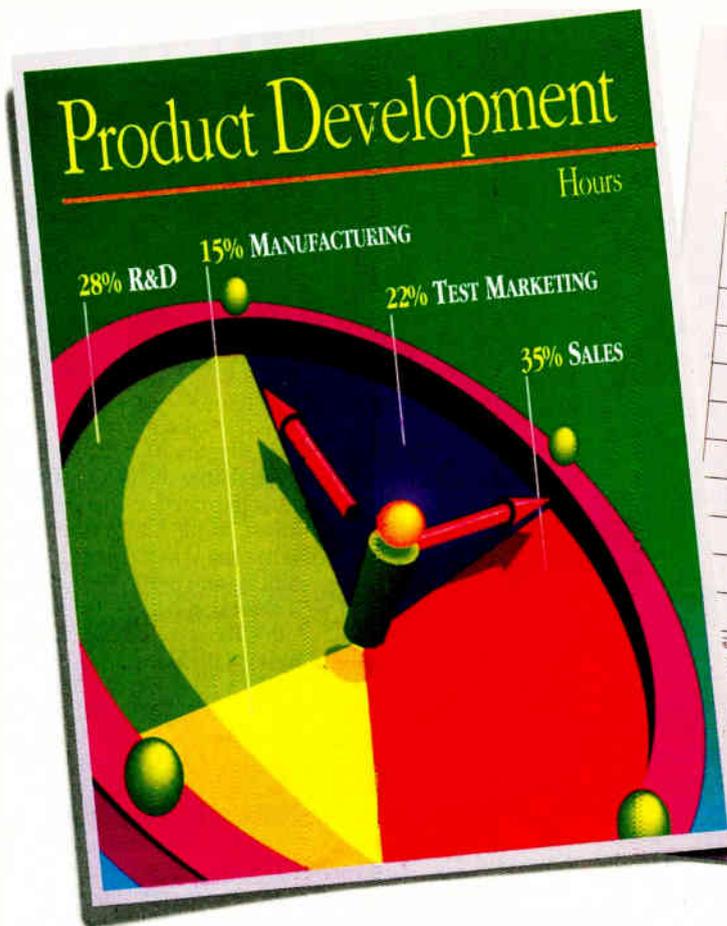
ple who need a notebook to supplement their office system.

AST is not alone in offering attractively priced notebook packages. Compaq and Toshiba, among others, offer modestly priced 386 systems. But for the purely price-sensitive shopper, the EL, at press time at least, leads the pack.

Like the higher-priced PowerExec, the preproduction EL I saw is a roadworthy notebook. It weighs in at almost 6 pounds and uses a nickel-cadmium battery pack.

Its base price includes an Intel 25-MHz 386SL processor, a coprocessor socket, a 60-MB hard drive, a 1.44-MB floppy drive, 2 MB of RAM, and one each of serial, parallel, monitor interface, keyboard/keypad connector, Type 2 PCMCIA slot, and expansion bus ports. For a \$2295 list price, you can get a 120-MB hard drive, 4 MB of RAM, Windows 3.1, and AST's SmartPoint trackball.

With the list price of the PowerExec at \$2395, just what do you give up when you



UNITED HEALTHCARE PURCHASE REQUISITION

REQUISITION NO. 163438

DATE: 12-10 REQUISITION BY: [Signature] DEPARTMENT: [Blank] NEW ORDER: [Blank] TO BE USED FOR: [Blank]

| QUANTITY | DESCRIPTION   | DATE REQUIRED | DATE RECEIVED | TOTAL COST |
|----------|---|---------------|---------------|------------|
| 1        | Tektronix Phaser 200<br>Color printer<br>✓ laser paper<br>✓ 2pp/min<br>✓ Adobe PS Level 2 |               |               | \$3,695.00 |

**APPROVED**

RECOMMEND: Recommend dual-tray option

SCOPE: \$3,695.00

WITHIN BUDGET  OUTSIDE BUDGET

SUPERVISOR: [Signature] DIRECTOR: [Blank] PRESIDENT: [Blank]

DEPT. MANAGER: [Signature] CONTROLLER: [Blank] CHIEF FINANCIAL OFFICER: [Signature]

# Our new color printer not only looks great on paper, it looks great on paper.

True, the brilliant color produced by the new Tektronix Phaser® 200 is captivating. But the price is equally attractive. And though we've become the award-winning leader in color printers by frequently outdoing the competition, this time we've even outdone ourselves. Introducing our newest business work group color printer.



The Phaser 200 is compatible with virtually any business software and can print two colorful pages per minute. No, not two minutes per page—two pages per minute. And even at a speed like that, it still manages to print eye-catching color on common laser paper or transparencies using a separate input tray for each. You select the medium you want at your computer keyboard. And it switches automatically from user to user just as easily, using its parallel, serial, AppleTalk™, or optional EtherTalk™ and Ethernet™ ports.

It has all the advantages of a laser printer. True Adobe PostScript™ Level 2, networkability, Pantone® colors, speed and price. (Did you notice it's only \$3695, slightly below unheard of?) And when you add to that extremely high materials capacity and sparkling TekColor™ output—not just any color, but the indisputably best color in the business—you've got something even better than our previous best. Which is quite a feat.

So stop by your nearest Tektronix dealer or call us at 800/835-6100, Dept. 28J for a free output sample. For faxed information call 503/682-7450, ask for document #1223. You won't find another business investment that looks this good on paper.



**Tektronix**

Phaser is a trademark of Tektronix, Inc. PostScript is a trademark of Adobe Systems, Inc. All other marks are trademarks or registered trademarks of their respective companies.

# Images in your Computer

from Video or full page Scanners. Boost your productivity in DeskTop Publishing, OCR and Multimedia applications.

## ColorSnap PC

Professional. REAL TIME. video image capture. full screen. 16.7 million colors & gray-scale. Use any NTSC/PAL video source, camcorder, live TV, still video, VGA, SVGA supported, files saved in standard formats. Free Aldus PhotoStyler. Video-for-Windows compatible. Digitize movies at 30 frames/sec. Hundreds of applications. Demo disks available. **\$599.00**



## ArtiScan 1200 dpi

1200 dpi, desk-top, fast (SCSI), 24-bit, flat bed, color scanner. True hardware resolution, superb picture quality, color-gray scale. Free Image Processing software. 600 dpi model \$975.00, 800 dpi, \$1289.00. Optional X-Ray, Slide Scanner (\$545.00). Twain univ. driver with all models. OCR software. Recognita, \$159.00 - WordScan, \$99.00. Best magazine ratings.



## LifeView Encoder

Record your computer presentations to video or display to any TV monitor. NTSC or PAL **249.00**



## Color 6000

600 dpi, full page, sheet-fed color (24-bit) scanner. Complete with Color Image Processing Software and WordScan OCR s/w. HP ScanJet emulation driver.. Color 3000, 300 dpi unit, \$495.00



## PageReader 300

Full Page, 300 dpi Scanner complete with OCR WordScan software & line-art Imager software!! HP-ScanJet emulation driver hence compatible with any OCR package. Fast! Reads avg. page in <10 sec. With Recognita, add \$159.00 - 9600 fax/modem send/rec, add \$99.00. Ideal in any office for text. AutoCad drawings, fax etc



Call/fax for Catalog on MultiMedia DeskTop Video Systems and Image Transfer Systems

30-day return guarantee. 1 year warranty. Major credit cards. Resellers Welcome.

Computer Friends, Inc. - 14250 NW Science Park Dr. - Portland OR 97229 Founded  
Toll Free 1-800-547-3303 - tel. (503)626-2291 - fax (503)643-5379 1982

# NEWS

get an "equivalent" EL? First, unlike with the PowerExec, you cannot upgrade the processor and there is no 64-KB cache. Second, there is only one PCMCIA slot with the EL. The 9½-inch-diagonal, 640-by 480-pixel resolution VGA display is different, too. It provides 64 shades of gray, but it's not quite as bright and doesn't offer as much contrast as the one on the PowerExec. Finally, the AC adapter takes a bit longer to recharge the battery pack.

AST says that the nickel-cadmium power pack will last about 3 to 4 hours because the EL has the same heuristic power management system as the PowerExec. In fact, with the exception of the differences noted, this EL is a PowerExec. The long list of options includes a nickel-metal-hydride battery pack, RAM modules (the EL expands to 20 MB), PCMCIA-based modems, Ethernet and SCSI adapters, and passive- and active-matrix color displays.

The PowerExec EL is a good example of the more-for-less, Windows-capable hardware trend so prevalent with desktop systems. Other examples of this move toward affordability in notebooks are systems from Toshiba, Compaq, and a few others that are full-featured competing notebooks at similar user-attractive prices. For example, the Compaq Contura 3/25 Model 84/w+ comes with an 84-MB hard drive and 4 MB of RAM. It can be had for a street price of about \$1900. Notebooks such as the PowerExec EL show that "entry level" doesn't have to mean starting at the bottom anymore. ■

—Gene Smarte

## THE FACTS

**PowerExec EL**  
with 2 MB of RAM, a 60-MB hard drive, and a monochrome display. \$1745  
with 4 MB of RAM, a 120-MB hard drive, Windows 3.1, and a Smart-Point trackball, \$2295  
display upgrades (done at factory): passive, \$1169; active, price not available at press time

AST Research, Inc.  
P.O. Box 19658  
Irvine, CA 92713  
(800) 876-4278  
(714) 727-4141  
fax: (714) 727-9355  
**Circle 1169 on Inquiry Card.**

**SUNDAY 10-5**

**PROMPT DELIVERY**

**NEC**

**COMPUTERS**

Laser 386 SX/16 2 MB 40 MB ... 659.99

2 FID VGA Color Mon. ... 779.99

Olivetti 386 SX/20 3 MB

1.4 FID 40 MB VGA Color ... 1049.99

Procolor Ball 486 SX/20 4/107 MB

2 FID VGA Color ... 1639.99

CANON 486 DX/33 4/130 MB

2 FID SVGA 28 Color ... 1639.99

**NOTEBOOKS**

Toshiba

T-1800 SX 2/60 MB ... 1249.99

T-1850 4/ 80 MB ... 1599.99

T-1850 4/120 HD ... 2249.99

T-1850 Cr 4/80 MB ... 2449.99

T-1850 Cr 4/120 MB ... 3499.99

T-4400 SX/20 2/60 MB ... 4099.99

T-4400 Cr 4/120 MB ... 2550.00

T-4400 DX Cr 4/200 MB ... 3749.99

T-4500 4/120 MB ... 5749.99

T-4500 Cr 4/120 MB ... 5749.99

T-6400 DX Cr 4/200 MB ... 5749.99

**FAX**

Brother 600/700 ... 375.99/439.99

Canon Fax 50 ... 414.99

Canon B-70 Pt. Paper ... 824.99

HP Fax 200 Plain Paper ... 894.99

Murata M-750 ... 489.99

Panafax PX-150 ... 1049.99

Panafax PX-350 ... 359.99/429.99

Pana. KXP-50 90 ... 359.99/429.99

**LASER PRINTERS**

HP Desk Jet 500 ... 369.99

HP Desk Jet 500 Color ... 493.99

HP Laser III Plus ... 749.99

HP Laser III Plus 220V ... 899.99

HP Laser III Plus ... 899.99

HP Laser III Plus 220V ... 899.99

HP LaserJet 4 w/Toner ... 2099.99

HP LaserJet XL300 ... 2099.99

HP PaintJet 97 ... 964.99

NEC Model 400 ... 964.99

Oki Laser 810 ... 819.99

Pana. KXP 4410 ... 999.99

Pana. KXP 4430 ... 999.99

Pana. KXP 4450 ... 999.99

Tax Font (Laser Jet 4) ... 74.99

2 MB VHP Laser Jet 4 ... 84.99

2 MB VHP Laser Jet ... 79.99

2 MB Mem. V/OkiData ... 104.99

**EXECUTIVE ORGANIZERS**

CASIO SF 5300 64 K ... 99.99

CASIO SF 8300 64 K ... 134.99

CASIO SF 9300 64 K ... 239.99

CASIO SF R20 256 K ... 369.99

CASIO Link V/IBM Mac ... 369.99

HP 95 LX 12 K ... 125.99

HP 95 LX 1 MB ... 184.99

1 or 2 MB F/95 LX ... 184.99

Sharp ZQ 5200 64 K ... 244.99

Sharp IQ 8200 128 K ... 244.99

Sharp IQ 8400 256 K ... 424.99

Sharp OZ-9600 256 K ... 424.99

Sharp Link V/IBM-Mac ... 424.99

**NETWORK/PERIPH**

Novell 3.11 5 User ... 539.99

Novell 3.11 10 User ... 1229.99

Novell 3.11 20 User ... 1599.99

Novell 3.11 50 User ... 2349.99

Novell 3.11 100 User ... 3349.99

**MONITORS**

NEC 4DS ... 569.99

NEC 3 FGX ... 609.99

NEC 4FG/5FG ... 719.99/1229.99

NEC 5D 20" ... 1299.99

NEC 5D 20" ... 2249.99

NEC 6 FG 21" ... 309.99

NEC C 1381 I ... 249.99

Pana C 1181 V ... 249.99

SVGA 28 110/220 V ... 349.99

Viewsonic 6E Non-Intouch ... 349.99

**PRINTERS**

Canon BJ 10 ex ... 244.99

Canon BJ 200 ... 324.99

Canon BJ 200 ... 279.99

Epson FX-870 ... 239.99

Epson FX-570 ... 364.99

Epson LQ-1070 ... 569.99

Epson LQ-1170 ... 169.99

Epson LQ-810 ... 299.99/419.99

Oki 320 / 321 ... 414.00/579.00

Oki 393 Plus ... 189.99

Panas. KXP 1123 ... 259.99

Panas. KXP 1124 ... 334.99

Panas. KXP 1624 ... 224.99

Panas. KXP 2123 ... 159.99

Panas. KXP 2180 ... 294.99

Panas. KXP 2124 ... 354.99

Panas. KXP 2624 ... 354.99

**SCANNERS**

HP ScanJet Plus ... 599.99

HP ScanJet III ... 849.99

HP ScanJet III Color ... 1299.99

Microtek Scan Maker II ... 799.99

Microtek MSF600Z Color ... 319.99

Intel Satisfaction 400 ... 259.99

Leg Scanman 256 ... 259.99

**IN USA & CANADA & P.R. INCLUDING NY STATE**

**1-800-874-1235**

Fax: (212) 463-8335 (Include Voice & Fax #)

**S & W COMPUTERS & ELECTRONICS**

31 West 21 Street, New York, NY 10010

NYC (212) 463-8330

Mon. Thurs. 9-6 Fr. 9-1:45

Saturday Closed

\* DISCOVER • M.C. VISA C.O.D. w/Deposit • No surcharge for credit cards. Ship to add'l Handling 2% Qty. Ltd. Prices subject to change. Returns w/written authorization. Free Parking Sunday. Meter parking available. Prices for consumers.

54 BYTE • MARCH 1993

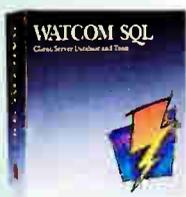
Circle 144 on Inquiry Card.

World Radio History



# Programmer's Paradise®

## WATCOM SQL Developer's Edition by WATCOM



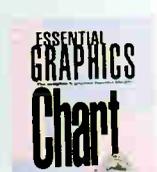
Complete client/server development tool allows you to develop and deploy single-user standalone applications, and to develop applications for use with the Network Server Edition. Includes: Single-user database server; ACME application development system; Embedded SQL C/C++ preprocessor; SQL libraries for WATCOM C, C/386, MS/C++ and BC/C++.

List: \$395 Ours: \$299  
FAX<sub>cetera</sub> # 1683-0010

## HUGE SELECTION AT THE RIGHT PRICE! CALL TODAY!

|                       |       |                         |         |
|-----------------------|-------|-------------------------|---------|
| 386MAX                | \$64  | Label Master            | \$429   |
| Baler                 | \$399 | Lahey EM/32 5.0         | \$1,015 |
| Bar Code Library      | \$350 | mini Ed Tools           | CALL    |
| Borland C++           | \$319 | MKS Learning UNIX       | \$99    |
| C Windows Tlkt. 386   | \$179 | MKS Toolkit             | \$239   |
| C++/Views             | \$449 | MS C/C++                | CALL    |
| C-DOC Professional    | \$269 | MS FoxPro               | CALL    |
| CAD/CAM Products      | CALL  | Multi-Edit Professional | \$139   |
| CASE:W Corporate      | CALL  | Norton Desktop/Win      | CALL    |
| Clipper               | \$499 | object-Menu             | \$269   |
| CodeWright            | \$225 | Opt-Tech Sort/Merge     | \$119   |
| dBASE IV              | \$499 | Paradox 4.0             | \$569   |
| dBFast Windows        | \$395 | PGL                     | CALL    |
| dGT-Unlimited Runtime | \$499 | .RTLink/Plus            | \$445   |
| Dr. Switch-ASE        | \$159 | SlickEdit               | \$149   |
| ED for Windows        | \$269 | SQA:Replay              | \$79    |
| GX Products           | CALL  | Turbo C++ for Windows   | \$112   |
| KPWin++               | CALL  | WATCOM FORTRAN 77/386   | \$719   |

## Essential Graphics Chart™ for Windows by South Mountain Software



Essential Graphics Chart for Windows lets you turn your data into charts and graphs that make an immediate visual impact. Features include: DLL-works with any Windows API compatible language, 2D bar, 3D bar, legends for all chart types, real-time charts, true perspective and rotational capability. No Royalties.

List: \$399 Ours: \$299  
FAX<sub>cetera</sub> # 2089-0017

## CA-dBFast Windows 2.0 by Computer Associates



The complete stand-alone dBASE/Xbase development language for MS Windows. Create fast, powerful, easy-to-use graphical applications. Over 200 extensions to the dBASE III PLUS language and includes an interactive editor, compiler, and linker. Challenge your creativity and imagination! Design multiple windows, pull-down menus, check boxes, list boxes, radio buttons, bit-map pictures, and more!

List: \$550 Ours: \$395  
FAX<sub>cetera</sub> # 1004-0003

## Dan Bricklin's Demo II by Lifeboat Software



Experience for yourself why 30,000 people have made Demo II 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 dedicated CBT authoring software.

List: \$249 Ours: \$215  
FAX<sub>cetera</sub> # 0233-0003

## Q+E Database Library (QELIB) 1.1 by Pioneer Software



A set of Dynamic Link Libraries providing a common call level interface for developer tools such as Visual Basic, ToolBook, Actor, Smalltalk, C, C++, etc. and most macro language products to access data from Oracle, SQL Server, Sybase, EE Database Manager, DB2, Netware SQL, dBASE, Paradox, Excel, and text files.

List: \$399 Ours: \$359  
FAX<sub>cetera</sub> # 2625-0003

## Microsoft Windows for Workgroups



Considering how easy it is to use MS Windows™, imagine what MS Windows™ for Workgroups can do for an entire group. Such as information sharing among many PC users that can lead to even better, more collaborative work. Printer sharing that uses hardware resources more efficiently. And schedule management that improves efficiency.

Workgroups List: \$249 Ours: \$175  
ADD-On List: \$ 79 Ours: \$ 61  
FAX<sub>cetera</sub> # 1269-0042

## MediaDeveloper by Lenel Systems



Create multimedia-enabled applications with MediaDeveloper and ObjectVision. It is THE Multimedia Development Toolkit to integrate sound, images, animation and full-motion video into Windows applications. Includes media and device control for multimedia peripherals including CD-ROMs, VCRs and laserdisc players; support for major animation, video, audio and graphics formats; a multimedia database; OLE server; and many DLLs.

MediaDeveloper List: \$595 Ours: \$449  
w/ObjectVision 2.1 List: \$745 Ours: \$499  
w/ObjectVision 2.1 Pro List: \$1090 Ours: \$749  
FAX<sub>cetera</sub> # 1005-0302

8  
0  
0  
4  
4  
5  
7  
8  
9  
9

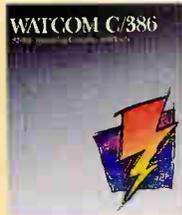
# Software that

# Sizzles!



## WATCOM C/386 9.0 by WATCOM

Develop and Debug 32-bit applications for extended DOS, Windows, and OS/2 2.0 with the most complete 32-bit C development package available. Includes the royalty-free DOS/4GW DOS extender by Rational Systems, components from MS Windows SDK, compiler, linker, debugger, profiler, plus numerous development tools. Supports other industry standard 32-bit DOS extenders. Create ADS Applications for AutoCAD or embedded systems development.



List: \$895 Ours: \$599  
FAXcetera # 1683-0001

## Visio by ShapeWare

Now everyone can create professional-quality graphics! Straightforward stencils, designed for everyday business drawings and technical diagrams, provide all the shapes you need. Whether you're creating engineering schematics, network or block diagrams, org charts, programming flow charts, or your own custom drawings, Visio has a stencil of shapes that will make your job easier. GET A \$79 VISIO PROGRAMMER'S STENCIL FREE WITH EACH COPY OF VISIO YOU ORDER!



List: \$299 Ours: \$225  
FAXcetera # 1006-2801



## WindowsMAKER Professional 4.0 by Blue Sky Software

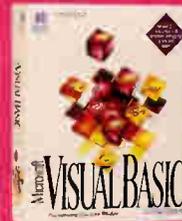
Next generation of industry standard C/C++ development tool for Windows. The easiest fastest way to create Windows apps, just point and click. New architecture uses Switch-It™ Code Generation Modules for generating ANSI C, MFC++, or OWL C++ code among others. Award-winning Visual Prototyper lets you test the look & feel and make changes on the fly. TrueCode

technology ensures the user code is preserved during code regeneration. Generates Windows .EXE w/fully commented C or C++ source.

List: \$995 Ours: \$695  
FAXcetera # 2602-0003

## PRODUCT OF THE MONTH

### Visual Basic for Windows by Microsoft Corporation



The fastest way to program for Windows just got faster. When you need to create a Windows application quickly, nothing offers the sheer productivity of Microsoft Visual Basic 2.0 Standard Edition. A visual development environment, flexible programming language, and fast runtime execution make this the shortest route to full-featured Windows

applications. The Professional Edition includes messaging and data access capabilities, a wide variety of add-on tools, and more.

Standard Edition List: \$199 Ours: \$139  
Professional Edition List: \$495 Ours: \$337  
FAXcetera # 1269-0039

## ED-The Programmer's Editor for Windows by Lifeboat Software

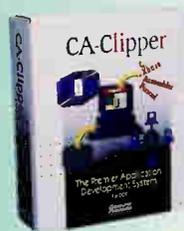
A full-featured Windows-based programmer's editor is here! ED is setting the standard with features like background compilation, automatic code indenting and completion, hypertext function/procedure lookups, "smart" language-specific editing, a fast "C" extension language, Windows Toolbar, unlimited undo and redo, keyboard macros and remapping, and emulation of popular DOS editors.



List: \$269 Ours: \$199  
FAXcetera # 0233-0011

## CA-Clipper 5.2 Competitive Upgrade by Computer Associates

Yes, the newly released CA-Clipper version 5.2 is being offered to Xbase language product owners at the low retail price of \$199. This competitive upgrade is available for a short term only! What a great opportunity to get the power of CA-Clipper, at a super price!



List: \$199 Ours: \$149  
FAXcetera # 5400-0001



## MS Visual Basic for DOS

Draw forms and controls, write event-procedures, use and create custom controls-in DOS! Create all-new apps or combine with existing C/C++ or Pascal code. Highly compatible with VB/Win for multi-platform development. Even run existing MS Quick Basic/Basic PDS code! Includes a native 80 x 86 compiler that creates 100% stand-alone .EXE files, 386 code generation,

MOVE overlays, an integrated ISAM and much more!

Standard Edition List: \$199 Ours: \$139  
Professional Edition List: \$495 Ours: \$325  
FAXcetera # 1269-0039



## Janus/Ada Compiler by R.R. Software

Janus/Ada for DOS: the power and reliability of Ada, priced for everybody! You get a full, validated implementation of Ada-compiler, linker, royalty-free runtime libraries, multiple memory models, environment, tools, and even a tutorial. And R.R. Software supports you with 12 years of Ada experience and know-how. Now's the time to use Janus/Ada.

List: \$129 Ours: \$115  
FAXcetera # 1876-0001

9  
9  
8  
7  
5  
4  
4  
4  
0  
8

# Programmer's Paradise®

## MetaWare High C/C++ by MetaWare, Inc.

MetaWare, Inc. announces its newest product! The 32-bit High C/C++ compiler version 3.0 is a true compiler, not a C to C++ translator. "Incremental Strengths" let you specify the level of C++ compilation, allowing you to migrate from C to C++, one C/C++ block at a time. Included is a C++ tailored source-level debugger and a 32-bit Application Development Kit for Windows. MetaWare offers a full line of multi-language, multi-platform compilers for professional software developers.

**List: \$795 Ours: \$669**  
**FAX<sub>cetera</sub> # 1590-0008**



## VM Data by PocketSoft, Inc.

VMData for Windows is a DLL that manages up to 128 MB of dynamic data. Eliminates annoying slowdowns commonly seen in 386 Enhanced Mode when programs use large amounts of dynamic data, and eliminates out-of-memory problems in Standard Mode. Provides superior run-time performance and ensures that your program is a good citizen under the Windows environment.

**List: \$495 Ours: \$359**  
**FAX<sub>cetera</sub> # 1987-0005**

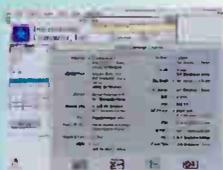


## WinGEN by Buzzwords International

**Converts ObjectVision .OVD to Source Code!**

Make the title bar disappear and run your application at compiled speed. WinGEN produces code for Windows versions of dBASE, C/C++, and Turbo Pascal. Supported engines include: Paradox Engine, Sequiter Codebase, POET, Raima, Faircom c-tree, Sybase, Novell Btrieve, Novell Btrieve with SQL/XQL Manager, OLE & DDE/DDEML, and Q & E.

**List: \$149 Ours: \$79**  
**FAX<sub>cetera</sub> # 1873-0002**



## DataBoss by Kedwell Software

Relational database application generator. Use to develop complete applications with menus, forms, browse tables, memo fields, reports and more. Includes sophisticated screen painter; field definition template for defining field characteristics, indexes, data files and their relations; WYSIWYG report designer; generator engine and skeletal files. Generates structured C/C++ or

Pascal source code. No license or runtime fees.

**List: \$695 Ours: \$499**  
**FAX<sub>cetera</sub> # 3758-0001**

## Multi-Edit Professional by American Cybernetics

A richly featured, easy-to-use programmer's text editor. Multi-Edit's flexibility and sheer power combine to provide you with unparalleled productivity. Features include: intuitive user interface, mouse support, syntax highlighting, cross directory multiple file search AND replace, color templates, + much more! Finally, a text editor that thinks like a programmer! Free demo disk available.

**List: \$199 Ours: \$139**  
**List: \$295 Ours: \$259**  
**FAX<sub>cetera</sub> # 1846-0001**

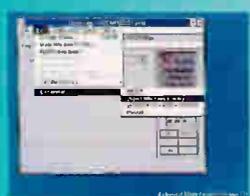


## SVS C<sup>3</sup>/FORTRAN-77 by Silicon Valley Software Version 2.8.2

SVS C3/FORTRAN-77 runs in and creates 32-bit executables for use with MS Windows 3.x as DPMI executables. Compiler, development tools and applications are DPMI conforming and support most VCP1 requirements.

Extensive graphics and scientific function library is included. Executables are run-time royalty free.

**List: \$395 Ours: \$356**  
**FAX<sub>cetera</sub> # 2863-0001**



## PROTOGEN 3.0 by ProtoView Development

NEW VERSION! The industry standard for code generation and prototyping Windows applications. Develop the user interface of your application using Visual prototyping methods. ProtoGen generates expert

level, commented code for ANSI C, Microsoft NT Win32. All generators included! User Code is preserved from one generation to the next. It's easy and fast.

**List: \$99 Ours: \$95**  
**FAX<sub>cetera</sub> # 2553-0002**



## GUARANTEED BEST PRICES! (Call for details)

**To order call: 800-445-7899**  
**Corporate (CORSOFT): 800 422-6507**  
**FAX: 908 389-9227**  
**International: 908 389-9228**  
**Customer Service: 908 389-9229**

For more information on the products featured on these pages call-  
**FAX<sub>cetera</sub>®: 908 389-8173**

*Programmer's Paradise®*

• All prices are subject to change without notice.

**Circle 102 on Inquiry Card.**

### SPARC-Based Portability

**A** portable workstation based on the 50-MHz Sparcengine LX board from Sun Microsystems, the BriteLite LX is 100 percent compatible with Sun hardware and software, according to RDI Computer. The Solaris 32-bit distributed environment is preinstalled.

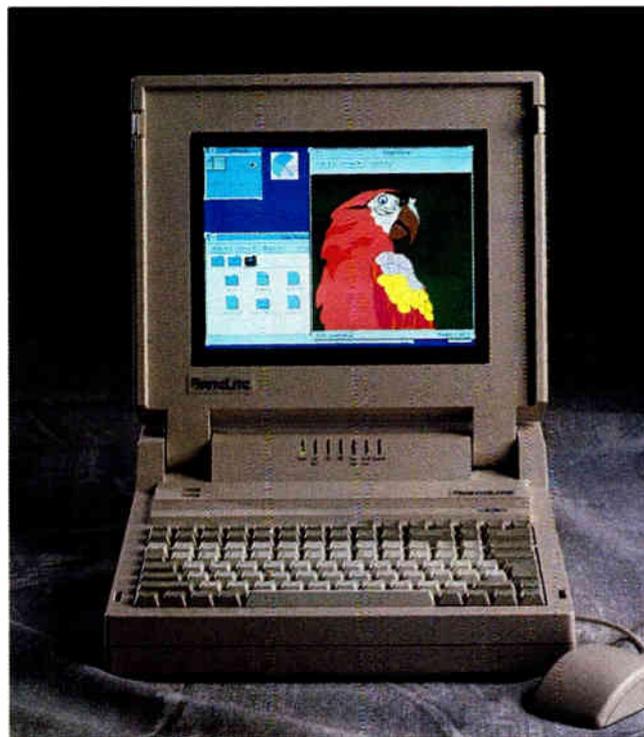
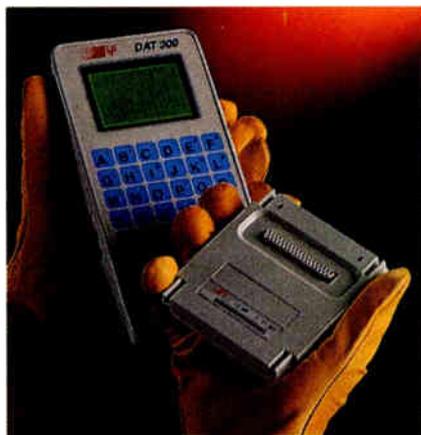
Features of the BriteLite LX include a Colorplus active-matrix TFT (thin-film transistor) LCD, which offers 256,000 colors and 64 levels of gray. Standard memory is 16 MB (expandable to 96 MB), and hard disk storage is 450 MB. Ports include a SCSI-2 connector, an audio/attachment unit interface port, and a bidirectional programmable parallel port. **Price:** \$15,995.

**Contact:** RDI Computer Corp., San Diego, CA, (619) 558-6985; fax (619) 558-7061.

**Circle 1075 on Inquiry Card.**

### Modular Power Fits in Your Hand

**A** hand-held PC geared for rugged use, the modular DAT300 features a removable data-cassette hard disk. You can use the cassette—available with from 256 KB



*The BriteLite LX puts SPARC power into a portable workstation.*

to 2 MB of SRAM (static RAM) or flash EPROM and as a 20- or 40-MB micro hard disk—like a floppy disk to exchange data and programs.

Other modules include a removable battery pack, a plug-in radio interface for wireless communications, and a plug-in impact mini-printer. The unit is C-programmable in Windows. You can access the removable data cassettes, as you would a normal hard drive, directly from your desktop PC's parallel port. **Price:** \$1350 (1,889,325 lira) and up.

**Contact:** 4P s.r.l., Padova, Italy, +39 498 700474; fax +39 498 700943.

**Circle 1076 on Inquiry Card.**

### Configuration Choice

**T**he expandable DT486 DLC-40 system is available in desktop, minitower, and medium-tower models. The system has a basic configuration of 4 MB of RAM (expandable to 32 MB on the motherboard), dual floppy drives, an 80-MB hard drive, a Super VGA color card and monitor, a keyboard, DOS 5.0, and a serial mouse.

Upgrades for the system include 120-, 170-, 200-, and 340-MB hard drives, a 2.5-MB IDE cache controller, and a Windows accelerator VGA card. You can also add Windows 3.1 and a 256-KB cache-memory module. **Price:** Basic system, \$1299. **Contact:** Diamond Technologies, Inc., Irvine, CA, (800) 989-7253 or (714) 252-1008; fax (714) 252-1508.

**Circle 1077 on Inquiry Card.**

### Desktop Power Packer

**T**he small-footprint Image 466/66i runs at 66 MHz internally and 33 MHz externally. The system has 4 MB of SIMM RAM, expandable to 36 MB on the system board, and 128 KB of ROM.

NEC's implementation of local-bus video technology, ImageVideo, is a dedicated video bus that operates at 33 MHz. ImageSync automatically synchronizes the system to the optimum frequency of one of NEC's MultiSync FG series of monitors. The system has four 8-/16-bit ISA expansion slots and four drive bays.

**Price:** With a 120-MB IDE hard drive, \$2501; with a 240-MB IDE hard drive, \$2677.

**Contact:** NEC Technologies, Inc., Boxborough, MA, (508) 264-8000.

**Circle 1078 on Inquiry Card.**

### Multiuser System

**A**lpha Microsystems' multiuser AM-1600LC runs on the company's proprietary operating system, AMOS, and is based on a 25-MHz MC68020 processor. Four memory slots accept 1- or 2-MB memory modules for expansion (up to 8 MB).

The system is available with the company's optional Virtual Personal Computer technology, which lets you execute DOS programs without a DOS workstation. **Price:** With 2 MB of RAM, four serial ports, one parallel port, a 120-MB SCSI hard drive, and a tape streamer for backup, about \$7624 (£4830). **Contact:** Alpha Microsystems (GB), Ltd., Maidenhead, Berkshire, U.K., +44 628 822120.

**Circle 1079 on Inquiry Card.**

### The SCSI-2 Advantage

The SiliconAdvantage SCSI-2 host adapter cards provide synchronous data transfer rates as high as 10 MBps and asynchronous rates as high as 7 MBps. Able to perform complex SCSI-2 command sequences without software intervention, the cards automatically handle all command-queue responses from the SCSI devices, in addition to sorting and reordering commands.

Other features of the cards include scatter/gather, enhanced virtual memory performance by off-loading disk I/O tasks from the operating system, connect/reconnect support, and slow cable mode for noisy environments. The cards support up to 49 SCSI devices via use of logical unit numbers. Optional driver support is available for operating systems such as DOS, NetWare, OS/2, Windows, SCO Unix, and Solaris. The software interface is ANSI CAM (common access method) compliant.

**Price:** ISA card, \$495; Micro Channel card, \$795.

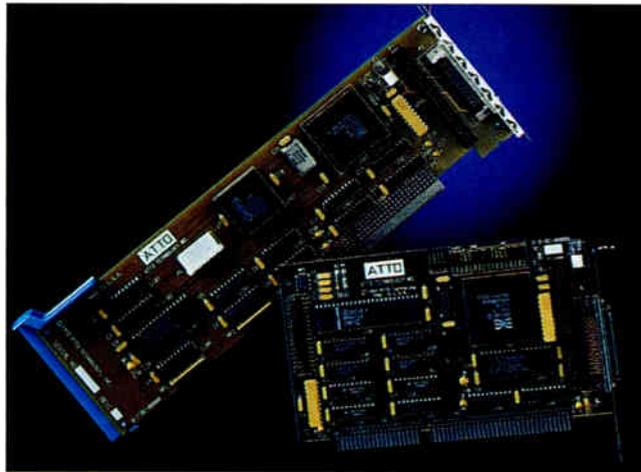
**Contact:** Atto Technology, Inc., Amherst, NY, (716) 688-4259; fax (716) 636-3630.

**Circle 1086 on Inquiry Card.**

### Up the Resolution

The LazerSetter PCL Plus provides 600- by 600-dpi resolution in PCL (Printer Control Language) mode on Hewlett-Packard LaserJet II, IID, III, and IIID printers. The optional LazerTrax PostScript-compatible interpreter can boost resolution to 1200 by 1200 dpi.

A controller card that plugs into the optional I/O slot of the printers, the LazerSetter PCL Plus is based on the 960SB/16 RISC processor. On-board RAM provides fast



*SiliconAdvantage cards boost data throughput in SCSI-2 systems.*

processing without your having to add additional memory to your printer.

**Price:** \$795 and up.

**Contact:** Bolder Systems, Inc., Boulder, CO, (800) 967-0973 or (303) 938-9949; fax (303) 449-4005.

**Circle 1087 on Inquiry Card.**

### A New View for PowerBooks

Applied Engineering's BookView Imperial pseudostatic RAM and video adapter card plugs into the memory-expansion slot on the motherboard of the Apple PowerBook to let you connect the notebook to large color monitors. The card, which has 6 MB of RAM, provides 8-bit color and levels of gray. It supports standard and full-page VGA, Apple monitors, NTSC, and overhead projectors.

**Price:** \$1116.

**Contact:** Applied Engineering, Dallas, TX, (800) 554-6227 or (214) 241-6060; fax (214) 484-1365.

**Circle 1088 on Inquiry Card.**

### DSP Boards

Three data acquisition boards use a DSP (digital signal processor) chip to give you the power of signal processing on your desktop system.

A complete DSP subsystem based on AT&T's DSP3210 chip, the Qw3210-SA signal analysis board has 136 KB of high-speed SRAM (static RAM) (expandable to more than 2 MB) and a dual-port RAM interface between the PC and the DSP. The board provides 32 MFLOPS of processing power.

Each of the two channels in the board's analog I/O subsection has a 200,000-sample-per-second 16-bit A/D and D/A converter; a differential-input, programmable-gain instrumentation amplifier; and optional programmable-cutoff analog filters. Software included with the board is a C interface library and Resmon, a memory-resident DSP program that sets up the hardware, reports on errors, and provides task-switching services.

**Price:** \$2995.

**Contact:** Quantawave, Marlborough, MA, (508) 481-9802; fax (508) 624-0942.

**Circle 1089 on Inquiry Card.**

The DSP\_400 and DSP\_MOD boards, based on AT&T's DSP32C chip, provide 25 MFLOPS of processing power and have up to 8 MB of zero-wait-state on-board memory. Each board has a 12.5-MHz, 32-bit parallel port for direct data transfers to the on-board memory without tying up the AT bus on your PC.

Each board comes with a complete software package that provides everything you need to begin developing DSP applications. The DSP\_400 uses individual memory chips, and the DSP\_MOD uses memory modules.

**Price:** \$950 each.

**Contact:** Symmetric Research, Kirkland, WA, (206) 828-6560; fax (206) 827-3721.

**Circle 1090 on Inquiry Card.**

### Sound Out Your PC

A sound board that automatically adapts to different voices and accents, the Cyber Audio Card lets you assemble your own vocabulary of voice commands. The card maintains an active 125-word vocabulary.

The board includes digital audio recording and playback on two mono channels or one stereo channel at 11 to 44 kHz and 8- or 16-bit resolution. Other features include compression/decompression as high as 4 to 1 at a 22-kHz sampling rate, a MIDI interface, compatibility with SoundBlaster and Adlib, and an on-board stereo mixer for three stereo channels or six mono channels.

**Price:** \$395.

**Contact:** Alpha Systems Lab, Irvine, CA, (714) 252-0117; fax (714) 252-0887.

**Circle 1091 on Inquiry Card.**

### Manage Networked PCs

Intel's LANdesk software tools provide simplified management of desktop PCs and related services on Novell NetWare 3.x LANs. The tools include LANdesk Manager, LANdesk Protect, and LANdesk Inventory Manager.

LANdesk Manager provides a single control point for all local network management solutions. The program lets you remotely view a workstation or file-server screen; query for system information; control the keyboard and mouse; and make changes to the system, such as moving or copying files, rebooting, and executing programs. LANdesk Manager also displays statistics such as packet traffic, error rates, and utilization.

LANdesk Protect continuously scans all network traffic to detect and isolate more than 1900 PC viruses, including common strains, self-encrypting stealth viruses, and polymorphic (i.e., mutation engine) viruses. LANdesk Inventory Manager generates a summary of the hardware and software resources on the network to help you manage upgrades, maintenance, contracts, and licensing compliance.

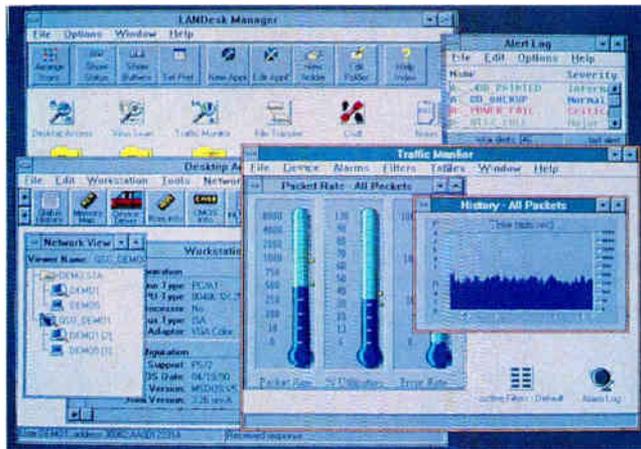
**Price:** LANdesk Manager, \$1295 per server; LANdesk Protect, \$995 per server; LANdesk Inventory Manager, \$595 per server.

**Contact:** Intel Corp., Santa Clara, CA, (408) 765-8080; fax (408) 727-2620.

**Circle 1092 on Inquiry Card.**

### 14,400-bps Notebook Modem

The Smart One 1442 PCMCIA modem from Best Data Products provides notebook PC users with high-



The LANdesk software tools provide LAN administration functions such as node management, network and application monitoring, virus protection, accounting, troubleshooting, capacity planning, remote control, and inventory.

speed, error-corrected data transfer and faxing capability. Using built-in CCITT V.42bis and MNP level 5 data compression and V.32bis error correction, the modem lets you achieve effective throughput rates of up to 57,600 bps even on dial-up lines, as well as full send-and-receive fax capability at 14,400 bps. In addition, the Smart One 1442 PCMCIA operates in full background mode for uninterrupted operation.

The modem's fax features include broadcasting of multiple files to various fax machines; the ability to view, rotate, and print incoming faxes; and time-scheduled transmission. You can keep data and fax numbers in a flexible phone book, and handy logs record fax and even error reports.

**Price:** \$599.  
**Contact:** Best Data Products, Inc., Chatsworth, CA, (818) 773-9600; fax (818) 773-9619.

**Circle 1093 on Inquiry Card.**

### Antivirus Utility for NetWare

Fifth Generation Systems' Untouchable Network NLM (NetWare loadable module) detects and recovers viruses on NetWare 386-based file servers. The package employs integrity checking on the file server to detect viruses without relying on frequent virus signature updates.

A patented virus-removal technique guarantees safe restoration of recoverable infected files, including those hit by new, unknown viruses. The package also features on-line scanning of compressed and archived files and seamless integration of Untouchable Network NLM for detection and recovery of viruses at individual nodes.

**Price:** \$995 per server.  
**Contact:** Fifth Generation Systems, Inc., Baton Rouge, LA, (504) 291-7221; fax (504) 295-3268.

**Circle 1094 on Inquiry Card.**

### Workgroup Connectivity

With Powerfusion for Workgroups, Unix resides as a peer partner in the Windows for Workgroups environment. The package supports Unix, DOS, Windows, and Windows for Workgroups users and provides three connectivity solutions: plug-and-play operation; support for Windows for Workgroups orphans, such as IBM XT and ATs and Unix; and low memory overhead.

Powerfusion for Workgroups allows network users to share resources such as disks, printers, keyboards, screens, and CD-ROMs.

**Price:** DOS and Windows users, about \$100 per workstation; supported Unix clients, \$100 each.

**Contact:** Performance Technology, San Antonio, TX, (210) 349-2000; fax (210) 366-0123.

**Circle 1095 on Inquiry Card.**

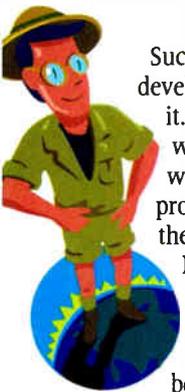
### PCMCIA Wireless Adapter

A wireless LAN adapter, the RangeLAN/PCMCIA fits the specifications of the Type II PCMCIA credit-card-type slot. Using spread-spectrum technology over a range of up to 800 feet, the adapter can operate at a data rate of 242 Kbps. The RangeLAN/PCMCIA adapter provides a wireless networking solution to portable users, allowing them to easily set up an "instant" LAN without cables or to extend an existing LAN to hard-to-reach places. The RangeLAN/PCMCIA comes with drivers for popular LAN operating systems.

**Price:** \$595.  
**Contact:** Proxim, Inc., Mountain View, CA, (415) 960-1630; fax (415) 964-5181.

**Circle 1096 on Inquiry Card.**

# Why some software sells more than others.



Success. All software developers strived for it. Now, Don Gall was on top of the world. Software protection made all the difference. Especially in Europe and Asia. Sales were four times better than before. He is the founding father of Sentinel — the guru of software success.

## Struggling Software Sales

One day, trekking through the coffee fields of Java, Don ran into his old college buddy Simon Seagull. "Don, my sales are well below expectations." Simon explained his plight. "My software should sell like yours, Don!" Yet despite critical acclaim Simon's company SimonSays Software, teetered on a financial tightrope. "What's your secret, Don?"

They spent hours analyzing potential problems. They looked at everything.

## The Key to the Problem

Finally, Don leaned back and asked the assumptive question, "What about protection?"

"Are you using Sentinel?" Nervously, Simon sipped his

coffee. His hands shaking as his eyes darted the room. "No. I didn't think I needed to."

Don's chair slid out from under him and he crashed to the floor. Amazed in disbelief, Don cried, "You What?!" Grabbing his tattered scrapbook, Don pulled out photos of his travels. "Ever been to Seoul? Prague? Anywhere? Ten bucks will buy you anything even bootlegged copies of software.

## Don's Road to Success

Thumbing through the scrapbook, Don shared his experiences. "Back in the '80s, I was in your shoes — beaten, battered and bruised." Simon listened. "Then, after a heart breaking trip around the world, I called the Software Publishers Association (SPA).

"I could hardly believe it." They told me developers lose billions of dollars each year. Why? Illegally copied software. "In some countries there are nine pirated copies for each legal copy sold."



Simon was disgusted, "It's just not fair."

"That's why I committed myself to solving the piracy problem." Simon's eyes lit up. "The dongle!" he shouted. Don corrected him, "Not just any dongle — the dongle that paved the road to success for over 10,000 developers worldwide — Sentinel."

## Successful Developers Use Sentinel

Don pulled a stack of letters out of his gunny sack. "All of these people tell the same story." Don read about a successful developer from California who swears she wouldn't be in business without Sentinel. Another company says protection costs less than litigation, plus they don't have to spend time and money supporting illegal users.

Others confessed they wouldn't market products internationally without protection.

The hours flew by, story after story, Simon learned Don Gall's secret. To succeed is to protect. To protect is to secure with Sentinel.



## Most Advanced and Widely Used Dongles in the World

Backed by the world leader in software protection, Rainbow Technologies, the Sentinel Family of hardware keys is the most diverse and comprehensive selection available. For DOS, OS/2, Mac, Windows, LAN, UNIX and others. They're simple to install, and are the most reliable and compatible available.

Rainbow offers just-in-time delivery and the largest technical support and engineering staff in the software protection industry.

Call Don Gall today for a free copy of "The Sentinel Guide to Securing Software." Or better yet, ask him for a low cost Sentinel Evaluation kit today — complete with a working dongle!

CALL  
**800/ 852-8569**

FOR YOUR FREE GUIDE TO  
SECURING SOFTWARE

**SENTINEL**  
Securing the future of software

**When you need a dongle, you need Sentinel.  
The only dongle Don Gall will use.**

**RAINBOW**  
TECHNOLOGIES

9292 JERONIMO ROAD, IRVINE, CALIFORNIA 92718 ■ 714/ 454-2100 ■ fax 714/ 454-8557  
International offices are located in the United Kingdom, Germany and France.

Circle 138 on Inquiry Card (RESELLERS: 139).  
World Radio History



# The *Evolution* Of P



**1984**

**The Luggables**

- 35 pounds
- 8088-class CPU
- 512K RAM
- Floppy drive
- No hard drive
- AC only
- Monochrome display
- \$4000 to \$5000



**1987**

**The Laptops**

- 15 to 20 pounds
- 8088 or 80286-class CPU
- 640K RAM
- Floppy drive
- 10 or 20MB hard drive
- AC only or 1.5-hour battery
- CGA display
- \$3500 to \$4500

You've been wrestling with over-sized, over-priced portables for nine long years! Now Gateway 2000 emerges from the struggle and introduces the missing link in the evolution of portable computing. It's the HandBook, a perfect combination of portability and functionality for all on-the-go Homo Sapiens.

The HandBook is a real PC in a revolutionary new form. Not a notebook, not a palmtop, the HandBook is the first fully-functional PC in a truly portable, handbook-sized form. You can easily take the HandBook anywhere because this new species measures a mere 6 x 10 inches and weighs only

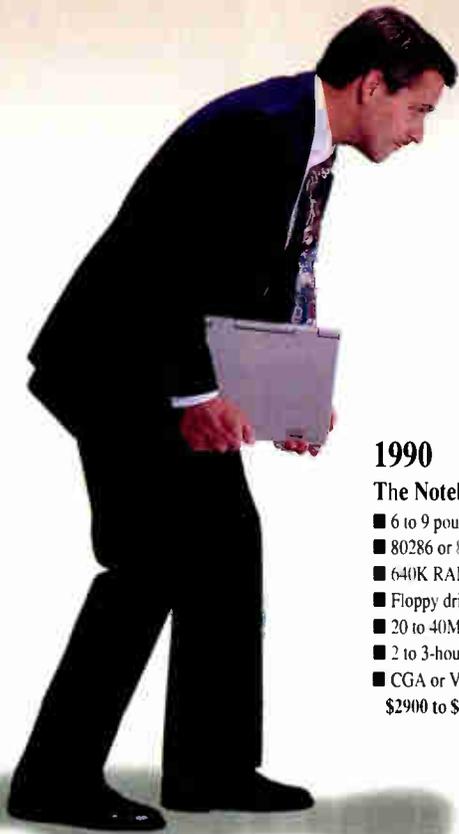
2.75 pounds, yet it runs over 5,000 of your favorite DOS applications. You aren't stuck buying and learning proprietary "card" programs when you have a HandBook.

The exclusive auto-resume feature enables the HandBook to work like no other PC you've ever seen. Auto-resume allows you to suspend the computer's operation for moments or weeks at a time, and then return to your work right where you left off – in seconds, and at the touch of a button.

With the HandBook you get 40MB of hard disk capacity to easily and quickly store all your DOS programs and files.

The quiet and comfortable touch-type keyboard allows you

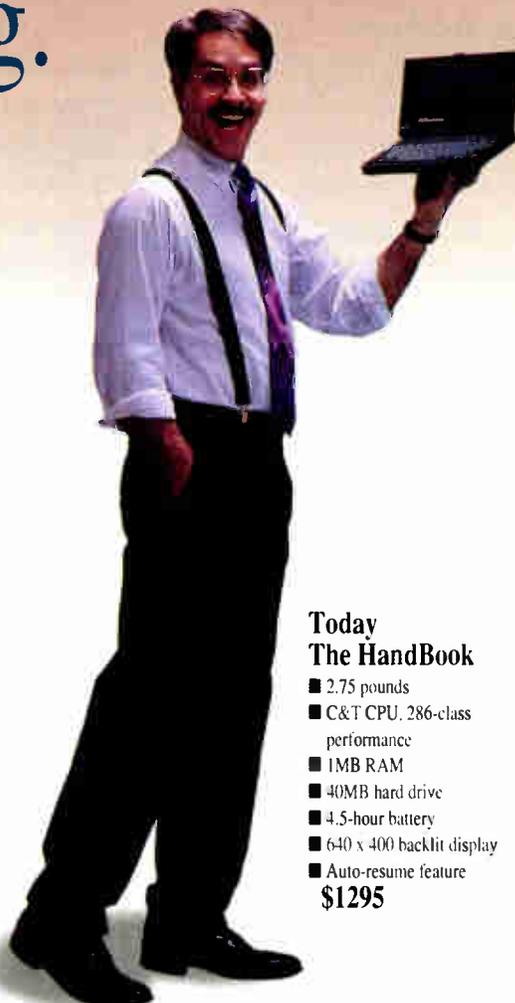
# Portable Computing.



## 1990

### The Notebooks

- 6 to 9 pounds
  - 80286 or 80386SX-class CPU
  - 640K RAM
  - Floppy drive
  - 20 to 40MB hard drive
  - 2 to 3-hour battery
  - CGA or VGA display
- \$2900 to \$4500



## Today

### The HandBook

- 2.75 pounds
  - C&T CPU, 286-class performance
  - 1MB RAM
  - 40MB hard drive
  - 4.5-hour battery
  - 640 x 400 backlit display
  - Auto-resume feature
- \$1295**

to type as fast as you can on your desktop keyboard.

The HandBook's 640 x 400 resolution backlit screen can be read in virtually any light and is large enough to display full 80-column lines of text, so you can use the HandBook whenever and wherever you need to. And the HandBook gives you all this with up to 4.5 hours of life on a replaceable battery.

The Gateway HandBook was designed specifically for you – today's on-the-move computer user. Once you get your hands on a HandBook, you'll struggle no more with a Neanderthal artifact

*The HandBook was named one of the year's "Best of What's New" products by Popular Science magazine and received BYTE magazine's Award of Distinction.*



8 0 0 - 8 4 6 - 2 0 0 0

610 Gateway Drive • P.O. Box 2000 • North Sioux City, SD 57049-2000  
605-232-2000 • Fax 605-232-2023

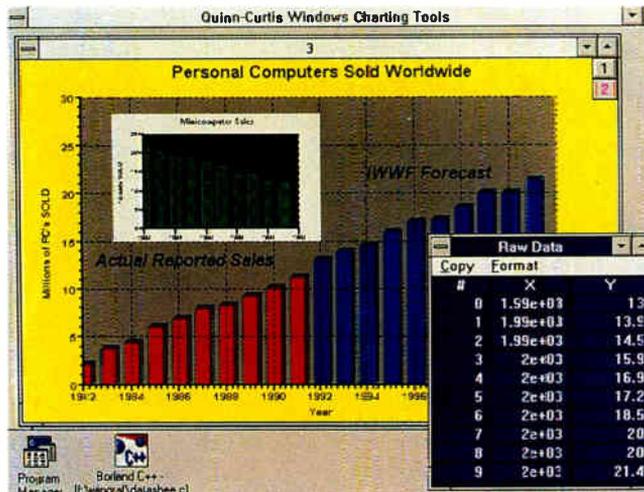
## Windows Charting Tools

A collection of graphics and user-interface routines, the Windows Charting Tools package helps C and C++ programmers add scientific, engineering, and business graphics to their applications. The package for Windows 3.1 provides dialog boxes, high-resolution printer support, and Clipboard and metafile support. It also includes a library of C functions that you can use to create charts such as line, area, scatter, and group plots; horizontal and vertical bar graphs; floating bars; error bars; open-high-low-close plots; and pie charts.

Windows Charting Tools let you combine multiple chart types, data objects, and *x* and *y* axes in the same graph. You can set axes for linear and logarithmic scaling, and you can label axes with numeric values in decimal and scientific notation or with user-defined strings. You can output your charts to Windows-supported printers. **Price:** \$400; with source code to the Quinn-Curtis Charting DLL, \$800. **Contact:** Quinn-Curtis, Needham, MA, (617) 449-6155; fax (617) 449-6109. **Circle 1102 on Inquiry Card.**

## Wireless Network Applications

You can add wireless capabilities to your new or existing applications with Motorola's WaveGuide 2.0 connectivity tool. WaveGuide provides a consistent API that lets you build applications for multiple wireless data networks in a DOS or Windows environment with minimal code changes. The WaveGuide API provides a high-level C-language interface that is independent of the un-



*With Windows Charting Tools, you can edit chart characteristics such as graph position, plot attributes, axis parameters, fonts, and data.*

derlying wireless network protocols and modem interfaces. WaveGuide 2.0-based applications allow two-way data communications over ARDIS and RAM, two popular wireless networks that transmit data using radio-packet technology.

**Price:** \$1495. **Contact:** Motorola, Inc., RadioWare Solutions, Schaumburg, IL, (708) 576-1600; fax (708) 576-0710. **Circle 1106 on Inquiry Card.**

## Mac Error Detection

StratosWare offers versions of its error detection and prevention product, MemCheck for the Macintosh, for the Think C and MPW C environments. Requiring no source code changes, MemCheck detects errors such as memory overwrites and underwrites, memory leaks (i.e., failure to free allocated memory), and heap corruption. MemCheck operates transparently, appearing only to report errors with exact file and line-number in-

formation in the source code.

MemCheck for the Macintosh can detect failures in memory allocation routines, failures in many resource operations, and invalid operations on unlocked and purged handles, as well as the inappropriate use of nonresource handles in Resource Manager traps. You can switch MemCheck on or off at run time, link it out via the Production library, or compile it out with no source code changes.

**Price:** \$179.95 each; bundled, \$239.95. **Contact:** StratosWare Corp., Ann Arbor, MI, (313) 996-2944; fax (313) 747-8519. **Circle 1103 on Inquiry Card.**

## Windows Program Generation

Microlex says that its GUIDE (GUI Development Environment) tool provides all the Windows program-generation facilities you need in one system. The package lets you create compiled programs in a fourth-generation-language environment, and it can handle future Windows developments such as Windows for Pen Comput-

ing, Windows NT, and multimedia.

Offering Novell NetWare compatibility, GUIDE provides features such as entity-relationship database design tools, a menu designer, and form- and screen-design tools. Other features include interactive multidimensional graphics, comprehensive font and color-palette controls, bit-map sequencing, an integrated table and spreadsheet tool, and report generation and project management facilities.

**Price:** Four-user version, about \$18,300 (£12,000). **Contact:** Microlex plc., Derby, U.K., +44 332 290630; fax +44 332 290624. **Circle 1104 on Inquiry Card.**

## Unix Productivity Tool

With iXBuild 2.1, you can build, prototype, and test OSF/Motif-based GUIs for software applications, independent of the underlying application. Interfaces that you build with iXBuild are run-time independent and can run on most Unix platforms. The package includes a graphical WYSIWYG editor; a set of Motif widgets; automatic interfacing to existing databases; graphical editing functions, which include a Search Editor for positioning, sizing, cutting, pasting, copying, inserting, and deleting elements of your work; context-sensitive on-line help; and dynamic testing facilities. You can also extend iXBuild 2.1 with user-defined widgets and resources (i.e., attributes).

**Price:** First user license, \$4500. **Contact:** UniPress Software, Inc., Edison, NJ, (908) 287-2100; fax (908) 287-4929. **Circle 1105 on Inquiry Card.**

# Since when is RAIMA *the* first in Database Database Development?

**RAIMA Data**

THE FIRST IN

OPERATION  
 ELECTRONIC SYSTEMS ENGINEERING ACTIVITY  
 PHANTAS

The New Performance  
 AMS for the Professional C Programmer

## Since April 7, 1992

Since April 7, 1992, RAIMA has been the database developer in the industry. The common sense of the industry has been to use RAIMA. Why?

1-800-DB-RAIMA Also available for DOS, OS/2, and UNIX



# See it first.

## Play to win in the “City of Winners”... *Atlanta*

**It's two world-class events happening side by side in Atlanta...and the year's first opportunity to go to the cutting edge in computer and communications technology.**

- More than 1,000 exhibiting companies with thousands of exciting new products!
- *Plus* dedicated Technology Showcases on Network Computing, Multimedia, Mobile Computing, UNIX®/Open Systems, OEM Sources, and Office and Imaging Systems!
- 75,000-plus attendees...including over 5,000 international delegates from more than 70 countries!

- *The rollout of Windows NT*—plus a world of new Windows applications!
- “Featured Country” program highlighting Canada!
- More than 100 separate educational conference sessions on the latest technology, business and distribution issues!
- Keynote addresses from Bill Gates of Microsoft and James Cannavino of IBM...plus “CEO Perspectives” from Robert Palmer of DEC and Jim Manzi of Lotus!

**If you play to win in the computer industry, there's only one place to go this spring—COMDEX and WINDOWS WORLD in Atlanta!**



# COMDEX®



**Don't miss the  
next COMDEX and  
WINDOWS WORLD!  
FAX: (617) 449-2674**

**Hotels fill up fast—reserve  
your accommodations today!**

**YES! I want to see it first at COMDEX and WINDOWS WORLD!**

- Send information on attending, including hotel and travel savings.
- Send information on exhibiting.

 **COMDEX/Spring'93**

The world's #1 computer and communications marketplace for resellers and corporate decision makers.

 **WINDOWS.WORLD'93**

The official conference and exposition on Windows computing. Produced in cooperation with Microsoft.

**May 24-27, 1993**

**Georgia World Congress Center • Atlanta, Georgia USA**

Name \_\_\_\_\_ 8LKCA

Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

Zip/Postal Code \_\_\_\_\_ Country \_\_\_\_\_

Telephone \_\_\_\_\_ Fax \_\_\_\_\_

**Fax 617-449-2674 or mail to: The Interface Group, 300 First Avenue, Needham, MA 02194-2722 USA.**

## Scientific Graphics

**G**rapher for Windows creates presentation-quality x,y graphs for scientific and engineering applications. Graph types include line, symbol, bar, and open-high-low-close graphs. You can add vertical and horizontal error bars, with complete control over their line style, width, and color.

The program provides automatic or user-defined axis scaling, tick marks, labels, and legends. You can choose from linear, logarithmic, exponential, power, spline, polynomial, and running-average curve fits, with an unlimited number of curves and fits on each graph. The program supports multiple axes per graph, and you can plot several graphs on a page.

Built-in drawing tools let you place rectangles, circles, areas, or points anywhere on your graphs. You can use the text editor to create text blocks with superscripts, subscripts, and mathematical formulas and symbols.

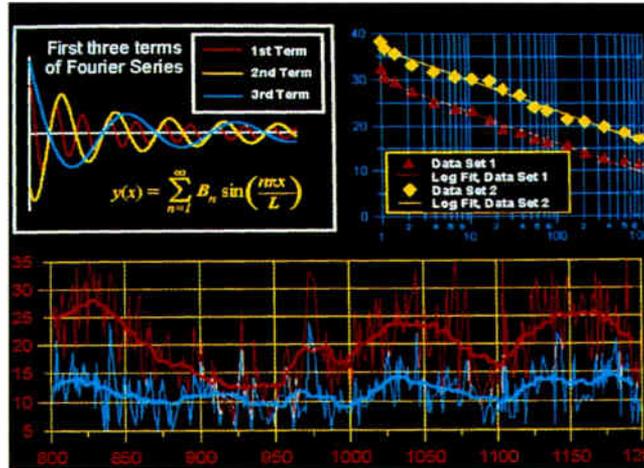
**Price:** \$199.

**Contact:** Golden Software, Inc., Golden, CO, (303) 279-1021; fax (303) 279-0909.

**Circle 1114 on Inquiry Card.**

## Project Visualization

**T**he CVpvs project visualization system for Sun, DEC, and Hewlett-Packard systems provides a virtual walk-through of large-scale 3-D CAD projects so you can see the structure and appearance of the project from every angle. Spatial orientation features let you move forward, backward, left, right, up, and down, as well as turn and orbit. They also control zooming, the point from which a view originates, and the direction of your gaze.



A 2-D scientific graphics package, *Grapher for Windows* supports up to 32,000 data points per curve.

In mechanical and manufacturing environments, the CVpvs software lets you inspect complete assemblies, subassemblies, and individual components by manipulating, communicating, and animating a large-scale design. The CVpvs program lets you interrupt display graphics, verify or query nongraphics model attributes from an external database, add notes and labels, and measure dimensions and distances.

**Price:** \$8925.

**Contact:** Computervision Corp., Bedford, MA, (617) 275-1800; fax (617) 275-2670.

**Circle 1117 on Inquiry Card.**

## Exploratory Data Analysis

**T**he latest version of Data Desk, exploratory data-analysis and graphics software for the Mac, works with an unlimited number of cases and adds multivariate general linear models, nonlinear

smoothers, automated slider tools, summaries by categories, derived variables, and random subset sampling. Fast calculations let you quickly pursue several analysis paths, and Data Desk 4.0 links all plots and analyses, so you can move from one to another to visualize your data in different ways.

A Linear Model Outline organizes the decisions you need to make to perform linear model analysis, as well as the results that linear models compute. An Overview table gives a summary of results from the analysis, so it is easy to identify factors with strong effects, factors with little or no effect, and factors whose effects are not consistent.

**Price:** \$595.

**Contact:** Data Description, Inc., Ithaca, NY, (607) 257-1000; fax (607) 257-4146.

**Circle 1116 on Inquiry Card.**

## Mathematical Modeling

**I**deal for technical specialists, VisSim is an interactive program for mathematical modeling, animated simulation, real-time control, and analysis of dynamic systems. The Windows software

offers more than 70 linear and nonlinear mathematical function blocks and six integration methods.

To visually solve complex differential equations, you select the blocks representing the standard procedures required, wire them together, and run the simulation. VisSim's function blocks cover most arithmetic, Boolean, transcendental, linear and nonlinear, integration, and signal-processing operations.

**Price:** About \$755 (£495).

**Contact:** Adept Scientific Micro Systems, Ltd., Letchworth, Hertfordshire, U.K., +44 462 480055; fax +44 462 480213.

**Circle 1115 on Inquiry Card.**

## The Engineer's Companion

**I**f you are involved in the mechanical design of structures for supporting, bracing, and containment, then *The Engineer's Companion* may interest you. More than 100 engineering calculations let you design and analyze torsional and thermal deflection and stress; contact deformation and stress between spheres, parallel and crossed cylinders, and spheres and cylinders on plates, as well as in sockets; beam-column instability; stress in curved beam sections; and mechanical and thermal stress and expansion in pressurized cylinders and spheres.

For most calculations, you can evaluate equations for a single set of values, tabularly display or plot them over a range of a variable, or plot families of curves based on a continuous range of the variable and stepped over a range in a chosen parameter.

**Price:** \$199.95.

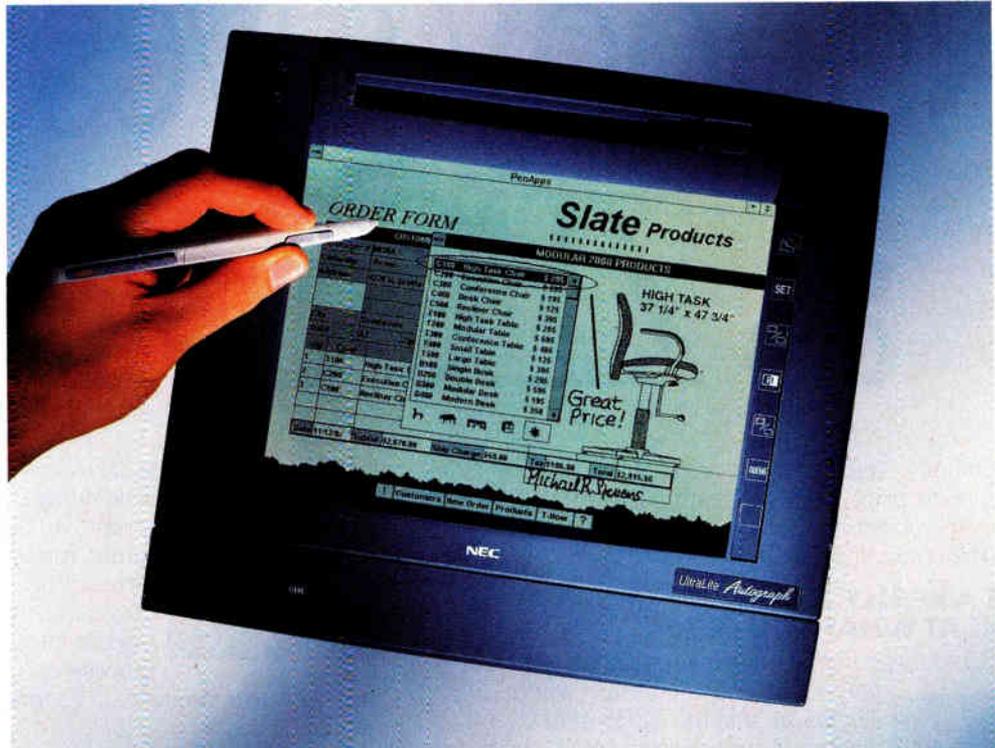
**Contact:** Dynacomp, Inc., Webster, NY, (716) 265-4040.

**Circle 1118 on Inquiry Card.**

# After you see our performance



*The UltraLite Autograph is just one of the many innovations NEC has brought to portable computing. Others include the first active-matrix color notebook, the first color laptop and the first portable Docking Station.™*



## you'll want our Autograph.

Applause and standing ovations. That's how people are reacting to NEC's new UltraLite® Autograph™. The UltraLite Autograph is a tablet computer that's designed to provide uncompromising performance anytime, anywhere. At just 3.9 lbs., and a mere 1.2" thin, this lightweight delivers heavyweight performance. The Autograph is loaded with advanced features like a powerful i486™SL processor. 40 or 80MB\* hard disk drive. A full complement of standard ports. Local bus video for dazzling video performance. A high-quality VGA transfective screen display for clear viewing indoors and outdoors. Two PCMCIA slots for easy installation of peripherals like fax modems and local area network cards. And programmable HotZone™ icons that work like function keys to allow quick, easy access to frequently used functions. And there's an optional keyboard that has been customized for portable use. It comes with plenty of battery life, thanks to its 3.3-volt design that gives users significant battery life improvement depending on usage (3-5 hours with a standard NiMH battery and 6-10 hours with a double-capacity battery pack). And the Autograph can run either Windows™ for Pen Computing™ or PenPoint™ software. NEC's UltraLite Autograph. You'll give its performance rave reviews. To find out where you can see the Autograph, call us at 1-800-NEC-INFO (in Canada, 1-800-343-4418) and we'll tell you where you can sign on the bottom line for one.



Because  is the way you want to go.

# NEC

\*80MB available 1st quarter 1993.

UltraLite is a registered trademark and UltraLite Autograph and HotZone are trademarks of NEC Corporation. Docking Station is a trademark of NEC Home Electronics, Inc. The Intel Inside Logo is a registered trademark of Intel Corporation. All other trademarks and registered marks are property of their respective owners. © 1993 NEC Technologies, Inc.

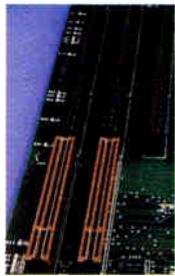
Circle 117 on Inquiry Card.  
World Radio History

# Nobody gives you as ZEOS<sup>®</sup>. At any

Everybody is talking price, price, price. Now ZEOS is talking price, price, price and features, features, features! Right now, you get more features at lower prices from ZEOS than from anyone else!

## TAKE A REALLY CLOSE LOOK AT WHAT YOU GET:

■ VESA-standard local bus video—the *fastest video performance* available anywhere. *PC Magazine* said the ZEOS 486DX2-66 “shattered our previous record... by nearly fourfold.” Now the dazzling video performance that rated #1 with *PC Magazine* can be yours!



■ Local bus IDE hard drives. Now we've made your hard disk drive data throughput *over twice as fast with local bus IDE!* Dell doesn't have it; few others do either. ZEOS does. You do.

■ You get eight expansion slots, including two that support VESA-standard local bus devices with bus mastering. *Expandability with local bus performance in mind!*

■ Twin cooling fans. A ZEOS quality extra to help *protect your long-term investment.* One cooling fan just isn't enough to cool any modern PC, particularly at such high speeds. That's why ZEOS gives you two.

■ *“An array of features to make a user's mouth water.”* —*PC Magazine.* Such as stronger cases, high-capacity power supplies with built-in surge suppression, floppy drives by Teac, and so much more.

■ *Award-winning 24-Hour-A-Day Toll-Free Technical Support.* We were the first to offer 24 hour support—years ago. Even now, few offer it 'round the clock. But with ZEOS you get it, 365 days a year.

■ On-board SCSI for only \$49. *Add SCSI devices (such as CD-ROM) now or later* and you get high performance on-board SCSI, cheap.



■ *ZIF (Zero Insertion Force) CPU upgradability* from the 486SX-25 right through to the 486DX2-66 and, in the future, Intel's Pentium™-based OverDrive™ processor. According to *PC Magazine*, a system that can accommodate Intel's future generations of processors “is an advantage that you are likely to appreciate...” Gateway doesn't have it. ZEOS does. You do.

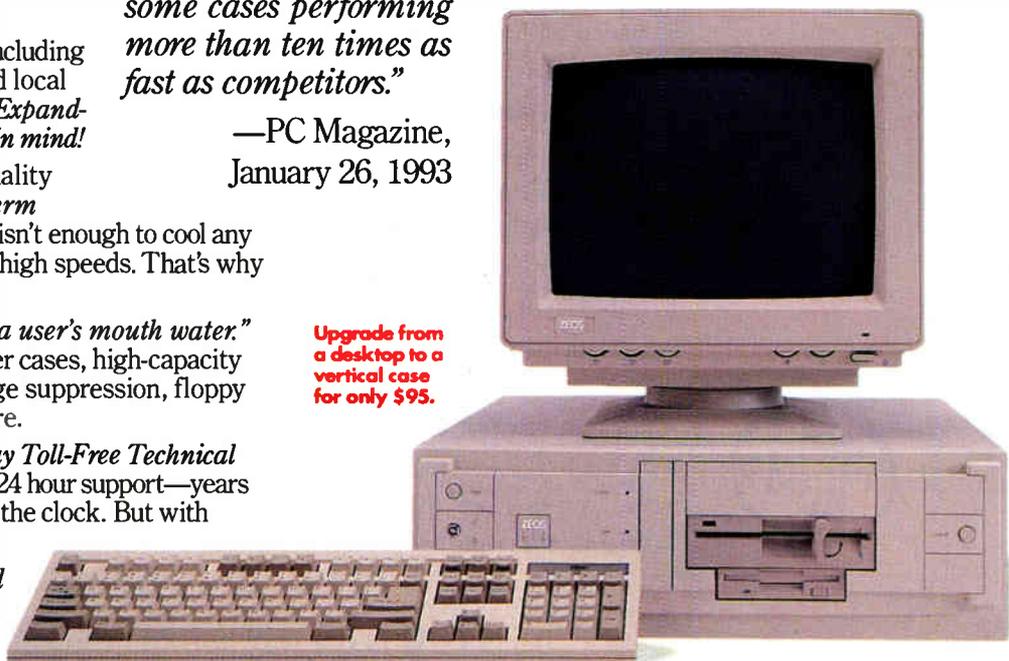
■ *“It's hard to imagine a brighter upgrade picture.”* —*PC World.* Flash BIOS for future upgrades by disk or modem, 6-bay cases, eight slots, cache all the way to 256K. Only from ZEOS!

■ Warranties, guarantees and more. If you're not absolutely convinced your new ZEOS PC is everything we say it is and more, *you have a full 30 days to return it*

*“The stand-out was the ZEOS 486DX2-66 system that blew all competitors away—in some cases performing more than ten times as fast as competitors.”*

—PC Magazine,  
January 26, 1993

**Upgrade from  
a desktop to a  
vertical case  
for only \$95.**



# as much price!

to us for a complete, no-questions-asked refund. Plus, you're covered by our One Full Year Limited Warranty, our Express Parts Replacement Policy and our Complete Customer Satisfaction Package.

■ Don't forget, *free software too*. ZEOS Windows systems include your choice of 1-2-3 for Windows, Ami Pro or Freelance, plus DOS, Windows and Lotus Organizer.

*"The ZEOS 486DX-33 is the fastest 33-MHz 486DX-33 system we tested, and its performance even topped that of two 50-MHz 486DX2s."*

—PC World, February 1993, BEST BUY

## NOBODY GIVES YOU SO MUCH.

Nobody, and we mean nobody, gives you as much as ZEOS.

At any price. And frankly, in the history of our company, we've never built better PCs than these. That means a lot from a company with *nine PC Magazine Editors' Choice awards*.

## SO GIVE US A CALL!

You can't make a better purchase decision than to buy your own ZEOS system. So why not give us a call right now and talk with your own friendly and knowledgeable ZEOS Systems Consultant. ZEOS is absolutely your best choice. And we don't just say it. We guarantee it!

## CALL NOW TOLL FREE

# 800-554-5226

Fax Orders: 612-633-1325, Government: 800-245-2449, TDD Orders (for the hearing impaired): 800-228-5389, Outside U.S. and Canada: 612-633-6131. MasterCard, VISA, Am Exp, Discover, Z-Card, COD and Leasing programs. Open 24 Hours a Day, 365 Days a Year!

Purchase orders from Fortune 1000 companies, governments and institutions subject to approval. Leasing programs available. All prices and specifications are subject to change without notice. Please call to confirm pricing, specifications and warranty details. All products and company names are trademarks or registered trademarks of their respective holders. © 1993 ZEOS International, Ltd., 1301 Industrial Blvd., Minneapolis, MN 55413 USA. ZEOS is a publicly traded company. (NASDAQ symbol: ZEOS). UPGR-BYT-9303



## CHOOSE FROM FOUR MONEY-SAVING PACKAGES.

Or we can custom-build a system to your exact specifications. Just call us!

| #1     | #2   | #3   | #4   |  |
|--------|------|------|------|--|
| \$1395 | 1895 | 2195 | 2595 | <b>486SX-25</b>  |
| \$1495 | 1995 | 2295 | 2695 | <b>486SX-33</b>  |
| \$1595 | 2095 | 2395 | 2795 | <b>486DX-33</b>  |
| \$1695 | 2195 | 2495 | 2895 | <b>486DX2-50</b>   |
| \$1795 | 2295 | 2595 | 2995 | <b>486DX2-66</b>   |
| ■      | ■    | ■    | ■    | Intel 486 CPU  |
| ■      | ■    | ■    | ■    | ZIF upgrade socket   |
| 2      | 4    | 8    | 16   | MB of RAM expandable to 64MB on motherboard                    |
| 85     | 130  | 245  | 340  | High-speed IDE hard drive (MB)                                 |
| 32K    | 32K  | 128K | 256K | Built-in hard drive cache                                      |
| ■      | ■    | ■    | ■    | Local bus IDE hard drive interface                             |
| 16     | 16   | 12   | 12   | Seek time (ms)   |
| ■      | ■    | ■    | ■    | 1.2MB Teac floppy drive  |
| ■      | ■    | ■    | ■    | 1.44MB Teac floppy drive                                       |
| ■      | ■    | ■    | ■    | ZEOS 14" high-resolution mono VGA monitor                      |
| ■      | ■    | ■    | ■    | ZEOS 14" high-resolution 1024x768 non-interlaced SVGA monitor  |
| .28    | .28  | .28  | .28  | Monitor dot pitch (mm)   |
| ■      | ■    | ■    | ■    | 1MB high-speed VESA local bus card                             |
| ■      | ■    | ■    | ■    | Eight expansion slots including two VESA local bus             |
| ■      | ■    | ■    | ■    | Two serial ports, one parallel port                            |
| ■      | ■    | ■    | ■    | Shadow RAM/EMS support   |
| ■      | ■    | ■    | ■    | Optional on-board SCSI port                                    |
| ■      | ■    | ■    | ■    | Flash BIOS   |
| ■      | ■    | ■    | ■    | High capacity 200W power supply and built-in surge suppression |
| ■      | ■    | ■    | ■    | ZEOS SpaceSaver case with six drive bays                       |
| ■      | ■    | ■    | ■    | Two cooling fans   |
| ■      | ■    | ■    | ■    | ZEOS 101-key tactile/click keyboard                            |
| ■      | ■    | ■    | ■    | Microsoft DOS 5.0 and Windows                                  |
| ■      | ■    | ■    | ■    | Microsoft Mouse  |
| ■      | ■    | ■    | ■    | Choice of 1-2-3, Ami Pro or Freelance Graphics                 |
| ■      | ■    | ■    | ■    | Lotus Organizer  |
| ■      | ■    | ■    | ■    | 24-Hour-A-Day Toll-Free Technical Support                      |
| ■      | ■    | ■    | ■    | 30-Day Money-Back Guarantee                                    |
| ■      | ■    | ■    | ■    | One Year Limited Warranty                                      |

Circle 169 on Inquiry Card.

### Automate MIDI Devices

**M**ark of the Unicorn offers Unisyn, a universal MIDI system editor/librarian program for the Mac. Unisyn gives you control over popular MIDI synthesizers and devices with integrated editing, librarian, and database functions to create, store, and manage synthesizer sounds and other MIDI device configurations. A graphical interface lets you edit patches and sounds, and Unisyn's on-screen sliders, buttons, and other controls facilitate programming even complex synthesizers.

The Performance function memorizes and restores the settings for an entire MIDI studio. You can build libraries of complete studio configurations as well as separate libraries for individual synthesizers and MIDI devices. Database functions let you tag sounds with multiple user-definable keywords. In addition, Unisyn lets you freely move patches among libraries, banks, and devices' internal memory.

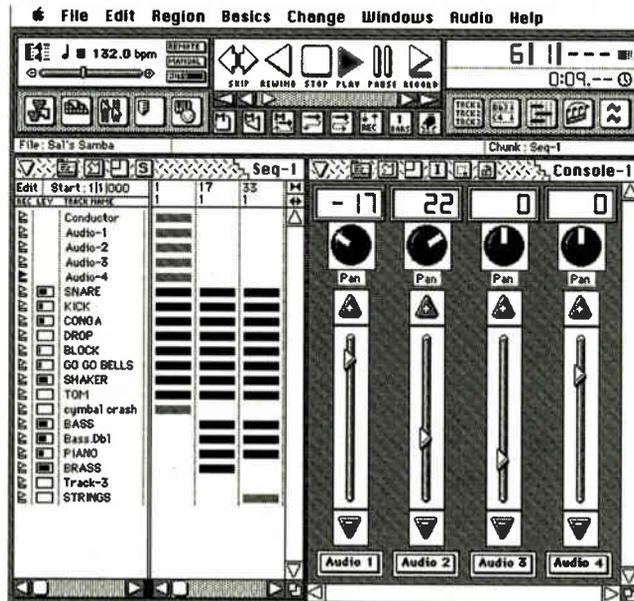
**Price:** \$395.

**Contact:** Mark of the Unicorn, Inc., Cambridge, MA, (617) 576-2760; fax (617) 576-3609.

**Circle 1140 on Inquiry Card.**

### Retrieve SQL Data

**I**Q Access can selectively retrieve and automatically reformat data for use with popular desktop applications such as Lotus 1-2-3, Microsoft Excel, WordPerfect, dBase, and Microsoft Word for Windows, as well as Btrieve, ASCII, and DIF files. The program for Unix SQL RDBMSes (relational database management systems) from Oracle, Sybase, Ingres, and Informix allows



*Unisyn lets you create performance snapshots of an entire MIDI studio, including individual patches and entire banks, and control patches, setups, and sounds for all the devices in your MIDI system.*

authorized users in an organization to access corporate data and, with just a few keystrokes, move it into their spreadsheets, word processing documents, or mail/merge files. There are no import routines or cleanup procedures because IQ Access handles the data conversions automatically.

The program is designed to take advantage of vendor-specific optimizing features, such as Sybase's dynamic SQL capability and Ingres's histogram-based query optimizer. In addition to the four Unix SQL RDBMSes, IQ Access will also be available for about 60 other databases and ISAM (indexed sequential-access method) file systems on DOS, VAX/VMS, and Data General's AOS/VS, as well as 35 Unix hardware

platforms. In client/server environments, the DOS version of IQ Access will work with software such as Oracle's SQL Net, Informix's I-Net, and IngresNet.

**Price:** \$1000 to \$42,500, depending on the CPU; client/server, \$2500 for a five-pack; network versions, \$1500 and up.

**Contact:** IQ Software Corp., Norcross, GA, (404) 446-8880; fax (404) 448-4088.

**Circle 1141 on Inquiry Card.**

### Documents to Data

**N**ow ListReader dbR lets you convert printed or typed documents to data records without keyboard entry. The Windows product

scans document pages, recognizes the text, and automatically places it into the correct data field. You can convert many kinds of documents, including lists, forms, or tables, and output data for DBMSes or spreadsheets at speeds of up to 2500 records per hour.

You can combine the lists, forms, or tables in any combination for complex documents. The program also supports one-to-many relationships for documents that have a master/detail arrangement. You create templates that tell ListReader dbR what to expect from individual pages—from simple mailing lists to complex insurance forms.

**Price:** \$895.

**Contact:** Solea Systems, Inc., Laguna Hills, CA, (714) 768-7736; fax (714) 380-8950.

**Circle 1142 on Inquiry Card.**

### Voice Annotation for WordPerfect

**W**ith VoiceOver, you can annotate your WordPerfect 5.1 documents with comments in your own voice. The program lets you record sounds, which it then stores within the WordPerfect document. Voice annotations appear on the screen as standard WordPerfect comments, and they include each annotation's author, date, time of creation, and length. In addition, you can cut and paste voice annotations like standard WordPerfect comments.

VoiceOver also works over a network. You can access VoiceOver documents on a file server or send them as an attachment via E-mail.

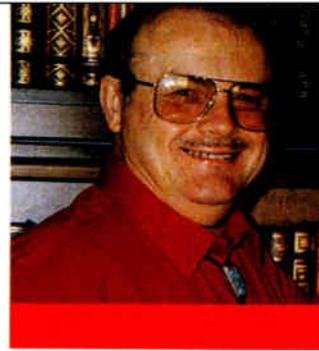
**Price:** Single-user license, \$129.

**Contact:** Rational Data Systems, San Rafael, CA, (415) 499-3354; fax (415) 499-8115.

**Circle 1143 on Inquiry Card.**

### SPREAD THE WORD

*Please address new products information to New Products Editors, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. The press release should contain the product description, price, ship date, and an address and telephone number where readers can get more information.*



JERRY  
POURNELLE

## CD-ROM SECRETS

**I**t has been a frantically interesting month. I finished *Prince of Sparta, A Novel of Falkenberg's Legion* by Jerry Pournelle and S. M. Stirling (Baen Books) two days ago. By the time you read this, you will be able to buy copies, which is astounding. Jim Baen takes my Word for Windows text, translates it to Xy-Write for prepping, pours it into Ventura Publisher, and prints out page proofs. Copyediting corrections are fed in. The book is then formatted, printed out with the LaserJet in Baskerville typeface, and photoreduced to proper page size. Go buy a copy and compare: I'll bet you the print quality will be as good as that of any other paperback original you'll find.

I did *Prince of Sparta* in Microsoft Word for Windows (W4W for short). Steve Stirling did a partial Word-Perfect draft from my outline. Then I used Mastersoft's Word for Word to convert his files to Q&A Write format, which is what I use for creative writing; but this time the first job was extensive editing of Stirling's draft, which is a great deal more easily done in W4W. I piped everything through Word for Word again, converting files to the Word for DOS format because Word for Word doesn't recognize W4W files. However, W4W reads Word for DOS files.

Amazingly, everything went fine. On a 486/33, W4W is very fast. While I get frustrated by some of its arcane command structure, I am getting used to it; and it is very powerful. I can keep an entire book in W4W, use book-marks at each chapter beginning or critical scene, and jump around like nobody's business. If I want to be sure of a character's name or make global changes, search and replace is very fast over the whole novel.

Jim Baen is a publisher, but he is also one of the best editors I've worked with. I'd PKZip each newly finished chapter and use ZMODEM protocol to squirt it up to BIX at 9600 bps with the USRobotics Courier HST V.32bis modem in about a minute; the whole book took under 5 minutes. Jim would download the latest version from BIX and upload editorial comments. I could then make editorial changes, such as expanding a scene to explain an apparent plot glitch or character inconsistency, and use search and replace to find the exact spot where a change was needed. Sometimes we'd work by telephone.

Toward the end, I was creating a new chapter de novo every two days. I would not have finished the book on time without W4W; and it wouldn't be typeset and in bookstores in such a short time without desktop publishing capability. Little computers are wonderful.

### CD-ROM and Workgroups

I say I've been using Windows, but actually I am using Windows for Workgroups, henceforth W4WG; and it's not quite the same thing.

The primary difference is network capability. With W4WG going, I can periodically squirt off a copy of my work to another machine, which makes for great peace of mind. Writers tend to be paranoid about losing text, and I don't really feel that work is saved until there are multiple copies on multiple machines; W4WG makes that easy to do.

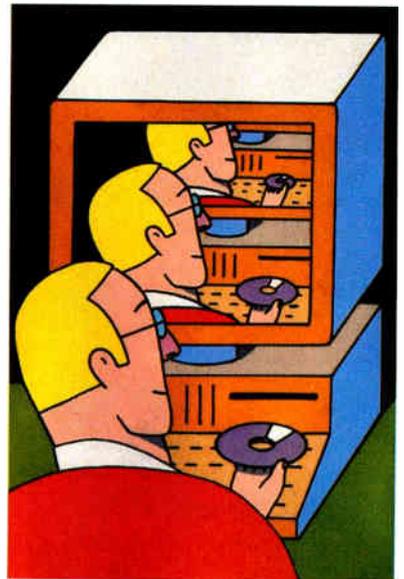
On the other hand, I nearly went nuts getting the CD-ROM drive to work with W4WG. The good news is that I did succeed.

My CD-ROM system ran fine with Windows 3.1. I was using a Corel driver card and software and a Toshiba CD-ROM drive, and all was well; but when I shifted to Windows so I could use W4WG, any attempt to access the CD-ROM while I was in Windows would lock up the machine. The infuriating part was that everything worked just *fine* as long as I was in DOS; but as soon as I got into Windows, accessing the CD-ROM drive locked things tight. I could recover from the lockup by doing Ctrl-Alt-Del, which would get me back to the program manager; but it certainly wasn't acceptable not to have a CD-ROM drive.

Then things got worse. I did something, I forget what, to CONFIG.SYS, and this time I was able to get the CD-ROM going in Windows. Joy. I told File Manager to share that CD-ROM drive on the network and went over to another machine on the network and accessed the CD-ROM. More joy. And then came disaster.

I got an error message I had never seen: SERIOUS DISK ERROR. Other mysterious things happened, and not even hardware reset worked. I had to turn the machine stone-cold off, and when I rebooted, CHKDSK

### Integrating a CD-ROM drive with Windows for Workgroups can be tricky



## USER'S COLUMN

For  
Windows  
And  
DOS!

Looking  
For A Fast,  
Accurate, Color  
Video Frame Grabber?  
Check Out  
The 'Eyes!



## ComputerEyes/RT

- Accurate, True 16 Million Color Video Frame Grabber
- Plug-and-Go Product - No Setup Hassles
- Excellent User Software For Both DOS And Windows
- Captures From Any Camcorder Or VCR - Composite and S-Video Inputs
- Supports All Common PC Image File Formats
- Includes CineMaker Movie Capture Software With Support For Popular Sound Boards
- Developers Software Package Available
- ComputerEyes/RT - \$599.95  
Monochrome-only Version Also Available - \$399.95

Also Check Out The New  
Low-Cost TelevEyes VGA-to-TV  
Converter - Just \$299.95!

See Your Dealer Or  
Call For More Information  
And Free Demo Disk

Digital Vision, Inc.  
270 Bridge St., Dedham, MA 02026  
(617) 329-5400 (800) 346-0090

said my disk was a mess. That was cured by my rebooting with a floppy disk—if you haven't made a bare-bones (no CONFIG.SYS and no AUTOEXEC.BAT) boot floppy disk for your system, go do it right now! Then I let Norton Disk Doctor do its thing. I could boot up again, but now, any attempt to access Windows failed. Up would come the Windows logo, then my wallpaper (I like EGYPT.BMP), and then that hourglass would sit there, and nothing would happen. Not good.

I went back into CONFIG.SYS and REMARKed out every reference to the CD-ROM drive, rebooted, and tried again. This time Windows told me that my swap file was corrupt, and did I want to erase it? Certainly, said I. It then said that it was impossible to share the E (CD-ROM) drive, and did I want that shared on start-up in future? No, no, a thousand times no; and that fixed things so that I could access Windows again. Of course, it still didn't get me a CD-ROM drive.

By this time I was talking to half a dozen Microsoft people who were eager to help, but nothing helped. The problem was passed upstairs to a senior Microsoft technical-support official, who said, "Ah, we know about that one. He's got to use the new MSCDEX.EXE that comes with W4WG, and it must have the /S switch in the command line that loads it." Alas, while those are both important points, I was already using the new MSCDEX and W4WG Setup had automatically added the /S option in the AUTOEXEC.BAT file.

### Be Relentless

I got a lot of advice from other technical-support people, but nothing worked. Time for my never-failing remedy, the relentless application of logic.

Start with when it last worked. That was under Windows 3.1, and I had carefully made no needless changes while converting to W4WG; so what changes had I made? One of them was obvious: I had added the Intel EtherExpress board that comes with the W4WG Starter Kit. Before I did that, I'd used Dariana's WinSleuth Gold to determine what port addresses and interrupts were in use and print out a report. This is one of those programs that you don't use often, but when you need it, you need it bad.

This time, though, I hadn't needed WinSleuth: the Intel Softset program looks for any conflicts and then reprograms the network board to an unused address and interrupts. It's very painless. I used WinSleuth Gold to have another look, and yep, it could see the EtherExpress board just fine, and it was indeed located in what

WinSleuth reported previously as unused locations.

It didn't look as if there were hardware conflicts; still, the first step in relentless logic is to remove all possible conflicts, so I removed the Sound Blaster card. No joy. CD-ROM worked in DOS, but it locked up in W4WG.

Next step: edit CONFIG.SYS to REMARK out all references to network driver software and run Softset again. When you do that, Softset sees the existing card and assumes that its current interrupt and address are in use; so it finds new ones and reprograms the board accordingly. Thus, if I were accidentally stepping on something already in use because Softset hadn't seen that the first time, this procedure, by relocating the board, should have cured that problem.

No joy. Symptoms unchanged. In fact, it made no difference whether I let CONFIG.SYS load the network drivers or I left them REMARKed out; meaning that it might not be the network that was causing the problem.

OK, it wasn't hardware. Microsoft technical support told me thousands of people were successfully using W4WG with CD-ROM, so it wasn't inherently impossible. Simplify the software, then. First thing, remove QEMM-386, the Quarterdeck memory manager, and stop loading things into high memory, and see if that works; and in fact it did.

The only trouble was that I now had about 400 KB of memory. While that's no problem for people who use Windows applications exclusively, about half the programs I run are DOS applications, and most of them want a lot more than 400 KB. Games, in particular, want upwards of 570 KB to run properly. Some Windows users get around that by rebooting the machine using a separate bare-bones CONFIG.SYS that doesn't load any TSR programs; then they play games and run other memory-hog programs in DOS. That doesn't appeal to me. I want big DOS sessions under Windows.

I reloaded QEMM and did more experimenting. I won't report all the tedious work that was involved. The result was that I found the secrets, some as a result of tips from Stafford Williamson of Quarterdeck's technical-support group and some by working on my own. Here, published for the first time anywhere, is the secret for CD-ROM under W4WG while retaining 600 KB of memory for DOS sessions under Windows.

### The Secret

The secret of success is that in W4WG you can load MSCDEX into extended

# MINUTEMAN TAKES CHARGE IN OVER 1000 JCPENNEY STORES.

Every time JCPenney sells a pair of jeans, a toaster or a bottle of perfume, MINUTEMAN takes charge. That's because more than one thousand JCPenney stores rely on MINUTEMAN UPS systems to back up power to their point-of-sale systems.

Every day your company relies on its voice and data communications equipment to stay productive. Unfortunately, the electricity that powers these vital systems is not reliable.

Blackouts, brownouts, spikes, surges and even lightning strikes are common in most business environments. And the high

**MINUTEMAN**  
**Alliance**  
**300VA**  
**\$159**



**MINUTEMAN**  
**Alliance**  
**425VA**  
**\$259**

cost of losing vital information and productivity due to power outages and surges calls for preventive measures.

Power requirements can be confusing. And your company has unique needs that often require

custom solutions. MINUTEMAN PRODUCTS:

- On-line and standby UPS 300VA to 10KVA
- Shutdown software for every available operating system
- Automatic voltage regulators
- Surge suppressors
- International models
- Two year warranty

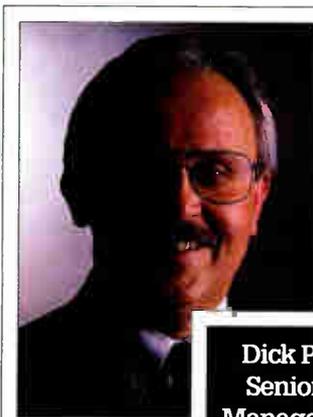
Call our toll-free POWER HOTLINE now for your free Power Protection Guide.

**(800) 238-7272**

**MINUTEMAN®**  
UNINTERRUPTIBLE POWER SUPPLIES

Reduced prices up to 36%

Call for complete price list.



**Dick Patefield,**  
**Senior Project**  
**Manager for Store**  
**Systems Support,**  
**JCPenney**

Recently JCPenney Co., Inc. changed its operations from the old POS systems to the new PC-based technology, relying on PC platforms for point-of-sale and in-store support. And they back each

one up with help from MINUTEMAN.

*"There was a violent surge in one of our stores," says Patefield. "If we didn't have the MINUTEMAN unit, it probably would have seriously damaged all of our point-of-sale equipment.*

*"The key was the switch-over time from AC to battery," says Patefield. "It really has the best continuity of the UPS systems we evaluated. Also, the price was very favorable. When you're installing them in as many locations as we are, the pricing was very attractive."*



Circle 121 on Inquiry Card.

memory (the /E switch works fine), but you must *not* let QEMM load MSCDEX high. I know that won't be clear to everyone, so I'll give details.

Set up your system without QEMM and get it running properly with the CD-ROM in DOS. Now install W4WG (if it wasn't already installed). When all that's done, you'll have about 400 KB of memory. Now, working in DOS, install QEMM and let its Optimize program do its thing. You may or may not need to do some memory

exclusions. In particular, nearly every system will need the line X=B000-B7FF to exclude some video areas from being used by QEMM; and if you have a caching disk drive controller or other SCSI device, you will need to exclude its address area as well.

The next time you boot up your system, you'll probably get some loud complaints. Microsoft Windows Setup generally automatically installs its SMARTDRV caching program with double buffering. Dou-

ble-buffered SMARTDRV comes in two parts: a chunk that's loaded by CONFIG.SYS and another that's loaded by AUTOEXEC.BAT. It's the CONFIG.SYS part that's causing the problem; that can't be loaded high, but Optimize will have a try at it.

The remedy is simple. Look into CONFIG.SYS (I use the little editor that's built into Norton Commander for this sort of thing). If you see a line that begins DEVICE=:QEMM\LOADHI.SYS, gives a couple of parameters, and continues :WINDOWS\SMARTDRV.EXE/DOUBLE\_BUFFER, delete parts of that line so that it reads DEVICE=:WINDOWS\SMARTDRV.EXE/DOUBLE\_BUFFER. You can also move the altered line up above the line that loads QEMM in case you need to use Optimize again.

Once that's done, it doesn't hurt to put the statement DBF=2 into the QEMM command line.

Now reboot. You shouldn't receive any more complaints, and your CD-ROM ought to work fine in DOS. Test to be sure it does. However, if you enter W4WG and try to access the CD-ROM drive, it will probably lock up (although it would work just fine in Windows 3.1). Even if it does not, don't take chances: exit Windows and edit AUTOEXEC.BAT.

In there you will find a command that begins :QEMMLOADHI and then has some parameters, continues with :WINDOWS\MSCDEX.EXE /S /V, and then has some more stuff. There may or may not be a /E in there after the MSCDEX. If there isn't one, put one in there. Now edit the line so that all traces of the QEMM attempt to load high are gone; that is, delete until the line begins :WINDOWS\MSCDEX.EXE and *do not* change anything after the MSCDEX except to add /E if needed. The /S is also needed, but I presume that W4WG's Setup will have added it automatically.

Now reboot. Your system should have something over 590 KB of DOS memory, and your CD-ROM will work fine in both DOS and Windows.

I don't want to take up the whole column with this, so I'll explain what's going on another time.

### Adding Network Resources

You might think that a writer has no need for networked computers, but that's not so. One major reason I want a network is to access resources that I simply can't pack onto my main system. In particular, I want the Pioneer read/write optical cartridge drive (files written to a glass disk are pretty safe), a WORM drive (files burned into a good WORM drive are nearly eternal),

## WE'VE JUST ADDED A NEW DIMENSION TO VT340 FUNCTIONS—WINDOWS.

KEAterm 340 gives the power of Windows to your host applications.

KEAterm products combine the features of Windows with the features of a VT terminal for true PC-to-host integration. Control your host data just as you control PC applications—with access to the same powerful software and printers. Host data becomes truly useable.

With KEAterm 340, you can use PC graphics tools to expand the use of host graphics. Copy ReGIS, Tektronix and sixel images into desktop publishing or draw packages for further manipulation.

Picture new power for host applications with KEAterm 340 for Windows.

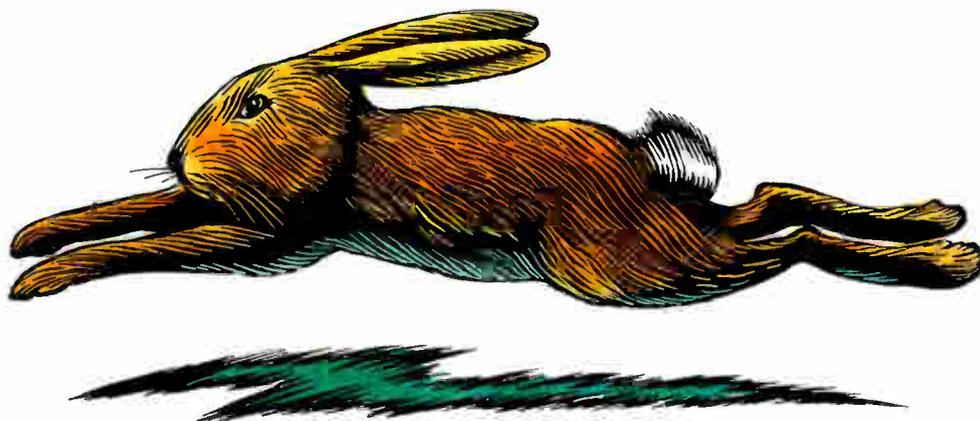


**KEA Systems Ltd.**  
**Call 1-800-663-8702**  
**Phone: (604) 431-0727**  
**Fax: (604) 431-0818**

KEA Systems Ltd. 5728 North Fraser Way, Unit 101, Burnaby, BC, Canada V5J 5G1  
 KEAterm, KEAterm 340, PowerStation, KEA and their respective logos are trademarks of KEA Systems Ltd. All other brand and product names are trademarks or registered trademarks of their respective holders.  
 Copyright © KEA SYSTEMS LTD. 1982. All rights reserved.

ALSO AVAILABLE IN A NEW CD-ROM MODEL

# NOW BACKPACK IS SMALLER. AND FASTER.



We've just made it easier to backup your hard drive with our 250 MB parallel port tape backup unit. One model works with all PC compatibles and portables.

Here's why:

**Backpack is easy to install.** Plug Backpack into the parallel printer port. Then plug the printer into Backpack!

**Backpack requires no cards.**

**Backpack is 30% smaller** (1.5" h x 4" w x 7.75" l).

**Backpack is easy to transport and share between computers** (2.5 lbs).

**Backpack can backup at a speed of up to 9 MB per minute.**

**Backpack is a QIC 80 compatible and can read QIC 40 tapes.**

**Backpack is available in 3.5" and 5.25" diskette, tape and hard disk models.**

So don't get left in the dust. Call for more information today.

Micro Solutions, 132 W. Lincoln Hwy., DeKalb, IL 60115, 815-756-3411, FAX: 815-756-2928



## backpack

### MicroSolutions

Computer Products

Circle 108 on Inquiry Card (RESELLERS: 109).

World Radio History

# 36 great products save your time and energy...



## Visual Basic for DOS by Microsoft Corporation

Draw forms, controls, write event-procedures; create custom controls—in DOS! Create new apps or combine with existing C/C++ or Pascal code. Highly compatible with Visual Basic for Windows. Run existing Quick Basic/Basic PDS code! 80x86 compiler creates 100% standalone .EXE files; 386 code generation; MOVE overlays; an integrated ISAM and much more!

|                 | LIST  | PS Price     |
|-----------------|-------|--------------|
| <b>PRO</b>      | \$495 | <b>\$339</b> |
| <b>Standard</b> | \$199 | <b>\$139</b> |

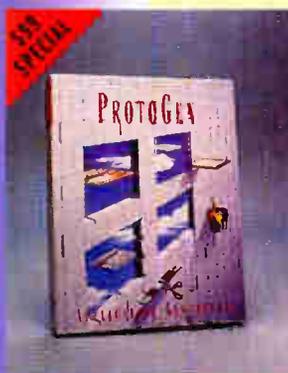
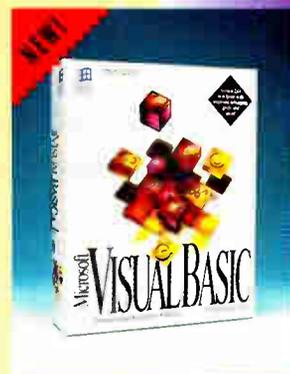
FastFacts 502-408: (PRO), 502-407: (Stand.)

## Visual Basic for Windows 2.0 by Microsoft Corporation

When you need to create a Windows application quickly, nothing offers the sheer productivity of Microsoft Visual Basic 2.0, Standard Edition. A visual development environment, flexible programming language, and fast runtime execution make this the shortest route to full-featured Windows applications. The Professional Edition includes messaging and data access capabilities, a wide variety of add-on tools, and more.

|                 | LIST  | PS Price     |
|-----------------|-------|--------------|
| <b>PRO</b>      | \$495 | <b>\$399</b> |
| <b>Standard</b> | \$199 | <b>\$139</b> |

FastFacts 502-443: (PRO), 502-431: (Stand.)



## ProtoGen 3.0 by Protoview

**NEW VERSION!** The industry standard for code generation and prototyping Windows applications. Develop the user interface of your application using Visual prototyping methods. ProtoGen generates expert level, commented code for ANSI C, Microsoft MFC C++, Borland OWL C++, Turbo Pascal, and Microsoft NT Win32. All generators included! User Code is preserved from one generation to the next. It's easy and fast.

LIST: \$199 **PS Price: \$99**

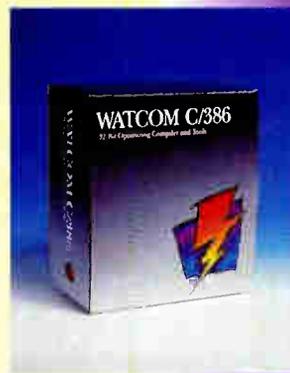
FastFacts 2115-009

## WATCOM C9.0/386 by WATCOM

Develop and debug 32-bit applications for extended DOS, Windows and OS/2 2.0. Includes royalty-free 32-bit DOS extender, true 32-bit Windows GUI Application Kit, our fast, tight, and reliable 32-bit Code Optimizer, licensed Microsoft Windows SDK Components, an interactive Source-Level Debugger, an Execution Profiler and more! Now includes OS/2 2.0 support.

LIST: \$895 **PS Price: \$599**

FastFacts 1044-029



## WindowsMAKER™ Professional by Blue Sky Software™

Considered the easiest and fastest way to create MS-Windows applications in C/C++. Generate 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. The leading development tool for Microsoft Windows. Highly Recommended.

LIST: \$995 **PS Price: \$895**

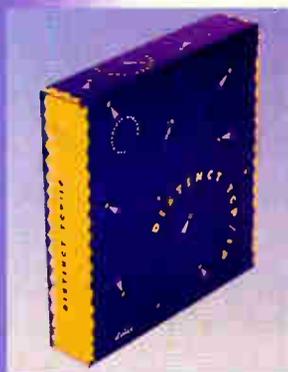
FastFacts 2001-006

## SVS C3 ANSI C, Pascal, or FORTRAN-77 by Silicon Valley Software

Only from the Programmer's Shop! ANSI compliant, optimizing, 32-bit compilers; DPML-compliant, royalty-free DOS extender; source level debugger; utilities. Supports "flat model" code. Linker, librarian, make, i387 emulation, W31/4167 support. Interoperable languages! Call: 413-572-880

|               | LIST  | PS Price     |
|---------------|-------|--------------|
| <b>ANSI C</b> | \$325 | <b>\$315</b> |
| <b>Pascal</b> | \$325 | <b>\$315</b> |
| <b>FORTAN</b> | \$395 | <b>\$375</b> |

FastFacts 1958-048: (C), 1958-050: (Pascal), 1958-049: (FORTAN)



## Distinct TCP/IP for Windows by Distinct Corporation

Distinct TCP/IP for Windows SDK extends the TCP/IP and RPC/NDR networking capabilities to Microsoft Windows. Includes the smallest and fastest DLLs today available for Berkeley Sockets, RPC, Telnet, and FTP. Coexists on the same board with Lan Manager, Novell and Banyan. Supports Packets, NDIS and ODI drivers. Only 5KB of DOS memory required.

(SDK) LIST: \$495 **PS Price: \$439**

(Applications) LIST: \$395 **PS Price: \$379**

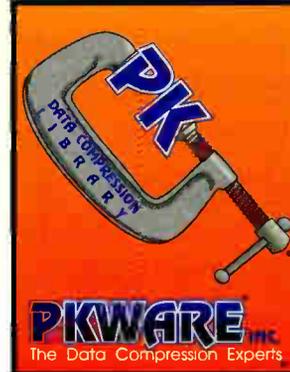
FastFacts 1951-003: (SDK), 1951-007: (App.)

## The PKWARE Data Compression Library by PKWARE

The PKWARE Data Compression Library allows software developers to add data compression technology to applications. The application program controls all data I/O, allowing data to be compressed or extracted to any device or area of memory. Only 35K of memory is needed to compress data, and only 12K is needed to extract data. Compatible with MSC, BC++, TC, TP 6.0, Clipper, Basic 4.5, 7.1, ASM.

LIST: \$295 **PS Price: \$275**

FastFacts 3043-011



# Create and Deliver Professional Applications with New CA-Clipper 5.2

## Create And Deliver Professional Applications With CA-Clipper

CA-Clipper consists of a robust language, an efficient linker, flexible preprocessor and high-performance compiler. Together with tools such as an editor, debugger and make utility, these elements form a complete development system for the creation and distribution of professional PC and LAN-based applications.

Only CA-Clipper gives you an open programming environment with high-level networking, data entry and database support. The extended memory system capability of CA-Clipper gives you additional power to build faster, more sophisticated applications.

## CA-Clipper Shatters DOS Memory Barriers

- Dynamic overlay management lets you run applications that exceed available RAM—without the need to manually create overlays
- Virtual memory management allows applications to have up to several megabytes of strings and arrays

## Open Architecture: Freedom to Grow

- Customize CA-Clipper with user-defined commands and functions
- Build generic libraries to eliminate repetitive programming tasks
- Build specialized libraries for applications such as accounting, real estate and personnel
- Seamlessly integrate modules from languages such as C, Assembler, dBASE™ and Pascal
- Access data transparently from foreign data sources with Replaceable Database Drivers and function libraries (available separately), including data on LAN database servers and mainframes via gateways

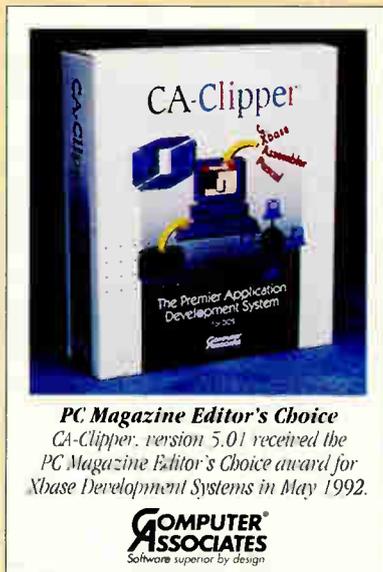
## Simplicity and Control: The Optimal Balance

- Descriptive function/command names and concise operators promote language fluency
- Syntax ranges from simple, expressive commands to precise string and file primitives for minimal programming with maximum control
- CA-Clipper promotes disciplined, modular programming for easier debugging, simplified maintenance and greater code reusability
- High level "objects" simplify the construction of sophisticated interfaces. Build pop-up and pull-down menus, custom BROWSES and text editors quickly and easily

## Open Networking: Freedom to Connect

- Create and distribute multiuser applications without LAN Packs or workstation licenses
- Applications run on all networks which support MS-DOS 3.1 and higher
- Modest memory requirements allow smooth operation with even the largest network shells

- Full-featured record and file locking gives developers precise concurrency control
- Intelligent design permits read-through record and file locks
- Applications run quickly and reliably, even as networks evolve



**PC Magazine Editor's Choice**  
CA-Clipper, version 5.01 received the PC Magazine Editor's Choice award for Xbase Development Systems in May 1992.

**COMPUTER ASSOCIATES**  
Software superior by design

- Connect to LAN database servers with Replaceable Database Drivers (available separately)

## Free Distribution of Applications

- CA-Clipper produces executable applications (EXEs) that you may distribute without additional cost
- Multiuser CA-Clipper applications require NO licenses, NO runtime fees and NO LANPacks

## Capacity

- Procedures per application: unlimited
- Functions per application: unlimited
- Array size: 4,096 elements per dimension, unlimited dimensions
- Expanded Memory use: 0 to 32 MB
- Virtual memory: up to 64 MB (main memory, expanded memory, hard disk space); up to 16 MB of object memory

(character strings, arrays); up to 9 MB (main memory, expanded memory) for database buffering

## Supplied Database Driver (DBF Format)

- 1 billion records per data file
- 1,000 fields per record
- Over 200 open data files (limited to file handles)
- 15 active indexes per open data file
- Character fields (fixed length): 65,536 characters
- Numeric fields: 30 digits, precision up to 16 significant digits
- Support for logical fields (true/false)
- Date fields: 01/01/0100-12/31/2999
- Memo fields (variable length): 65,536 characters

## System Requirements

CA-Clipper 5.2 requires an IBM PS/2, AT, XT, PC or its compatibles; 640K RAM; expanded memory requires LIM 3.2 or higher; hard disk required for development; DOS 3.1 or higher; works with all networks compatible with DOS 3.1 or higher.

## For a limited time only!

Clipper users can upgrade to version 5.2 for only \$139. A competitive upgrade is also being offered for a limited time to all Xbase system users for only \$179, and you'll receive a free CA-dBase, CA-Clipper Tools or CA-Clipper/Compiler Kit for dBASE IV (your choice).

To qualify for the competitive upgrade, fax a copy of your manual cover to 617-749-2018.

**To order, call the Programmer's Shop at 800-421-8006. Hurry, time is of the essence. Call to place your order today. Mention Code BY393**

To Order Call **THE PROGRAMMERS SHOP** 1-800-421-8006

and the Pioneer six-pack CD-ROM Minichanger.

I had the Pioneer R/W optical drive and the Minichanger in a SCSI daisy chain run by a Corel interface card. They were running fine, but as a test, I had, with some help from Alan Rogers ("arog" on BIX), converted that machine to run under DR DOS 6.0. It worked fine, and I so reported, but networking a DR DOS machine into my Windows system was not something I would get done in time for this column.

Converting back turned out to be harder than you'd think, because DOS 5.0 generally comes as an upgrade, not as a stand-alone product. Somewhere I suppose there are floppy disks of the original DOS that came with that 486 machine, but this is Chaos Manor: the chances of finding them are about nil.

The solution was to boot with a barebones DOS floppy disk that contains SYS.COM, use Norton Commander to find and delete all the hidden system files in the machine's root directory, and use the SYS command to install the system from the boot floppy disk. I could then re-boot from the hard disk and use the Microsoft DOS 5.0 and Windows upgrade

package to complete the job.

Next I restored the original CONFIG.SYS and AUTOEXEC.BAT so that the machine would access the optical and CD-ROM drives. That turned out to be a tedious job, but eventually I had it done. Moreover, when I brought up Windows and opened File Manager, there were drives D (the optical drive), and E, F, G, H, I, and J, the six CD-ROM drives on the Minichanger. Joy.

At this point I confess a lapse of faith. Remembering the problems I had with converting my main system with one CD-ROM to W4WG, I was so certain I was going to have real problems connecting up to a system with six CD-ROMs and an optical drive that I sent off E-mail to the long-suffering Microsoft PR people, who must pretend to like putting up with my problems, and a copy to the Corel people in case I needed help from them. Incidentally, when it comes to systems integration, Corel has always proved to be a tower of strength. They really understand SCSI and other peripheral devices and how to make them work with both DOS and Windows.

Having confessed my breach of faith, I

proceeded to open the machine and insert the EtherExpress board, run Softset and let it choose where to set the board, connect the Ethernet cable and terminator to the new machine, and install W4WG.

When that was done, I tested nothing: I entered Windows, opened File Manager—and Lo!, there were all my assets, and they all worked. When I told the system to share them (CD-ROM as read only, the Pioneer drive as read and write), it made no complaint. I then put Microsoft Bookshelf into one of the six CD-ROM slots, went over to my main machine, and proceeded to install Bookshelf across the network.

It works wonderfully. It's a little slower than what I can get with the Bookshelf disk in the CD-ROM drive connected to my local machine, but that's probably because my local drive is faster than the Pioneer Minichanger. That, incidentally, is about to change. At Comdex, Pioneer showed me a new Minichanger that is so blazingly fast I can hardly believe it, and I'm supposed to have one about the time you read this.

And in any event, what I've got now is Good Enough, and the installation was harder to describe than to do. Once you

## ...Shop the Shop.



### Janus/Ada for Windows by R. R. Software

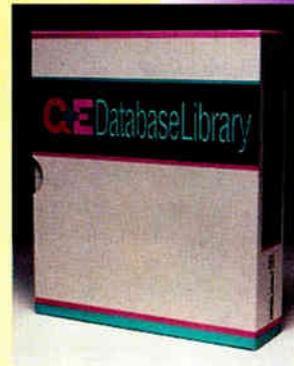
Janus/Ada for MS Windows is a complete implementation of Ada for Windows. Windows Applications can be developed in Ada when the Toolkit is used with the Janus/Ada PDS. Hosted on 80386 and 80486 platforms, the Windows toolkit with PDS includes: royalty-free runtime libraries, Ada-sensitive editor, Ada make utility, Ada syntax checker and pretty printer, Full Chapter 13 support including C interfacing, assembler, and tutorial.

LIST: \$900 **PS Price: \$849**  
FastFaxts 586-061

### Q+E Database Library by Pioneer Software

Q+E Database Library provides complete database connectivity to Windows and OS/2 applications using Dynamic Link Libraries. QELIB can read, insert, update, create or delete database records for the following database formats: Btrieve, dBASE, DB2, Excel files, INGRES, NetWare SQL, Oracle, OS/2 DBM, Paradox, SQL/400, SQLBase, SQL/DS, SQL Server, Sybase, Tandem NonStop SQL, text files, and XDB.

LIST: \$399 **PS Price: \$339**  
FastFaxts 2137-012



## But wait, there's more: Bargains galore!

|                               | LIST | PS  |                              | LIST | PS  |                               | LIST | PS  |
|-------------------------------|------|-----|------------------------------|------|-----|-------------------------------|------|-----|
| • After Dark for Windows      | 50   | 28  | • DR DOS                     | 99   | 59  | • ObjectVision 2.1            | 150  | 115 |
| • Blinker                     | 299  | 269 | • LapLink Pro                | 170  | 109 | • ProComm Plus                | 129  | 89  |
| • Borland C++ 3.1             | 495  | 319 | • Lotus 1-2-3 for Windows    | 495  | 359 | • QuattroPro                  | 495  | 349 |
| • Btrieve for DOS             | 595  | 399 | • Microsoft Excel            | 495  | 329 | • R&R Report Writer Xbase Ed. | 249  | 159 |
| • Carbon Copy 6.1             | 199  | 165 | • Microsoft Windows 3.1      | 150  | 99  | • WATCOM C 9.0/386            | 895  | 599 |
| • Clarion Prof. Developer 2.1 | 845  | 469 | • Microsoft Word (Windows)   | 495  | 339 | • WordPerfect                 | 495  | 279 |
| • CA Clipper 5.2              | 795  | 499 | • Norton Desktop for Windows | 179  | 139 | • 286/DOS Extender SDK 2.5    | 495  | 435 |
| • DESQview 386                | 220  | 149 | • Norton Utilities           | 179  | 115 | • 386/DOS Extender SDK        | 495  | 435 |

**Call the Programmer's Shop today: 1-800-421-8006**

Mention Code **BY393**

Call FastFaxts for product information any time, day or night. 617-740-0025.

Get free information on all of our more than 10,000 products any time you like • Dial from a fax machine or fax-board equipped PC • Follow the voice computer's instructions • Receive literature instantly via fax

**THE SHOP**  
PROPRIETARY

Canada 800-446-3846  
MA 617-740-2510  
FAX: 617-749-2018  
90 Industrial Park Road, Hingham, MA 02043

• Credit card orders processed only when product is shipped • All prices subject to change  
• International prices will vary

# The only Windows™ statistics package you'll ever need.

**NEW**  
SYSTAT® for WINDOWS

## #1 for DOS and Windows

Rated "the best general-purpose statistics program" for the PC by *Software Digest*®, SYSTAT for DOS is now joined by SYSTAT for Windows. This addition to the SYSTAT family takes full advantage of Windows, with pull down menus, dialog boxes, sizable windows, and the ease of use you expect in a Windows package.

SYSTAT for Windows runs in standard and 386 enhanced modes and can take advantage of Windows advanced memory management. No matter how large or complex your analysis is, you can use SYSTAT.

SYSTAT delivers a balance of power and simplicity. It lets you analyze and manipulate data

with a comprehensive range of advanced statistical procedures, and present your results with stunning graphics.

## Just point and click

SYSTAT is a full-fledged Windows application. Just point and click. SYSTAT's QuickStat™ buttons give you simple, single-click shortcuts to common statistical analyses.

## More statistics, from the basic to the most sophisticated

A full range of univariate and multivariate statistics—from *t* tests to multidimensional scaling. With a few clicks you can turn most statistics into graphs and perform:

- multiway crosstabs with log linear modeling
- nonparametric statistics
- principal components and factor analysis
- cluster analysis
- time series
- nonlinear estimation
- correlation matrices
- means, effect, and dummy models
- post hoc tests

SYSTAT offers the most advanced multivariate general linear model available for Windows.

## The most graphics

No other statistical or graphics package can produce all the scientific and technical graphs that SYSTAT can—nor surpass its ease of use. Graphics capabilities include:

- histograms
- single, multiple, stacked, and range bar graphs
- single and grouped box plots
- stem-and-leaf diagrams
- pie charts
- scatterplot matrices
- 3-D data and function plots
- contour plots
- control charts
- maps with geographic projections
- Chernoff faces
- complete color spectrum
- log and power scales
- confidence intervals and ellipses
- linear, quadratic, step, spline, polynomial, LOWESS, exponential, and log smoothing

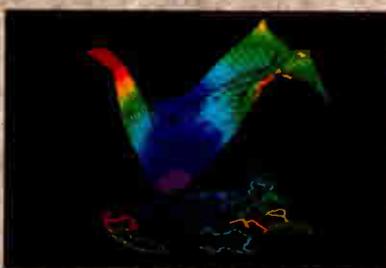
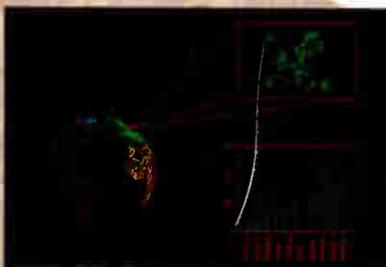
## A compatible family of products

Whichever you choose—SYSTAT for Windows, SYSTAT for DOS or both—you'll enjoy the most powerful statistics and scientific graphics software available for the PC.

For more information, special offers for current users, and demo disks, call:

**708-864-5670**

For Windows circle 150,  
For IBM/DOS circle 151.



**SYSTAT**

For more information call or write: SYSTAT, Inc., 1800 Sherman Avenue, Evanston, Illinois 60201-3793. Tel: 708.864.5670, Fax: 708.492.3567

Australia: Hearne Marketing 61.3.8661766, BeNeLux Countries: Oasis 31.3402.66336, Denmark: Agrolab 45.64.406575, France: Deltasoft 33.76.418508, Germany: STATCON 49.55.4272075, Italy: PiSoft 39.587.213640, Japan: HuLinks 81.33.5902311, Malaysia: Dagang Teknik 6.03.719.8299, New Zealand: Hoare & Assoc. 64.78.562675, Spain: AddLink 34.3.4590722, Switzerland: Fritschy & Partner 41.31.215151, SYSTAT UK: 44.81.4620093

© 1992 SYSTAT®, Inc. *Software Digest Ratings Report* 8.5, May, 1991. Software Digest is a registered trademark of NSTL, Inc.

have a W4WG network running, adding assets to it really is simple.

**LAN Alternatives**

The major advantage to W4WG is the simplicity. You can set it up quickly, and you don't have to know about network management to use it. However, there are limits to what W4WG can do (it won't, for example, run on a 286 machine). Much more on that another time, but you should be aware of alternatives.

One is to install Novell NetWare and run W4WG on top of it. That works, but there are disadvantages, two chief ones being that it costs money and you end up with limited DOS memory.

The other is not to use W4WG, but use regular Windows and Artisoft's LANtastic for Windows. This has the added advantage that you can network in Artisoft's Central Station, which is a network hub without computer to which you can plug in your laptop and other assets for sharing

across the network. Another advantage is that you can hook up LANtastic for Windows and LANtastic for the Mac, thus networking the different platforms with something a lot faster and better than AppleTalk.

I have all the Artisoft products, and I'll set up a LANtastic network as soon as I have a bit of time. This is indeed the Year of the LAN, and I expect to be doing a lot of LAN development and testing before it's over.

**Creative's Multimedia Upgrade**

There hasn't been a lot of multimedia software, but I think the flood is about to begin. Even if it doesn't, there are a lot of good reasons to upgrade your system by adding a CD-ROM drive, and if you don't have a sound board, you're missing something.

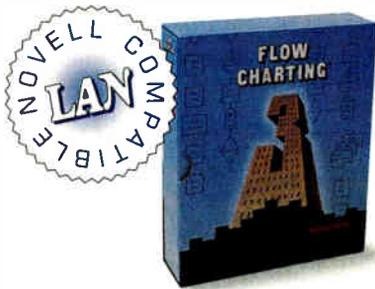
Of course, you can add a CD-ROM drive to any SCSI device string, and there are a dozen sound boards ranging from expensive professional systems down to swap-meet el cheapos. For that matter, Microsoft has come out with a new Windows sound system. Interestingly, the Microsoft sound board has no joystick port: the product manager claims they consulted businesspeople, and the overwhelming opinion was that business purchasers would pay extra *not* to have a game port. One wonders what that means; after all, you can control most games quite nicely with a mouse...

Anyway, one simple way to add multimedia capability is to get the Creative Labs Sound Blaster Multimedia Upgrade Kit. This comes with a CD-ROM controller on a Sound Blaster Pro card, an internally mountable CD-ROM drive, a MIDI adapter kit, all kinds of software, lots of books about the software, and a bunch of CD-ROMs, including Windows 3.1, various sound stuff, Microsoft Works, Microsoft Bookshelf, and Sherlock Holmes, Consulting Detective. The software includes Macromedia's Authorware Star and Action programs, and they're actually pretty nifty for ginning up multimedia presentations.

The instructions for installing the Sound Blaster Pro are complete. The board comes set to IRQ (interrupt request) 7 but tells how to set it for other possibilities, including IRQ 10. Since nothing I know uses IRQ 10, and I might one day want to add something that uses 7, I set mine for 10. Otherwise, I used the default settings. Sound Blaster Pro comes with an installation disk that includes a test of whether or not the board is working: just click, and music plays. No problem, so now it was time to install the CD-ROM drive.

I already had a Corel card and CD-ROM

# ARE YOU SPENDING TOO MUCH TIME DRAWING FLOWCHARTS? YOU NEED FLOW CHARTING™ 3.



Every day, professionals worldwide save time and money using Flow Charting 3. It's fast, efficient, easy to use, and always produces presentation-perfect charts and diagrams.

With Flow Charting 3's built-in flexibility, you can create customized charts using a variety of shapes, lines, and text—placed where you want them.

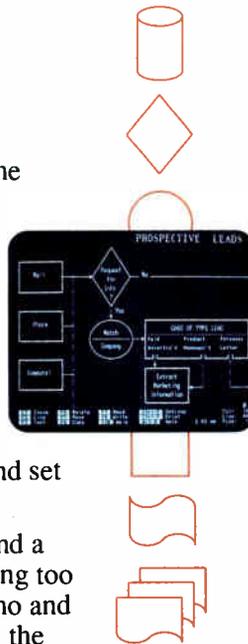
Plus, Flow Charting 3 is now available in a LAN version. Making it easy to share files and set up work groups for specific projects.

And it's backed with free technical support and a 90-day no-risk guarantee. So if you're spending too much time drawing charts, call for a free demo and see for yourself what makes Flow Charting 3 the best-selling flowcharting software.

**See your dealer today! Or for a free interactive demo disk, call 1-800-525-0082, ext. 112**

International: 408-778-6557, ext. 112

Novell is a registered trademark of Novell, Inc.



**PATTON & PATTON**  
Software Corporation

*Excellence in charting the flow of ideas!*

Patton & Patton Software Corp. 485 Cochrane Circle, Morgan Hill, CA 95037

# There Is Strength In Numbers.



**TravelMate™ 4000 WinSX™ or WinDX™**

- 486 SX/25MHz or 486 DX/25MHz
- 4MB RAM std. (20MB max.)
- 120MB HDD
- 5.6 pounds

\$2,799/\$3,299 SRP\*

**TravelMate 4000 WinDX2™**

- 486 DX2/50MHz
- 8MB RAM std. (20MB max.)
- 200MB HDD
- 5.6 pounds

\$3,899 SRP\*

**TravelMate 4000 WinSX COLOR**

- 486 SX/25MHz
- 4MB RAM std. (20MB max.)
- 120MB HDD
- 6.3 pounds

\$3,699 SRP\*

**TravelMate 4000 WinDX2 COLOR**

- 486 DX2/40MHz
- 8MB RAM std. (20MB max.)
- 200MB HDD
- 6.3 pounds

\$4,499 SRP\*

Texas Instruments comes on strong with the widest selection of powerful 486 notebooks at incredible prices. From 25MHz to the world's most powerful 50MHz notebook in a 5.6-pound package, there's a TI TravelMate just for you.

Take a look at these

numbers. You get superior 486 performance with an extraordinary three to five hours of battery life. On our color models, you get 256 simultaneous brilliant colors on a large 9.4" display. All these numbers add up to outstanding performance and value.

There's one more important number. For more information and the dealer nearest you, call 1-800-527-3500.



 **TEXAS INSTRUMENTS**

TravelMate, WinSX, WinDX and WinDX2 are trademarks of Texas Instruments. The Ready-to-Run logo is a trademark of Microsoft Corporation. The Intel Inside logo is a trademark of Intel Corporation.  
\*Manufacturer's Suggested Retail Price. Dealer prices may vary.

© 1992 TI 76574

**Circle 153 on Inquiry Card.**

World Radio History

drive, and you have seen what I had gone through trying to get it working with W4WG, so I was a bit reluctant to change; but what the heck, it was only a couple of hours' work, and whatever happened I'd get a story for the column, so I yanked the Corel card and started in.

There were two problems: the instructions said, "refer to the instructions that came with your CD-ROM drive." There was another instruction sheet, but that got lost in the chaos. That turned out not to be a problem: it was obvious where the cables connected, and they were keyed so that it was impossible to attach them the wrong way.

The second problem was a bit more serious: there is no mounting hardware with the drive. It does come with four tiny drive screws, but there are no mounting rails, nothing to hold the drive in the drive bay. Some computers come with lots of extra mounting hardware, but my Cheetah 486 didn't. I managed a kludge that permitted me to install the drive, but be warned, if you get Creative's kit, be sure you have hardware to mount an internal drive in your computer.

That done, I ran the CD-ROM installa-

tion program. That is, there is a program on the Creative disk entitled INST-CD.EXE, and having lost the instructions, that seemed reasonable. It wouldn't work: the program would get ready to install and then suddenly announce that it couldn't find SBPCD.SYS.

This was odd, because I could see that SBPCD.SYS was on the installation floppy disk. Then I noticed a file called CD-DRIVE.BAT, and sure enough, running that did the job. The CD-ROM was installed. I rebooted, and I could read the E drive.

Since Sherlock Holmes comes with the Creative package, that looked like a good test program. So I put in the CD-ROM, logged on to E, got a directory to be sure I was properly reading the CD-ROM, and ran SHERLOCK.EXE. The system trundled for a moment and announced that I had no compatible sound card. Then it dumped me back to DOS.

It seemed very odd that a program bundled with the Sound Blaster Pro card, and running on a CD-ROM drive controlled by a Sound Blaster Pro card, would be unable to find the Sound Blaster Pro card. I tested the card, both with its test program

and with a couple of games, and there was no problem.

Eventually, I wondered if changing the IRQ from 7 to 10 had anything to do with it. I pulled the sound card and moved the jumper; and Lo!, up came the Sherlock Holmes game. Apparently the game designers hard-coded the interrupt, and no one at Creative has tested Sherlock Holmes with a Sound Blaster Pro set to IRQ 10. Sigh. I left mine set to the default IRQ 7 so that I could fool around with the Sherlock Holmes game, but that's not really very satisfactory.

Once I was sure that the CD-ROM was working in DOS, I let Optimize do its thing and then fixed AUTOEXEC.BAT so that MSCDEX.EXE wasn't trying to load high. That gives me 598-KB DOS sessions under Windows; and the CD-ROM works just fine, both on my local machine and shared across the network. It's a good, fast drive, and having the CD-ROM drive mounted internally certainly saves space. My friend Rich Heimlich, who does game testing, says that the Creative CD-ROM and Sound Blaster Pro boards are compatible with more games than any other. If you want to upgrade to multimedia, this

# A PORTABLE DISK DRIVE YOU'LL NEVER OUTGROW.

Valitek sets the standard for the next generation of portable disk drives with the *new* Valitek PST<sup>2</sup>-MO128. It's a 3.5" rewritable magneto-optical system that delivers *unlimited* portable disk storage.

Simply connect it to the parallel, serial or SCSI port on any PC or Mac, and store up to 128 MB of data on a single interchangeable disk. Like every

Valitek, the PST<sup>2</sup>-MO128 features an industrial-grade steel case that stands up to wear and tear. It's *built to last* in today's hard-knock portable environments.

If you can't afford to lose a single bit of data, get a Valitek – the new PST<sup>2</sup>-MO128 or a best-selling Valitek high capacity tape drive.

## VALITEK

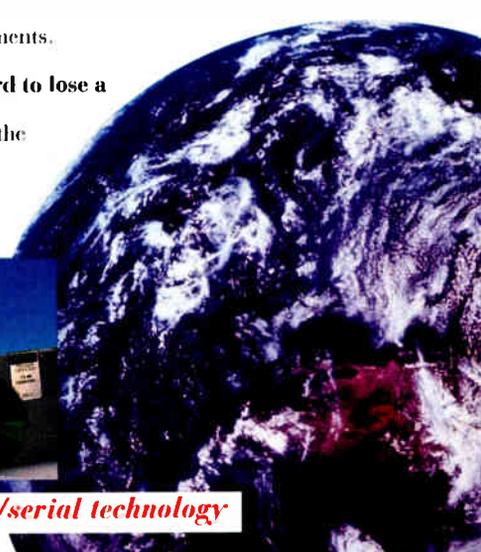
100 University Drive, Amherst, MA 01002

CALL: 1-800-VALITEK or 413-549-2700

FAX: 413-549-2900



*From the worldwide leader in parallel/serial technology*



# New Version 5.0 of Phar Lap's 386|DOS-Extender™ Now Supports 32-Bit Microsoft C/C++!

## Microsoft® C/C++ users: the wait is over!

Now you can finally build multi-megabyte 32-bit DOS applications with your familiar Microsoft tools! Version 5.0 of Phar Lap's 386|DOS-Extender lets you run Microsoft's 32-bit Windows NT C/C++ compiler under DOS. You get all the advantages of Phar Lap's industry-leading DOS extender technology, while using the most popular C/C++ compiler available. Multi-megabyte 32-bit DOS development has never been easier.



## Award-winning 32-bit technology.

386|DOS-Extender turns DOS into a 32-bit operating environment with a flat, workstation-like address space. Your programs can access all the memory in the machine — up to 4 gigabytes! — and take advantage of true 32-bit speed and power. No more segmentation or overlay hassles. And in addition to 32-bit Microsoft C/C++, 386|DOS-Extender supports a wide range of 32-bit languages, including Fortran, Pascal, Ada, Assembler and other C and C++ compilers. An add-on Run-Time Kit is also available for delivering Extended-DOS applications to customers.



## Industry-leading compatibility.

386|DOS-Extender is compatible with more than 60 popular libraries and utilities, making it easy to select the best tools on the market for your 32-bit development. Choose from user interface libraries including C-scape, DataWindows/386, WNDX and Vermont Views Plus; graphics libraries including HALO Professional, HOOPS and MetaWINDOW/PREMIUM; database libraries including AccSys, CodeBase and Raima Data Manager; class libraries including Tools.h++ and Math.h++; and many others. Only 386|DOS-Extender can offer you the universal third-party support you need.

**“the highest quality 32-bit DOS extender available”**

—Robert Wenig, Autodesk

## Complete Microsoft support.

386|DOS-Extender, Version 5.0 gives you the full functionality of the Microsoft run-time libraries, including graphics. You can still make all your 16-bit Microsoft C/C++ calls — but now with 32-bit power!

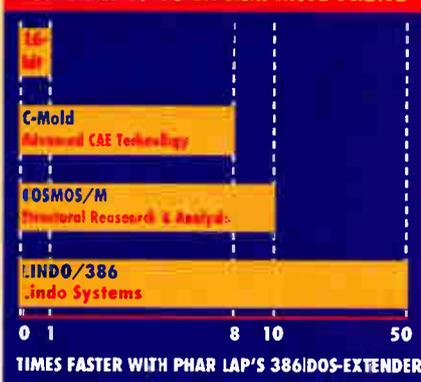


## New source-level debugger.

386|DOS-Extender, Version 5.0 includes Phar Lap's new 386|SRCBug, a powerful 32-bit source code debugger for protected mode 386|DOS-Extender applications.

## See how much faster your 32-bit DOS version could run:

COMPARED TO 16-BIT REAL MODE VERSION



## 286|DOS-Extender — the easy way to build multi-megabyte 16-bit DOS applications.

If you'd rather use 16-bit Microsoft C/C++, Borland C++ or Microsoft Fortran, then Phar Lap's award-winning 286|DOS-Extender™ is your solution. With 286|DOS-Extender, your program can break the 640K DOS barrier and access up to 16 megabytes of memory on any 80286 or higher DOS-based PC. You can even use CodeView or Turbo Debugger to debug your protected mode program.



# Phar Lap Software, Inc.

60 Aberdeen Avenue, Cambridge, MA 02138 617-661-1510 FAX 617-876-2972

286|DOS-Extender and 386|DOS-Extender are trademarks and Phar Lap is a registered trademark of Phar Lap Software, Inc. Borland and Turbo Debugger are registered trademarks of Borland International. Windows NT is a trademark and CodeView and Microsoft are registered trademarks of Microsoft Corp. Other product and company names are trademarks or registered trademarks of their respective holders.

Circle 128 on Inquiry Card.

World Radio History

# BEFORE PROTECTING YOUR SOFTWARE...

**NEW!**  
**TimeHASP®**  
Protect Your Software  
Keep the Time

...against piracy and unauthorized use, make sure that your protection system has all the following qualities:

## A GOOD HARDWARE KEY

Hardware-based software protection systems are now the standard worldwide. However, not all keys are the same. A good key should have all the following features:

✓ Compatibility and transparency. The key should work without any problem on your customers' computers. The user should be able to forget the key after connecting it.



✓ Unbreakable electronics. A customized ASIC (Application Specific Integrated Circuit) component should be integrated in the key. This prevents reverse engineering and makes cracking virtually impossible.



✓ A unique and inaccessible software developer's code burnt into the ASIC. (This code should not be held in the key's memory, where it can be read and altered.)

✓ A Read/Write Memory inside the key should be available on demand. The memory should be writable in the field, on any PC, without any special programming equipment.

✓ Very low power consumption, enabling the key to work even under the worst power conditions, on PCs and laptops, with or without a printer.

## POWERFUL SOFTWARE

Since it's practically impossible to crack or duplicate a key having all the features mentioned above, a pirate will usually go for the software linking the protected program to the key. Therefore, check that your protection software has all of the following:

✓ A Linkable Protection Module with which calls can be made to the key from any point in the protected program.



✓ An "Envelope" installation program. Such programs enhance security while making it possible to protect a software even without its source code.

✓ Sophisticated antidebugging and encryption mechanisms.

## HASP®, THE PROFESSIONAL SOFTWARE PROTECTION SYSTEM, OFFERS YOU ALL THESE FEATURES AND MORE:

HASP was designed by a team of computer experts, professional cryptologists, and electrical engineers. As a result, HASP keys are supported by what is probably the best software in the market, and the HASP system has worked on every computer it has been tried on. In addition to all the features mentioned above, HASP provides:

✓ A Full Authorization System for protecting dozens of programs using only one key.

✓ A Pattern Code Security System (PCS) enabling parallel processing of multiple calls by the Linkable Protection Module.

✓ A Virus Detection option that can be incorporated in the protected program to check whether it has been infected by a virus or tampered with in any way.

✓ Several HASP keys can be daisy-chained.



## NETHASP, SOFTWARE PROTECTION FOR NETWORKS

✓ Only one NetHASP key is needed to run a protected program from many stations in a network. NetHASP provides full support for protecting DOS and WINDOWS software under network environments, including Novell dedicated & non-dedicated servers, Lan Manager, Lantastic, Banyan, DLink, and NET-BIOS based LANs.

**IN A TEST CARRIED OUT BY AN INDEPENDENT LAB, HASP WAS THE ONLY KEY WHICH WAS NOT BROKEN\*.**

## OPERATING ENVIRONMENTS

✓ **PC:** DOS, WINDOWS, OS/2, SCO UNIX, SCO XENIX, INTERACTIVE UNIX, AIX, AUTOCAD, DOS EXTENDERS

✓ **MAC (ADB Port):** System 6.0.5 and up

✓ **NEC (Serial Port):** DOS, WINDOWS

## AND THE BOTTOM LINE:

We offer some of the most competitive prices in the market.

Since 1984, HASP has enabled thousands of software producers in more than 40 countries, including several Fortune 500 companies, to protect their software.

To learn more about why so many professionals have chosen HASP, call us for our low price evaluation package.



**North America:**

200 Broadhollow Rd., Suite #207  
Melville, NY 11747, USA  
Tel: 800-223 4277  
516-424 5100  
Fax: 516-424 8300

**International Office:**

**ALADDIN KNOWLEDGE SYSTEMS LTD.**  
15 Beit Oved St., Tel-Aviv, Israel  
P.O.Box: 11141 Tel-Aviv 61110,  
Tel: 972-3-5375795  
Fax: 972-3-5375796

- Australia Conlab Pty. Ltd., Tel: 3 8985685
- Belgium Akkermans bvba, Tel: 3 2338826
- CSFR ATLAS Ltd., Tel+Fax: 2 766085
- Chile Micrologica S.A., Tel: 562 222 1388
- Denmark SC Metric a/s, Tel: 42 804200
- France Logidata Intl., Tel: 50707375
- Germany CSS GmbH, Tel: 201 749860
- Greece Unibrain SA, Tel: 1 6856320
- Holland Akkermans BV, Tel: 45 241444
- Italy Partner Data S.r.l., Tel: 2 33101709
- Korea Dae-A Engineering, Tel: 2 848 4481
- New Zealand Training Solutions, Tel: 4 5666014
- Poland Systherm Tel: 061 45065
- Portugal Futurmatica Lda., Tel: 1 4116269
- South Africa D Le Roux, Tel: 11 886 4704
- Spain PC Hardware, Tel: 3 4493193
- Switzerland Opag AG, Tel: 61 7112245
- Taiwan Teco Ltd., Tel: 2-555 9676
- Turkey Mikrobeta Ltd., Tel: 4-4677504

\* CT Magazine, May 1990.

© Aladdin Knowledge Systems Ltd. 1985-1992

See us at CeBIT '93, Hall 018, Floor 1.0G, Booth B20

Circle 63 on Inquiry Card.

World Radio History

## USER'S COLUMN

is a good way to do it, and in fact the installation is simpler than describing it has been. Recommended.

### Power Japanese

Want to learn Japanese? If so, Power Japanese looks like what you need. You get some flash cards, a dictionary, 15 high-density 3½-inch disks of software, a sound-converter gizmo to attach to your printer port, a set of headphones, some exercise books, a dictionary, and instructions.

I don't know Japanese, and at my age I'm not likely to learn a new language, so I'm not sure I'm competent to judge the effectiveness of this as a learning tool. It seems to do what you'd want it to: it shows you how to draw and pronounce different Japanese characters, both katakana and hiragana, and has workbooks for you to practice doing those in. It will also show you on-screen other styles of Japanese, including classical Ming. Meanwhile, the program talks to you. Hear the words, and see it written out on-screen.

The speech adapter is small enough that you would have no trouble with it on a portable machine, so instead of watching bad movies and drinking too much on your next flight, you could be learning Japanese.

Learning a new language is more dependent on the determination of the learner than on the instruction method, and I'm not at all sure that if you're serious about learning Japanese, you won't be better off getting human instruction; but if you'd like to try it on your own first, this looks to be the way to do it. With those caveats, recommended.

### From Space to Dinosaurs

If you ever wonder what's the point of multimedia, get one of the Knowledge Adventure products. I've previously written about two of their products, Knowledge Adventure and Science Adventure; now they've got two more, Space Adventure and Dinosaur Adventure. Both are wonderful, combining beautiful VGA images, interactive maps and diagrams, and all kinds of other great stuff. I cannot imagine any kid in the world who wouldn't want to spend hours playing with either of these programs. Heck, I like playing with them.

You don't need a CD-ROM drive for Dinosaur Adventure. You do need a good bit of hard disk space and a sound board; Sound Blaster Pro works just fine. If you don't have a sound board, these programs alone justify installing one. Knowledge Adventure is a candidate for a big Orchid and a Chaos Manor User's Choice Award, and it gets a highly recommended rating. This is what educational software ought to be.

PC MEMORY PROCESSOR & DRIVE UPGRADES

# PS/2 Processor Upgrades..

**NEW!**

Model 70  
Slotless  
Hard  
Drive  
535 Mb  
340 Mb  
213 Mb

- 486 upgrades for Models 70 & 80
- 386 upgrades for Models 50, 50z & 60

**33 MHz Speed! Zero-Slot Solution!**

Call 800-446-4525 today for details!

## Σ Sigma Data

THE UPGRADE SPECIALISTS

P.O. BOX 1790, NEW LONDON, NEW HAMPSHIRE 03257 FAX 603-526-6915

MATH CO-PROCESSORS WORKSTATION MEMORY LASER PRINTER MEMORY DRIVE UPGRADES

### The Compleat AI

This is a CD-ROM in ISO-9660 format (meaning it is readable by PCs, Macs, Amigas, Unix systems, and almost anything not coal-powered) with hundreds of AI and related programs. Want source code to a dozen versions of the Eliza program, including one you can put on your BBS to talk to people? An artificial-life program? Expert-system builder? Neural-network builder, including source code to simulate a cockroach brain? It's all here, and more, in FORTRAN, Prolog, Lisp, and even BASIC. There are also hundreds of articles about AI and related matters and tutorials on using many of these programs. It's the most complete collection you're likely to see anywhere.

Steve and Susan Chance Rainwater, the principals of Network Cybernetics, told me about this as they drove me to the airport from a speaking engagement a few months ago; this project is more a labor of love than a profit-making venture. Incidentally, they're OS/2 and Ami Pro enthusiasts. Clearly, you can get CD-ROM systems running with OS/2, even if I've had rather bad luck with it myself.

If you have any interest whatever in AI, natural-language processing, neural networks, artificial life, or related subjects, get this disk, for either yourself or your users group; you won't be disappointed. Recommended.

### Trantor MiniSCSI

This product, the T348 MiniSCSI Plus, is darned near perfect. It consists of a cable to connect your parallel port to any SCSI device, such as an external hard drive or CD-ROM; software to install the MiniSCSI; and a needless cable to connect your printer to the MiniSCSI cable so that you can print when you're not using the parallel port for SCSI. That last cable is needless because any old Centronics printer cable will do; but the FCC requires them to furnish this expensive thing because using your own cable might result in some radio noise detectable 10 feet away. Your tax dollars at work.

Installing the software is absurdly simple. In my case, I wanted to put the T348 MiniSCSI Plus on my Gateway Handbook: this wonderful little portable computer can access its floppy drive only through the parallel port, so it would be an interesting test. It turned out to be simple: I created a directory called FOO, copied the floppy disk to it, replaced the floppy drive with the MiniSCSI cable connected to a Toshiba CD-ROM, logged on to FOO, and did an automatic installation. That's it. In seconds, I was reading the CD-ROM drive.

What else can I say? It works, it's easy to install, and it's another candidate for a Chaos Manor User's Choice Award. Recommended.

*continued*

**Winding Down**

The computer books of the month are both from Sams. First, Gary Entsminger's *Secrets of the Visual Basic Masters* (Sams, 1992). An understanding of Visual Basic is important to everyone working much with Windows, since more and more Windows programs have hooks to interface with it. This is an excellent intermediate-level book on writing, debugging, and error-proofing Visual Basic programs.

Second, John M. Goodman's *Memory Management for All of Us* (Sams, 1992). The most complete exposition on memory management I know of is in Quarterdeck's manuals for QEMM and Desqview. Unfortunately, they are great for reference but unreadable for learning. Goodman's book takes a difficult subject and gives you considerable understanding of it. Reading this wouldn't have solved my CD-ROM/W4WG problem, but knowing what's in this book gave me the approach

I needed. If you wonder what the differences between 386Max and QEMM are, this is the book that will tell you, and a lot more.

The book of the month is Graham Fuller's *The Democracy Trap: Perils of the Post Cold War World* (Dutton, 1991). Fuller is a former diplomat and intelligence officer, and he has some of the clearest views on the subject of foreign policy I've seen since Stefan Possony stopped publishing.

The game of the month is Quantum Quality Productions' *Battles of Destiny*. Think of this as *Empire* died and, if not gone to heaven, then at least to heaven's anteroom. The perfect improvement to *Empire* hasn't come, but this one is a valiant attempt. There are some frustrations in the user interface, but if you want to handle enormous armies and try your hand at air/land battle planning, this will do it. A second game of the month is MicroProse's

*Ancient Art of War in the Skies*, and while you can play arcade sequences if you like, the fun part to me is strategic.

As is usually the case, I've still got a huge pile of really good stuff here and no space to write about it. I love it. Next month, a pile of new CD-ROMs and more about networking, including alternatives to W4WG. ■

*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 "jerry."*

**ITEMS DISCUSSED**

**Ancient Art of War in the Skies**.....\$59.95  
MicroProse Software, Inc.  
180 Lakefront Dr.  
Hunt Valley, MD 21030  
(800) 879-7529  
(410) 771-1151  
**Circle 1153 on Inquiry Card.**

**Battles of Destiny**.....\$59.95  
Quantum Quality Productions, Inc.  
1046 River Ave.  
Flemington, NJ 08822  
(908) 788-2799  
**Circle 1154 on Inquiry Card.**

**The Compleat AI CD-ROM**.....\$129  
Network Cybernetics Corp.  
4201 Wingren Rd., Suite 202  
Irving, TX 75062  
(214) 650-2002  
fax: (214) 650-1929  
**Circle 1155 on Inquiry Card.**

**Dinosaur Adventure**.....\$49.95  
**Space Adventure**.....\$99.95  
Knowledge Adventure, Inc.  
4502 Dyer St.  
La Crescenta, CA 91214  
(800) 542-4240  
(818) 542-4200  
fax: (818) 542-4205  
**Circle 1156 on Inquiry Card.**

**Power Japanese**.....\$389  
BayWare, Inc.  
1720 South Amphlett Blvd., Suite 205  
San Mateo, CA 94402  
(800) 538-8867  
(415) 312-0980  
fax: (415) 578-1884  
**Circle 1157 on Inquiry Card.**

**QEMM-386 6.0**.....\$99.95  
Quarterdeck Office Systems, Inc.  
150 Pico Blvd.  
Santa Monica, CA 90405  
(800) 354-3222  
(310) 392-9851  
fax: (310) 314-4217  
**Circle 1158 on Inquiry Card.**

**Sound Blaster Multimedia Upgrade Kit**.....\$799.95  
Creative Labs, Inc.  
1901 McCarthy Blvd.  
Milpitas, CA 95035  
(800) 998-5227  
(408) 428-6600  
fax: (408) 428-6611  
**Circle 1159 on Inquiry Card.**

**T348 MiniSCSI Plus**.....\$229  
Trantor Systems, Ltd.  
5415 Randall Place  
Fremont, CA 94538  
(800) 872-6867  
(510) 770-1400  
fax: (510) 770-9910  
**Circle 1160 on Inquiry Card.**

**Ventura Publisher**.....\$795  
Ventura Software, Inc.  
15175 Innovation Dr.  
San Diego, CA 92128  
(800) 822-8221  
(619) 673-0172  
fax: (619) 673-7562  
**Circle 1161 on Inquiry Card.**

**Windows for Workgroups**.....\$249.95  
**Windows for Workgroups Starter Kit**.....\$849.95  
**Word for Windows 2.0**.....\$495  
Microsoft Corp.  
1 Microsoft Way  
Redmond, WA 98052  
(800) 426-9400  
(206) 882-8080  
fax: (206) 936-7329  
**Circle 1162 on Inquiry Card.**

**WinSleuth Gold 3.04**.....\$169  
Dariana, Inc.  
5241 Lincoln Ave., Suite B5  
Cypress, CA 90630  
(800) 892-9950  
(714) 236-1380  
fax: (714) 236-1390  
**Circle 1163 on Inquiry Card.**



# SUPERIOR DISPLAYS ARE PART OF OUR HERITAGE.



June 30, 1992  
FlexScan F550i



1993  
FlexScan F550i

Three hundred years ago, our ancestors in the Nanao area of Japan created Kutani, one of the classic styles of Japanese porcelain that is meticulously crafted for display. Inspired by their vision to create such colorful, intricate art, we recreate the richest, deepest colors in our innovative computer displays: the distinguished Nanao FlexScan® monitor family.

Inherited with a discerning eye and practiced touch, we finely tune every monitor, bringing you displays with a brilliant palette and clear, sharp images – retaining a tradition that reflects our vibrant history and parallels the technology of today.

From the affordable 15" to the 21" big-screen, our FlexScan family features top-of-the line flat-square CRTs with ergonomic enhancements including easy-to-use microprocessor-based controls, flicker-free refresh rates and a healthy work environment that meets the Swedish MPR II and TCO low emission standards. We've also added ecological features such as an energy-saving auto-power ON/OFF switch. And all of our monitors optimize performance for Windows users or CAD/CAM, DTP professionals.

From generations of finely-crafted displays, our renowned monitor family continues a heritage that is uniquely Nanao.



FlexScan T660i



Finalist  
FlexScan F340W

## NANAO®

Superior in every detail.™

NANAO U.S.A. CORPORATION

23535 Telo Avenue, Torrance, CA 90505  
(310) 325-5202

1-800-800-5202

Circle 114 on Inquiry Card (RESELLERS: 115).

World Radio History

# Smarter E-Mail Is Coming

Rebuilding your business processes to take advantage  
of E-mail promises dramatic productivity gains

ANDY REINHARDT

**F**orget for a moment the confusing alphabet soup of E-mail acronyms. Look past the gateways, switches, and battles over APIs. Despite these hurdles, it's only a matter of time before E-mail is as pervasive and easy to use as the telephone system.

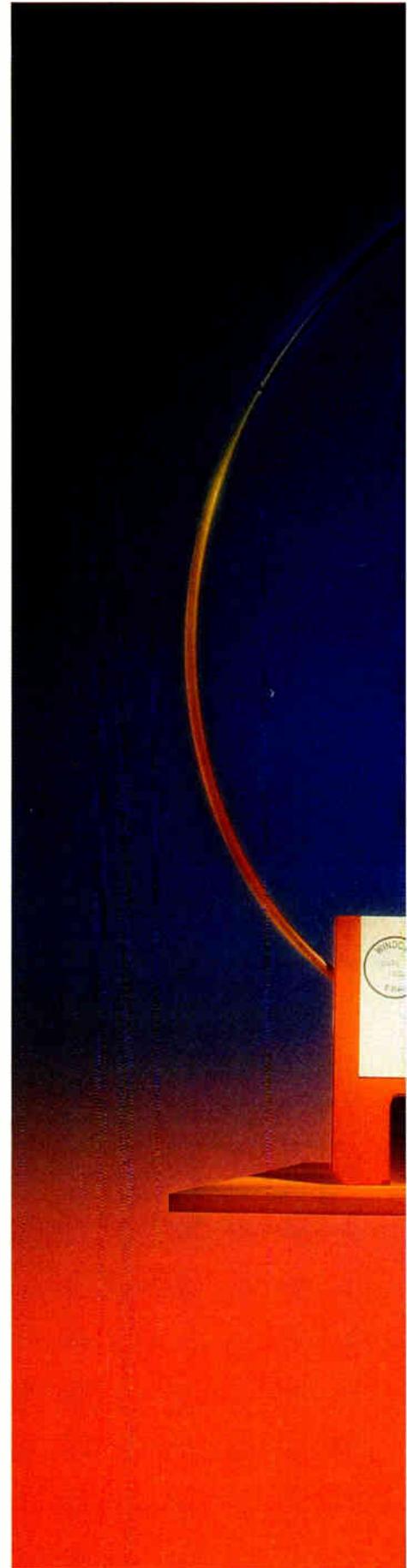
Once E-mail nirvana arrives, huge changes will occur. Organizations that have already implemented enterprise-wide E-mail find that it flattens the management hierarchy, improves project tracking, and speeds time to market for new products or services. E-mail's greatest benefit, however, goes beyond ad hoc exchange of information among employees: Messaging is the foundation for a new wave of work-group software packages that will alter traditional work structures and could dramatically boost productivity.

"Mail should not be thought of as an application," says Eugene Lee, director of product planning for mail software vendor Beyond (Cambridge, MA). "It's an enabling technology."

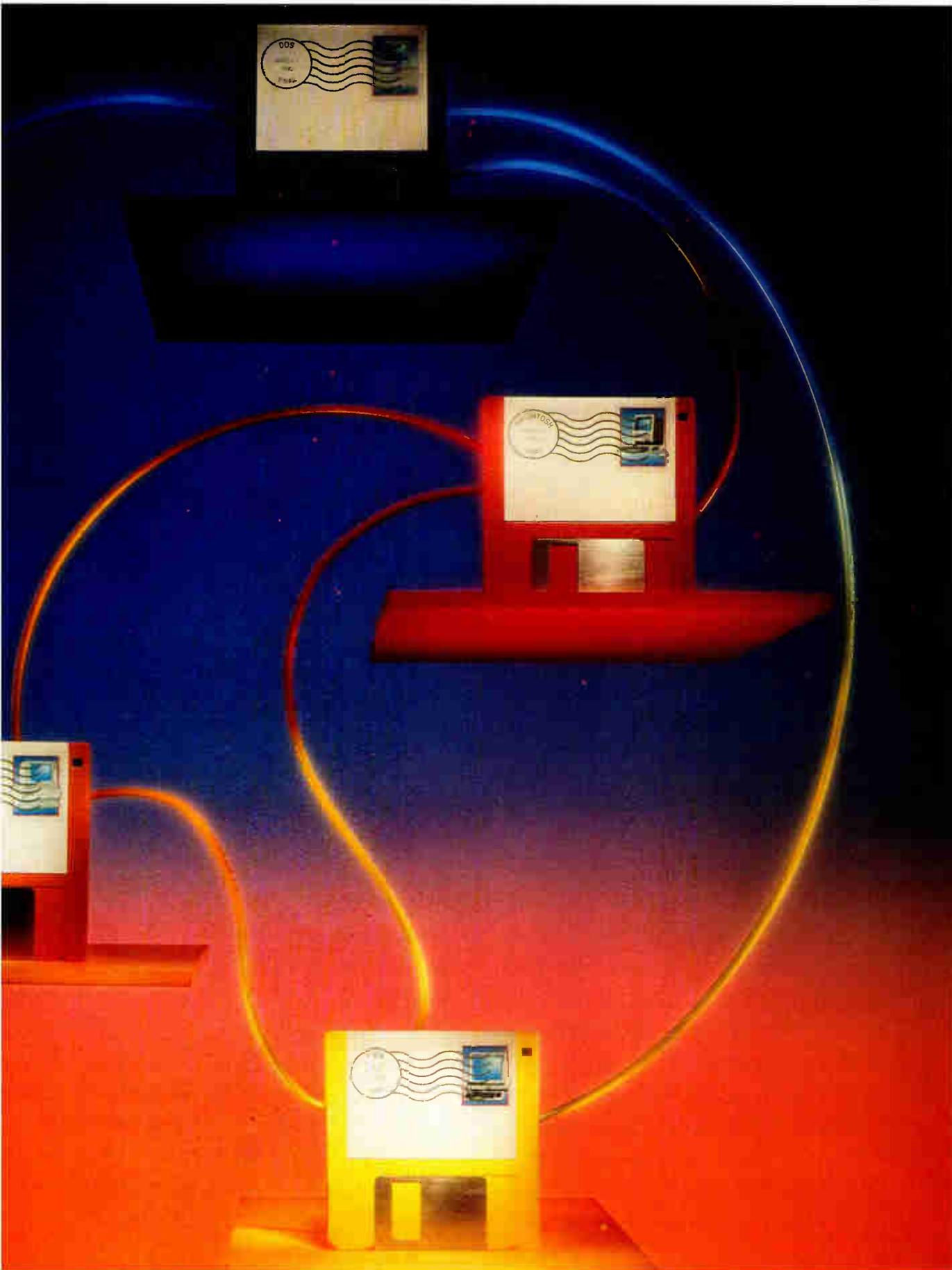
After years of wrangling with complicated client/server technologies such as RPCs (remote-procedure calls), users and developers are discovering that E-mail's store-and-forward, network-independent messaging provides many of the same capabilities for a fraction of the cost and complexity (see the text box "The Messaging Model" on page 92). In effect, messaging enables a type of do-it-yourself distributed computing.

"People tend to think of mail today as messages sent between people, but that's just the tip of the iceberg," says John Rymer, an analyst with the Patricia Seybold Office Computing Group (Boston, MA) and the editor of the *Distributed Computing Monitor*. E-mail can also be used for communication between people and processes—known as virtual users—or even among processes themselves; in fact, Rymer says, most communication between applications will ultimately use E-mail transports.

Applications that will build on the messaging infrastructure include multimedia mail, fax routing, database access, scheduling, and document sharing (see figure 1). Perhaps the most promising avenue is the broad category known as work flow, which encompasses information routing, task automation, and decision support. "We've spent millions of dollars on E-mail," says Larry Quinlan, the manager of LAN services for the accounting firm of Deloitte & Touche (Atlanta, GA), "and you can't get a good return on investment from simple messaging alone." Organizations



PHOTOGRAPHY. ELLE SCHUSTER © 1993



# The Messaging Model

To facilitate interoperability among mail systems, vendors are decoupling the front-end mail client from the back-end mail server. Most packages today, such as cc:Mail and Microsoft Mail, supply both the client and the server in a single box and use their own proprietary message transports.

The exception is Novell (Provo, UT), whose MHS (Message Handling Service) has used a client/server architecture with a published API for more than five years; Novell doesn't market an MHS client, leaving that instead to companies such as Da Vinci Systems (Raleigh, NC) and Beyond (Cambridge, MA).

The implications of this shift are twofold. First, breaking the link between the client and server lets customers use whatever combination of front and back ends they choose. Second, an open interface exposes the mail transport for use by applications other

than a mail client; conventional productivity packages (e.g., word processors and spreadsheets) will be able to talk directly to mail engines, and new types of workgroup applications can be built on top of the mail transport.

It is often cheaper and easier to implement distributed computing with messaging than with client/server RPCs (remote procedure calls). RPCs use live "virtual circuits" between applications and require expensive equipment such as high-speed routers and private T1 phone links for WAN (wide-area network) implementations.

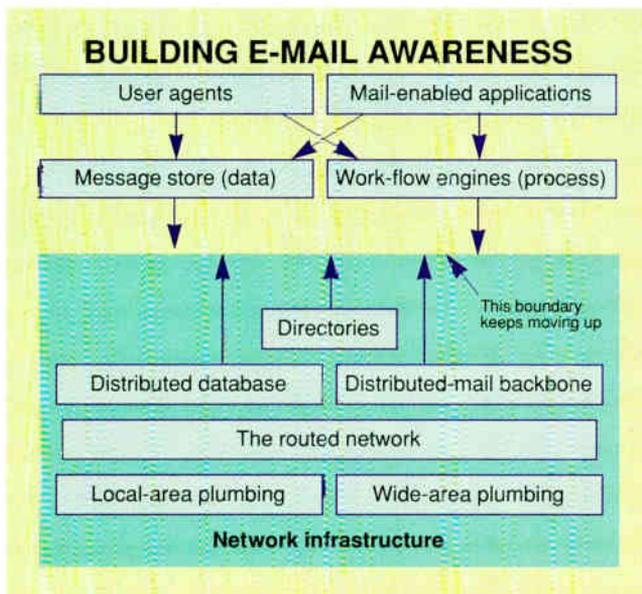
"The bottom line is that people want a simple method of routing information," says Rick Bohdanowicz, director of messaging for Novell. E-mail is cost-effective, he says, because users can implement their own schemes using off-the-shelf software, modems, and dial-up phone lines.

Store-and-forward is a good mechanism for remote access, because it

places less of a burden on field systems and communications links than does a client/server architecture. LAN managers concerned about network bandwidth also appreciate that using messaging instead of virtual circuits frees up network resources for time-critical tasks.

Messaging can also play a role in connecting desktop systems to host programs, says John Rymer of the Patricia Seybold Office Computing Group (Boston, MA). For example, you could communicate with a system not designed for the distributed world by giving it an interface for messaging.

Compared to the hard-wired design of client/server programs, Rymer says, the more generic messaging interface can prove to be a vital asset in today's climate of corporate mergers and divestitures. "If you're a corporate developer, you need to build applications that can interface easily to new systems," he adds.



**Figure 1:** The messaging architecture of the future will let mail-enabled applications and messaging agents communicate interchangeably with message stores and work-flow engines. This layered design permits users to use the networks, mail services, and front ends of their choice.

that use E-mail find that it quickly becomes a vital part of their information structure. E-mail is the "de facto mechanism" for moving files at the Social Security Administration (Baltimore, MD), says Jan Hoffman, director of intelligent workstations and LAN engineering. The agency has a network of 15,000 PCs running NetWare and cc:Mail. A fax server routes incoming and outgoing faxes, and staffers use E-mail to update databases. Future projects may include tracking and monitoring letters and the use of digital signatures for approving documents.

Companies such as Beyond, Action Technologies (Alameda, CA), and Reach Software (Sunnyvale, CA) are creating tools to electronically control the flow of data and forms around organizations. These "rules engines" capture existing business processes or stimulate users to pioneer new, more efficient procedures.

The results can be staggering. Most business processes have built up over the years without the advantage of modern technology. By applying both workgroup technology and modern organizational theories, says Walter Ulrich, a director of the consulting firm Arthur D. Little (Cambridge, MA), "businesses can move decision making down to the people who have immediate contact with customers and cut cycle times by up to one-third."

## Building on E-Mail

Analysts expect LAN-based E-mail use to grow explosively over the next few years. Market-research firm The Yankee Group (Boston, MA) estimates that the number of LAN E-mail users in the U.S. rose 60 percent last year, from 5.9 million to 9.4 million, and will climb another 60 percent this year to 15.1 million users

# FIX YOUR PC FAST!



## RECOVER DATA FROM PHYSICALLY DAMAGED FLOPPIES & HARD DRIVES!

There's no other program like it anywhere! When you have a disk that returns GENERAL FAILURE READING DRIVE (X), **RESCUE™** will read it anyway!

**RESCUE™** bypasses DOS's inability to read disks that have been physically damaged and will move the drive heads directly!

**RESCUE™** will even read a floppy that has a hole poked through it! You can recover all the data excluding, of course, the actual destroyed area.

This revolutionary program is now your first line of defense when it comes to recovering your valuable data. Save hundreds — even thousands — of dollars by doing your own data recovery! With **RESCUE™** you can perform miracles.\* Your data is too valuable not to have **RESCUE™** within reach! **CALL NOW FOR PRICING!**

\*Some failures may be beyond **RESCUE™**'s ability to recover data.

*"I've never seen anything like this... I was horrified when I thought I would be unable to recover 3 years worth of my research... **RESCUE™** did exactly what you said it would... It's priceless." R.G., VP Research/TTI*



## THE LARGEST COMPILED REFERENCE ON HARD DRIVES AVAILABLE FOR THE PROFESSIONAL!

3 VOLUMES • OVER 1100 PAGES!

### VOLUME ONE...SET-UP GUIDE

- Interface Types and Installation
- Hard Drive Specs for over 1800 drives: Make, Model, Formatted Capacity, Data Heads, Cylinders, Average Seek Times, Form Factor, Height, Interface, Encoding, Landing Zone, Sectors Per-Track, Write Precompensation Cylinder, Reduced Write Current and Mean Time Between Failure.
- BIOS Drive Type Tables
- Directory of Manufacturers
- The Floppy Drive Cable
- Power Connector
- Pin Assignments and Specifications

### VOLUME TWO...DRIVE SETTINGS

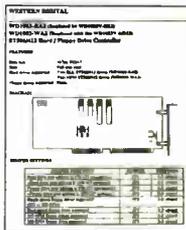
- Explanation of Jumper Types, Changes in Make & Model and Default Jumper Settings
- Diagrams for over 500 drives with: Specifications, Drive Sizes, Interface Types, Jumper Settings and Locations, Terminal Resistor Locations, Pin Assignments, Pin 1 Locations, Cable Type and Locations.

### VOLUME THREE...CONTROLLERS

- Over 275 Diagrams of Controllers With: Specifications, Card Sizes, Largest Head and Cylinder Sizes, Interface Type, Detailed Jumper Settings, Pin Assignments and Cable Locations.
- Controller to Drive Power Connections, Drive Activity L.E.D. Connections, Common Debug BIOS Format Codes and Default Jumper Settings

### PLUS...

- 1 year subscription with quarterly printed updates • On-line Bulletin Board for immediate access to the most current updates • Plus more! **CALL NOW FOR PRICING!**



## NEW! THE LARGEST COMPILED REFERENCE ON MOTHER BOARDS EVER! 5 VOLUMES! HOT OFF THE PRESS!

Over 850 diagrams showing all necessary jumper, connection and component locations! Each diagram includes technical specs such as: processor, processor speed, chip set, max. onboard DRAM, SRAM cache, BIOS, dimensions, I/O options and NPU options. Also includes easy to understand tables giving configuration for: user settings, DRAM, SRAM, CPU type jumper and CPU speed jumper. **PLUS MUCH, MUCH MORE!**

**CALL NOW FOR PRICING!**



## EVERYTHING YOU NEED TO INSTALL, SET-UP AND OPTIMIZE HARD DRIVES!

The **Hard Disk Technical Guide™** is the most complete paperback on hard drives ever published. This 1992 version has 424 pages and is ideal for in the field or office use!

- Set-up Specs for all drives from 1984 to present • Diagrams of the most common controller cards with jumper settings and functions • Diagrams and drive settings of common drives • Installation procedures • PLUS MUCH MORE!

**DrivePro™** the all-in-the utility for the most efficient and correct installation and maintenance of any hard drive!

- No more DEBUG - Finds and executes controller's on-board firmware
- No more FDISK - Full featured partition table creator and editor
- No more SETUP - View and edit BIOS drive type table and set CMOS
- No more FORMAT - High-level DOS format with operating system transfer
- Drive Table Override allows almost any BIOS to have a user definable drive type
- Drive boot fixer will solve drives that won't boot
- Complete drive diagnostic and performance tests and much, much more!



The Hard Drive Kit™

"The most comprehensive guide of disk drive and controller card specifications I have ever seen... will save any field technician valuable time. I use it at least twice a day and it's well worth the money I paid for it!" SB, Customer Services Division, MCR Corp.

Completely tune your hard drive to last longer and run faster with **DPTune™**, the fastest file defragmenter and disk optimizer. Also optimizes DOS structure • Verifies physical surface • Adjusts interleave setting • Moves data from bad clusters and much more! Automatically optimize files every time you turn on your computer! **PC World Best Buy! CALL NOW FOR PRICING!**

## PC DIAGNOSTICS THAT REALLY FIND THE BUGS!

The **Troubleshooter™**, a self-booting disk, is unlike other diagnostic programs that rely on DOS. The **Troubleshooter™** bypasses DOS and tests all major hardware components directly for true accuracy while other programs frequently give erroneous test results. Works on DOS, UNIX, Novell, XENIX, OS/2, etc. Loaded with all the tests you need to quickly and accurately isolate the source of PC failures.

**PocketPost™**, the most compact and feature packed diagnostic Power-On Self Test (POST) Card in the world! You can debug dead PC's in less than 5 minutes! Jumper settings allow you to read the BIOS POST codes from 6 different addresses. Debugs XT, AT, Compaq, EISA, PS/2 (25/30) and compatible. 170 page manual includes the most complete source of BIOS codes in a single reference to allow instant translation of error codes. **AND MORE! CALL NOW FOR PRICING!**



The Troubleshooter Kit™

Circle 175 on Inquiry Card (RESELLERS: 176).

• Free Tech Support  
• Performance Guaranteed  
• Next Day Shipping

**CALL (800) 65-FIXED**  
800-653-4933  
**AllMicro, Inc.**

1250 Rogers St. • Suite D • Clearwater, FL 34616  
(813) 446-6660 • Fax (813) 446-8075

Copyright © 1992, The Hard Drive Kit, and The Troubleshooter's Kit are trademarks of AllMicro, Inc. All Rights Reserved. Other names are trademarks of their associated owners. Specifications subject to change.

Dept. B3, 5370 52nd Street SE, Grand Rapids, MI 49512  
Phone: (616) 698-0330 • Fax: (616) 698-0325

**Circle 61 on Inquiry Card (RESELLERS: 62).**

Total amount (US funds): \_\_\_\_\_  Yes, please rush your free catalog of PC books and software.

Dept. B3

a massive roll-up, you'll be able to see incremental changes."

The same model could be applied to Ami Pro documents or Freelance Graphics slide shows, but Lotus hasn't committed to delivery dates for workgroup-enabled versions of these packages. "Our goal is to do more than just mail-enable our products," says Greif. "We want to build on the communications infrastructure by using both mail and databases."

Borland (Scotts Valley, CA) is keeping quiet about its E-mail strategy, but it is known to be developing a software architecture that will support an upcoming line of workgroup applications. Called Object Exchange, or OBEX, the architecture is built on BOCA (Borland's Object Component Architecture), which builds on the company's InterBase database engine. Borland will likely use VIM as the interface between applications and mail services.

As with other vendors' products, Borland's mail-enabled applications will let users send messages without exiting to a separate mail client. But the company's ultimate ambition is to harness mail as a medium for IAC (Interapplication Communication). The link to InterBase suggests that Borland has set its sights on work flow.

### Meetings, Meetings

The leading category of messaging-centric applications is group scheduling and calendaring, which lets you plan meetings and allocate the use of resources such as conference rooms or audiovisual equipment. Microsoft's Schedule+, shipped as a part of Windows for Workgroups, may help grow the market, which is already addressed by PowerCore's Network Scheduler, Da Vinci's Coordinator, Futurus's Team, On Technology's ScheduleMaker, and Attachmate's ZipOffice.

While scheduling seems an ideal application for store-and-forward messaging, not everyone sees it that way. Campbell Services' (Southfield, MI) OnTime for Networks relies on Banyan (Westboro, MA) Vines RPCs to ensure the real-time response needed to reach quick consensus (see the text box "The Vines Advantage" on page 98).

"Message-based scheduling systems today don't do a good job of handling conflicts," says Anik Ganguly, vice president of product development at Campbell Services. However, OnTime does support a store-and-forward transport, because many Vines users can't afford the full-time WAN (wide-area network) links necessary for a true client/server system. Messaging also serves remote users who dial in to collect and send mail and then read and respond off-line.

Another promising application for messaging is user notification; for example, Texaco (Tulsa, OK) uses E-mail to coordinate employee activities when a tanker pulls into port. A series of synchronized actions must occur among oil terminal workers, ship crew, salespeople, and headquarters; the company uses the mail system to send automatic assignments and updates to employees. The goal is to reduce the potential for costly mistakes and seaport overtime charges of \$10,000 per hour, says consultant David Ferris of Ferris Networks (San Francisco, CA). User notification can also advertise job openings, company events, or changes in personnel policy.

Fort Howard (Green Bay, WI) has instituted an application that uses messaging to remotely manage the laptops that its field sales force uses. Rob Williams, a personal computer analyst for the firm, says that by using BeyondMail rules scripts and

DOS batch files, he can upgrade software in the field, change menu screens, and distribute new E-mail directories. Williams broadcasts mail containing codes that trigger BeyondMail rules running on the laptops. The rules uncompress the attached batch file, execute it while piping the screen to a DOS file, and send a message back with the screen-capture file attached. Williams can verify that the update has succeeded, or he can diagnose and fix any failures.

### Work Flow

Among the many potential applications for E-mail, the one that has sparked the most interest—and could provide the biggest payoff—is work-flow automation. Datapro Research (Delran, NJ) says that work-flow software will be a \$250 million market this year, while related hardware and software sales will amount to \$1.6 billion.

Work-flow packages digitally replicate existing business processes that involve routing paper or forms among employees (see figure 3). By using electronic forms riding on E-mail transports, users save paper, boost efficiency, and add intelligence to data distribution. But equally important, according to a Datapro report, organizations look to work flow as a means to reinvent the way they do business and create new structures.

"The whole way we work and manage will change," agrees Tom White, president of Action Technologies. "Work flow lets your work become more decision-related and less paper-related."

A frequently cited example of work flow is in processing travel expense reports. In such a system, an employee fills out an electronic expense form that is automatically routed to his or her manager for approval. After that, the form goes directly to accounting, or if the expense level is high enough to require additional approval, it is sent to the manager's boss. The routing of the form follows preprogrammed rules, typically described graphically or with scripts or both.

Other basic work-flow applications include purchase-order and invoice processing, vacation and leave requests, creation of sales proposals, engineering change orders, and editorial production flow. Beyond's Lee says that the company uses its own software for an automated sales-lead routing system. Names are entered into forms and sent to a virtual user acting on behalf of the firm's Paradox database. From the "application mailbox," BeyondMail's rules engine retrieves a message, extracts data values, and imports them into Paradox.

Work flow is a subset of groupware, which also includes shared-information systems such as Lotus Notes (see "Collaborative Computing" on page 112). The difference, says Esther Dyson, editor of the industry newsletter *Release 1.0*, is that Lotus Notes is a fundamentally passive system that makes no effort to track who gets what information or what they do with it, whereas work-flow systems play an active role in disseminating data to

the people who need it. She adds that intelligent routing is based on a combination of rules, events, and time.

Dyson divides the universe of work-flow applications into two categories: scripted work flows (also known as forms-based or E-mail-based routing) and work-flow tools that enforce process integrity. Into the first category she places BeyondMail and Reach Software's Workman; in the latter category, she calls Action "the conceptual leader." Says Dyson, "Action alone understands the relationships that underlie the flow

### Work-Flow Applications

- ◇ purchase-order processing
- ◇ travel expense reports
- ◇ sales-lead routing
- ◇ sales-proposal creation
- ◇ document management
- ◇ field sales-force automation
- ◇ non-real-time database access

# FIX YOUR PC FAST!

## DATA RECOVERY SOFTWARE

RESCUE



## RECOVER DATA FROM PHYSICALLY DAMAGED FLOPPIES & HARD DRIVES!

There's no other program like it anywhere! When you have a disk that returns GENERAL FAILURE READING DRIVE (X), **RESCUE™** will read it anyway!

**RESCUE™** bypasses DDS's inability to read disks that have been physically damaged and will move the drive heads directly!

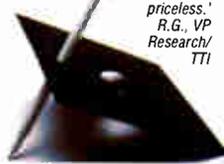
**RESCUE™** will even read a floppy that has a hole poked through it! You can recover all the data excluding, of course, the actual destroyed area.

This revolutionary program is now your first line of defense when it comes to recovering your valuable data. Save hundreds — even thousands — of dollars by doing your own data recovery! With **RESCUE™** you can perform miracles.\* Your data is too valuable not to have **RESCUE™** within reach! **CALL NOW FOR PRICING!**

\*Some failures may be beyond **RESCUE™**'s ability to recover data.

*"I've never seen anything like this... I was horrified when I thought I would be unable to recover 3 years worth of my research..."*

*RESCUE™ did exactly what you said it would... It's priceless."*  
R.G., VP Research/TTI



Encyclopedia of Hard Drives™

## THE LARGEST COMPILED REFERENCE ON HARD DRIVES AVAILABLE FOR THE PROFESSIONAL!

3 VOLUMES • OVER 1100 PAGES!

### VOLUME ONE...SET-UP GUIDE

- Interface Types and Installation
- Hard Drive Specs for over 1800 drives: Make, Model, Formatted Capacity, Data Heads, Cylinders, Average Seek Times, Form Factor, Height, Interface, Encoding, Landing Zone, Sectors Per-Track, Write Precompensation Cylinder, Reduced Write Current and Mean Time Between Failure.
- BIDS Drive Type Tables
- Directory of Manufacturers
- The Floppy Drive Cable
- Power Connector
- Pin Assignments and Specifications

### VOLUME TWO...DRIVE SETTINGS

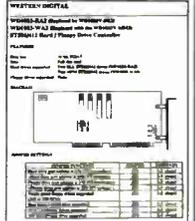
- Explanation of Jumper Types, Changes in Make & Model and Default Jumper Settings
- Diagrams for over 500 drives with: Specifications, Drive Sizes, Interface Types, Jumper Settings and Locations, Terminal Resistor Locations, Pin Assignments, Pin 1 Locations, Cable Type and Locations.

### VOLUME THREE...CONTROLLERS

- Over 275 Diagrams of Controllers with: Specifications, Card Sizes, Largest Head and Cylinder Sizes, Interface Type, Detailed Jumper Settings, Pin Assignments and Cable Locations.
- Controller to Drive Power Connections, Drive Activity L.E.D. Connections, Common Debug BIDS Format Codes and Default Jumper Settings

### PLUS...

- 1 year subscription with quarterly printed updates • On-line Bulletin Board for immediate access to the most current updates • Plus more! **CALL NOW FOR PRICING!**



NEW!

## THE LARGEST COMPILED REFERENCE ON MOTHER BOARDS EVER! 5 VOLUMES! HOT OFF THE PRESS!

Over 850 diagrams showing all necessary jumper, connection and component locations! Each diagram includes technical specs such as: processor, processor speed, chip set, max. onboard DRAM, SRAM cache, BIOS, dimensions, I/O options and NPU options. Also includes easy to understand tables giving configuration for: user settings, DRAM, SRAM, CPU type jumper and CPU speed jumper. **PLUS MUCH, MUCH MORE!**

**CALL NOW FOR PRICING!**



## EVERYTHING YOU NEED TO INSTALL, SET-UP AND OPTIMIZE HARD DRIVES!

The **Hard Disk Technical Guide™** is the most complete paperback on hard drives ever published. This 1992 version has 424 pages and is ideal for use in the field or office use!

- Set-up Specs for all drives from 1984 to present • Diagrams of the most common controller cards with jumper settings and functions • Diagrams and drive settings of common drives • Installation procedures • PLUS MUCH MORE!

**DrivePro™** the all-in-the utility for the most efficient and correct installation and maintenance of any hard drive!

- No more DEBUG - Finds and executes controller's on-board firmware
- No more FDISK - Full featured partition table creator and editor
- No more SETUP - View and edit BIOS drive type table and set CMOS
- No more FORMAT - High-level DOS format with operating system transfer
- Drive Table Override allows almost any BIOS to have a user definable drive type
- Drive boot fixer will solve drives that won't boot
- Complete drive diagnostic and performance tests and much, much more!



The Hard Drive Kit™

"The most comprehensive guide of disk drive and controller card specifications I have ever seen... will save any field technician valuable time... I use it at least twice a day and it's well worth the money I paid for it!" SB, Customer Services Division, NCR Corp.

Completely tune your hard drive to last longer and run faster with **OPTune™**, the fastest file defragmenter and disk optimizer. Also optimizes DOS structure • Verifies physical surface • Adjusts interleave setting • Moves data from bad clusters and much more! Automatically optimize files every time you turn on your computer! **PC World Best Buy!** **CALL NOW FOR PRICING!**

## PC DIAGNOSTICS THAT REALLY FIND THE BUGS!

The **Troubleshooter™**, a self-booting disk, is unlike other diagnostic programs that rely on DOS. The Troubleshooter™ bypasses DOS and tests all major hardware components directly for true accuracy while other programs frequently give erroneous test results. Works on DOS, UNIX, Novell, XENIX, OS/2, etc. Loaded with all the tests you need to quickly and accurately isolate the source of PC failures.

**PocketPost™**, the most compact and feature packed diagnostic Power-On Self Test (POST) Card in the world! You can debug dead PC's in less than 5 minutes! Jumper settings allow you to read the BIOS POST codes from 6 different addresses. Debugs XT, AT, Compaq, EISA, PS/2 (25/30) and compatible. 170 page manual includes the most complete source of BIOS codes in a single reference to allow instant translation of error codes. **AND MORE!** **CALL NOW FOR PRICING!**



The Troubleshooter Kit™

- Free Tech Support
- Performance Guaranteed
- Next Day Shipping

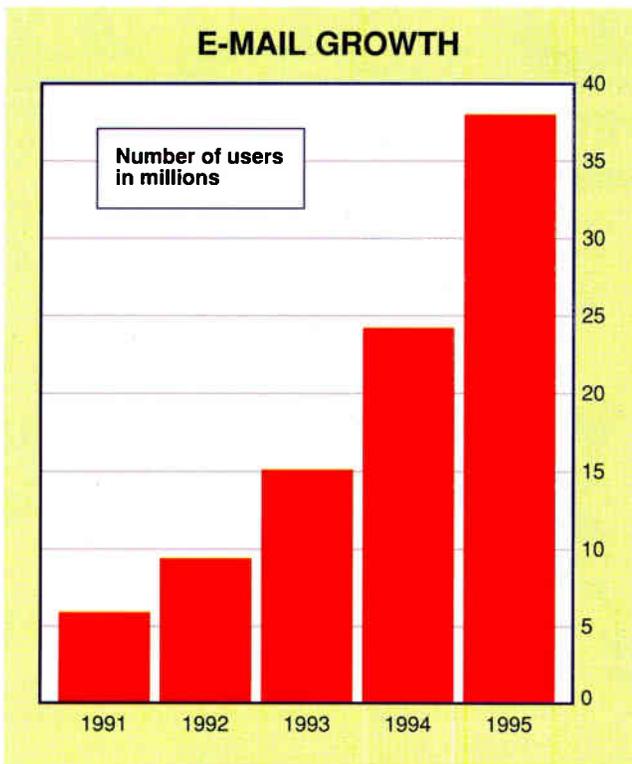
CALL     
**(800) 65-FIXED**  
**800-653-4933**

**AllMicro, Inc.**

1250 Rogers St. • Suite D • Clearwater, FL 34616  
(813) 446-6660 • Fax (813) 446-8075

Copyright © 1992, The Hard Drive Kit, and The Troubleshooter's Kit are trademarks of AllMicro, Inc. All Rights Reserved. Other names are trademarks of their associated owners. Specifications subject to change.

Circle 175 on Inquiry Card (RESELLERS: 176).



**Figure 2:** The number of E-mail users in the U.S. is expected to climb 60 percent this year over last year's levels; by 1995, the user base could reach 38 million. Accurate worldwide figures for E-mail are not available. (Source: The Yankee Group)

(see figure 2). By 1995, the figure could climb to 38 million. Meanwhile, the number of messages transmitted within Fortune 2000 firms in North America will surge from 6.1 billion in 1993 to 14.3 billion in 1995 (including both private E-mail and public services, such as MCI Mail and EasyLink), says the trade group the Electronic Mail Association (Arlington, VA).

The size of the potential network E-mail market is limited by the penetration of LANs. Only 42 percent of the estimated 47 million personal computers in the U.S. are connected by LANs, says market researcher Dataquest. That figure is projected to grow to 52 percent by 1996.

In the short term, the greatest problem facing enterprise-wide mail is that most of today's mail packages won't talk to one another (see "Mixed Messaging" on page 136). User woes include the inability to link different packages across heterogeneous networks and the thorny problem of how to synchronize distributed directories of network and mail users. For many, the best solutions are gateways from companies such as SoftSwitch (Wayne, PA) and Retix (Santa Monica, CA) that interconnect different mail platforms. In the long term, the emergence of mail standards (i.e., APIs, file formats, transports, and directory services) will ease the need for gateways (see the text box "Standards Coming, But Slowly" on page 96).

Aetna Life and Casualty Insurance (Hartford, CT), for example, has 36,000 employees on five E-mail systems—IBM PROFS, DEC All-In-1, cc:Mail, and Microsoft Mail for DOS and for the Mac—down from nine systems a few years ago. Kevin Ryan, director of E-mail services, says the firm uses a SoftSwitch messaging backbone to connect the different systems internally and X.400 gateways to talk with outside companies, primarily large

policyholders. But managing the system isn't easy. "E-mail directories are still cumbersome, overly complex, and not well understood by users," Ryan says. A company as large as Aetna has a lot of people coming and going. "You've got to propagate [directories] out to all post offices and keep all those changes in sync," he says. It's a labor-intensive process.

Until standards are in place, MIS managers must struggle to patch together disparate systems or force all employees to use the same software. The latter is nearly impossible for many organizations. Workgroups have already settled on different mail packages, and the MIS department must also support public services, such as MCI Mail or CompuServe, and legacy host-based mail packages, such as PROFS or All-In-1.

Integrating different software and services is technically possible. "It's just that some things are difficult or expensive," says consultant Amy Wohl of Wohl Associates (Bala Cynwyd, PA). "The real hurdles are administrative."

### E-Mail Applications

The types of applications that can capitalize on the E-mail infrastructure fall into two groups: mail-enabled (or mail-aware) programs (e.g., spreadsheets or word processors that also access mail services) and messaging-centric programs built specifically around E-mail transports and store-and-forward messaging.

A few packages, such as Software Publishing's Professional Write Plus, can already talk directly to mail services through custom interfaces. Now, by virtue of standards, such as Microsoft's MAPI (Messaging API) and the VIM (Vendor-Independent Messaging) interface from a rival group headed by Lotus Development (Cambridge, MA), developers can add mail access to any program. In the near term, the most common mail-enabled programs are likely to be versions of shrink-wrapped packages such as WordPerfect, Lotus 1-2-3, Excel, and Freelance Graphics. "It sounds simple," says analyst Mike Heylin of market researcher Creative Strategies Research International (Santa Clara, CA), "but [mail-enabled versions of familiar software] are what users want right now."

When Windows applications support mail APIs, for example, you will be able to select Mail from the File menu in the same way you choose Print. A compose-mail dialog box will pop up in the application, along with fields for addressing, priority, and other options. When you send the message, the spreadsheet or word processing file is automatically attached. In Windows and Mac systems (and with some DOS packages), the recipient can then launch the creating application directly from the mail attachment; if the application isn't available, many mail clients provide a means to view the file.

By tapping into messaging transports, mail-enabled programs will also be able to communicate with each other, much as they do now through virtual-circuit mechanisms such as DDE, OLE, and Apple Events. "We're very keen on doing mail-enabled applications," says Deloitte & Touche's Quinlan. The real reward, he says, comes from the ability to move data among applications. For example, Deloitte & Touche provides electronic meeting registration. Built using cc:Mail's import/export facility, the application lets auditors sign up for company seminars via E-mail. The company also provides automated audit software to its field staff, which uses E-mail to exchange audit workpapers. By hiding the mail capability within the application, Quinlan says, auditors can exchange data without being computer jocks.

Building on the foundations of VIM, cc:Mail, and Notes, Lotus plans to enhance its applications suite with workgroup capabilities, says Irene Greif, director of workgroup technologies. For example, the mail-enabled 1-2-3 for Windows 2.0, expected to ship early this year, will include technology called Version



# Standards Coming, But Slowly

**A**n industry executive once quipped that there was no clearer sign of the failure of E-mail than the success of the fax. People needed a fast, standardized way to exchange data and were willing to sacrifice the benefits of editable documents for the one-touch convenience of a fax.

Today the situation has improved, but it will be years before standards are established that make E-mail as easy to use as the phone or the fax. The charge toward standards is being fought on three fronts: mail APIs, transports, and file formats. A fourth category—directory services—is so complex that proprietary solutions may continue to dominate for the rest of this decade.

## Easy Access

The fight over mail APIs has garnered the most attention, perhaps out of proportion to its long-term importance. Microsoft touts the Windows-based MAPI (Messaging API), parts of which have already been added to Windows for Workgroups, while Lotus (Cambridge, MA) and others are promoting the cross-platform VIM (Vendor-Independent Messaging) API. Apple offers OCE (Open Collaborative Environment), but it also intends to support VIM. Novell (Provo, UT), IBM, and Borland (Scotts Valley, CA) back VIM, too.

The mail API battle has generated open hostility among the camps, but many observers view it as a red herring. "It doesn't matter what the mail API does," says Eugene Lee of Beyond (Cambridge, MA), "as long as I can run my application on your mail server."

The premise of MAPI is similar to that of the Windows printer architecture: It's an intervening layer that abstracts the behavior of the device on the other side of the interface (see figure A). MAPI specifies a series of 60 operating-system calls that invoke common mail actions such as send, receive, and mailbox management. A DLL performs the client mail services and interfaces to mail engines through what Microsoft calls the SPI (Service Provider Interface). Consequently, any MAPI-compliant Windows application can talk

through the DLL to any SPI-compliant mail engine. Hewlett-Packard, WordPerfect, DEC, SoftSwitch, Novell, Banyan, and AT&T have already committed to MAPI-enabling their mail engines.

Microsoft is shipping a subset of MAPI, known as Simple MAPI, in Windows for Workgroups, but it works only with the Microsoft Mail engine. The complete MAPI subsystem, known as Full MAPI, will operate only in Windows for DOS and Windows NT, and it won't be bundled with any operating system until late this year.

VIM takes a different approach. Instead of a set of routines that ship with the operating system, VIM is a specification for directly accessing mail engines from various client environments. Lotus will offer implementations for Windows and OS/2 clients talking to the cc:Mail engine, but other parties will have to provide VIM hooks for their respective engines or client environments. For example, Apple is expected to support OCE for Mac-only users but enable VIM access from the Mac for users who want to address other mail engines on other platforms.

Lotus promises to provide a subsystem to remap VIM calls to a MAPI back end, thus allowing VIM-compliant applications to talk to MAPI mail engines. Also, Microsoft and VIM supporters joined forces in a group called the XAPIA (X.400 API Association), which is creating a set of multiplatform Common Mail Calls that offer capabilities analogous to Simple MAPI.

But Suzan Fine, the MAPI product manager at Microsoft, argues that when standards are made generic enough to work across platforms, they forfeit richness and specificity. She says that developers writing complex messaging-based applications such as BBSes or work-flow systems will probably choose to work within a single environment, such as Windows with Extended MAPI. This offers them advanced features, such as folder management, while still allowing access from non-Windows systems via XAPIA.

Microsoft's main criticism of VIM, that it is too firmly tied into the cc:Mail

engine, rings hollow as long as MAPI works only with Microsoft Mail. For the balance of 1993, software developers will rewrite their applications to one or both of the mail APIs, and users will eventually be able to invoke mail capabilities from within their programs without giving a thought to what engine lies in the background.

## Free E-Mail

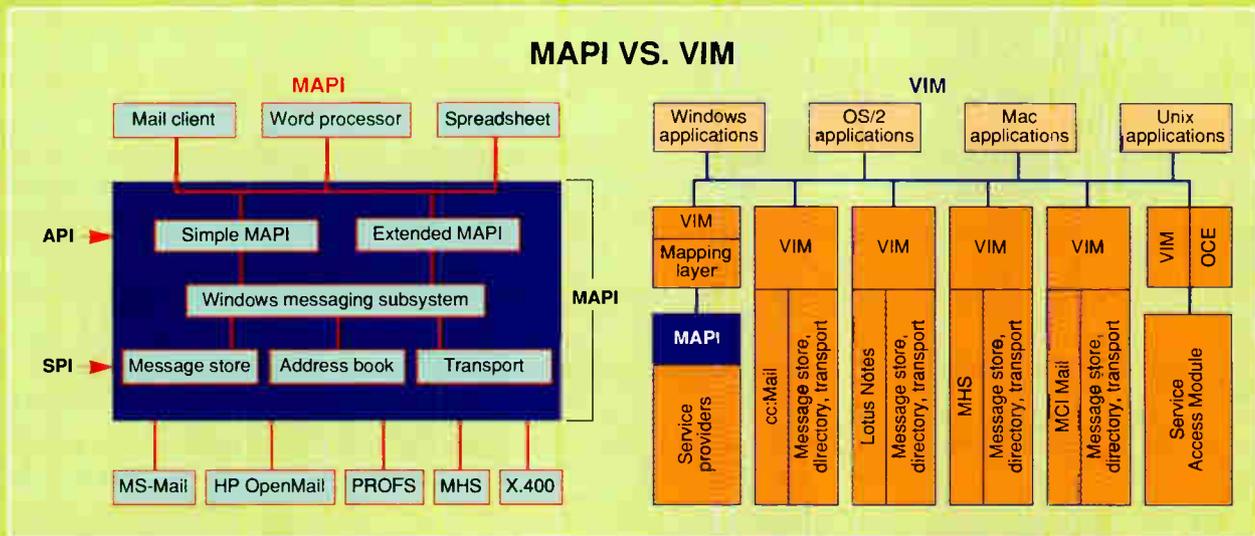
The inclusion of Simple MAPI in Windows for Workgroups points to a controversial result of separating mail clients and servers. To an increasing extent, the client will become a standard part of the operating system. Microsoft and Apple are moving in this direction. "What this means is that basic E-mail is free in the long run," says Beyond's Lee. In the future, he says, vendors will have to compete based on advanced features such as Beyond's rules engine, which helps users route E-mail and cope with message overload.

Not everybody agrees that the operating system is the best place for the mail client, however. Novell argues that, as a network function, mail needs to be cross-platform. Analyst Mike Heylin of Creative Strategies Research International (Santa Clara, CA) says that integrating E-mail into the operating system could discourage innovation by third parties. "Personal computing is not a monolithic structure," he says, "and Windows is starting to look more and more monolithic."

## Servers and Formats

VIM and MAPI do not address the issue of mail engines talking to one another. The solution is likely to come from international standards, specifically X.400, which defines a universal mail-transport protocol. Until now, X.400 hasn't been widely adopted for PC LAN-based mail systems, because it is complex and vendors were already committed to proprietary transports. The protocol is more widely applied outside the U.S., where there is greater demand for international standards.

People use X.400 mostly for mail backbones. Through a gateway such as



**Figure A:** Microsoft's MAPI and Lotus's VIM specifications offer top-level APIs that let applications talk to mail back ends. In the Windows-only MAPI, the layer interfaces to mail engines via drivers, while in the cross-platform VIM, the layer is actually part of the engine itself.

the Retix OpenServer 400, mail messages are translated from their native format into X.400 and then back to the same or a different format on the other side. But native X.400 mail servers are growing in popularity; for example, Microsoft is developing an X.400-based mail server for Windows NT.

Not everybody agrees that X.400 is the ultimate solution. Consultant David Ferris calls it the "lowest common denominator" and projects that it will be three to four years before X.400 becomes attractive. In today's market, he says, customers often decide that they are better off using proprietary mail switches from SoftSwitch (Wayne, PA) or DEC (Maynard, MA).

Even if you use X.400 natively or as a backbone, you face yet another problem for which no clear solution is in sight. "If the protocol situation is OK, and you've carefully unified the APIs and mail services, you still have to deal with incompatible file formats," says Nina Lytton, president of the consulting firm Open Systems Advisors (Boston, MA). "This is the big smoking gun."

For example, Lytton says, efforts are under way to standardize Windows and Mac calendar formats in group scheduling programs. But these efforts aren't

cross-platform, nor do they address access to Unix- and host-based calendaring systems. However, some vendors offer point-to-point file conversions, such as between Microsoft Schedule+ and IBM PROFS calendars.

One technology that may ease the file-format problem is Adobe's (Mountain View, CA) Acrobat, a portable document format that renders WYSIWYG documents correctly across platforms. Acrobat will make it possible to distribute complex documents via E-mail to users on an incompatible system. But while it provides accurate document display, its files won't be editable in initial releases of the software. You will still need file converters to collaborate on projects across platforms.

#### Directory Assistance

Most mail systems use incompatible naming conventions and addressing schemes. Naming inconsistencies mean that sometimes messages crossing gateways get lost and aren't delivered. To make matters worse, many LANs can't share their user directories with the mail systems that ride on top of them, which means that lists of LAN and mail users must be separately maintained and propagated throughout the network.

Help is on the way. NetWare 4.0 will replace the server-based Bindary user directory, which requires manual propagation from one server to another, with NetWare Directory Services, an open, networkwide, self-propagating user directory. For users of earlier versions of NetWare, Novell will also offer NetWare Global Messaging, an NLM (NetWare Loadable Module) implementation of MHS (Message Handling Service) that taps into the Bindary. Banyan will also target pre-NetWare 4.0 customers with a port of its directory services, StreetTalk, to the NetWare environment.

The long-term solution to directory services is another international standard, called X.500, that codifies directory structures and provides a way for directories on linked systems to find and query each other. X.500 is even further from wide-scale implementation than X.400 because it is complex and poses unresolved problems, such as how to limit the extent of a distributed search. Most analysts don't expect X.500 to be widely adopted until the late 1990s. Microsoft plans to use X.500 natively in its Windows NT-based messaging server, but many other mail and network software companies are taking a wait-and-see attitude.

# The Vines Advantage

JON UDELL

Vines users view the chaotic mail situation that prevails on most PC networks with Olympian detachment. They have enjoyed seamless global E-mail for eight years, thanks to Banyan's (Westboro, MA) legendary distributed name service, StreetTalk. As a result, Vines' modest 8 percent share of the PC network market includes several of the world's most sophisticated wide-area installations. "We see a lot of Fortune 1000 customers who use Vines as a backbone, with pockets of NetWare at the department level," says Robert Hankin, director of marketing for CCOM Information Systems (Iselin, NJ). CCOM's HelpLine is a mail-enabled help desk application that supports Vines mail, cc:Mail, and Microsoft Mail.

When an operator logs a call, HelpLine automatically mails the user a call reference number and then follows up with additional messages as the operator researches the problem. Running on Vines, HelpDesk exploits the fact that a user's StreetTalk ID is both a network address and an E-mail address. That identity eliminates the directory synchronization woes so vexing to administrators of other PC networks. Moreover, Vines' mail system exhibits a simplicity and robustness that so far eludes the Unix mail systems to which it is distantly related. "The mail engine and transports just work, without any fuss, on local- and wide-area networks," says Ted Kull, project manager for systems engineering at the Educational Testing Service (Princeton, NJ).

Has Vines, with its superb mail services, fostered a rich set of mail-enabled applications? Ironically, not yet. In part, that's because Banyan only recently released its Intelligent Messaging mod-

ule, which offers message compression, restartable transmission, multithreaded processing, and network management. These features make Vines mail an efficient handler of not only interpersonal message traffic but also the huge file transfer load that companies like Compaq were placing on it. Mostly, though, Vines users, like their Novell counterparts, are tire-kicking Reach Software's Workman, Beyond's BeyondMail, and Lotus's Notes, looking for ways to model organizational paper flow and transform it into mail-enabled software.

Some Vines developers have built custom forms-routing applications using the Vines gateway API, which, unlike the mail client API, can access all users' mailboxes. LANshark Systems (Reynoldsburg, OH), a developer of Vines utilities, has exploited the gateway API to build simple information servers that receive mailed requests for information and mail back files or the results of database queries. Because the data repository (e.g., a Paradox database) is not typically mail-enabled, this kind of application requires homegrown protocols and polling of shared directories. When mail awareness is as common as DDE support, says Scott Sharkey, president of LANshark Systems, you will see several more systems of communicating applications built on a mail substrate.

Sharkey is skeptical that Banyan's promised support for VIM (Vendor Independent Messaging) and MAPI (Messaging API) will smooth the way for Vines developers. "It would be like looking at the world through a periscope," he says. Neither API accommodates the richness of StreetTalk. Users of Vines 5.5, for example, can

attach a wealth of attributes to each item in the StreetTalk database. That means an application that encodes the rule "send a copy to Joe's supervisor" can look up the boss's name at run time. Until the APIs and directory services catch up with Vines, Sharkey plans to continue developing two versions of his software: one that fully exploits Vines and one for the rest of the world.

Sharkey may not have to wait long. The Vines ENS (Enterprise Network Services), which shipped last December, brings StreetTalk and the Vines mail APIs to NetWare 2.x and 3.x. Implemented as a dedicated Vines server, a NetWare VAP (value-added process) or NLM (NetWare loadable module) and a small DOS TSR program, Vines ENS threatens to steal the thunder of Novell's (Provo, UT) forthcoming NetWare 4.0. Automatically synchronizing StreetTalk with the NetWare bindery, ENS gives existing NetWare 2.x and 3.x installations the unified network view that would otherwise require an upgrade to NetWare 4.0.

Some Vines services may even run better on NetWare than on Vines. For example, the optional Intelligent Messaging module can use high-performance NetWare threads for its multithreaded message processing. Moreover, while mail-aware applications will need to be rewritten to exploit 4.0's new API, Sharkey says that his Vines applications run on ENS today as is. It's a smart move on Banyan's part, and one that brightens the future of mail-enabled software on NetWare LANs.

*Jon Udell is a BYTE senior technical editor at large. You can contact him on BIX as "judell."*

Manager, formerly code-named Chronicle, that facilitates sharing worksheet data.

Version Manager provides a new format for spreadsheet cell ranges that lets users import and export them as objects with attached properties such as version number, author name, and assumptions. For example, a colleague could mail a range object, not to your personal in-box, but to 1-2-3's in-box, from which the application would fetch it and incorporate it into a worksheet.

For workgroups, Version Manager lets you publish cell ranges into the Lotus Notes database, where they become separate entries. Greif says this will let groups work in parallel on spreadsheet projects while taking advantage of Lotus Notes features—data replication across servers, security, and the ability to sort and view messages by criteria such as author or region. The payoff comes for projects that require consolidating spreadsheets. Greif says, "Instead of waiting for everybody to finish and then doing

# THE BENCHMARK FOR HIGH PERFORMANCE

## 3.5-Inch Disk Drives

**Have It Your Way**  
Upgrade your AT™ system without changing the interface using a Model 2112A drive with IDE interface; upgrade any Workstation with the Model 2112 with Fast SCSI-2 interface

**Super Fast Performance**  
A 10ms Average Seek, a 5.56ms Average Latency and a 512K Buffer with Advanced Cache Management (SCSI models only)

**Multi-Segmented, Read-Ahead Cache**  
Permits multiple seeks to be serviced from the buffer without the delay of mechanical seeks and latency

**Write-Behind Cache**  
Provides up to a 300% improvement in write performance by managing writes to the disk

**Tagged Command Queuing**  
Increases data throughput by optimizing seek and latency and minimizing other delays (SCSI models only)

**Fast Command Processing**  
Cuts command processing time to as low as 180μs (IDE) or 350μs (SCSI)

Call 1-800-395-3748 for the name of your nearest Micropolis Authorized Distributor

### IDE (AT) INTERFACE

| Model Number | Formatted Capacity | Average Seek | Transfer Rate (MB/s) | 5-Year Warranty |
|--------------|--------------------|--------------|----------------------|-----------------|
| 2105 A       | 560 MB             | 10 ms        | 5 max*               | Yes             |
| 2112 A       | 1,050 MB           | 10 ms        | 5 max*               | Yes             |

\*Asynchronous



### FAST SCSI-2 INTERFACE

| Model Number | Formatted Capacity | Average Seek | Transfer Rate (MB/s) | 5-Year Warranty |
|--------------|--------------------|--------------|----------------------|-----------------|
| 2105         | 560 MB             | 10 ms        | 10 max               | Yes             |
| 2112         | 1,050 MB           | 10 ms        | 10 max               | Yes             |

# MICROPOLIS®

Micropolis is a registered trademark of Micropolis Corporation. AT is a registered trademark of IBM

Circle 107 on Inquiry Card.  
World Radio History

a massive roll-up, you'll be able to see incremental changes."

The same model could be applied to Ami Pro documents or Freelance Graphics slide shows, but Lotus hasn't committed to delivery dates for workgroup-enabled versions of these packages. "Our goal is to do more than just mail-enable our products," says Greif. "We want to build on the communications infrastructure by using both mail and databases."

Borland (Scotts Valley, CA) is keeping quiet about its E-mail strategy, but it is known to be developing a software architecture that will support an upcoming line of workgroup applications. Called Object Exchange, or OBEX, the architecture is built on BOCA (Borland's Object Component Architecture), which builds on the company's InterBase database engine. Borland will likely use VIM as the interface between applications and mail services.

As with other vendors' products, Borland's mail-enabled applications will let users send messages without exiting to a separate mail client. But the company's ultimate ambition is to harness mail as a medium for IAC (Interapplication Communication). The link to InterBase suggests that Borland has set its sights on work flow.

### Meetings, Meetings

The leading category of messaging-centric applications is group scheduling and calendaring, which lets you plan meetings and allocate the use of resources such as conference rooms or audiovisual equipment. Microsoft's Schedule+, shipped as a part of Windows for Workgroups, may help grow the market, which is already addressed by PowerCore's Network Scheduler, Da Vinci's Coordinator, Futurus's Team, On Technology's ScheduleMaker, and Attachmate's ZipOffice.

While scheduling seems an ideal application for store-and-forward messaging, not everyone sees it that way. Campbell Services' (Southfield, MI) OnTime for Networks relies on Banyan (Westboro, MA) Vines RPCs to ensure the real-time response needed to reach quick consensus (see the text box "The Vines Advantage" on page 98).

"Message-based scheduling systems today don't do a good job of handling conflicts," says Anik Ganguly, vice president of product development at Campbell Services. However, OnTime does support a store-and-forward transport, because many Vines users can't afford the full-time WAN (wide-area network) links necessary for a true client/server system. Messaging also serves remote users who dial in to collect and send mail and then read and respond off-line.

Another promising application for messaging is user notification; for example, Texaco (Tulsa, OK) uses E-mail to coordinate employee activities when a tanker pulls into port. A series of synchronized actions must occur among oil terminal workers, ship crew, salespeople, and headquarters; the company uses the mail system to send automatic assignments and updates to employees. The goal is to reduce the potential for costly mistakes and seaport overtime charges of \$10,000 per hour, says consultant David Ferris of Ferris Networks (San Francisco, CA). User notification can also advertise job openings, company events, or changes in personnel policy.

Fort Howard (Green Bay, WI) has instituted an application that uses messaging to remotely manage the laptops that its field sales force uses. Rob Williams, a personal computer analyst for the firm, says that by using BeyondMail rules scripts and

DOS batch files, he can upgrade software in the field, change menu screens, and distribute new E-mail directories. Williams broadcasts mail containing codes that trigger BeyondMail rules running on the laptops. The rules uncompress the attached batch file, execute it while piping the screen to a DOS file, and send a message back with the screen-capture file attached. Williams can verify that the update has succeeded, or he can diagnose and fix any failures.

### Work Flow

Among the many potential applications for E-mail, the one that has sparked the most interest—and could provide the biggest payoff—is work-flow automation. Datapro Research (Delran, NJ) says that work-flow software will be a \$250 million market this year, while related hardware and software sales will amount to \$1.6 billion.

Work-flow packages digitally replicate existing business processes that involve routing paper or forms among employees (see figure 3). By using electronic forms riding on E-mail transports, users save paper, boost efficiency, and add intelligence to data distribution. But equally important, according to a Datapro report, organizations look to work flow as a means to reinvent the way they do business and create new structures.

"The whole way we work and manage will change," agrees Tom White, president of Action Technologies. "Work flow lets your work become more decision-related and less paper-related."

A frequently cited example of work flow is in processing travel expense reports. In such a system, an employee fills out an electronic expense form that is automatically routed to his or her manager for approval. After that, the form goes directly to accounting, or if the expense level is high enough to require additional approval, it is sent to the manager's boss. The routing of the form follows preprogrammed rules, typically described graphically or with scripts or both.

Other basic work-flow applications include purchase-order and invoice processing, vacation and leave requests, creation of sales proposals, engineering change orders, and editorial production flow. Beyond's Lee says that the company uses its own software for an automated sales-lead routing system. Names are entered into forms and sent to a virtual user acting on behalf of the firm's Paradox database. From the "application mailbox," BeyondMail's rules engine retrieves a message, extracts data values, and imports them into Paradox.

Work flow is a subset of groupware, which also includes shared-information systems such as Lotus Notes (see "Collaborative Computing" on page 112). The difference, says Esther Dyson, editor of the industry newsletter *Release 1.0*, is that Lotus Notes is a fundamentally passive system that makes no effort to track who gets what information or what they do with it, whereas work-flow systems play an active role in disseminating data to

the people who need it. She adds that intelligent routing is based on a combination of rules, events, and time.

Dyson divides the universe of work-flow applications into two categories: scripted work flows (also known as forms-based or E-mail-based routing) and work-flow tools that enforce process integrity. Into the first category she places BeyondMail and Reach Software's Workman; in the latter category, she calls Action "the conceptual leader." Says Dyson, "Action alone understands the relationships that underlie the flow

### Work-Flow Applications

- ❖ purchase-order processing
- ❖ travel expense reports
- ❖ sales-lead routing
- ❖ sales-proposal creation
- ❖ document management
- ❖ field sales-force automation
- ❖ non-real-time database access

# The death Has been greatly exaggerated of DOS

DOS is still the preferred operating system on over 80% of the PCs in Fortune 1,000 companies, according to recent studies.

## Bring Windowing Advantages to DOS.

Many Fortune 1,000 companies are using DESQview™ as the best solution for keeping the dependability and familiarity of DOS programs and adding multi-tasking, windowing productivity. DESQview users give up nothing—since it actually runs MS Windows better

should users wish to run Windows programs.

As you may know, DESQview 386 has been around for years, evolving into a highly efficient multitasking, windowing environment that extends the power of DOS, giving you increased productivity while conserving precious memory and disk space. In fact, the vast majority of 386 and 486 PCs need no additional memory or disk space to run DESQview.

DESQview 386 gives you pre-emptive multitasking like OS/2, but with 1/20th of the disk space and 1/20th of the memory requirements. It gives you windowing like MS Windows, but with greater speed and efficiency and fewer 'crashes.' And DESQview lets you use a mouse or stick to the keyboard.

## You Create the Standards; We Follow.

We've never been confused about our role. We believe software companies exist to make your job easier and your working day more productive. When publishers step out of that mold and begin to tell you what hardware you need and that you should throw out



somebody else's perfectly good software—well, they simply are not operating in your best interest.

Software publishers don't create standards. You do. And whatever standard you choose, we support it.

If you like a program that only runs in MS Windows, like Wordperfect for Windows, DESQview 386 supports your choice. If you prefer a spreadsheet that runs in DOS, Lotus 1-2-3 Release 3, for example, we support that too. In fact, DESQview 386 lets you run

your favorite DOS and Windows programs side-by-side.

## Have Your Cake and Eat It, Too.

DESQview 386 comes with QEMM-386, the number one memory management utility, and Quarterdeck Manifest, the award-winning memory analysis and monitoring program. Between them, they assure you every last 'K' of memory is put to use\*. In many cases, QEMM can mean the difference between running the TSRs you want and not having enough memory.

And DESQview is an open doorway to the future, too. Our next step up, DESQview/X, opens your PC to a network full of possibilities, including graphic workstation standards—X Window System software—all while retaining the compatibility of DESQview.

If you're as committed to DOS as we are, and feeling left out by the so-called industry leaders, take heart. There's no reason to leave DOS. If more productivity is what you need, we can provide it.

Quarterdeck helps you get the most out of the hardware and software you own today.

# Quarterdeck

Quarterdeck Office Systems, 150 Pico Boulevard, Santa Monica, CA 90405 (310) 392-9851 Fax (310) 314-4219  
Quarterdeck International Ltd., B.I.M. House, Crofton Terrace, Dun Laoghaire Co. Dublin, Ireland Tel.(353) (1) 284-1444 Fax: (353) (1) 284-4380

\* DESQview makes multitasking and windowing available to users of 286-class machines with similar memory efficiencies through QEMM-50/60 for IBM™ PS/50 and 60 users and QRAM for other 286 users.  
©1992 Quarterdeck Office Systems. Trademarks are property of their respective owners.

of work and provide the framework for completion of tasks, as opposed to stepping through actions.”

Dyson identifies three basic architectures for work-flow systems. BeyondMail typifies the first type: user- or client-based. Systems such as Beyond’s, she says, are tools for individuals to automate their interactions with other people and applications (see screen 1). While Beyond doesn’t use a centralized model, you can create virtual users in the mail system (e.g., Beyond’s use of Paradox) that receive messages and act on them according to rules.

Beyond’s work-flow capabilities spring from the rules engine it provides for filtering and sorting mail. Company president and CEO Chuck Digate says that BeyondMail offers a bottom-up, ad hoc approach to automation: Using the BeyondRules scripting language and BeyondMail Forms Designer, users set up their own rules for tasks ranging from personal mail management to complex forms routing. The package is available for DOS and Windows clients, and it supports Novell MHS and Banyan Vines mail engines. The company also sells a version of BeyondMail that acts as a front end for Lotus Notes.

BeyondMail lacks graphical tools for diagramming work flow, such as those supported by Reach Software’s Workman. But Workman requires a more top-down approach, in which processes are targeted for automation and then work flows are engineered. With BeyondMail, “users get mail first, and then they

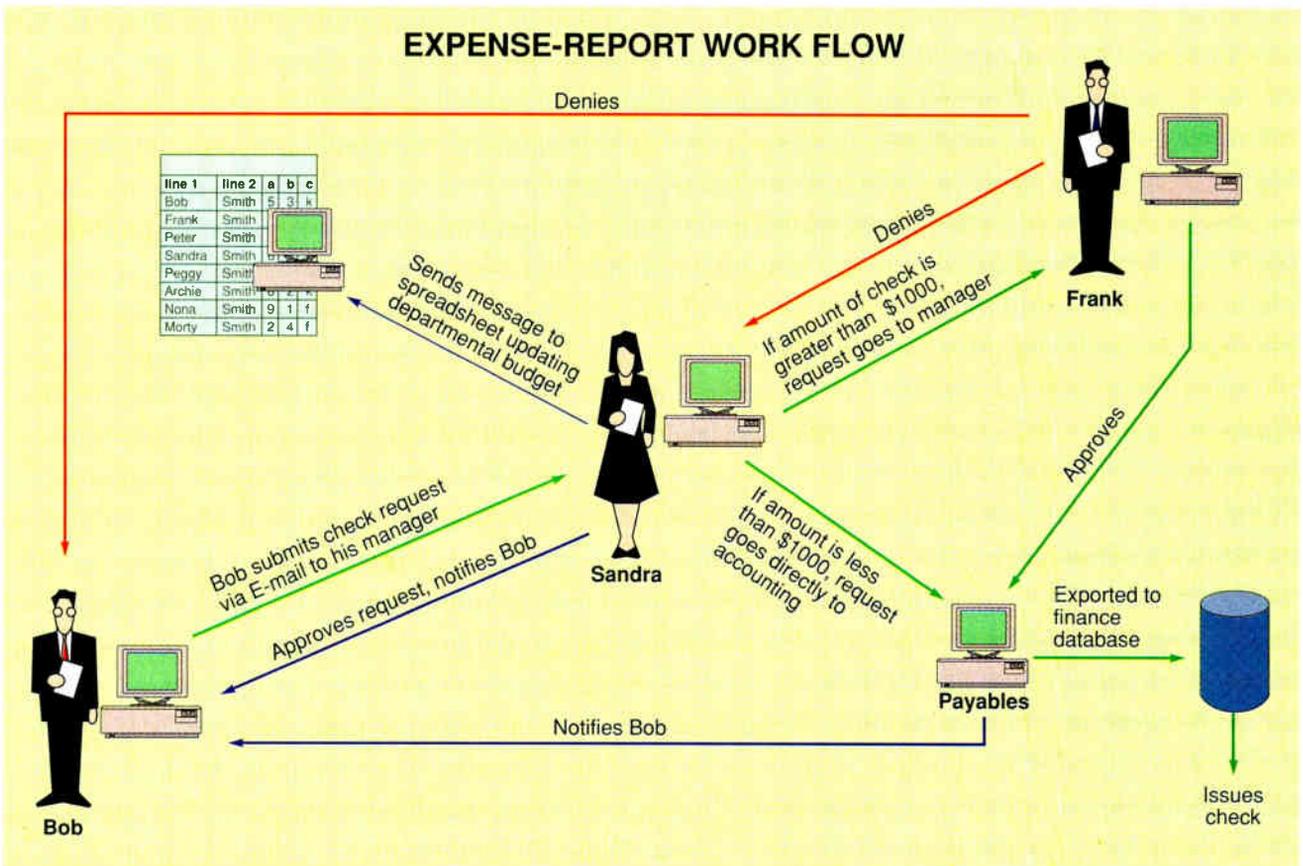
can add incremental functions,” says Digate.

The second type of work-flow system is object- or agent-based, exemplified by Workman. Forms in Workman carry the intelligence that each client needs to process the form correctly (see screen 2). Workman treats data as objects, letting you view the underlying values through a variety of forms. Each form has active fields that can invoke specific actions, such as calling an external database; the form design decides which fields are active or even visible to each user.

As with user-based systems, agent-based systems usually use E-mail transports. But Hewlett-Packard’s NewWave, for example, uses an object repository and proprietary internal circuits to pass agents around the Windows environment. While Workman doesn’t use a central database to manage the work flow, information about the status of each form is reported back to a database for tracking and reporting. Workman runs under Windows and supports MHS, NetWare Global Messaging, and Vines mail systems.

The routing engine, which lives on client systems, is programmed through a combination of graphics tools and scripts; objects can flow on paths through the organization—serial, parallel, or looped, depending on actions taken at each step. The status of objects is stored in a Btrieve database (Reach Software plans to support a SQL engine this year as well), and a Query/Select tool lets you define management views of work-flow status.

*continued*



**Figure 3:** A prototypical work flow is processing check requisitions. In this example, Bob submits a request by filling out an electronic form, which is automatically routed to his manager, Sandra, who can approve or deny the request. If the amount is greater than \$1000, Sandra’s boss Frank must also add his digital signature. The approved form is forwarded automatically to accounts payables. At several steps along the way, information about the transaction is sent to other software packages, such as a spreadsheet and the finance department’s database.



# Don't Shoot It, Troubleshoot It.

**LANDMARK... the widest selection of PC diagnostic software, firmware, and hardware in the world!**

## PC WON'T BOOT? KICKSTART IT!

Don't replace your motherboard, 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!



*"The number of tests KickStart 2 can perform is mind-boggling... IF THE KICKSTART 2 CAN'T FIND THE PROBLEM, IT PROBABLY EXISTS IN YOUR HEAD, not in the hardware."*  
Rich Santalesa, Computer Shopper

*"KickStart 2 system diagnostics board helps users check out virtually every aspect of a PC's hardware system... THE BOARD IS A WORTHY INVESTMENT for computer maintenance."*  
David Claiborne, PC Week

Built-in serial and parallel I/O *allows for testing remote 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 for quick future use. On-board switches, LEDs, and digital displays allow complete control over testing in systems lacking video or disk.

KickStart 2 is the ultimate **SECURITY CARD**, too. With two levels of password protection and pre-O/S activation, you can confidently prevent unauthorized use of your PC.

Includes serial and parallel loopback plugs and the Landmark **JumpStart™** AT ROM BIOS for testing ATs that don't issue POST codes. KickStart 2 works independent of your operating system. You can use it on DOS or UNIX systems. **CALL for current pricing.**

## PROFESSIONAL LEVEL PC TROUBLESHOOTING

Landmark **Service Diagnostics™** is ideal for professionals requiring the most exhaustive diagnostic test capabilities.

Service Diagnostics is not just a single product, but a complete LINE of products. It's comprised of software, hardware, and firmware so you can choose the best "tool" for the job.



When your PC won't boot, you'll need **ROM POST** firmware, a plug-in chip that virtually "jumpstarts" the system to determine what's wrong. And, when your printer isn't working, you won't know whether it's the LPT port, cable, or printer without hardware, like our loopback plugs (which together with our software completely test the COM ports).

To provide you a complete troubleshooting resource, Service Diagnostics is offered in single modules or in "kits." Components include: CPU-specific software (PC, XT, AT, 386/486, PS/2), ROM POSTS (PC, XT, AT) and floppy alignment disks (3.5" and 5.25").

All the Service Diagnostics software modules are available in self-booting versions for use with non-DOS operating systems like UNIX.

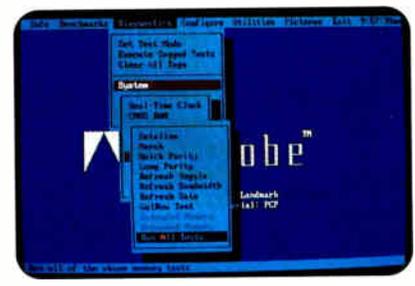
Service Diagnostics is powerful and flexible. Hundreds of tests can be performed on your motherboard, memory, video, COM ports, floppy and hard drives, printer, and more. **CALL for a customized quote on the kit that's right for you!**

## PC DIAGNOSTICS MADE EASY

You don't need to be technical to use **PC Probe™**. With clear, intuitive, pull-down menus and 206 pages of on-line help, troubleshooting your PC is truly **MADE EASY!**

And, you don't have to be handy with a screwdriver to make PC Probe pay for itself. Just by providing a diagnostic report to your service and repair shop, you'll save money and receive quicker service.

PC Probe runs over 150 tests including: motherboard and CPU, memory, video card and display, keyboard, COM ports, floppy drive and controller, hard drive and controller, and more. Includes **VirusCure**, Landmark **Speed Test**, **AT Setup** & loopback plugs. **CALL for current pricing!**



## SLASH HARD DISK SET-UP TIME

If you install, upgrade, or maintain hard drives, then you need **DiskBase™**. It'll save you boat-loads of time and money by putting the exact hard disk information you need at your fingertips... whenever you need it.

DiskBase reveals 12 technical specs on over 2500 hard disk drive models and 8 technical specs on over 220 controllers. Once you've located the correct hard disk model, you can instantly bring up a listing of all compatible controllers. **CALL for current pricing!**

- TOLL FREE TECH SUPPORT
- 90 DAY PERFORMANCE GUARANTEE
- ORDER DIRECT: NEW HOURS EST  
Mon - Thur: 8AM - 9PM, Fri: 8AM - 6PM, Sat: 10AM - 3PM

# CALL (800) 683-6696

FAX (813) 443-6603 • Int'l (813) 443-1331

**LANDMARK**  
RESEARCH INTERNATIONAL CORPORATION  
703 Grand Central Street • Clearwater, FL 34616



## THE 5 MINUTE SOLUTION TO FLOPPY DRIVE FAILURE

With **AlignIt™** you can clean, diagnose, and align your floppy drives in minutes without a scope. Patented technology requires only a screwdriver to perform ANSI-accurate alignments (.3 mils).

AlignIt is ideal for corporate users with multiple PCs. The **GOLD STANDARD** feature allows you to align all your PCs to the same in-house standard, guaranteeing that all your floppies are perfectly interchangeable between PCs! Available in 3.5" or 5.25" for both high and low densities. **CALL for current pricing.**

Copyright © 1992, PC Probe, AlignIt, KickStart, JumpStart, ROM POST, Service Diagnostics, DiskBase, and Speed Test are trademarks of Landmark Research International Corp. All Rights Reserved. Other names are trademarks of their associated owners.

Circle 148 on Inquiry Card (RESELLERS: 149).  
World Radio History

# Waiting for the ultimate UNIX system?

# MEET YOUR DESTINY...

**Consensys V4.2 is a licensed implementation of UNIX<sup>®</sup>SVR4.2 developed by USL and Consensys Corp. Its new features include:**

- Veritas Journaling Filesystem for high performance and reliability.
- Desktop Manager with a point-and-click X-based interface to applications and system administration.
- Full iBCS2 support, including compatibility for XENIX and SCO UNIX applications.
- NFS- and RFS-based TCP/IP networking (client & server) with simple network administration.
- PC-Interface for DOS/Windows network connectivity.
- ANSI C Language Development System, with enhanced graphical debugger.
- Simplified Installation.
- Online Manual Pages.
- Support for a wide range of disk controllers, network cards and other peripherals.

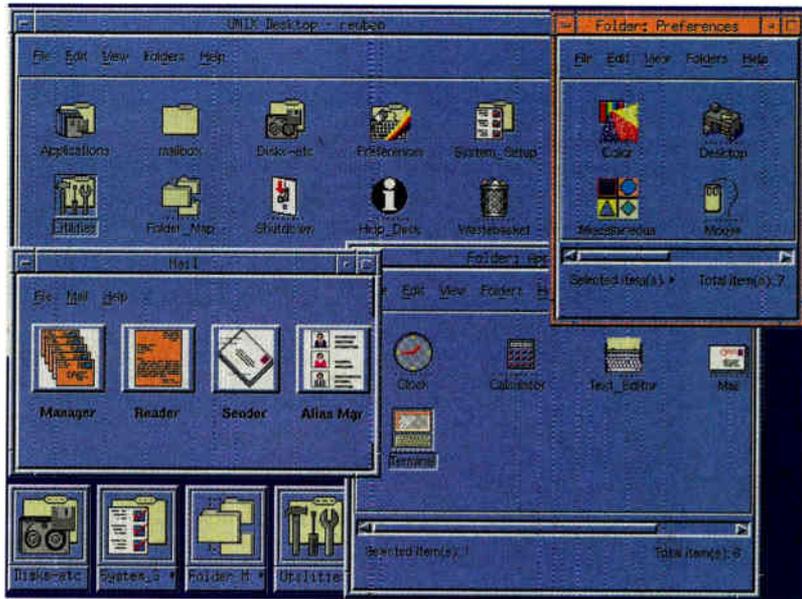
For more information about V4.2, including details of special upgrade prices for users of older versions of UNIX, please call or fax us.

**Phone: 1-800-388-1896**  
**FAX: 1-416-940-2903**  
**Outside USA: 1-416-940-2900**

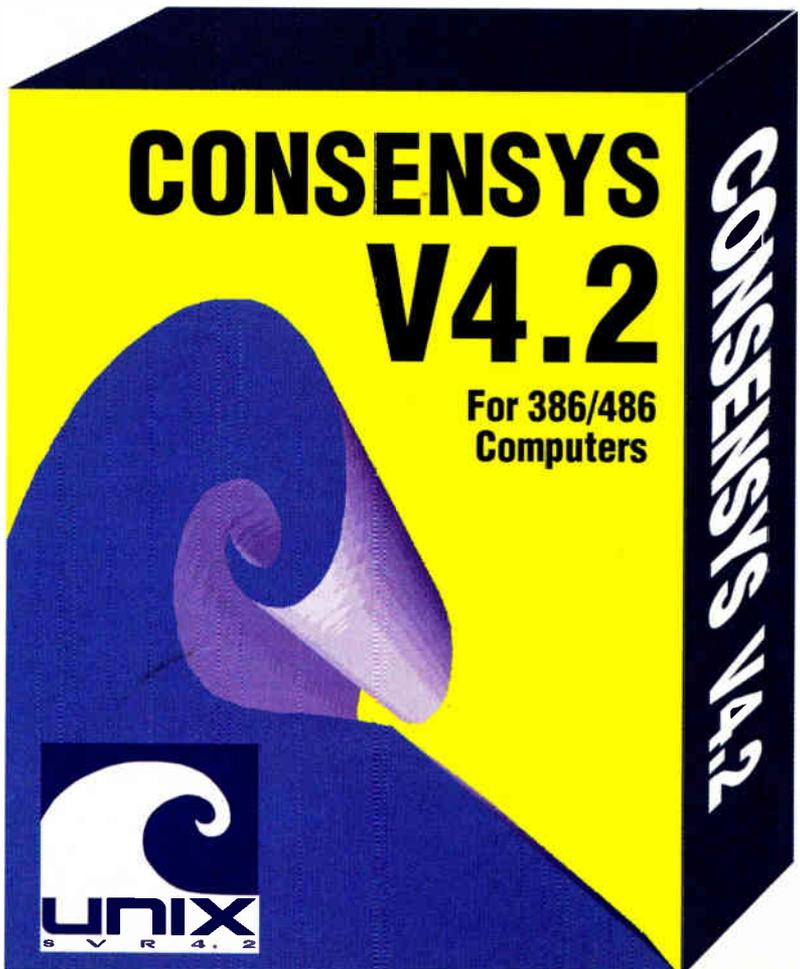
**CONSENSYS CORPORATION** 1301 Pat Booker Rd.  
Universal City, TX  
78148

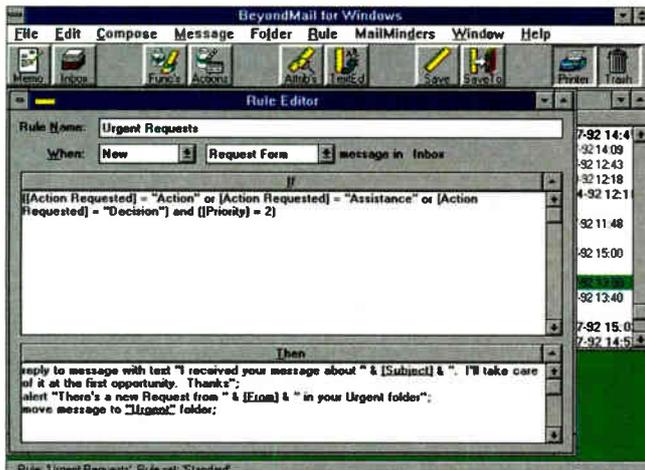
Trademarks|Owner: Consensys, V4.2|Consensys Corp.; UNIX|UNIX System Laboratories, Inc.; SCO|The Santa Cruz Operation; XENIX|Microsoft Corp.

**Circle 186 on Inquiry Card (RESELLERS: 187).**



Suggested List Price for Consensys V4.2 starts at \$395 for the Desktop Platform and \$995 for the Unlimited User Platform. A complete V4.2 system, including networking and C Development, is priced at \$995 for the Desktop version and \$1495 for Unlimited Users.





**Screen 1:** *BeyondMail's Urgent Request rule takes advantage of the product's forms capability. If a form is marked urgent, the Urgent Request rule informs the sender that the form was received, alerts the recipient that an urgent request has arrived, and moves the request message to the recipient's urgent folder.*

Workman also supports easy connections to other programs, through DDE scripts, calls to SQL databases, and support for DLLs. Mike Spies, vice president of marketing for Reach Software, says, "It's not enough just to move things around; you have to provide a means to process information through integration with other applications."

Spies says that one major difference between Workman and Action's work-flow tools is that Workman is client-based. "Server-based technology is limited to those who can gain access to the server," he says. Store-and-forward allows easier implementation and administration, relieves bandwidth crunch on LANs, and makes it easier for remote users to use the system.

Inventa (Cupertino, CA), a consulting firm specializing in software development, uses Workman to help implement work-flow systems for clients. "Most people aren't thinking 'I'm going to buy a work-flow engine,'" says Ken Santoro, vice president of the firm. "They want to automate purchase orders or sales leads." To make work flow successful, he adds, "you have to build applications that automate processes, not just tasks."

Action represents the third type of work-flow architecture—server-based systems. These systems build around a single logical center, although the database itself can be physically distributed. By actively monitoring the status of tasks throughout a system, Dyson says, a server-based system makes it easier for a central administrator to track work flow (see screen 3). Systems built this way also enjoy benefits from piggybacking on a relational database engine, including the availability of tools for managing transaction processing.

Best known for developing MHS and The Coordinator, Action is concentrating its efforts solely on work-flow software. An implementation of the company's Workflow Management System tools will be sold by Lotus as an add-on for Lotus Notes 3.0. Action's software is available only on an OEM basis.

Action's Workflow Management System includes a workflow designer and an applications builder for connecting work flows into external applications, such as E-mail or databases. The work-flow server stores information about the status of work flows in a relational database, and the reporting tool lets you manage work flows and inspect your performance.

An Action customer and a maker of document-imaging systems

# The league's toughest expansion team.



Introducing a full range of rugged slot solutions.

When it comes to PC expansion, Texas Micro offers the best computer systems in the field.

We now offer systems that have 5, 10, 14 or 20 ISA or EISA slots. So there's a system for applications with space restrictions, such as embedded control, all the way up to applications that require numerous peripherals and option boards.



These chassis are not only ruggedized for industrial environments, but they have passive backplanes to make option board and CPU upgrades easy. Desktop, tower and rackmount configurations are available. And each is competitively priced.

So call today for price and specification literature. And find out what makes Texas Micro so hard to beat.



**Call 1-800-627-8700.**

©1993 Texas Micro, Inc. The Intel Inside logo is a registered trademark of Intel Corporation.

Circle 154 on Inquiry Card.

MARCH 1993 • BYTE 105

# PROTECT YOUR SOFTWARE

**FREE!**  
Authorization Button.  
Call 800-258-5061



**NO BUTTON,  
NO ACCESS.**

Dallas Semiconductor is re-shaping the world of software protection and distribution control with a new family of microchips called Buttons. We put the lid on software piracy by packaging microchips in button-shaped, stainless steel cans. The chips contain missing but critical information to make the software run.

We offer a variety of Authorization Buttons and features so you can select the level of protection and price point that are right for you.

### Security Continuum

| Button Type         | Unique Serial # | Read/Write Memory | Password Protection | Expiration Timer | Decoy Responses |
|---------------------|-----------------|-------------------|---------------------|------------------|-----------------|
| DS1420 ID Button    | X               |                   |                     |                  |                 |
| DS1427 Time Button  | X               | 4K bits           |                     | X                |                 |
| DS1425 Multi Button | X               | 2K bits           | X                   |                  | X               |

### Snap In, Snap Out

Authorization Buttons interface to the installed base of 100+ million PC's via the DS1410 Button Holder. They simply snap in and out. The DS1410 accepts two Buttons concurrently.

### Toward a Dongleless World

New computers that accept Buttons directly, including palm and notebooks, are being designed at OEM's today. Our Dongle Trade-In Program will help in your transition to this world. With an approved application, we'll pay you \$7.00 for each dongle that you trade in for an Authorization Button and Holder. This offer is good until August 31, 1993. The one-piece price for the DS1420 is \$4.35; volume discounts apply.



### We're Serious About Security

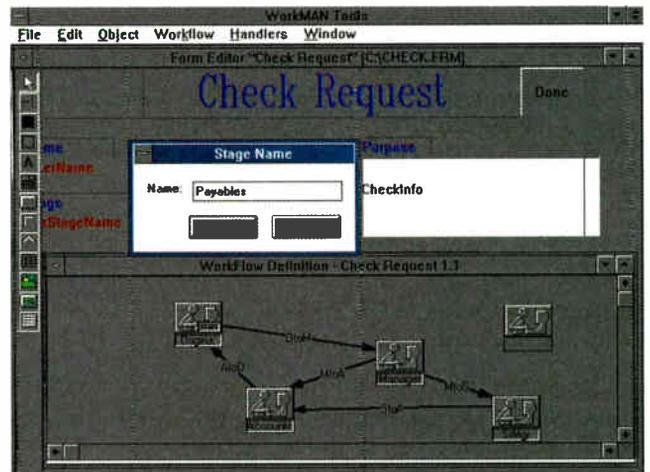
At Dallas Semiconductor, we design and manufacture our own microchips. And we're the only ones in the software protection business who do. Sixty intricate process steps and a 64-bit unique registration number lasered into each chip prevent duplication.

To learn how to button down your software, give us a call.

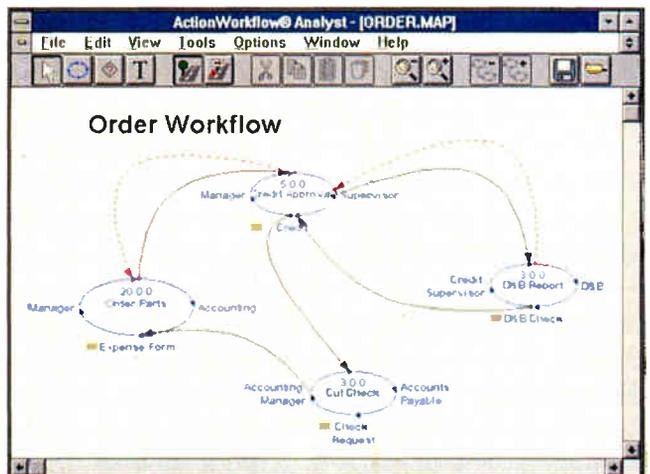
**DALLAS  
SEMICONDUCTOR**

4401 South Beltwood Parkway, Dallas, Texas 75244-3292  
Telephone: 214-450-8170 FAX: 214-450-3715

## E-MAIL



**Screen 2:** Workman adds to forms the intelligence needed to process them correctly. Active fields can invoke specific actions, such as calling an external database. The form editor, shown here, lets the form designer decide which fields are active or even visible to each user.



**Screen 3:** Action's Workflow Management System is server-based, which allows easier tracking of work flow. It includes a work-flow designer and an applications builder for connecting work flows into external applications, such as E-mail or databases.

for PC LANs, LaserData (Tyngsboro, MA) plans to resell Action's tools starting in the second half of this year, and it is also incorporating work-flow technology into a document management system set for release by the third quarter. Rodney Rogers, vice president of engineering for LaserData, says Action's advantage is that the work flow and task status are monitored and controlled by a central database. "Coded into its design is the knowledge of what is to be done," he says. By comparison, client-based products offer less control. "Nothing [in client-based systems] tracks the state of completion of tasks," he says. "This can be built, but it's part of the application, not the underlying work-flow engine."

Another Action customer is Verimation AB, a Swedish maker of PC LAN and host-based E-mail systems and a pioneer in developing intelligent electronic forms and routing systems for

"Recommended."  
Jerry Pournelle, Byte, July 1992

# Inside Out

SupraFAXModem V.32bis Internal  
**\$349.95** Dos/Windows



Inside or Out, now you can choose the hot-selling SupraFAXModem technology that best fits your computer. Either way, Supra can turn your PC into a communications powerhouse!

SupraFAXModems come in a wide range of models, from our budget-minded SupraFAXModem 24/96i to the fastest fax modem available: the SupraFAXModem V.32bis. Whichever model you choose, you will get Supra's proven technology and reputation for high-quality, reliable modems.

Supra modems are designed for novice and expert communicators alike. Whether you use DOS™, Windows™, or a Macintosh™, we've got a package for you — and our

Featuring  
**Rockwell**  
Modem Technology

## The Best Choice: SupraFAXModem

packages include everything you need. Plus our easy-to-follow Getting Started manuals will help you install your modem and start using it in just a few minutes! Imagine sending and receiving perfect faxes, exploring the world of on-line databases, or retrieving an important work file — all from the convenience of your desk. And advanced users will appreciate the error-correction and data-compression features that can save you money!



SupraFAXModem V.32bis External  
**\$399.95** Stand Alone  
**\$439.95** Dos/Windows



No matter what your needs, a Supra modem is your best choice. Call us today at **1-800-727-8647**, and find out why!

| MODEL                 | INT./EXT. | FAX        | DATA   | V.42bis & MNP 5 | MAX THROUGHPUT |
|-----------------------|-----------|------------|--------|-----------------|----------------|
| SupraFAXModem V.32bis | E,I       | 14,400 S/R | 14,400 | yes             | 57,600         |
| SupraFAXModem 24/96i  | E         | 9600 S/R   | 2400   | yes             | 28,800         |
| SupraFAXModem Plus    | E         | 9600 S/R   | 2400   | yes             | 9600           |
| SupraFAXModem 24/96i  | I         | 9600 S/R   | 2400   | no              | 28,800         |

**DOS Package** includes modem, Fax Talk™ Plus, COMIt™, cables, manuals • **Windows Package** includes modem, Winfax™, cables, manuals

All trademarks belong to their respective companies. 7101 Supra Drive S.W., Albany, OR 97321 USA • 503-967-2411 • Fax 503-967-2401  
World Radio History

CALLER ID  
AVAILABLE NOW



Circle 173 on Inquiry Card.

# The Time Has Come...

...to send for the latest copy of the free Consumer Information Catalog.

It lists more than 200 free or low-cost government publications on topics like money, food, jobs, children, cars, health, and federal benefits.

Don't waste another minute, send today for the latest free Catalog and a free sample booklet. Send your name and address to:

**Consumer Information Center  
Department TH  
Pueblo, Colorado 81009**



A public service of this publication and the Consumer Information Center of the U.S. General Services Administration

## E-MAIL

mainframes. Adam Sroczynski, president of Verimation's U.S. subsidiary, says that his company chose Action because its features met customer demand for process management capabilities. "I don't think you can take BeyondMail very far in terms of reengineering your business," he says. "How can you manage and improve a process that's controlled by the user? You need a more top-down approach."

Sroczynski says that work-flow customers typically have two demands. First, they want a tool that helps to improve processes, find bottlenecks, and reduce cycle times. Second, "they want to remove the definition of routing from the form application itself and put it into a server process so that they can replicate those functions elsewhere." Verimation is shipping an E-mail package called Memo LAN that incorporates Action tools for creating ad hoc work flows; in the third or fourth quarter of this year, new releases will add Action's front-end work-flow design and management tools, as well as the ability to access the Action work-flow server from a mainframe.

In addition to Beyond, Reach Software, and Action, other players in the work-flow software market include HP, Recognition Equipment/Plexus (Dallas, TX) (which supplies the Unix-based technology used in NCR's ProcessIt work-flow system), and Workhorse (Dublin, Ireland). Keyfile (Nashua, NH) and FileNet (Costa Mesa, CA) market work-flow-oriented document-image-processing systems, while JetForm (Ottawa, Ont.), Da Vinci Systems, and Delrina (Toronto, Ont.) offer forms-routing packages. The recently merged PowerCore (Manteno, IL) and Finansa (London, U.K.) plan to deliver a work-flow package in the third quarter, and Microsoft is rumored to be developing a work-flow capability for Windows, code-named Calvin and Hobbes. In the host world, IBM's OfficeVision/VM and DEC's All-In-1 offer mail management and forms-routing capabilities.

### Users Lead the Way

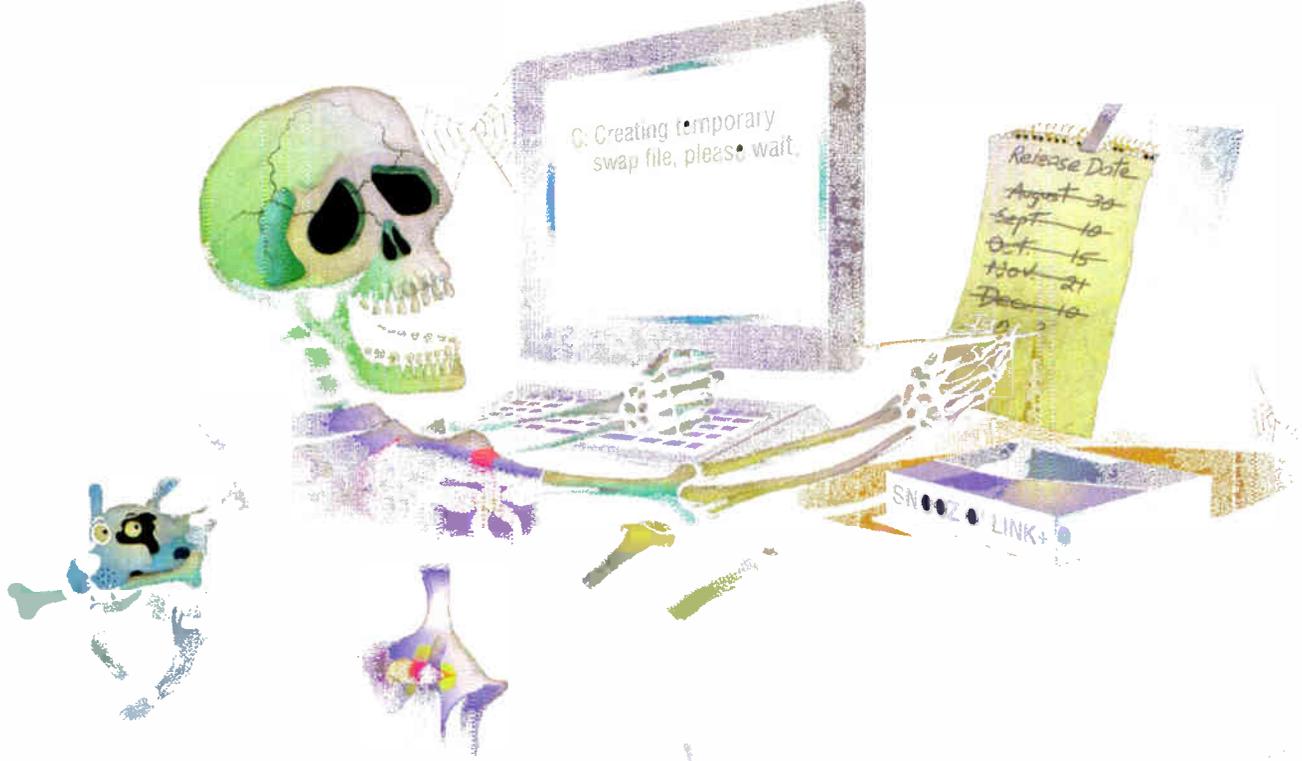
At many firms, says consultant Ferris, the people installing E-mail are technical-support staff more focused on making the hardware and software work than on its potential for reducing costs or enabling new applications. Without the involvement of senior information executives, he says, the investment in E-mail infrastructure may not be fully harvested.

Fortunately, says Reach Software's Spies, a growing number of customers are realizing that messaging applications afford an opportunity to reengineer their businesses. "This whole thing is being driven by users who have needs and are looking for solutions," he says. "Instead of having something foisted on them by vendors, this is a rare instance where users are way ahead." Messaging is becoming the foundation of a new information infrastructure, because it's simple and cheap compared to other techniques for IAC and distributed computing. The pending arrival of mail-enabled applications will expose users as never before to E-mail's power as a data distribution medium. The next step is to implement work-flow automation.

Best of all, messaging and work flow build naturally on the most important resource of all—human capital—by giving employees tools to do their jobs better. "You don't even have to explain this stuff to people," says Nick Rudd, the chief information officer for advertising agency Young & Rubicam (New York). "It mirrors the reality of what they deal with every day." ■

Editor's note: Also contributing to this story were BYTE senior news editor Tom Halfhill, senior technical editor Jon Udell, and news editors Dave Andrews and Ed Perratore.

Andy Reinhardt is BYTE's West Coast bureau chief. You can reach him on BIX as "areinhardt."



# How much longer can you afford to wait?

## Create Overlaid Programs-Fast.

BLINKER™, the world's first and fastest dynamic overlay linker, reduces your link time to seconds and reduces program memory requirements. Now you can use one linker for all your software projects.

## One Linker, Many Languages.

BLINKER 2.0 links and automatically overlays DOS programs written in Microsoft® C, BASIC, Assembler, QuickBASIC™, Fortran, Pascal, Watcom™ C, Zortech® C++, Clipper®, FORCE® and in Borland® C, C++, Assembler, and more.

## Save Time and Memory.

BLINKER removes the need for overlay structures, simplifies program design and reduces memory requirements to save you time, effort and memory.

## Memory Swap Function.

BLINKER is the ONLY linker to offer an integrated memory swap function, so you can run other large programs from within your program, with negligible memory overhead.



**BLINKER™**  
High Performance Dynamic Overlay Linker

## Don't Settle for Less.

Other major features include full CodeView® support, use of EMS/XMS at program run time, and enhanced execution speed of overlaid code.

## Time is Money.

BLINKER offers all this in a fraction of the time it takes to link with your current overlay linker. You know time is money, and link time is no exception.

## Free Demo

To try our free demo on your own code



**Call: 804-747-6700** or  
**FAX: 804-747-4200**

## Order now!

If you can't wait any longer, we offer a risk free 30 day money back guarantee.

Available in 5.25" or 3.5" diskette format.

**Price \$299**  
plus shipping & handling



**Blinkinc**  
P.O. Box 7154  
Richmond VA  
23221

© 1991 Blinkinc. Blinker is a trademark of ASM, Inc. Offer only applicable in US and Canada.

Circle 171 on Inquiry Card (RESELLERS: 172).

World Radio History

# WE'RE ONLINE. AND IN LINE WITH YOUR OBJECTIVES.

- BUSINESS WEEK
- AEROSPACE DAILY
- AIRPORTS
- AVIATION DAILY
- AVIATION WEEK & SPACE TECHNOLOGY
- BIOTECHNOLOGY NEWSWATCH
- BYTE
- CHEMICAL ENGINEERING
- CLEAN-COAL/SYNFUELS LETTER
- COAL WEEK
- DATA COMMUNICATIONS
- ELECTRIC UTILITY WEEK
- ENGINEERING NEWS-RECORD
- HAZARDOUS WASTE BUSINESS
- INDEPENDENT POWER REPORT
- INDUSTRIAL ENERGY BULLETIN
- INSIDE ENERGY/  
WITH FEDERAL LANDS
- INSIDE F.E.R.C.

- INSIDE N.R.C.
- INTEGRATED WASTE MANAGEMENT
- LAN TIMES
- NUCLEONICS WEEK
- POSTGRADUATE MEDICINE
- PLATT'S INTERNATIONAL  
PETROCHEMICAL REPORT
- PLATT'S OILGRAM NEWS
- PLATT'S OILGRAM PRICE REPORT
- S&P'S EMERGING & SPECIAL  
SITUATIONS
- S&P'S REVIEW OF BANKING  
& FINANCIAL SERVICES
- S&P'S REVIEW OF SECURITIES  
& COMMODITIES REGULATION
- SECURITIES WEEK
- TECH TRANSFER REPORT
- UTILITY ENVIRONMENT REPORT
- THE WEEKLY OF BUSINESS AVIATION
- UNIXWORLD
- AND MORE . . .

When you need business information, why not get the total story, instantly! Word for word. The McGraw-Hill Publications Online database gives you just that. Unedited, full-text retrieval (except graphics) of articles exactly as they are published in McGraw-Hill magazines and newsletters.

Now you can get information on companies, people and products on any topic — pertaining to one particular industry, or search the entire McGraw-Hill library (over 35 leading publications online) for diverse editorial perspectives. Only McGraw-Hill, the world's foremost business information publisher, can deliver it all so completely — immediately! McGraw-Hill unabridged.

Access an entire universe of business information. Go online with our line. McGraw-Hill Publications OnLine. For more information, including our latest list of publications, contact Andrea Broadbent at (609) 426-5523. Or fax this coupon to (609) 426-7352.

Or send it to the address below.

Available through Dialog®, Dow Jones News/Retrieval®, NewsNet® and Nexis®.

## McGRAW-HILL PUBLICATIONS ONLINE



Princeton-Hightstown Road  
Hightstown, NJ 08520 U.S.A.

Please send me the complete 1992 list of your publications online. BY

Name

Title

Company

Address

Civ  State

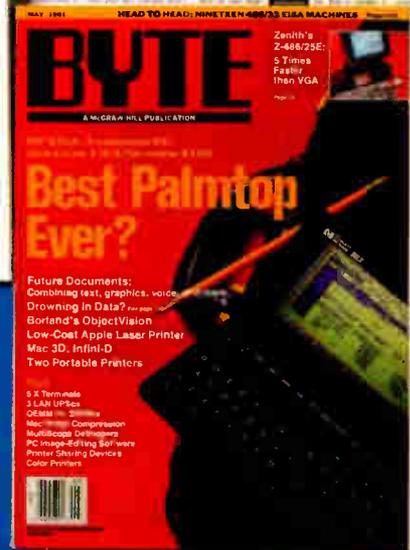
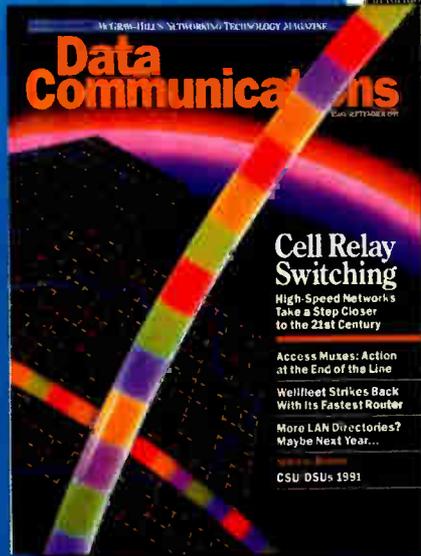
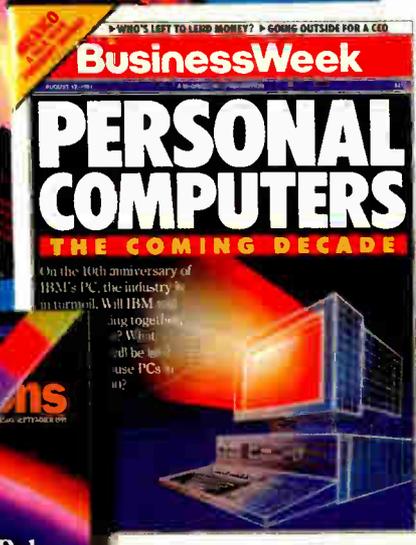
Zip/Postal Code  Country

Tel.

GO ON LINE WITH OUR LINE.

# Your network buy for today's business technology market.

**McGraw-Hill TechNet**



## McGraw-Hill Magazines. Your Best Business Partners.

- 4- Architectural Record ■ 7- A/C Flyer, Aviation Week & Space Technology, AW & ST China Quarterly, AW & ST USSR, Business & Commercial Aviation, World Aviation Directory and Buyer's Guide ■ 20- Business Week, Business Week China, Business Week Hungary, Business Week International, Business Week USSR
- 28- Chemical Engineering ■ 32C- BYTE, Data Communications, Data Communications International, LAN Times, UnixWorld ■ 39-Electrical World ■ 41- ENR, Construction News Publishing Network (11 magazines, 4 newspapers) ■ 46- Global Finance ■ H6- The Physician & Sportsmedicine, Postgraduate Medicine
- 114- Modern Plastics, Modern Plastics International ■ 117- Power, Power International





# COLLABORATIVE COMPUTING

Computer-aided teamwork will change your office culture forever

JEFFREY HSU AND TONY LOCKWOOD

**C**ollaborative computing is a catchphrase for a new body of software and hardware that helps people work better together. A collaborative system creates an environment in which people can share information without the constraints of time and space.

Network groupware applications link workgroups across a room or across the globe. The software gives the group a common, on-line venue for meetings, and it lets all members labor on the same data simultaneously.

Collaborative applications include calendar management, video teleconferencing, computer teleconferencing, integrated team support, and support for business meetings and group authoring. Messaging and E-mail systems represent the most basic type of groupware.

"I hear of new groupware products every day," says David Coleman, conference chair of Groupware '93, a trade show to be held this August in Palo Alto, California. Coleman expects to list more than 400 products from over 250 companies in a catalog scheduled to be published later this year.

Sales of workgroup software are soaring, according to WorkGroup Technologies (Hampton, NH). Sales for 1992 were \$1.3 billion worldwide; this year, projections call for \$1.93 billion in worldwide sales.

## No Commander Datas

The best that any of these products can do is to put text, data, and graphics together in an integrated groupware package, creating what's known as *comprehensive workgroup support*. For example, Instant Update from On Technologies (Cambridge, MA) is a product for the Mac that lets you create and manipulate tabular data as well as import graphics into your documents. Some packages, such as GroupSystems from Venetana (Tucson, AZ), provide transparent access to other applications residing on your server.

Although an integrated groupware system allows you to bring supporting applications and information into your collaborative environment, some researchers, such as Robert Johansen from the Institute for the Future and Mark Stefik

from Xerox's PARC (Palo Alto Research Center), hope to extend this support by bringing in artificial team members that can interact with a workgroup. These expert-system and AI technologies provide you with software entities called *agents* that constantly rummage through information warehouses, seeking the data that you need. These info-houses are part of your collaborative work environment and are continually fed new information from the workgroup and other data streams that you develop. Like parts constantly arriving at a busy factory, data flows non-stop into your info-house. The agents serve as receiving clerks, routing data to you and your workgroup.

"In the short run, it's more likely that, instead of a Commander Data [the android on the TV show *Star Trek: The Next Generation*], you're going to have an information refinery that will be a part of your collaborative work environment," says Johansen. "You would have individual agents, programmed by team members, pulling out that information they want."

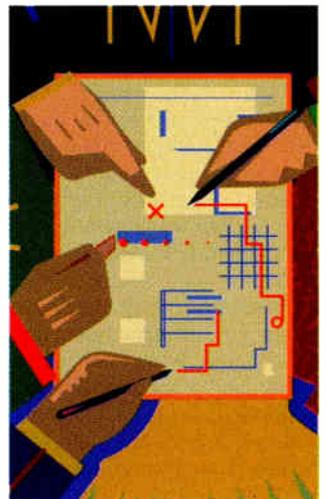
## Designed to Help

There are three fundamental aspects of collaborative systems: common task, shared environment, and time/space. The first measures the extent to which the members of a

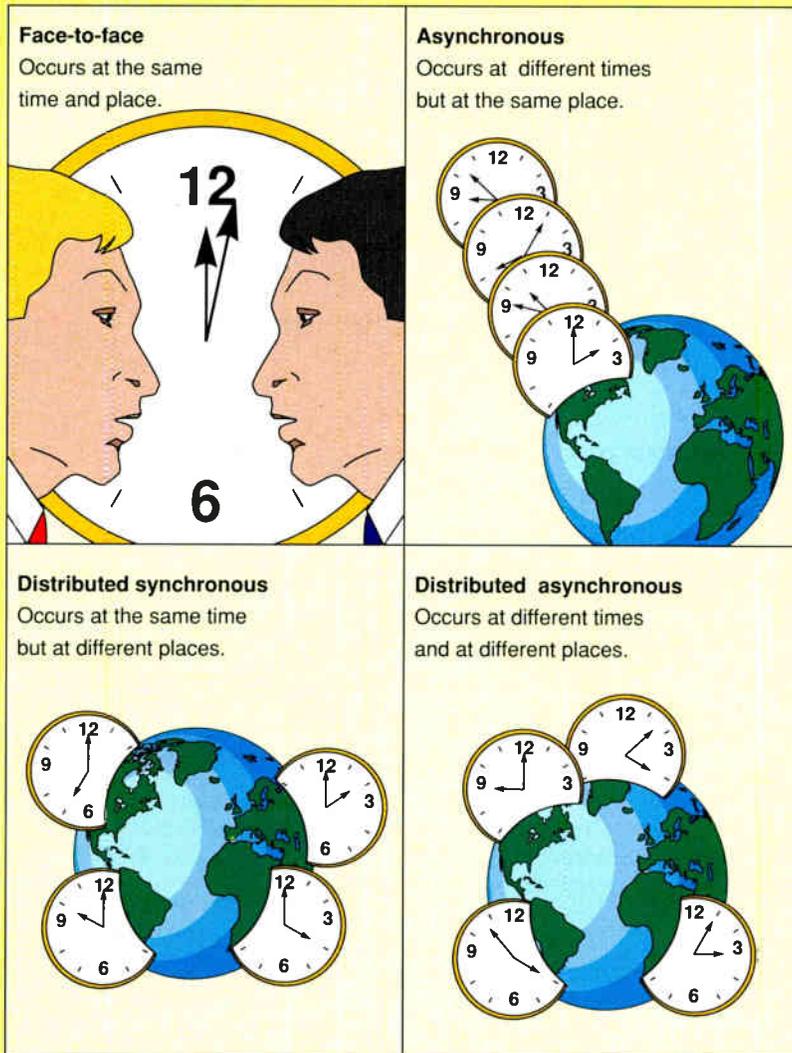
**Collaborative Computing**  
BY JEFFREY HSU AND TONY LOCKWOOD  
**112**

**Hitting Warp Speed for LANs**  
BY MARK A. CLARKSON  
**123**

**Better Than Being There**  
BY TOM YAGER  
**129**



## TYPES OF COLLABORATIVE INTERACTION



Workgroup interaction can occur in the following dimensions of time and space: face-to-face, same place at different times, same time at different places, and different times and places.

workgroup can work on the same task. If the system allows many people to work on the same task, it ranks high on the common-task spectrum (e.g., a software design system that lets programmers interact frequently in real time on a module of code).

A strong shared-environment system keeps you informed of what a project's condition is, what your coparticipants are doing, and what atmosphere or setting is supported. An E-mail system that simply sends messages back and forth isn't high on the shared-environment scale. However, an electronic classroom—with its

emulation of traditional classroom settings, including blackboard windows, lists of students, and questions/responses—rates much higher.

Time/space collaborative systems focus on the time and place of the interaction (see the figure). Face-to-face, or *synchronous*, interaction is at the same time and place. *Asynchronous* interaction occurs at one place at different times. If the interaction is at the same time but at different places, it's *distributed synchronous* interaction. And interaction at different places and times is *distributed asynchronous* interaction.

### System Types

E-mail, computer-teleconferencing, real-time-teleconferencing, and video-teleconferencing systems all help to create or to support electronic meetings. Meeting environments are created through text and graphics on computer terminals or via audio and video transmitted from one location to another. Computer-teleconferencing systems (e.g., BIX and CompuServe) represent an extension of the messaging and E-mail system models.

Real-time teleconferencing—such as Team WorkStation, a research system designed by Hiroshi Ishii of the Nippon Telegraph & Telephone's Human Interface Laboratories (Kanagawa, Japan)—is an example of distributed synchronous interaction. It allows participants in different locations to interact.

Another approach to real-time teleconferencing places a single-user application in a computer-teleconferencing environment. Information is exchanged among multiple users using a protocol that determines who has the floor at any given time.

Unlike computer teleconferencing, in video teleconferencing, video and audio connections link meeting rooms or networked workgroups. Participants can see and hear other members of the dispersed group (see "Better Than Being There" on page 129).

Electronic whiteboards, or live boards, electronically mimic the whiteboard that you find in many conference rooms. In this working environment, each member of a workgroup has a terminal on which to work and can broadcast results to everyone else's screen.

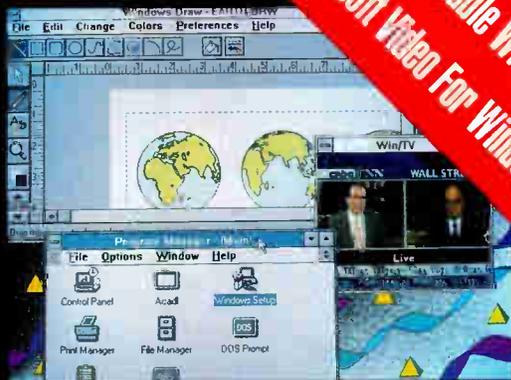
Xerox PARC developed an advanced electronic whiteboard that uses a projected LCD. Each participant in a meeting gets a stylus that allows him or her to write on the whiteboard from anywhere in the room. Xerox has connected the system to a network and has even used it to connect remote sites (see "The Electronic Whiteboard," July 1992 BYTE, page 166). At this writing, Xerox is in the process of setting up a commercial unit to sell the system.

Notable Technologies (Foster City, CA) recently announced Shared Whiteboard, communications software for Go Corp.'s PenPoint operating system that creates a real-time connection between two pen systems. It uses a phone line to transmit graphics and text between remote locations. A second phone line is needed for voice communications. David Larson, Notable Technologies' vice president of sales and marketing, says the company is working on a version that will allow more than two users to participate.

*continued*

# PICTURE WINDOWS.

Now Available With Microsoft Video For Windows



*You're never out of touch with your own personal "Windows on the World"!*



*Resize or reposition your Win/TV window anywhere on the screen—while running other Windows applications.*



*Capture the perfect "still" with "Frame Grabber" feature—great for presentations with impact.*

## Hauppauge!

Hauppauge Computer Works, Inc.  
91 Cabot Court • Hauppauge, N.Y. 11788  
In N.Y.: Tel: (516) 434-1600 • Fax (516) 434-3198  
Toll Free: 800-443-6284 • In Europe: (+9)-2161-17063

Circle 88 on Inquiry Card.

**Picture This...** a real-time television monitor built right into your PC... Now, picture using this monitor while running Windows™ 3 applications at the same time... And, picture taking that video image and resizing, (right down to crystal-clear icon size!) or clicking and dragging it to any position on the screen as easily as moving any other Window...

**Picture Perfect.** With Win/TV's "frame grabber" you capture and save any "still" frame and save it to disk. Using Win/TV and Microsoft® Video for Windows™, you capture FULL MOTION VIDEO, saving synchronized video and audio clips to disk. You can then send those video and audio files across the network. Seamlessly integrate still and full motion video images into productive multimedia applications such as databases or training and marketing presentations... or give your E-mail a powerful new dimension!

Any Windows 3 user can access 122 channel television reception with the built-in tuner, PLUS two additional video sources, (such as VCR, video camera, laser disk, etc..) all with stereo audio capability! Automatically fit real-time video images into any size Window while running your other Windows 3 programs. *Hauppauge Computer Works* introduces **Win/TV™**, the Windows television adapter

**Picture Yourself** owning your own "Windows on the World"! Maybe you want to work on your spreadsheets but don't want to miss an important news flash or a current stock market report. **Win/TV** is perfect for you. Keep an eye on current events while keeping control of your inventory... No problem!

Get the new Win/TV and open a window on some fresh, new, and exciting possibilities.

**Suggested Retail: \$495.00**

**PC Connection™**

PC Connection, call:  
1-800-243-8088

**MicroWAREHOUSE**

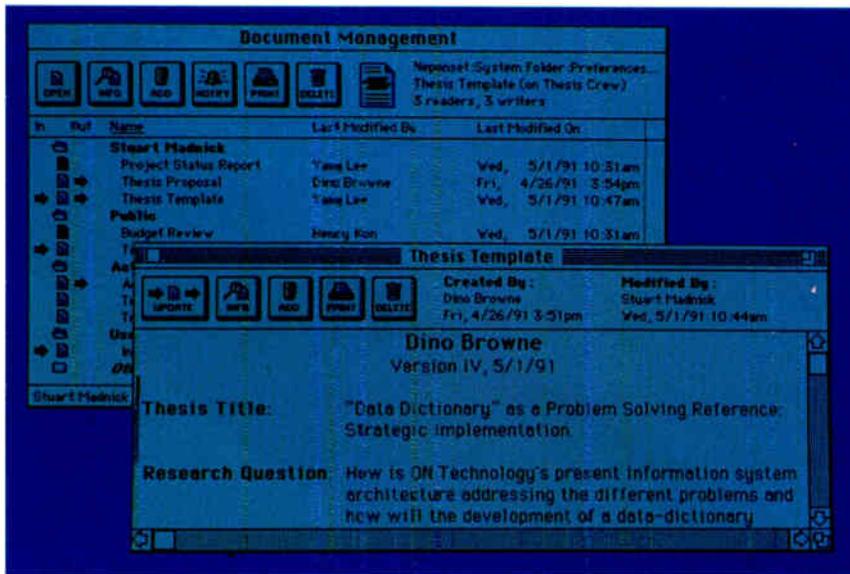
Micro Warehouse, call:  
1-800-367-7080

Trademarks: Win/TV is a trademark of Hauppauge Computer Works, Inc., Windows 3 is a trademark of Microsoft Corp.

World Radio History



PC Zone: 1-800-258-0270  
Please mention code 21244 when ordering.



Instant Update uses arrows to indicate updated documents. In the foreground, you see who made changes and when. (Screen courtesy of On Technology)

## Collaborative Writing

Multuser editors and group-authoring systems are able to bring a workgroup's collective input to bear during the creation and editing of a document. Such collaborative systems can be either real-time or asynchronous.

If the authoring system is real-time, it lets several participants edit a document at the same time by parceling out logical segments of the document to members of the group. The system controls the read/write access to the various segments (e.g., the Group Writer facility in GroupSystems).

Asynchronous editors, such as Instant Update, store both the original text and the reviewers' comments. This allows a document manager to evaluate all comments before making final changes (see the screen).

Thomas W. Malone, director of the MIT Center for Coordination Science (Cambridge, MA) and developer of the research collaborative systems Information Lense and Oval, sees group-authoring systems evolving beyond document creation/editing systems. Malone envisions workgroups collectively creating knowledge networks that describe real-world objects or ideas. The networks would connect those ideas and objects and use hypertext-like links to represent the relationships and dependencies among the items. "These knowledge networks will be viewable through a variety of displaying and summarizing tools," says Malone. "They will be shareable across global networks and readable, browsable, and searchable" by you and

your computer.

Conversational structuring, used in Coordinator II, an asynchronous groupware application published by Da Vinci Systems (Raleigh, NC), allows the structure of a workgroup's conversations to be developed and used during what is normally an unstructured meeting. You can see at a glance those messages that are most urgent.

Coordinator II comes with seven conversational paradigms (e.g., an informal note, an action proposal, and a what-if scenario) and prompts you to put your message into one of them. But it's fluid: Your responses need not follow the original message's paradigm. For example, you could reply to a what-if message using a for-your-information response.

This approach works well for Woods Wire Products (Carmel, IN), according to Robert L. Bogue, its LAN/wide-area network manager. Woods Wire Products, a manufacturer of electronic components and telephone accessories, uses Coordinator II to keep in touch with its offices

in Canada, Mexico, Europe, and the Far East. "The conversation types that Coordinator II comes with are the basic building blocks of business communications," Bogue says. "I have not encountered any deficiencies in the conversation structures provided."

## Group Decision Making

GDSSes (group decision support systems) are designed to facilitate face-to-face meetings (see the text box "The Public Reacts to GDSS" on page 118). They provide tools for decision structuring, idea generation, voting, and ranking. GDSS meetings are frequently conducted by a facilitator.

GDSSes have three feature levels, but individual systems can have features in more than one level. Level 1 emphasizes the improvement of communication, idea formation and discussion, and messaging. Tools for Level 1 include messaging, screen viewing, rating/ranking scales, agendas, and voting.

For example, VisionQuest, which was developed by Collaborative Technologies (Austin, TX), provides an agenda structure that a workgroup can use to collaborate on documents and to generate, prioritize, and evaluate ideas. VisionQuest allows comments on ideas to be anonymous, and it manages all communications and document proceedings.

Level 2 systems incorporate the strengths of decision-support modeling and group-decision techniques to enhance the system. Examples of these techniques include project planning and control/operations research tools such as CPM (critical path method) and PERT; probability and decision-tree software; and statistical features and decision techniques that are designed to solve complex, unstructured problems and to help to coordinate information exchange in asynchronous problem-solving groups.

When equipped with its optional Advanced Tools, GroupSystems V provides a Level 2 environment on desktop computers linked by an Ethernet or token-ring LAN or in a specialized meeting room (see the photo). An outliner lets a group analyze ideas by constructing an eight-level outline. Its Idea Organization facility lets a workgroup build a list of ideas or categories and attach or import unstructured comments to any item on the list. You can rearrange, edit, and consolidate items and comments. Its group matrix feature helps establish relationships between rows and columns in a matrix format. Ventana's TeamGraphics, which runs on Microsoft's Windows 3.1 or Windows for Workgroups, features collaborative design of graphical

## Workgroup Goals and Tasks

- generate ideas
- develop action plans
- refine data, graphics, and text
- make decisions
- negotiate solutions

# What You Want,



## Keyboards

Fujitsu 101-key enhanced keyboard  
Part no.: 2B17128  
Product no.: FKB4700  
**\$79.95**



## Floppy Disk Drives

Toshiba 1.44MB  
3.5" Internal Floppy Disk Drive  
Part no.: 2B40774  
Product no.: 356KU  
**\$99.95**



## Memory

SIMM Module  
Function: 1MBx9 80ns  
Part no.: 2B41769  
Product no.: 421000A9B-80  
**\$47.95**

DRAM  
Function: 1MBx1 80ns  
Part no.: 2B42251  
Product no.: 511000P-80  
**\$4.99**

## Computer Cards

16-bit VGA Card  
Part no.: 2B67459  
Product no.: VG7700  
**\$99.95**

## Cables, Gender Changers, and Adapters

6-foot parallel DB25-pin male to Centronics male printer cable  
Part no.: 2B28716  
Product no.: PPC6  
**\$7.95**

DE9 female to DB25 male serial adapter  
Part no.: 2B10305  
Product no.: AD925  
**\$4.95**



## Hard Drives (IDE)

Capacity: 120MB  
Speed: 19ms  
Part no.: 2B14074  
Product no.: CP30104  
**\$389.95**



## Metex Digital Multimeters

4.5 digit w/frequency & capacitance & data hold switch  
Part no.: 2B27158  
Product no.: M4650  
**\$99.95**



## Power Supplies

150 watt 8088  
Part no.: 2B19465  
Product no.: JE1030  
**\$69.95**

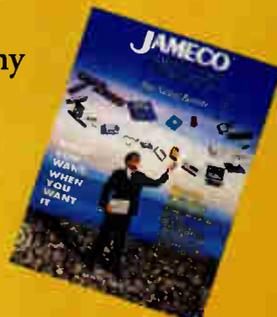
**Over 5000  
Products in  
Stock**

# When You Want It.

Jameco offers a full line of competitively priced computer products for immediate delivery. Select what you want from our 100-page catalog. Priority orders placed before 2:00PM(PST) are shipped the same day. All products are backed by our customer service experts and a 30-day full-refund guarantee. Once you buy, you'll understand why millions of customers have been choosing Jameco for over 20 years.

**GET A FREE JAMECO CATALOG  
CALL 1-800-637-8471** Mention V.I.P.#2B3

© 2/93 Jameco Electronic Components Computer Products.  
All trademarks are registered trademarks of their respective companies.  
Terms: Prices are subject to change without notice. Items subject to availability and prior sale. Complete list of terms/warranties is available upon request.



**JAMECO™**  
ELECTRONIC COMPONENTS

COMPUTER PRODUCTS

1355 Shoreway Road, Belmont, CA 94002

Sales: 1-800-831-4242

Jameco ServiceLine™: 1-800-831-8020

Technical Support: 1-800-831-0084

Circle 95 on Inquiry Card.

# The Public Reacts to GDSS

JAMES D. GANTT AND CATHERINE M. BEISE

**W**hen was the last time you enjoyed a meeting and looked forward to your next one? Surprisingly, these sentiments were expressed by the participants in several tests of GDSS (group decision support system) software.

Early in 1992, we tested reactions to GDSS for the U.S. Army. Test-group sizes ranged from six to 20 members. Participants represented military (20 percent), government (23 percent), and civilian (58 percent) organizations. About one-third of the people were members of minorities, and one-fifth were women. Computer literacy levels ranged from none to expert. Participants were connected by a LAN running GroupSystems V software from Ventana (Tucson, AZ). GroupSystems provides anonymous, real-time, text-based interaction for workgroups.

We collected quantitative data and open-ended comments from participants. Participants used a five-point scale to rate their reactions; 5 was the highest score (see the table).

Our posttest interviews indicated that the less computer literate found GDSS meetings more effective than did their high-powered colleagues, perhaps reflecting lower expectations on the part of the former. More participants commented on GDSS's speed and efficiency than on anything else. And an additional benefit cited was the way GDSS forces a structure on meetings.

Participants believed that learning GDSS was a barrier. But many felt that it would be beneficial after frequent use.

Some participants initially feared using a computer, but they overcame this trepidation, perhaps in their desire to

join in the discussion. Others felt interaction was limited by the system's structure. The meeting facilitator's skill affected whether the GDSS system structure was viewed negatively or positively.

One of our more interesting sessions involved members of an academic department with a reputation for raucous meetings. At the end of their test, they were amazed: They had reached a consensus on a touchy curriculum issue with everyone participating but with no one yelling in anger.

In most groups, the participants believed there was a benefit to the level playing field offered by anonymous communication. But this was put to the test by a group of managers. A gentleman in the group began to type his messages in uppercase, perhaps to differentiate himself from others. To his frustration, someone else opted to do the same. We don't know if these actions were deliberate, but one group

member said, "I need to know who made a comment to evaluate it."

Overall, our test results indicate that people react positively to GDSS. Its ability to provide anonymity seemed to increase everyone's participation. More important, groups are more likely to achieve consensus and commit to following through on action plans developed at a GDSS meeting.

#### ACKNOWLEDGMENT

*The authors thank Rick Watson and Alan Dennis of the University of Georgia for their contributions.*

*James D. Gantt is the director of groupware research at the U.S. Army Research Laboratory in Atlanta, Georgia. Catherine M. Beise is an assistant professor of information systems at West Georgia College and a member of the staff at the Army's research laboratory in Atlanta. You can reach them on BIX clo "editors."*

#### PUBLIC REACTIONS TO GDSS

*A test group of individuals ranging from computer novices to experts reacted favorably to a GDSS trial run by the U.S. Army. Participants rated each category on a scale of 1 to 5, with 5 being the most favorable rating.*

|                                     |     |
|-------------------------------------|-----|
| Willingness to use GDSS tools again | 4.4 |
| Task accomplishment                 | 4.3 |
| Even participation                  | 4.2 |
| Satisfaction with process           | 4.1 |
| Satisfaction with outcome           | 4.1 |
| Good outcome                        | 3.9 |
| Commitment to results               | 3.8 |

diagrams, graphical what-if brainstorming, and a group whiteboard to share text and ideas.

Level 3 systems, which are in the developmental stage, automate group communications patterns. They allow you to select and arrange meeting rules and include such tools as an automated counselor and Robert's Rules of Order.

#### Lotus Notes

Notes from Lotus Development (Cambridge, MA) is a different type of collaborative system, but its effects are far-reaching. "Lotus legitimized groupware with its introduction of Notes," says Groupware '93's Coleman.

Notes can best be described as a group communications environment that lets you

access and create shared information. It gives your workgroup E-mail, distributed databases, bulletin boards, text editing, document management, and various applications development tools, all integrated into an environment with a graphical, menu-based user interface. "It's the Swiss Army knife of tools," says Tim Deagan, manager of the services tools development

# CodeBase 5.0

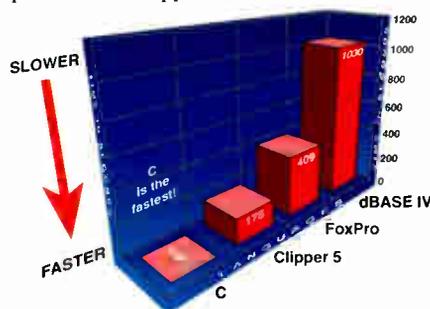
## Discover why FoxPro, Clipper, and dBASE were all written in C.

There is a good reason why your database language was developed in C. In fact, there are many good reasons.

C code is small. C code is fast. C code is portable. C code is flexible. C is the language of choice for today's professional developer. With the growing complexity of database applications, C is a realistic alternative. Now with CodeBase 5.0, you can have all the functionality, simplicity and power of traditional database languages together with the benefits of C/C++.

### C speed - fast code, true executables...

FoxPro, Clipper, and dBASE were written in C primarily for speed. But those compilers don't really compile, they combine imbedded language interpreters into your .EXE. Now that's slow. For dazzling performance you need the true executables of C. With CodeBase you get the real thing, C code. Consider the following statistics, from the publisher of Clipper:



"Sieve of Erasthones" Benchmark for Prime Number Generation Shows C to be incredibly faster!

### C size - small executables, no added overhead...

FoxPro, Clipper and dBASE would like you to believe you need their entire development system to build database applications. But

remember, those products are all written in C. So why do you need to lug all their extra code around? You don't. CodeBase is a complete DBMS, in C. No fat executables stuffed with unused code. No runtime modules. No royalties. Just quality C code. CodeBase is just what you need.

### C portability - ANSI C/C++ on every hardware platform...

No other language exists on more platforms than C/C++. Why rewrite your entire application for DOS, Windows, Windows NT, OS/2 or UNIX? With CodeBase the complete C source code is included, so you can port to any platform with an ANSI C or C++ compiler. Now and in the future.

### dBASE Compatible data, index and memo files...

You want the industry standard. You need compatibility. Sure, dBASE is the standard, but every dBASE compatible DBMS product uses its own unique index and memo file formats. Only CodeBase has them all: FoxPro (.cdx), Clipper (.ntx), dBASE IV (.mdx) and dBASE III (.ndx). Now it's your choice, we're compatible with you.

## Announcing CodeBase 5.0

The power of a complete DBMS, the benefits of C

### NEW - Multi-user sharing with FoxPro, Clipper and dBASE...

Now your multi-user C/C++ programs can share data, index and memo files at the same time as concurrently running FoxPro, Clipper and dBASE programs. No incompatibilities. No waiting.

### NEW - Queries & Relations 1000 times faster...

CodeBase 5.0 now lets you query related

data files with any logical dBASE expression. Our new Bit Optimization Technology (similar to FoxPro's Rushmore technology) uses index files to return a query on a 1/2 million record data file in just a second. Automatically take advantage of this query performance by using our new CodeReporter:

| Month        | Product     | Value              |
|--------------|-------------|--------------------|
| Nov 1992     | Product 02  | \$21,137.00        |
| Nov 1992     | Product 03  | \$21,088.00        |
| Nov 1992     | Product 121 | \$47,993.00        |
| <b>TOTAL</b> |             | <b>\$90,218.00</b> |

| Product      | Quantity | Value              |
|--------------|----------|--------------------|
| Product 02   | 82       | \$21,137.00        |
| Product 03   | 78       | \$21,088.00        |
| Product 121  | 121      | \$47,993.00        |
| <b>TOTAL</b> |          | <b>\$90,218.00</b> |

To use CodeReporter, simply draw your report, then include it in any program you write. Call 403/437-2410 now for your FREE working model of CodeReporter.

### New - Design complex reports in just minutes...

Our new CodeReporter takes the painstaking work out of reports. Now simply design and draw reports interactively under Windows 3.1, then print or display them from any DOS, Windows or UNIX application.

### SPECIAL - FREE CodeReporter

Order CodeBase 5 before April 30, 1993 and receive CodeReporter for free! This offer includes our no-risk, 90-day money back guarantee, so order today!



**CodeBase 5.0**  
The C/C++ Library for DataBase Management

**Call Now**  
**403-437-2410**

**SEQUIETER SOFTWARE INC.** FAX 403-436-2999  
Europe 33.20.24.20.14

#209,9844-54 AVE., EDMONTON, AB, CANADA T6E-5V1

©1992 Sequiter Software Inc. All rights reserved. CodeBase is a trademark of Sequiter Software Inc. All other trade names referenced herein are property of their respective companies. M40-cv153 by Microsoft

Circle 142 on Inquiry Card.

World Radio History



Workgroups connect with each other from remote sites via a LAN or meet in special conference rooms, as pictured here. (Photo courtesy of Ventana Corp.)

group at Dell Computer (Austin, TX).

Deagan's group at the time, the R&D department, was among the first Notes takers at Dell, where it flourished. However, Deagan says, other department managers, especially those responsible for cost containment, were hesitant to spend the money (i.e., license fees of \$395 per user) for a tool that seemed to many not to have a clear mission.

MIT's Malone also sees this as a problem for Notes. "Precisely because Notes is so general, it is often hard to understand at first what it is useful for," says Malone.

Notes has gained acceptance at Dell, says Deagan, finding uses in such diverse areas as database development, training, and quality control. But it was a long journey: "You have to lure people to Notes," he says. "Its versatility has kept Notes above water, but its versatility smothers it."

### Windows for Workgroups

Windows for Workgroups integrates groupware into the network environment. It gives you E-mail; group scheduling; real-time conference facilities; network-monitoring utilities; and file, printer, and Clipboard sharing (see "Windows for Workgroups," November 1992 BYTE).

The Windows GUI is an important part of Windows for Workgroups. Its ClipBook Clipboard sharing facility lets you cut, paste, and share pages of data, such as when you transfer pages of information directly into someone's Clipboard. The Schedule+ feature helps you plan meetings on-line by merging prospective attendees' schedules, finding a suitable time, and mailing out invitations.

Brian Howden, a technical specialist working for the British Columbia Ministry of Forests (Victoria, BC, Canada), says that his organization is conducting

pilot programs to determine if Windows for Workgroups will solve some of the ministry's connectivity and API problems.

At the ministry, more than 1500 desktop computers run Windows. Dozens of LANs provide shared resources for these and other types of computers, and an IBM mainframe provides ministrywide E-mail. Ensuring connectivity among all workstations and peripherals is a costly and ongoing problem. But Windows for Workgroups supports the Windows Open Services Architecture, so it provides out-of-box standard APIs for applications development. "Anything that provides a standard API is attractive to us," Howden says.

If Howden is apprehensive about anything in Windows for Workgroups, it's that the groupware has its own mail application, which could disturb the ministry's existing E-mail service. Unless the ministry migrates to Microsoft Mail, Windows for Workgroups mail could "entice users to set up noncompatible islands of E-mail within our organization," says Howden (see "Smarter E-Mail Is Coming" on page 90).

### Cultural Challenges

Collaborative systems can meet stubborn resistance when they are introduced in a company, because they challenge the organizational culture with a new means of communication. "Groupware moves a company from a very hierarchical structure to one where each individual's input is accepted regardless of sex, race, or office status," says Harold J. Gallagher, CEO of Collaborative Technologies.

Some managers have problems with this because collaborative systems can upset a company's unique environment for getting work done. You must take this into account when planning your collaborative information system. "The collaborative

environment adds a new, on-line culture to your organization," says John Donovan, an analyst with Workgroup Technologies. As manager, your "challenge is to define that culture so that you have a more effective organization."

But the higher you climb in a company's organization, the more you can encounter resistance to collaborative computing, says Bernard DeKoven, a management consultant based in Palo Alto, California. DeKoven argues that the monetary incentive systems of upper management are often disincentives to sharing ideas and data, because personal information is an individual's powerbase. "If you don't acknowledge the incentives for competition that exist in your organization, any effort at creating a collaborative system will be sabotaged" by office politics, says DeKoven.

Groupware and collaborative efforts are most successful at the lower levels of an organization, says DeKoven. Lower-echelon employees are used to workgroup projects, have fewer incentives for competitive behavior, and usually are so disempowered that they prefer to wrap their comments, ideas, and suggestions in anonymity, says DeKoven.

DeKoven has worked with several companies that have successfully integrated collaborative systems into their environments. Mostly, they've been companies that have adopted flat organizational structures, where everyone has access to information, and high-tech companies, where workgroups are the norm. In more traditional businesses, collaborative systems succeed best when they spread above and below from middle management, according to DeKoven.

But "the technology is not going to drive the cultural changes," says DeKoven. "As long as there are incentives for competition and control, people will use groupware only to further their individual goals."

For collaborative systems to be truly successful, you must change the way you operate. According to Groupware '93's Coleman, collaborative systems can provide that incentive to change: "Often people perceive their value to a company as their expertise, and if they share that expertise, they've lost their value. But frequently it turns out to be the other way around—their coworkers find out just how valuable they are to the company." ■

*Jeffrey Hsu is a computer consultant and a professor of information systems at Montclair State College in Upper Montclair, New Jersey. You can reach him at JHSU on MCI Mail. Tony Lockwood is a BYTE technical editor. You can contact him on BIX as "lockwood."*

# EMBARC<sup>SM</sup>, from Motorola, delivers information to moving targets

## Users roam the nation and stay in the loop

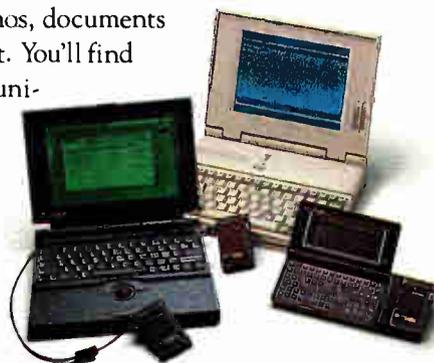
Portability doesn't have to mean isolation from important, timely information, thanks to EMBARC wireless networking.

Anywhere in America's top 200 cities, users stay connected—to E-mail from the office and news and weather briefs from *USA TODAY* as well as optional services such as sports, key market and financial developments, and targeted industry news briefs from HeadsUp.<sup>TM</sup> They can even have their important databases routinely updated—automatically!

All that's required is EMBARC's compact, powerful NewsStream receiver (it plugs directly into most laptop, palmtop and notebook computers) and the simple software package that drives it. It installs in minutes and is ready to operate—without wires, faxes or phones.

Equip your whole team and send memos, documents and file updates for pennies per recipient. You'll find EMBARC so cost effective you'll communicate more.

Our corporate trial program lets you try it virtually risk-free. Sign up right now by phoning **1-800-EMBARC4, Ext. 350**. Give your team the home-field advantage... even when they're on the road.



*EMBARC service is available for DOS-based laptops and notebooks, HP 95LX palmtops and Macintosh Powerbooks.*

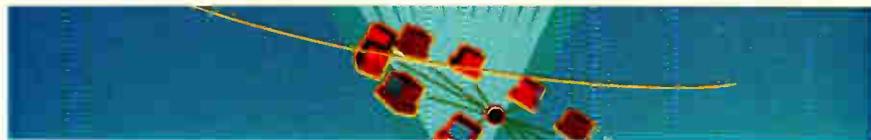
# EMBARC<sup>SM</sup>

Circle 225 on Inquiry Card (RESELLERS: 226).



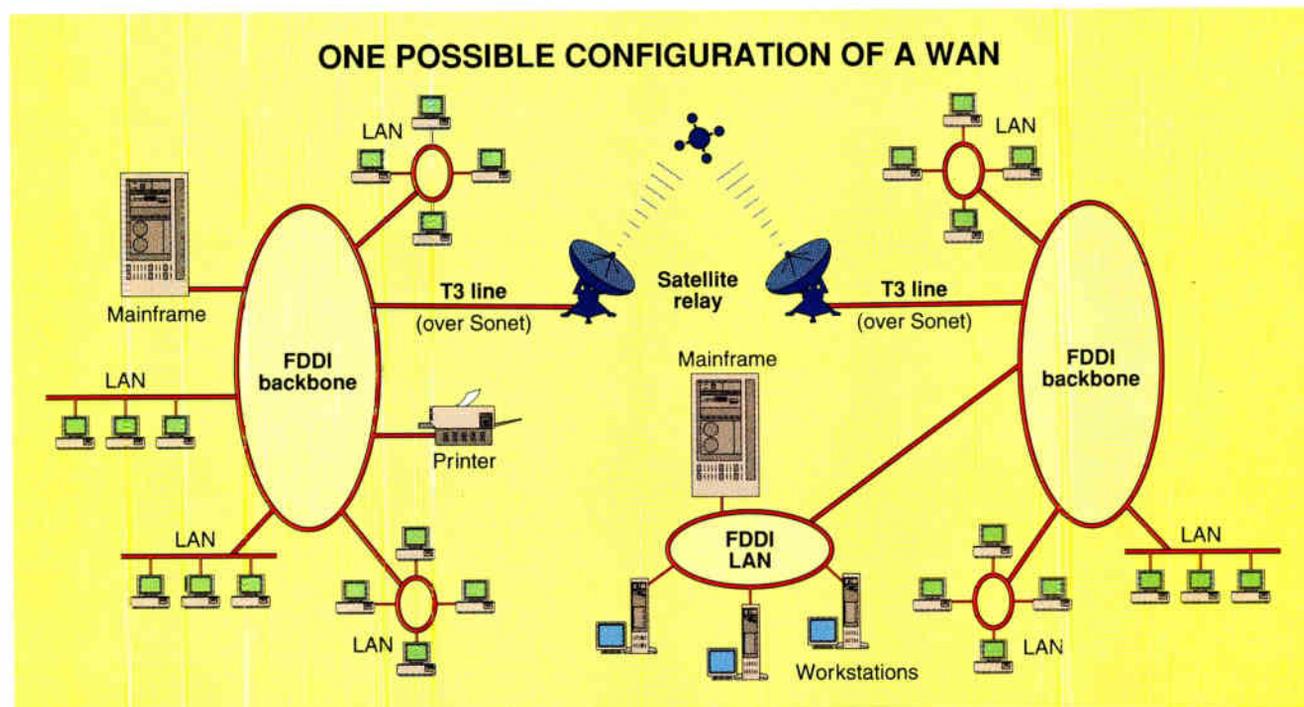
Motorola and NewsStream are trademarks of Motorola, Inc. EMBARC is a servicemark of Motorola, Inc. © Motorola, Inc. 1992

same server. Because the server can talk to only one workstation at a time, it scarcely matters that the conversation takes place over a shared-media LAN. A network that primarily handles E-mail traffic will do



# Now Even

## HITTING WARP SPEED FOR LANS



**Figure 1:** LANs connect to each other over a backbone network. In this example, FDDI, a 100-Mbps optical-fiber network, provides the connection. Backbone networks can be connected to each other via a variety of private and public services, including leased lines and satellite links.

just fine at token-ring speeds, but shared-media networks are not good at handling continuous data streams, like those created by a video teleconference.

Collaborative computing presupposes more interactive use of networks than just providing a medium for E-mail traffic. Much of the use is workstation-to-workstation (many-to-many) rather than client-server (many-to-one).

Because you might want to collaborate with someone across town or across the Pacific, your LANs must be connected to each other, and your bandwidth demands grow with every step. To link the slower 10-Mbps LANs, you use the faster 100-Mbps backbone networks. And to tie these together into a WAN (wide-area network), you use an even faster network, say something with a 1-Gbps or higher data transfer rate (see figure 1).

Although today's networks are too slow for advanced collaborative applications, a number of network-bandwidth boosters are coming into their own and may provide solutions to the problem. These technologies include FDDI (Fiber Distributed Data Interface), ATM (Asynchronous Transfer Mode), and switching hubs.

### Video a Problem

"Video is the data type that will force the commercial networking business to come

to grips with the bandwidth issue," says Jim Long, president of Starlight Networks (Mountain View, CA), a maker of video software for Ethernet networks.

Video is a key component of the next generation of collaborative applications, whether for desktop videoconferencing, training, or visualization. Other data (e.g., CAD drawings and true-color scanned images) may gobble up great chunks of network bandwidth, but none so voraciously as video.

"Video is not only huge, but it's con-

tinuous," says Long. Unlike a still image, which is finite and will be on the network for a short time, video just keeps coming. Single frames of broadcast-quality video—with compression—are about 12 KB each, and a new frame is shipped 60 times a second. Meanwhile, other devices sit idle because the network hasn't any bandwidth to spare for them. "Even a low-grade teleconference," says Long, "sends more data over your network in an hour than it has ever seen before." Studio-quality video requires 10-Mbps or faster data streams, which overwhelms a typical LAN.

## Advanced High-Speed Networks

### The Promise:

- variable bandwidth on demand
- new kinds of workgroup applications
- studio-quality desktop audio and video

### The Reality:

- incomplete standards
- three to 10 times more expensive
- possible software incompatibility

### Token Ring on Steroids

How do you increase your bandwidth? One way is to switch to a faster network, such as FDDI. "FDDI is really a token ring on steroids," says Long. Like token-ring networks, FDDI passes data around a ring, but its bandwidth is 100 Mbps, far faster than a token-ring or Ethernet network. For example, at 100 Mbps, you could ship this article around a network 1000 times a second.

But FDDI has problems. It's a new network with new protocols, and your software may not run on it. FDDI is also 10 times more expensive than an Ethernet network. Pricing for adapter cards starts at around \$1000; Ethernet cards begin at about \$100.

If FDDI is too expensive, how about

# EMBARC<sup>SM</sup>, from Motorola, delivers information to moving targets

## Users roam the nation and stay in the loop

Portability doesn't have to mean isolation from important, timely information, thanks to EMBARC wireless networking.

Anywhere in America's top 200 cities, users stay connected—to E-mail from the office and news and weather briefs from *USA TODAY* as well as optional services such as sports, key market and financial developments, and targeted industry news briefs from HeadsUp.<sup>SM</sup> They can even

have their important databases routinely updated—automatically!

All that's required is EMBARC's compact, powerful NewsStream receiver (it plugs directly into most laptop, palmtop and notebook computers) and the simple software package that drives it. It installs in minutes and is ready to operate—without wires, faxes or phones.

Equip your whole team and send memos, documents and file updates for pennies per recipient. You'll find EMBARC so cost effective you'll communicate more.

Our corporate trial program lets you try it virtually risk-free. Sign up right now by phoning **1-800-EMBARC4, Ext. 350**. Give your team the home-field advantage... even when they're on the road.



*EMBARC service is available for DOS-based laptops and notebooks, HP 95LX palmtops and Macintosh Powerbooks.*

# EMBARC<sup>SM</sup>

Circle 225 on Inquiry Card (RESELLERS: 226).

World Radio History



Motorola and NewsStream are trademarks of Motorola, Inc. EMBARC is a servicemark of Motorola, Inc. © Motorola, Inc. 1992

# Now Even Bad Reports Can Look Good.

New CA-RET™ 1.0: The Friendliest, Most Powerful Report Writer Ever.

Add bitmapped images anywhere in your report for graphic impact.

**The United States House Of Representatives**  
**THE HOUSE BANK** MONTHLY BANK STATEMENT-APRIL, 1993

**Phil A. Buster** Acct. # D 3320 67 55509  
14 E. Pork Barrel Lane, Potomac, MD 20519  
(301) 555-0269  
District: 153 Party: Frequently  
Campaign Slogan: "A Vote For Buster Is A Vote For Me"

| YTD SUMMARY                  | AMOUNT       |
|------------------------------|--------------|
| Total Number of Bad Checks   | 6014         |
| Average Daily Balance        | -\$41,449.00 |
| Average Amount of Bad Checks | \$19,242.00  |
| Largest Overdraft            | \$49,650.00  |
| Outstanding Loans            | \$85,320.00  |
| Overdraft Fees (Waived)      | \$1,250.00   |
| Interest Owed (Waived)       | \$5,360.43   |

| ACTIVITY SUMMARY |      |                                       |           |         |             |
|------------------|------|---------------------------------------|-----------|---------|-------------|
| Date             | No.  | Memo/Category                         | Payment   | Deposit | Balance     |
| 3/17             | 5861 | The Watergate Hotel                   | 1,589.38  |         | -25,623.00  |
| 3/21             | 5862 | The Hair Club For Men                 | 21,530.00 |         | -47,153.00  |
| 3/28             | 5863 | Club Med                              | 3,850.79  |         | -51,003.79  |
| 4/7              | 5864 | Larry's Lexus Dealer                  | 49,650.00 |         | -97,653.79  |
| 4/15             | 5865 | Burning Tree Country Club Annual Dues | 10,000.00 |         | -107,653.79 |
| 4/17             | 5866 | American Express                      | 23,400.09 |         | -131,053.88 |

PREVIOUS BALANCE **\$25,623.00** TOTAL PAYMENTS **\$0.00**  
NEW BALANCE **\$131,053.88** AMOUNT DUE **\$0.00**

Using different fonts adds pizzazz to your reports. CA-RET makes it a snap.

Create exciting output from your CA-Clipper, dBASE and text files.

The allure of color: You get it in an easy, WYSIWYG environment.

Dozens of built-in number-crunching functions are available for powerful data analysis.

You can even turn your data into eye-catching graphs.

Whatever the news, make it look great with new CA-RET/Xbase, the visual report writer for Windows.

With drag and drop, WYSIWYG design, it's as easy to use as a word processor, yet powerful enough to produce

stunning results. Choose a wide variety of pre-formatted tabular layouts, labels and form letters — or create your own. Now you can add dazzling color, fonts and bitmaps to any report.

Place database fields, computed fields and aggregate computations anywhere and use the more than 40

built-in functions for extensive analysis.

And CA-RET's single-pass computation engine is the

most efficient available. From dBASE to Clipper, CA-RET/Xbase works with top databases (or text files) and acts as a DDE server so you can include reports in other Windows applications. And the unlimited use runtime license lets you distribute report applications for free.

## SPECIAL OFFER FOR R&R USERS.

Registered users of R&R Report Writer for Xbase can upgrade to CA-RET for just \$79 (\$89 in Canada). Call 1-800-531-5236 (Canada: 1-800-665-5449) or see your local dealer.

Call today and find out how easy it is to turn the mundane into the magnificent.

**COMPUTER ASSOCIATES**  
Software superior by design.

© Computer Associates International, Inc., One Computer Associates Plaza, Islandia, NY 11788-7000. All product names referenced herein are trademarks of their respective companies.

# HITTING WARP SPEED FOR LANs

High-speed networks promise the performance that collaborative computing needs—at a price

MARK A. CLARKSON

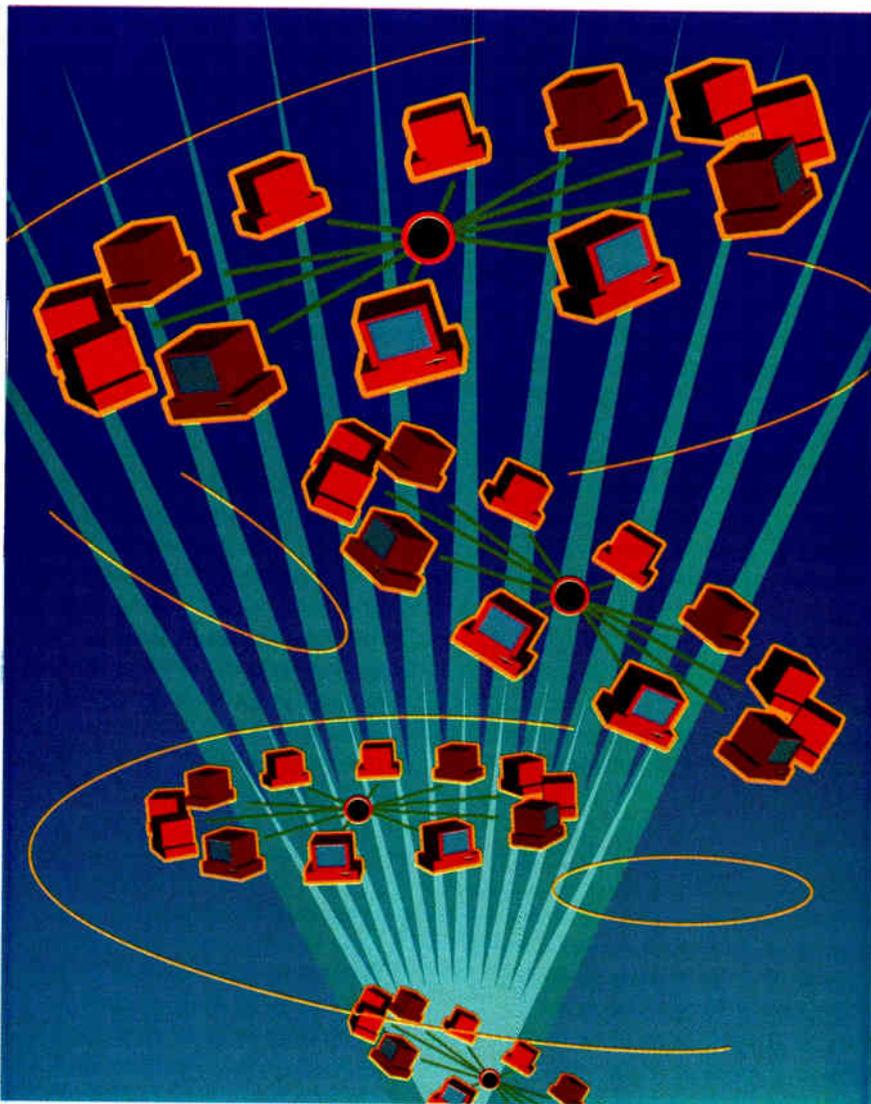
**B**rian Lyles, a researcher at Xerox PARC (Palo Alto Research Center), designs collaborative applications of the future in areas such as scientific visualization, desktop teleconferencing, and advanced document management. The feasibility of these applications depends on the resolution of formidable problems.

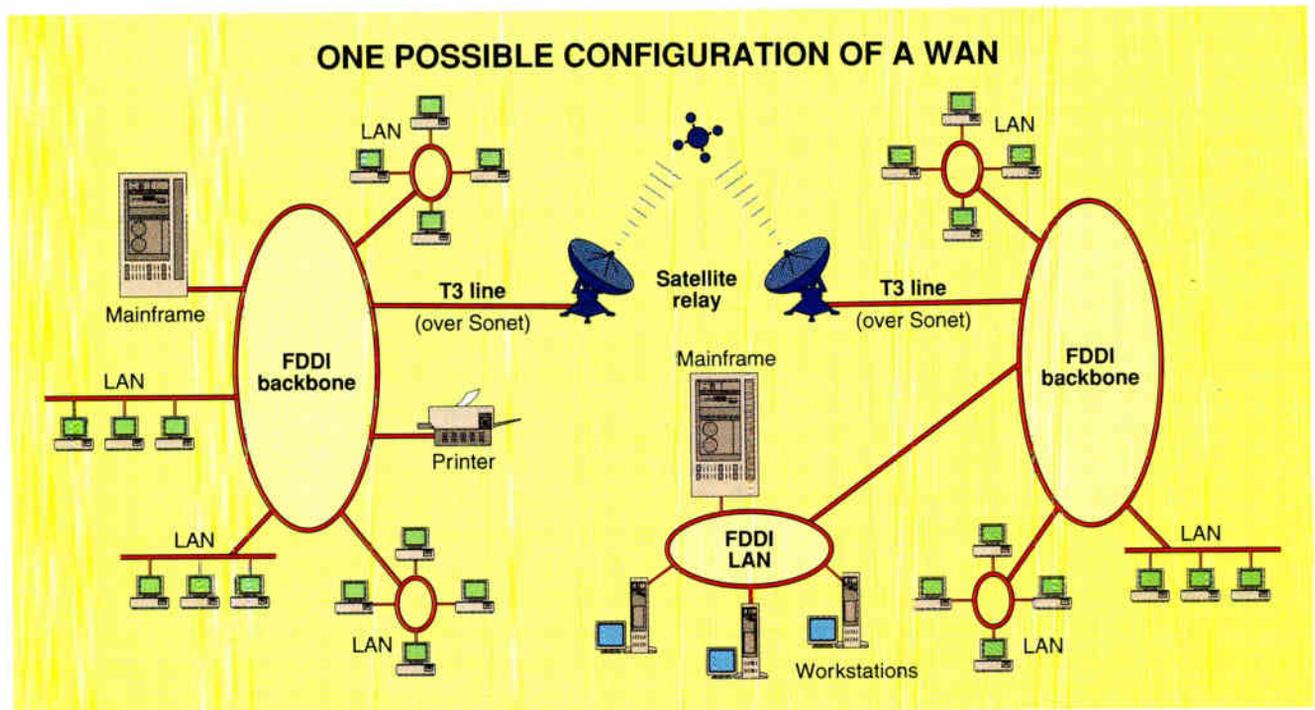
LANs provide limited data-carrying capacity (i.e., bandwidth)—10 Mbps on an Ethernet and 4 to 16 Mbps on a token-ring network. But collaborative applications require moving huge data sets that can overwhelm a network's bandwidth. For example, broadcast-quality video, even at 20-to-1 compression, requires a 6-Mbps data transfer rate. At that rate, a 10-minute broadcast represents half a gigabyte of data, the equivalent of five sets of the *Encyclopaedia Britannica*.

The applications that Lyles envisions involve continuous streams of high-quality audio and video data. "We're not going to settle for one stream of video to the desktop. We have applications that use many streams," says Lyles.

To make matters worse, LANs such as token-ring and Ethernet networks are shared-media networks. They allow only one conversation to take place at a time. And their bandwidth must be shared by all the users on a network.

Shared-media networks work best with short bursts of data (e.g., E-mail messages). In a client-server environment, for example, a number of workstations might share the same server. Because the server can talk to only one workstation at a time, it scarcely matters that the conversation takes place over a shared-media LAN. A network that primarily handles E-mail traffic will do





**Figure 1:** LANs connect to each other over a backbone network. In this example, FDDI, a 100-Mbps optical-fiber network, provides the connection. Backbone networks can be connected to each other via a variety of private and public services, including leased lines and satellite links.

just fine at token-ring speeds, but shared-media networks are not good at handling continuous data streams, like those created by a video teleconference.

Collaborative computing presupposes more interactive use of networks than just providing a medium for E-mail traffic. Much of the use is workstation-to-workstation (many-to-many) rather than client-server (many-to-one).

Because you might want to collaborate with someone across town or across the Pacific, your LANs must be connected to each other, and your bandwidth demands grow with every step. To link the slower 10-Mbps LANs, you use the faster 100-Mbps backbone networks. And to tie these together into a WAN (wide-area network), you use an even faster network, say something with a 1-Gbps or higher data transfer rate (see figure 1).

Although today's networks are too slow for advanced collaborative applications, a number of network-bandwidth boosters are coming into their own and may provide solutions to the problem. These technologies include FDDI (Fiber Distributed Data Interface), ATM (Asynchronous Transfer Mode), and switching hubs.

### Video a Problem

"Video is the data type that will force the commercial networking business to come

to grips with the bandwidth issue," says Jim Long, president of Starlight Networks (Mountain View, CA), a maker of video software for Ethernet networks.

Video is a key component of the next generation of collaborative applications, whether for desktop videoconferencing, training, or visualization. Other data (e.g., CAD drawings and true-color scanned images) may gobble up great chunks of network bandwidth, but none so voraciously as video.

"Video is not only huge, but it's con-

tinuous," says Long. Unlike a still image, which is finite and will be on the network for a short time, video just keeps coming. Single frames of broadcast-quality video—with compression—are about 12 KB each, and a new frame is shipped 60 times a second. Meanwhile, other devices sit idle because the network hasn't any bandwidth to spare for them. "Even a low-grade teleconference," says Long, "sends more data over your network in an hour than it has ever seen before." Studio-quality video requires 10-Mbps or faster data streams, which overwhelms a typical LAN.

## Advanced High-Speed Networks

### The Promise:

- variable bandwidth on demand
- new kinds of workgroup applications
- studio-quality desktop audio and video

### The Reality:

- incomplete standards
- three to 10 times more expensive
- possible software incompatibility

### Token Ring on Steroids

How do you increase your bandwidth? One way is to switch to a faster network, such as FDDI. "FDDI is really a token ring on steroids," says Long. Like token-ring networks, FDDI passes data around a ring, but its bandwidth is 100 Mbps, far faster than a token-ring or Ethernet network. For example, at 100 Mbps, you could ship this article around a network 1000 times a second.

But FDDI has problems. It's a new network with new protocols, and your software may not run on it. FDDI is also 10 times more expensive than an Ethernet network. Pricing for adapter cards starts at around \$1000; Ethernet cards begin at about \$100.

If FDDI is too expensive, how about

# The VESA Local Bus Has Arrived!



Call today for pricing.  
**1-800-93-GENOA**  
 (SALES ONLY PLEASE)

## Speed And 16.8 Million Colors With The TurboBahn Combo From Genoa

The Combo includes -

**Windows VGA 24 (Model 8500VL)** - Fast 24-bit graphics accelerator at 32-bit speed. 16.8 Million colors at up to 640 x 480 and 64K colors with up to 800 x 600 resolution. 1MB DRAM display memory. VESA, IBM VGA, EGA, CGA, MDA and Hercules compatible. Advanced drivers include AutoCAD®, AutoShade™, Lotus® 1-2-3, OS/2® 2.0, Microsoft Windows™ 3.1, and more. Flickerfree™ 70 or 72Hz vertical refresh rate. Two year warranty.



TurboExpress 486VL

**TurboExpress 486VL** - Fast motherboard performance (300% increase over ISA bus) incorporating the latest in VESA Local Bus technology. Supports up to 50MHz and 256 cache. CPU-486 SX-20, 25 / 486 DX-33, 50 / 486DX2-50, 66 combinations. Seven 16-bit expansion slots consisting of two VESA local bus slots. Two year warranty.

| Accelerator / Driver Combination     | Winmark (16.8 Million colors in 640 x 480 Resolution*) |
|--------------------------------------|--|
| Genoa Model 8500VL with Genoa Driver | 2.159 Million 1.42                                     |
| S3 86C805 Adapter + S3 Driver        | 0.828 Million .55                                      |

**Genoa**  
 SYSTEMS CORPORATION  
*The Ultimate Graphics Solution*

\* Benchmark results were collected using 640 x 480 resolution in 16.8 Million color mode, Winbench 3.1 on a 486DX / 33 VESA local bus. Other Color and resolutions will vary. ©Genoa Systems Corporation 75 East Trimble Road, San Jose, CA. 95131 all rights reserved. TurboBahn, TurboExpress and WindowsVGA are trademarks of Genoa Systems. All other registered trademarks and un-registered trademarks are the property of their respective owners. Specifications are subject to change without notice.

Circle 84 on Inquiry Card (RESELLERS: 85).

# Rolling the DICE

**D**ICE (Distributed Interactive Collaboration Environment) is a research project under way at the National Center for Supercomputing Applications (Champaign, IL). DICE allows researchers—who may be physically far apart—to collaborate on large visualizations, which they can all view and with which they can all interact simultaneously. Several people can steer and control the parameters of the visualization.

The project was conceived as an environment in which to develop applications that exploit gigabit networks. Although the image processing and number crunching in DICE run primarily on supercomputers, the interactive user interface and the graphical output run on workstations.

Sending a continuous stream of high-definition images can consume more than 500 Mbps of bandwidth for each workstation viewing the simulation. "Nothing has been geared up to support these speeds," says DICE author Jeff Terstriep. "Every step you take, you hit another bottleneck."

As fast as computer speeds have increased, network speeds have grown faster. "All of a sudden, we've got a network that's faster than the VME bus that these workstations are built around," says Terstriep. "Even supercomputers don't necessarily have as much I/O speed as you'd like. It's a challenge."

For a network to support an advanced, interactive, collaborative environment, says Terstriep, it must be fast and exhibit low latency—outgoing data must not sit at your workstation, waiting for an opening in net-

work traffic. Without low latency, the value of a fast network diminishes.

One intent of DICE research is to develop methods of efficiently moving large data sets on networks. DICE uses a message-passing system designed to move scientific data sets that range in size from 8 MB to 2 GB (e.g., multi-dimensional arrays of data) through various pipelines. It uses both high-bandwidth and low-latency networks, splitting the message to achieve the highest performance possible.

For example, the handshaking and control information has low latency. It doesn't require the high data transfer rate that a 2-KB by 2-KB by 24-bit image requires. DICE sends the handshake information through an Ethernet or FDDI (Fiber Distributed Data Interface) network and the image through a high-performance parallel-interface network. DICE ensures that these multiple networks operate in harmony and that the operation is transparent to the application and to the end user.

"Current high-speed networks have relatively high latency. I think you'll see ATM take over, because it offers very low latency at very high bandwidth," says Terstriep.

But better machine architectures are needed to exploit gigabit networks. The speed at which you can read and write to the RAM on your workstation becomes an issue.

"You find you can't afford to copy data from the user space to the operating system, to the networking card, and out on the wire," says Terstriep. All those copies take time and CPU cycles, and at gigabit speeds, time is precious.

speeding up your existing LAN? Grand Junction Networks (Union City, CA) is developing a product called Fast Ethernet, which is an Ethernet standard that matches FDDI's 100 Mbps. Also, IBM has reportedly pushed Token Ring to 64 Mbps.

The idea behind such pumped-up versions of familiar networks is to preserve your investments in network wiring and software while boosting network capacity to meet increased demands. But these so-

called fast LANs are up to three times more expensive per installation, although they are far less expensive than FDDI.

In addition, all these fast networks—including FDDI—have flaws that may prove fatal over time. For example, none guarantee real-time data delivery. When audio and video are shipped as separate data streams, it's important that they arrive at the same time. The question becomes: Will 100 Mbps be enough?

"Some people say 100 Mbps is plenty of bandwidth," says Steve Krause, a technology analyst at SRI (Menlo Park, CA), an independent research institute. "But when Ethernet was introduced, people said, 'Ten megabits! No one will need more than this.'" Krause believes that as applications become more LAN-intensive they will need more than 100 Mbps.

## Near-Unlimited Bandwidth

If 100 Mbps is not enough, there is a way to achieve almost unlimited bandwidth: *switching*. To understand switching, think about making a telephone call. You dial my number. I answer. We talk. In effect, we have a dedicated line linking us. In fact, our telephones are connected through one or more switches—universal connections—and can be similarly connected to any of millions of other telephones across the U.S. Millions of other telephone conversations are going on concurrently with ours. Even though the telephone lines have a low bandwidth, the capacity of this huge switched network—its *aggregate bandwidth*—is astronomical.

In a shared-media LAN, the aggregate bandwidth is the same as the peak bandwidth of the individual lines. For example, an Ethernet's aggregate and peak bandwidths are both 10 Mbps. Thus, adding nodes to your network increases its load, but not its capacity.

The aggregate bandwidth of a switched network is equal to the peak bandwidth of each line *times* the number of lines going into the switch divided by two. For example, 100 10-Mbps lines equals 0.5 Gbps (i.e.,  $100 \times 10 \text{ Mbps} \div 2 = 0.5 \text{ Gbps}$ ).

"That's why I like switched technology like ATM," says Xerox PARC's Lyles. "Switched networks tend to have an aggregate bandwidth that is much higher than their peak bandwidth." When the ATM standard is finalized, says Lyles, ATM should provide sufficient bandwidth for most collaborative applications.

ATM is isochronous (i.e., real-time) and provides high bandwidth on demand. Because it's a *packet-switched* network, it divides data into small clusters, called packets; moves them around the network; and reassembles the packets at their destination. ATM lets you mix and match channels of varying bandwidths and data types (e.g., video, data, and voice). You can have 150-Mbps, 600-Mbps, and 2.4-Gbps links on the same network. "ATM allows you to stop asking, 'What video quality can I get over the network?' and start asking, 'What video quality do I want?'" says Lyles.

Some companies, such as DEC (Maynard, MA), are developing ATM LANs. But the technology is sophisticated and

# 45 SECONDS OF COLOR VIDEO ON 1.44 MB !!!



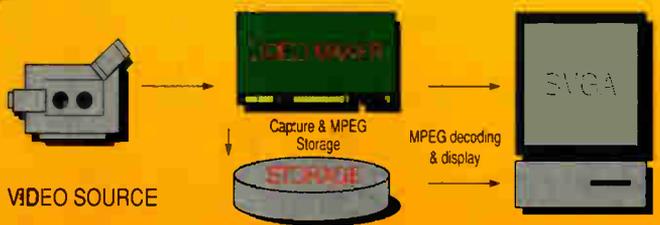
**VIDEO SEQUENCE CAPTURE: 1st MPEG SOLUTION**

**VIDEOMAKER**

PROFESSIONAL  
FRAME CAPTURE:  
16 MILLIONS  
OF COLORS

**\$695**

**Dealers are welcome !!**



**VIDEO MAKER™ is delivered with the best software under WINDOWS:**

| COMPARISON                 | VIDEO MAKER  | THE MARKET                            |
|----------------------------|--|---------------------------------------|
| Movies capture             | yes  | no                                    |
| MPEG compression           | yes (about 30 Kbytes per second)                                   | no                                    |
| Digital VCR(100% software) | yes  | no                                    |
| Frame capture              | high professional quality  | medium quality                        |
| Colors                     | 16 millions colors per pixel<br>4:2:2 (2 times more color samples) | 16 millions colors per pixel<br>4:1:1 |
| Video standard             | NTSC, PAL and SECAM  | NTSC, PAL                             |
| Spatial definition         | 768 x 576 (PAL and SECAM)<br>640x480 (NTSC)                        | 720x512 (PAL)<br>640x480 (NTSC)       |
| Aspect ratio               | square pixel   | rectangular pixel                     |
| Size of the board          | short: compatible with desktop PCs                                 | long                                  |
| Technology                 | miniaturized: SMT  | classic                               |
| Installation               | no switches at all   | many switches                         |
| I/O, DMA                   | none: high compatibility   | several I/O and DMA                   |
| SVGA modes                 | all  | limited                               |
| Video feature connector    | no needed  | absolutely necessary                  |
| RAM limitation in your PC  | unlimited  | conflict above 8 MB                   |

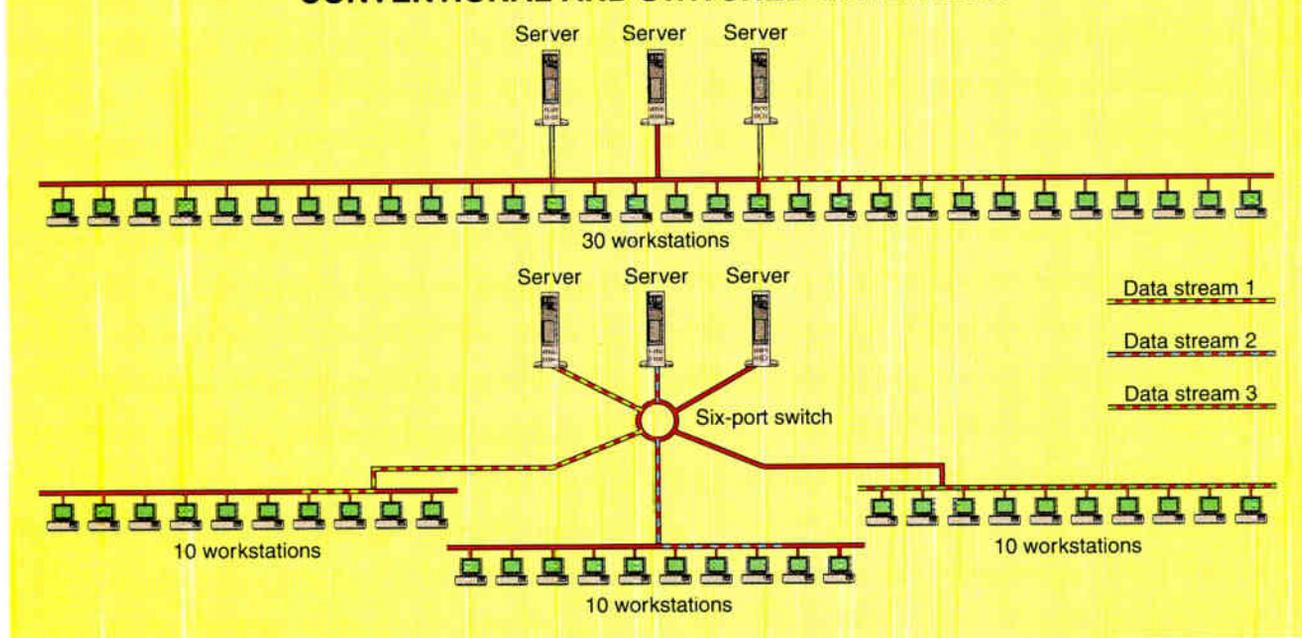
*Cable: 2 meters with RCA, BNC, SCART connectors*

- IMAGER™**: frame capture, video sequence capture, MPEG compression, image edition (color controls, text overlay, cropping, zoom, vertical & horizontal flip, numerous filters, contour extraction, ...), save images in .BMP (8 bits or 24 bits), .TIF (G, P, RGB, YUV, CMYK, ...), .PCX, .VSP, .MPG, ...
- MPEG PLAYER™**: veritable digital VCR, letting you play MPEG-compressed sequences in normal mode or single-step forward or backward under WINDOWS 3.0 and 3.1.
- MULTIMEDIA MANAGER™** from MULTIMEDIA TELECOM: true generator of multimedia and hypermedia applications with the following main features:
  - intuitive icon-based interactive multimedia scenarios,
  - directly compatible with VIDEO MAKER™,
  - compatible with all the MPC audio cards (ex.: SOUND BLASTER™),
  - manages multimedia libraries with sound, image, ...
  - manages active regions in the images.

**VIDEO MAKER  
MANUFACTURER**

U.S. & CANADA  
Ph.: 404 921 61 67 - Fax.: 404 921 92 43  
E.E.C. Ph.: 33.1.46.29.03.06  
Fax.: 33.1.46.29.03.04

## CONVENTIONAL AND SWITCHED ETHERNETS



**Figure 2:** In a conventional Ethernet network with three file servers shared among 30 workstations, only one conversation can take place at a time. With a three-by-three switch added to the network, you can have three conversations on the network at once.

expensive—about \$6000 per connection, says Howard Salwen, president of Proteon (Westborough, MA), a company that makes networking equipment and plans to deliver its first ATM-based products late this year. Given its cost and that the standard has yet to be finalized, ATM will probably not be a major player in the desktop arena for at least five years—pundits are reluctant to guess exactly how long. “ATM is a wonderful technology,” says Salwen, “but it isn’t soup yet.”

### Ethernet for Everyone

Switched-hub technology is already being added to Ethernet. It can turn a single Ethernet into an Ethernet for every network user (see figure 2). The upgrade is simple: You replace the old hub in your wiring closet with a new one. Instead of 100 people sharing 10 Mbps, you have 100 people sharing 1 Gbps. You haven’t restrung any wires. You are still using the same adapter cards and software as before. And it’s still Ethernet.

“This could mean a new life for Ethernet,” says Avi Fogel of Lannet (Huntington Beach, CA), a manufacturer of LAN hardware products. “It’s no longer a shared medium—it provides each user with bandwidth on demand up to the full capacity of the network.”

EtherSwitch from Kalpana (Santa Clara, CA) adds ATM-like packet switching to

existing Ethernet LANs. It is similar to ATM in that it’s a packet-switched technology, says Larry Blair, Kalpana’s vice president of marketing. EtherSwitch is intended to boost throughput between desktops and servers.

Seeq Technology (Fremont, CA) adds another dimension to switched-hub Ethernet. Its 80C04 LAN-controller chip set provides Ethernet with two-way, or full-duplex, capabilities. Normally, Ethernet networks are one-way—only one node at a time can transmit, and a node cannot receive data while transmitting. By enabling full-duplex, the 80C04 doubles Ethernet’s bandwidth to 20 Mbps (i.e., 10 Mbps to send data, and 10 Mbps to receive data).

A switching hub is about an order of magnitude more expensive than standard Ethernet, say \$700 versus \$70 per connection, but you preserve a significant part of your network investment. The Ethernet switched-hub approach is so powerful, says Starlight Networks’ Long, “that many networking companies are abandoning FDDI for the desktop.”

Ethernet may become the ubiquitous connection between computers and peripherals. “Ethernet could become the RS-232 of the nineties,” says Long.

### FDDI Squeezed

“Ninety-five percent of all computer users will do just fine for the next five years

with 10 Mbps,” says Long. “Shared servers and backbone networks—that’s the arena where the battle for high-speed networks will take place first.”

“It’s hard to justify investing in a 100-Mbps ATM or FDDI for the desktop,” says Lannet’s Fogel. “But what if you can find a way at well under \$1000 per user for each user to have a full, dedicated 10-Mbps network available? That’s a different story.”

For those that need 100 Mbps to run the advanced collaborative applications that Lyles is dreaming up in Palo Alto, what will the LAN of choice be? FDDI? Not according to SRI’s Krause. “FDDI is in danger of being squeezed out of the desktop marketplace by faster Ethernets and token rings from below and ATM from above.”

Most experts agree that the eventual winner in high-speed networks of all sizes will be ATM. According to Proteon’s Salwen, ATM delivers bandwidth on demand; synchronous delivery of voice, video, and data; and the possibility of seamless connection between public and private networks (because it’s a global standard). “We can do lots of things with ATM that we haven’t been able to do before,” says Salwen. ■

*Mark A. Clarkson is a freelance science writer living in Wichita, Kansas. You can reach him on BIX c/o “editors.”*

# BETTER THAN BEING THERE

Desktop video teleconferencing could change how you do business

TOM YAGER

Companies labor under primitive notions when it comes to transacting business. Employees commute to and from offices, spend countless wasted hours on airplanes and in hotel rooms, and generally make bad use of time because people insist on doing business face-to-face.

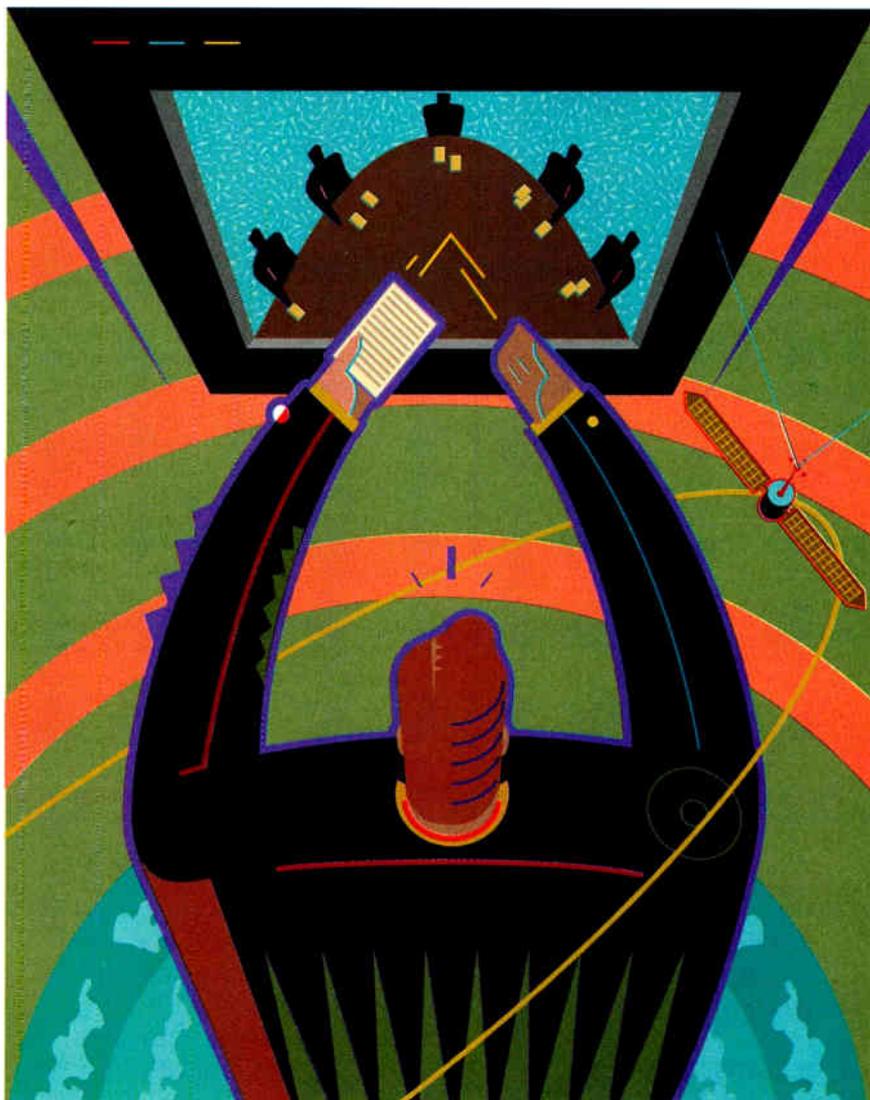
Telephones help, and fax machines and modems help more, but these limited technologies support only one form of communication at a time. Business leaders are reluctant to buy into telecommuting because they understand that *true* communication hinges on the full range of human contact: expressions, sights, and sounds. Yet bringing people together for meetings is costly, both in time and money.

Big outfits like IBM and AT&T are applying technology to solving this problem. They're using expensive satellite-based video-teleconferencing systems to create "virtual meetings" with people in multiple locations. But those without massive resources are in a bind; even scaled-down video-teleconferencing systems cost tens of thousands of dollars. Perhaps more important, they don't offer a complete solution: You still have to go to the video-teleconferencing center.

Why can't video teleconferencing be something you do from your own desk, just like making a telephone call? That's the objective of many companies working on desktop video-teleconferencing solutions. The technology has a long way to go before it's practical, but today's solutions suggest plenty of reason for hope.

## Say What You Will

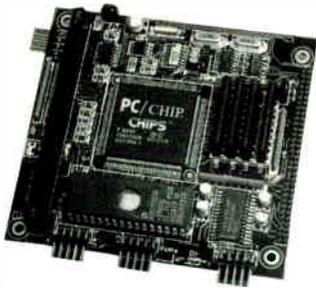
Today's teleconferencing technology falls into one of three categories: voice or data



## "WORLD'S SMALLEST COMPUTER" CREDIT CARD SIZE PC

Now embed a 14MHz DOS compatible PC board in places where you thought it was impossible. It is now simple and inexpensive to build a low power consumption

**Palmtop, Data Collection Unit, Portable Communications Device, PDA, Pen based hand held unit, and more...**



### CAT-3000

- 8086/80186 CPU, Full 16-bit
- Runs at 14MHz
- Fully compatible with DOS 3.0+,
- 1MB RAM, 256K SRAM, 512K EPROM (Optional larger size DRAM, SRAM available)
- Socket for PCMCIA memory card CGA and LCD support
- Keyboard, serial port RS-232 or RS485 support
- Low power consumption
- Optional peripheral board for FDD, IDE, controller, parallel, mouse port, analog to digital converter, sophisticated control functions.

Call for sample unit and complete development kit pricing.

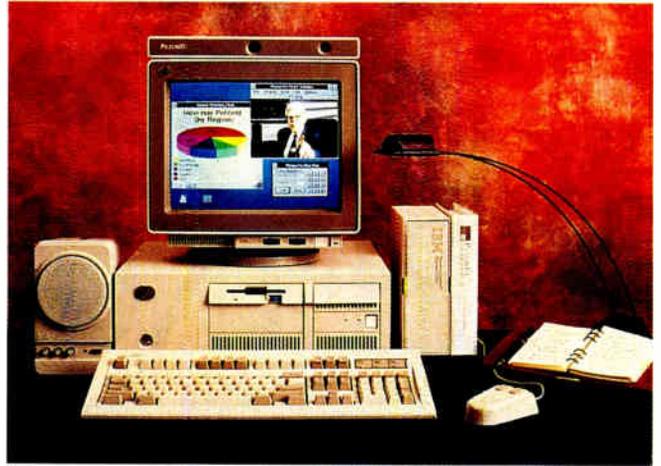
**Phone (800) 662-8904  
Int'l 1-508-975-4392  
Fax (508) 689-8351**

*Custom hardware  
and software  
designs available.*

**DSP DESIGNS INTERNATIONAL**  
70 Flagship Drive, N. Andover, MA 01845

## BETTER THAN BEING THERE

**Photo 1: The PictureTel video-teleconferencing system.**  
(Photo courtesy of PictureTel)



only; voice and video; and voice, video, and data. Everyone is familiar with the first category; it has been around for years in the form of telephone conference calls—an uncontrolled exchange with notoriously poor quality.

Combining voice and video is advanced technically when compared to an ordinary telephone call. But most commercial video phones support only one video and audio connection (with a maximum of two participants). That's too limited for most business uses.

Once you add the ability to pass binary data with the voice and video, the possibilities are limited only by communications-channel bandwidth, data compression, and applications software (see "Hitting Warp Speed for LANs" on page 123). With the right application, you can start a meeting with a colleague in another office and, without making another call or breaking the conversation, send the colleague a document containing a color chart simply by dragging the document into the appropriate folder icon. In addition to that one-shot use of a data channel, you are able to have a constant binary data stream passing other information, such as the data streaming to and from sensory I/O devices (see the text box "Being Here and There" on page 132).

To enhance your productivity, a teleconferencing solution must at least provide the benefits available in an in-person meeting. You want to be able to distribute a written agenda or a proposal for consideration, scribble on an electronic whiteboard, or even pound on a virtual table to get attention. Without electronic equivalents for the things that happen in a face-to-face meeting, teleconferencing comes up short. But more than that, if a computer's going to be involved in the process, you expect it to let you do things *better* than you can in person.

### Both Sides Now

Video teleconferencing is a new spin on an old idea. A dial-up computer service's chat mode is a bottom-rung, multiparticipant teleconference. Participants talk through keyboards instead of with their voices.

More serious versions of text teleconferencing are in widespread use. For example, the U.S. Army Missile Command at the Redstone military base in Alabama uses GroupSystems, a text-based teleconferencing system from Ventana (Tucson, AZ). This system links participants in graphically managed meetings. Files can be shared among participants, and the system's group-writing feature lets them mark up and comment on shared documents. Meetings can be for brainstorming, voting, and alternative evaluation, according to Danny Washington, one of the system's implementers. External participants can dial in and participate in meetings.

In general, Washington believes that electronic meetings are adequate replacements for in-person encounters and that they may be better than face-to-face meetings for large numbers of people. Washington's group plans to add video capability to its electronic-meeting system, but the text-based side will be maintained.

Others at Redstone use MediaMax from

## Video Teleconferencing

- integrates data, voice, and video
- can be used by workgroups
- can reduce business travel expenses
- speeds decision making
- is migrating to the desktop

# The Evolution of CAD

From the beginning of time, we have tried to express ourselves through graphics.

In the beginning of time people had to use primitive design tools for creating any type of graphics.



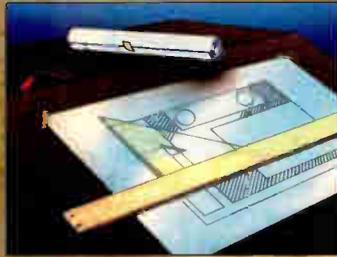
In the 15th Century design tools were quill ink pens and crude styles of paper.



300 to 400% less \$ than AutoCAD!

Faster and easier to use than AutoCAD!

By the 18th Century we had advanced to the drafting table with T-squares, and the dreaded eraser.



In the 20th Century the first CAD programs were very slow and extremely difficult to use, not to mention the expense of buying them.



Now step into the 21st Century...

## DesignCAD

NEW

### Professional Version



DesignCAD Professional is the only complete CAD solution. It's **6 packages in one!**

- **DesignCAD 2D** has all the tools and power necessary to produce professional architectural or mechanical blueprints. With DesignCAD 2D you will become extremely productive!
- **DesignCAD 3D** gives you the power to create and manipulate solid or wireframe objects with quick and easy commands. Render your designs with outstanding photorealistic color!
- **Video Training Tapes** for DesignCAD Professional, are produced in a state-of-the-art facility using award winning writers, and professional technicians. Using these video tapes will assure you of learning faster with higher retention, while becoming more productive!
- **SmartEST** quickly generates a spread sheet from your DesignCAD drawings so you may estimate cost, and do take-offs for accurate bidding.
- **Symbol Libraries** contain over 6700 pre-drawn Architectural and industry standard symbols. These alone will save you a tremendous amount of time and money!
- **ScanPRO** converts (Raster to Vector), scanned images into files that can be read by DesignCAD or most other CAD programs.

Circle 67 on Inquiry Card.

Call, fax or write for a **FREE brochure & demo!**



American Small Business Computers

One American Way  
Pryor, OK 74361

ph: (918) 825-4844 fax: (918) 825-6359

MARCH 1993 • BYTE 133

Gateways are likely to become more important as more companies install E-mail systems. At the very least, having gateways in place can save you from having to dial into several commercial systems each day to pick up all your mail. And a fax gateway would allow anyone in your department to send and receive faxes from his or her desk.

continued

MARCH 1993 • BYTE 137

MULTIPLATFORM E-MAIL

# Gateways and Backbones

**W**hen all your E-mail communication is local, life is simple. You can easily build a robust and secure mail system with any of the packages we've reviewed here. But this simple case is also a trivial one—it's not until your E-mail system can reach out and talk to the rest of the world that you can take full advantage of it.

Reaching out to other sites and other organizations often involves communicating between different E-mail systems, for which you need gateways. All the E-mail systems that we reviewed for this article have gateways to other E-mail systems, at least as options. Besides these, there are also third-

party gateways: For example, Computer Mail Services (Southfield, MI) markets M-Bridge (an SMTP-to-MCI Mail gateway) and S-Bridge (an MHS [Message Handling Service]-to-SMTP gateway).

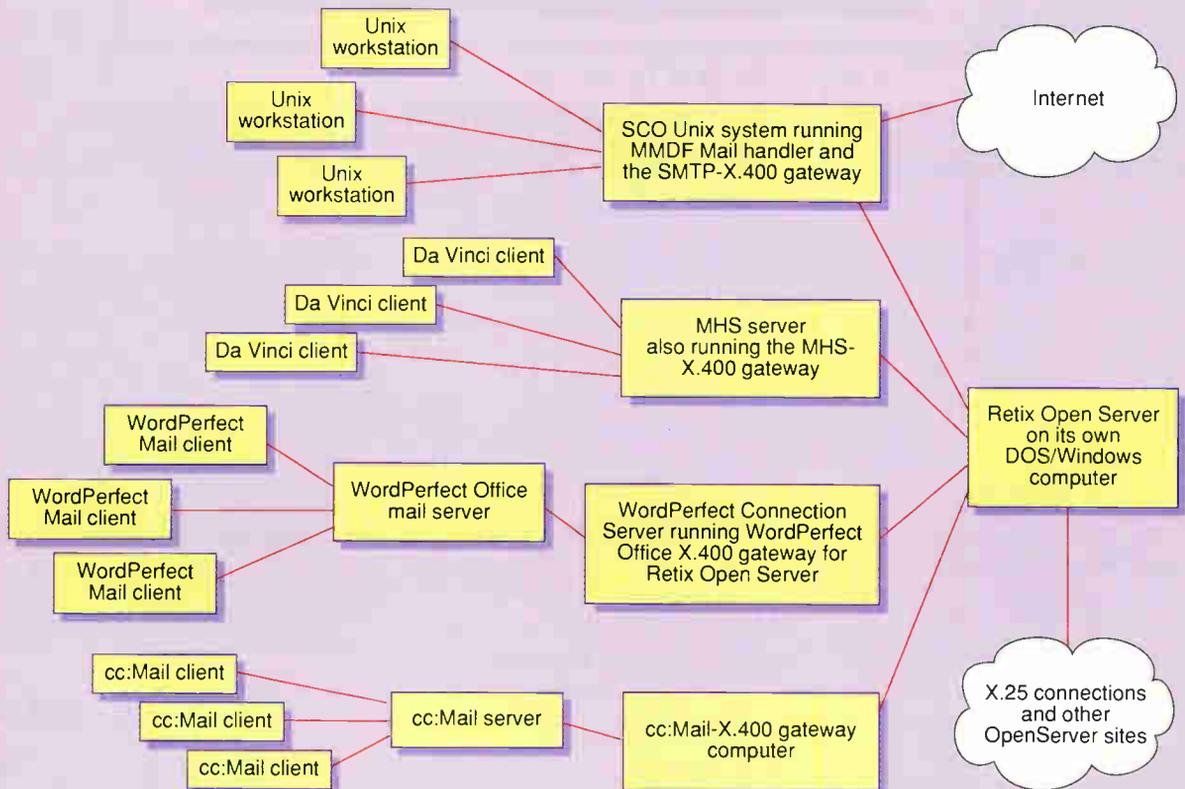
The two most common gateways are to SMTP, the Unix/Internet E-mail protocol, and to X.400, the CCITT-standard E-mail protocol (see "X.400: Standardizing E-Mail" in the December 1990 BYTE). SMTP is important because it is the protocol of the Internet—some 10 million to 15 million mail users. X.400 is important because it is the behemoth of E-mail addressing protocols and a common superset between disparate mail systems. SMTP and

X.400 are the protocols that come closest to establishing a common "language" for E-mail systems.

The basic role of an E-mail gateway is to translate address headers between two different mail systems, leaving messages intact. If you have five different E-mail systems and no common denominator among them, you need 10 different gateways, one for each pair. If one of the E-mail systems changes, you must modify four of the 10 gateways. From the perspective of software installation and maintenance alone, this is obviously a nightmare.

An E-mail backbone can help to alleviate this problem. A backbone is a single-protocol connection among dif-

## SAMPLE GATEWAY TOPOLOGY



BYTE's network topology, which we used for testing Retix Open Server 400.

# The Evolution of CAD

From the beginning of time, we have tried to express ourselves through graphics.

In the beginning of time people had to use primitive design tools for creating any type of graphics.



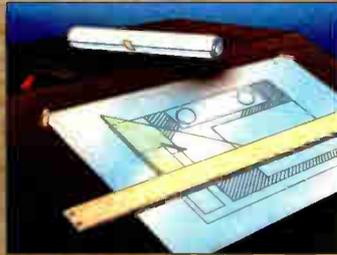
In the 15th Century design tools were quill ink pens and crude styles of paper.



300 to 400% less \$ than AutoCAD!

Faster and easier to use than AutoCAD!

By the 18th Century we had advanced to the drafting table with T-squares, and the dreaded eraser.



In the 20th Century the first CAD programs were very slow and extremely difficult to use, not to mention the expense of buying them.

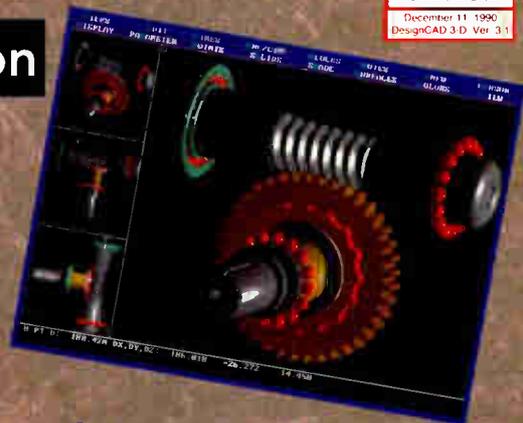


Now step into the 21st Century...

## DesignCAD

NEW

### Professional Version



DesignCAD Professional is the only complete CAD solution. It's 6 packages in one!

- **DesignCAD 2D** has all the tools and power necessary to produce professional architectural or mechanical blueprints. With DesignCAD 2D you will become extremely productive!
- **DesignCAD 3D** gives you the power to create and manipulate solid or wireframe objects with quick and easy commands. Render your designs with outstanding photorealistic color!
- **Video Training Tapes** for DesignCAD Professional, are produced in a state-of-the-art facility using award winning writers, and professional technicians. Using these video tapes will assure you of learning faster with higher retention, while becoming more productive!
- **SmartEST** quickly generates a spread sheet from your DesignCAD drawings so you may estimate cost, and do take-offs for accurate bidding.
- **Symbol Libraries** contain over 6700 pre-drawn Architectural and industry standard symbols. These alone will save you a tremendous amount of time and money!
- **ScanPRO** converts (Raster to Vector), scanned images into files that can be read by DesignCAD or most other CAD programs.

Circle 67 on Inquiry Card.

Call, fax or write for a **FREE** brochure & demo!



American Small Business Computers

One American Way  
Pryor, OK 74361

ph: (918) 825-4844 fax: (918) 825-6359

World Radio History

# Being Here and There

DAVID H. MITCHELL

**T**ele-presence is like the old-time radio broadcasts in which actors re-created the actions of a distant event, except that with this technology you are a part of the action. With tele-presence, you can be in your office in San Francisco and with your colleagues in London at the same time.

Tele-presence uses virtual-reality technology to simulate objects, people, sounds, and worlds (see photo A). You are hooked to your computer through tactile-sensor-equipped gloves and head-mounted displays (see photo B). Your computer (an Amiga 4000 or a Sun Sparcstation 2 is muscular enough) brings to life events in a distant, virtual world using databases or real-time objects and sounds.

Modem-to-modem links or a packet network convey the distant event's essence to you. High-speed (i.e., 19,200 bps) modems are sufficient for two users. ISDN channels are recommended when large amounts of data must be moved quickly for true tele-presence. "With the proliferation of broadband ISDN, virtual worlds will be able to be shared over the phone lines," says Dave Blackburn, founder of The Virtual Reality Institute (Santa Monica, CA).

The output from the digital databases of real objects and sounds are sent to your head-mounted display, depicting scenes such as the one in photo A. Your senses are immersed in an illusionary, yet sensate, world.

These databases are key: They minimize the amount of information that has to be sent to you through your communications pipeline. "With a tele-presence database, you simulate virtual reality without having to pass horrendous amounts of data back and forth," explains Clint Woeltjen, a virtual-reality



**Photos A and B:** Photo A (above) is a virtual model of San Francisco. Photo B (right) shows a man wearing tele-presence equipment. (Photo courtesy of Sense8 Corp.)



researcher and developer.

Photo B shows a man wearing a head-mounted display and a tactile-sensor-equipped glove, with which he is reaching out to manipulate a remote object. The roller panels underneath his wheelchair measure direction and velocity, which are used to create a viewpoint in his virtual world. As the man moves, his viewpoint of the world he's seeing changes.

Today, this equipment is as rare as it is expensive. A typical setup like this requires remotely operable hands to manipulate objects, two-way microphones for conversations, and stereoscopic TV cameras so that you can see what's going on. Costs can start at more than \$100,000 per user.

In spite of the high costs, tele-presence's proponents are increasingly optimistic. Programs that let you design custom databases of real-world objects are already beginning to show up on the market. For example, the WorldToolKit from Sense8 (Sausalito, CA) gives you a set of C functions that you

use to build interactive, 3-D, real-time graphical simulations. WorldToolKit runs on IBM ATs, Sun Sparcstations, and Silicon Graphics Indigo computers. It costs \$3500.

Tele-presence is "going to be on-line by the end of 1993 in several large corporations," says Mike J. Donahue, president and CEO of Ono-Sendai (San Francisco, CA), a start-up company specializing in virtual-reality products. Industry insiders anticipate that the first generation of mass-market, affordable tele-presence gear will enter the market in 1994.

*David H. Mitchell is president of the Diaspar Virtual Reality Network (Laguna Beach, CA), an on-line system devoted to providing an experimental platform for virtual-reality development.*

VideoTelecom (Austin, TX) for video meetings. This conferencing system works with DOS-based PCs and ISDN connections to manage multiple-participant video teleconferencing. Tim Bell, a communications officer, finds that MediaMax is able to handle five or six participants simultaneously

before the group's size becomes unmanageable. Participants see color images of each other, accompanied by audio, and they can pass around data through the ISDN link. "The productivity gains are tremendous," says Bell. The video allows them to exchange graphical information

and to see facial expressions.

Redstone conference members have to trek to specially equipped video-teleconferencing rooms. There are no plans to equip every desk with video, but offices big enough for small meetings may be set up for video teleconferencing, says Bell.

## BETTER THAN BEING THERE

Alison Raffalovich, marketing communications manager for VideoTelecom, credits her company with pioneering the type of video teleconferencing that is being adopted by emerging desktop products. The MediaMax system that is in use at Redstone operates over any digital link (telephone and satellite links are preferred) with a bandwidth of 56,000 bps or higher. MediaMax is not a desktop solution—at least not yet. Some VideoTelecom customers wire multiple rooms and cart the gear from one location to another, says Raffalovich.

With each site costing from \$35,000 to \$80,000 to equip, it's likely to be some time before MediaMax or something of its ilk lands on your desktop. But when video-digitizing and compression/decompression chips become less expensive, standards for passing large amounts of data through networks are solidified, and ISDN becomes more available, VideoTelecom's strategy should map well to a desktop or small-group environment.

### To Your Desktop

The goal shared by those with a stake in video teleconferencing's success is to make a video call as simple to place as a telephone call while retaining all the benefits that high-speed digital channels offer. As with most things, there's more than one worthwhile approach.

PictureTel (Danvers, MA) is shunning the low end of the market, preferring instead to sell smaller systems that equal the quality of their conference-room gear (see photo 1). "People need systems that deliver good-quality video in a 5-inch window or a 27-inch boardroom monitor," says Ron Taylor, manager of media relations for PictureTel. The company's least expensive system costs about \$20,000 and requires an under-the-desk processor unit, but future plans call for personal computer board-based systems and stand-alone video-phones.

PictureTel's goal, according to Taylor, is to ensure complete cross-product compatibility. Video-teleconferencing systems "must have a certain level of quality and performance that makes them more than a toy," says Taylor. PictureTel will eventually compete in the low-end market, but for now it seems content to take the high road.

If Taylor's predictions are correct, PictureTel has plenty to look forward to. He estimates that the worldwide video-teleconferencing market will be worth about \$7 billion by 1997, with 30 percent to 40 percent of those dollars invested in desktop systems. Because desktop solutions cost less, the share of the market occupied by

desktop systems will be closer to 80 percent, says Taylor.

In the meantime, Northern Telecom (Research Triangle Park, NC) is exploring the market with its own full-featured, card-based desktop video-teleconferencing system. Best known as a supplier of corporate telephone equipment, Northern Telecom has long enabled companies to meld their data and voice networks. The advent of ISDN (and its counterparts, such as Switched 56) paved the way for Northern Telecom to extend its connection model to a dial-up video-teleconferencing system that it calls Visit.

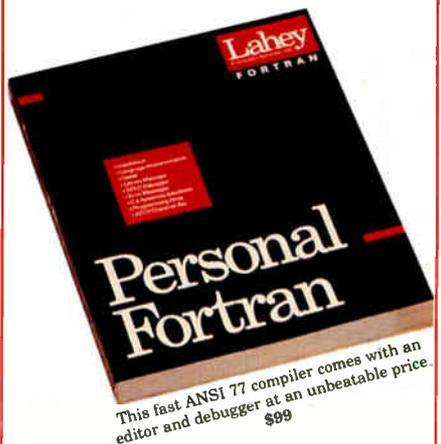
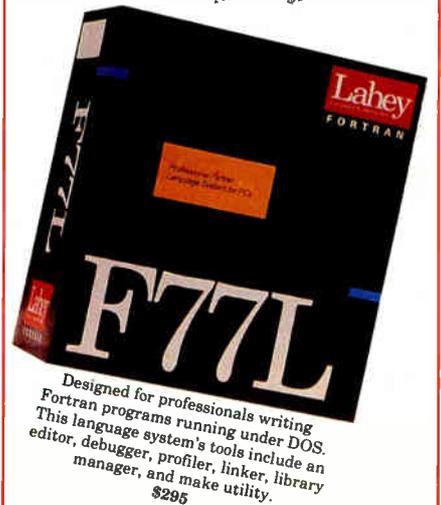
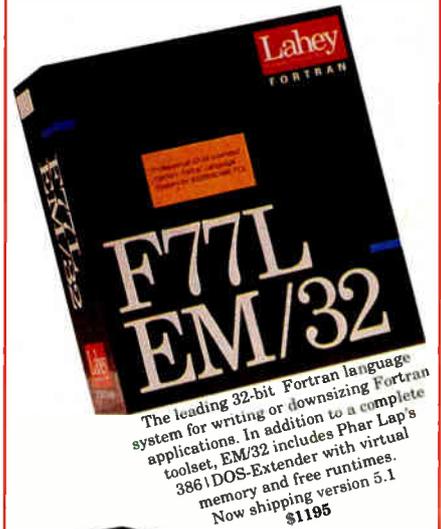
With all its options, Visit equips a PC or a Mac to manage both video teleconferencing and ordinary voice telephone calls (with voice mail). After connecting with another Visit-equipped computer, Visit produces a resizable window displaying a gray-scale moving video of the person you're calling. You also see your own image, which lets you keep yourself properly framed. Both participants can bring up drawings and documents in a shared work space, and Visit has annotation tools for simultaneous markup and written comments. In addition, two-way file transfers are supported.

Visit dynamically manages the data channel. When nothing else is going on, the video and audio occupy the channel's full bandwidth, delivering 8 to 14 video frames per second, depending on the size of the viewing window and the transmission medium. Once you initiate a file transfer or do something in the shared work space, Visit multiplexes the channel, trimming the video frame rate and giving the freed bandwidth to the nonvideo activity. If you want faster file transfers, you can put your video window on hold—whatever you're not doing makes everything else go faster.

Visit works with a PBX, which solves one of video teleconferencing's dicker problems: how to get connections to multiple desks (see the figure). Rather than investing in ISDN or Switched 56 for every desk in the company, you have to buy only enough technology to support all simultaneous video users. Visit communicates with a PBX to allocate line resources and route them to the appropriate desk. It doesn't require a Northern Telecom PBX, but its capabilities are said to be enhanced by the pairing.

Jeff Benson, Northern Telecom's market development manager, says that Visit offers robustness, low cost, ease of use, and performance. The per-seat cost of \$3899 (this does not include the expense of the computer or the hardware for the telephone connection, which adds from

## Just Add Code.



**(800) 548-4778**

Free, Unlimited Technical Support  
30-Day Money-Back Guarantee  
Same-Day Shipping

**Lahey**  
University Research, Inc.

(702) 831-2500

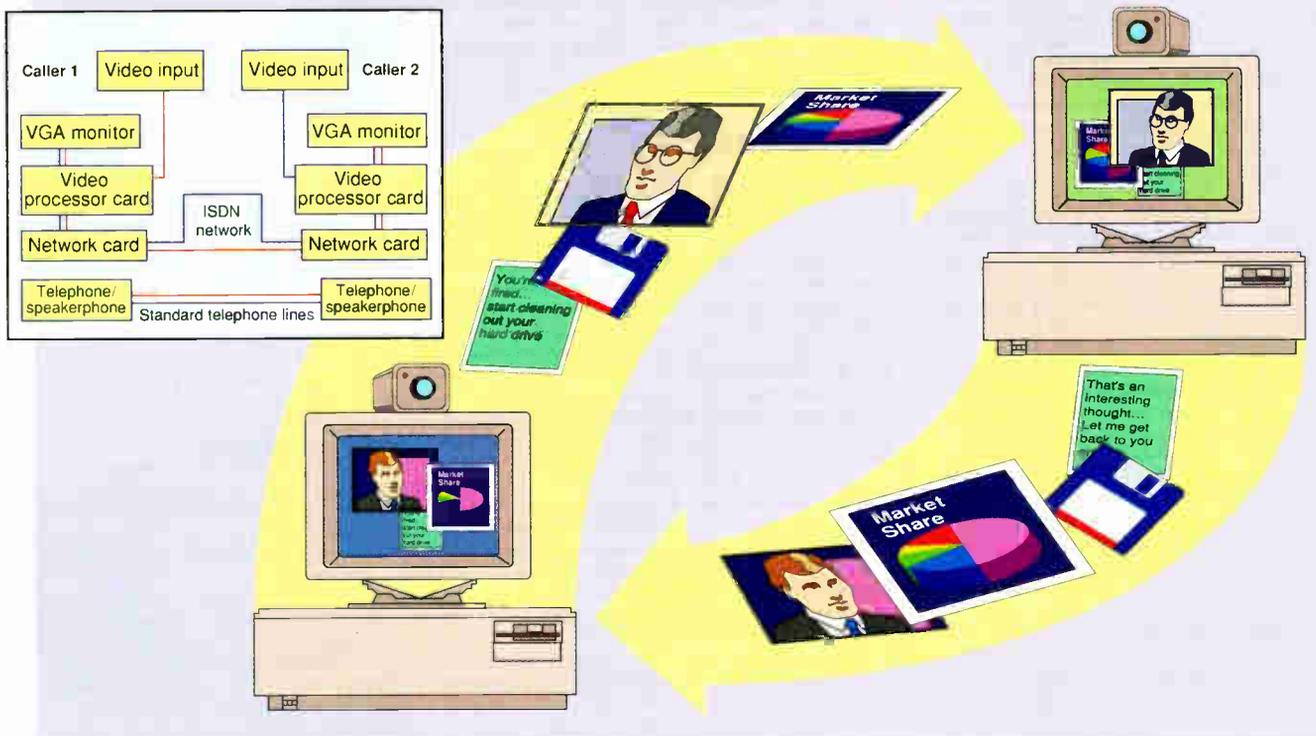
Fax: (702) 831-8123

P.O. Box 6091

Fortran is our forte

Incline Village NV 89450

A TYPICAL VIDEO-TELECONFERENCE SETUP



In video teleconferencing, your images are captured by computer-mounted cameras. Video processors digitize and compress images, which are transmitted over a network bidirectionally. Audio travels via telephone lines or through your network.

\$300 to \$1500) seems to bear out at least the low-cost portion of that claim.

Benson is not optimistic that Visit or something like it will run on an ordinary voice-grade telephone line. Although he allows that modem and compression technology might advance far enough to make it possible, "the real answer has more to do with market requirements than technology." Users, he says, expect a video-teleconferencing link to deliver good-quality video and snappy performance for data-sharing exercises. Thus, even though they cost more, digital-grade transmission lines will be the favored pipeline for systems like this.

**No Longer on Hold**

The future of video teleconferencing looks bright. The rush of interest in multimedia is driving the development of custom hardware and software to digitize and compress video signals. And video teleconferencing is helping to drive the proliferation of ISDN in the U.S. Assuming the future will offer accessible digital telephone connections and inexpensive video-processing hardware, how far can this technology take us?

Brett Boston, president of Group Solu-

tions (Atlanta, GA), a teleconferencing consulting firm, sees the limited implementation of ISDN as a barrier to widespread acceptance of teleconferencing, "but only in the U.S.—Europe is already there." Small private carriers are already building fiber loops through major U.S. cities. In addition, cellular communications will soon gain enough bandwidth for high-speed data transfer and possibly for low-speed video, he says.

Another impediment to the acceptance of teleconferencing is the lack of conference-capable environments and applications. Of the popular computer operating environments, only the X Window System is inherently able to provide the support for the networked user interface that teleconferencing and groupware require. "More vendors have to put better hooks in their software so stuff works together over a network link," says Boston.

Boston believes that Unix will win out because it already supports most of the cooperative attributes that other environments are struggling to acquire. A Unix application, whether text or graphical, can be run almost effortlessly through any kind of digital data link. It's a short hop from there to the connection of multiple

parties in a shared session.

But the biggest problem has nothing to do with technology. "People are just now learning to use voice and electronic mail," says Boston. "Groupware is damn scary for some because it is, by design, quick and completely democratic." That goes against the cultural philosophy of most managers, who are accustomed to central decision making and waiting for paperwork and travel arrangements.

On the other hand, success is often determined by the speed with which a company can make key decisions. Video teleconferencing has the power to reduce or eliminate paperwork delays and commuting and travel time and offers the potential of reducing operating costs by making an employee's work location irrelevant. "Within seven years," says Boston, "there won't be any companies with 3000-person staffs all in one place." ■

*Tom Yager is a multimedia consultant and the author of The Multimedia Production Handbook for the PC, Macintosh and Amiga (Academic Press, forthcoming). You can contact him on BIX as "tyager" or on the Internet at tyager@byteph.byte.com.*

# Get a hold of the best value in LAN power protection

## Now just \$139!

suggested list price

Blackouts, brownouts, sags...  
Your data and hardware are vulnerable to problems that surge suppressors and power directors are just not equipped to handle.

Now there's a complete Uninterruptible Power Supply solution to suit any budget. The Back-UPS™ 250 is reliable protection for LAN nodes, 386SX machines, 286, small PS/2 systems, and internetworking hardware such as routers, bridges, gateways and repeaters.

From the largest server to the smallest router, the Back-UPS Series will increase your productivity by providing a cost-effective solution to power problems. Call for your free power protection handbook.



The **Back-UPS 250** offers even more cost-effective protection for LAN nodes (typical runtime for a 386SX system is 10 minutes).

**NEW!**



■ **ABSOLUTE™** Protection guarantees repair or replacement of equipment (up to \$25,000) if damaged by a surge while protected by a properly installed Back-UPS (See warranty for details).

■ UL, CSA and Novell approved with a 2 year warranty

■ Full-time surge protection and line filtering

■ Most models include LAN interface for automatic-shutdown of Novell, LAN Manager, LAN Server, LANtastic, Banyan, SCO Unix, and others

■ Ask about PowerChute® UPS monitoring software and Novell compatible UPS monitoring boards

■ 230V models available



1991, 1990



| Model                | Application  | List             | New List     |
|----------------------|--|------------------|--------------|
| Back-UPS 250         | LAN nodes, 386SX, 286, internet hardware, POS              | <del>\$109</del> | <b>\$139</b> |
| Back-UPS 400         | Desktop 386, 486 systems, 286 servers                      | <del>\$249</del> | <b>\$229</b> |
| Back-UPS 450         | Tower 386, 486 systems, servers                            | <del>\$329</del> | <b>\$279</b> |
| Back-UPS 600         | Heavily configured systems, CAD/CAM workstations           | <del>\$449</del> | <b>\$399</b> |
| <b>Back-UPS 900</b>  | Multiple systems, longer runtime applications              |                  | <b>\$599</b> |
| <b>Back-UPS 1250</b> | Multiple systems, LAN hubs, small minis, telecom equipment |                  | <b>\$799</b> |

**NEW!**  
**NEW!**

**The Back-UPS™**  
by American Power Conversion  
(800)800-4APC, Dpt. A2

APC Europe TEL: (+33)1.64.62.59.00 FAX: (+33)1.60.17.80.29  
Latin American TEL:(401)789-9771 Asia/Pacific FAX:(401)789-1631

©1993, Back-UPS, PowerChute, Guaranteed ABSOLUTE Protection are trademarks of APC. All other trademarks are property of their respective owners.

**Circle 66 on Inquiry Card.**

# MIXED MESSAGING

**Multiplatform  
internetwork mail links  
diverse network clients**

**HOWARD EGLOWSTEIN  
AND BEN SMITH**

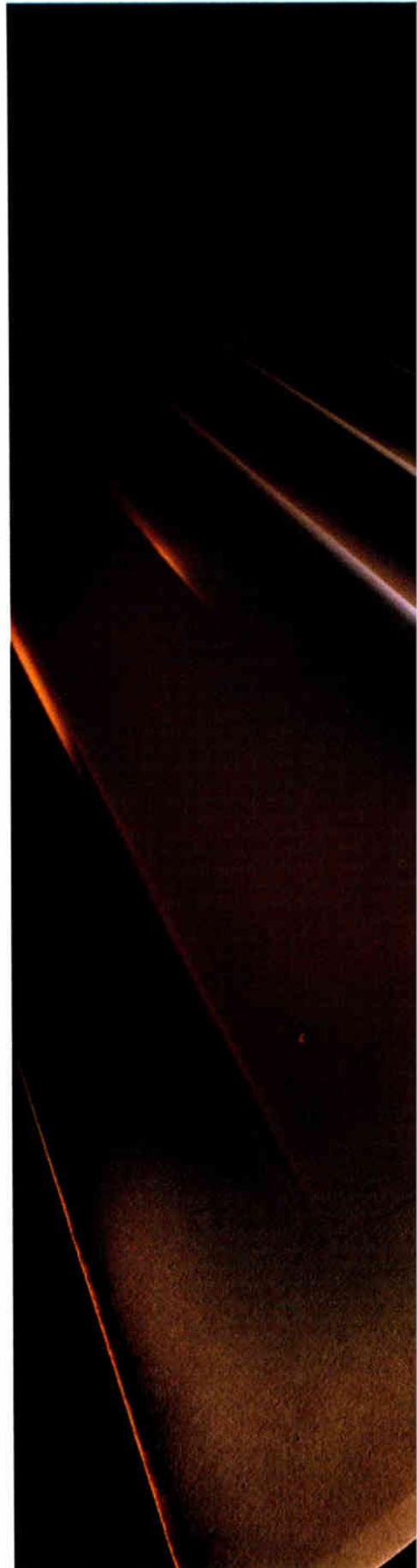
working requirements in mind. Unix mail is a viable solution, but it's one that doesn't readily lend itself to extensive existing PC or Mac networks. For a look at the state of Unix E-mail, see the text box "The Unix Mail Story" on page 148. (Our cover story, "Smarter E-Mail Is Coming" on page 90, explores how E-mail can automate workflow.)

It's the third category, single-vendor mail systems, that we've focused on in this article. We've reviewed E-mail systems that are part of a family of products that promise a full solution to the complex problem of internetwork E-mail. In a shrinking world, where communicating with dissimilar systems at various sites is an everyday requirement, these systems look particularly attractive.

We've selected five E-mail systems that provide both multiplatform client support and a generous allotment of external gateways. Lotus Development's cc:Mail is a network-based system that relies on a shared-file network connection to share mail among Macs, PCs, and Unix systems. Da Vinci Systems' Da Vinci eMail provides client support for PCs and Macs through Novell's MHS (Message Handling Service). Microsoft Mail comes in two flavors, a Macintosh network version (which connects Macs and PCs through AppleTalk) and a PC network version (which connects similar clients through shared files). We tested the PC network version only. CE Software's QuickMail is an AppleShare-based mail system that supports Mac and PC clients. Finally, WordPerfect Office works through various networks and supports many different workstation platforms. The table presents details of client support and lists other features of each product.

Naturally, all these interconnections and all this rampant interoperability create a testing challenge. Our test setup included a battery of Macs and PC compatibles,

**I**f you want to build a multiplatform internetwork mail system today, you have three basic choices. First, you can establish a Unix network and use standard Unix mail protocols. Second, you can mix and match client modules for each platform with vendor-supplied gateways and third-party mail routers. Or, third, you can set up an integrated mail system designed with multiplatform internetworking





## BYTE ACTION SUMMARY

- **WHAT MULTIPLATFORM E-MAIL IS**  
Multiplatform E-mail systems offer support for clients on various operating systems and network platforms and provide extensive gateway links to other E-mail systems.
- **LIKES**  
Gateway connections to virtually every mail system; good user interfaces common among platforms.
- **DISLIKES**  
Client support is uneven on different platforms, and some client user interfaces are poor. Configuring and connecting mail systems is very complex.
- **RECOMMENDATIONS**  
For a wide range of client platforms and for connecting to the most diverse systems, cc:Mail excels. For Mac-specific applications, QuickMail is the best choice.

plus a few Unix workstations, all connected over a mixed Ethernet and LocalTalk network. Cayman Systems' Gator-Box CS provided the connection between LocalTalk and Ethernet, and a NetWare 3.11 file server running NetWare NFS and NetWare for Macintosh provided a common shared-file system. For wide-area connections, we relied on three Hayes V-Series Ultra (9600-bps) modems.

Each E-mail system that we tested used these resources in a different way; we discuss the configurations in the individual product descriptions. We also describe what it's like to set up, administer, and use each E-mail package in a mixed-client, mixed E-mail configuration.

There's one piece of the internetwork E-mail puzzle that these systems, for all their flexibility, don't totally address—the issue of multiprotocol mail gateways and mail backbones. We get into that subject, with some hands-on experience with Retix Open Server 400, in the text box "Gateways and Backbones" on page 146.

Gateways are likely to become more important as more companies install E-mail systems. At the very least, having gateways in place can save you from having to dial into several commercial systems each day to pick up all your mail. And a fax gateway would allow anyone in your department to send and receive faxes from his or her desk.

*continued*

# MULTIPLATFORM E-MAIL

## FEATURES SUMMARY: MULTIPLATFORM E-MAIL

Gateway support and user-interface features are the concerns we concentrated on during our review, but security and configuration issues are also critical. (● = yes; ○ = no.)

|                                 | cc:Mail   | Da Vinci eMail 2.0   | Microsoft Mail<br>for PC Networks 3.0   | QuickMail 2.5  | Wordperfect<br>Office 3.0   |
|---------------------------------|---|--|---|--|---|
| <b>Configuration</b>            |   |  |   |  |   |
| Workstation environments        | Mac, DOS, Windows,<br>Open Look, OS/2   | Mac, DOS, Windows,<br>OS/2   | Mac, DOS,<br>Windows  | Mac, DOS   | Mac, DOS, Windows, SunOS,<br>SCO Unix, Interactive<br>Unix, DEC VMS |
| Requires dedicated mail server  | ○   | ○  | ○   | Mac only   | ● <sup>1</sup>  |
| Conferencing                    | ●   | ○  | ○   | AppleTalk clients only   | ○   |
| On-line conferencing            | ○   | ○  | ○   | AppleTalk clients only   | Mac networks only   |
| Remote-user access              | ●   | ●  | ●   | Mac or terminal  | PCs only  |
| Mail-center forwarding          | ●   | ●  | ●   | ●  | ●   |
| <b>Message creation</b>         |   |  |   |  |   |
| Text editor                     | ●   | ●  | ●   | ●  | ●   |
| Graphics editor                 | ●   | ○  | ○   | ○  | ○   |
| Custom forms                    | Third party   | ○  | ○   | ●  | Mac only  |
| Voice mail                      | Third party   | ●  | ○   | Mac only   | Mac and Windows only  |
| Attachments per message         | 20  | Unlimited  | Unlimited   | 16   | 100   |
| Message priority levels         | 3   | 3  | 5   | 5  | 3 <sup>2</sup>  |
| Return receipts                 | ●   | ●  | ●   | ●  | ●   |
| <b>Message receipt</b>          |   |  |   |  |   |
| Audio alert                     | Mac, DOS, Unix  | All clients  | All clients   | All clients  | All clients   |
| Pop-up                          | Mac, DOS, Unix  | All clients  | All clients   | All clients (icon)   | All clients   |
| TSR/INIT size                   | 32 KB (Mac), 17 KB (DOS)  | 4 KB (DOS)   | 42 KB (Mac), 12 KB (DOS)  | 96 KB (Mac), 9 KB (DOS)  | 7 KB (DOS), 76 KB (Mac)   |
| View attachments                | ●   | Launches application   | Text only   | ○  | Launches application  |
| <b>Administration</b>           |   |  |   |  |   |
| Read any message                | ○   | ○  | ○   | ○  | ○   |
| Delete any message              | ○   | ○  | ●   | ●  | ●   |
| Purge old messages              | ●   | ○  | ●   | ●  | ○ <sup>3</sup>  |
| Message tracking                | ○   | ○  | ○   | ●  | ●   |
| <b>Security</b>                 |   |  |   |  |   |
| Message encryption              | ●   | ○  | ●   | ●  | ●   |
| Administrator can access mail   | ○   | ●  | ○   | ●  | ○   |
| External mail can be restricted | ○   | ●  | ●   | ○  | ●   |
| <b>Gateways</b>                 |   |  |   |  |   |
| MHS                             | Optional  | Native transport   | Optional  | Third party  | Optional  |
| X.400                           | Third party   | Third party  | Optional  | Third party  | Optional  |
| Fax                             | Optional  | Third party  | Optional  | Third party  | Optional  |
| SMTP                            | Optional  | Third party  | Optional  | Third party  | Optional  |
| MCI Mail                        | Optional  | Third party  | Optional  | Through script   | Optional  |
| EasyLink                        | Third party   | Third party  | ○   | ○  | Optional  |
| AT&T Mail                       | Optional  | Third party  | ○   | Through script   | ○   |
| CompuServe                      | ○   | Third party  | ○   | Through script   | ○   |
| SprintMail                      | Optional  | Third party  | ○   | Through script   | ○   |
| DEC All-in-one                  | Third party   | Third party  | ○   | Third party  | ○   |
| IBM PROFS                       | Optional  | Third party  | Optional  | Third party  | Optional  |
| IBM DISOSS/SNADS                | Optional/third party  | Third party  | Optional  | Third party  | Optional  |
| Banyan Vines Mail               | Third party   | Third party  | ○   | Third party  | ○   |
| VMS Mail                        | Third party   | Third party  | ○   | Third party  | ○   |
| User-definable                  | ○   | ○  | ○   | ●  | ○   |
| Others                          | X.25 networks, GE Quick-Comm,<br>Wang VS, Lotus Notes,<br>Voice/PBX, Telex  |  | Microsoft Mail for<br>AppleTalk   | Microsoft Mail   | OfficeVision/VM,<br>Verimation Memo                                 |
| <b>Price</b>                    |   |  |   |  |   |
|                                 | Open Look, \$895 <sup>4</sup><br>Mac, Windows,<br>OS/2, \$495 <sup>4</sup><br>DOS, \$295 <sup>4</sup><br>10 users, \$345<br>25 users, \$845<br>100 users, \$3295<br>cc:Mail Remote for<br>Mac or DOS, \$295<br>MCI Mail gateway, \$1295<br>cc:Mail Router, \$1295<br>SMTPLink, \$2995 | DOS Starter<br>(10 users), \$499<br>DOS/Windows Starter<br>(10 users), \$799<br>5 users, \$249<br>30 users, \$1299<br>100 users, \$2999<br>1000 users, \$19,999<br>MacAccess<br>(5 users), \$395 | Microsoft Mail Server<br>(10 users), \$695<br>5 users, \$395<br>20 users, \$1349<br>50 users, \$2499<br>100 users, \$5500<br>500 users, \$22,500<br>(All clients included<br>in server price) | 1 user, \$199<br>5 users, \$399<br>10 users, \$599<br>50 users, \$2499<br>100 users, \$4699<br>1-user add-on, \$99 | 5 users, \$495  |

**Notes:**

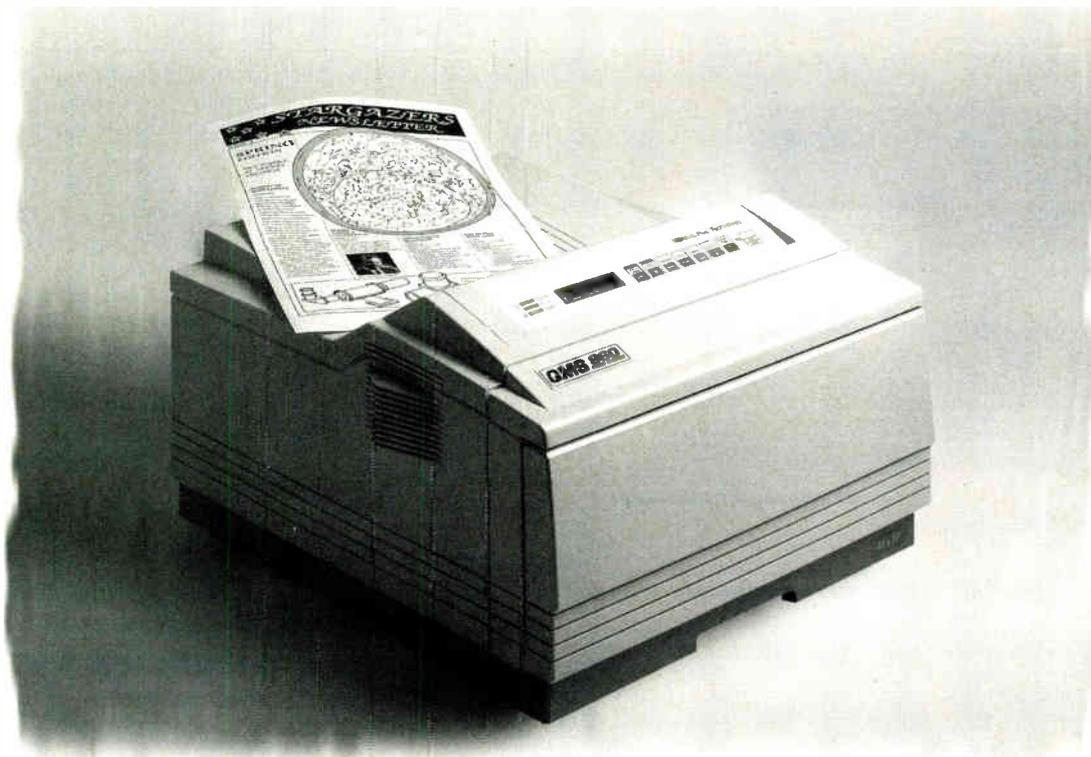
<sup>1</sup> Dedicated server required if more than one post office.

<sup>2</sup> There are 27 priority levels for Mac clients.

<sup>3</sup> Connection server queues only.

<sup>4</sup> Prices are per post office.

**SOME FEAR IT. ALL RESPECT IT.**



**WE BUILD IT.**

# **HAMMERHEAD**

**THE PERFECT PRINTING MACHINE.**

QMS has just released a serious predator into the sea of ordinary printers. The QMS® 860 Hammerhead printer is the first to feed on a Canon® LBP®- BX engine to give you true 600x600 dpi output in up to 11x17/A3 format. Its 25MHz RISC processor and optional EtherTalk®, NetWare®, or a host of other network support make it sleek, fast, and capable. It has everything you've asked for in a desktop printer— high resolution, PostScript™ Level 1 and 2 compatibility, HP PCL® and HP-GL® emulation, and up to 11x17/A3 output. It's fast, compact, compatible with all major platforms, and so affordable that it's causing a frenzy among the competition. The QMS 860 Hammerhead™ is the perfect printing machine. Get it. Call **800 841-0760** or **205 639-4400** for your nearest QMS dealer.

**True 600x600 dpi • 11x17/A3 • \$4595\***

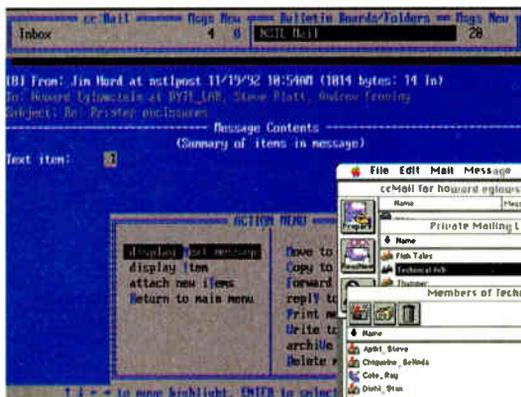


\* Suggested retail price, U.S.



QMS, the QMS logo, and Hammerhead are trademarks or registered trademarks of QMS, Inc. PostScript is a trademark of Adobe Systems Incorporated which may be registered in certain jurisdictions. All other product and company names are trademarks or registered trademarks of their respective companies.

**Circle 98 on Inquiry Card (RESELLERS: 99).**



**Screen 1:** *cc:Mail's DOS interface (left) is straightforward after a little practice. After you select a message from your in box, cc:Mail displays the message and presents you with the Action menu. From here you can reply to, delete, or file the message.*

## cc:Mail

In the BYTE Lab's last review of E-mail systems ("Please, Mister Postman," March 1991), we found a lot to like in cc:Mail 3.15. We judge the latest cc:Mail, now under the auspices of Lotus Development, to be much improved. In addition to the DOS, Mac, and Unix clients, we also tested an alpha version of a client for the OS/2 Workplace Shell (see the text box "E-Mail from the Workplace Shell" on page 142).

The central cc:Mail engine remains unchanged. On either Mac or PC servers, cc:Mail uses a shared file area on your network for mail exchange, providing BBS and user-to-user communication. All network users access the same mail database, and cc:Mail relies on file locks to control the mail system. We tested cc:Mail in a NetWare environment to make Unix connectivity easier, but the system should work just as well with an AppleShare file server.

You buy cc:Mail in a "platform pack," which consists of an administration package, client software for any one platform, and the ability to create one user, the system administrator. To add more users to your mail system, you buy user packs that add another 10, 25, or 100 users. The administrator copies serialized data from the pack disks to expand the system's capabilities.

The administration utilities are much better than they were in the older version, and they're now available for either Mac or PC platforms. Most of the user interface (see screens 1, 2, and 3) is unchanged. The Mac interface has clear, easy-to-follow icons to lead you through creating and reading your mail. The DOS version mimics the Mac's functionality through a menu system. Once you've spent some time with the DOS interface, it's



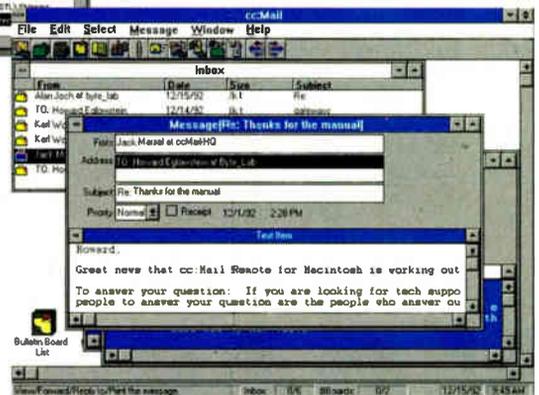
**Screen 2:** *With cc:Mail for the Mac (left), clearly labeled icons are the norm. The second window shows the buttons used to prepare new messages. Even the user directory uses icons to show you the location of each user. The large mailboxes are local LAN users; the smaller ones are users at another post office. The blue postal drop box is another post office—in this case, an Internet mail gateway.*

perfectly usable—it's not a Mac, but not much can compare to a good Mac interface.

The Windows client software is brand new. While it has some attributes of the Mac version, there are a few important differences. Lotus's influence shows in the incorporation of SmartIcons in the Windows interface. "Smart" is something of a misnomer, though, because the icons themselves are small and obscure. The Mac interface has fewer icons and a word or two under each icon to describe its function. The Windows SmartIcons are simply clumped together in a single row, with no label, leaving you to guess what they might mean.

The system administrator manages a system directory, which is the complete list of all users and post offices available to system users. Users can be local (they have mailboxes on the LAN), remote (they have no mailboxes but call in using remote software), or remote via a post office (their mailboxes are not on this LAN but on another). The administrator adds users by name and assigns each a mailbox or a remote address.

Perhaps the most powerful feature of cc:Mail is its wide variety of external gateway support and the ease with which your local users can send external mail. The cc:Mail gateways are typically programs that run on dedicated PCs on your network. When you address mail to a gateway, the gateway machine picks it up, readdresses it, and sends it out via modem, network, or whatever mechanism is appropriate.



**Screen 3:** *The Windows user interface (above) has many features in common with the Mac screen, but it suffers from extensive reliance on obscure icons.*

For example, cc:Mail's SMTPLink gateway provides transparent two-way access to the worldwide Internet mail system. In the cc:Mail directory, the gateway appears as the post office "SMTPLink." Suppose that your site and ours are both equipped with cc:Mail and an SMTP gateway but don't have a direct cc:Mail connection. If you wanted to send mail to us at BYTE, you'd simply select the SMTP post office and, when prompted, enter the address as letters@bytepb.byte.com. The SMTP gateway sees the message, retrieves it from the network, and forwards it to the local mail relay (you need an existing Internet mail link to use the gateway). The Internet brings the mail to our link, bytepb.

The bytepb link sees the message and forwards it to our SMTP gateway via TCP/IP. Our gateway sees the incoming message, recognizes the addressee as a cc:Mail user, and places the message in our cc:Mail mailbox. A similar mechanism provides for dial-up cc:Mail-to-cc:Mail post office communication, communication between



# A chain is as strong as its weakest link.

Picture your Hardlock™ key as a bike lock, and the accompanying software routines used to implement the copy protection as the chain. You can own the best lock that money can buy, but that lock is useless if the chain is weak.

Introducing **HL-Crypt**, a major breakthrough in copy protection. HL-Crypt is not just a shell or simple conditional response checker. Using our proprietary Patcher Technology, HL-Crypt encrypts and binds the application to your Hardlock™ device. HL-Crypt features many protection modules that secure the application against piracy, reverse engineering, and debugging, to name a few.

Picture HL-Crypt as an ironclad chain. The only ironclad chain in the industry today. For more information, call

1-800-562-2543

## HL-Crypt

**The Fortified Protection Linker  
for Hardlock**

**GLENCO**   
**ENGINEERING INC.**

SERVING THE SOFTWARE INDUSTRY SINCE 1979

270 Lexington Drive  
Buffalo Grove, IL 60089-6930  
Phone 708/808-0300  
Fax 708/808-0313

The only product that combines fortified software encryption with the Hardlock™ family of copy protection devices for single user and network implementation. Made in the USA.

For a distributor in Europe contact East Electronic GmbH, Tel: 49-89-539-800-20 Fax: 49-89-539-800-40  
In Korea contact Finecom, Tel: 82-4-590-5811 Fax: 82-2-605-5729  
In Brazil contact HT MAX, Tel: 21-257-0214 Fax: 21-235-6808  
In Lille contact Datasoft S.A., Tel: 562-240-7943 Fax: 562-208-0591  
In Peru contact YC H.L., Tel: 51-14-440567 Fax: 51-14-475984  
In Uruguay contact Soltec, Tel: 90-60-10-92-31-08 Fax: 0598-2-92-16-18

# E-Mail from the Workplace Shell

JON UDELL

Testing cc:Mail in the BYTE Lab gave us the opportunity to explore an alpha version of cc:Mail's OS/2 2.0 client (see screen A). We ran the client on an IBM PS/2 Model 90 running OS/2 2.0, which was connected to our NetWare host via the NetWare requester for OS/2 and an SMC (Standard Microsystems Corp.) EtherCard Plus Elite/A Ethernet adapter. We found that cc:Mail for the OS/2 Workplace Shell (the client's official name) lives up to its lengthy title—it is one of the first applications we've seen that truly exploits the WPS (Workplace Shell).

Because the cc:Mail folder is a standard WPS folder, you can use the normal Control-Shift-drag procedure to "shadow" the objects it contains (i.e., an in box, public and private mailing lists, a folder list, and a message template) to the desktop for quick access. But just dragging these objects to the desktop, without the Control-Shift modifier, achieves the same result, because objects in the cc:Mail folder exhibit shadowing as their default drag behavior. This is just one example of the useful customization available through the WPS API. If you check the cc:Mail folder's "work area" option (another standard feature of WPS folders), the shell will retain the state of your cc:Mail objects and restore them—opening and placing windows as needed—when you reopen the folder.

As with the Windows cc:Mail client,



Screen A: cc:Mail provides excellent WPS integration, including "mail-enabling" of the desktop.

each of the cc:Mail folder's child windows presents a row of SmartIcons that make nearly every function locally available. However, right-clickable context menus localize control even further. In Windows you create a new folder by way of the MDI (Multiple Document Interface) parent's File/Create Folder menu option. Under OS/2, the folder list floats free of a containing MDI parent; you create a new folder by right-clicking and choosing Create Another. You can also reorder any of the list-style displays (messages, folders, addresses) by clicking at the top of the column that you want to be the primary key.

Drag-and-drop behaviors abound in the OS/2 cc:Mail client. To add a user to a private mailing list, you drag an entry from the address book and drop it onto the list. To move a message from

the in box to a folder, or between folders, you drag and drop. This internal drag-and-drop capability resembles that of the cc:Mail Windows client. But the OS/2 client goes further: There are various drag-and-drop operations that extend past the boundaries of the cc:Mail folder and the objects it owns. To mail someone a file, you can drag a file icon from a folder and drop it on a message template. (The Windows version can in principle accept drops from File Manager, but currently it does not.) Or you can drag individual messages to the desktop or to other WPS folders,

where they can freely intermingle with data objects that represent ordinary files.

You can also drag a cc:Mail message template from the Templates folder. The resulting customizable object acts as a new kind of private mailing list that can contain boilerplate text and attachments and can accept dropped files. Moreover, cc:Mail makes the entire WPS mail-aware: Every file object's context menu offers a "cc:Mail It!" option that invokes a message template containing that file as an attachment. It's a pleasure to see the WPS's rich programming model exploited to such good effect.

*Jon Udell is a BYTE senior technical editor at large. You can reach him on BIX as "judell" or on the Internet at judell@byteph.byte.com.*

cc:Mail and MCI Mail, or communication between cc:Mail and a long list of supported systems.

When you travel away from the office, you'll want a copy of cc:Mail Remote for either DOS or the Mac. It has essentially the same interface as the local version, but it allows you only to read new messages.

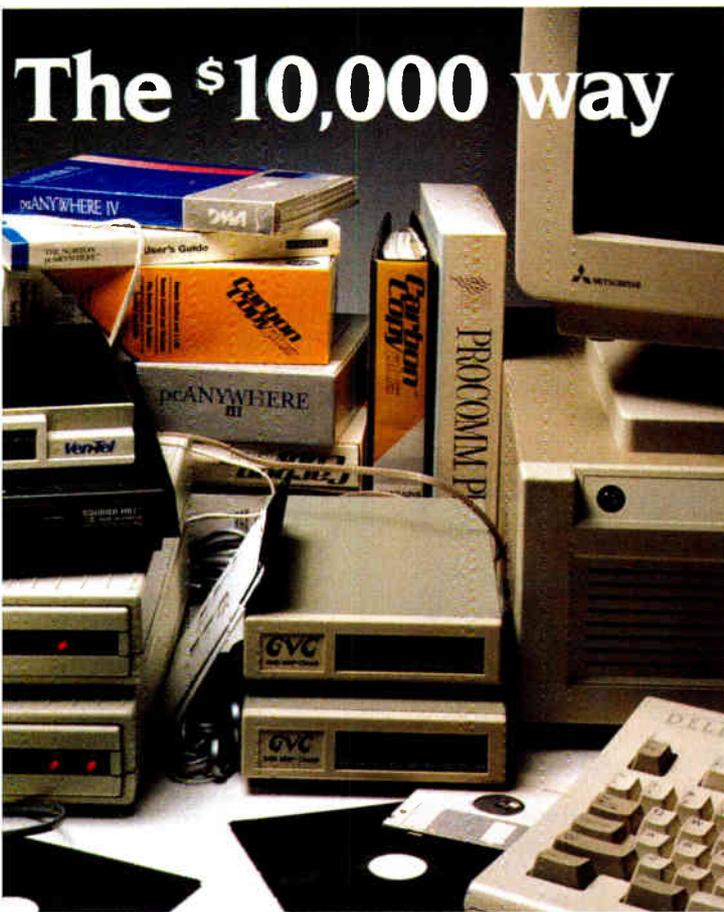
You can't access the BBSes or stay on-line while you write your replies. When you make a connection, Remote snags your new messages and sends out any you've written; you read your mail off-line and post your reply to your portable's hard drive.

Sending a reply to a new cc:Mail mes-

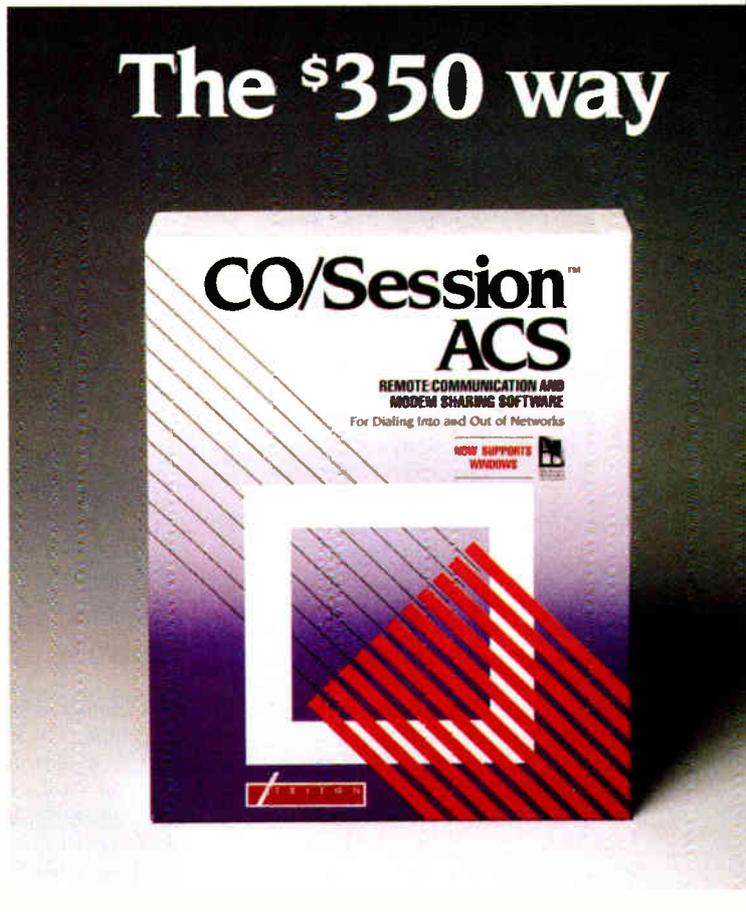
sage requires two connections: one to receive the message and one to send back the reply. Although this might be the most cost-effective way to handle remote mail, it would be handy if cc:Mail allowed you to stay on-line and respond. That way, you could avoid having to establish two connections.

*continued*

# How to provide dial-in, dial-out access for every user on your LAN



The \$10,000 way



The \$350 way

## CO/Session™ ACS modem sharing software. The only communication software a LAN needs.



Data exchange from one location to another is a vital part of daily business operation. Until now, you had to buy thousands of dollars worth of modems, phone lines and software to provide the necessary communication access to LAN users. Not anymore! CO/Session ACS lets *all* network users share from one to twenty modems on your LAN with full communication capabilities — all for as little as \$350.

### Remotely dial into any PC on the LAN through shared modems

CO/Session ACS' easy-to-use selection menu lists all available PCs on the LAN. Simply dial in with CO/Session remote control software and select the network PC you want to control — even PCs without attached modems. You can run that PC as if you were sitting at its keyboard — to access the company database, transfer files, or check E-mail. CO/Session is PC Magazine Editors' Choice, so you'll be assured the fastest, most reliable remote access for both DOS and Windows.

### Use shared modems to dial out from your network PC

Use CO/Session ACS to connect to bulletin boards, online services or other PCs. Or, use any communication software that supports Interrupt 14 including PROCOMM™ and Crosstalk®.

### The Best Value

Unlike other solutions, there's no need to dedicate a PC for sharing modems. Requiring fewer modems, phone lines and software, CO/Session ACS handles all your network communication needs and will save you thousands of dollars!

For more information on CO/Session ACS call toll free:

**800-322-9440**



TRITON TECHNOLOGIES, INC.

200 Middlesex Turnpike, Iselin, NJ 08830  
908-855-9440/Fax: 908-855-9608

CO/Session is a registered trademark of Triton Technologies Inc. Other products are trademarks or registered trademarks of their respective companies.

Circle 157 on Inquiry Card.

World Radio History



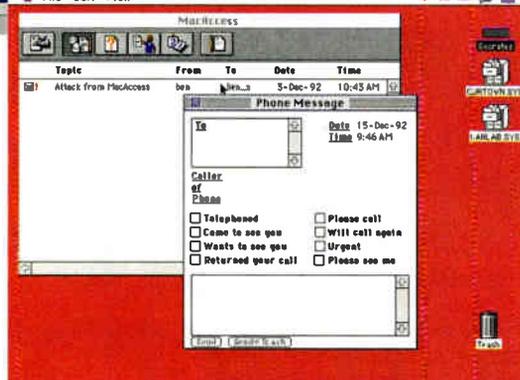
Screens 4 and 5: *Da Vinci eMail* provides an excellent Windows user interface (left). It includes tools for composing messages, selecting addresses, and other common functions. *Da Vinci MacAccess* (below) provides Mac clients with access to MHS-based *Da Vinci eMail*.

## Da Vinci eMail 2.0

**D**a Vinci eMail relies on NetWare MHS as its mail carrier, so it's inherently a PC-centric mail package (see screen 4). However, Da Vinci provides support for Macintosh clients through Da Vinci MacAccess (see screen 5), a Mac MHS client.

Relying on a specific network configuration limits the applicability of the system, but it also greatly simplifies its installation and maintenance. Exploiting MHS also gives you the advantage of not requiring a dedicated mail server. Of course, as with all the DOS E-mail systems, you will need separate computers for each gateway.

Da Vinci eMail's Windows user interface is very good. It includes all the standard tools for composing messages, selecting addresses, searching the mailbox



or folders for messages, and building personal mailing lists. You can include enclosures with your messages; Da Vinci gives you a long list of predefined scripts for launching applications associated with enclosures. If your Windows system can record voice messages, you can easily attach voice components (i.e., .WAV files) to your E-mail messages. Da Vinci for Win-

dows can also send strings and Clipboard contents as E-mail messages through DDE. There are two E-mail DDE request commands: one that finds the current user name, and one that brings up the address list.

The Windows client also includes predefined forms (e.g., While You Were Out slips). These forms make an excellent addition to standard mail. Unfortunately, there are two critical drawbacks: First, you can share forms only among Windows clients (DOS and Mac clients see only the text), and second, you can't define your own forms.

When you send a message, you can request a return receipt (Da Vinci calls this "Certified Mail"). This forces the recipient's E-mail post office to send you a message when the addressee reads the message or deletes it without reading it.

Under DOS or Windows, Da Vinci eMail notifies you of incoming messages through a separate application that periodically checks your mailbox for new mail. Da Vinci MacAccess clients get notification only when they make connection.

Da Vinci eMail has long excelled in ease of use for both users and administrators. Mail gateway support is outstanding; MHS-based, Da Vinci eMail offers easy access to other mail systems through a long list of third-party MHS gateways.



Screens 6 and 7: *Microsoft Mail* provides a good measure of user control over outgoing mail. When you mail from one post office to another, the gateway will notify you if your mail isn't delivered in a timely fashion. Both DOS (above) and Mac (right) mail clients are simple and easy to use. The Windows client provides similar functions.

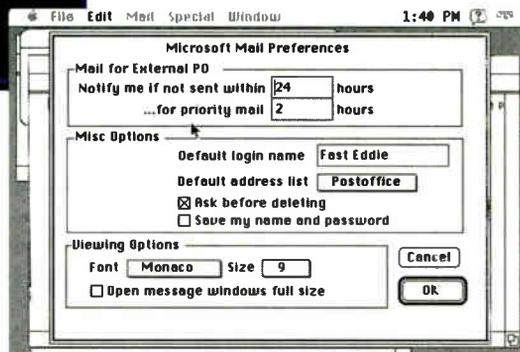
## Microsoft Mail for PC Networks 3.0

**W**hen we last looked at Microsoft Mail (March 1991), there was only a Mac network version. The Mac version uses a dedicated Macintosh on your AppleShare network to store all the mail. To use a PC client, you have to in-

stall an AppleTalk board in the PC.

The Mac version (Microsoft Mail for Macintosh Networks) is still out there, but this time we reviewed the PC Network version. The primary difference between the two is that in the PC Network version the shared files reside on a file server, not a dedicated machine. The user interface and gateway issues are essentially the same.

Version 3.0 has an improved interface (see screens 6 and 7). The main window gives you clearly labeled icons for the functions you will use most often. We will not go into elaborate detail, as the interface items are mostly self-explanatory. What we found most useful is the rich variety of administration tools. Of the five E-mail systems in this review, Microsoft Mail gives the



# WEIGH THE OPTIONS



**New Plus Series  
with 19.2Kbps &  
Voice Capability  
starting at \$649**

**ONLY!  
\$469**  
Also Available:  
PC Plug-In Card  
U-1496 B \$449

14.4 Kbps - V.32bis + V.42bis High Speed Modem/Fax

| Model                            | Price        | Fast Renegotiation<br>Online Fall<br>Back/Forward | Remote<br>Configuration | Call Back<br>Security With<br>Password<br>Protection | FAX V.17<br>14.4 Kbps<br>S/R | Caller ID  | Distinctive<br>Ring |
|----------------------------------|--------------|---|-------------------------|--|------------------------------|------------|---------------------|
| Digicom 9624LE+                  | \$695        | NO  | NO                      | NO   | NO                           | NO         | NO                  |
| Practical 14.4 SA                | \$549        | YES   | NO                      | NO   | NO                           | NO         | NO                  |
| Microcom<br>GX/4232bis           | \$899        | YES   | YES                     | NO   | NO                           | NO         | NO                  |
| Hayes Ultra 14.4                 | \$999        | YES   | NO                      | NO   | NO                           | NO         | NO                  |
| U.S. Robotics<br>Courier V.32bis | \$995        | YES   | YES                     | NO   | NO                           | NO         | NO                  |
| Telebit T3000                    | \$949        | YES   | YES                     | YES  | NO                           | NO         | NO                  |
| Multimodem<br>MT1432BA           | \$899        | YES   | YES                     | YES  | NO                           | NO         | NO                  |
| <b>ZyXEL U-1496E</b>             | <b>\$469</b> | <b>YES</b>  | <b>YES</b>              | <b>YES</b>   | <b>YES</b>                   | <b>YES</b> | <b>YES</b>          |

14.4Kbps-V.32bis/V.32 + V.42bis/MNP<sup>®</sup> 5, V.42/MNP<sup>®</sup> 4,3

## The features you want in a High Speed-14.4Kbps Modem/Fax. At nearly half the Price!

ZyXEL's U-1496E offers all the standard features available in a 14.4Kbps- V.32bis+V.42bis modem/fax with DTE speeds up to 57.6Kbps. But you'll also find features you'd expect in only the "top-of-the-line" modems. So why pay more for the features you want, when you can get the best value from ZyXEL for less?

### Caller ID/Distinctive Ring

Displays the caller's phone number, time and date stamp directly on your screen, and responds to the distinctive rings for incoming fax or modem calls.

### Enhanced FAX

14.4Kbps G3 fax with automatic detection of fax or modem calls. Automatically receives, stores and/or prints faxes with our FREE ZFAX software.

### Automatic Fast Rate Renegotiation

Online automatic speed fall-back/fall-forward allows the highest throughput achievable during poor line conditions.

### Multi-Level Security

Security password protection and automatic call-back features are designed so only authorized callers can access your system.

### Nonvolatile Memory Storage

Store up to 4 user configuration profiles in NVRAM, plus up to 10 user phone numbers and their associated passwords.

### Software/System Compatible

Supports V.25bis autodial and enhanced AT Command Set, ensuring compatibility with popular communications/fax software. Available with MIC<sup>™</sup>, Windows<sup>™</sup> and DOS fax software packages.

### Guarantees

We offer a Full 5 year Parts and Labor Warranty, a 30 day money back guarantee and full BBS technical support line.

Once you've weighed the options, you'll agree: ZyXel's U-1496E offers the best value for less than any other modem/fax in its class. So, don't hesitate. **Call Today.**

**ZyXEL USA**  
**(800) 255-4101**  
Reseller discounts available

TEL (714) 693-0808  
FAX (714) 693-0705  
BBS/Tech.Support  
(714) 693-0762



Editor's Choice: ZyXEL U-1496E  
German Edition, 4/92

ZyXEL USA, 4920 E. LaPalma Ave., Anaheim, CA 92807  
All brand names and trademarks are the property of their respective owners.  
Comparison chart was completed in May, 1992.

Circle 178 on Inquiry Card (RESELLERS: 179).

World Radio History

# Gateways and Backbones

**W**hen all your E-mail communication is local, life is simple. You can easily build a robust and secure mail system with any of the packages we've reviewed here. But this simple case is also a trivial one—it's not until your E-mail system can reach out and talk to the rest of the world that you can take full advantage of it.

Reaching out to other sites and other organizations often involves communicating between different E-mail systems, for which you need gateways. All the E-mail systems that we reviewed for this article have gateways to other E-mail systems, at least as options. Besides these, there are also third-

party gateways: For example, Computer Mail Services (Southfield, MI) markets M-Bridge (an SMTP-to-MCI Mail gateway) and S-Bridge (an MHS [Message Handling Service]-to-SMTP gateway).

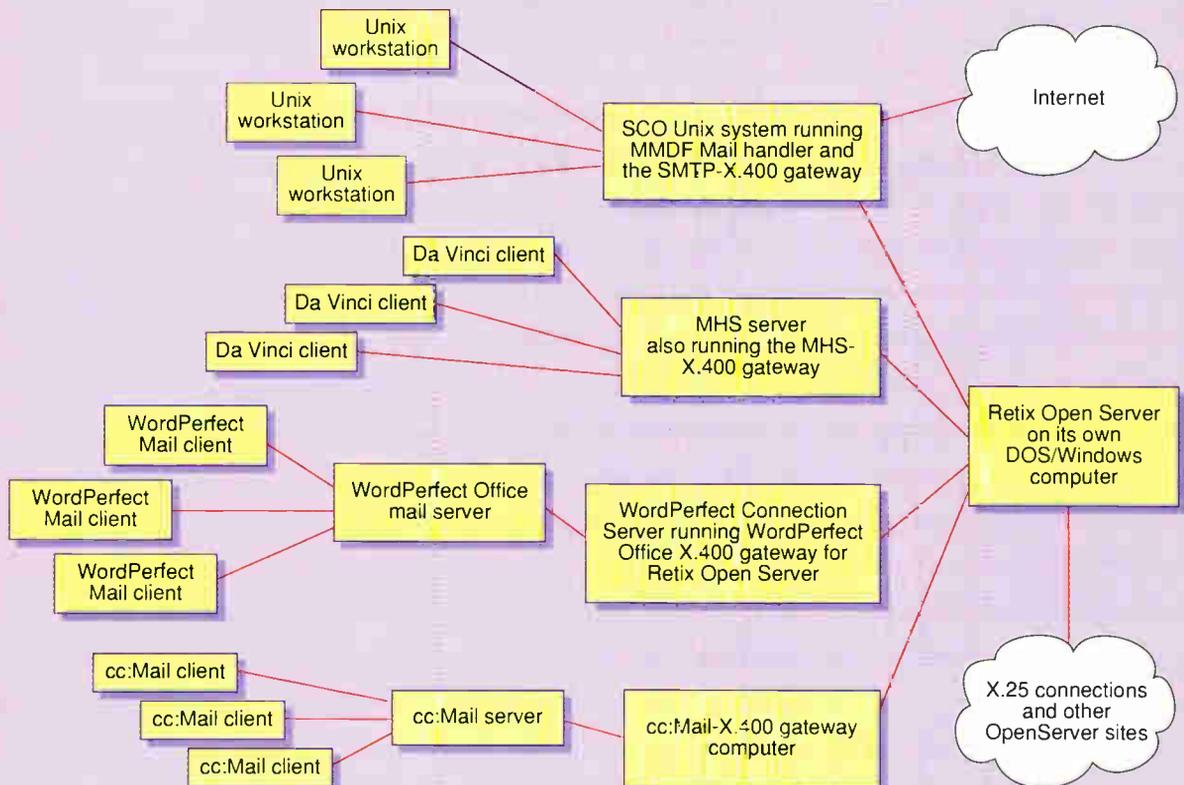
The two most common gateways are to SMTP, the Unix/Internet E-mail protocol, and to X.400, the CCITT-standard E-mail protocol (see "X.400: Standardizing E-Mail" in the December 1990 BYTE). SMTP is important because it is the protocol of the Internet—some 10 million to 15 million mail users. X.400 is important because it is the behemoth of E-mail addressing protocols and a common superset between disparate mail systems. SMTP and

X.400 are the protocols that come closest to establishing a common "language" for E-mail systems.

The basic role of an E-mail gateway is to translate address headers between two different mail systems, leaving messages intact. If you have five different E-mail systems and no common denominator among them, you need 10 different gateways, one for each pair. If one of the E-mail systems changes, you must modify four of the 10 gateways. From the perspective of software installation and maintenance alone, this is obviously a nightmare.

An E-mail backbone can help to alleviate this problem. A backbone is a single-protocol connection among dif-

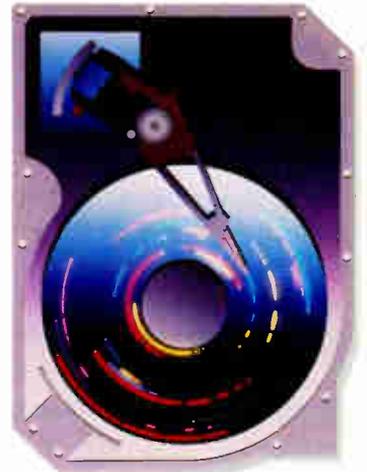
## SAMPLE GATEWAY TOPOLOGY



*BYTE's network topology, which we used for testing Retix Open Server 400.*

UPGRADE TO v6.5  
\$19.95 — 1-800-344-4323

## Hard Drive Installation and Diagnostics



### Made Easy.

Now, adding a hard drive to your system is as easy as typing "install." There's no need to know DOS or complicated commands. SpeedStor automatically performs all of the operations to make your drive "data ready." And to keep your drive "data safe," SpeedStor contains critical diagnostics not found in DOS — diagnostics that safeguard your valuable data and ensure your hard drive is trouble free.

Available at Best Buy, Egghead Software, Computer City Supercenter, CompUSA, Elek-Tek and Software Etc. Order today, call 1-800-344-4323.

 STORAGE DIMENSIONS

**SpeedStor**  
Storage Installation And Diagnostic Software

SpeedStor is a registered trademark of Storage Dimensions.  
©1992 Storage Dimensions

MARCH 1993 • BYTE 147

ferent systems. Each system has a gateway to the common backbone protocol. An X.400 mail server, such as Retix's Open Server 400 (see below), serves this purpose well. X.400 mail servers also have an advantage in being well suited for X.25 wide-area links.

Of course, there are other mail-routing systems, based on proprietary backbone protocols. The most famous of these is a mail-switch system from Soft-Switch (Wayne, PA) that runs on IBM mainframes and the Data General Avion.

Even though a backbone system may simplify the overall administration of multiprotocol E-mail networks, it is never a trivial task to set one up. E-mail networks of this complexity are much more complicated than a single homogeneous LAN-based system. If it is at all possible, getting everyone to use the same protocol will probably result in the easiest design, both for installation and maintenance.

#### Running Retix Open Server 400

To better understand the complexities and requirements of installing a mail backbone, we evaluated Retix's Open Server 400 with gateways to WordPerfect Office, cc:Mail, SMTP, and MHS. We weren't able to get our installation fully operational in the week or so we spent on the project; the major hurdle was understanding X.400 requirements and nomenclature.

Retix requires a "hub-and-spoke" network topology. The Retix server system communicates via X.400 links with each gateway (see the figure). In addition to serving as the local hub, the Retix server is responsible for internetwork mail connections. You need a Retix server system at each non-X.400 site.

We installed Retix Open Server, a software-only product, on an Advanced Logic Research Powerpro running DOS. This was far more machine than was needed for the task.

The MHS gateway ran on the same machine as the MHS server. We installed the cc:Mail gateway on a ded-

icated low-end PC. The SMTP gateway to X.400 (a Retix product) ran on an SCO Unix system also tied to the Internet. The WordPerfect Office X.400 gateway for Retix Open Server (a product from WordPerfect) required a high-end dedicated PC. However, you can run other WordPerfect gateways on this system.

Installing the Retix server and gateways was easy, at least within the context of configuring the X.400 system. The entire configuration process was very difficult. If you are inexperienced with X.400, count on spending several days studying the concepts and grappling with acronyms before getting under way.

Retix simplifies the task with excellent help screens for every field of every form in its Windows-based configuration utilities. But the help windows are not enough to teach the concepts; Retix's manuals fill this role. In fact, despite the complexity of X.400, a novice network or mail administrator can expect to grasp all the crucial concepts from Retix's manuals alone.

Each Retix gateway performs the same function: mapping the addresses of its mail system to X.400. For users, the entire universe of mail connected to the Retix server appears to fit within the addressing scheme of the host E-mail system, and users can connect to local and remote mail systems using familiar methods.

The user benefit of not having to deal with an address of unknown syntax is nothing to be sniffed at, particularly with X.400 addresses, usually something like G=ben;S=smith;P=byte;A=telemail;C=us. Contrast that with the comparable Internet-domain mail address ben@hytepb.byte.com, which can even be shortened to ben@byte.com.

But the most obvious benefit is for the network mail administrator. With Open Server, you can connect far-flung sites together through any of a multitude of commercial or private transport services. Open Server also simplifies a heterogeneous set of mail systems.

# The Unix Mail Story

**Y**ou may have noticed that the E-mail systems we reviewed for this Solutions Focus are either PC- or Mac-based systems. Where then, you might ask, are the Unix E-mail systems? The answer is: where they have always been—bundled with the operating system.

There are commercial third-party E-mail systems for Unix, but the most common type of Unix E-mail product is merely an enhanced E-mail user agent, the front-end mail component used for sending and reading mail. The underlying routing and transport parts of the system remain untouched. Even the most elaborate Unix user agents (e.g., Next Computer's E-mail, Asterix's E-mail, Z-Code Software's Z-Mail, and Alfa Software's Poste) use standard SMTP transports.

E-mail is such an integral part of the Unix world that well-established standards are more easily accepted. This isn't to say that routing and transport components can't be improved on or enhanced. The most commonly distributed routing component for Unix, Sendmail, is an obnoxious kludge. To understand and respect Sendmail, you have to appreciate that significant parts of Unix have grown through accretion of academic endeavors rather than purposeful commercial design.

Sendmail was developed as an experimental project that was distributed and accepted because it fulfilled a need. Understanding and modifying Sendmail's addressing and routing rules is more akin to playing Adventure than to building a structured rule table.

On the other hand, MMDF (the router distributed with SCO Unix) is a very flexible and well-organized system that offers better security and organization than Sendmail. What

MMDF lacks is the simplicity of adding connections that Sendmail (and its little brother, Smail) offers. With MMDF, you have to edit and rebuild tables every time you add a new connection. With Sendmail and Smail, you just add the new sites to standard tables.

It's only when you add a new *kind* of connection to Sendmail that you end up getting lost in its twisty little passages, all alike. And it's with this aspect of E-mail—communication in a heterogeneous E-mail world—that Unix mail systems have the most difficulty.

## Unix E-Mail Transport

The most common transport mechanism is a temporary asynchronous communication link established through UUCP. This mechanism is the most consistent with the "store-and-forward" model of E-mail. Messages bounce from machine to machine as systems establish connections. The second most common transport mechanism is via an IP network connection using SMTP.

The use of UUCP and SMTP for E-mail is governed by RFC 822, a message-format specification. RFC 822 indicates that the message header and body can consist only of 7-bit ASCII characters. But next to PC-based E-mail systems that allow binary enclosures, Unix mail systems that adhere to RFC 822 seem dated. Users want to send sound and video clips, as well as spreadsheet, word processor, and desktop publishing files. To stay within RFC 822 guidelines, any binary files must first be converted to a 7-bit printable character equivalent. Once a message is received, it must be converted back (traditionally by the programs `uuencode` and `uudecode`). Most E-mail user agents that provide for binary enclosures automate this process.

The other Unix approach is not to send the binary file at all, but just a file that notes where the binary file is located and appropriate methods for retrieving it from the sender's computer. This is the approach that is taken by MIME (Multipurpose Internet Mail Extensions), an emerging standard for attaching enclosures.

One great advantage to MIME is that no files are sent until the recipient explicitly requests them. Since these files can be very large, there is a substantial saving of resources when the attachment isn't retrieved. The other advantages are that existing routing and transport mechanisms need not be changed. Only the user agents have to deal with the details. Older user-agent programs can still be used: If you receive a MIME message with a non-MIME-enhanced user agent, you can retrieve the attachment manually by using the human-readable instructions that are part of the MIME message body.

## Internet and OSI

If the Internet can make up for its only real E-mail weakness (binary attachments) with MIME, does it need the complexity of X.400 messaging? This is a hotly debated question. After all, the Internet is the great mother of all electronic-message backbones.

But it is the success and growth of the Internet that makes it look to OSI (Open Systems Interconnection) standards. The Internet addressing scheme is too limited; the Internet is running out of addresses. As long as users are protected from the complexity of X.400 addressing, there is no reason not to implement X.400 gateways on all Internet systems. With X.400 addressing and MIME, Unix E-mail will be as flexible as the rest of the E-mail world.

system administrator the most control over user access.

As an administrator, you assign rights to users as you create them. Some users in your organization may not need to create mail, only receive it, or vice versa. Or you may decide to restrict Urgent mail priority to senior management or to keep some

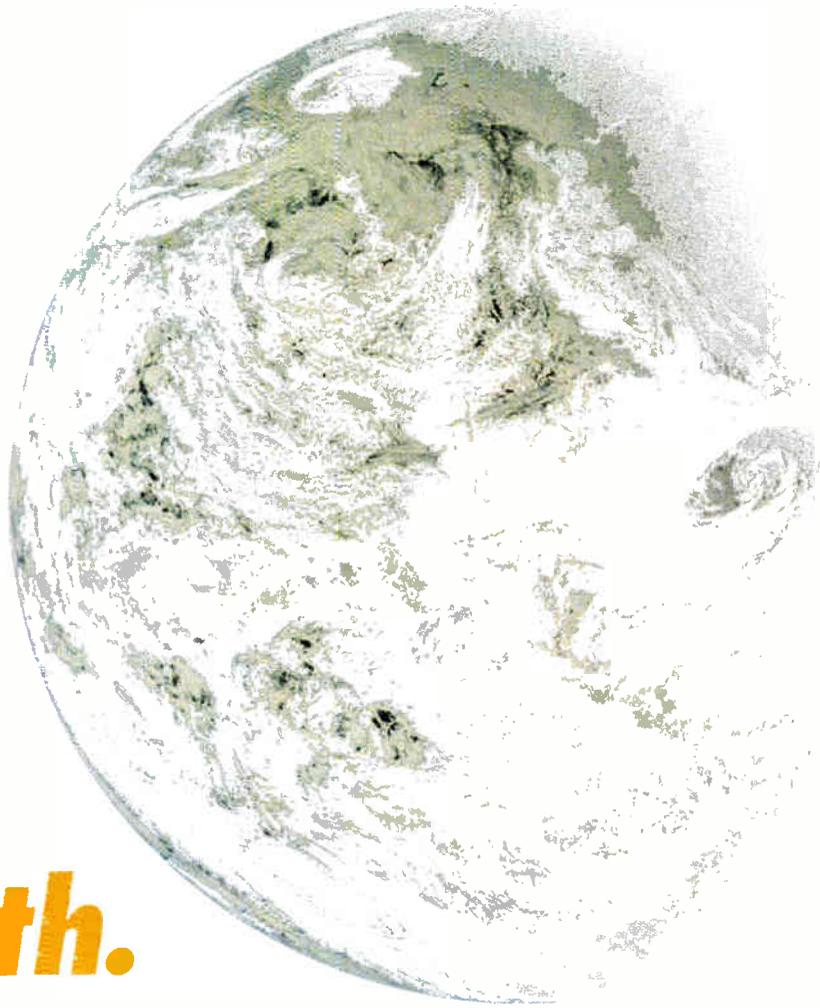
staff from sending mail externally. No other package we reviewed gives you this level of control.

Also new in this version is an automatic directory update feature. On a set schedule, Microsoft Mail can automatically exchange user directories with other post offices. This can come in handy if you're

working with people who are on the move (e.g., senior engineers who might spend a few weeks at each of your R&D centers). You don't have to burden your mail administrator with making all the address changes. In `cc:Mail`, the only other package with this feature, it comes as an extra-cost option.

*continued*

# Up to Date. Down to Earth.



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.

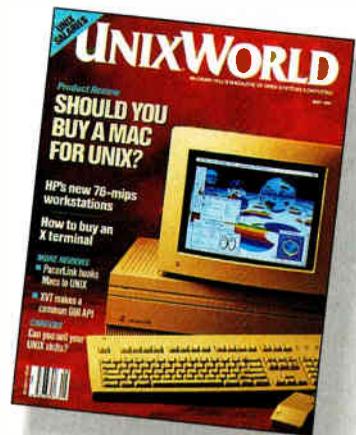
That's why you need **UNIXWORLD** – the magazine that keeps you up to date on the rapidly changing world of open systems computing. Each issue brings you the latest product trends and technical advances that can affect your business. The inside story on some of the biggest high-tech companies. Easy-to-understand programming tips and tutorials that can help your company use UNIX to its fullest. And unbiased hardware

and software reviews to help you invest wisely when you buy.

**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 strategies that are changing your world. And **UNIXWORLD** consistently offers the freshest, most down-to-earth writing that you'll find in any computer publication.

Subscribe today and receive the next 12 issues of **UNIXWORLD** for just \$18.00 – 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\*.

**Subscribe now!**  
**Call toll-free:**  
**1-800-257-9402 ext. 29**



**If you're into UNIX, you need**

**UNIXWORLD**  
McGraw-Hill's Magazine of **OPEN SYSTEMS COMPUTING.**

\***UNIXWORLD's** no-risk guarantee: If not satisfied, cancel and receive a full refund for the balance of your subscription.  
UNIX is a registered trademark of UNIX System Laboratories, Inc.

DH1AUW9

**THIS IS  
YOUR  
DRIVE**

**THIS IS  
YOUR  
DRIVE ON**

**winSTORE**

**ANY  
QUESTIONS?**



It doubles your performance.  
It doubles your disk capacity.  
It's fast and easy to install.  
It's priced right.

It's winSTORE™, created for the Windows™ user. The first product of its kind, winSTORE combines two award-winning technologies: high-speed disk control from Perceptive Solutions and advanced Stacker™ data compression from Stac®, in a plug-and-play solution.

It's winSTORE—think of it as overdrive for Windows!

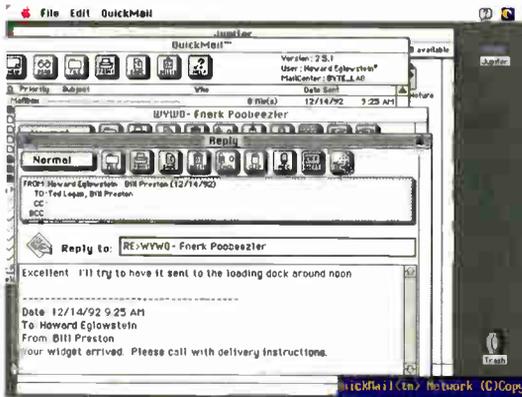
**Perceptive Solutions, Inc.**  
**800-486-FAST**

Main: 214-954-1774 · FAX: 214-953-1774

©1992 by Perceptive Solutions, Inc. winSTORE and the Perceptive Solutions logo are trademarks of Perceptive Solutions, Inc. Windows is a trademark of Microsoft Corp. Stacker is a trademark and Stac is a registered trademark of Stac Electronics, Inc.

Circle 125 on Inquiry Card  
(RESELLERS: 126).

## MULTIPLATFORM E-MAIL



### QuickMail 2.5

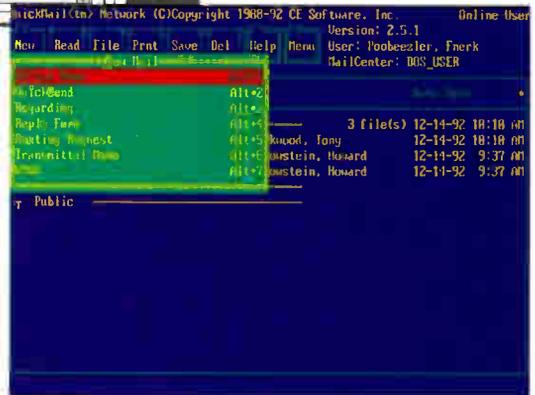
If E-mail can be called fun, CE Software's QuickMail (see screens 8 and 9), a Mac-based mail system, neatly fits the description. Macintosh clients use AppleTalk protocols to communicate directly with the dedicated Mac mail server. The mail server stores messages; it's also where you install gateway software and physical connections to other networks.

If you need PC clients, you can add them to the AppleTalk network with a LocalTalk card or create a separate post office (a "mail center") to handle the PC side of the network. With mail centers, DOS clients access a shared file area on a server that's accessible to the Mac mail server (in our test environment, a NetWare server running NetWare for Macintosh). The DOS mail center acts as a gateway between the shared file area and the Mac-based mail server. You end up with two separate mail systems, which means that your messages may be delayed crossing platforms.

More important, the two mail centers maintain their own separate user lists. If you set up Bill as a user on the Mac mail center and Ted as a user on the DOS mail center, Bill can't read his mail from a DOS client and Ted can't read his from a Mac.

By running the Mac clients over AppleTalk, QuickMail can take advantage of the direct user-to-user link and provide real-time conferencing. From your Mac, you can get a list of other active Mac QuickMail users on your LAN. Select from the list, and you're in a Quick-Conference, where everything you type appears immediately on the other users' screens. It's not a replacement for a face-to-face meeting, but it's better than

Screens 8 and 9: QuickMail for the Mac (left) and for DOS (below) use a similar command structure. The Mac version provides labeled icon push buttons, while the DOS version uses a character-based interface. The DOS functions appear in roughly the same place on the screen. Both versions can share forms that you create with the Mac-based forms editor.



waiting for an E-mail reply, and it sure beats walking across the building to find somebody. Unfortunately, (file-based) PC clients are reduced to second-class citizenship, as QuickConferences work only on Macs.

For remote access, QM Remote gives Mac users the same mailbox access they enjoy from the LAN. You can read any message and reply to it while still on-line. CE Software doesn't offer a DOS version of its remote package but goes one better by providing character terminal access. If you dial into the server via generic communications software, you get a simplified ASCII interface. Any remote user with an ID and a password can send and receive mail without special software.

As with Microsoft Mail, QuickMail's gateways give you good control over external mail. The mail server can display a list of messages in the send queue and give you the choice of canceling any message or returning it to the sender. We also liked QuickMail's catchall gateway, QM-

Script, which allows you to define a script to parse your way through any mail system with an ASCII interface.

We have used QM-Script as a gateway to handle BIX mail, and we also spent a few days trying to get it to handle our Opus BBS system. The prompts from an Opus BBS are pretty typical



# Create an Enterprise-Wide Mail Network with OpenServer 400™ from Retix.

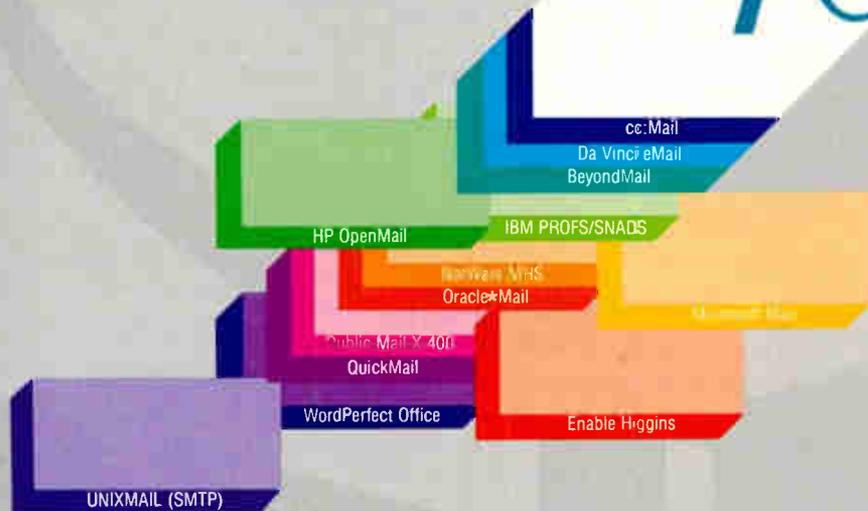
ALL-IN-1

Digital's Message Server  
for X.400 (MVS)

VMSmail

## OPENServer 400

**NOW WITH  
DIRECTORY  
SYNCHRONIZATION  
AND REMOTE  
MANAGEMENT**



## TIE YOUR PC LAN APPLICATIONS TO ALL-IN-1 AND VMS MAIL VIA X.400

OpenServer 400 ties all of your e-mail systems together. Users see one integrated mail system with the added benefit of convenient, enterprise-wide connectivity.

There's no need for users to leave their favorite mail program. No need to replace existing equipment. No need to limit the possibilities of their current e-mail system.

OpenServer 400 works in conjunction with e-mail gateways, operating behind the scenes to automatically translate and transfer information using standard X.400 format.

With OpenServer 400, your LAN-based e-mail users can instantly communicate with ALL-IN-1 and VMS Mail

users, as well as users of other main-frame and minicomputer mail systems like IBM's PROFS. Connecting to public mail networks like CompuServe and MCI Mail is just as easy.

OpenServer 400 uses the power of X.400 to link virtually every e-mail application your company may be using—whether it's Lotus/cc:Mail, Da Vinci eMail, Microsoft Mail, NetWare MHS, Oracle\*Mail, WordPerfect Office, or one of the many other popular mail programs. Users can send text, graphics, and virtually any type of binary file with maximum ease and reliability.

Put the pieces of your e-mail system together. In the U.S., call Retix at **1-800-255-2333**.

**YES!** We want to create an integrated mail system. Please send more information including the "OpenServer 400 Application Guide."

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_

Telephone \_\_\_\_\_

Return to:  
Retix, MarCom Dept. D, 2401 Colorado Ave.  
Santa Monica, CA 90404-3563 USA BYTE 0393

Circle 140 on Inquiry Card.

 **Retix**<sup>®</sup>  
The OPENNetworking Company™

for BBS systems, and it seemed simple enough to set up QM-Script to handle the menu system. Alas, it turned out to be trickier than we thought. A number of the user prompts look similar from menu to menu, and the QM-Script string-matching utilities had some difficulty distinguish-

ing between some of the prompts.

Also, QM-Script doesn't offer any sort of debugger for testing out a new script. You can put comments in the script that get written to a log, but we would have liked an interactive debugging mode. We never were able to get the QM-Script-

to-Opus BBS gateway completely ironed out. Still, QM-Script offers a flexible gateway alternative that is not matched in other mail packages. QuickMail and QM-Script represent a good solution to any application that requires linking proprietary messaging systems.



**Screens 10 and 11:** *WordPerfect Mail, the E-mail component of WordPerfect Office, runs on a host of systems. The Windows (left) and Mac (below) clients are shown. With WordPerfect Office, Mac clients enjoy many capabilities that don't extend to other platforms.*

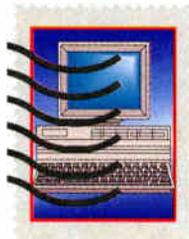
## WordPerfect Office 3.0

**W**ordPerfect Mail is the base component of WordPerfect Office, an all-around groupware package for Mac LANs, PC LANs, VAX (VMS) systems, Sun-4 and Sun Sparcstations, and SCO Unix systems. The WordPerfect Office mail host runs on all these platforms, and WordPerfect Office includes gateways connecting each of them. WordPerfect also offers gateways to Unix- (SMTP) and VMS-based E-mail.

On the PC network side, you administer E-mail through a complex collection of menu-controlled forms and DOS scripts; WordPerfect Mail is difficult to install and configure. The only saving grace is WordPerfect's excellent technical-support crew, who can walk you through all the nuances of this system.

In contrast, WordPerfect Office is easy to install and configure on Mac networks. The interface to the administration tools is very similar to that of AppleShare Admin, right down to the icons. But building the Mac-to-PC LAN mail gateway is a complex, difficult process, again mainly because of the problems with the PC LAN configuration.

Surprisingly, WordPerfect Mail for Windows (see screen 10) has the prettiest user interface of any client on any E-mail system we looked at. You can forget about all the unfathomable function-key combinations and convoluted procedures of the WordPerfect word processor. The Windows client has the eas-



iest and most flexible window widgets and gadgets: resizable, movable, tear-off report labels for reports and lists; drag-and-drop selection lists; and hypertext-based, context-sensitive help windows. This interface could well be the flagship for future WordPerfect products on Windows.

You can send and receive attachments as well as messages. The mail reader can launch an application for each attachment based on file extension, and you can add to and modify the list of associations. There is a mail-list manager and message archiving, as well as folders for holding messages.

WordPerfect Mail for Windows supports DDE for Interapplication Communication. However, WordPerfect Mail's documentation of DDE limits the discussion to integration with the WordPerfect word processor.

WordPerfect Office is not balanced between platforms; in addition to a nice client interface of its own, the Macintosh version has significant features that the other versions lack (see screen 11). It includes a forms

generator, broadcast capability, and the ability to carry on multiway real-time conversations with other Mac clients. You must observe one caution when using the broadcast feature: The mail notifier locks up any operations on the receiving Mac until it has been cleared.

The varying capability of each client is unfortunate. It's understandable that the chat mode doesn't exist on some networks, but it would be nice if forms generation were supported at least on both the Mac and Windows.

The DOS version of WordPerfect Mail and Office is the same old maddening WordPerfect world of inconsistent and incomprehensible menus. This interface fronts the Unix version, too, with the additional aggravation of a nonstandard terminal-naming scheme and weird screen controls.

One very nice feature of all the clients (even the DOS and Unix versions) is status track-

ing for outgoing mail. You can see if messages have been received, read, or deleted. What WordPerfect Mail lacks most significantly is a mechanism for automatic mail handling (e.g., an automatic reply when you are on vacation).

### First-Class Mail

Choosing one of these systems over the others requires a bit of study. If your organization is already using an E-mail system, that should form the foundation for your choice. Gateways from one system to another aren't always available, and installing universal backbones and multi-protocol mail routers is a very complex task.

If you're not using an E-mail system now, look around and see if you could benefit from store and forward. Even small workgroups can gain productivity through the off-hours and remote communication that E-mail offers.

Despite their multiplatform flair, most of these systems are better on some platforms than others. If you can live with a Mac-centric mail server, choose QuickMail. It doesn't offer a lot for DOS users, and its

# Share a single LaserJet® 4 with up to 10 people, simultaneously

Easy to use—includes all the cables, adapters, and software needed

- Provides fast printed output
- Low priced sharing solution—up to \$800 less than competitive products
- Unbeatable customer support—lifetime warranty, unlimited technical support at no cost, 60-day money back guarantee of satisfaction
- Supports both PCs and Macintoshes



Installation couldn't be easier! Just plug the cable into the I/O slot of your LaserJet. Easy front panel configuration.

## Pacific Connect Xi and the HP LaserJet

| LaserJet Series II, IID, III, IIID  | LaserJet 4 and IIISi*               |
|-------------------------------------|-------------------------------------|
| 5 port (4 serial, 1 parallel) \$399 | 7 port (6 serial, 1 parallel) \$599 |
| 10 port (10 serial) \$599           | 10 port (10 serial) \$699           |

\* Also compatible with HP PaintJet®XL300 and DesignJet® plotter

SAN DIEGO—Pacific on the LaserJet II, IID, This includes the price

# The new LaserJet 4 has arrived. Pacific Connect® Xi lets you share the good news.

If you'd like more information on the best way to share your LaserJet printer, or about our Pacific 4 SIMM Memory® upgrades for the LaserJet 4, call Pacific Data Products at (619) 625-3593, Fax (619) 552-0889.



Pacific Data Products, Inc., 9125 Helico Road, San Diego, CA 92121 Pacific Connect is a registered trademark and Pacific 4 SIMM Memory is a trademark of Pacific Data Products, Inc. HP, LaserJet, PaintJet and DesignJet are registered trademarks of Hewlett-Packard Co. All other trade names referenced are the trademarks or registered trademarks of the respective manufacturer. EUROPEAN OFFICES: England Tel: 0900 51 5511, Fax: (44) 442 236540; France Tel: 05 90 65 09, Fax: (33) 1 39 63 20 41; Germany Tel: 0130 81 3685, Ireland Tel: (533) 61 475609, Fax: (353) 61 475608; Switzerland Tel: (41) 22 341 26 50, Fax: (41) 22 341 06 82; Belgium Tel: 078 111292, Netherlands Tel: 06 0222065. © 1992 Pacific Data Products, Inc.

reliance on the mail server as a gateway is limiting. Still, on-line conferencing is a great feature, and QuickMail's remote access and QM-Script are far better than any similar features we've seen.

If mixed-client platforms and internet-

working are truly crucial components, choose between Microsoft Mail and cc:Mail. Our choice is cc:Mail. It supports all the major platforms, offers gateways to just about everything, and garners support from dozens of third parties. ■

*Howard Eglowstein and Ben Smith are testing editors for the BYTE Lab. You can contact Howard on BIX as "heglowstein" and on the Internet at howard@byteph.byte.com. Ben is the author of UNIX Step-*

*by-Step (Howard W. Sams, 1990) and UNIX E-Mail and Usenet News (Howard W. Sams, forthcoming). You can contact him on BIX as "bensmith" and on the Internet at ben@byteph.byte.com.*

**COMPANY INFORMATION**

**cc:Mail, Inc.**  
 (division of Lotus Development Corp.)  
 (cc:Mail)  
 2141 Landings Dr.  
 Mountain View, CA 94043  
 (415) 961-8800  
 fax: (415) 961-8400  
**Circle 1273 on Inquiry Card.**

**CE Software, Inc.**  
 (QuickMail 2.5)  
 1801 Industrial Cir.  
 West Des Moines, IA 50265  
 (800) 523-7638  
 (515) 224-1995  
 fax: (515) 224-4534  
**Circle 1271 on Inquiry Card.**

**Da Vinci Systems Corp.**  
 (Da Vinci eMail 2.0)  
 4200 Six Forks Rd.  
 Raleigh, NC 27609  
 (800) 328-4624  
 (919) 881-4320  
 fax: (919) 787-3550  
**Circle 1272 on Inquiry Card.**

**Microsoft Corp.**  
 (Microsoft Mail for PC Networks 3.0)  
 1 Microsoft Way  
 Redmond, WA 98052  
 (206) 882-8080  
 fax: (206) 936-7329  
**Circle 1274 on Inquiry Card.**

**Novell, Inc.**  
 (NetWare MHS 1.5)  
 122 East 1700 South  
 Provo, UT 84606  
 (801) 429-7000  
**Circle 1275 on Inquiry Card.**

**Retix Corp.**  
 (Retix Open Server 400)  
 2401 Colorado Ave.  
 Santa Monica, CA 90404  
 (310) 828-3400  
 fax: (310) 828-2255  
**Circle 1276 on Inquiry Card.**

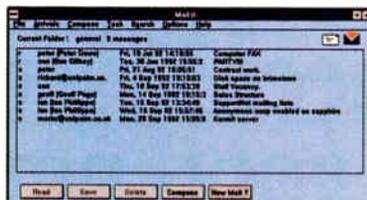
**WordPerfect Corp.**  
 (WordPerfect Office 3.0)  
 1555 North Technology Way  
 Orem, UT 84057  
 (800) 451-5151  
 (801) 225-5000  
 fax: (801) 222-5077  
**Circle 1277 on Inquiry Card.**

**A MESSAGE  
 TO ALL UNIX  
 MAIL USERS  
 DON'T MISS  
 OUT ON  
 MAIL-IT**

*PC to UNIX E-mail  
 for Windows 3*

Interested in an easy-to-use email package that works under Windows, is fully SMTP, POP-2 and UUCP-compliant, and without need for expensive gateways, can put you directly in touch with thirty million Internet, Usenet and UUCP mailboxes worldwide?

Then don't miss out on Mail-it, from Unipalm. It works with all leading TCP/IP and NFS transport packages for Windows, including PC-NFS, PC/TCP, LAN WorkPlace, and WINSOCK. Call toll-free for more details.



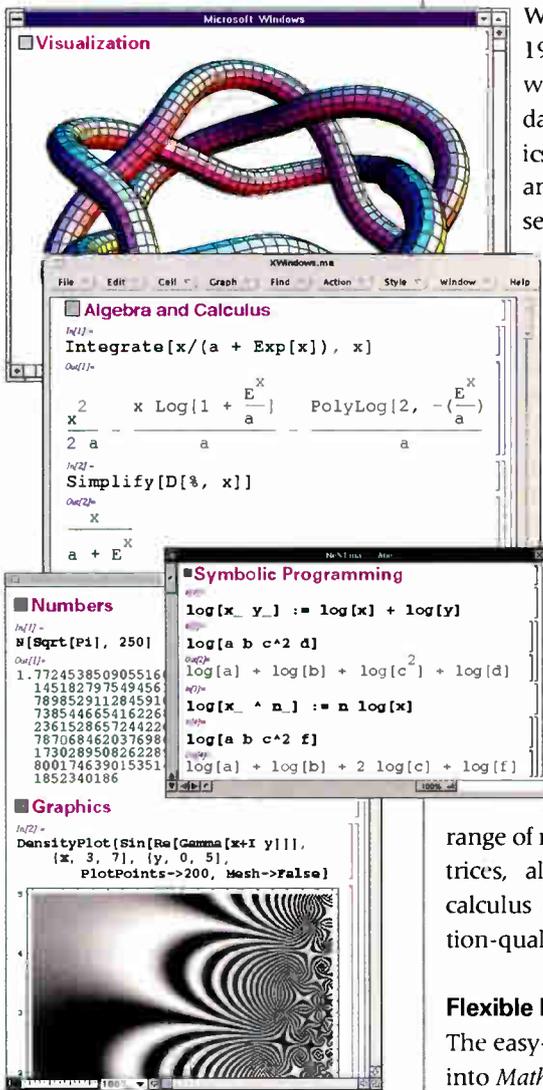
**1-800-563-6245**  
 (or email: [mail-it@unipalm.co.uk](mailto:mail-it@unipalm.co.uk))



Call toll-free in US & Canada only. Elsewhere, call Unipalm direct on +44 223 420002. Mail-it is a trademark of Unipalm Limited.

# Mathematica

## THE COMPLETE SOLUTION FOR TECHNICAL COMPUTING



When it was released in 1988, the *New York Times* wrote that *Mathematica* "fundamentally alters the mechanics of mathematics." Four and a half years later, with several hundred thousand scientists, engineers, students, financial analysts, medical researchers, and others using the system, *Mathematica* is firmly established as the standard environment for technical computing.

### Starting Out

When you first get started, you can use *Mathematica* just like a calculator. But it is a calculator that lets you do calculations as large as you want, and that can handle the full

range of mathematical functions, matrices, algebraic manipulation, and calculus as well as creating publication-quality 2D and 3D graphics.

### Flexible Programming

The easy-to-use language that is built into *Mathematica* requires no learning

for simple calculations, but has the power to let you create even the most sophisticated programs. And with the Notebook concept pioneered by *Mathematica*, you can create interactive documents that mix text, graphics, animations, and sounds with live formulas and programs.

### A Range of Applications

Whether you design airplanes, solve quantum field theories, analyze medical experiments, or just want to do your algebra homework, *Mathematica* provides a unique environment for solving your problems.

And you can run your same *Mathematica* programs without change on everything from Macintosh and PCs (with or without Windows) to Unix workstations and supercomputers.

To get the latest information call:

**1-800-441-MATH**  
Extension 400



## Wolfram Research

### Wolfram Research, Inc.

100 Trade Center Drive, Champaign, IL 61820-7237, USA  
+1-217-398-0700; fax: +1-217-398-0747; email: info@wri.com

### Wolfram Research Ltd.

Evenlode Court, Main Road, Long Hanborough, Oxon OX8 2LA, UK  
+44-01993-883400; fax: +44-01993-883800; email: info-euro@wri.com

Representatives in over 30 countries; contact main office.

### Technical Information:

Numerical computation with unlimited precision integer, real, and complex numbers. Exact symbolic computation. Wide range of mathematical functions, including hypergeometric special functions, number theory functions, statistics. Numerical and symbolic matrix operations. Numerical and symbolic equation solving, root finding, integration, differential equations, optimization. 2D and 3D color graphics, animation, and sound generation. Graphics language for representation of arbitrary structures. Output in standard PostScript. Data importing and exporting. External program linkages. Full built-in symbolic programming language, with procedural, functional, and rule-based capabilities. Notebook front end with hierarchical documents, style sheets, importing and exporting of graphics, sound, animations, and typesetting. Network operation supported. Journal, newsletters, more than 30 books on *Mathematica* available. Add-on packages, free *MathSource* electronic resource. Versions: Microsoft Windows • Macintosh • MS-DDS • NEC PC • SPARC • DEC RISC, VAX • HP • IBM RISC • NeXT • SGI • Convex • and others. Student versions available. Now shipping Version 2.1.

©1992 Wolfram Research, Inc. *Mathematica* is a registered trademark of Wolfram Research, Inc. *Mathematica* is not associated with Mathematica Inc., Mathematica Policy Research, Inc., or MathTech, Inc. All other product names mentioned are trademarks of their producers.

For Macintosh information circle 166, For IBM/Compatible information circle 167, For UNIX information circle 168 on Inquiry Card.

**HARDWARE**

**A New Resolution for Desktop Lasers**

**G. ARMOUR VAN HORN**

**A**lthough the 300-dot-per-inch laser printers of the last several years were a dramatic improvement over the dot-matrix and daisy-wheel printers that preceded them, the increasing sophistication of graphics used in business have made them seem slow and coarse. To solve these problems, new 600-dpi laser printers have come to market with better resolutions than typical laser printers, but with price tags that keep them within the range of general office budgets.

In this roundup, I look at five such printers. All of them offer true 600-dpi resolution, multiple interfaces, multiple PDLs (page-description languages), and high base memory configurations at prices ranging from about \$2200 to \$4600 (see the table on page 158).

Three of these units—the Dataproducts LZR-965, the Hewlett-Packard LaserJet 4M, and the QMS 860 Print System—are good choices for small workgroups using both Macintosh and DOS/Windows systems, because they offer three active ports ready to respond to users over parallel, serial, or AppleTalk connections. The QMS 860 accepts simultaneous print jobs from its three ports. At 10 pages per minute, the Lexmark LaserPrinter 4029 10A and 10P printers offer the fastest engine-speed ratings in the test group.

**A Graphic Difference**

None of these printers was designed specifically to serve the needs of graphic artists, although most artists will be delighted with the results. These printers won't threaten imagesetters for reproduction work that includes photographs, but documents comprising text, line art, and screen captures can be published economically with speed and minimal loss of quality.

The geometry of the 600-dpi grid al-

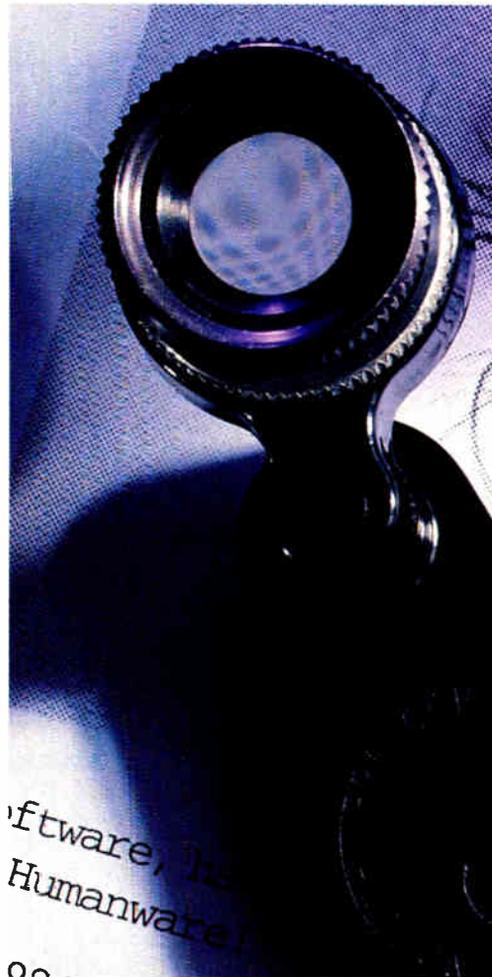
lows for both a finer halftone dot when printing photographs and more gray levels. Most 300-dpi printers offer a choice of 53- or 60-line-per-inch halftones, with more gray levels and better appearance coming from the lower value. These values were replaced by 71 and 85 lines with these higher-resolution units, and the 71-line screen offers a less-visible dot structure and greater tonal range than 300-dpi printers using a 53-line screen. The higher screen value still sacrifices too much tonal range for photographic images, but the less-apparent dots would be useful for illustrations with multiple gray values or graduated tints of small range. Graduated or radial fills that extend over large areas still need the extra gray tones that come with the larger dot size.

A 600-dpi engine creating 71-line halftones should be able to produce 72 gray tones; 53-line screens from a 300-dpi printer have 33 possible tones. Imagesetters operating at 2540 dpi can create all 256 possible PostScript grays with screens of over 200 lines per inch.

**The Performance Penalty**

The BYTE Lab ran a complete suite of compatibility and performance tests that consisted of a custom version of the Genoa Technologies suite (see the graph on page 160). The results are indexed on the 300-dpi LaserWriter IINTX, so longer bars indicate better performance. Because these printers stock more processing power to deal with higher-resolution output, the performance penalty for better quality is minimal.

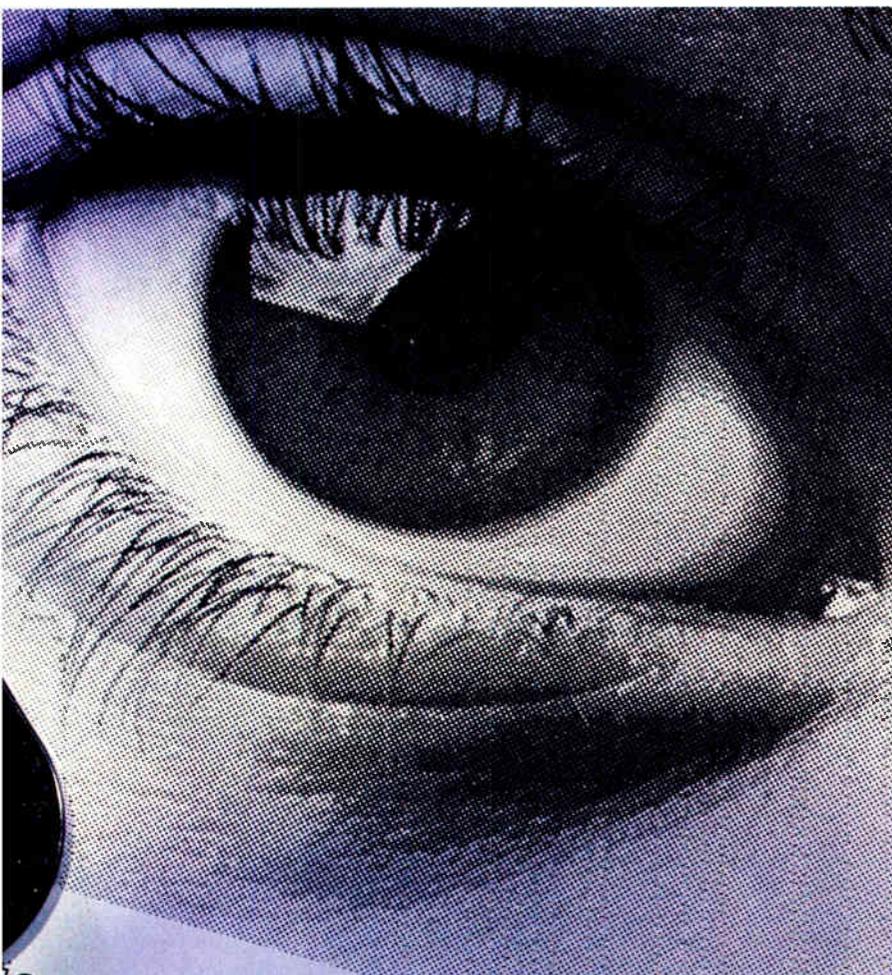
In other tests, I strung all the printers on a LocalTalk network attached to my Mac SE/30 and a 386-based PC running Farallon Computing's PhoneNet Talk PC. I sent documents to each printer from a



typical range of applications: Word, Free-Hand, and PageMaker on the Mac; and Word for Windows, Excel, CorelDraw, and FoxPro on the PC.

There were copious minor problems with device driver files, but each manufacturer said it was working to eliminate them. At press time, Adobe had published a new standard for PPD (printer page description) files to support PostScript Level 2, which Hewlett-Packard had dutifully followed but most software doesn't properly support yet. Adobe had not yet released its Level 2 drivers, and three of these printers support Level 2. The QMS 860 has three selectable options for PostScript support. Printing with Level 2 selected almost doubled the time to print a tabloid page, but color images would not print with Level 1 selected. The promised speed advantages of Level 2 presumably will require the final drivers. In most cases, either the manufacturer or I came up with a reasonable workaround.

All PostScript Level 2 printers will present some of these problems for the next



## BYTE ACTION SUMMARY

- **WHAT 600-DPI LASER PRINTERS ARE**  
Laser printers with true 600-dpi resolution supported in the engine, not via software algorithms.
- **LIKES**  
Print quality is clearly superior to that of 300-dpi printers, but prices are in the same range as lower-resolution printers.
- **DISLIKES**  
These printers can't match imagesetters for reproduction work that includes photographs.
- **RECOMMENDATIONS**  
Choose the LaserJet 4M for image quality and ensured support for third-party add-ons, consumables, and drivers.

several months, possibly years, until complete support for Level 2 becomes commonplace. One Level 2 feature, cached forms, will allow blank forms to be downloaded to the printer. The computer will then send the specific data for an invoice or purchase order along with a request for a specific form, drastically cutting down on the network traffic. Until all Level 2 features are widely supported, printer drivers and PPD files will probably need to be updated frequently.

The HP LaserJet 4M and the QMS 860 both use new Canon P270 engines rated at 8 ppm; the Dataproducts LZR-965 uses a Sharp engine rated at 9 ppm; and the Lexmark 10A and 10P are built on Lexmark's own 10-ppm engine. That said, these ratings are generally irrelevant. They come into play only on the very simplest of pages, or when printing multiple copies of a single page. In daily use, the speed of a laser printer depends on the performance of the CPU on the printer's controller.

By the same token, I am mostly ignoring life-expectancy ratings for toner and other

consumables. The actual rate depends on your images, and the estimates from the manufacturers are not strictly comparable.



### **Dataproducts LZR-965**

Based on Dataproducts' history in the large-computer market, I expected more of an industrial feel to the LZR-965. In reality, this was the smallest and lightest printer of the group. With the paper tray at the bottom of the unit, the only protrusions during normal operation are the cables, of which there can be several.

The rear panel on the LZR-965 is very clean, with connectors for an external SCSI drive, an RS-232 serial port, Centronics, and LocalTalk, all of which are active until a print job is sent to one of the ports. The printer ships with 8 MB of memory, expandable to 16 MB, and it contains the Weitek 8200 RISC chip. Running at only 7.5 MHz, the chip was specifically designed for printers, so the LZR-965 performs acceptably even when printing complex graphics. Although I did not test this printer with an external disk drive, my experience is that even a small drive attached to a printer—when loaded with the most commonly used fonts—can dramatically speed printing.

The LZR-965 is built around a Sharp engine, the only model in this review to use multiple consumable cartridges. The documentation has clear diagrams for setup, and a 20-minute VHS cassette covers first-time setup, including installing the photoreceptor drum, developer unit, toner tray, toner collector, and fuser roll cleaner. The first four of those parts are combined in the other printers tested, as they have been in all Apple LaserWriters and HP LaserJets. The individual components should reduce the operating cost of the printer, as the drum has a life expectancy of 50,000 pages; the other printers call for replacement or exchange of the toner cartridge when the toner runs out, typically after 3000 to 5000 pages.

*continued*

## 600-DPI PERFORMANCE

All the printers reviewed include true 600- by 600-dpi resolution supported in hardware. A SCSI drive, when loaded with the most commonly used fonts, can dramatically speed printing.

|                               | Dataproducts<br>LZR-965                            | HP<br>LaserJet 4                    | HP<br>LaserJet 4M                             | Lexmark<br>4029 10A           | Lexmark<br>4029 10P  | QMS 860<br>Print System  |
|-------------------------------|--|-------------------------------------|---|-------------------------------|--|--|
| <b>Price</b>                  | \$2995   | \$2199                              | \$2999  | \$2799                        | \$2499   | \$4595   |
| <b>RAM (min./max.; MB)</b>    | 8/16   | 2/34                                | 6/22  | 5/9                           | 5/9  | 12/32  |
| <b>CPU</b>                    | Weitek 8200<br>at 7.5 MHz                          | Intel 960<br>at 20 MHz              | Intel 960<br>at 20 MHz                        | Motorola 68020<br>at 16.7 MHz | Motorola 68020<br>at 16.7 MHz  | Intel 960<br>at 25 MHz   |
| <b>SCSI drive support</b>     | Yes  | No                                  | No  | No                            | No   | Yes  |
| <b>Interfaces</b>             | LocalTalk,<br>RS-232,<br>Centronics,<br>SCSI drive | RS-232/422,<br>Centronics           | LocalTalk,<br>RS-232/422,<br>Centronics       | LocalTalk                     | RS-232,<br>Centronics  | LocalTalk,<br>RS-232,<br>Centronics,<br>SCSI drive                   |
| <b>Emulations</b>             | PostScript Level 2,<br>HP PCL 4                    | HP PCL 5+ <sup>1</sup>              | PostScript Level 2,<br>HP PCL 5+ <sup>1</sup> | PostScript                    | PostScript,<br>PCL 5,<br>IBM PPDS,<br>PCL 4,<br>HPGL standard<br>HPGL/2 optional | PostScript Level 1<br>and Level 2,<br>HP PCL 4, HPGL                 |
| <b>Page sizes (*Standard)</b> | Letter*, legal,<br>executive,<br>statement         | Letter*, legal,<br>A4, executive    | Letter*, legal,<br>A4, executive              | Letter*, legal,<br>A5         | Letter*, legal,<br>A5  | Letter*,<br>legal, tabloid*,<br>A3, A4, A5,<br>A6, B5, B6, executive |
| <b>Fonts</b>                  | 35   | 45 <sup>2</sup>                     | 80  | 39                            | 39   | 39   |
| <b>Paper</b>                  | 16- to 21-pound<br>bond, 250 sheets <sup>3</sup>   | 16- to 36-pound<br>bond, 350 sheets | 16- to 36-pound<br>bond, 350 sheets           | 200 sheets                    | 200 sheets   | 16- to 36-pound<br>bond, 350 sheets                                  |

<sup>1</sup> PCL 5 enhanced with TrueType rasterizer.

<sup>2</sup> 35 Intellifont faces, 10 TrueType.

<sup>3</sup> From cassette; 16- to 31-pound stock from manual feed slot.



### Hewlett-Packard LaserJet 4M

The newest member of the LaserJet family was the first to arrive, and it set my expectations for the other printers. It also earned a Best Printer honor in the 1992 Best of Comdex/Fall awards sponsored by BYTE and the Interface Group (see "A New LaserJet, a New Standard," December 1992 BYTE). I received the 4M printer, which includes LocalTalk and PostScript built-in, but the table also lists information on the standard LaserJet 4.

The printer opens so that you can easily install the toner cartridge without having to contend with any glaring or obtrusive labels or release buttons. A small lever extends from the paper tray to the front, indicating the level of paper remaining in the tray. The design was so clear, so obvi-

ous, that the first page of 600-dpi text rolled out of the printer 7 minutes after I opened the box, and I never referred to the documentation. (When you need detailed information for configuring options, setting up the printer for DOS applications, or maintenance, the manuals are clear.)

The I/O ports—including LocalTalk, Centronics, and RS-232—are clearly labeled and accessible, and all are active. The LocalTalk interface is installed in the MIO (modular I/O) port and can be replaced by interfaces for Ethernet, Token Ring, TCP/IP, and EtherTalk from HP, and third parties are sure to support other specialized network options.

HP's Resolution Enhancement Technology, first introduced on the LaserJet III, is even more dramatic when applied to a true 600-dpi image. The edge quality of text from this printer is the sharpest I've seen. Unfortunately, this only applies to line art and has no impact on the quality of halftones.

Font support is very strong: the standard model comes loaded with 35 Intellifont (HP) and 10 TrueType typefaces; in addition to these 45, the 4M includes the standard 35 PostScript typefaces. An industry-standard cartridge slot adds support for the substantial library of font cartridges developed for past LaserJets.



### Lexmark LaserPrinter 4029 10A and 10P

IBM's Lexmark unit was the first of this group to market; Lexmark should have waited until an industrial designer could be brought into the process. Attention to the way printers are used would have warranted substantial redesign. This unit is just not attractive—especially when compared to the others. Three contrasting colors were used in such a way as to emphasize every lump and protuberance. The printer's ivory body is about the same size as the LZR-965's, but the elements that protrude from the shell cause it to take up more space than the LaserJet 4M.

Inattention to the design process didn't stop with the appearance. This is the only printer in the test that required the manual

“Does Maynard® really offer the MaynStream® 4 GB DAT tape system at a 2 GB price?”

“Yes.”

“And MaynStream systems come with software that supports DOS, Microsoft® Windows, OS/2®, and NetWare® NLM\*?”

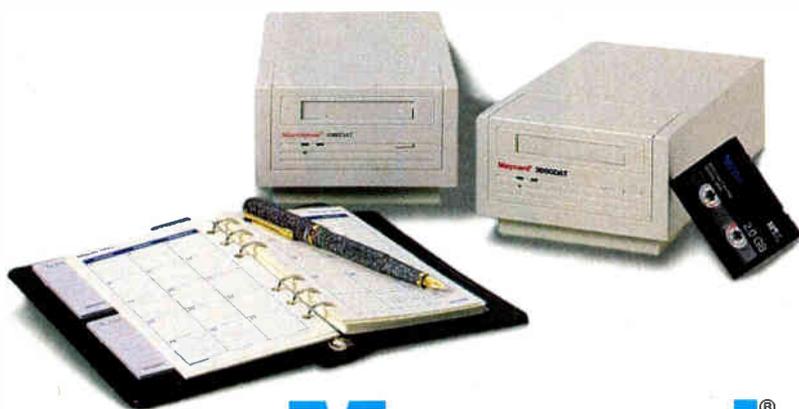
“Yes.”

“I know I can depend on toll-free support and 48 hour repair/replacement† for any MaynStream system.”

Enough said.

For product literature, including your free Networking Disaster Prevention Information Kit, call 1 800 755-0535.

For specific sales or product assistance, call 1 800 845-3125.



**Maynard**®

An ARCHIVE® Company

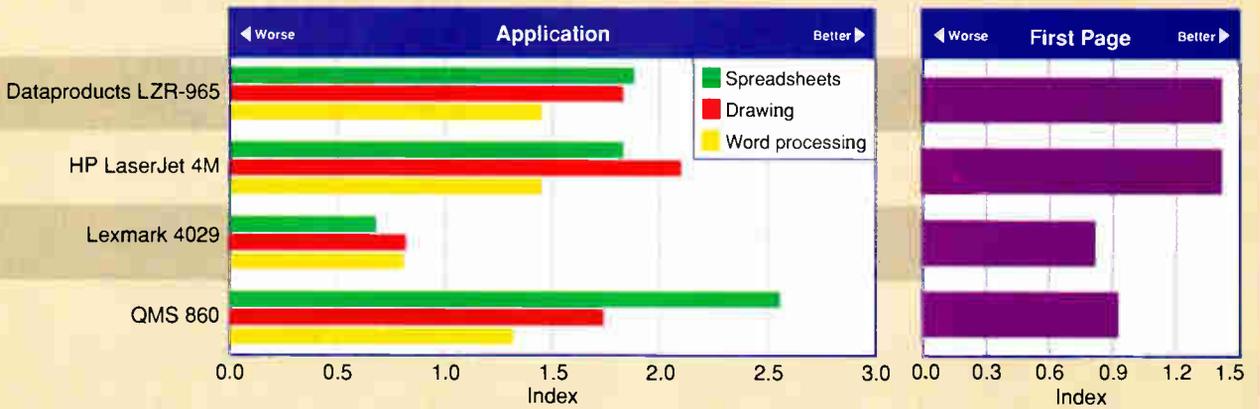


Maynard, a division of Archive Corporation • Marketing Communications • 36 Skyline Drive • Lake Mary, FL 32746 • FAX (407) 263-3638 • (407) 263-3500 (USA) • 44-494-473-434 (UK)  
Maynard and MaynStream are registered trademarks of Archive Corporation. \*All other products herein mentioned are trademarks or registered trademarks of their respective corporations.  
†Domestic U.S. Only.

Circle 104 on Inquiry Card (RESELLERS: 105).

World Radio History

600-DPI PERFORMANCE



The First-Page Index tests how fast a printer can produce short memos and letters. The Application Index tests common jobs from popular spreadsheets, drawing and design packages, and word processors. Tests are indexed on the LaserWriter IINTX, which has an index of 1 for each test; longer bars indicate better performance.

for basic use. The Lexmark printers share one unusual feature: The toner cartridge is shipped installed. After lifting the printer from the carton, you open the printer

and withdraw a laminated foam pad that prevents vibration from damaging the toner cartridge or the contacts with the printer. This almost compensated for the need to

attach various feed and delivery guides. The LocalTalk interface plugs into the Centronics connector, receives power from a separate connector, and is lashed to the

THE LOWELL DAVIS FARM  
GAZETTE

PRINT THIS

Presenting Another Peek at the 1992 Lineup!

As promised, this issue of the Gazette continues our ongoing look at the 1992 lineup of Mr. Lowell's figurines and collectibles. Our promise does present a bit of a problem, though, because each of these pieces is so exceptional it's hard to decide which one to talk about first!

Well, perhaps we should start with something completely new and different in the line: the Lowell Davis profile. It is a wonderful likeness of the artist, and something we are sure every Lowell Davis collector would love to have. Of course, no Lowell Davis devotee will be able to resist "Miss Private Time" a 1992 debut in the witty collection Lowell calls "The World Of The Little Critters." Like last year's "Private Time," this hilarious figurine finds one of Lowell's critters relaxing on the chamber pot — caught, quite literally, with her pants down.

Comments Lowell: "The inspiration for this figurine came from a childhood memory that goes back before we had indoor plumbing, to a night when my Aunt Lena was visiting. For just a minute, I forgot she was there and walked into her room while she was sitting on the chamber pot. I don't know which of us was more embarrassed! I wonder if any of the Little Critters ever get caught with their pants down."



Miss Private Time

Another wonderful new "Little Critter" figurine is "A Wolf In Critter's Clothing," which captures a wolf strutting gaily along with a sheepskin tied to its back.



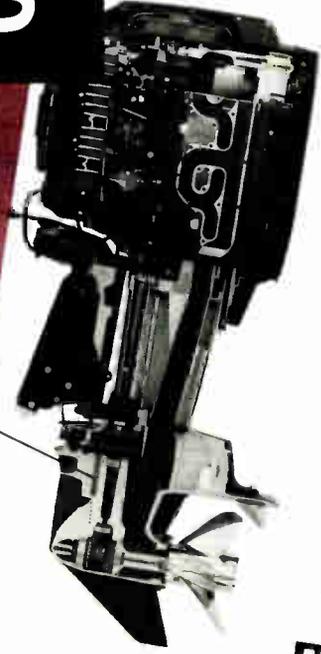
A Wolf In Sheep's Clothing

"Although I have never seen a wolf dressed up in sheep's clothing myself," says Lowell, "I have heard that this is practiced in the World of the Little Critters."

A slice of real life is presented on "The Grass Is Always Greener," which finds Blossom heading through a wire fence into the vegetable garden. "One of the worst sounds on the farm is the muffled cold of the cows in the milking parlor and rainy night," declares Lowell. "Jolted awake, you realize that they are trampling the vegetable garden and flower beds. Of course, you have to get out of bed, put the cows back in and fix the fence — all in the dark. When it happens here on the farm, you can always bet that the culprit is Blossom."

1200 dpi TEXT

2400 dpi PHOTOS



115/100/90/75 FEATURES

- Heavy-duty electrical system components are more durable, better insulated, mounted to absorb shock and be more reliable in rough water.
- Optional QuickStart® Ride Guard® Power Steering kit available on all models shown here. Less vibration, better control and quicker response than with unassisted systems. Less than 3 turns lock-to-lock vs. up to 8 turns with some hydraulic systems. Now available for single- and dual-engine applications, on 75-200 hp models.
- Optional factory-installed tiller handle model available on both 75 and 90 hp models.
- Loop-charged induction for best power and economy.
- Thunderbolt® CD ignition delivers up to 40,000 volts to spark plugs for smooth starts.
- Integral power trim is totally self-contained within engine mounting bracket, eliminating hydraulic line breakage and leakage at fittings.
- High-output 16-amp regulated alternator, nearly twice the output of some competitive engines.
- Reliable, single-point, variable-ratio oil mix (no mixer gun and oil at correct ratio for economy and efficiency).

MERCURY OUTBOARDS

## DESKTOP LASERS

back of the printer housing like freight on-board an oil tanker. The 10A version, intended for Mac users, supports only LocalTalk; the 10P, intended for DOS/Windows users, supports only Centronics and RS-232. While the 10P supports PCL (Printer Control Language) 4 and HPGL (Hewlett-Packard Graphics Language), neither of these is available on the 10A. Mac users aren't likely to miss PCL, but CAD and sign-making applications can make good use of HPGL in a laser printer prior to running full-size plots.

Printing from the Mac required more attention than with the other units, even though this printer is driven by a 16.7-MHz Motorola 68020 that has been in use in laser printers for several years. Rather than use the LaserWriter driver to allow printer options to be chosen when printing, a DA (desk accessory) is used to configure the printer. Using this slow CPU could have been justified if easy backward compatibility had been the goal, but there seems to be none.

During my evaluation cycle, Lexmark dropped the 10A's price by \$1200, putting it a little below the LZR-965 and the LaserJet 4M. The slow printing speeds, awk-

ward use, and lack of multiple PDLs in the Mac configuration suggest that this printer should be priced with personal laser printers instead of with these workgroup printers.



### QMS 860 Print System

The QMS 860 is priced at \$4595, 50 percent above the other printers in this review and over twice the price when in the test configuration. However, it offers immediate value: This printer can satisfy some formidable printing needs.

The new Canon LBP-BX engine supports tabloid (11- by 17-inch) paper at 4 ppm, and letter size output at 8 ppm. The base memory configuration is 12 MB, with

expansion to 32 MB possible. My testing was done with 28 MB installed, although the formal benchmarks were run with the base configuration.

All four printers included warnings not to lift the printer out of the carton without help. At 50 pounds for the QMS 860, it would be wise to obey the warning. Although I did need the manual to install the additional RAM and paper tray, I was able to print without it.

As with the other printers, the primary paper tray slides into the bottom of the printer from the front. The test unit came with the 500-page letter-size tray, which installs below the printer in a special feed module. These options attach without tools and are only difficult to install if you insist on doing it alone. After installing the second tray, I ignored the upper and lower feed cassette choice in the printer driver, and the printer correctly determined the proper tray automatically.

Along with the large-format printing, this unit stands apart on the basis of its operating system, QMS Crown. Based on the Intel 960 RISC processor running at 25 MHz, QMS Crown can accept simultaneous printing jobs from the three

# FROM THIS

# FOR THIS.



**Introducing the Image Xpert 1000. Windows™ output that looks like a million at a price that looks like a typo.**

XLI's new desktop printer just pushed the PC publishing revolution into overdrive. For less than the price of most new generation 600 dpi printers, the Image Xpert 1000 delivers 1200 dpi for text and graphics, plus an incredible 2400 dpi equivalent with 256 gray levels for halftones, all on a single page. Type prints crisp and clean; photos

show amazing detail. That means business and professional users at all levels can now produce high resolution plain paper masters and proofs without outside services, saving time and money.

The Image Xpert 1000 is the first laser printer to incorporate XLI's acclaimed LaserPix 5.0, the image controller board with patented SUPER LGA™ technology that has taken the world of Windows desktop imaging by storm.

**Circle 218 on Inquiry Card (RESELLERS: 219).**

Before you spend a dime upgrading your output, call us for the whole story on how the competitively-priced Image Xpert 1000 can produce high resolution documents for your application. **1-800-433-8040**

**XLI**  
CORPORATION

XLI Corp., 800 West Cummings Park,  
Suite 6650, Woburn, MA 01801.

# HOW DO YOU GET A JOB WITHOUT EXPERIENCE? AND HOW DO YOU GET EXPERIENCE WITHOUT A JOB?

Most young people have one answer to this problem. They avoid it until they're out of college. But they could be getting solid work experience while they're still in college. With your company's help. And ours.

We're Co-op Education. A nationwide program that helps college students get real jobs for real pay, while they're getting an education.

But we can't do it without you. Those real jobs have to come from real companies. Like yours.

For more information on how you can participate in this valuable program, write Co-op Education, Box 775E, Boston, MA 02115.

Not only will you be giving students a chance to earn money and pick up the most valuable kind of knowledge, you'll be giving yourselves a chance to pick up the most valuable kind of employee.

## Co-op Education.

You earn a future when you earn a degree.



A Public Service of This Publication ©1987 National Commission for Cooperative Education

## DESKTOP LASERS

standard interfaces. Adding a network interface board does not require removing or disabling any of the three standard ports. Utilities are included that allow the installed memory to be configured as buffers for each port, font caches, or, with application support for PostScript Level 2, logo and form storage. If one or more SCSI hard drives are installed for font storage, the controller can be programmed to use space on the hard drive as additional print spooling.

This system features an intermediate page-description format that is more compact than the bit maps that printers ultimately generate. Information received as PostScript, PCL, or HPGL from the computers is interpreted and converted to this display-list format and queued for printing, increasing the speed at which jobs can be accepted and enhancing the capacity of the printer's installed RAM. Once the print job has been converted to the QMS display-list format, the generation of the bit maps can then take place at the printer's rated engine speed. This will allow multiple-copy printing of collated sets without the time penalty other printers suffer, as the computer normally sends the complete sequence of pages several times when collated output is required.

The QMS 860 includes the basic 35 PostScript fonts, plus the Helvetica Condensed family.

### The Remaining Field

One printer that was intended to be part of this comparison is the NewGen Turbo 660 PS, which uses the AMD 29000 processor and the same engine and case as the QMS 860. NewGen was unable to solve my concerns about print quality in time for this review and withdrew the printer from the market until final debugging was accomplished. I expect that it will have printing characteristics very similar to the QMS 860, without the multi-tasking interface system, and should be available for a price roughly midway between the tabloid 860 and the letter-size printers I reviewed here. I recommend taking a good look at this printer when it is released.

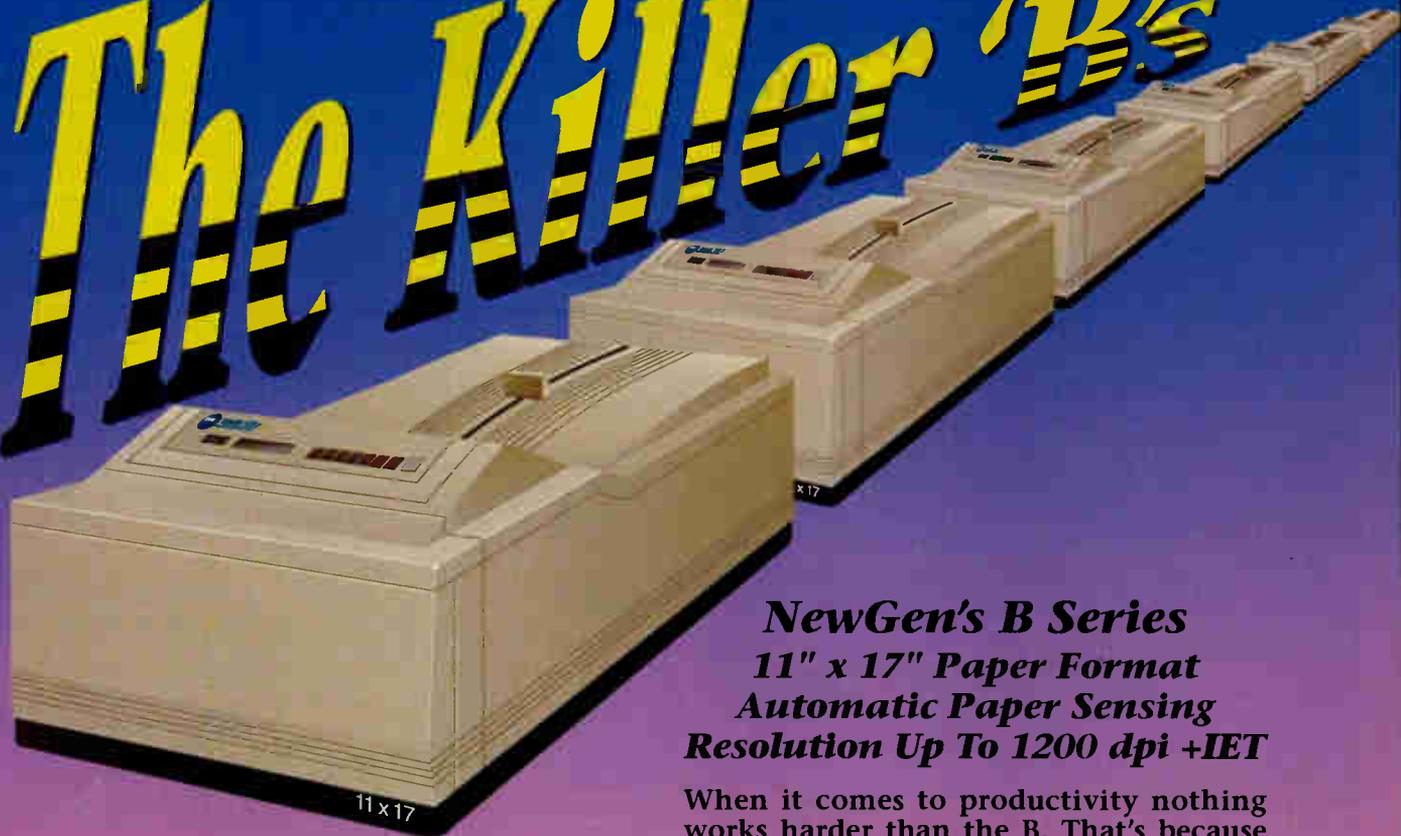
True 600-dpi printers are also expected soon from such vendors as Calcomp, Xante, and LaserMaster.

### Final Resolutions

I can't recommend the Lexmark printers. These models simply aren't competitive with other available models at the same or similar price levels.

The LZR-965 is fast, sharp, and compact. It supports hard disk storage to facilitate rapid printing as your type collection

# The Killer 'B's



**NewGen's B Series**  
**11" x 17" Paper Format**  
**Automatic Paper Sensing**  
**Resolution Up To 1200 dpi +IET**

When it comes to productivity nothing works harder than the B. That's because NewGen's B Series was designed to deliver the value and quality that experienced PostScript® users demand.

The affordable B Series wide format laser printers offer you powerful Ethernet capability, innovative paper handling, and the sharp graphics and high resolution that have made NewGen famous.

Call us today for more information at:

**1-800-756-0556**

**Now Showing At A  
Dealer Near You!**

*See us at CeBIT  
Hall 6, Booth B63*

**newgen**

*The Hi-Res People™*

17580 Newhope Street, Fountain Valley, CA 92708  
Telephone 714-641-8600 • Fax 714-641-2800

© 1992, NewGen Systems Corporation. All trademarks and registered trademarks are of their respective companies.

Circle 118 on Inquiry Card (RESELLERS: 119).

World Radio History



## No Wild, No Wildlife.

The California desert tortoise is losing ground. Its young are being crushed by motorcycles and off-road vehicles. Sheep and cattle grazing are diminishing an already scant supply of food while mining and road building are destroying the tortoise's natural habitat.

The fact is that the tortoise population has declined as much as 90% over the last fifty years. This drop is a true biological indicator of how severely the desert ecosystem is at risk.

The Sierra Club works to save wildlife by saving the wilderness. We have a history of victories. And, we believe with your help, the three-million-year-old desert tortoise can win back its native turf.

For information on how you can help:



**Sierra Club**  
Dept. DT  
730 Polk Street  
San Francisco, CA 94109  
(415) 776-2211

## DESKTOP LASERS

grows beyond the 35 fonts in ROM, and you'll be able to store forms on a hard drive when that component of PostScript Level 2 is implemented.

If you need to print tabloid pages, the QMS 860 offers print speed barely slower than the LZR-965 and the LaserJet 4M. It also offers the greatest flexibility in memory, interfaces, emulations, and paper handling.

Overall, my vote goes to the LaserJet 4M. It is flexible and offers the best image quality of the group. It also will be supported by a host of third parties offering supplies and enhancements in addition to HP's offerings, and very few software vendors will omit drivers and other support for this model. ■

*G. Armour Van Horn is a writer and graphics consultant based in Freeland, Washington. He can be reached on BIX as "vanhorn."*

## COMPANY INFORMATION

### Dataproducts Corp.

(LZR-965)  
6219 De Soto Ave.  
P.O. Box 746  
Woodland Hills, CA 91365  
(818) 887-8000  
fax: (818) 887-4789

**Circle 1229 on Inquiry Card.**

### Hewlett-Packard Co.

(LaserJet 4 and LaserJet 4M)  
Direct Marketing Organization  
P.O. Box 58059  
MS 511L-SJ  
Santa Clara, CA 95051  
(800) 752-0900  
fax: (208) 344-4809

**Circle 1230 on Inquiry Card.**

### Lexmark International, Inc.

(LaserPrinter 4029 10A and 10P)  
740 New Circle Rd. NW  
Lexington, KY 40511  
(800) 358-5835  
(606) 232-2000  
fax: (606) 232-2380

**Circle 1231 on Inquiry Card.**

### QMS, Inc.

(860 Print System)  
1 Magnum Pass  
Mobile, AL 36618  
(800) 631-2692  
(205) 639-4400  
fax: (205) 633-0013

**Circle 1232 on Inquiry Card.**

# Train for a High-Paying Career as a Computer Service Technician

**NEW!**  
486sx/25 MHz  
computer. 80 meg  
hard drive!



**Only NRI, the leader in hands-on training for 78 years, could give you training this complete, experience this practical. You actually build a powerful 486sx/25 MHz computer system — including an 80 meg hard disk drive — all the while gaining the hands-on skills you need to service today's sophisticated computers with confidence!**

Over 220,000 jobs! That's what the Department of Labor forecasts for computer service technicians by the year 2005, a 38% increase over today's level. For you, that means tremendous opportunity if you have the training and the skills to get into this high-paying, top-growth field.

Now you can cash in on this opportunity — full-time, part-time, or in a computer service business of your own — once you've mastered electronics and computers the NRI way.

**NEW! Get inside a 486sx/25 MHz computer system ... and experience all the power and speed of today's computer technology!**

Now NRI includes a powerful new 486sx/25 MHz mini-tower computer system as the centerpiece of your course to give you hands-on training with state-of-the-art computer technology. You build this 1 meg RAM, 32-bit CPU computer from the keyboard up, plus you now go on to install an 80 meg IDE hard disk drive to complete your total computer system. But that's not all!

You also learn to diagnose and repair IBM-compatible computers with the remarkable diagnostic hardware and software included in your NRI training. See the other side for more details about this exciting NRI training breakthrough.

## Understanding you get only through experience

You need no previous background in electronics to succeed with NRI. You start with the basics, rapidly building on the fundamentals of electronics to master advanced microcomputer concepts.

Best of all, you learn by doing — performing hands-on experiments with your NRI Discovery Lab and digital multimeter, then actually building and testing the powerful 486sx/25 MHz computer system you train with and keep.

## Your incomparable hands-on training includes all this:

NRI's Discovery Lab you use to design and modify circuits, diagnose and repair faults • Hand-held digital multimeter with "talk-you-through" instructions on audio cassette • Digital logic probe that lets you visually examine computer circuits • A state-of-the-art 486sx/25 MHz computer, featuring a 32-bit 80486sx CPU, "intelligent" keyboard, and 1.2 megabyte, high-density 5-1/4" floppy drive • 80 meg IDE hard disk drive you install internally • 64K ROM, 1 meg RAM • MS-DOS, QBasic, and Microsoft Works software • Ultra-X diagnostic package including R.A.C.E.R. plug-in card and QuickTech menu-driven software for fast, professional troubleshooting • Reference manuals, programming guidelines, and schematics.

## Learn at home in your spare time, backed by your personal NRI instructor

With NRI, you learn at your own convenience in your own home. No classroom pressures, no night school, no need to quit your present job until you're ready to make your move. And all throughout your training you've got the full support of your personal NRI instructor and the entire NRI technical staff.

Get all the facts from NRI's free full-color catalog. Send today!

See other side for highlights of NRI hands-on computer training 

## SEND CARD TODAY FOR FREE NRI CATALOG!



**NRI Schools**  
McGraw-Hill Continuing Education Center  
4401 Connecticut Avenue, NW,  
Washington, DC 20008



For career courses approved under GI Bill,  check for details

### ✓ Check one free catalog only

- Microcomputer Servicing
- TV/Video/Audio Servicing
- Industrial Electronics & Robotic
- Basic Electronics
- Computer-Aided Drafting
- Computer Programming
- Desktop Publishing & Design
- PC Applications Specialist
- Programming in C++ with Windows

Name \_\_\_\_\_ (please print) Age \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_ 170-0393

Accredited Member, National Home Study Council

# Get In-Demand Computer Servicing Skills With NRI "Hands-On" Training



You set up and perform electronics experiments and demonstrations using your NRI Discovery Lab. You even interface the lab with your 486sx computer to "see" keyboard-generated data.



After you build this digital logic probe, you explore the operation of your computer's 101-key, detached "intelligent" keyboard and its dedicated microprocessor.



You install the 1.2 meg, 5-1/4" floppy disk drive, learning disk drive operation and adjustment. Later, you dramatically improve your computer's data storage capacity by installing a powerful 80 meg IDE hard drive.



You learn to quickly diagnose and service virtually any computer problem with the extraordinary R.A.C.E.R. plug-in diagnostic card and QuickTech diagnostic software included in your course.

## NRI training is so complete, hands-on mastery is "built-in"

No other training — in school, on the job, *anywhere* — prepares you so thoroughly for today's money-making opportunities in computer service. And only NRI builds meaningful training around the kind of powerful computer system you'll be called on to service and repair in the real world.

As you assemble your 486sx/25 MHz mini-tower computer system — complete with monitor, floppy drive, hard drive, operating and applications software — you'll perform hands-on demonstrations and experiments that bring theory to life, giving you a total mastery of computer operation. But NRI doesn't stop there.

## Now! Includes diagnostic hardware and software for quick, accurate troubleshooting

Your NRI training now includes a remarkable diagnostic package that allows you to quickly locate and correct defects in IBM-compatible computers.



You'll use the Ultra-X R.A.C.E.R. diagnostic card to identify individual defective RAM chips, locate interfacing problems, and pinpoint defective support chips. Experts call the R.A.C.E.R. card the easiest to use, most powerful tool for PC troubleshooting available today!

With your QuickTech diagnostic software package, also from Ultra-X, you'll go on to test the system RAM and such peripheral adapters as parallel printer ports, serial communications ports, video adapters, and floppy and hard disk drives.

This ingenious diagnostic package is just one more way NRI's real-world, hands-on training gives you both the knowledge and the professional tools to succeed as today's in-demand computer service technician.

## FREE catalog tells more ... send today!

Send the postage-paid card today for NRI's big, free catalog that gives all the facts about NRI computer training. See for yourself how NRI hands-on training can help you cash in on the growing opportunities for skilled computer service technicians.

If the card is missing, write to NRI at the address below.

**NRI Schools**  
McGraw-Hill Continuing Education Center  
4401 Connecticut Avenue, NW  
Washington, DC 20008



IBM is a registered trademark of International Business Machines Corp. R.A.C.E.R. and QuickTech are registered trademarks of Ultra-X, Inc.

Card 101

## SEND CARD TODAY FOR FREE NRI CATALOG!



### BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 10008 WASHINGTON, D.C.

POSTAGE WILL BE PAID BY ADDRESSEE

**NRI Schools**  
McGraw-Hill Continuing Education Center  
4401 Connecticut Avenue, NW  
Washington, DC 20078-3543

NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES



## APPLICATION

# How to Deal with Taxing Questions

KATHLEEN LARIVIÈRE AND STAN MIASTKOWSKI

The approach of April 15 is looked upon with much fear and loathing in the U.S., as yearly income tax returns are due to the IRS. If you're a typical taxpayer—an hourly or salaried worker with perhaps a house and a few investments—tax-preparation software can help in a big way. These programs guide you through the procedure of calculating your taxes and filling out IRS forms, help you make sure you get what refund is due you, and keep you from filing an incomplete form.

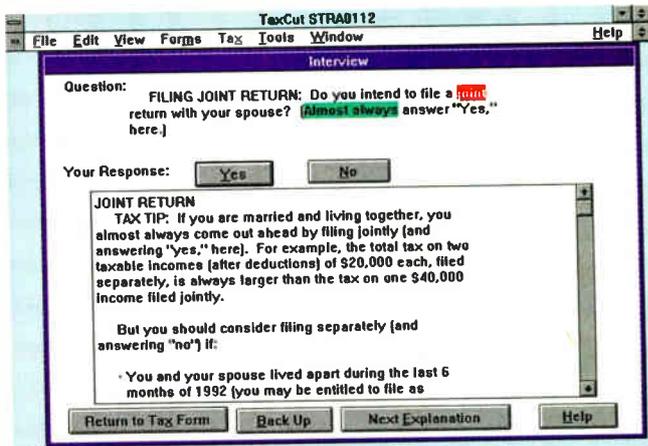
We looked at four families of tax-preparation programs for DOS, Windows, and the Macintosh: Meca Software's Andrew Tobias' TaxCut for DOS, TaxCut for Windows, and TaxCut for the Macintosh; Parsons Technology's Personal Tax Edge and Personal Tax Edge for Windows; Intex Solutions' Tax Solver (for Excel, Lotus 1-2-3, and Symphony); and ChipSoft's TurboTax for DOS, TurboTax for Windows, and MacInTax. Prices range from \$49 to \$80.

At their heart, all these tax-preparation programs are actually spreadsheets using complex links to interrelate numbers and calculations from various IRS forms, schedules, and worksheets. These interrelationships are a big advantage of tax software. You don't need a calculator; most numerical calculations are done for you, and most packages have a pop-up calculator. The programs automatically enter calculated numbers in the correct locations on the related forms, schedules, and worksheets. This capability alone is almost worth the price of admission.

Because there are so many individual items that go into the preparation of a tax return, taxpayers can easily miss common deductions that reduce the tax they owe. To maximize the return, the best of today's tax-preparation programs use a step-by-step interview technique—much like what would happen if you sat down with an experienced tax preparer. This on-line interview approach isn't perfect, but it goes a long way toward making the preparation of your taxes less headache-provoking.

After using one of these packages, you end up with a completed tax return. Instead of filling out printed IRS forms, these programs use printer graphics (laser or dot-matrix) to create a finished package that the IRS will accept in lieu of its own

**Screen 1:** Andrew Tobias' TaxCut, available for DOS, Windows (shown here), and the Mac, features an easy-to-use interview process, although you can't see the forms as you answer questions.



forms. With a complex return, the package can run to many pages.

Because the IRS will not release all the necessary tax forms until around the first of the year (after this article went to press), we used the prerelease version of each package. All the companies offer early versions that taxpayers can use for planning and then ship final versions to customers during January.

We tested the packages as if we were three hypothetical taxpayers: two had relatively simple returns, and one was slightly more complex (with self-employment income). All the scenarios involved several gotchas—common yet often-missed income and deductions that can make a substantial bottom-line difference on tax liability.

### Filing Electronically

The best tax-preparation packages also offer you the option of filing your return electronically, sending it via modem (or by mailing a disk), but not directly to the IRS. Because of security considerations and other requirements, the IRS does not encourage individual taxpayers to become "direct transmitters." Instead, you send your return to an IRS-authorized service bureau, which then transmits it to the IRS. (Technically, it is possible to become authorized to file returns directly, but it requires a special 4800-bps modem and a testing process. It's simply not worth the trouble for an individual taxpayer.)

Electronic filing costs extra (costs vary by package, usually \$10 to \$20), and these packages allow electronic filing only if you have a refund coming to you. The bottom line is, you'll get your refund weeks

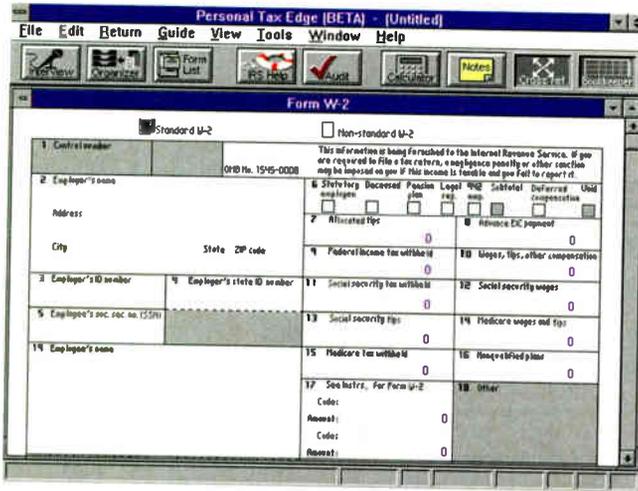
earlier. If you owe money, you'll have to find a professional who handles balance-due returns electronically, or simply mail your return in the usual manner.

### Andrew Tobias' TaxCut

Meca Software's TaxCut carries the moniker of well-known financial planner and

## BYTE ACTION SUMMARY

- **WHAT TAX SOFTWARE DOES**  
It guides you through the task of preparing income tax returns.
- **LIKES**  
Interview techniques (usually) help you avoid mistakes that can cost you money; programs perform automatic calculations; links with forms put numbers in the right places.
- **DISLIKES**  
All programs require some tax knowledge, but that's a function of the complex U.S. Tax Code. Some low-cost packages don't give enough help or explanation.
- **RECOMMENDATIONS**  
TurboTax and MacInTax are the best designed and most comprehensive. TaxCut and Personal Tax Edge are also fine, especially in their ability to import a wide range of data.



**Screen 2:** *Parsons Technology's Personal Tax Edge has a useful toolbar and allows you to see forms as you answer questions. It's available in both DOS and Windows (shown here) versions.*

calculating the penalty for underpaying estimated tax. This is not an unusual form for self-employed individuals, but TaxCut refused to calculate it, with a message saying it's "too complex." Other packages handle it with no problems.

You can electronically file your finished TaxCut tax return, with or without a modem. (If you don't have a modem, you can send a disk to the service bureau.) Either way, it costs \$19.95.

## Personal Tax Edge

Personal Tax Edge from Parsons Technology is available for both DOS and Windows. Because of its newness, we focused our testing on the Windows version (see screen 2). The interface is clean, and the forms and instructions are easy to read, even on a standard 640- by 480-pixel VGA screen.

PTE has a unique approach to the interview process compared to the other packages we reviewed. Other packages do not show you the forms until you're done with the interview; PTE shows you the actual forms and source documents as they're being filled out. This is a handy way of keeping track of your progress.

On the negative side, PTE's interview isn't as comprehensive as the others. In some cases, PTE assumes that you have enough tax knowledge to know where to go. For example, while filling out Schedule C (business profit and loss), line 10, the program leads you directly to the related Form 4562 (depreciation), but it gives you no help on how to fill out the form correctly.

PTE ties in most directly with Parson's MoneyCounts financial package, and it will also handle data from Quicken, Managing Your Money, Microsoft Money, and ASCII text. The program has about 70 forms, schedules, and worksheets. You

author Andrew Tobias, who's involved in the design of the program. TaxCut is actually one of the oldest of the personal tax-preparation programs, and it's now available in versions for DOS, Windows, and the Mac.

Internally, all three versions are virtually identical, with, of course, slight differences in the look and feel for each platform. Not surprisingly, the graphics-oriented interfaces for Windows and the Mac result in tax forms that look like the real thing on-screen. But the text and details are identical across the three versions.

Of the packages we looked at, TaxCut has by far the most informative interview process (see screen 1). Its friendly tone and positive approach almost make preparing your taxes a pleasure—almost. As you go through the interview process, TaxCut keeps you informed of what it's doing and why. For example, it tells you what form it's filling in and shows the calculations, points you to further information (e.g., advantages of filing a joint return), and gives you progress reports on how much of the return you've filled out. TaxCut also allows you to jump easily between the form and the interview. Particularly handy is a mini-worksheet that appears between the lines of the form you're working on, giving handy tips and information on what's been calculated and where the numbers came from. In a complex tax return, this can be useful indeed.

TaxCut's interview process isn't perfect. One of our test returns included a scholarship, but the interview never asked about it. If you go directly to the 1040 line 7, where this information would be entered, the program essentially ignores that scholarship income exists; TurboTax, on the other hand, asks specifically about it. TaxCut's failure to flag scholarship income resulted in a miscalculation that (in our test) would have cost the taxpayer an

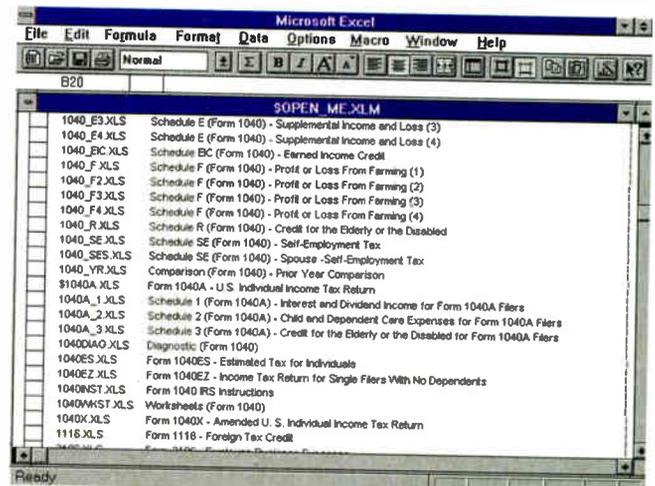
additional \$150 of unnecessary tax liability. (It can be fixed, but only if you know how.)

Not surprisingly, TaxCut is tightly integrated with Managing Your Money. If you've used that package to keep track of your finances throughout the year, TaxCut will import the files, do the calculations, and place the right numbers in the right places. Except for very complex situations, it makes tax preparation almost automatic. TaxCut also imports files from Quicken, Microsoft Money, CheckFree, TurboTax, and the TXF (Tax Exchange Format) used by popular accounting programs.

TaxCut's on-line help is very useful, but it fell down on describing inventory and accounting methods used by small businesses, providing a simplistic (and incomplete) explanation. And the definition of handling bad debt was misleading.

TaxCut features almost every possible form, schedule, and worksheet you'll ever need—about 95. But it balked at filling in page 2 of Form 2210, which covers cal-

**Screen 3:** *Tax Solver from Intex Solutions has a selection of 147 linked forms, schedules, and worksheets available for Lotus 1-2-3 and Symphony, as well as Microsoft Excel (shown here).*



# There's Sound...

"vrooom, vrooom"

## ...And There's SoundMan™

GUARANTEED COMPATIBLE  
or your money back



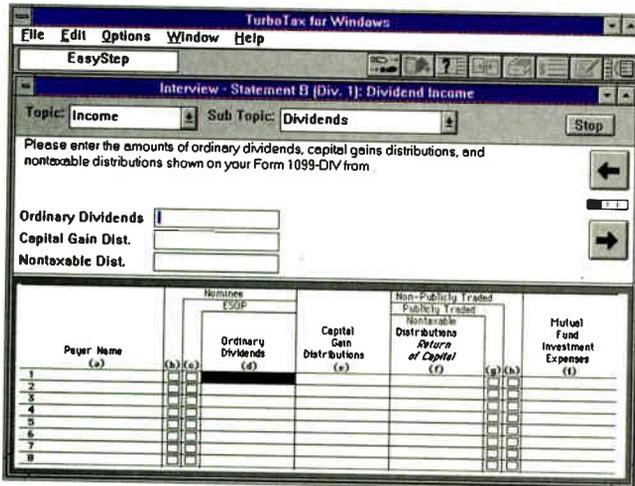
SoundMan™ 16. Get Real.

SoundMan 16 delivers sound so real, 85% of the time people can't tell the difference from live sound. That's because it's packed with the absolute latest in sound board technology: up to 16-bit/44KHz record/playback, Yamaha OPL-3 stereo synthesis 20-voice chip, 100% Sound Blaster™ and Ad Lib™ compatibility, and more. SoundMan brings you the highest CD-quality sound available, for all your games and applications, in Windows™ and DOS. From Logitech, the peripherals leader. At your dealer, or call 1-800-231-7717. TM/® Trademarks belong to their respective owners.



The Senseware™ Company

Circle 100 on Reader Card (RESELLERS: 101).



**Screen 4:** ChipSoft's TurboTax is the most comprehensive tax-preparation package. It's available in DOS and Windows (shown here) versions. MacInTax is its equivalent for the Mac.

can also file forms electronically through PTE for only \$10.

### Tax Solver

This package, also designed for the experienced tax preparer, is an unusual animal. It's the only package we looked at that doesn't stand alone. Different versions of Tax Solver are available for Microsoft Excel, Lotus 1-2-3 (DOS or Windows), and Lotus Symphony.

To use Tax Solver, you need to know how to use the related spreadsheet packages, and the more you know about them, the better. Tax Solver also has the largest selection of forms: 147 (see screen 3). Essentially, Tax Solver is a collection of linked spreadsheets that take up about 4 MB of disk space.

Tax Solver is recommended for the experienced number cruncher who is also comfortable with taxes. It doesn't have an interview form, and it doesn't import from other tax or financial programs (unless they export to spreadsheet formats). And there are no help screens for any of the schedules.

The advantage of Tax Solver is that you can use the advanced what-if capabilities of the underlying spreadsheet. The other packages reviewed here have worksheets for looking at alternative tax scenarios, but they don't have the extensive conjunctural capabilities of Excel or 1-2-3.

### TurboTax and MacInTax

ChipSoft's TurboTax is available for DOS and Windows (see screen 4); MacInTax is for the Mac. Both programs offer an extensive and helpful interview process, although they tend to assume some knowledge of tax law. For example, they rightly ask if you have any "nominee interest," but they don't explain what that is.

TurboTax and MacInTax also offer the most comprehensive final review of your

tax return of any of the packages reviewed here. They are chock-full of hints and suggestions, including steps you can take to reduce your tax liability during the next year. Both offer electronic filing (via modem or disk) for \$19.95.

TurboTax and MacInTax neglect to give you a running update on your tax liability until you're done with the entire interview, unless you specifically switch to the forms. And they import data only from Quicken and TXF formats.

Despite minor shortcomings, TurboTax and MacInTax stand out among the packages here in their ability to handle virtually any tax situation. The packages effortlessly and correctly calculate even the most complicated of tax returns. They offer extensive help and hints on advanced tax matters and even point you to IRS publications for further reading.

ChipSoft is the only company here that also sells versions of its programs specifically designed for professional tax preparers. In fact, if you prepare your return with TurboTax and bring it to professional preparers who use the pro packages, they can import your return and check or complete it for you.

### Taxing Choices

For taxpayers who want to spend the least amount of time dealing with Uncle Sam (and aren't interested in becoming tax experts), any of the packages offering interview process is logical choices. TaxCut's interview process is thorough, but it has some limitations for complex returns. And while TurboTax's interview has its drawbacks, it's most effective and accurate for all types of returns. Interview-type programs are most effective when used with the financial management packages whose data they can import. That can eliminate the dreaded Shoebox Syndrome as you sift through piles of receipts as the tax deadline nears.

While the DOS versions of these programs are just as functional, we recommend that PC users buy the Windows versions: They put on-screen what looks like an actual IRS form, which is definitely helpful. And surprisingly, we found that the Windows versions were just as fast as their DOS counterparts.

A dose of reality: Because of the complexity of the U.S. Tax Code, the more complex your tax situation, the less cut-and-dried the "answers" are. Like law, taxes require interpretation and opinions, dependent on "facts and circumstances," as the IRS likes to say. Given any complex situation, all these packages could deliver slightly different bottom lines based on the interview. Programs like we've reviewed here are designed for the vast majority of taxpayers and are no substitute for a one-on-one interview with a real tax professional. ■

*Kathleen LaRivière has over 14 years' experience as a tax professional; she owns and operates a tax practice in Peterborough, New Hampshire. Stan Miaszkowski is a BYTE consulting editor and a freelance writer specializing in computer technology. Both can be reached on BIX c/o "stanm" or via MCI Mail at 530-9979.*

## ITEMS DISCUSSED

**Andrew Tobias' TaxCut for DOS, TaxCut for Windows, TaxCut for the Macintosh**.....\$50

Meca Software, Inc.

(203) 256-5000

fax: (203) 255-6300

**Circle 1225 on Inquiry Card.**

**Personal Tax Edge, Personal Tax Edge for**

**Windows**.....\$49

Parsons Technology

(319) 395-9626

fax: (319) 393-1002

**Circle 1226 on Inquiry Card.**

**Tax Solver for Excel, Tax Solver for 1-2-3, Tax Solver for Symphony**.....\$79.95

Intex Solutions, Inc.

(617) 449-6222

**Circle 1227 on Inquiry Card.**

**TurboTax for DOS, TurboTax for Windows, MacInTax**.....\$79.95

ChipSoft, Inc.

(619) 453-4446

**Circle 1228 on Inquiry Card.**

## SYSTEM

# Compaq Stakes Out Both Ends of the Server Spectrum

**BARRY NANCE**

**W**hen it comes to the network server market, one size most definitely does not fit all. One shop may require nonstop operation, another excellent I/O performance for a large LAN, and a third high-speed processing for a database server. And some companies just need reasonable performance at a reasonable price.

Compaq has addressed both ends of the server spectrum with two recent server introductions. The Systempro/XL (see the photo) is a high-end, dual-processor system with fault-tolerant and management features; Compaq's new ProSignia is a new low-end, single-processor server.

I tested both servers for speed in two environments. In my lab, I alternated between Ethernet and Token Ring to connect up to eight workstations. For a larger-scale test, I used a battery of 50 PCs on 16-Mbps Token Ring to give the XL and ProSignia servers more of a workout. I used the BYTE LAN Benchmarks (for NetWare and Unix) to measure performance on NetWare 3.11 from Compaq and SCO Unix 3.2.4. Figure 1 shows results for varying workstation levels on a Token Ring network.

In the following sections, I'll discuss performance and reliability aspects of the XL. You'll find details on the ProSignia in the text box "You're Not Going to Pay a Lot for This Server," page 172.

### Inside the XL

The XL is based on Compaq's new TriFlex system architecture, which Compaq designed to be upwardly compatible with Intel's entire family of fast CPUs. A natural extension to Flex/MP, TriFlex separates system operations among the 64-bit processor bus, the 128-bit memory bus, and the 32-bit EISA bus. The TriFlex DataFlow Manager coordinates the work of EISA adapters and the CPU, providing a 267-Mbps path to and from main memory. (For comparison, the IBM Model 295 operates at 200 MBps.)

DataFlow Manager is Compaq's solution to a performance problem that sometimes plagues bus-master adapters. Ironically, as a bus-master adapter uses more memory bandwidth, it reduces the CPU's ability to access main memory during instruction fetch cycles. According to Compaq, the DataFlow Manager lets proces-



*The Systempro/XL features dual processors and advanced system architecture for high performance.*

sors and EISA bus-masters access main memory simultaneously more than 70 percent of the time.

The XL can accept an optional second processor board. The two CPUs in my review unit were 50-MHz 486s, but Compaq says that the XL's 64-bit processor architecture will readily accommodate Intel's future high-speed CPUs—Pentium and beyond. The XL's processor boards also add 256 KB of two-way set-associative, write-back cache.

NetWare can take advantage of the large CPU cache, but it can't make use of the second CPU. Novell says it's still in the design stages of multiprocessor support for NetWare and that SMP (symmetric multiprocessing) support may appear in a subsequent release of NetWare 4.0 late in 1993. Until then, you'll find the dual-processor architecture most useful in an application or database server running SCO Unix with MPX (multiprocessor extension) or Banyan Vines SMP.

The XL comes bundled with a new Compaq network interface card. The NetFlex dual-physical-layer-protocol adapter

## BYTE ACTION SUMMARY

### ■ WHAT THE SYSTEMPRO/XL AND PROSIGNIA ARE

The XL is a new high-end server with fault-tolerant features. The ProSignia is a fast, low-cost server.

### ■ LIKES

Fault tolerance and excellent capacity on the XL; low cost but good performance on the ProSignia.

### ■ DISLIKES

No hot-swap capability for the XL; multiprocessing practical only on Unix networks.

### ■ RECOMMENDATIONS

Both servers fit their niches well.

### ■ PRICE

Systempro/XL (with SCSI, four 550-MB hard drives, dual 486/50s, 16 MB of RAM, Token Ring), \$22,014  
ProSignia (with SCSI, one 550-MB hard drive, one 486DX2/66, 16 MB of RAM, Token Ring), \$6097

### ■ FOR MORE INFORMATION

Compaq Computer Corp.  
P.O. Box 692000  
Houston, TX 77269  
(800) 345-1518  
(713) 370-0670  
fax: (713) 374-1740

**Circle 1223 on Inquiry Card.**

BYTE NETWORK BENCHMARKS

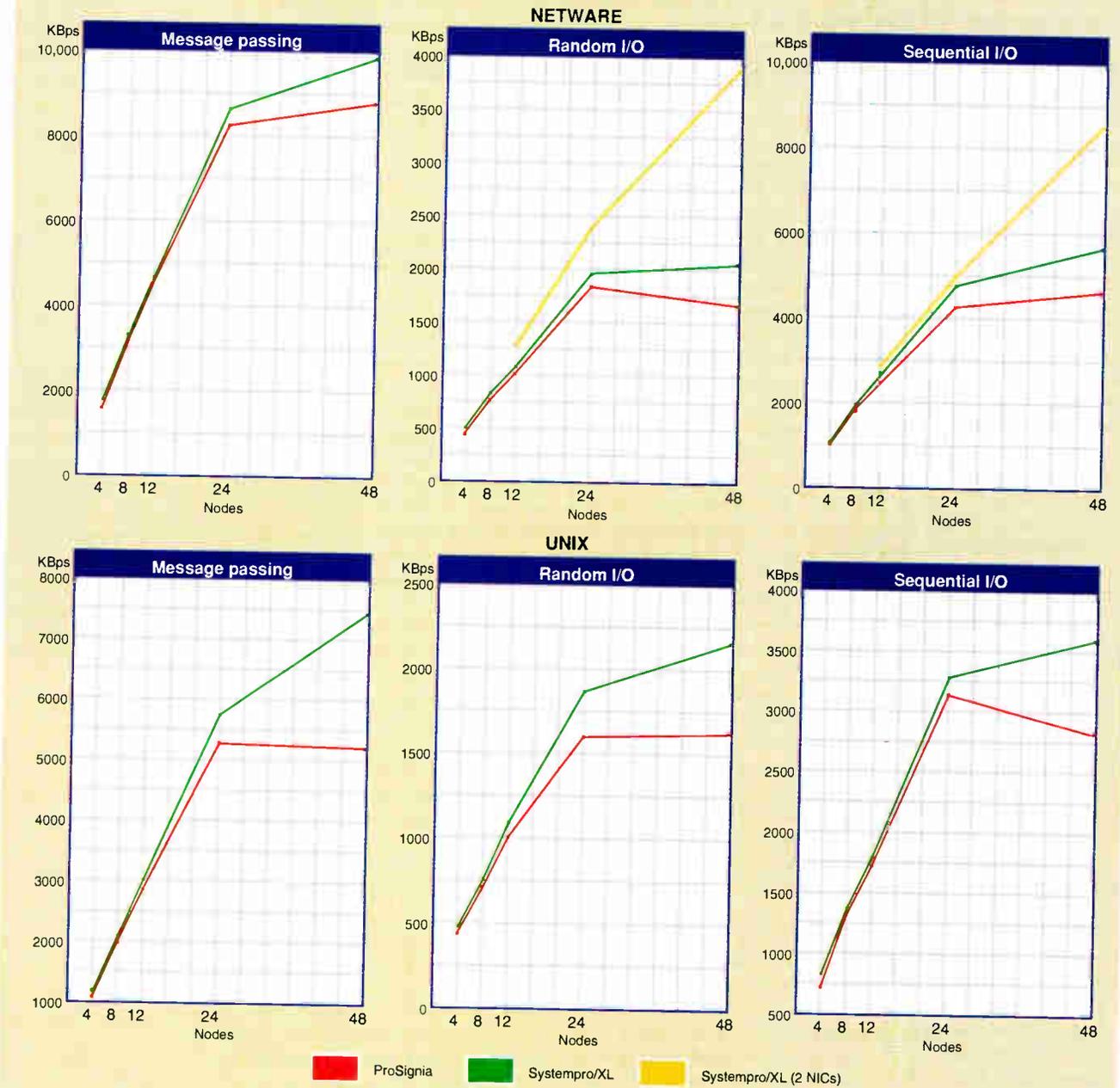
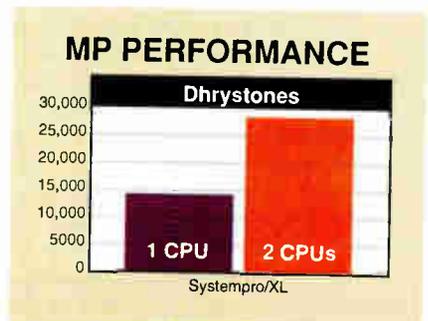


Figure 1: NetWare benchmark results show that both servers are fast but that the Systempro/XL has considerably higher capacity than the ProSignia. The XL shows no degradation at all with two NICs installed. It ran in a dual-processor configuration on the Unix tests, but because I/O is such a significant component of the BYTE Unix Network Benchmarks, the XL doesn't show much benefit.

Figure 2: The Systempro/XL shows a linear increase in processing power when adding an additional CPU running Dhrystones under MPX.



# We made this ad the same way some people still do calculations.

Aside from the quarter million or so people who already use Mathcad, most engineers and scientists continue to do calculations by hand. Using calculators and

And print presentation quality documents complete with text, graphics and equations in real math notation.

Mathcad comes with more

than 200 commonly used

functions built-in, including exponentials, differentials, cubic splines, FFTs and more. Full symbolic capabilities are available with a menu pick, so you can evaluate any integral, Taylor series or infinite

to fully interactive formulas, diagrams and data tables directly from popular reference books. Work with them right in the handbook itself. Or

click and paste them for use in your Mathcad documents.

Plus optional

Applications Packs with modifiable templates are available for all major engineering and science fields.

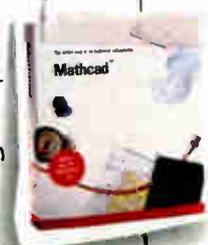
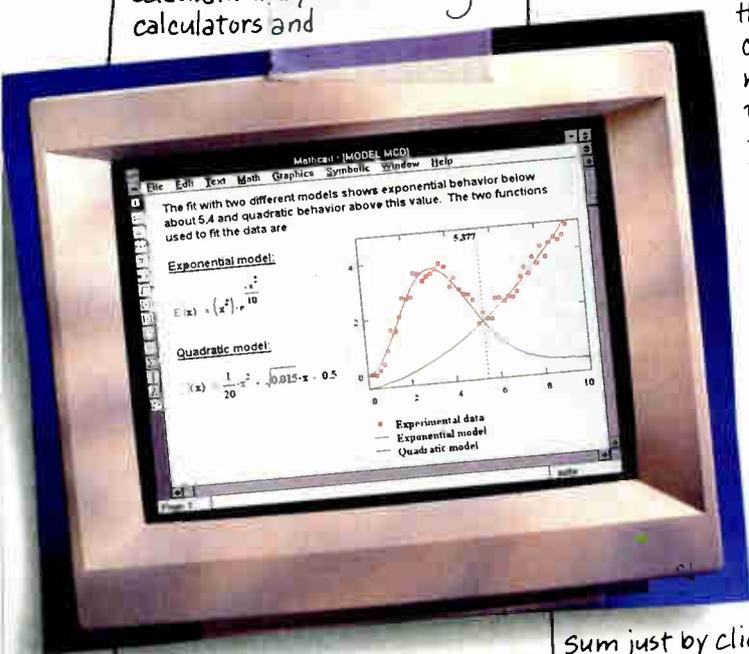
So put down your pencil, pick up the phone and call now to get a free Mathcad Working Model and complete information. Or mail or fax the coupon below.

Once you get your hands on Mathcad, you'll never do math the same way again.

Call: 617-577-1017

Fax: 617-577-8829

**1-800-MATHCAD**



scratch pads. Or jamming them into spreadsheets. Or pounding away at code on their keyboards.

Which is all quite unnecessary when you consider that Mathcad provides a faster, more natural, less error-prone alternative. Simply enter equations anywhere on the worksheet. Graph results in 2-D and 3-D. Change variables and instantly update answers. Add text to support your work.

Sum just by clicking.

Optional Electronic Handbooks\* give you instant access

## FREE Mathcad Working Model.



The Mathcad Working Model includes a concise demonstration and a fully functioning version of the product. It's the best way to introduce yourself to the power and ease of Mathcad. **396**

Name \_\_\_\_\_  
 Title \_\_\_\_\_  
 Company \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
 Country \_\_\_\_\_ Phone \_\_\_\_\_

SPECIFY:

- PC Windows™
- PC DOS  UNIX®
- Macintosh®
- 3 1/2"  5 1/4" Diskette

MathSoft, Inc. 201 Broadway, Cambridge, MA 02139 USA • Phone: 1-800-628-4223 • 617-577-1017 • Fax: 617-577-8829

For information on Mathcad distributors outside of the U.S., contact MathSoft USA © 1992 MathSoft, Inc. TM and ® signify manufacturer's Trademark or registered Trademark respectively. \*Electronic Handbooks require Mathcad 3.1.

Circle 103 on Inquiry Card.

World Radio History

## You're Not Going to Pay a Lot for This Server

Compaq's ProSignia is a midrange EISA server, a little smaller than your average Systempro. With a 66-MHz 486DX2 CPU, 16 MB of RAM, a 550-MB hard drive, a network card, and the usual peripherals, the ProSignia costs \$6097.

You can choose either a 33-MHz 486 or the clock-doubled 66-MHz 486DX2, boosted by a 256-KB cache. The large CPU socket will support a CPU chip upgrade to a 32-bit Pentium (P24T) chip. You can in-



However, the standard ProSignia does include Rapid Recovery Services and

stall up to 128 MB of RAM in the ProSignia. It doesn't have the Systempro XL's TriFlex architecture, but it still held its own on the benchmarks at low usage levels.

The ProSignia server also doesn't have ECC (error-correction code) or other fault-tolerant features of the Systempro/XL, although you can optionally add an IDA-2 (Intelligent Drive Array).

Compaq's Insight. Standard features of the ProSignia include a 32-bit SCSI-2 controller designed especially for NetWare, built-in server monitoring and recovery, and the 32-bit NetFlex EISA network adapter capable of either Ethernet or Token Ring.

The ProSignia is a fast file server, almost as fast as the XL when equipped with the 66-MHz 486DX2 processor. For networks where fault tolerance and killer capacity aren't critical, the ProSignia is a good investment. It would be an unusual setup, but you could even use DOS 5.x and either LANtastic or Windows for Workgroups 3.1! to turn an XL into a server on a peer LAN.

is based on Texas Instruments' Super Eagle controller. The bus-mastering 32-bit EISA NetFlex provides an RJ-45 port for UTP (unshielded twisted-pair) connection to either Token Ring or Ethernet, an AUI (attachment unit interface) port for thick Ethernet, and a nine-pin port for STP (shielded twisted-pair) Type 1 Token Ring.

I tested the XL with its fast SCSI-2 array controller. This controller gave excellent performance and of course will work with the fault-tolerant features of NetWare, such as mirroring and controller duplexing. To get full fault tolerance, however, you need an optional \$2499 IDA-2 (Intelligent Drive Array) controller. The IDA-2 controller supports RAID levels 0 (mirroring), 4 (data-guarding with parity drive), and 5 (data-guarding with distributed parity).

For faster, easier maintenance, disk drives snap into the XL chassis. However, you can't hot-swap; you have to power down the XL to replace internal drives (or any other failed system module).

In addition to fault tolerance at the drive controller level, the XL also includes fault-tolerant memory features. The XL supports up to 512 MB of ECC (error-correction code) RAM. The XL also incorporates memory tracking, which catches ECC RAM faults.

### Software for Servers

Compaq offers NetWare 3.11 as an option for both the XL and ProSignia. Compaq supplies the disks; you choose your own configuration options and preferences as

you install NetWare. Compaq provides all the necessary drivers, as well as a set of NLMs (NetWare loadable modules) for diagnostic purposes.

The diagnostic NLMs turn the XL into an SNMP agent. You can use Insight Manager, a Windows-based utility for over-the-network management of Compaq PC servers, to collect information from the SNMP agent NLMs.

Rapid Recovery Services, a built-in management feature, monitors for hardware failures and network-operating-system crashes, including specific NetWare ABEND conditions. The diagnostics reside on a separate disk partition.

### Measuring the XL's Speed

A faster CPU in a server generally means capacity for more users rather than faster response times for fewer users. A single workstation's response times depend mostly on the speed of the server's I/O subsystems: the hard drives, controller, disk cache, and network adapters.

Figure 1 graphs server throughput for four, eight, 12, 24, and 48 workstations under NetWare 3.11. With one NIC, the XL's server performance degraded somewhat between 24 and 48 workstations. When I added a second NetFlex, the XL performed spectacularly. At up to 48 very heavy, simultaneous users, the XL shows no saturation with two NICs.

The lower row of graphs shows results for Unix at the same usage levels. I didn't run the Unix tests with multiple NICs, but

I would expect to see no saturation at these levels (as with NetWare). Although the XL used both processors on this test, the I/O-heavy benchmarks didn't show much advantage. However, if you designate the XL as an application or database server, you should see the benefit of the extra processor as MPX distributes client/server tasks across the CPUs.

I ran Dhrystone tests to more fully test the XL's MP features (see figure 2). The graph shows that performance simply doubles with two processors; you wouldn't see that kind of linear performance gain on an MP system that wasn't symmetric.

### More Capacity, Brighter Future

The XL isn't much faster than fast low-end servers like the ProSignia, but it offers much higher capacity for large networks. It's also worth considering as a high-performance application server.

A two-CPU XL is overkill right now for NetWare servers. Further down the road, however, MP NetWare and the XL's support for 64-bit Intel processors should make the Systempro/XL an excellent long-term solution. ■

*Barry Nance, a programmer for the past 20 years and a BYTE contributing editor, is the author of Using OS/2 2.0 (Que, 1992), Network Programming in C (Que, 1990), and Introduction to Networking (Que, 1992). He is the editor for the IBM Exchange on BIX, where you can reach him as "barryn."*

## SYSTEM

# Two PowerBooks Great and Small

TOM THOMPSON

Apple's latest round of PowerBook introductions splits the product line into two distinct branches—the high-end, self-contained machines (the PowerBook 160 and 180) and the lightweight, dockable Duo family.

Most of the specifications for these notebooks can be found in my First Impression "New Macs for the Desktop and Road," December 1992 *BYTE*. Since then, I've had a chance to really live with a PowerBook 180 and a PowerBook Duo 230 for a few weeks, and I've had time to test their performance mettle with the latest revision of *BYTE*'s Macintosh benchmarks.

### What They've Got

The PowerBook 180 shares its 6.8-pound, clamshell design with previous PowerBooks. Like the older 145, it has a built-in 1.44-MB SuperDrive floppy drive and includes the usual entourage of I/O ports for ADB (Apple Desktop Bus), serial, sound I/O, and SCSI. Where the 180 breaks from the pack is in performance; its 33-MHz 68030, combined with a 33-MHz 68882 FPU, makes it the fastest portable Mac on the market. The 180 also has a new 10-inch, backlit, 640- by 400-pixel, active-matrix LCD panel that supports 16 gray levels. Finally, the 180 directly supports external video (8-bit color monitors of up to 16 inches) through a display port and a bundled adapter cable (see photo 1).

The PowerBook 180 is a trim machine, but it's a behemoth next to the PowerBook Duo 230. The latter is a svelte slab that weighs only 4.2 pounds, measures somewhat smaller than a notebook page (10.8 by 8.5 inches), and clears only 1.4 inches. The clamshell Duo 230 opens to reveal a 9-inch, backlit screen—a 640- by 400-pixel, supertwist LCD panel that supports 16 gray levels. But to pack that much computer into such a small frame means making compromises.

The system has neither an FPU nor a SuperDrive. The only I/O ports are a mini-DIN-8 LocalTalk/serial connector and an RJ-11 connector for an internal modem. To access floppy disks while on the road, you'll need an optional Mac Duo Floppy Adapter (\$135) and Floppy Drive (\$199).

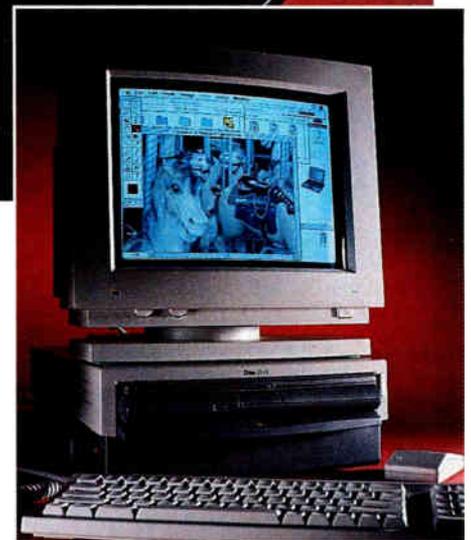
However, the Duo 230 is really designed to park inside a Duo Dock docking sta-



**Photo 1:** *The PowerBook 180, shown here with an external color monitor, bundles more performance than a Mac IIfx into a 9.3- by 11.25- by 2.25-inch package.*

tion, which provides the balance of the features you'd expect in a desktop Mac (see photo 2). A 152-pin docking connector at the back of the Duo 230 acts as a Processor Direct Slot and processor and I/O signals into the Duo Dock. The Duo Dock routes these signals to two NuBus slots, an army of I/O ports (ADB, sound I/O, two serial, SCSI), a SuperDrive floppy drive, an FPU socket, and an optional internal hard drive. The Duo Dock provides 8-bit color output for 12- to 16-inch monitors (16-bit color with additional video RAM).

A motorized mechanism in the Duo Dock pulls the Duo 230 into the dock when you insert it and ejects it when you press an eject button (almost exactly like a videocassette). This arrangement makes



**Photo 2:** *The Duo Dock turns the svelte PowerBook Duo 230 into an uncompromising desktop Mac.*

for a reliable electrical connection, and it also provides safeguards that prevent you from accidentally clobbering files. For example, you can't insert the Duo 230 into the dock while it's in sleep mode: The Duo Dock ejects the computer, and a dialog box appears on the notebook's screen advising you to shut down the Duo 230. When

## TWO POWERBOOKS GREAT AND SMALL

you press the eject button, the Duo Dock issues a Shut Down command to the Duo 230, which closes all running applications and prompts you to save any open files before ejecting the computer.

The Duo/Duo Dock combination gives you a powerful computer that you can leave parked on a desk, equipped with a keyboard, a mouse, and an external color monitor, and with access to the office network. But at a moment's notice, you can punch the eject button, grab the Duo 230 out of the Duo Dock, and carry it away on a company mission, secure that all your work is in your hands.

### Checking Out the Books

I looked at a PowerBook 180 equipped with 4 MB of RAM, a 120-MB hard drive, and an Apple 2400-bps fax modem. The PowerBook Duo 230 was equipped with 12 MB of RAM and a 120-MB hard drive. It packs more processing power, storage, and memory than the Mac IIci I use at the office.

My first job was to install System 7.1, included with each machine. Along with the usual pack of six high-density System software disks, you also get an Install Me First disk that contains a System file, the Installer application, and a System Enabler file. This System Enabler file contains hardware-specific code and resources required to run System 7.1 on each machine.

You boot the PowerBook with Install Me First; the Installer copies the System

Enabler file to the computer's hard drive, and then the installation process runs as usual. The important thing to note here is not to toss the System Enabler file into the Trash: Your PowerBook 180 or Duo 230 won't start without it, and you'll be forced to copy the file off the bootable Disk Tools floppy disk.

The PowerBook 180 supports a SCSI disk mode, in which it acts as a SCSI disk when connected to a desktop Mac with a System Adapter cable. This cable has an extra pin and a female 50-pin SCSI connector; it fits between a standard SCSI cable and the PowerBook. The extra pin signals the PowerBook to operate as a slave SCSI device. I used the System Adapter to copy all my applications and utilities from my IIci to the PowerBook 180. The Duo 230 also supports this SCSI function through an optional MiniDock that provides a SCSI connection. Since the Duo 230 lacks built-in SCSI, I parked it in the Duo Dock and copied the files from the IIci via the network.

The Duo Dock works superbly. It recharges the Duo 230's battery while the notebook is docked—a nice touch. However, there are some mechanical difficulties in working with the Duo Dock. First, the SuperDrive is mounted on the right side of the chassis, and I didn't like having to reach around to insert floppy disks. Second, adding NuBus boards is a chore: You have to remove the cover, loosen some screws, and then flip over a panel covered

with electronics to add the boards.

One additional note of caution regarding the Duo Floppy Adapter: Once you get used to the idiot-proof protection mechanisms of the Duo Dock, it's hard to go back to less-tolerant hardware. Plugging in the Duo Floppy Adapter while the Duo 230 is awake causes it to lose power—and any active files.

### Software Compatibility Problems

Normally you expect minor software-compatibility problems with any new Mac, but with these PowerBooks the problems are compounded by changes brought on by System 7.1. Specifically, fonts are now located in a Fonts folder rather than in the System file. This makes managing your fonts easier, but it freaks out any software that makes assumptions about font location. Therefore, you'll need to update some applications.

Fifth Generation Systems electronically distributes an update that patches Suitcase 2.1.1 to work with System 7.1. Adobe Type Manager 2.0.3 crashes, because it expects to find its outline fonts in the Extensions folder. Adam Stein's ATM Fixer is an on-line patch that fixes this problem. ATM 3.0 and a beta version of SuperATM (3.5b13) worked just fine.

There were some other software snags. Adobe Photoshop 2.0.1 works, displaying images adequately in 16 grays, but the Mac Desktop palette shifts into a black-and-white mode when you exit the application. Connectix's PowerBook Utilities (CPU) requires version 1.0j to work with the new PowerBooks' gray-scale screens and new hardware. However, there's an interaction between CPU and Suitcase that hangs the PowerBook when you open the CPU Control Panel. Connectix has traced the problem to a bug in the Resource Manager and suggests rebooting with Extensions disabled when you change settings.

Despite these glitches, most software worked fine on both machines, including Adobe Illustrator 3.2 and Adobe Dimensions 1.0, ZTerm 0.9, NOW Utilities Super Boomerang 4.0.1 and WYSIWYG Menus 4.0.1, plus Claris Resolve and MacWrite II. Shiva's NetModem and NetSerial software also worked when hooked to a LAN.

### Portable Performers

The BYTE CPU benchmarks show that both the PowerBook 180 and the Duo 230 are about 20 percent faster than a 25-MHz Mac IIci for some operations (see the figure). The Duo 230 didn't do as well on the floating-point tests because it lacks an FPU, but you can install one in the Duo Dock. These notebooks provide full mid-range processing power that will satisfy

## BYTE ACTION SUMMARY

### ■ WHAT THE POWERBOOK 180 AND POWERBOOK DUO 230 ARE

Both are 33-MHz, 68030-based portable Macs. The PowerBook 180 is a high-end stand-alone portable; the PowerBook Duo 230 is small and light and mates with a docking station.

### ■ LIKES

Both are fast and powerful. They have display support for 16 gray levels.

### ■ DISLIKES

The PowerBook 180's high price; the PowerBook Duo 230's lack of an FPU and a floppy drive.

### ■ RECOMMENDATIONS

For those who need a self-contained Mac with a sharp display, the PowerBook 180 is ideal. For those who won't compromise on weight and size, yet need desktop power, the PowerBook Duo 230 is excellent.

### ■ PRICE (AS TESTED)

PowerBook 180, \$4788  
PowerBook Duo 230, \$3439  
Mac Duo Dock, \$1079

### ■ FOR MORE INFORMATION

Apple Computer, Inc.  
20525 Mariani Ave.  
Cupertino, CA 95014  
(800) 776-2333  
(408) 996-1010  
fax: (408) 974-6412

Circle 1224 on Inquiry Card.

# STATISTICA/W

Windows, DOS, Macintosh  
See us at CeBit Hannover:  
Hall 4, 1st Floor, Booth C-60 (33)

**STATISTICA/W™** (for Windows) Complete Statistical System with thousands of on-screen customizable, presentation-quality graphs fully integrated with all procedures ■ Complete Windows 3.1 support, DDE, OLE, TT-fonts, multiple toolbars, right mouse button support ■ Unlimited numbers of data-, results-, and graph-windows ■ Inter-window integration: data, results, and graphs can be treated as objects and converted into one another in a number of ways ■ The largest selection of statistics and graphs in a single system; comprehensive implementations of: Exploratory techniques; multi-way tables with banners (presentation-quality reports); nonparametrics; distribution fitting; multiple regression; general nonlinear estimation; stepwise logit/probit; 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 ■ Hypertext-based Stats Advisor expert system ■ Extensive data management facilities (spreadsheet with long formulas, block operations, advanced Clipboard support, DDE hot links, relational merge, data verification, powerful programming language) ■ Batch command language and macros also supported, "turn-key system" options ■ All output displayed in Scrollsheets™ (dynamic, customizable, presentation-quality tables with toolbars, pop-up windows, and instant 2D, 3D and multiple graphs) ■ Extremely large analysis designs (e.g., correlation matrices up to 32,000x32,000, unlimited ANOVA designs) ■ Megafile Manager with up to 32,000 variables (8 Mb) per record ■ Unlimited size of files; extended ("quadruple") precision; unmatched speed ■ Exchanges data and graphs with other applications via DDE or an extensive selection of file import/export facilities ■ Hundreds of types of graphs, including categorized multiple 2D and 3D graphs, matrix plots, icons, and unique multivariate (e.g., 4D) graphs ■ Facilities to custom design new graphs and add them permanently to menu ■ On-screen graph customization with advanced drawing tools, interactive stretching and resizing of complex objects, interactive embedding of graphs and artwork, special effects, icons, maps, multi-graphics management, page layout control for slides and printouts; unmatched speed of graph redraw ■ Interactive rotation, perspective and cross-sections of all 3D and 4D graphs ■ Extensive selection of tools for graphical exploration of data: fitting, smoothing, overlaying, spectral planes, projections, layered compressions, marked subsets ■ Price \$995.

**Quick STATISTICA/W™** (for Windows) A comprehensive selection of basic statistics and the full graphics capabilities of STATISTICA/W ■ Price \$495.

**STATISTICA/dos™** (for DOS) A STATISTICA/W-compatible data analysis system ■ Price \$795.

**Quick STATISTICA/dos™** (for DOS) A subset of STATISTICA/dos statistics and graphics ■ Price \$295.

Domestic sh/h \$10 per product, 14-day money back guarantee.

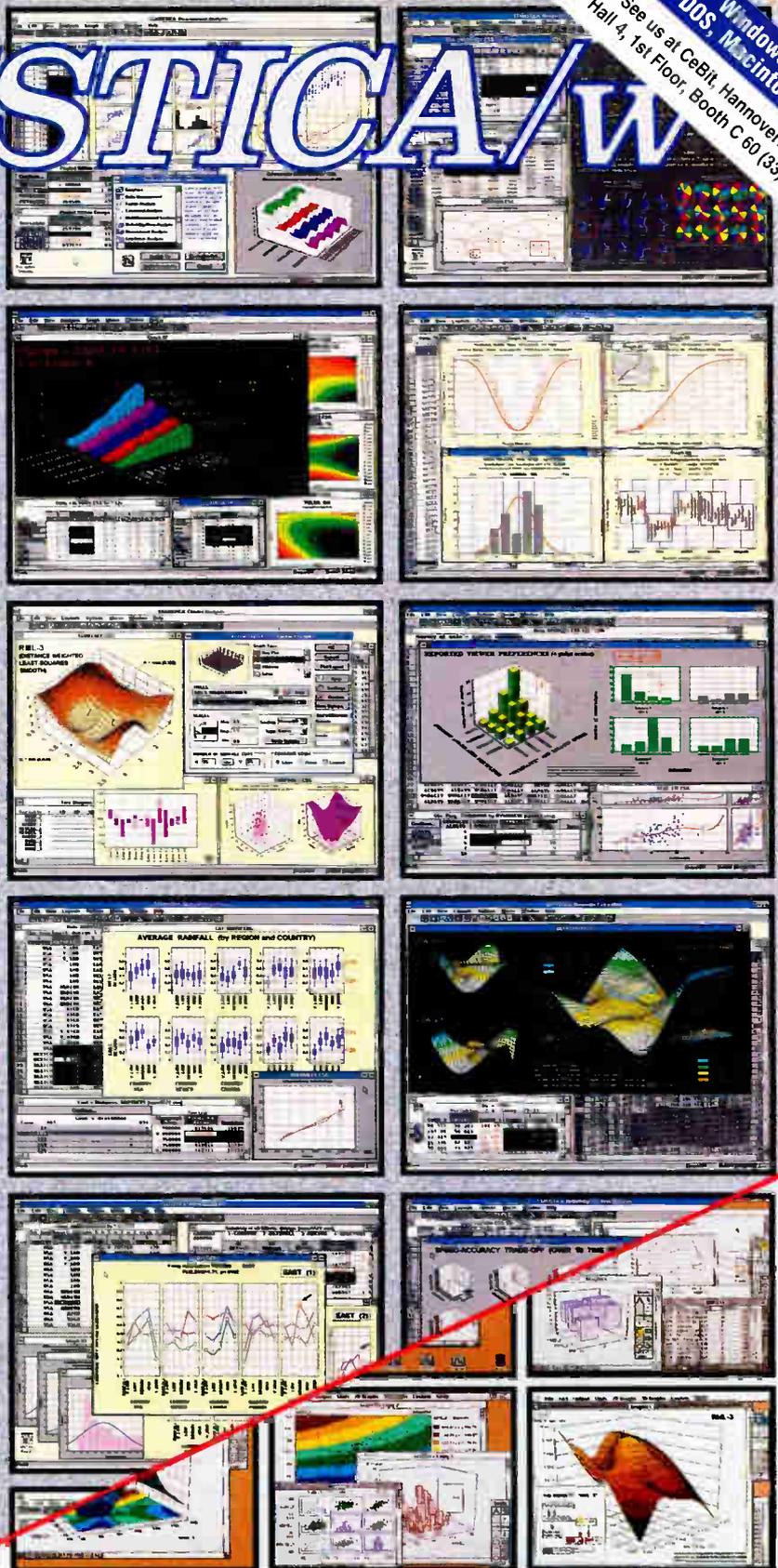
Circle 145 on Inquiry Card.



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: 0462/482822, fax: 0462/482855; StatSoft Pacific (Melbourne, Australia), ph: (03) 663 6580, fax: (03) 663 6117; StatSoft Canada-CCO (Ontario), ph: 416-849-0737, fax: 416-849-0918. Available From: CORPORATE SOFTWARE and other Authorized Representatives Worldwide: Holland: MAB Julsing, 071-230410; France: Version US (1) 40590913; Sweden: AkademiData 018-240035; Hungary: Dagent Kft 186-5782; Belgium: TEXMA 10 61 16 28; South Africa: Osiris 12 663-4500; Japan (Macintosh): Three's Company, Inc., 03-3770-7600; Japan (DOS and Windows): Design Technologies, Inc., 03-3667-1110.

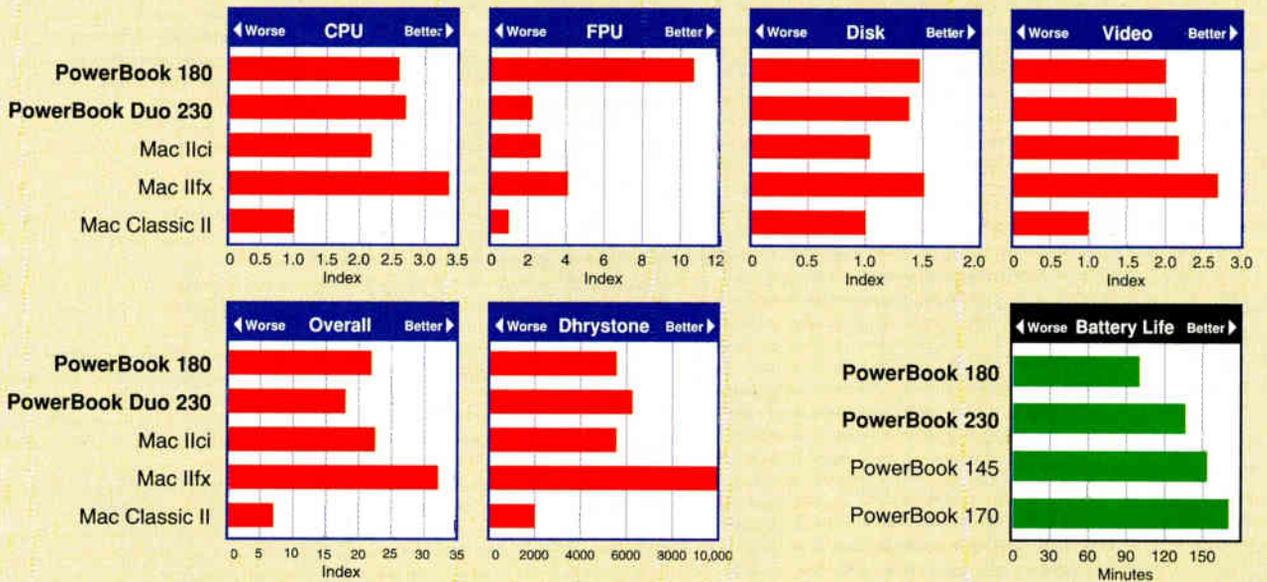
StatSoft, STATISTICA/W, Quick STATISTICA/W, STATISTICA/Mac, Quick STATISTICA/Mac, STATISTICA/DOS, Quick STATISTICA/DOS, and Scrollsheet are trademarks of StatSoft, Inc.



**STATISTICA/Mac™** (for Macintosh) A STATISTICA/W-compatible, comprehensive data analysis and graphics system designed for the Macintosh ■ Large selection of statistical methods fully integrated with presentation-quality graphics (incl. FDA, multiplots, a wide selection of interactively rotatable 3D graphs; MacDraw-style tools) ■ Unlimited size of files ■ Full support for System 7, incl. "Publish and Subscribe" ■ Price \$595.

**Quick STATISTICA/Mac™** (for Macintosh) A subset of STATISTICA/Mac: a comprehensive selection of basic statistics and the full graphics capabilities of STATISTICA/Mac ■ Price \$295.

## BYTE MACINTOSH BENCHMARKS



### BENCHMARK SUMMARY

|                                | PowerBook 180 | PowerBook Duo 230 | Mac IIci | Mac IIx | Mac Classic II |
|--------------------------------|---------------|-------------------|----------|---------|----------------|
| <b>Low-level performance</b>   |               |                   |          |         |                |
| CPU index                      | 2.60          | 2.70              | 2.18     | 3.36    | 1.00           |
| FPU index                      | 10.68         | 2.22              | 2.66     | 4.10    | 1.00           |
| Disk index                     | 1.47          | 1.38              | 1.04     | 1.51    | 1.00           |
| Video index                    | 2.00          | 2.14              | 2.17     | 2.68    | 1.00           |
| <b>Application performance</b> |               |                   |          |         |                |
| Word processing index          | 2.76          | 2.90              | 2.99     | 4.39    | 1.00           |
| DTP index                      | 1.81          | 1.86              | 1.80     | 2.44    | 1.00           |
| Database index                 | 2.50          | 2.59              | 2.67     | 3.46    | 1.00           |
| Development index              | 2.19          | 2.27              | 2.06     | 2.83    | 1.00           |
| Graphics applications index    | 2.63          | 2.63              | 2.63     | 3.63    | 1.00           |
| Scientific index               | 4.46          | 2.67              | 4.33     | 6.81    | 1.00           |
| Spreadsheet index              | 5.54          | 3.02              | 5.98     | 8.52    | 1.00           |
| Overall application index      | 21.91         | 17.93             | 22.47    | 32.08   | 7.00           |
| <b>Dhrystone</b>               | 5555          | 6250              | 5555     | 10,000  | 2000           |

All machines were tested using System 7.1. Except for the Dhrystone and battery-life tests, all results are indexed, and higher numbers indicate better performance. For each indexed test, a Mac Classic II = 1. Comprehensive test results and detailed configurations are available for all machines on request.

*The 33-MHz PowerBook 180 and PowerBook Duo 230 are about 20 percent faster than a 25-MHz Mac IIci in some operations.*

the needs of all but the most demanding users.

Both computers' screens were bright and clear, but I especially enjoyed the crystal sharpness of the 180's active-matrix display. As for the Duo, there are a lot of little features to like: the LED in the Caps Lock key, the easy-to-reach Power On button (it's by the keyboard rather than in the rear), and its going into sleep mode when you close the lid. However, its smaller, recessed trackball takes some getting used to.

The trackball got mixed reviews among other BYTE editors.

Which computer should you choose? That depends on what you need on the road, and your working style. I have to admit my bias toward the complete, self-contained system represented by the PowerBook 180, and I can't praise the display enough.

There's a lot to like about the Duo 230's smaller size and lighter weight. Nevertheless, its lack of a floppy drive scares me.

While the Duo Floppy Adapter and external SuperDrive are a good solution, it requires keeping track of too many little parts on the road. If the Duo 230 had a built-in floppy drive, I'd like it a lot better. As it is, I'll stick with the PowerBook 180. ■

*Tom Thompson is a BYTE senior technical editor at large with a B.S.E.E. from Memphis State University. You can contact him on BIX as "tom\_thompson" or on the Internet at tomt@bytepb.byte.com.*

## APPLICATION

# Visual Basic for Windows Gets a Face-Lift

TOM YAGER

Until the arrival of Microsoft's Visual Basic for Windows, programmers had to spend hours learning complex development tools just to work in Windows. Visual Basic simplified working in Windows and gave the rewards of custom programming to even occasional programmers. However, its limited feature set was deficient for some, particularly when a large application needed to be created. At those times, many programmers were forced to write portions of their programs in C or another language.

The latest release, version 2.0, removes many but not all of the original version's limitations. Improved performance and new capabilities make custom Windows programming easier than ever. However, Visual Basic still lacks some pieces that I consider important, including a native-code compiler.

### Greater Magnitude

I tested Visual Basic for Windows 2.0 on three machines: a Toshiba T2000SX laptop (a 16-MHz 386SX), an ALR Flyer 32LCT with a 66-MHz 486DX2, and a Uniq file server with a 50-MHz 486. I spread the testing around to get a feel for the new Visual Basic's performance. However, I did most of my test work on the laptop because I wanted to see how Visual Basic's changes played on a system with minimal display resolution and color depth, limited CPU speed, and relatively limited memory (5 MB). If Visual Basic 2.0 could make it there, it could make it anywhere.

The first thing that struck me about Visual Basic 2.0 was its magnitude. I installed the Professional Edition, which occupied about 22 MB of disk space and took close to an hour to load on the T2000SX. The installation lets you selectively leave out parts of the package and does a fine job of comparing and displaying required and available disk space.

The appearance of Visual Basic 2.0 has changed noticeably (see the screen). Most obvious is Microsoft's ubiquitous toolbar. The toolbar is where the old properties combo box pair used to be; Visual Basic 1.0 users might find the change a little confusing at first. Properties are now managed through a floating window.

I wasn't sure I'd like the new setup until I loaded a project I created in the old

*Visual Basic 2.0 sports a new toolbar and floating window, where you can see multiple properties at once and change properties for multiple selected controls.*

Visual Basic. The new properties window has a spreadsheet-like feel to it, with one column each for names and values. The type and name of the selected control are always visible at the top, and a single interface gives you access to all the properties of all the controls in your application. Double-clicking on a cell in the properties window cycles that property's value—true becomes false, numerics get incremented, and so on. When you select multiple controls, the values column in the properties window goes blank and the properties list is trimmed to only those shared by all the selected controls.

### Reduced Tedium

Veterans of Visual Basic 1.0 will recognize the properties window as a blessing because it puts an end to the familiar and tedious "select control—change property—select control..." cycle. Also, Visual Basic 1.0 allowed changes to only one property at a time through the toolbar. Multiple controls can now be selected by dragging a marquee around them, and properties shared by those controls can be changed with a single action.

I recommend that you get used to the new properties window's approach (a two-column grid topped by a combo box) because it appears elsewhere in the new Visual Basic, including the environment and project options dialog boxes. The only drawback of the properties window is that it takes up more screen space than the old method. On my laptop's display, I had to keep popping the properties window up and down because there wasn't room for it to be on-screen constantly. All my non-

portable systems have at least 1024- by 768-pixel screens, and I leave the window permanently popped up. Even when you're not actively changing properties, the window holds a lot of useful information.

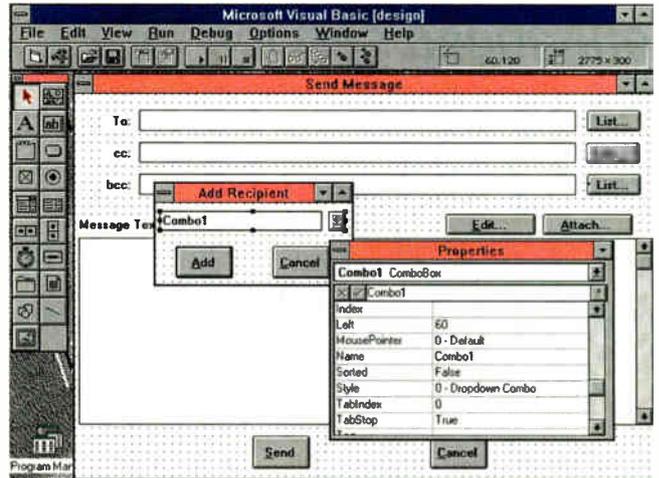
Once I loaded code into Visual Basic 2.0, I found it easier to find my way around this version than previous releases. A dialog box pops up with a key press and lets you zip to any procedure in your application by name. The syntactic color coding in the edit windows is an aid, particularly for large projects or big edit windows. Although there's multilevel undo and redo, the undo stack is strictly last-in, first-out. There's undo/redo in the forms builder as well, but that's only one level deep.

Overall, the new Visual Basic environment is at least as comfortable as the old one. The properties window is a big improvement if you can afford to leave it on-screen most of the time.

### Some Performance Improvement

Microsoft says it improved performance through faster application starts, smaller .EXE files, and faster access to those attributes of objects called *properties*. In addition, version 2.0 lifts the barriers on array sizes, so you can use all available memory in your system. (Arrays also can now be resized without discarding their contents.) Other arbitrary limits have been raised, including the number of procedures in a program and the number of controls (i.e., interface elements) per form.

My testing turned up mostly positive results, but there were a few questionable areas. The size of my test projects didn't benefit from the claimed reduction in .EXE





# Your Direct

**BYTE introduces Your Direct Link – An enhanced service for BYTE readers that gives you free information on products – faster and easier!**

In the NEW Direct Link section, here's what you'll find:

**Alphabetical Index to Advertisers Including Phone Numbers**

Now dial companies directly.



**Product Category Index to Advertisers**

Order information on individual products or complete product categories.

**Redesigned Editorial Index**

Free information from companies covered in articles, columns, or news stories.

**New Enhanced Direct Link Card**

Receive free information quickly by filling out and mailing or faxing *Your Direct Link Card* today!



Send for FREE product information by filling out *Your Direct Link Card* found in the back of every issue.

**Buy It Through BYTE!**

**BYTE**

**Link to Products**

## VISUAL BASIC FOR WINDOWS

file size. The faster loading and displaying of a program's initial form *did* show itself: All the applications I ported from the old Visual Basic to the new one had their load delay time cut almost in half.

The lifting of data size limitations seems more dramatic than it actually is; many kinds of data still suffer from limits imposed by segmentation. Individual strings are still limited to 64 KB each, and the manual paints a confusing picture of how segment limits affect other data types.

Among the other enhancements for version 2.0 is the program's support for the MDI (Multiple Document Interface) to provide access to the MDI services and events that the previous version wouldn't let you near. Standard now is 256-color support, as are access to DOS file I/O functions and the `hWnd` property of every windowed control (primarily for use with Windows API routines). Also, you can independently set the Z-order (i.e., stacking order) of each control and form.

The language itself has some significant changes as well. There is a new data type, called `variant`, that you can use practically anywhere a typed variable will serve. Controls can now have default values—data returned when the control name is referenced alone in a program. A single form can exist in multiple instances as well (particularly useful with MDI applications), and variable type declarations and global definitions can exist anywhere in the program. Programs, forms, and projects can all be stored in ASCII representation, making room for the use of code management tools and code generators.

Finally, buyers of the Professional Edition will find an assortment of custom controls similar to those included in Visual Basic 1.0's Professional Toolkit. New to this release are Windows 3.1 support (the help compiler and on-line API reference), MAPI (Messaging API) support for E-mail links, ODBC (Open Database Connectivity) support for database access, a communications control for serial communications including file transfer, and a host of other features. Two parts of Visual Basic 1.0's Professional Toolkit have been moved to 2.0's Standard Edition: the spreadsheet-like grid control and the OLE client control.

### Missing Pieces

For all the changes Microsoft made, it still didn't address some of the areas I consider important and missing in Visual Basic. To name a few, there still isn't a native-code compiler, and there's no option to produce single .EXE files (Visual Basic .EXEs require separate DLLs at run time, sometimes several). The program also

lacks integration of an ISAM (indexed sequential-access method) or other database engine into the Professional Edition (Visual Basic for DOS has this, and the Windows version will communicate with optional, external databases through ODBC).

Even with those areas in mind, Microsoft has taken giant strides toward making Visual Basic palatable to programmers. The need to run off to C or some other language to get the work done has been diminished somewhat. While I'm not packing up my compilers just yet, I am a fan of the new Visual Basic for the same reason that I like the old: It's still the quickest, most painless way to create professional-looking Windows applications. ■

*Tom Yager is a former BYTE technical editor and consultant for multimedia and Unix applications. He can be reached on BIX as "tyager" and on the Internet at tyager@bytepb.byte.com.*

## BYTE ACTION SUMMARY

- **WHAT VISUAL BASIC 2.0 IS**  
A new release of Microsoft's programming system for Windows applications.
- **LIKES**  
Floating properties window; huge arrays; faster application loading and display.
- **DISLIKES**  
Still lacks some features that professional developers expect; runs best at screen resolutions of 800 by 600 pixels or better.
- **RECOMMENDATIONS**  
The best choice for the development of non-performance-critical Windows applications.
- **PRICE**  
Standard Edition: \$199  
(upgrade from version 1.0, \$79);  
Professional Edition: \$495  
(upgrade from version 1.0, \$99)
- **FOR MORE INFORMATION**  
Microsoft Corp.  
1 Microsoft Way  
Redmond, WA 98052  
(206) 882-8080  
fax: (206) 936-7329  
**Circle 1131 on Inquiry Card.**

Announcing the

**BYTE**  
**EURODECK**

### The First Computer Postcard Deck Targeting the Exploding European Market!!!

By the end of 1992, the European Community will be a \$14 trillion market. In fact, behind the US, it's the largest microcomputer market in the world!

If you are a BYTE subscriber in Europe, watch for the new EURODECK coming to you soon! The BYTE EURODECK contains a selection of state-of-the-art products important to you and your business.



### Advertisers!

The BYTE EURODECK offers you a unique direct mail approach to increasing sales in this fast-paced computer market.

Circulation of the BYTE Eurodeck is targeted to 50,000 computer buyers in over 20 countries in Western Europe. Take full advantage of the benefits of the upcoming unification of Europe in 1992! For information on the next BYTE EURODECK,

call Jim Bail today at

**603-924-2533!**

Companies outside of North America, please contact your local representative.

# Where Do You Go for Help When You're the Expert?

BIX is the collective computing power of thousands of hardware and software engineers, independent consultants, systems designers, technology buffs, and computer industry celebrities. With BIX and the people you'll meet online, you'll have access to information, software, source code, news reports, and advice. And BIX now offers an optional access program that lets you take advantage of Windows<sup>™</sup> while you're online.\*

# BIX

- Access at **9600 bps** with **NO SURCHARGE**

- Search the full text of **BYTE** online

- Get quick answers to tough coding questions from industry experts
- Download source code, utilities, & other programs from **BYTE**
- Chat with other BIX members in real time
- Access via telnet over the Internet - telnet x25.bix.com, then type bix

## BIX is a Great Deal!

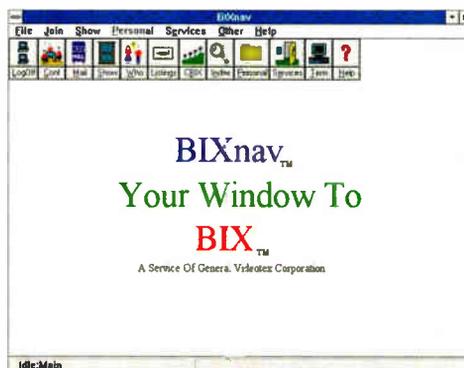
Subscribe to BIX for only \$13 per month! You can access BIX via SprintNet or Tymnet from over 600 locations in the continental US. Connect for only \$3 per hour in the evening and on weekends. Daytime rates are \$9 per hour. **International users:** access from many international locations at 9600 bps for \$24 per hour using SprintNet.

## Join BIX Now!

Using any communications program:

- Dial by modem: 1-800-695-4882
- At "login" enter **bix**
- At "Name?" enter **bix.byte**

Further details and rate information will be provided during the toll-free registration.



\*Optional Windows<sup>™</sup> access program — just \$9.95

**Money-Back Guarantee:** If for any reason you aren't happy with BIX, simply cancel your account and request a refund of your first monthly fee.

**Questions?** Call 1-800-695-4775; fax: 617-491-6642; or send Internet mail to: [bix@genvid.com](mailto:bix@genvid.com)

## APPLICATION

# Imagining the World

RAYMOND GA CÔTÉ

Computers are the ultimate what-if machines. Beyond the what-if solutions offered by spreadsheets extends a realm of real-world problems. Extend+ Manufacturing 2.0 from Imagine That is a professional-quality computer simulation tool for the Macintosh that allows you to explore real-world problems.

Simulations cross many disciplines, such as business, finance, process, science, engineering, and manufacturing. Extend provides a set of well-stocked component libraries to address problems in these widely diverging areas. Basic library elements include discrete and continuous events, animation, and plotting.

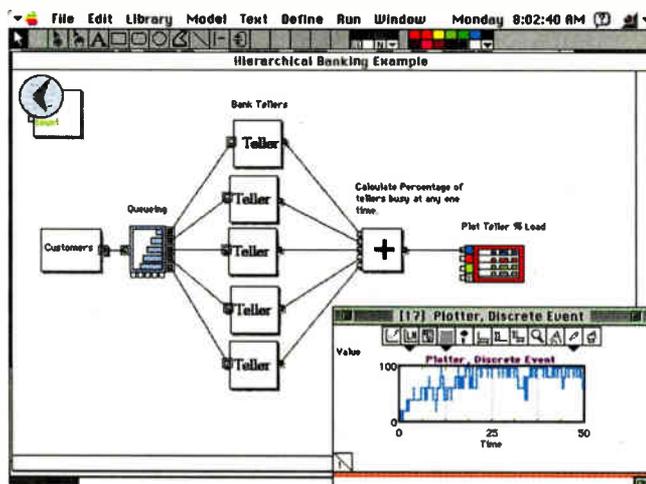
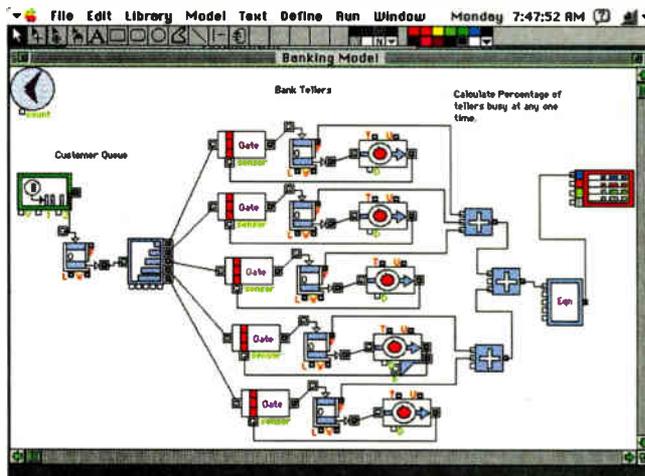
The plotting library provides various on-screen output devices for graphing the simulation results. The electronics library provides various digital and electronic components, but Extend is not suitable for simulating complicated circuit designs. Instead, items such as an A/D converter and voltage sources could be integrated into a process-control simulation. The \$300 Manufacturing Library extension provides just about everything you need to lay out a complete manufacturing facility—including assembly stations, stock rooms, conveyor belts, palletizing stations, and automatic guided vehicles that follow a prescribed path from station to station.

### Flexible Design

With almost any type of graphical development tool, your display rapidly devolves into a mass of unreadable lines and boxes: the ultimate spaghetti code. Hierarchical blocks are the solution to this problem. Screen 1 shows my first effort to design a simulation where a single queue of bank customers waits to be serviced by multiple tellers. Although this simulation works well, it does not efficiently communicate the process. Too many details get in the way. Screen 2 shows a hierarchical solution to the same problem. All the gritty details have been hidden within the custom-built blocks. Once I had built the original model and understood how to compose a teller queue, the second diagram was simpler to complete.

If the standard building blocks are not sufficient, you can extend the simulation environment with new blocks. The simplest way is by using ModL, a C-like pro-

**Screen 1:**  
*A banking simulation model without hierarchical blocks. Although technically correct, the details of the model get in the way of the process. Even if you are familiar with all the Extend icons, the number of interconnections is confusing.*



**Screen 2:** *This model works the same as the model shown in screen 1. All the details have been hidden in hierarchical blocks. Although operation of the two models is identical, this version is much simpler to explain and modify.*

gramming language built into Extend. The language library includes support for file I/O, statistics, financial calculations, and matrix manipulation. ModL also provides you with a link to the outside world by way of a generic driver interface, XCMD support, and Apple events. These three features provide the gateways to communicate with any other application or drivers installed on your Macintosh. Sample applications include using Apple events to access an external spreadsheet for calculations and another block for communicating with an IEEE-488 test interface.

### The Learning Curve

Extend is fairly easy to learn. I was able to build and run several original simulations within an hour of installing the software. My original flat-model simulation took

slightly over an hour to construct. Once the application was up and running, it took only about half an hour to break it into the more understandable hierarchical blocks and rebuild the system.

At this point, I could put my model through its paces and determine if it actually did what I expected it to do. I wandered down to the local bank with a stopwatch and notepad to capture some real live banking action. Armed with my small real-world sample, I returned to put the model through its paces. Although several parameters required final tweaking, it performed as expected.

Now I could really begin to work. What happens if I reduce the number of available tellers by half? Can they handle an extra-large lunchtime crowd? What happens if the average transaction time increases?

*continued*

**BYTE ACTION SUMMARY**

■ **WHAT EXTEND+MANUFACTURING 2.0 IS**

A computer simulation design tool for the Macintosh.

■ **LIKES**

Graphics presentation; extensibility; hierarchical designs.

■ **DISLIKES**

Small-scale tutorials.

■ **RECOMMENDATIONS**

An effective simulation tool.

■ **PRICE**

Extend 2.0, \$695; with Manufacturing module, \$990

■ **FOR MORE INFORMATION**

Imagine That, Inc.  
(408) 365-0305  
fax: (408) 629-1251

Circle 1132 on Inquiry Card.

While using my model and comparing it to the real world, I found several deficiencies. Most important was the inability to add a new teller temporarily during peak traffic times. It took me about 45 minutes to redesign the model to trigger the opening of one or two more teller stations based on the number of people waiting in line and limited by the total number of tellers available. Finally, I had a simulation that met my needs and correctly approximated the real world.

Although it sounds tedious, each of the redesigns went quickly because I could cut and paste large sections of previous designs into a new model. Also, the reusable hierarchical components could be modified and used in each new design. This allowed me to leverage my previous experience in constructing new models.

My final simulation is fairly complicated, but it models a simple process. These models still only scratch the surface of Extend's capabilities. Experienced Extend users are simulating complex and innovative environments. For example, Je Oh of Pitney Bowes Strategic Information uses Extend's discrete simulation abilities to demonstrate the flow of mail through a

large mail-processing line. An example of a large continuous-process simulation was provided by Michael Locasio of Gentek, who uses Extend to simulate alternative energy systems that include ice ponds for cooling and cogeneration plants for generating electricity. Both Je and Locasio cite the ease with which simulations can be built and the ability to use hierarchical design to hide the complexity of a simulation during presentations.

Extend 2.0 is a suitable tool for simulation professionals as well as novices. Although it is a complex product for solving complex problems, its consistent user interface requires a relatively short learning period. If you have a process over which you need to gain control, and particularly if you want to present the process to others, then Extend 2.0 is the tool of choice. ■

*Raymond GA Côté is a software development engineer for Appropriate Solutions, Inc., specializing in cross-platform applications development. He also edits the Robot Explorer newsletter. You can contact him on BIX as "rgacote" or on the Internet at rgacote@bytepb.byte.com.*

**ROMDISK™**

**SOLID STATE  
Disk and Drive  
Emulators**

- **Proven Performance!** For OEM/Military, Embedded Systems, Diskless/High Performance PC's, CAD/CAM, Industrial Control, Medical, POS, LAN's, etc.
- **High Capacity** Models (PCF/PCM)
- **Low Cost** Models (FERO, E/2-SR/ Special OEM)
- **Dual Mode Emulation** Models (PCF, PCM/2, PCE/2)
- **Autoboot Capabilities**, all models
- MS DOS/DR DOS/E-Venix OS Support
- **NEW! PCMCIA models (PCM, PCM/2) and accessories**

● ● ● **CURTIS, INC.**

*Industry Leader in Disk and Drive Emulation Products*

418 W. County Rd. D • St. Paul, MN 55112

**612/631-9512**

**FAX 612/631-9508**

DR DOS is a trademark of Digital Research; MS DOS is a trademark of Microsoft

**A MESSAGE TO  
OUR SUBSCRIBERS**

**F**ROM 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



## It Worked Fine a Minute Ago

RICK GREHAN

**T**houghts about things Macintosh have dominated the BYTE Lab in recent weeks, thanks to a host of new products coming from Apple (see "Two PowerBooks Great and Small" on page 173), the updating of our Mac benchmarks, and last month's accelerator roundup. As we tested these dozens of new products and fashioned tests that could accommodate the range of CPUs, we constantly ran into hardware and software incompatibilities.

Compatibility is a hard job for Motorola's CPU designers, who build the 68000 family of processors used in the Macintosh. Engineers seek backward compatibility so that new chips can run existing software. At the same time, they must add new, performance-enhancing features to the CPU line to keep pace with users' expectations and those of Apple's systems engineers.

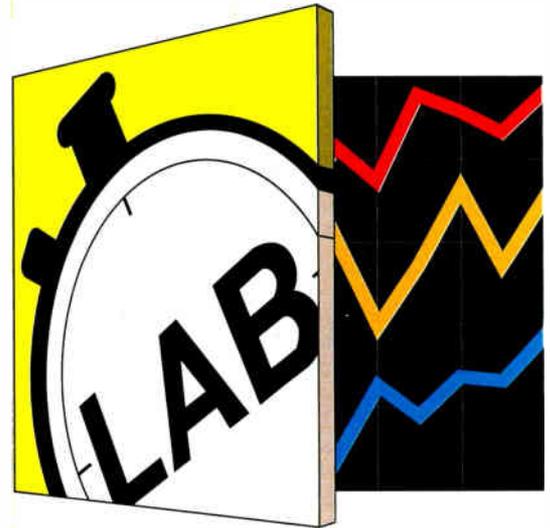
To protect existing software, Apple indicates throughout its gargantuan *Inside Macintosh* documentation the importance of accessing the Mac system's internals via the operating system. It boils down to this: If your program wants to tweak the machine's hardware or operating-system software, it must do so by using documented operating-system calls.

### The DOS World

Let's draw a parallel with the MS-DOS world. On PC-class machines, BIOS routines allow a program to read and write individual pixels on the screen. Most MS-DOS applications that perform substantial graphics operations simply ignore the BIOS and instead read and write video memory directly. This direct access lets software programmers optimize graphics code for speed.

In the IBM PC world, processors such as the 80x86 series let code and data exist side-by-side in the same memory region. Granted, the processor does distinguish between code and data segments via the CS and DS registers, but it's easy for a program to sidestep this distinction with segment-override instructions. And although the 386 and 486 allow protected-mode programs to set specified segments as being "execute only" (and therefore code segments), an "unprotected" MS-DOS program can more or less freely mix code and data.

**Who is to blame when incompatibilities grind your Mac to a stop? Blame those who deserve it: applications builders who failed to follow Apple's guidelines.**



This isn't the case on Macs incorporating 68020s, 68030s, and 68040s. When the 68020 appeared, Motorola had taken a step in the direction of separating code and data. The trend continued with the 68030 and 68040. Although code and data come into the processor from a single 32-bit-wide data bus, the internals of the CPU see code and data as flowing from separate sources. This occurs thanks to separate on-chip instruction and data caches that feed the processor's heart.

Separation of code and data increases the parallelism inside the processor. For example, in a 68040, if upcoming instructions can be fetched from the instruction cache, they move directly from the cache to the execution unit and free the data cache for simultaneous transfers of data values to and from memory. This parallelism improves performance.

However, this also causes one of the most frequent Macintosh compatibility problems you'll encounter. Some applications practice "self-modification"; they write instruction codes into memory as though they were writing data to memory (this can happen if a program builds a jump table). The idea is that the program will execute that code in the future.

Unfortunately, this has the danger of placing the contents of memory out of synchronization with the instruction cache. The result is that the program "thinks" it's executing the proper instruction, but it isn't. In the best case, you'll get a bomb box; usually, the Mac just freezes.

We in the Lab recall when the Mac II

and its 68020 first appeared. Applications failed so often that we had to write an Fkey to disable the processor's cache. Most accelerators come with similar, though more sophisticated, software.

### Who Done It?

So who's to blame when your Mac grinds to a stop? Let's put the blame on those who deserve it. Admittedly, programmers working on the Mac before the appearance of the 68020, 68030, and 68040 probably had performance as their top priority and therefore put future compatibility in the backseat. Many programmers might reasonably argue that while they were writing 68000 code, they had no idea what the 68020 would look like, so how could they prepare for it? But in the great majority of cases, Mac applications that run on early-generation Macs but break on later-generation models do so because the applications builders failed to follow Apple's guidelines.

Dan Monahan of Radius, the company that markets the Radius Rocket accelerator, says the company's software engineers spent an excessive amount of time trying to keep misbehaving applications running on the Rocket. "If more applications builders would follow Apple guidelines," he concludes, "we could be spending our time developing new products rather than working out compatibility problems." ■

*Rick Grehan is technical director of the BYTE Lab. You can reach him on BIX as "rick\_g."*

# BOOK AND CD-ROM REVIEWS

HUGH KENNER

If you were born the year *What Computers Can't Do* was first published, well, congratulations. Old enough now to order a martini, you're still young enough to have missed a lot of wrangling with and about Hubert Dreyfus. Prof. HD, whose field is philosophy, was suspicious of roseate AI claims as long ago as the 1960s. Back when 10-year-old chess novices were beating the best available programs, *Science Journal* had machines already playing chess "at the championship level."

It's amazing, that early hype for AI. And when Dreyfus launched his skeptical book (1972), how vehemently he got smeared is arresting, too. *Creative Computing* was warned by one AI guru that to publish a piece by HD would be to incur "disapproval from the AI community and reprisals from MIT Press." Well, MIT Press not only hasn't flayed HD, it has now taken over his book and published an update (the second) as *What Computers Still Can't Do*. Even if you read the first version all those years ago, you'll find it a different book in the light of what we take for granted today and what we've quietly jettisoned.

The argument, when we get to it, is essentially that the general knowledge required to understand—let alone answer—a random but sensible query is not the kind that can be reduced to a database. Pooh, says AI, we just need "a machine with the child's ability to learn." Ah, says HD, but that would entail a suite of transmechanical capabilities, for instance, a child's understanding of involvement with a body. (Nausea, fatigue, ecstasy: Define for a machine what such words say to a human.)

Chess programs are an instructive special case. If today's best, like Belle and Deep Thought, are very good, it's thanks to the CPU speed that permits the evaluation of several million potential positions. A chess master assesses only about 100, but he or she has learned how to first zero in on an



## THE AI DEBATE REVISITED

**What Computers  
Still Can't Do**

Hubert L. Dreyfus  
MIT Press, \$13.95,  
ISBN 0-262-54067-3

## The Twenty-Four Hour Society

Martin Moore-Ede  
Addison-Wesley, \$22.95,  
ISBN 0-201-57711-9

In *The Twenty-Four Hour Society*, Dr. Martin Moore-Ede explains why it compels. We work graveyard shifts, cross six time zones at a leap. We doze off—Chernobyl, Exxon's *Valdez*. Hence, researchers, and more about sleep than you knew there was to know.

Thus, research shows that to suppress the night-shift worker's "waves of sleep," we need the same light that adjusts our bedtime seasonally, and at something like the same intensity. But Edison put us in a dim world indeed. A "brightly lit office," nighttime, boasts about 500 lux; in nature, that's before sunrise. Boost it to, oh, 10,000 lux and watch alertness soar.

We all sleep, even you. And you'll not soon find a book closer to your most restorative experience. ■

*Hugh Kenner is Franklin and Callaway Professor of English at the University of Georgia. His recent books include Mazes and Historical Fictions. You can contact him on BIX as "hkenner."*

## OBJECT LOGIC

**Logic and Objects**, Francis G. McCabe, Prentice-Hall, \$18, ISBN 0-13-536079-X

*Logic and Objects* is the name of both this book and the new programming language that it describes. L&O is the brainchild of Francis McCabe, a computing lecturer at London's Imperial College, who also had the distinction of producing the first microcomputer implementation of Prolog (MicroProlog for CP/M in 1980).

McCabe's book explains why it's a good idea to meld object orientation with logic programming. He critically reviews several previous experiments in this direction before presenting his own elegant solution, L&O. His argument in

brief is that object orientation adds the modularity necessary for structuring large applications, which is lacking in Prolog's clause-based syntax.

L&O offers full OOP (object-oriented programming) features, including multiple and differential inheritance as well as a functional programming notation. The syntax of L&O remains very much like that of Prolog, but groups of clauses get bracketed together as named objects called "theories." The book is clearly written and illustrated, but it will be comprehensible only if you have a working knowledge of Prolog. McCabe develops several nontrivial program examples, including a Macintosh-graphics solution to the Traveling Salesman problem, in L&O. If you believe that C++ does not mark the end of history, and that progress in language design must continue, there's much here of interest.

—Dick Pountain

## THE INTERNET WORLD TOUR

**Exploring the Internet: A Technical Travelogue**, Carl Malamud, Prentice-Hall, \$26.95, ISBN 0-13-296898-3

**Zen and the Art of the Internet**, Brendan Kehoe, Prentice-Hall, \$22, ISBN 0-13-010778-6

**The Whole Internet User's Guide and Catalog**, Ed Krol, O'Reilly & Associates, \$24.95, ISBN 1-56592-025-2

**The Internet Message**, Marshall T. Rose, Prentice-Hall, \$44, ISBN 0-13-092941-7

The Internet, that wild, sprawling conglomeration of uncontrolled and uncontrollable computer connections, is garnering much recent media attention. Accompanying this newfound attention is an increase in Internet-related books ranging from popular travelogues to detailed user's manuals.

Most Internet community denizens restrict their travels to the worldwide electronic highways. Carl Malamud, on the other hand, decided to see the world node by node. The result is *Exploring the Internet: A Technical Travelogue*. Like many travelogues, this book provides insight into the sights and wonders of far-off places. Unlike traditional guides, these sights consist of high-speed backbones, racks of Cisco routers, and standards meetings. Beyond the technology exist the personalities that continue to make the Internet happen. *Exploring the Internet* paints a picture of this thing called cyberspace.

*Zen and the Art of the Internet* by Brendan Kehoe should be given to each and every first-time Internet user. It answers many of the novice questions that plague network administrators and consume network bandwidth. This is not a user's manual, but rather a beginner's guide to the services and wonders available on-line. Issues such as etiquette, proper usage, and societal rules are presented to ensure that your passage into this new community is a smooth one. The list of telnet-available databases (from scholarships to extragalactic technical data) provides a starting point for your own explorations.

Kehoe's book tempts you with tantalizing glimpses of far-flung data. Ed Krol's *The Whole Internet User's Guide and Catalog* is more of a Baedeker-style guide. Krol takes a practical approach to the Internet, from turning off that first, massive news feed to accessing servers using telnet, ftp, and E-mail techniques. Access to services ranging from Archie to WAIS are described in detail sufficient to guarantee first-time success. Members of the Internet community will want to keep this practical handbook.

Mail on the Internet comes in many shapes, from the simple transmission of text to multimedia films. *The Internet Message* by Marshall T. Rose is an in-depth look at E-mail—its transport and its format. Even if you never have to write or maintain a secure multimedia mail application, Rose's book is handy for deciphering problems when things go wrong. Although it's packed with technical data, this book maintains a light, readable tone, making it suitable for those who simply want to know how the world works.

—Raymond GA Côté

## IMPRESSIVE SEARCHING

**The New Grolier Multimedia Encyclopedia for Macintosh, DOS, or Windows/MPC**, Grolier Electronic Publishing, Sherman Tpk., Danbury, CT 06816, (203) 797-3530

Here's the *Academic American Encyclopedia*, all 21 volumes, on a single CD-ROM. The "1992 edition" (internal evidence hints at a 1990 cutoff) claims some 7000 new or revised articles; many new images, monochrome or color; motion-video sequences (i.e., film clips) of such events as the first space-shuttle launch; animated sequences to explicate global matters like weather, the human body, and the solar system; and a Timeline and a Knowledge Tree, both of which we'll come to. Only DOS and Macintosh versions support the motion-video feature, only Macintosh and Windows/MPC the animation.

As encyclopedias go, Grolier's, print or CD-ROM, is about average. One entry begins, "A bed is a piece of furniture on which persons sleep or rest," and must thereafter struggle to justify its presence. (Whoever will look up *bed*?) There's an overall looseness—T. S. Eliot did not "decide" to stay in England permanently in 1914; he was stranded there by the war—offset by occasional crisp authority, as in the "fractal geometry" entry.

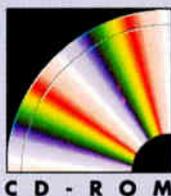
Which brings us to one advantage of CD-ROM searching. Scan through the book version

the only way you can, by article title, and you'll not find "Mandelbrot, Benoit." But go to the CD-ROM version's first menu, which has five options; choose the first, Word Search; type "Mandelbrot"; and you'll quickly find that he's present again and again, notably in "fractal geometry," but in other entries as well. If you'd just this morning happened on the word *fractal*, Grolier Multimedia would be a quick and effective way to acquire a sense of its scope. Word Search produces every instance of any word you type, save for 134 deemed too common to matter.

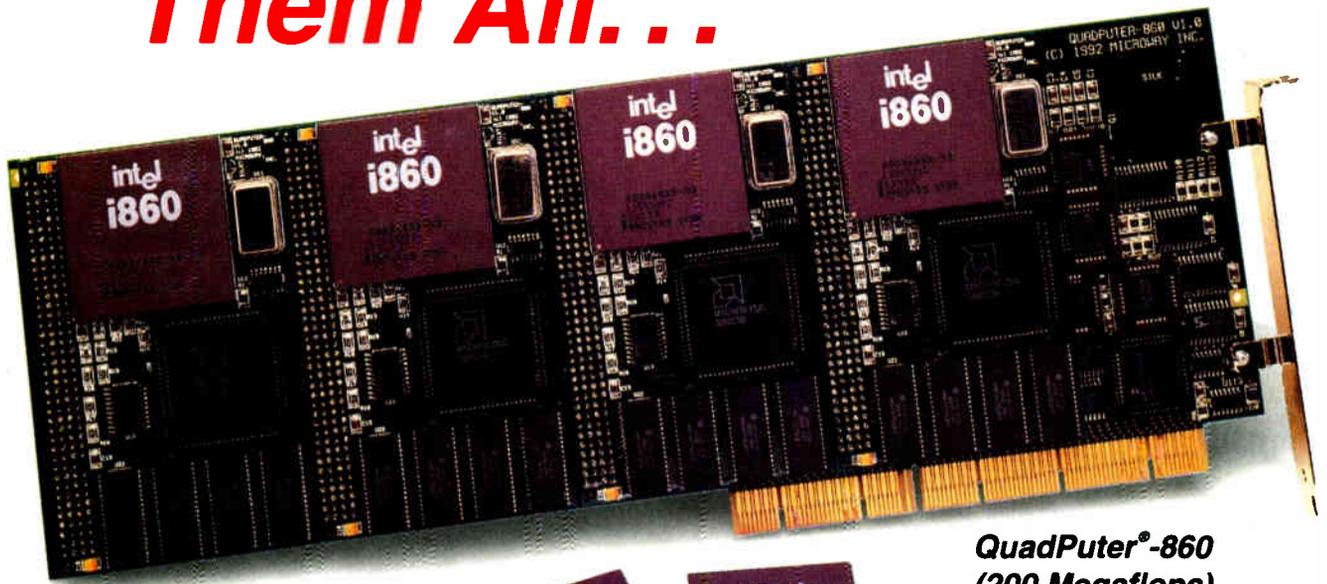
Other options on that first menu include Browse Article Titles, Knowledge Tree, Timeline, and Multimedia. Knowledge Tree is "a hierarchical list of topics," something that's fascinated savants since the late seventeenth century. The first stab here is, The Arts, Geography, History, Science, Society, Technology. Select Science to get a submenu, a lot of sciences starting with astronomy.... You see the idea.

As for Timeline, it comes up telling you that in 40,000 B.C., Cro-Magnon man (i.e., *Homo sapiens*) was active in Europe and the Middle East. You can just go paging down that list, or you can zero in on a date like 1914. Any of the items there will send you to an encyclopedia entry you might not have found. Thus, 1914 includes Chaplin, the article on whom branches to items like "slapstick" and "film, history of." You can even view those two on adjacent windows, even if you're in DOS instead of Windows. Not a bad knowledge engine, no, not at all.

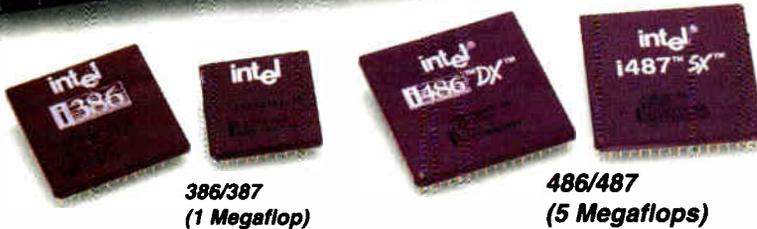
—Hugh Kenner



# NDP™ Fortran Drives Them All...



**QuadPuter®-860  
(200 Megaflops)**



**386/387  
(1 Megaflop)**

**486/487  
(5 Megaflops)**



## **Extended DOS • OS/2 • NT • UNIX V.3/4 • Solaris • Coherent**

NDP Fortran has been the leading 32-bit PC Fortran since its introduction in 1987. It produces the highest quality numeric code and supports virtually all x86 operating systems, processors and numeric devices. These are just a few of the reasons it was used by hundreds of ISVs to port their 3090, VAX and Cray codes to the 386. NDP Fortran is required to run packages from IBM, Aspen Technologies and Fluid Dynamics. IBM chose it to port their Optimization Subroutine Library to DOS and more recently OS/2. Aspen Plus, the world's leading thermo/chemical-process control software package, is the standard employed by corporations like DuPont. Every copy of Aspen Plus for the PC ships with NDP Fortran-486!

One reason NDP Fortran is still the 32-bit leader is tools. It runs with native tools on UNIX, OS/2 and NT. For DOS, Microway created 32-bit tools that were tuned to the needs of our customers. These include efficient demand paged virtual memory for our Extender and a linker that could handle a 20-megabyte library without going to sleep. We are the only vendor that provides a variety of numeric runtime libraries that make it possible to tune speed against

precision and error recovery. The correct choice of a library vs inline intrinsics can result in a factor of three increase in speed for some applications. Then there is the issue of numeric code quality. NDP compilers are not only globally optimized, but take good advantage of the Intel 387/487 stack, use advanced numeric optimizations and schedule instructions - all of which favor fast numeric and RISC devices like the 860 and 586.

Finally, Microway customizes its compilers to the environment. Our DOS 386/486 product includes over 1,000 pages of documentation, 300 of which are devoted to our GREX™ graphics extensions. The 200 megaflops of our QuadPuter-860 are optimally harnessed using NDP Fortran-860, libraries from IMSL, NAG and KAP and the PSR Vectorizer. Microway can build you a gigaflop NFS computational server using five QuadPuters housed in our industrial grade 486-B<sup>3</sup> for just \$50K - massive power without massive price. If you plan to use a 386, 486, 586 or 860 and require portability, numeric speed, precision and technical support, then NDP Fortran, C | C++ or Pascal is the only solution.

The Intel Inside Logo, Intel, 286, 386, 387, 486, 487, 586 and 860 are trademarks of Intel Corporation. Microway and QuadPuter are registered trademarks of Microway, Inc.

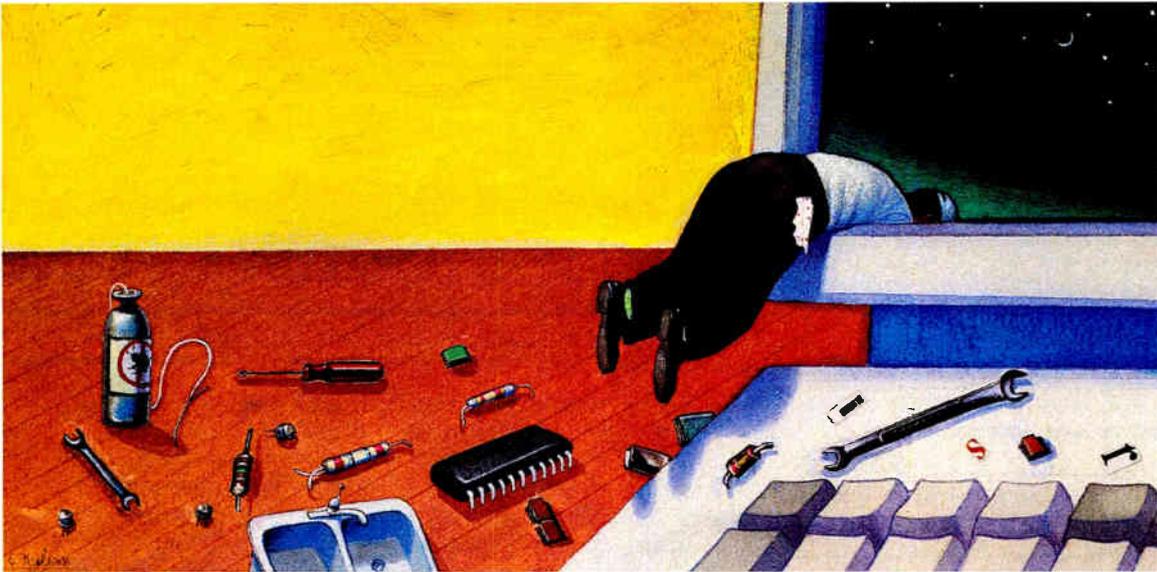
# Microway®

**Technology You Can Count On**

Corporate Headquarters, Research Park, Box 79, Kingston, MA 02364 USA • TEL 508-746-7341 • FAX 508-746-4678

International Sources: Kingston-Upon-Thames, U.K. 081-541-5466. Distributors: Germany 069-752023 • Greece 30 12915672 • Italy 027490 749 • Japan 047 423 1322 • Poland 22-414115

# DIVIDE AND CONQUER



**M**any programmers—even very good ones—would rather have their teeth pulled than face writing interrupt service routines. ISRs are demanding; writing them usually calls for knowledge of assembly language, multitasking, hardware, and sometimes special coding techniques. However, most programmers can handle those items reasonably successfully, or are willing to learn as part of taking on an ISR. The real roadblock is in the debugging phase.

Debugging is often a challenge in any kind of programming, but with non-interrupt-based code, you can usually get enough of the code running to get some clues that will help you narrow your focus. If the program crashes every time you read data from the disk, you'll figure out pretty quickly that you forgot to initialize the pointer to the data buffer. If your floating-point calculations are producing incorrect results, you don't need to bother looking at the screen-drawing code while searching for the problem.

ISRs are not quite so nice. Often the only clue provided is a complete system crash, with a cryptic message like "Stack Overflow." Once you've paid your dues and written a few ISRs, you'll have a better idea of how to interpret such gems. The learning curve, however, can be steep and painful.

## Diagnostic Limitations

With mainline code, you can usually write diagnostics to the screen or a disk file (e.g., `printf()` or `fprintf()`).

In general, this is not possible in an ISR, either because of operating-system limitations (e.g., DOS is not reentrant, so an ISR cannot safely call video and disk I/O functions) or because of the time-critical nature of interrupts.

I remember a client calling me while trying to incorporate into his program an ISR I had written. The program was crashing in my code, and we were trying to figure out what was wrong. I asked him to try to narrow down the exact place where the program was crashing.

"That's easy," he said. "It crashes during the `printf()`."

"Ummm... what `printf()` is that?" I asked.

"Why, the `printf()` I put in your code to see if it was working, of course!"

Needless to say, once the offending `printf()` was eliminated, the program ran just fine.

These days, programmers are used to tools that perform much more sophisticated tasks than writing to the screen or to a file. Source-level debuggers let you step through your code, watching variables and catching side effects before they have a chance to be noticed as bugs. Source-level debuggers are great, but some of the worst bugs in ISRs revolve around concurrency issues, and stepping through code on the interrupt usually doesn't give you an

**It's best to follow a methodical approach when you are debugging interrupt service routines**

**Listing 1:** A complete ISR skeleton.

```
.DATA

int_seg  dw 0 ;for DOS timer interrupt vector
int_off  dw 0 ;segment and offset
int_used db 0 ;the interrupt number we are using
_counter dw 0 ;this can be used to test if ISR is
           ;accessing data properly
@curseg  ends

.CODE
;Here's the trick—we save the application's
;data segment in the code segment of the
;interrupt handler, so the interrupt handler
;will know where to find it.

datsegst dw 0 ;storage for data segment

Inthandler proc FAR ;This is the interrupt handler,
                   ;capable of accessing data.
    push ds
    push ax
    mov ax,cs:datsegst ;note segment override!
    mov ds,ax ;now we have access to data
    inc _counter ;just to prove we can do it
    mov al,EOI
    out 20H,al ;send EOI to 8259 interrupt controller
    pop ax ;restore registers
    pop ds
    iret ;note special return instruction
Inthandler endp

GLOBAL _setint:proc
_setint proc ;This function saves the vector for
            ;the interrupt to be changed and
            ;then points the vector at Inthandler.
            ;The interrupt number is in AL on
            ;entry to the function. This version
            ;saves the data segment for later use
            ;by the interrupt handler.

ARG int_requested:WORD
    push bp
    mov bp,sp
    mov al,int_requested
    mov int_used,al
    push ax ;save interrupt number
    mov ax,ds ;get the data segment,
            ;store in code segment
    mov ax,cs:datsegst ;note segment override!
    pop ax ;restore interrupt number
    push es
    push bx
    cli ;disable interrupts
    mov ah,35H ;get the old vector from DOS
    add al,8
    int 21H
    mov int_off,bx ;and store it
    mov int_seg,es
    mov dx,OFFSET Inthandler ;get offset of new
                            ;vector
    push ds ;save the data segment
    push cs ;get code segment in data segment
    pop ds
    mov al,25H ;AL has vector no., AH has int no.
    mov al,int_used
    add al,8
    int 21h ;have operating system change vector
    pop ds ;now restore DS to proper state
    sti ;enable interrupts
    pop bx
    pop es
    pop bp
    ret
@curseg ends
END
```

**Listing 2:** This C program sets the interrupt vector to point to your ISR and then looks to see if the ISR is correctly incrementing the variable.

```
#include <stdio.h>

#define TIMER_INT 0 //use timer interrupt for test,
                  //since we know it's active

extern unsigned int counter;

main()
{
    Setint(TIMER_INT); // set interrupt vector

    printf("\nPress any key to exit.\n\n");

    while(!kbhit())
        printf("\ncounter = %u",counter);

    Restoreint();
}
```

**Listing 3:** This small subroutine takes the values in AL and BL and puts them in a trace buffer each time it is called until the trace buffer is full. AL and BL were chosen arbitrarily for the sake of illustration; any desired variables or tokens can be written. You can use a circular buffer if needed.

```
.DATA

TRACE_BUFF_SIZE EQU 40*0
BYTES_PER_WRITE EQU 2

trace_buff db TEST_BUFF_SIZE DUP(OFFH)
trace_buff_ptr dw OFFSET trace_buff
trace_buff_end dw (OFFSET trace_buff +
                 TRACE_BUFF_SIZE - BYTES_PER_WRITE)

@curseg ends

.CODE
;Enter with first byte of data to be stored in AL
;and second byte in BL; keep writing data until
;buffer is full.
trace_data:
    push di ;DI used as index into trace buffer
    mov di,[trace_buff_ptr] ;Get place in trace
    ;buffer
    cmp di,[trace_buff_end] ;Make sure don't overrun
    jae no_more
    mov [di],al
    inc di
    cmp di,[trace_buff_end] ;Make sure don't overrun
    jae no_more
    mov [di],bl
    inc di
    mov [trace_buff_ptr],di
no_more:
    pop di
    ret

@curseg ends
```



# Everyone makes claims. We make sure.

## When the industry wants product testing taken to the nth degree, they take it to NSTL.

In every field, one name sets the standard. In microcomputer testing, the name is NSTL, the leading independent testing lab.

The NSTL compatibility certification seal on a product says that it withstood the toughest lab in the industry — and it's ready for your business.

The seal saves you a lot of comparison and guesswork. It says you'll find the product compatible with a wide range of business applications and hardware. It helps you make the right choice.

## Real-world testing for real-world use.

Beyond compatibility testing, we access nearly every conceivable

problem — from engineering-level hardware bugs to the everyday usability of business software.

And we test with the end-user in mind, in a real-world environment, just the way your staff uses equipment. Except our trials are more punishing.

## Our publications, and others that publish our work.

In a separate facility we also do comparison testing for our own Ratings Reports: *Software Digest*®, *PC Digest*® and *LAN Reporter*®. They're read by people who purchase an average of more than \$500,000 in microcomputer hardware and software annually.

And because of the respect we've earned, some of the industry's leading publications, like *Data Communications*,

*LAN Times*, *Unix World* and *Datapro Research Group* publish our test results.

## Look for the NSTL seal and be sure.

Experts rely on the NSTL name: now you can, too. The final test of a product is its compatibility in a business environment. The NSTL mark tells you it's already met that test. Look for it when you compare products.



Plymouth Corporate Center  
Box 1000, Plymouth Meeting, PA 19462  
215-941-9600

Micro Channel™ and OS/2™ are trademarks of the IBM Corporation.

Circle 120 on Inquiry Card.

World Radio History

## SOME ASSEMBLY REQUIRED

accurate idea of the order of events. Older chips (e.g., the 8086) don't let you trace on the interrupt, so sometimes source debuggers are not an option even for simple problems. Also, source debuggers don't usually help find problems related to the use of the interrupt hardware.

So what's a programmer to do? It would be nice if you could buy ICEs (in-circuit emulators), which provide all sorts of neat things, such as trace buffers, that can tell you exactly what instructions were executed in which order. However, ICEs can cost well into five figures. Most individual programmers and even small companies can't afford such equipment.

### Tricks of the Trade

I started writing ISRs on machines with very primitive debugging capabilities, and, painful as those early experiences were, I learned some tricks that I still use, even when I have sophisticated hardware and software available to assist in debugging. The examples in this article are for Intel microprocessors, but the principles apply to almost any environment.

The first and most important technique I use is no stranger to believers in modular

programming. The strategy boils down to this: Divide and conquer. There are three basic areas of difficulty common to most ISRs: dealing with the interrupt mechanism itself (both the hardware and the operating system), getting access to your data, and debugging the actual functional code that runs on the interrupt. If you can get each of these three areas working independently, when you combine them you will have to worry only about problems introduced by their interaction.

Typically, there are four parts to dealing with the interrupt mechanism: telling the system to call your code when an interrupt happens, catching the interrupt when it occurs, returning control to the system, and making sure the normal interrupt vector is restored when your program exits.

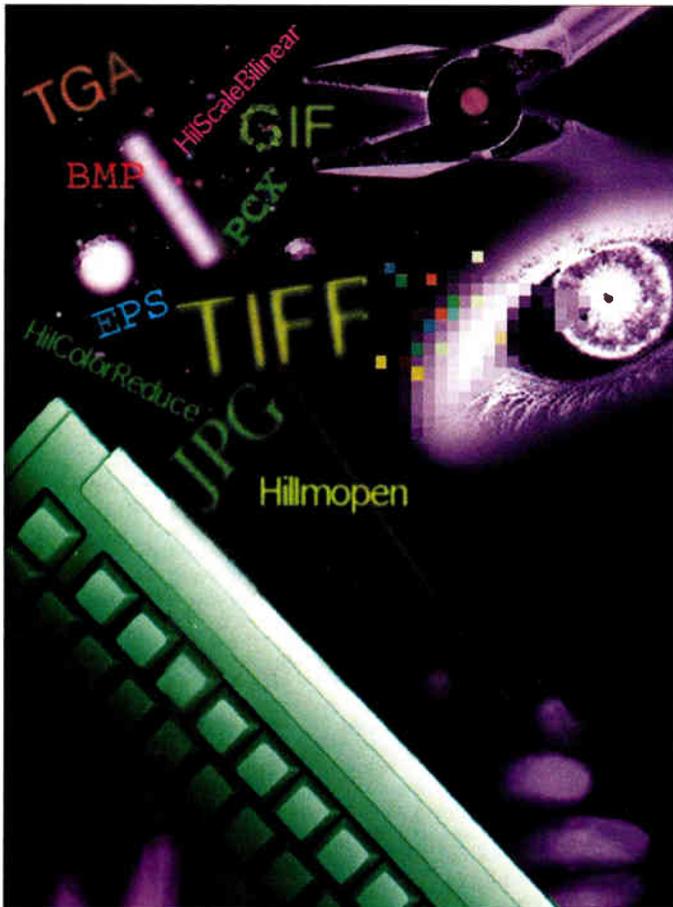
Wherever possible in dealing with the interrupt mechanism, use operating-system services to avoid the need for debugging. For example, in MS-DOS, you can write directly to the interrupt vector table to set up your interrupt, or you can use INT 21h services to get and set the vector. Programmers who decide to write directly to the interrupt vector table create programs that will not work as expected

under environments like Windows, which runs in protected mode and virtualizes memory. Save yourself trouble down the line, and do it the right way from the start. The best debugging is the debugging you never have to do.

Next, write an ISR that consists of the absolute minimum of instructions—just a return, if possible. Remember to use the right kind of return; on Intel systems, the mnemonic is IRET. On IBM PCs and compatibles, you will also need to send an End Of Interrupt signal to the interrupt controller. (See listing 1 for a complete, if tiny, ISR skeleton for the IBM PC.) Then write the code needed to set the appropriate interrupt vector to point to your ISR. Even if you can't use your source debugger on the ISR itself, you should be able to use it to double-check that you're passing the correct address and selecting the correct interrupt.

Now run the code. If nothing seems to happen, you probably got it right. Next, try loading in another program. If the system crashes, you almost certainly changed the interrupt vector successfully. Now you must change it back to the original vector before exiting your program.

*continued*



## HALO IMAGING LIBRARY GIVES PROGRAMMERS THE POWER TO WRITE IMAGING MAGIC.

A sophisticated toolbox for today's program designers who need state-of-the-art imaging technology in their software programs—read, write and convert such popular formats as TIFF, PCX, BMP, GIF and more. Enhance and Transform your images...Pixelize, Posterize, Blend and Sharpen...Save time and money with this powerful, modular library. Produce sophisticated programs using award-winning technology from the industry-recognized leader. Contact Media Cybernetics to learn more about this imaging alchemy...

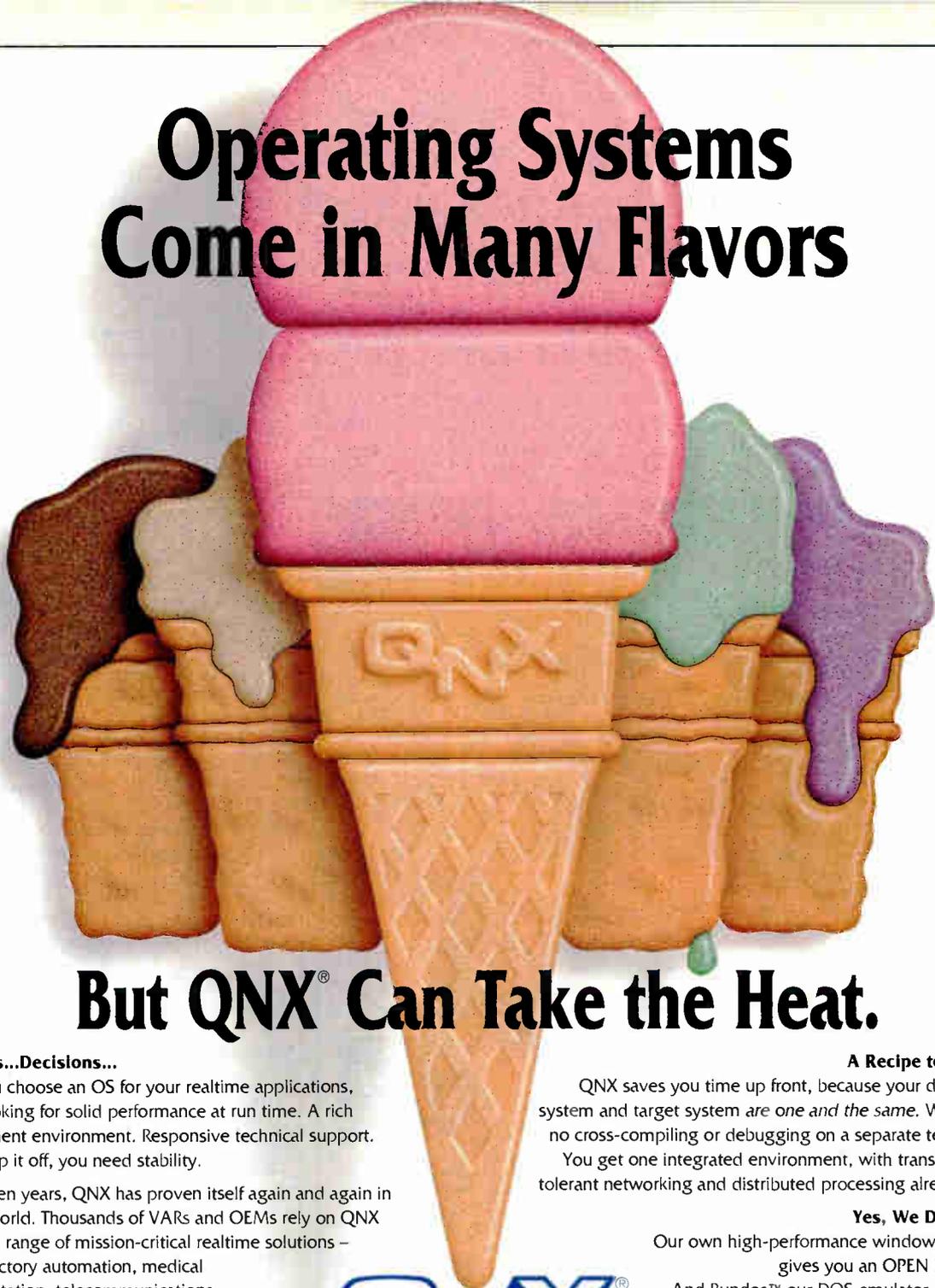
Call **1-800-992-HALO**

**MEDIA  
CYBERNETICS®**  
The Imaging Experts

Available for—  
Windows  
OS/2  
Macintosh  
OPEN LOOK  
Motif

8484 Georgia Avenue • Silver Spring, Maryland 20910 • USA  
301/495-3305—voice • 301/495-5964—fax

# Operating Systems Come in Many Flavors



## But QNX® Can Take the Heat.

### Decisions...Decisions...

When you choose an OS for your realtime applications, you're looking for solid performance at run time. A rich development environment. Responsive technical support. And to top it off, you need stability.

For over ten years, QNX has proven itself again and again in the real world. Thousands of VARs and OEMs rely on QNX for a wide range of mission-critical realtime solutions – in POS, factory automation, medical instrumentation, telecommunications.

### POSIX Plus Performance

QNX follows the latest IEEE POSIX 1003.1 and 1003.2 Open Systems standards, so you get the same API and utility set found in many UNIX® systems. But with its innovative microkernel architecture, QNX out-performs any standard vanilla OS.

### The Right Ingredients for Real Time

QNX delivers the speed of a fast, realtime executive (16 µsec per context switch on a 33 MHz 80486). And its priority-driven, preemptive scheduling will help you build responsive solutions that won't melt under *real* realtime conditions.

### A Recipe to Save Time

QNX saves you time up front, because your development system and target system *are one and the same*. Which means no cross-compiling or debugging on a separate test platform. You get one integrated environment, with transparent fault-tolerant networking and distributed processing already built in.

### Yes, We Do Windows

Our own high-performance windowing package gives you an OPEN LOOK® GUI. And Rundos™, our DOS emulator, lets you run Microsoft® Windows™ 3 in *standard mode*, so your favorite graphics programs will have enough memory to feel right at home.

### We Don't Scrimp on Support

During the last ten years, we've earned a reputation for outstanding technical support. Since we offer everything from 24-hour online conferencing to onsite consulting, you can easily reach the people who make up the QNX development team.

So if you're looking for an operating system that gives you more than the standard fare, try QNX. You're in for a real treat.



WE WORK IN REAL TIME.™

1-800-363-9001

(EXT. 101)

Circle 134 on Inquiry Card.

Quantum Software Systems Ltd. 175 Terrence Matthews Crescent, Kanata, Ontario K2M 1W8 Canada Tel: 613-591-0931 Fax: 613-591-3579

© Quantum Software Systems Ltd. 1992 QNX is a registered trademark and Rundos is a trademark of Quantum Software Systems Ltd. UNIX and OPEN LOOK are registered trademarks of UNIX System Laboratories, Inc. Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation.

World Radio History

## SOME ASSEMBLY REQUIRED

If your tiny program crashes, you have to find out whether the problem lies with the way you are altering the interrupt vector or with the ISR itself. Usually there is some way you can find out whether your ISR is being executed—for example, by writing a character directly to screen memory. If your ISR is being called, then the problem is almost certainly in the code being executed in the ISR. Double-check to make sure you have saved every register you use, including the flags if the micro-

processor doesn't save them; triple-check to make sure you have restored all registers in the proper order. If you are calling a function in a high-level language, make sure all registers get saved before the call and restored after the call. Better yet, eliminate all calls to external functions until you are sure they are not the source of the problem.

It is realistic to expect to have to reboot frequently while getting your first ISR running, especially while working on setting

up the interrupt mechanism. If you don't have to reboot quite a few times on your first ISR, you're doing a lot better than I did on my first one.

### The Next Step

Once your program can set up and restore the interrupt vector and execute an interrupt without crashing, the worst is over. Now you can start working on the second area of basic difficulty: accessing your data.

With the old 8-bit processors, it was easy: Memory was limited to 64 KB of absolute address space. Both 16- and 32-bit processors usually use some form of relative addressing—for example, segment-relative addressing on the Intel chips or address register-relative addressing on Motorola chips. Motorola chips offer the option of absolute addressing, but there are penalties in both code size and execution speed, so most systems use relative addressing.

The trick is getting your data's base address (usually referred to as the *segment* or *selector* with Intel microprocessors). When you enter an interrupt, the only registers you can count on are the ones that point to the current instruction. There are two ways of getting a base data address: You can store it at a known absolute address or at a known offset to the current instruction.

Storing something at an absolute address is fine if you are sure you're the only one that will ever be using the system. That leaves out almost all PCs, since, even if you are not actively multitasking, you have to make sure you don't step on the operating system or a TSR program. In fact, this option is mainly viable for embedded systems.

Fortunately, storing the data at a known offset from the ISR's first instruction is relatively simple. The exact details vary with different chips and compilers, but listing 1 shows one way (of several possible ways) to accomplish this under MS-DOS.

The next step is to make sure that your ISR works and that you really can get at your data. Listing 2 shows a small test program, again for MS-DOS, that simply increments a variable on each interrupt, with some mainline code that prints the variable to the screen. If the variable is being incremented, your code is correct; if not, make sure you're using the correct base data address.

Sometimes it's hard to tell whether there is a problem with the base data address or whether your ISR is simply not being executed. In this situation, here is a useful trick: Set up your ISR to replace an ISR that you know is being called (on a PC,

# Big screen. Will travel.



**21" SCREEN**

**Introducing new ScreenStar™ from BitWise,** the world's first transportable with dual-page display. It's a 486 50MHz PC workstation constructed within a suitcase for unrivaled performance in a transportable package.

**DUAL-PAGE** ScreenStar's massive 21.3" gas plasma screen folds flat within the suitcase, and easily displays *two* 8-1/2" x 11" documents at full size, to powerfully present data in meetings, in the field, or on the road.

5-1/4" bay for optical/CD ROM/WORM drive/more  
1280 x 1024 resolution  
3 full-length slots  
Up to 32 MB RAM  
Up to 1 GB hard drive  
Designed and built in the USA

**Imagine the possibilities.** Effortlessly run the most demanding software, *anywhere*. Impressively present to large groups. Effectively travel with a powerful document imaging system.

**Portable computing without compromise.** Discover the quality and innovation of our full line of portable systems. Otherwise, it isn't a BitWise.

**486 50MHz**



**ANYWHERE**





**1-800-THE-BIG-ONE**  
**(800-843-2446)**  
BitWise Designs, Inc.  
Technology Center  
Rotterdam Industrial Park  
Schenectady, N.Y. 12306  
Fax: 518-356-9749

COMPUTERS WITHOUT COMPROMISE™

# Essential Development Tools At Your Fingertips.

## MKS Toolkit — All the Tools of the Trade for Professional Programmers and Application Developers.

**M**KS Toolkit puts a powerful suite of easy-to-use development utilities within your grasp. MKS Toolkit was designed by developers for developers. That's how we knew precisely which programming instruments to give you — and how to make them work together so you can achieve levels of productivity you've only dreamed about — until now!

Developers working on DOS can now get the extraordinary power of tools that were once available only on UNIX. Only MKS Toolkit delivers a full suite of these essential tools on your PC, and allows you to switch quickly back to your DOS applications. For multi-platform environments, MKS Toolkit is fully compatible with UNIX systems, and tracks both POSIX and x/Open standards.

Now it's easy to take hold of all the tools of your trade. MKS Toolkit enables you to develop the technology of tomorrow — today.

Start shaping the applications of the future! *Call now to order your copy of MKS Toolkit.*

### Some of the 170+ utilities in MKS Toolkit 4.1:

- ▶ A new, easy-to-use, efficient UUCP communications package that connects you to the world.
- ▶ MKS AWK, the fast prototyping and report generating language, now with a new AWK compiler.
- ▶ MKS KornShell, the full-featured programming language that allows you to interchange scripts with UNIX and POSIX systems.
- ▶ MKS Make, the software construction utility that lets you update files automatically.
- ▶ MKS Vi, the full-screen editor.
- ▶ New Windows icons for frequently used commands.
- ▶ Full on-line reference manual.
- ▶ Interoperability with Open VMS, CTOS and MPE/iX.
- ▶ A full array of commands for profiling, compression, archiving, file processing and customizing your PC environment.

**MKS** 35 King Street North  
Waterloo, Ontario, Canada  
N2J 2W9

Price: \$299, Upgrade \$99. Call for multi-user pricing. 30 day money back guarantee.

For information on how to order, call MKS at: 1-800-265-2797 (US and Canada) or (519) 884-2251 • Fax (519) 884-8861. International customers please call:

AUSTRALIA +61 03 580 1333 • BRAZIL +55 83 333 1904 DENMARK +45 87 72 00 • FRANCE +33 1 48 77 22 44 / +33 1 47 81 10 11 • GERMANY +49 0721 988 280 / +49 0551 50762 0 / +49 06126 595 0 / +49 0221 35 15 24  
JAPAN +81 3 5702 0351 • NETHERLANDS +31 020 6 14 24 63 • SWEDEN +46 013 111588  
SWITZERLAND +41 061 421 32 01 • UK +44 0364 53499 / +44 0763 244114 / +44 071 833 1022

MKS and MKS Toolkit, MKS KornShell, MKS AWK, MKS Make, MKS UUCP and MKS Vi are trademarks of Mortice Kern Systems Inc. UNIX is a registered trademark of UNIX System Laboratories, Inc. All other trademarks are acknowledged.

Circle 112 on Inquiry Card.

World Radio History



24. — 31. 03. 1993

See us at Hall 8, stand C20-D19



**UniForum**  
CORPORATE SPONSOR

See us at Booth 4115 and 2549

the timer interrupt is ideal). If nothing changes, you are probably missing the data. If the data is now being accessed, the interrupt that you were using before is not being generated.

At this point, note what you've accomplished: All the interrupt-related issues have been isolated (well, most of them; more about that later), and you can proceed to the third basic area—debugging the functional code—without worrying about the interrupt.

**Defensive Programming**

Several other common trouble spots are best dealt with through defensive programming. First, since the interrupt occurs asynchronously, you must be absolutely certain that you save and restore all registers. Normally, you make assumptions about registers: For example, AX (or D0) is not preserved across function calls. Interrupts are a different story. They can happen at any time, between any two instructions, and if they trash a register, the

results are unpredictable.

Second, on most systems, especially IBM PCs, interrupt code needs to execute quickly and get out of the way. Several problems can occur when one interrupt interrupts an ongoing interrupt; the most severe is a system crash, but none of them is fun. Avoid complex calculations (e.g., floating point) during interrupts. Pass the values to the mainline code to do the slow stuff. If possible, avoid high-level languages and stick with assembly language for ISRs. You'd be surprised at just how inefficient C can be.

Again, practice defensive programming. Debugging the problems that arise from a slow ISR can be difficult, so avoid the situation. There's still a place for tight, fast code, even in this power-glutted age.

I find it useful to write the functional code for an ISR so that it can be called from mainline code. In this way, I can step through it before it is running on the interrupt, to catch bugs and side effects when it's still easy to do so. Just make sure that your code is not also being executed by the ISR while you're stepping through it from mainline code, or you'll hopelessly confuse your debugger.

**Other Snags**

Usually, once the basic pieces of your ISR are working correctly, you're finished. Sometimes, however, problems arise involving coordination between the ISR and the mainline code. The ISR may access a variable before it is set to the correct value, or the mainline code may alter the variable before the ISR has a chance to do what it needs to do with the old value. These concurrency problems can be very hard to debug, and source-level debuggers don't always help, because they can alter the order of events. I suggest two techniques for solving these classic real-time bugs.

Say you need to know the value of a variable during the first execution of the ISR. Simply have the ISR copy the variable into another memory location, and have the mainline code display the copy.

Even if you don't have an ICE, you can roll your own software trace buffer. Set up a circular buffer, and write data and tokens to it that you can examine later to see just what happened during interrupt processing. You can often find subtle order-of-execution problems by carefully examining this buffer. You can use the buffer to accumulate information during processing, and then you can print it to the screen or write it to disk and examine the information at your leisure. Listing 3 demonstrates this technique.

I recently used this technique while I



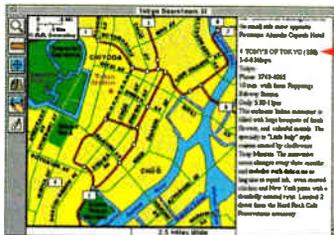
**IT'S THE BEST PIZZA JOINT IN TOKYO.**  
*(But how would you know that?)*

Goat cheese and grilled octopus?

Okay, it's not what you'd expect to find on your ordinary pizza. But then again, you don't go to Tony's of Tokyo for ordinary pizza. Of course if you had LOCAL EXPERT™, you'd already know that.

"LOCAL EXPERT?" Yes, it's the new software package that gives you all the travel tips and inside information you'll ever need. It's the food critic, business resource, nightlife review and sports directory all rolled into one. And, best of all, it's rolled tight enough to fit easily onto your laptop computer.

LOCAL EXPERT comes with an extensive collection of world and regional maps, plus lots of useful information. Order now, and you'll get LOCAL EXPERT for the special introductory price of just \$99. And that includes a detailed guide to the city of your choice from over 100 cities worldwide. To order, just call 1-800-442-8887. After all, it's not a lot of dough.



All the details come with one easy to read map.



**\$99**

**LOCAL EXPERT™**

1 - 8 0 0 - 4 4 2 - 8 8 8 7

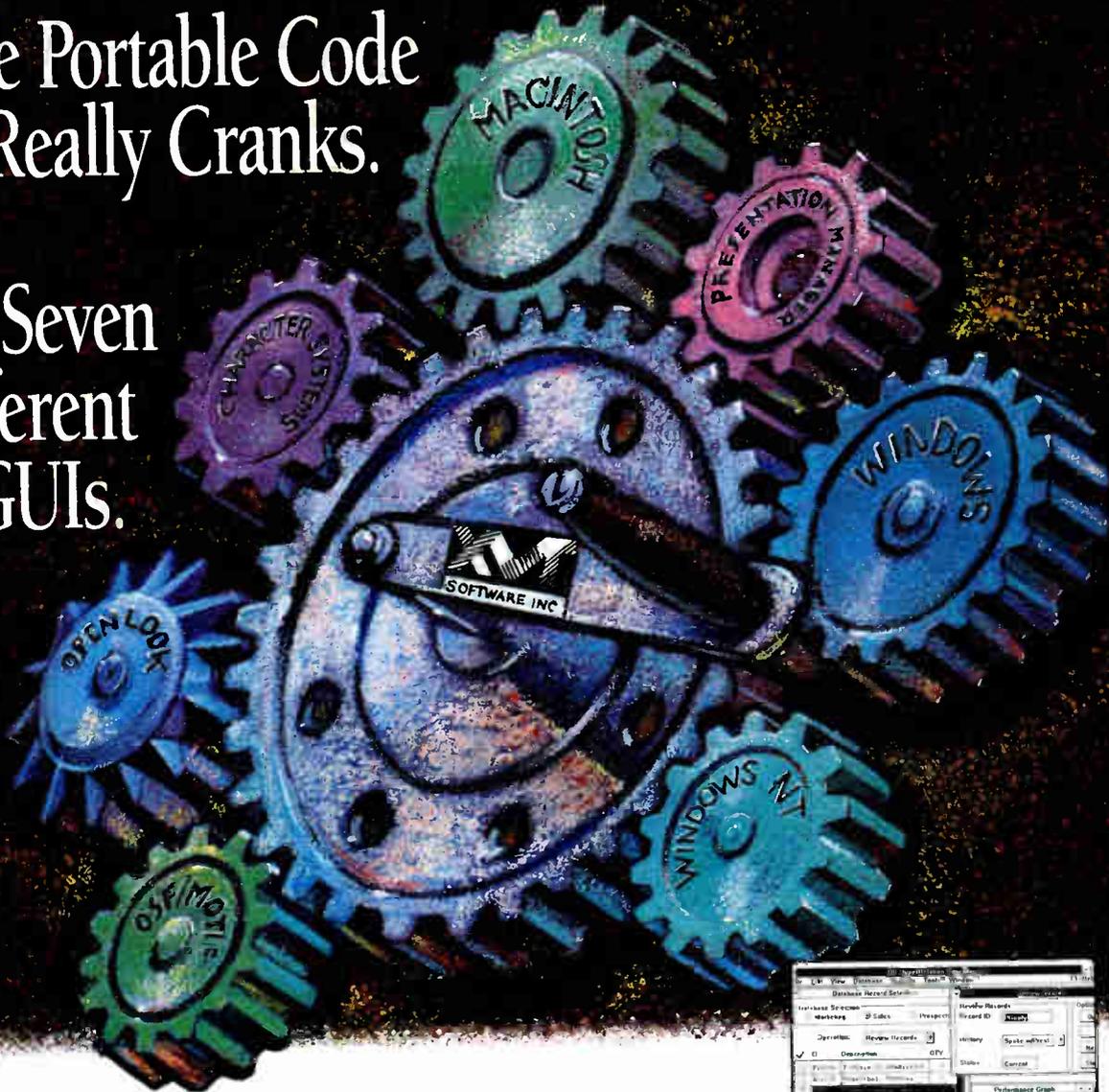
Available for Macintosh™ computers and PC compatibles running Microsoft® Windows™. Comes with an unconditional 30 day money back guarantee. AE, MC & VISA accepted. All trademarks and registered trademarks are of their respective owners. SMI, 3135 Kifer Rd., Santa Clara, CA 95051



THE MAPPING SOFTWARE EXPERTS™

# Write Portable Code That Really Cranks.

## On Seven Different GUIs.



XVT's Portability Toolkit™ is a powerful C development environment that allows you to build a single application, then re-compile to every major GUI without rewriting code. XVT solutions also include an interactive design tool and a class library for C++ developers.

- Supports Macintosh, Microsoft Windows, Windows NT, OS/2 Presentation Manager, OPEN LOOK, OSF/Motif, and Character Systems
- Native look-and-feel to all target GUIs
- Portability to 26 hardware systems
- Access to the complete functionality of every windowing system
- Easier to use than native development toolkits
- Minimal size and performance overhead
- Shorter development cycles
- No royalties or runtime fees
- Clear documentation and responsive technical support

Now in its third generation, XVT is recognized as the industry leader in portable GUI development solutions and is the base document for the emerging IEEE standard. It is used by world-class software developers like •Novell •HP •AT&T •Digital •Lockheed •Kodak •Grammatik/Reference Software, because it allows them to take their applications to the widest market, quickly and cost effectively.

Don't write another line of code without gearing up to develop your application simultaneously for all GUIs. Call for technical materials and a demo.



SOFTWARE INC

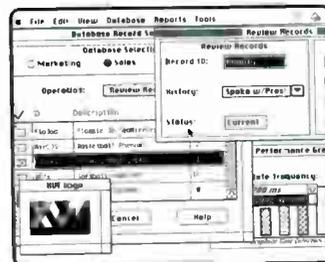
The portable GUI development solution.

**1-800-678-7988**

XVT Software Inc. 4900 Pearl East Cr. Boulder, CO 80301  
(303) 443-4223 FAX (303) 443-0969  
For European Inquiries, contact: PVI Precision Software GmbH  
Phone: 49 0 61 03/37 94 0 Fax: 49 0 61 03/36 95 5



▲ Microsoft Windows & Windows NT



▲ Macintosh



▲ OSF / Motif

Shown above are four of the seven GUIs supported by XVT.

Circle 164 on Inquiry Card (RESELLERS: 165).

World Radio History

was writing a Windows device driver. I could step through the code and everything would work fine, but when the code ran in real time, something went awry. The code was complex: Data was passed to the driver in a series of buffers of varying sizes, copied in small chunks into other buffers, and then sent via interrupt-driven DMA to a peripheral board. Both the mainline and interrupt code used the key functions, and everything had to happen in the right order. It was impossible to tell the order of execution by any conventional means, so I added a software trace buffer and wrote tokens to it that indicated the order in which functions executed. Once I had the tokens to examine, finding the problem was simple.

## Debugging Tools

My emphasis in this article has been on worst-case debugging—routing out the nasty little critters when normal techniques won't help. If your equipment allows you to use a source-level debugger, then by all means do so. You can find some fairly inexpensive hardware and software tools that will help, too. I work almost entirely on IBM PCs, so the list I give here won't

help much if you work on Macs or Sun workstations, but it may give you some ideas.

One of my favorite tools is the breakout switch, which causes an NMI (nonmaskable interrupt). You need software that patches the NMI vector to point to debugging code; then, when the machine hangs, you can hit the switch and find out what code was executing. Periscope makes a great hardware/software combination with a breakout switch that lets you pop into any executing code.

Both Periscope and Nu-Mega provide software that—when running on a 386 or higher processor with adequate RAM—performs many of the functions of an ICE, including complex breakpoints and trace buffering of code that has executed. This kind of tool is almost indispensable if you write a lot of ISRs. Nu-Mega also sells a tool that will spot out-of-bounds memory accesses. That's handy for finding uninitialized pointers in mainline code and ISRs alike.

If you have the money, Periscope also makes a board that contains a trace buffer that errant code can't overwrite. With this board, you have almost all the function-

ality of a true ICE at significantly lower cost.

A true ICE lets you do more than just buffer instructions. It can also keep track of exactly what is happening on the bus and at selected other points in your system. However, most of the time you will not need this information for debugging ISRs; it's mainly needed for hardware development.

The time will come, though—no matter what debugging hardware and software you own—when you won't be able to find a way to trace the problem through ordinary means. That's when you need to apply the fundamental rule of dividing the problem into its component parts and then use your ingenuity to find out what is going wrong. ■

Editor's note: *The complete listings for this article are available in electronic format. See page 5 for details.*

*Thomas Jeffries is president of Singing Electrons, a Lopez, Washington, company specializing in developing multimedia audio tools and products. You can reach him on BIX as "tjeffries."*

fractal

image

compression

**F**ractal image compression. The technology that inspired *PC Magazine* to proclaim "The advantages of fractal compression are unmatched." The technology selected for Microsoft's breakthrough CD-ROM Encyclopedia, Microsoft® Encarta.

This technology is now available to Windows 3.x developers in **POEM ColorBox**, which provides DLLs for:

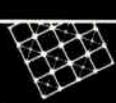
- ultra-high compression;
- resolution independent images;
- fast decompression; and
- superior 24-bit color rendering.

For multimedia, archiving or other imaging applications, **ColorBox** is comprehensive, easy-to-use and at \$995, surprisingly affordable.

Call today for more information. Learn why **ColorBox** is the solution to your image compression needs.

**Iterated Systems**  
5550-A Peachtree Pkwy., Suite 650  
Norcross, GA 30092  
Tel: 1-800-4FRAC TL  
Fax: (404) 840-0806

## Which computer guru founded Dial-a-Joke?



Now's your chance to stump the experts with the most intriguing, funny, or just downright strange computer trivia you can think of. It's the 1993 Computer Bowl, being held on May 14, 1993 in San Jose, California. Two teams made up of industry notables go head to head in this grueling competition. The examiner is again Bill Gates (who on his days off runs a small company in Washington state). So submit as many questions as you want, but do it soon — only a select number are chosen. If we use one, we'll list you in the 1993 Computer Bowl program and you'll get a videotape of the whole event. Send your questions — and answers — in advance to: The Computer Bowl Project Manager, The Computer Museum, 300 Congress Street, Boston, MA 02210. And think hard. Mr. Gates is waiting.



For sponsorship and ticket information, call  
**(617) 426-2800 x346**

**Answer:** Let's just say he co-founded another company named after fruit.



## CD-ROM INSIDE AND OUT



**T**echnology advancements, new standards, and improved software are propelling CD-ROM toward widespread acceptance among personal computer users. But while the impact of CD-ROM technology is clear (see "Start the Presses," February BYTE), the underlying technology and standards can be confusing. Knowing how typical CD-ROM drives work and what standards such as ISO 9660 and CD-ROM XA (Extended Architecture) mean should help anyone who's shopping for a CD-ROM drive.

CD technology was developed in 1976, the result of a joint effort between N.V. Philips of the Netherlands and Sony Corp. of Japan. This led to the 1982 Red Book specification for CD audio, which defined media size and characteristics, physical data layout on the disc, error correction, disc rotation speed, and other parameters.

The potential application of CD-ROM technology as a high-capacity, low-cost medium for read-only data storage resulted in the 1983 Yellow Book CD-ROM specification. While the basic technology remains the same as that for CD audio, CD-ROM data requires greater data integrity: A corrupt bit that's not noticeable during audio playback becomes intolerable with computer data. In addition to the Red Book CIRC (cross-interleaved Reed-Solomon code) standard for audio CDs, the Yellow Book specification dedicates more bits for EDCs (error-detection codes) and ECCs (error-correction codes).

Other CD-ROM specifications have followed, including the Green Book CD-I (Compact Disc Interac-

tive) specification, which allows for interleaved audio and video data, and the upcoming Orange Book specification, which governs the new CD-R (CD recordable) drives.

### CD-ROM Basics

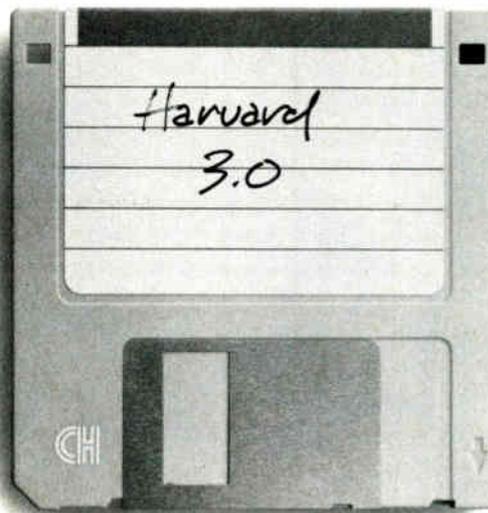
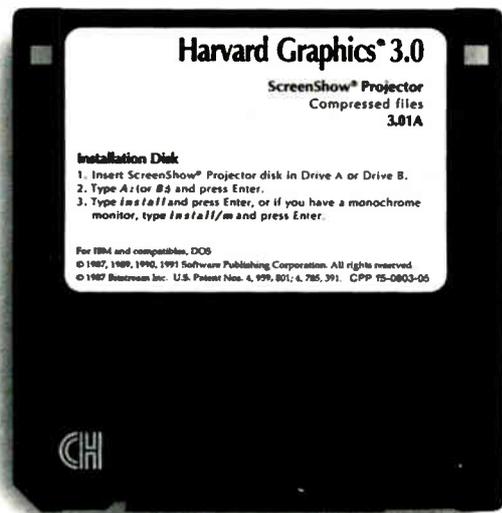
A standard CD-ROM disc measures 120 millimeters (4.72 inches) across and has a 15-mm (0.6-inch) spindle hole in the center and a thickness of 1.2 mm. Unlike conventional disks, which have concentric circular tracks divided into sectors, CD-ROM discs have a single spiral track, as a record does, that starts near the center and spirals outward (see figure 1). This 3-mile-long track is divided into equal-length sectors, or *blocks*. The track width is about 600 nanometers wide, and adjacent turns of the spiral track are about 1600 nm apart, for a density of about 16,000 turns per inch.

Data on the spiral track is in the form of small, variable-length, 120-nm-deep depressions called *pits* and intervening flat areas called *lands*. The CD-ROM's read head—an optical assembly with a low-power gallium arsenide laser and a photodetector—reads the pits and the lands. The assembly directs the laser beam through a one-way reflective mirror to the disc's surface (see figure 2). The lands reflect light from the laser; the pits disperse it. The reflective mirror redirects the returning light to a photodiode.

*continued*

**Here's how CD-ROM drives work, how CD-ROM discs store data, and what the standards mean**





# They're exactly the same, but somebody just paid \$100,000 for the one on the right.

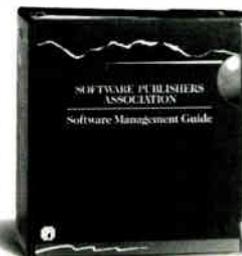
When you use illegally copied software, you're committing a federal crime and risking a fine of up to \$100,000. How can you and your company stay legal? It's easy with our Software Management Guide. You'll receive SPAudit for



DOS and Macintosh™, comprehensive auditing software, a video and procedures for establishing and enforcing a policy that will keep your organization's software legal. And, at only \$80, it's a real bargain when you consider what some people pay.

**Keep your software legal.** To order, call the Software Publishers Association at **1-800-388-7478**, or include credit card information or a check and send or FAX this coupon to: SPA Management Guide, P.O. Box 79237, Baltimore, MD 21279-0237, FAX (202) 223-8756

Name \_\_\_\_\_  
 Company \_\_\_\_\_ Title \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
 Phone ( ) \_\_\_\_\_ Ext \_\_\_\_\_  
 Please send me \_\_\_\_\_ copies at \$80 each. Total \$ \_\_\_\_\_ (DC residents add 6% sales tax)  
 Check enclosed    American Express    VISA®    MasterCard®  
 Card Number \_\_\_\_\_ Exp. Date \_\_\_\_\_  
 Signature of Cardholder \_\_\_\_\_ Name of Cardholder \_\_\_\_\_



13



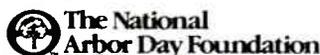
## You Need Tree City USA

City trees add the soft touch of nature to our busy lives. They cool our cities, fight pollution, conserve energy, give wildlife a home, and make our neighborhoods more liveable.

The trees on city property, along streets and in parks, are an essential part of the urban forest. To keep these trees healthy and abundant, your town needs an organized program for their care...an annual action plan to plant and prune the city's trees, and to maintain their health.

You can make a difference — by planting and caring for trees in your yard and in your neighborhood, and by encouraging your city government's community forestry program.

Support Tree City USA where you live. For your free booklet, write: Tree City USA, The National Arbor Day Foundation, Nebraska City, NE 68410.



## UNDER THE HOOD

approach allows the drive to create a disc that, optically speaking, has the same lands and pits as a standard CD-ROM disc and thus can be read by an ordinary CD-ROM drive. While the CD-R head assembly has more components, the path from laser to photodiode is essentially the same as for a standard CD-ROM drive.

### Data Organization

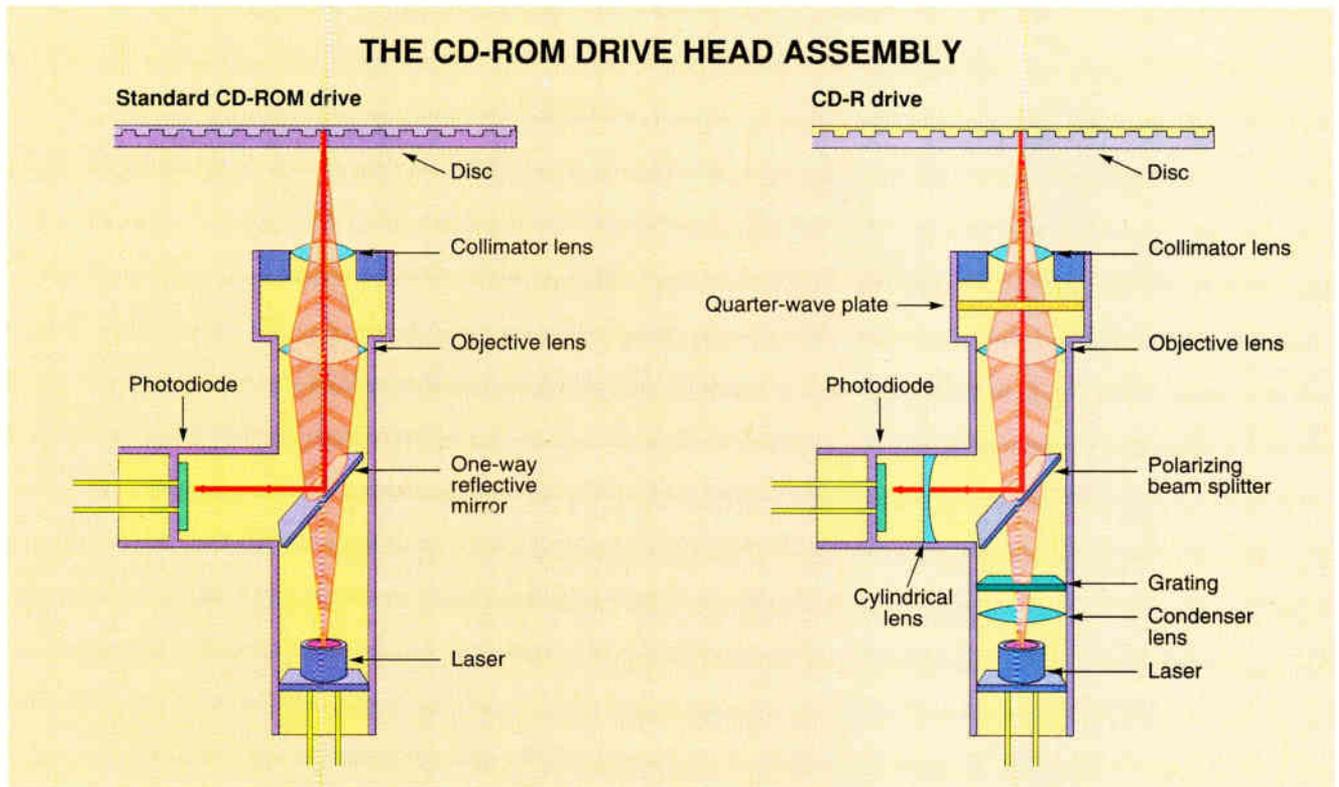
The lands and pits on a CD-ROM disc do not represent ones and zeros. The reason is complex to explain. Briefly, each bit requires about 300 nm of length along the spiral track. Thus, if a sector had 2048 data bytes consisting of all zeros or ones, then it would have a pit or land measuring 4,915,200 nm or longer. The CD-ROM drive would have to maintain a precise clock that ticked at an interval representing 300 nm in distance so the next bit could be read at the right time. That's virtually impossible with today's technology.

Instead, designers limited the length of the pits and lands to a specified range. This ensures that a transition from one to the

**C**D-R is the most exciting and technologically advanced area of recent CD-ROM development.

other occurs frequently enough for the CD-ROM drive to derive a clock. The drive uses this clock to count the number of bits a pit or land represents, as determined by its length. The bits are stored on the disc in RLL (run length limited) format—the same self-clocking approach used for storing data on most hard disks.

Each transition on a disc between a land and a pit represents a one, and each non-transition represents a zero. The minimum practical length of a pit or land is 3 bits (900 nm); the maximum is 11 bits (3300 nm). It's important to note that the 3-bit minimum precludes having two consecutive one bits (i.e., two back-to-back transitions). In other words, you must have at least two, but not more than 10, zero bits



**Figure 2:** In standard CD-ROM and CD-R drives, a laser beam passes through a one-way mirror or polarizer and a set of lenses on its way to the disc. Reflected light passes through the lenses and is redirected to a photodiode.

between one bits.

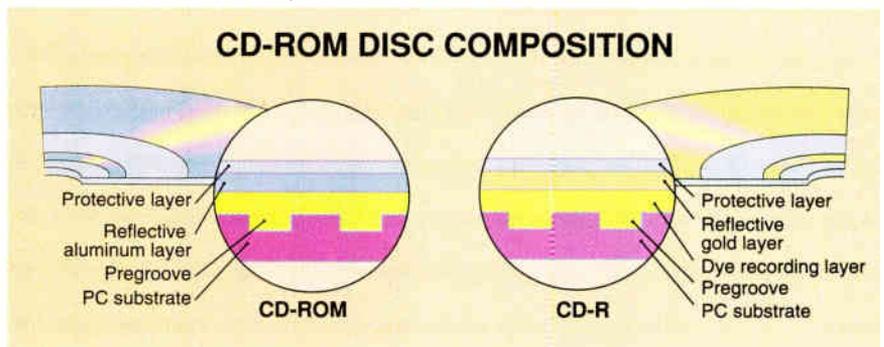
However, a byte of data stored on disc might have combinations of eight ones and zeros that violate the 3-bit minimum, and multiple consecutive bytes could result in bit patterns that exceed the 11-bit upper limit. To solve this problem, CD-ROM drives use an encoding scheme that converts data bytes into 14-bit patterns called *channel bits*. A 14-bit binary value provides 16,384 bit patterns; more than 256 of these meet the requirements for the CD-ROM encoding format. A one-to-one correlation is then made between each of the 256 binary patterns represented by an 8-bit byte and 256 of the channel bits that meet the CD-ROM formatting requirements. This method, called EFM (eight-to-14 modulation), requires a lookup table to correlate the 14-bit patterns on the disc to their 8-bit data values.

While the use of these 14-bit codes generally supports the criteria for CD-ROM data storage, it also creates a potential problem. When you place multiple 14-bit codes consecutively on disc, it's possible to violate the run-length limits where the codes meet. To alleviate this problem, three *merging bits* are placed between each 14-bit code to ensure that no run-length violations exist.

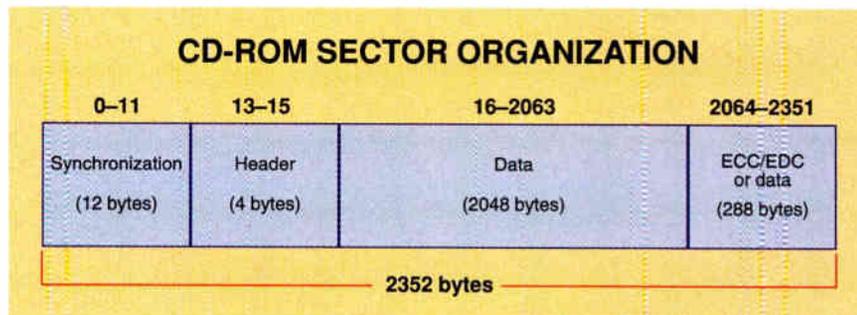
Standard CD-ROM sectors consist of 2352 bytes organized as shown in figure 4: 12 bytes of synchronization data, followed by a 4-byte header, 2048 bytes of error-corrected data, and a 288-byte segment for ECCs/EDCs.

The sector header consists of three sector-address bytes and a mode byte. Three sector modes are defined for standard CD-ROMs. A mode 0 sector contains all zeros

(this sector might represent a blank area in a line-art image). In mode 1, a sector contains 2048 bytes of data plus 288 bytes of ECCs/EDCs. Mode 2 sectors contain 2336 bytes of uncorrected data. If you use the last 288 bytes for data instead of ECCs/EDCs, the amount of data per sector increases to 2336 non-error-checked bytes. This is normally reserved for data that is insensitive to occasional errors, such as



**Figure 3:** In a standard CD-ROM disc, a manufacturer impresses a pattern of lands and pits into a transparent polycarbonate substrate, which is backed with a reflective aluminum film, a coat of lacquer, and the vendor's label. The drive reads the disc from the bottom, through the substrate. The substrate layer on a CD-R disc is coated with an organic-dye recording layer, a gold layer, and a lacquer coating.



**Figure 4:** A typical CD-ROM disc sector can contain either 2048 bytes of error-corrected data or 2336 bytes of uncorrected data. Dispensing with error correction (which is recommended only for more tolerant audio or video data) expands the disc capacity by more than 50 MB.

digitized audio and video data. For sensitive data, mode 1 error detection is very effective: The likelihood of an undetected error is about  $10^{-25}$ , or about 1 bit per 2 quadrillion CD-ROM discs.

As with audio CDs, CD-ROM discs are generally made using a 60-minute spiral consisting of 270,000 sectors. These discs can, however, be made using up to a 74-minute spiral, with 333,000 sectors. The additional 14 minutes are located on the outer 5 mm of the disc. This area is the hardest to record well and keep clean, so it is often left unused.

Manufacturers cite widely varying CD-ROM disc capacities. It all depends on whether they are using 270,000 or 333,000 sectors and how they perform the calculations. A 270,000-sector CD-ROM disc with 2048 bytes (2 KB) of corrected data per sector has a capacity of 552,960,000 bytes. Some manufacturers round this off to 552 MB or divide by 1 KB (1024 bytes) and round it off to 540 MB. The correct method is to divide by 1 MB (1,048,576 bytes), for a total of about 527 MB of error-corrected data. If you use uncorrected sectors (2336 bytes per sector), the capacity increases to 601 MB. Using 333,000 sectors per disc, the 681,984,000 bytes on an error-corrected disc add up to 650 MB of usable storage, or 742 MB without error correction.

**ISO 9660**

While the Yellow Book specification now exists to detail the low-level organization of sectors and data on a CD-ROM disc, early CD-ROMs were fraught with system-level incompatibilities because no standard existed for a file structure or higher-level data organization. In response, an ad hoc group of companies, known as the High Sierra Group, defined today's de facto CD-ROM file-format structure.

The High Sierra format quickly became the standard for CD-ROM data storage

and established a high level of intersystem compatibility for CD-ROM discs. The ISO adopted it in 1988, with minor modifications, as ISO 9660. ISO 9660 is the least common denominator for CD-ROM discs. It offers interoperability at the expense of platform-specific file-system features, such as the Mac's data and resource forks.

A new standard, called the Frankfurt specification, will eventually augment the Orange Book specification. It will support Unix, OS/2, Macintosh, and Windows NT file-system conventions, as well as incremental update (i.e., multisession) capability for CD-R drives. It won't, however, be compatible with today's CD-ROM software.

**Drive Mechanics**

The data bits on a CD-ROM disc must pass under the read head at a constant rate, known as CLV (constant linear velocity). Because the sectors on the outer and inner edges of the disc are the same length (see figure 1), achieving a CLV requires changing the rotational speed of the disc as the head position changes. As the head moves farther away from the center, the rotational speed slows; if it didn't, the bits on the outer edge of the disc would go past the read head about three times faster than those near the center. In contrast, conventional hard disks operate at a constant angular (i.e., rotational) velocity, or CAV; as a result, the physical sector sizes grow longer as the tracks get farther from the center.

The CD-ROM optical head assembly stays a relatively long (1-mm) distance away from the disc, virtually eliminating the possibility of a head crash. The read/write heads of conventional hard disks, in comparison, float a fraction of a micrometer over their disk platters—more than 2000 times closer.

While head crashes are rare, dust is a

problem for CD-ROM drives. The guts of a CD-ROM drive are exposed to the outside world each time the user inserts or removes a disc. Accumulating dust on the optical head assembly can reduce the effectiveness of the laser or the photodiode and can cause drive performance to deteriorate or even fail.

Some drive vendors use double doors to minimize the entry of dust into the drive. Others incorporate an automatic laser lens cleaner that dusts off the optical head assembly each time the user ejects a disc. Not all CD-ROM drives have a dust-protection mechanism, however.

**Drive Performance**

The performance of a CD-ROM drive is measured in *access time*, which is the average amount of time it takes the read head to reposition itself to a new location on the disc and start reading the data. Older drives required as much as a second or longer to perform this operation, while modern drives accomplish this task in well under 400 milliseconds.

Most CD-ROM drives share the same nominal 150-KBps data transfer rate to conform with the Yellow Book's 75-sector-per-second data read-rate specification. This makes access time all the more significant in differentiating the performance of CD-ROM drives—much more so than with conventional hard disks.

CD-ROM drive access times are very large (i.e., slow) when compared to the sub-20-ms access times of most hard drives. The sheer bulk of a CD-ROM optical head's assembly is one limiting factor. Hard drive read heads are small and light, while the laser, lenses, and other CD-ROM head-assembly hardware make it difficult for a CD-ROM's optical head to move quickly.

A more significant performance obstacle is the drive's variable rotation speed. The rotation speed must change depending on the sector being read and its position relative to the center of the disc. The drive might hit the brakes to slow the disc speed to access data at the outer edge of the disc and then go full tilt to access data on an inner track. This *whipsaw effect*—changing disc speed and then waiting for the desired speed change before a read can occur—is the single greatest contributor to a CD-ROM drive's relatively slow access time.

To accommodate multimedia applications, drives with faster data transfer rates have appeared on the market in the past year that offer nearly double the standard 150-KBps rate. Multidisc subsystems offer nearly four times the standard data transfer rate.

*continued*

# Take the Lead with DataFlex!



**Isn't it time you experienced the benefits of object-oriented programming?**

**You can with DataFlex.**

DataFlex's comprehensive 4GL, robust class libraries, object-oriented program generators, and proven database management system provide you with a complete library of tools for application development.

Generating complete object-oriented programs is as easy as clicking on AUTOCREATE in DataFlex's menu system. Utilizing DataFlex's many other language features lets you create fully customized CUA applications.

Experience faster development, easier maintenance, re-usable code, and better looking applications now with DataFlex for \$795.

The benefits of object-oriented programming are here now. Don't get left behind.

Take the lead... with DataFlex!

#### Features of DataFlex:

- Object-Oriented Programming
- Application Generators
- Relational DBMS
- Portability (DOS, DOS Networks, Unix, Windows)
- Client/Server Solutions

#### Time Saving Benefits of DataFlex:

- Reusable Code
- Easier Design
- Speed
- Flexibility
- Reliability

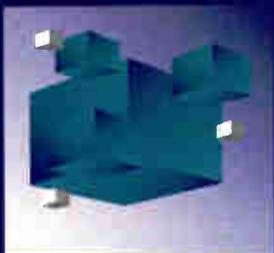
Call 1-800-451-FLEX for complete DataFlex information and the dealer nearest you.

**DATA ACCESS**  
CORPORATION

Miami, FL USA  
305/238-0012

For information via CompuServe: GO DAC

**Circle 81 on Inquiry Card  
(RESELLERS: 82).**



**DATA FLEX**

Object-Oriented 4GL  
Application Development Environment  
DBMS

Australia 61-3-699-7044

Austria 43-662-658-2237

Belgium/Luxembourg 49-61-727-5014

Brazil 55-11-872-9266

Canada 416-226-2181/416-785-5041

Chile 56-2-231-70-5

Denmark 45-45-76-4545

France 33-1-47-241-951

Germany 49-61-727-5014

Hong Kong 852-311-7922

Italy 39-587-422-022/39-51-437-025

Japan 81-480-856-565

Mexico 525-545-6327

Minsk 7-0172-236797

Moscow 7-405-4342060

Netherlands 31-74-555-609

New Zealand 64-9-772-701

Norway 47-2-559-366

Singapore 65-775-5588

Spain 34-1-402-2298

Sweden 46-300-19530

Taiwan 7-0142-233035

United Arab Em. 97-12-331-685

United Kingdom 44-71-729-4460

Prices may vary by country. DataFlex is a registered trademark of Data Access Corporation.

Faster data transfer rates are accomplished by spinning the disc faster; thus, these faster drives must incorporate heavier motors to quickly accelerate and decelerate the rotation speed of the disc at these higher rpms. Typically, these drives also support the conventional 75-sector-per-second read rate for backward compatibility for playing audio CDs.

To create a smoother—and effectively faster—data transfer rate, some CD-ROM drives incorporate a RAM cache. This al-

lows read-data buffering while the drive sends data to the host processor.

### Mixed Media

While standard CD-ROM discs can mix text, audio, and video, synchronization is often disappointing because the data isn't interleaved. One of the first enhanced incarnations of CD-ROM to address this problem was the 1986 Philips/Sony CD-I, or Green Book, specification.

Unlike standard CD-ROM drives, which

operate as a computer peripheral, CD-I specifies a complete system, with an integrated computer and NTSC output. One of its most significant enhancements over standard CD-ROM technology is the ability to interleave audio and video information for synchronized playback. CD-I defines a CD-ROM drive's mode 2 sector type with an 8-byte subheader to support additional data types, including interleaved audio and video data.

CD-I calls for a Motorola 68000 processor using the OS-9 RTOS (real-time operating system). The use of an RTOS is necessary to achieve the functional concurrency that is the key to CD-I operation: audio output, video output, and disc accesses occurring simultaneously.

CD-I also incorporates the MPEG (Moving Pictures Experts Group) video compression standard. With an MPEG decompression chip operating in a CD-I drive, video data can be decompressed and sent to the host processor on the fly. Compressing video data frees up storage capacity and effectively increases the playback data transfer rate by outputting more decompressed pixels per sector than a standard uncompressed sector can hold. CD-I does not currently support audio compression.

### DVI

DVI was originally developed by General Electric/RCA's Sarnoff Labs and appeared, like CD-I, in 1986. Intel bought the technology in 1987 and announced an Intel/IBM joint venture to exploit the technology in 1989.

DVI is a computer-based peripheral. It's not a complete system, but it is otherwise similar to CD-I. DVI supports interleaved audio and video data for synchronized playback and incorporates video data compression. Running on 80x86-based PCs prevents DVI from using the OS-9 RTOS found in CD-I. Instead, DVI uses its own real-time executive that takes over system resources to accomplish audio-/video-/disc-access concurrency.

Intel developed a special 750 video processing chip set that performs real-time video compression and decompression operations for IBM's 750-based DVI controller board, the ActionMedia II. The IBM board can both play and develop (i.e., pre-master) DVI applications.

Intel is working on a special version of its 486 processor that supports DVI. The availability of the new device was uncertain as this article went to press, but it might be on the market by the time you read this. Such a device could allow more economical DVI computers to be produced without external plug-in boards like IBM's

# Complete, Powerful Connectivity

## SmarTerm<sup>®</sup> 340 for Windows

## SmarTerm<sup>®</sup> 420 for Windows

**Free Multiprotocol Kit!**

- Implementations of LAT, Telnet, and FTP
- Support for third-party TCP/IP
- Token Ring drivers

**N**ew SmarTerm for Windows clearly puts more VT text and graphics emulation power and ease at your fingertips. Corporate support features include a toolbox, button palettes, trace and remapping utilities, scripting, keyboard mapping, and customizable-help. SmarTerm 340 for Windows provides outstanding ReGIS, Tektronix, and sixel graphics capabilities. SmarTerm, connecting users worldwide, is also available for VT320 and VT340 emulation using DOS.

Persoft, Inc. 465 Science Dr. P.O. Box 44953  
Madison, WI 53744-4953  
Call toll-free 1-800-EMULATE Fax (608) 273-8227  
European Headquarters World Trade Ctr. Beursplein 37  
Box 30237 3001 DE Rotterdam The Netherlands  
Phone +31 10 405.3560 Fax +31 10 405.5073



©1992, Persoft, Inc. All Rights Reserved.

Persoft and SmarTerm are registered trademarks of Persoft, Inc. All other trademarks mentioned are properties of their respective owners. Rev. 11/92

# EXCEED THE LIMITS OF X TERMINAL EMULATION.

## Turn your PC into an X station.

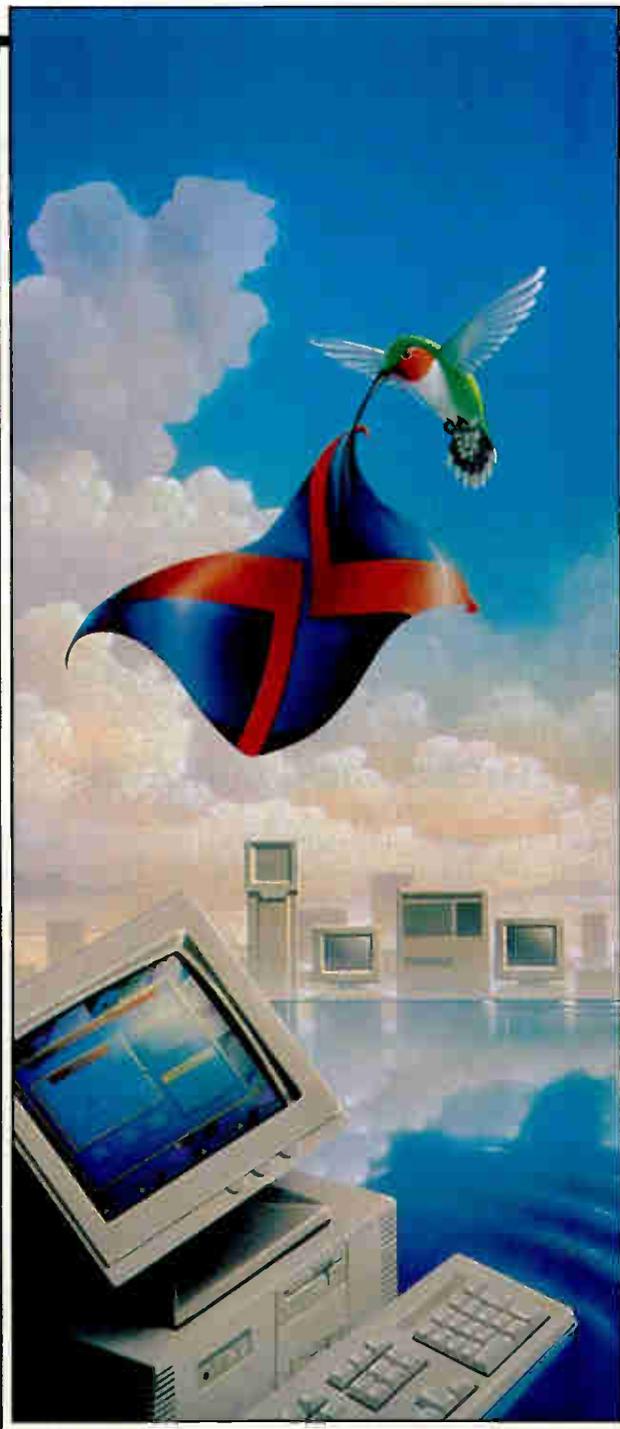
With HCL-eXceed/W PC X server software, Hummingbird allows you to live in two worlds: DOS/MS-Windows and X Windows/UNIX.

Imagine being able to move both text and images between UNIX hosts and your DOS PC. It's as simple as copying and pasting from one window of your PC screen to another.



Discover other innovative capabilities of HCL-eXceed/W.

- Launch Pad menuing facility
- Telnet and FTP applications
- X11 R5: support for scalable fonts, font servers, XDMCP security
- Xstart — X client program starter
- Xtrace — protocol tracing facility
- single window and multiple window mode
- supports 15 different TCP/IP transports and DECnet



- supports up to 16 million colors
- plane mask support

## X Development Tools

HCL-eXceed/W now includes the Xlib, Xt intrinsics, Xaw and Xmu libraries. This introduces a whole new dimension to PC X servers. Now you can use your PC as a low-cost workstation to develop and run X applications. You can also give other PCs and workstations access to these applications over the network.

HCL-eXceed/W from Hummingbird. It's far more than X terminal emulation for PCs. And it's one of the family:

**HCL-eXceed Plus** — A DOS-based X server with a local window manager that supports EGA, VGA and Super VGA.

**HCL-eXceed HiRes** — The same as "Plus" but it also supports 8514A, XGA and TIGA 2 high resolution graphic standards.

**HCL-eXtend** — UNIX host-based X clients for accessing DOS services.



**HUMMINGBIRD  
COMMUNICATIONS LTD.**

For the name of your closest reseller, please contact:

2900 John Street, Unit 4, Markham, Ontario, Canada L3R 5G3

Telephone: (416) 470-1203, Fax: (416) 470-1207

In Europe: 37-39 rue de Vermont, 1202 Geneva, Switzerland

Telephone: 41 (22) 733 18 58, Fax: 41 (22) 734 14 79

### ActionMedia II.

DVI supports FMV (full-motion video) at frame rates of up to 30 frames per second, at 512 by 482 pixels per frame. With video compression, a maximum of 72 minutes of high-quality FMV (or the equivalent amount of audio) can be placed on a single disc. With adequate processing power, DVI is also capable of supporting 24-bit color images at 1024 by 768 pixels and 30 fps.

### CD-ROM XA

Philips, Sony, and Microsoft introduced CD-ROM XA in 1988. CD-ROM XA defines Microsoft's Level 2 standard for CD-ROM and multimedia applications. Like CD-I, CD-ROM XA supports interleaved audio and video data that can be played back in sync, but without the OS-9 RTOS requirement.

CD-ROM XA maintains the standard CD-ROM ISO 9660 file structure and 2048-byte error-corrected sectors. As with CD-I, you can add header information to support additional data types and interleave audio and video data. CD-ROM XA also supports up to 16 parallel audio channels.

CD-ROM XA does not yet support video compression, but it does support audio compression using ADPCM (adaptive differential pulse-code modulation). It supports four different audio-quality levels that trade off storage space for quality and allow the storage of up to 19 hours of audio on a single disc. To support the compressed audio data, either the CD-ROM XA drive or its controller must have an ADPCM chip that decompresses the data as it is read from the disc. CD-ROM XA is not yet widely supported.

### Photo CD

Kodak's Photo CD is an interesting application of CD-R technology. The Photo CD system can compress and store up to 100 high-quality photographs digitally on a single disc.

Photo CD uses the same file format structure as CD-I and CD-ROM XA. To produce Photo CD discs, your local photo lab must purchase a Photo CD system.

Photo CD discs are readable on CD-ROM XA and CD-I devices with the appropriate software. They are not readable, however, on a standard CD-ROM drive. Kodak will also offer its own stand-

alone Photo CD reader.

In addition, Kodak has developed its own variation on the CD-R disc. Its discs are similar to other writable discs, but Kodak adds an additional UV-curable durability coating on top of the lacquer layer to increase durability.

### The Future

As the price of an entry-level CD-ROM drive has dropped into the \$200 range, CD-ROM discs have increasingly become the preferred medium for distributing everything from operating systems to multimedia applications. The advent of CD-R drives that have price tags of less than \$10,000 is accelerating this trend by lowering the cost barriers to publishing CD-ROM discs.

Understanding CD-ROM drive designs and the evolving standards is a good place to start if you're looking for the right CD-ROM drive for your needs. ■

*Roger C. Alford is a BYTE consulting editor and president of Programmable Designs, a Michigan-based electronics design firm. You can reach him on BIX as "rogera."*

## 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

BY393

# IF LOGIC ALONE DOESN'T CONVINCE YOU TO USE PROGRESS, THEN HOW ABOUT A LITTLE PEER PRESSURE?

## 1992 DATAPRO DBMS USER SURVEY

|                             | PROGRESS<br>SOFTWARE | SYBASE | INFORMIX | INGRES | FOCUS | ORACLE |
|-----------------------------|----------------------|--------|----------|--------|-------|--------|
| <b>ATTRIBUTES</b>           |                      |        |          |        |       |        |
| Reliability                 | 8.9                  | 8.7    | 8.9      | 8.1    | 7.7   | 7.9    |
| Ease of Use                 | 9.1                  | 8.2    | 8.2      | 8.2    | 7.9   | 7.6    |
| Ease of Install/Upgrade     | 8.4                  | 8.0    | 8.8      | 7.8    | 8.1   | 6.3    |
| Price/Perform Return        | 8.1                  | 8.3    | 8.5      | 7.9    | 8.1   | 7.4    |
| <b>FUNCTIONALITY</b>        |                      |        |          |        |       |        |
| Flexibility                 | 8.1                  | 8.8    | 8.6      | 8.4    | 8.4   | 7.6    |
| Interface Capabilities      | 8.0                  | 8.9    | 8.4      | 8.1    | 8.7   | 7.4    |
| Comprehensiveness           | 8.7                  | 8.8    | 8.8      | 8.3    | 8.7   | 7.6    |
| User Friendliness           | 8.4                  | 7.7    | 8.3      | 8.1    | 7.5   | 7.0    |
| OS Compatibility            | 9.6                  | 8.4    | 8.9      | 9.0    | 8.8   | 7.5    |
| <b>PRODUCT SUPPORT</b>      |                      |        |          |        |       |        |
| Documentation               | 9.0                  | 8.2    | 8.6      | 7.4    | 6.2   | 6.8    |
| Vendor Training             | 8.7                  | 7.9    | 8.0      | 7.9    | 7.6   | 6.7    |
| Problem Response Time       | 8.8                  | 7.5    | 7.2      | 6.8    | 6.4   | 6.2    |
| Quality of Vendor Support   | 9.0                  | 7.8    | 7.5      | 7.4    | 6.9   | 7.2    |
| Frequency of Releases       | 8.5                  | 7.5    | 6.7      | 6.9    | 7.7   | 7.2    |
| Response to User Request    | 8.8                  | 7.5    | 7.8      | 7.6    | 7.0   | 6.5    |
| <b>OVERALL SATISFACTION</b> | <b>9.3</b>           | 8.7    | 8.5      | 8.3    | 8.0   | 7.6    |

Compiled from the latest Datapro reports on DBMS/Computer System Series Software available for each product listed (for Informix, see Informix/SQL). All results are those of actual users of the product as surveyed by Datapro.

## 1992 VARBUSINESS DBMS REPORT CARD

|   | PROGRESS<br>SOFTWARE | BORLAND | INFORMIX | INGRES |
|---|----------------------|---------|----------|--------|
| <b>PRODUCT FEATURES</b>                 |                      |         |          |        |
| Ease of use                             | 8.78                 | 6.87    | 6.80     | 6.00   |
| Memory requirement                      | 7.28                 | 6.30    | 6.14     | 5.11   |
| Ease of programming                     | 8.87                 | 6.74    | 6.79     | 6.37   |
| Ability to manipulate data              | 8.73                 | 7.24    | 7.14     | 7.07   |
| Sorting capabilities                    | 8.29                 | 7.24    | 7.21     | 7.58   |
| Provision for software security         | 8.09                 | 6.23    | 7.00     | 6.70   |
| Report writing capabilities             | 7.84                 | 6.54    | 6.59     | 6.50   |
| Ease of use of Interface                | 8.15                 | 6.89    | 6.85     | 6.50   |
| Software integration capabilities       | 8.08                 | 6.92    | 7.20     | 6.15   |
| Ease of data retrieval                  | 8.29                 | 7.26    | 7.65     | 7.04   |
| Satisfaction with product profitability | 7.98                 | 6.61    | 6.79     | 5.19   |
| Overall quality of product              | 8.87                 | 6.97    | 7.35     | 6.71   |
| <b>PRODUCT FEATURES AVERAGE</b>         | <b>8.33</b>          | 6.82    | 6.96     | 6.41   |
| <b>SUPPORT FEATURES</b>                 |                      |         |          |        |
| Provision for customer support          | 8.28                 | 6.73    | 6.10     | 5.44   |
| Charges for training time               | 8.91                 | 5.79    | 5.56     | 4.71   |
| Provision for technical support         | 7.27                 | 6.14    | 6.00     | 5.15   |
| Provision for marketing support         | 7.04                 | 5.97    | 5.33     | 4.04   |
| Documentation & product information     | 8.92                 | 7.03    | 6.57     | 6.00   |
| Frequency of updates & revisions        | 7.73                 | 6.26    | 6.05     | 5.74   |
| <b>SUPPORT FEATURES AVERAGE</b>         | <b>7.88</b>          | 6.32    | 5.93     | 5.18   |
| <b>OVERALL AVERAGE</b>                  | <b>8.11</b>          | 6.65    | 6.62     | 6.00   |

© 1992 VARBUSINESS Software Report Card reprinted with permission.

For the second consecutive year, PROGRESS resoundingly swept all 18 categories of the VARBUSINESS Report Card. And for the fourth year in a row, PROGRESS came out on top in the Datapro surveys. Once again, users rated PROGRESS superior to competitors on everything from strength of product to quality of service and support. Which is only logical, since PROGRESS is the one develop-

**PROGRESS  
SOFTWARE**

ment system that gives you the flexibility to build and implement high performance applications independent of platforms and database systems. It even lets you deploy any application in both multi-user and client/server environments. But don't take our word for it. Listen to a source far more convincing. Your peers. For survey results or a test drive, call 1-800-4 PROGRESS.

### THE APPLICATION DEVELOPER'S CHOICE.

PROGRESS applications are fully portable across the broadest spectrum of hardware platforms, operating systems, network protocols and user interfaces. So many, in fact, that we had to list them here in small type: AIX,™ CTOS, H/UX,™ NOVELL™ NLM, OS/1,™ OS/2,™ OS/400,™ UNIX™ ULTRIX,™ VMS,™ XENIX,™ MICROSOFT™ WINDOWS,™ X WINDOWS,™ DECnet,™ LAN MANAGER,™ NETBIOS,™ NOVELL™ SPX/IPX, TCP/IP and SNA APPC LU 6.2. Also, PROGRESS lets you process information in other databases, including AS/400, C-ISAM,™ CT-ISAM,™ ORACLE, Rdb, and RMS.

Circle 132 on Inquiry Card (RESELLERS: 133).

World Radio History

# AUTOMATIC NETWARE LOG-INS

**E**xcuse me for hacking this month, but I have good reason. I needed to better understand the dialogue that occurs between Novell's LOGON.EXE and a NetWare file server. I had to find out how to build a program that would log in a PC to a NetWare file server automatically, without human intervention.

With some disassembly of the NETX.COM program and some help from Terje Mathesen's NETWARE.PAS code from the lans conference on BIX, I untangled the rather convoluted sequence of events that occurs when the file server verifies your log-in password. This month's Software Corner entry is LOGON, a NetWare log-in utility with Pascal source code. LOGON.PAS is written in Turbo Pascal, and you can compile it with Turbo Pascal 3.0 or higher.

LOGON.COM accepts three parameters—server name, user ID, and password. On the version that I actually used for automatic logging, these parameters are hard-coded into the executable file. It almost goes without saying that treating the password as a command-line parameter is a bad idea security-wise. However, the Soft-

## How to log in to NetWare from your programs without user interaction

ware Corner version of the program accepts these parameters so you can use it as is; you should strongly consider modifying my code and embedding your log-in parameters directly into source code.

Much of LOGON.PAS deals with upercasing strings and handling the differences between Pascal strings and the zero-terminated strings the file server expects. LOGON.PAS also locates the entry in the server name table located in NETX.COM corresponding to the server name you specify. This lets LOGON set the correct preferred server before beginning the log-in sequence.

Both NetWare's LOGIN and my LOGON rely heavily on NetWare's undocumented FileServiceRequest () function. Subfunction 17h of FileServiceRequest () returns an encryption key that LOGON uses, along with a table of en-

ryption keys in the Pascal source code, to encode the password for verification by the file server. Subfunction 18h of FileServiceRequest () actually performs the log-in. If by chance you run LOGON against an older version of NetWare (or the NetWare shell) that doesn't support encrypted passwords, LOGON reverts to using the LoginToFileServer () function that's documented in the DOS technical reference to NetWare system calls.

LOGON.PAS doesn't perform any drive mapping, nor does it attach to additional servers. For the unattended workstation I set up with an automatic log-in, I didn't need extra drives or servers beyond the defaults that NetWare provided. If you would like to map drives or attach to servers from within your code, you may want to get either Novell's DOS reference or my *Network Programming in C* (Que, 1990).

With the LOGON.PAS source code, you should be able to create unattended applications that can log in to any NetWare server. While the source code reveals how the NetWare encryption sequence works, you can't use it for breaking encrypted NetWare passwords. ■

MAC / Tom Thompson

## Industrial-Strength Text Editing

**B**BEdit is a freeware text editor written by Rich Siegel that started life as a bare-bones text editor (hence the name). However, BBEdit has evolved into an industrial-strength text editor offering numerous features found in commercial software. BBEdit can open multiple files, compare differences between files, and search multiple files for text strings. For lengthy multilevel searches, the search operation runs in the background, and it pops up a notification dialog box when it's done.

The editor window can display the time the file was last saved, and you can click on several icons to print a file, save it, change the quote style, or lock the text. When you save a file, you can choose the type of line breaks. For all these features, BBEdit takes up only 200 KB on disk and uses only 300 KB of RAM. (You'll have to allocate more RAM to work with bigger files.) BBEdit is an ideal companion for PowerBook users.

UNIX / Ben Smith

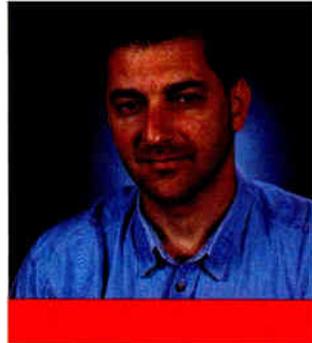
## A Viewer for X Images

**I**f you have an X Window System-based GUI and work with images, you need xv. This is a shareware graphical image viewer and translator for X systems.

You may already have xgif, the GIF file viewer that's often distributed with X. But there are some limitations to xgif. As John Bradley (the author of both) says: "xv probably wouldn't have been written were it not for all the abuse [I received] about the shortcomings of xgif."

Version 2.21 of xv will display GIF, PBM, PGM, PPM, X11 bit map, and PM images on up to 32-bit X displays. You can correct color mapping, adjust gamma correction, rotate and crop images, and change the aspect ratio. Then you can save out to any supported format. The only shortcoming to xv is that it works with images at screen depth; in other words, if you have an 8-bit system, even 24-bit images will be saved at 8 bits.

Editor's note: *Software Corner highlights public domain, freeware, and shareware programs. The programs are available electronically. See "Program Listings" on page 5 for details. We solicit your contributions. We pay \$50 for any program we use. Write to: Software Corner, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.*



**BRUCE D.  
SCHATZMAN**

## NEXT-GENERATION OLE

**A**lthough OLE has begun to change the way we build and use Windows software, its first incarnation hasn't been trouble-free. You can create systems of communicating applications, but doing so is not always seamless or intuitive. In OLE 1.0, there are several nuances and rules that users don't understand. Moreover, it stores and transmits object data inefficiently, so performance is not optimal. For developers, its large API and state transition logic make adding full OLE support to Windows applications a difficult task.

The forthcoming OLE 2.0 solves the first two of these problems. However, to make OLE-compliant applications more intuitive and faster, developers will be expected to digest a more complex programming model.

As usual, Microsoft is claiming that OLE 2.0 is an evolutionary technology. Although it's true that OLE 2.0 applications will talk to OLE 1.0 applications, OLE 2.0's long-term impact really will be revolutionary. It encourages a document-centered model in which you focus primarily on your data, not on applications. When you're driving, you keep your eye on the road, not on the controls. OLE 2.0 aims to make computing a similarly natural, goal-directed activity.

### New Features

For users, the most obvious new feature is *in-place activation*. That means you can double-click on an embedded object and edit or "play" the object without leaving the current window. The user-interface controls of the containing document's window merge with appropriate controls (i.e., menus, buttons, palettes, and toolbars) of the object's server application. When the embedded object loses focus, its server's controls vanish and the containing window reverts to its original appearance. This feature finally provides seamless integration of communicating applications.

OLE 2.0 supports in-place activation

only for embedded objects. Double-clicking on linked objects results in the standard OLE 1.0 behavior—you are sent to a separate application window to interact with the object. Why? Links to an object may exist in more than one document. By requiring a separate window for editing, the system gently reminds you that ownership of the object extends beyond the boundaries of the current document.

Also new in OLE 2.0 is an enhanced drag-and-drop capability that works between or within application windows (or anywhere else a drop is accepted). Because OLE 2.0 supports nested objects, you can also drag objects into or out of other objects.

Another feature enables an OLE 2.0 ap-

plication to define a callable interface to certain internal functions that it chooses to export. Thus, you'll be able to control such an application from another program or a systemwide script language. The idea isn't a new one. Among today's Windows applications, those that can act as DDE servers are frequently controllable by DDE clients. Hewlett-Packard's NewWave defined a more formal API for doing this kind of thing. Microsoft is betting that the OLE 2.0 mechanism will find broader support than the NewWave API did.

As with NewWave, there will be degrees of support for OLE 2.0. You will have to learn to be discriminating when an application advertises OLE 2.0 compliance.

### OLE 2.0 is faster and simpler for users, but it's trickier for developers

#### Still to Come

A number of features are described in the OLE 2 specification that will not be available in OLE 2.0. These include the following:

- an extended layout mechanism that supports irregularly shaped objects, not just rectangular ones
- property negotiation, so that an object can adapt its properties to those of its surrounding container
- string searches and spelling checks that "tunnel" inside objects within compound documents, and even within objects embedded in other objects

#### Tuning the Engine

OLE 2.0 has a new linking model that overcomes some of the limitations that are inherent in OLE 1.0. This model enables links to objects that exist only as embedded items in a document and are not stored as separate files. In OLE 1.0, you can link only to an object that lives in its own DOS file.

The new linking model also improves the persistence of links; that is, there are more ways to copy documents without breaking links. In OLE 1.0, objects are





# Unleash Your 486!

**NDP Fortran** is now six years old, yet people still call with 486 performance questions related to their use of 16-bit compilers. Therefore, we decided this was a good time to remake the case for 32-bit tools and languages.

To get full access to a 386 or 486 requires that it be placed in 32-bit protected mode. This is done by 32-bit operating systems and some Extenders. Running in 32-bit protected mode increases the 486's segment size from 64 Kbytes to 4 Gigabytes and breaks the 640K DOS barrier. This makes it possible to access

arrays larger than 64K using the 486's 32-bit "flat" model, which runs 2 to 4 times faster than the huge model employed by 16-bit compilers. 32-bit tools also simplify ports. Programs written for mainframes often assume that integers and pointers are 32-bits long or depend on binary representations, especially when written in Fortran 66 and C. Our 32-bit NDP compilers eliminate porting headaches by providing the extensions you need to recompile your VMS, VS, Cray and MS codes. We also sell the IMSL, NAG and VAST II tools that frequently get bundled with mainframes.

Before you give up on your 486, give us a ring. Whether you are looking for the 5 megaflops your 486 produces by itself, the 12 megaflops it delivers with a Weitek 4167 or possibly the 80 megaflops we can coax out of our Number Smasher-860, you owe it to yourself to contact our excellent Tech Support Staff today. Microway has had the answers to your PC performance problems since 1982!

Phone: (508) 746-7341  
Fax: (508) 746-4678

## 386, 486 and i860 Compilers

Microway's **NDP** family of 32-bit compilers generate globally optimized mainframe quality code that runs on the 386, 486 and i860. They require the use of 32-bit operating systems such as OS/2, UNIX, Xenix, Solaris, Coherent, DESQview/X and DPML and VCPI DOS Extenders.

**NDP Fortran™** is a full F77 with F66, DOD, VMS and MS extensions.

**NDP C/C++™** includes a full C compiler that runs in both K&R and ANSI modes plus a C++ compiler that is Release 2.1 compliant.

**NDP Pascal™** is a full ISO Level 1 Pascal with BSD extensions that can interface the NDP C runtime libraries.

### NDP Language Pricing

**Coherent** versions use the Coherent tools and support the x87 family.....\$295

**MS-DOS** versions include a VCPI virtual memory DOS Extender, a DPML interface layer, support for the x87 and Weitek coprocessors, NDPLink, NDPLib and GREX - our DOS graphics library. The 486 version adds 486 code generation, royalty free DPML and VCPI plus ClearView, Microway's symbolic debugger.

386 Release.....\$595

486 Release.....\$995

**OS/2** releases include x87 support, a WorkFrame interface and our 486 extensions. These tools work with the IBM Linker. C/C++ includes the portions of the IBM Tool Kit needed to interface the PM API's.....\$695

**UNIX/Xenix 386/486** use the native tools on the system in question. V.3 and V.4 versions are available.....\$1195

**DESQview/X**.....\$1195

## Coprocessors

**Weitek** 4167 25/33 \$350/\$795 3167 \$200/\$250  
**Cyrix** D8733/40..\$99/129 S87..\$79 EMC \$250  
**Intel** 387SX..\$80 387DX..\$85 287..\$80  
OverDrive 25 MHz \$475..33 MHz \$675

## i860 Supercomputers

**QuadPuter-860** The world's most cost effective SuperComputer, the QuadPuter comes with four modules each of which has an i860 and two megabytes of local memory. The modules sit on an EISA base board that can be purchased with 8 or 32 megabytes of shared memory. Five QuadPuters have an aggregate throughput of a gigaflop! The card comes with one NDP language plus MAX-860.  
From.....\$9995

**Number Smasher-860** our ISA card can be purchased with 8/32 megabytes of memory running at 33 or 40 MHz. Options include EISA and ISA Fifos, a P version with built-in Fifos for distributed parallel processing and a 24-bit graphics buffer. The card includes one NDP Language plus OS860. From.....\$3995

**NDP Fortran-860** along with our C/C++ and Pascal utilize advanced scalar code generation techniques designed to optimize the i860's RISC performance. The languages run on DOS, UNIX, OS/2 and i860 UNIX V.4 Workstations.....\$1995

**PPS-860** postprocessing scheduler, takes assembler output and converts scalar operations into pipelined. It also reschedules using dual instructions. Scalar speed ups in the range of 10 to 40% are produced.....\$595

**VAST-II** from PSR is the same vectorizer that is used with Cray's.....\$1495

## AT Accelerators

**FASTCache-X86/Plus™** — The "Windows Solution" - easily converts your 286 based PC into a 386/486 powered workaholic. The board takes up a slot in AT bus designs and has sockets for up to 16 megabytes of DRAM. It plugs into your 286 using a cable. The PS/2 version has no memory. All boards have a 16K four way cache and run at 25 MHz. Two processors are available, including the Cyrix CX486SLC.  
From.....\$399

## 486 Workstations

A Microway Black Tower is the ideal solution to your 486 needs. They feature industrial grade American power supplies, heavy duty cooling and easy access. All motherboards are carefully burned in before shipping and equipped with heavy duty power connectors. Our BX Towers are ideal for use as desktop workstations, file servers, RAID servers and CAD/CAM stations. They were originally engineered to house i860 arrays, which frequently get attached to SUN Networks as computational servers. We customize each system with the OS of your choice, including UNIX, OS/2, DOS and Windows. The base systems listed include case, 4 MB, tactile response keyboard, supply, floppy and mouse. The B<sup>2</sup>T is our tall tower, the B<sup>3</sup> is a larger box that features front and side hinged panels. All but the 386 system use industrial supplies and the B<sup>3</sup> is available with a 12 slot EISA channel. To see why Microway systems have earned an international reputation for outstanding design, price/performance, value and reliability, ask for our **BX Series Catalogue**.

|   |      |        |
|---|------|--------|
| <b>386B<sup>2</sup>T-40</b> ISA 64K Cache       | 200W | \$1395 |
| <b>486B<sup>2</sup>T-33</b> ISA 64K "           | 250W | \$2495 |
| <b>486B<sup>2</sup>T-33</b> EISA 256K "         | 250W | \$3395 |
| <b>486B<sup>2</sup>T-50</b> EISA 256K "         | 250W | \$3995 |
| <b>486B<sup>3</sup>-50</b> EISA 256K "          | 350W | \$4495 |
| <b>486B<sup>3</sup>-66</b> EISA 512K & 12 Slots | 350W | \$5495 |

## 386, 486, i860 Libraries

**NDP IMSL** Microway compiled and validated version of the IMSL mainframe libraries, available for the 386/486 and i860.....\$2,000

**NDP NAG** Microway compiled and validated NAG Workstation library, available for the 386/486 and i860. 386/486.....\$995, i860.....\$1495

**KUCK & ASSOCIATES** hand coded i860 libraries. DSP library does 1024 real FFT in 500 microseconds! DSP..\$750 BLAS..\$500

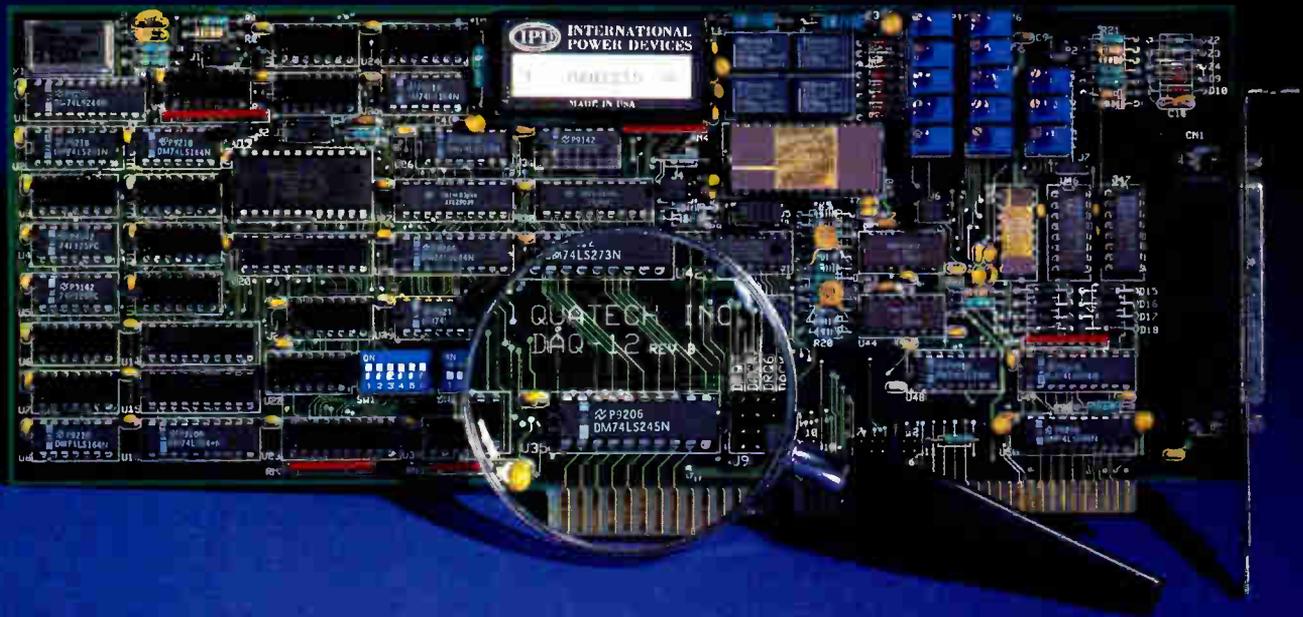
**LAPACK and BLAS** vectorized, sources included. 386/486.....\$295 i860.....\$495

# Microway<sup>®</sup>

## Technology you can count on!

Research Park, Box 79, Kingston, MA 02364 USA (508) 746-7341 FAX (508) 746-4678  
Kingston-Upon-Thames, U.K., 081-541-5466 Spain/Portugal 351-1-604-049  
Germany 069-752023 Greece 30 12915672 Italy 02 7490749 Japan 047 423 1322 Poland 22-414115

# If your board doesn't say Quatech Inc., you may be missing something...



Ask a Quatech sales Engineer to show you  
the value of quality, service and support.

- Quatech manufactures a complete line of data acquisition, communication, and Micro Channel boards for the PC AT/XT, PS/2 and compatible computers.
- Quatech's user friendly software drivers enable our full featured adapters to support most popular operating systems.
- Quatech's adapters are backed by our free on-line technical support.



For a free catalog call: **800-553-1170**

International: Australia/Interworld Electronics 03-563-7066, Canada (Western)/Interworld VCR 604-984-4171 (Toronto office 416-513-7027), England/Diamond Point International 634-722-390, Finland/Lab Hitech OY 358-0-804-2522, France/Elexo 33-1-69302880, Germany/Jupiter Electronic Systems 06181/75041, Israel/RCM Ltd. 972-03-5447885, Italy/N.C.S. Computer Italia 0331/770-016, Netherlands/ACAL Auriema 040-816565, Korea/Sam Boo Enterprise Co. 82-2-538-4001, Spain SANTA Barbara SA 34-3-203-9916, Singapore Bliss Services Pte Ltd (65) 338-1300. IBM PC-XT, AT, PS/2 and MicroChannel are registered trademarks of IBM Corp.



**662 Wolf Ledges Parkway  
Akron, Ohio 44311 U.S.A.  
216-434-3154**



# BUY IT THROUGH **BYTE**

## Mail Order

The latest offerings from vendors supplying products of all leading manufacturers at extremely competitive prices.

**214**

## Hardware/Software Showcase

This *categorized* four-color display section makes it easy to find Hardware and Software products from a wide variety of manufacturers and suppliers.

**235**

## Buyer's Mart

From Accessories to Laptops to Word Processors, you can easily find the dealers you are looking for in this directory of products and services.

**244**

ILLUSTRATION: SUSAN KINGSBURY

GOVERNMENT, SCHOOL AND CORPORATE ORDERS WELCOME TO RECEIVE YOUR FREE COPY OF OUR PRODUCT CATALOG. JUST CALL.

All specifications subject to change without notice. 2-Year Parts Warranty applies to advertised LodeStar systems only. Money Back Guarantee does not include shipping & handling, and all returns must be shipped pre-paid & in reasonable condition. Please call to confirm all warranty details. Photography is for illustration only. No surcharge on VISA, MasterCard & Discover. Purchase orders are accepted on approved credit. California orders add 8.25% sales tax. All product names, trademarks and registered trademarks are the property of their respective companies. © 1992 LodeStar Computer Corp.

Open Hours:  
Mon-Fri: 7am-7pm (PST)  
Sat: 9am-4pm (PST)

Circle 204 on Inquiry Card.

WorldRadioHistory.com



## Rack Mount Computers - Motherboard or Passive Backplane

Use external monitor  
Up to 6 drives



8.75" high

Mono or color monitor  
Up to 5 drives



8.75" high

14" color monitor  
Up to 3 drives



12.25" high

## Rack Mount Monitors

10" mono or color  
monitor



8.75" high

14" mono or color  
monitor



12.25" high

Enclosure for most  
desk top monitors



14.0" high

## Rack Mount Keyboards

Drawer mounted  
keyboard



1.75" high

Drawer for desk top  
keyboards



3.5" high

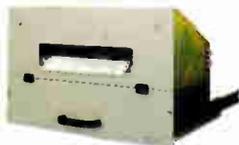
Vertical-mount, sealed  
membrane keyboard



5.25" high

## Rack Mount Printer

Dot matrix printer with  
industrial rating



12.25" high

Call for our other Rack Mount computer  
and "enclosure only" product offerings.

# RECORTEC, INC.

1290 Lawrence Station Road, Sunnyvale CA 94089  
Tel. [408] 734-1290 Fax: [408] 734-2140

## 1-800-729-7654

# 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.

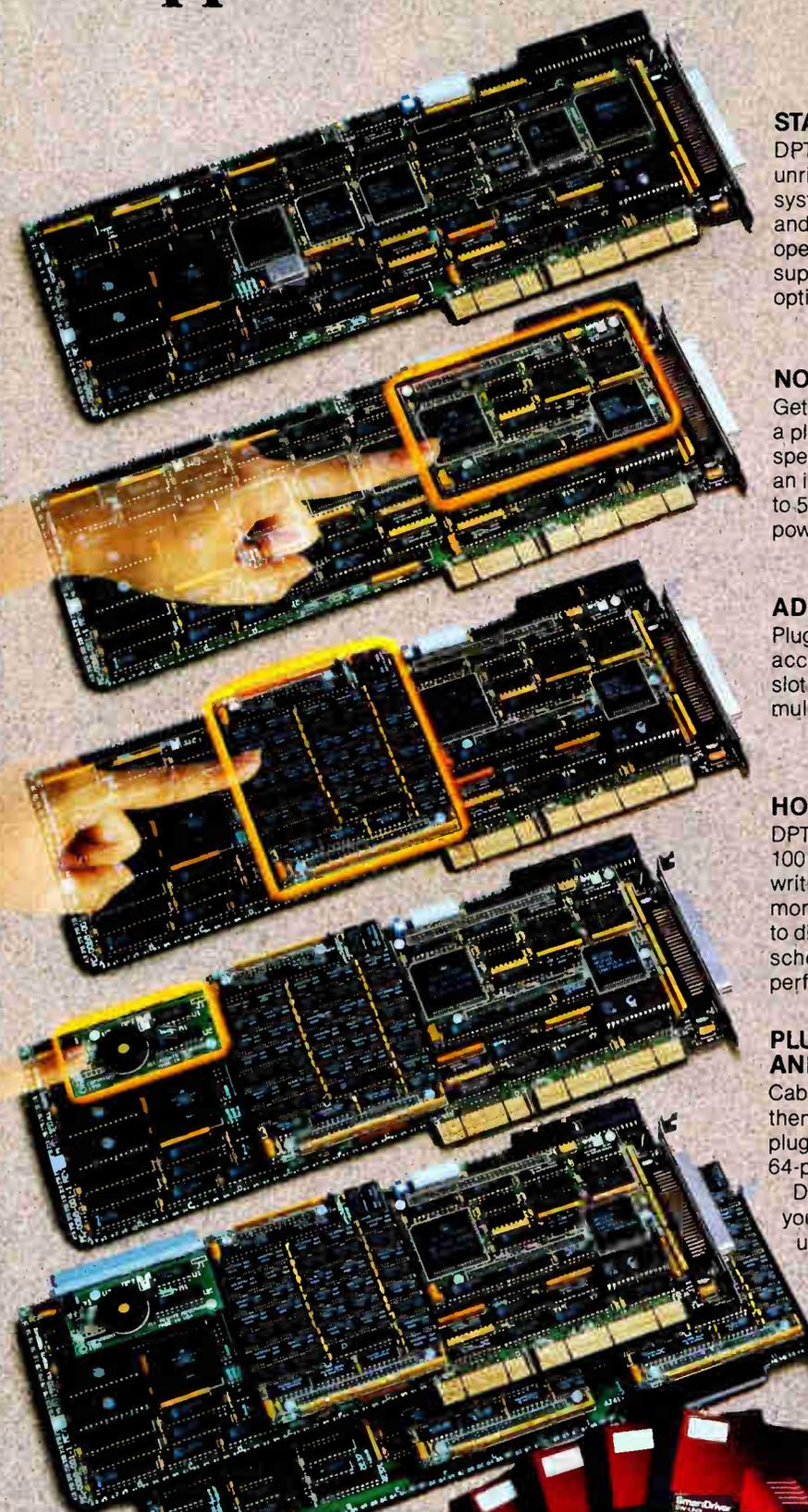
## HOW ABOUT DISK MIRRORING?

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!

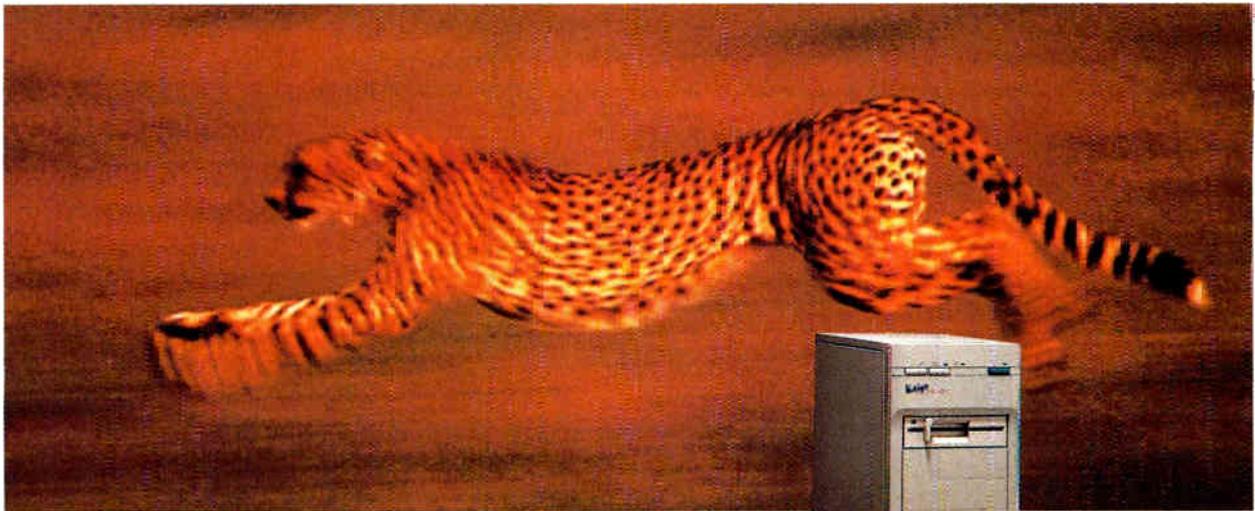
DPT has your solution—no matter how you grow. Performance, compatibility and upgradability make SmartCache Plus the only SCSI controller you'll ever need. For details, contact Distributed Processing Technology, 140 Candace Drive, Maitland, FL 32751. Phone (407) 830-5522; FAX (407) 260-5366.



**DPT**

Circle 195 on Inquiry Card (RESELLERS: 196)

# Speed that Excels



The power, reliability and price of Kaiyo computers make them stand out among other leading computer systems. Thanks to the Local Bus VGA design, Kaiyo offers you the best performance, especially in the CAD and windows environments.

Rated by Chip Magazine of Germany as its January "Tip of the Month", Kaiyo enhances video performance by more than ten-times that of normal VGA display. In utilizing a full 32-bit CPU bus. Kaiyo's local bus design lets VGAs operate at the processor's clock speed. This versatile series includes a comprehensive range of PCs guaranteed to meet the needs of all your customers. It features up to 66 MHz 80486DX2 EISA bus microprocessors so they'll never be at a loss for computer power. Incorporating the most advanced

microprocessor technology, Kaiyo has among the smallest, yet most powerful compact desktop computers in the world.

But don't just take our word for it. Over the years, our Group has established a strong base of over 190 active customers in 46 countries. We're particularly strong in Western Europe, especially Germany. And our sales in Eastern Europe have increased

by over 74% over the last year.

Team up with us— long-term business partner that support you every step of the way.

Visit us at:  
HANNOVER FAIR / CEBIT '93  
Booth # 2, A18-D17  
Mar. 24-31, 1993



"The Intel Logo is a trademark of Intel Corporation"

(All brand names are registered trademarks of their respective owner.)



## Ocean Office Automation Ltd.

Head Office: Ocean Office Automation Ltd.  
4th & 5th Floor, Kader Industrial Building, 22 Kai Cheung Road, Kowloon Bay, Kowloon, Hong Kong.  
Tel: (852) 3051800 Telex: 52289 OCCOM HK Fax: (852) 799 2398 (5 lines)

U.S.A. Office: Ocean Information Systems, Inc.  
12155 Mora Dr. Suite 6, Santa Fe Springs, CA 90670, U.S.A.  
Tel: (213) 946 5888 Fax: (213) 946 0929

For US Enquiry—Call Toll Free: 1-800-32-KAIYO (52496)

# Kaiyo

## The Power In PCs

Circle 213 on Inquiry Card (RESELLERS: 214).

# MEMORY... YOU JUST CAN'T DO WITHOUT IT.

## Picture this:

You bought a new software package. You try it out on your computer and soon find yourself working for hours on a sophisticated graphic design. While scrolling through your worksheet, it feels like you are moving through pudding. Your hard disk has a tough time trying to catch up. You then try to print, but the laser printer's buffer is full. You reset it, try again, and find that it spits out only part of your beautiful graphic...

## No problem!

We'll take it from here. With our **JetRam™** line that supports the leading brands of laser printers and **PcRam™** line that upgrades your Notebook, Laptop or Desktop computers, Transcend can help solve your memory problems.

## What you get from our memory upgrades

- Life time warranty on all our products
- Full memory lines support a variety of brand names of laser printers and PCs
- High quality at a reasonable price
- Easy-to-install

Office hours: 6:00 a.m. to 6:00 p.m. Mon. to Fri.

**"You order in the morning, we will ship in the afternoon."**



\* All brand names are registered trademarks of their respective owners.

## Transcend

Your Supplier, Your Partner,  
Your Friend.

220 BYTE • MARCH 1993

## Transcend Information Inc.

104 Exchange Place,  
Pomona, CA 91768 U.S.A.

TEL: (909) 598-5500

FAX: (909) 598-5050, (909) 598-6050

3Fl., No. 465, Chung Hsiao East Road,  
Sec. 6, Taipei, Taiwan, R.O.C.

TEL: (886) 2-7881000

FAX: (886) 2-7881919, 7889191

Circle 210 on Inquiry Card (RESELLERS: 211).

# NEVADA COMPUTER MEMORY SALE 4 MEG X 9, 800MS \$124

IN STOCK WITH 5 YEAR WARRANTY! GUARANTEED LOWEST PRICE

## SOFTWARE LIQUIDATION WORDSTAR

Wordstar 2000 Rel. 3.5  
This is not a misprint. These are the exact same ones selling for over \$3000 from our competitors. We have thousands in stock. FOR SALE BELOW

**\$69**

DEALERS WELCOME  
RETAIL BOXED & FACTORY SEALED  
100 FOR \$55 EACH

## COMPUTER PERIPHERALS INC.

### MEMOS

2400 Internal, 1/4 Card for IBM PC, XT, AT and compatibles. CGIT V.2200 & V22 and Ball 212A. Auto dial/Auto answer. Supports Com1, 1/4RQ 2-5. Software included, \$59

2400 External, same as above plus 1 LED status light, requires serial port, \$69

### FAX MODEM

9600 BPS Group III Facsimile, 2400 BPS Hayes Compatible Modem. True Background Send and Receive. Menu Driven, Command Line, Normal and Fine Mode. Hall Card.

One Year Warranty  
**\$68**

## intel CPU's

|             |       |             |      |
|-------------|-------|-------------|------|
| 80386 SX/16 | \$29  | 386DX       |      |
| 80386 SX/20 | \$39  | 80386 DX/20 | \$39 |
| 80386 SX/25 | \$49  | 80386 DX/25 | \$71 |
| 80386 SX/33 | \$59  | 80386 DX/33 | \$81 |
| 80486 DX/25 | \$299 |             |      |
| 80486 DX/33 | \$349 |             |      |
| 80486 DX/50 | \$549 |             |      |
| 80486 DX/66 | \$699 |             |      |
| 80486 SX/25 | \$189 |             |      |
| 80486 SX/30 | \$124 |             |      |

## 386 CPU UPGRADES

For Windows 3.0, OS/2 and 386 software. SX/NOW improves system performance by up to 350%. Available for HP ES/286/12 & ES 8, EPSON EQUITY line & its, IBM ORIGINAL AT & XT/286, AGI 1800A, 1800B & 1800C, AST TREASURE 286, BRACV 286, COMPAQ PORTABLE III, DESKPRO 286, NEC POWERMATE 286+ & PORTABLE+, IBM PS/2, 25/286, 30/286, 50, 50, 60

|               |       |
|---------------|-------|
| 2.5MHz SX/NOW | \$349 |
| 3.3MHz SX/NOW | \$399 |
| 4.0MHz SX     | \$499 |
| 4.8MHz SX     | \$599 |
| 8.0MHz SX     | \$899 |

## intel COPROCESSORS

| 80387 BASED MACHINES | 80386 BASED MACHINES | 80386 BASED MACHINES |       |
|----------------------|----------------------|----------------------|-------|
| 80387 286            | \$49                 | 80387 286            | \$49  |
| 80387 386            | \$89                 | 80387 386            | \$89  |
| 80387 486            | \$129                | 80387 486            | \$129 |
| 80387 586            | \$169                | 80387 586            | \$169 |
| 80387 686            | \$209                | 80387 686            | \$209 |
| 80387 786            | \$249                | 80387 786            | \$249 |
| 80387 886            | \$289                | 80387 886            | \$289 |
| 80387 986            | \$329                | 80387 986            | \$329 |

## Overdrives

|                   |        |
|-------------------|--------|
| 80486 SX to 386DX | \$499  |
| 80486 SX to 486DX | \$599  |
| 80486 SX to 586DX | \$699  |
| 80486 SX to 686DX | \$799  |
| 80486 SX to 786DX | \$899  |
| 80486 SX to 886DX | \$999  |
| 80486 SX to 986DX | \$1099 |

## Grix COPROCESSORS AND CPU's

Plug compatible with Intel, the times lasted 5 year warranty

|                     |        |
|---------------------|--------|
| CRX87 8307 33MHz    | \$88   |
| CRX87 8307 40MHz    | \$104  |
| CRX87 8307 50MHz    | \$118  |
| CRX87 8307 60MHz    | \$132  |
| CRX87 8307 80MHz    | \$146  |
| CRX87 8307 100MHz   | \$160  |
| CRX87 8307 120MHz   | \$174  |
| CRX87 8307 150MHz   | \$188  |
| CRX87 8307 200MHz   | \$202  |
| CRX87 8307 250MHz   | \$216  |
| CRX87 8307 300MHz   | \$230  |
| CRX87 8307 350MHz   | \$244  |
| CRX87 8307 400MHz   | \$258  |
| CRX87 8307 450MHz   | \$272  |
| CRX87 8307 500MHz   | \$286  |
| CRX87 8307 550MHz   | \$300  |
| CRX87 8307 600MHz   | \$314  |
| CRX87 8307 650MHz   | \$328  |
| CRX87 8307 700MHz   | \$342  |
| CRX87 8307 750MHz   | \$356  |
| CRX87 8307 800MHz   | \$370  |
| CRX87 8307 850MHz   | \$384  |
| CRX87 8307 900MHz   | \$398  |
| CRX87 8307 950MHz   | \$412  |
| CRX87 8307 1000MHz  | \$426  |
| CRX87 8307 1050MHz  | \$440  |
| CRX87 8307 1100MHz  | \$454  |
| CRX87 8307 1150MHz  | \$468  |
| CRX87 8307 1200MHz  | \$482  |
| CRX87 8307 1250MHz  | \$496  |
| CRX87 8307 1300MHz  | \$510  |
| CRX87 8307 1350MHz  | \$524  |
| CRX87 8307 1400MHz  | \$538  |
| CRX87 8307 1450MHz  | \$552  |
| CRX87 8307 1500MHz  | \$566  |
| CRX87 8307 1550MHz  | \$580  |
| CRX87 8307 1600MHz  | \$594  |
| CRX87 8307 1650MHz  | \$608  |
| CRX87 8307 1700MHz  | \$622  |
| CRX87 8307 1750MHz  | \$636  |
| CRX87 8307 1800MHz  | \$650  |
| CRX87 8307 1850MHz  | \$664  |
| CRX87 8307 1900MHz  | \$678  |
| CRX87 8307 1950MHz  | \$692  |
| CRX87 8307 2000MHz  | \$706  |
| CRX87 8307 2050MHz  | \$720  |
| CRX87 8307 2100MHz  | \$734  |
| CRX87 8307 2150MHz  | \$748  |
| CRX87 8307 2200MHz  | \$762  |
| CRX87 8307 2250MHz  | \$776  |
| CRX87 8307 2300MHz  | \$790  |
| CRX87 8307 2350MHz  | \$804  |
| CRX87 8307 2400MHz  | \$818  |
| CRX87 8307 2450MHz  | \$832  |
| CRX87 8307 2500MHz  | \$846  |
| CRX87 8307 2550MHz  | \$860  |
| CRX87 8307 2600MHz  | \$874  |
| CRX87 8307 2650MHz  | \$888  |
| CRX87 8307 2700MHz  | \$902  |
| CRX87 8307 2750MHz  | \$916  |
| CRX87 8307 2800MHz  | \$930  |
| CRX87 8307 2850MHz  | \$944  |
| CRX87 8307 2900MHz  | \$958  |
| CRX87 8307 2950MHz  | \$972  |
| CRX87 8307 3000MHz  | \$986  |
| CRX87 8307 3050MHz  | \$1000 |
| CRX87 8307 3100MHz  | \$1014 |
| CRX87 8307 3150MHz  | \$1028 |
| CRX87 8307 3200MHz  | \$1042 |
| CRX87 8307 3250MHz  | \$1056 |
| CRX87 8307 3300MHz  | \$1070 |
| CRX87 8307 3350MHz  | \$1084 |
| CRX87 8307 3400MHz  | \$1098 |
| CRX87 8307 3450MHz  | \$1112 |
| CRX87 8307 3500MHz  | \$1126 |
| CRX87 8307 3550MHz  | \$1140 |
| CRX87 8307 3600MHz  | \$1154 |
| CRX87 8307 3650MHz  | \$1168 |
| CRX87 8307 3700MHz  | \$1182 |
| CRX87 8307 3750MHz  | \$1196 |
| CRX87 8307 3800MHz  | \$1210 |
| CRX87 8307 3850MHz  | \$1224 |
| CRX87 8307 3900MHz  | \$1238 |
| CRX87 8307 3950MHz  | \$1252 |
| CRX87 8307 4000MHz  | \$1266 |
| CRX87 8307 4050MHz  | \$1280 |
| CRX87 8307 4100MHz  | \$1294 |
| CRX87 8307 4150MHz  | \$1308 |
| CRX87 8307 4200MHz  | \$1322 |
| CRX87 8307 4250MHz  | \$1336 |
| CRX87 8307 4300MHz  | \$1350 |
| CRX87 8307 4350MHz  | \$1364 |
| CRX87 8307 4400MHz  | \$1378 |
| CRX87 8307 4450MHz  | \$1392 |
| CRX87 8307 4500MHz  | \$1406 |
| CRX87 8307 4550MHz  | \$1420 |
| CRX87 8307 4600MHz  | \$1434 |
| CRX87 8307 4650MHz  | \$1448 |
| CRX87 8307 4700MHz  | \$1462 |
| CRX87 8307 4750MHz  | \$1476 |
| CRX87 8307 4800MHz  | \$1490 |
| CRX87 8307 4850MHz  | \$1504 |
| CRX87 8307 4900MHz  | \$1518 |
| CRX87 8307 4950MHz  | \$1532 |
| CRX87 8307 5000MHz  | \$1546 |
| CRX87 8307 5050MHz  | \$1560 |
| CRX87 8307 5100MHz  | \$1574 |
| CRX87 8307 5150MHz  | \$1588 |
| CRX87 8307 5200MHz  | \$1602 |
| CRX87 8307 5250MHz  | \$1616 |
| CRX87 8307 5300MHz  | \$1630 |
| CRX87 8307 5350MHz  | \$1644 |
| CRX87 8307 5400MHz  | \$1658 |
| CRX87 8307 5450MHz  | \$1672 |
| CRX87 8307 5500MHz  | \$1686 |
| CRX87 8307 5550MHz  | \$1700 |
| CRX87 8307 5600MHz  | \$1714 |
| CRX87 8307 5650MHz  | \$1728 |
| CRX87 8307 5700MHz  | \$1742 |
| CRX87 8307 5750MHz  | \$1756 |
| CRX87 8307 5800MHz  | \$1770 |
| CRX87 8307 5850MHz  | \$1784 |
| CRX87 8307 5900MHz  | \$1798 |
| CRX87 8307 5950MHz  | \$1812 |
| CRX87 8307 6000MHz  | \$1826 |
| CRX87 8307 6050MHz  | \$1840 |
| CRX87 8307 6100MHz  | \$1854 |
| CRX87 8307 6150MHz  | \$1868 |
| CRX87 8307 6200MHz  | \$1882 |
| CRX87 8307 6250MHz  | \$1896 |
| CRX87 8307 6300MHz  | \$1910 |
| CRX87 8307 6350MHz  | \$1924 |
| CRX87 8307 6400MHz  | \$1938 |
| CRX87 8307 6450MHz  | \$1952 |
| CRX87 8307 6500MHz  | \$1966 |
| CRX87 8307 6550MHz  | \$1980 |
| CRX87 8307 6600MHz  | \$1994 |
| CRX87 8307 6650MHz  | \$2008 |
| CRX87 8307 6700MHz  | \$2022 |
| CRX87 8307 6750MHz  | \$2036 |
| CRX87 8307 6800MHz  | \$2050 |
| CRX87 8307 6850MHz  | \$2064 |
| CRX87 8307 6900MHz  | \$2078 |
| CRX87 8307 6950MHz  | \$2092 |
| CRX87 8307 7000MHz  | \$2106 |
| CRX87 8307 7050MHz  | \$2120 |
| CRX87 8307 7100MHz  | \$2134 |
| CRX87 8307 7150MHz  | \$2148 |
| CRX87 8307 7200MHz  | \$2162 |
| CRX87 8307 7250MHz  | \$2176 |
| CRX87 8307 7300MHz  | \$2190 |
| CRX87 8307 7350MHz  | \$2204 |
| CRX87 8307 7400MHz  | \$2218 |
| CRX87 8307 7450MHz  | \$2232 |
| CRX87 8307 7500MHz  | \$2246 |
| CRX87 8307 7550MHz  | \$2260 |
| CRX87 8307 7600MHz  | \$2274 |
| CRX87 8307 7650MHz  | \$2288 |
| CRX87 8307 7700MHz  | \$2302 |
| CRX87 8307 7750MHz  | \$2316 |
| CRX87 8307 7800MHz  | \$2330 |
| CRX87 8307 7850MHz  | \$2344 |
| CRX87 8307 7900MHz  | \$2358 |
| CRX87 8307 7950MHz  | \$2372 |
| CRX87 8307 8000MHz  | \$2386 |
| CRX87 8307 8050MHz  | \$2400 |
| CRX87 8307 8100MHz  | \$2414 |
| CRX87 8307 8150MHz  | \$2428 |
| CRX87 8307 8200MHz  | \$2442 |
| CRX87 8307 8250MHz  | \$2456 |
| CRX87 8307 8300MHz  | \$2470 |
| CRX87 8307 8350MHz  | \$2484 |
| CRX87 8307 8400MHz  | \$2498 |
| CRX87 8307 8450MHz  | \$2512 |
| CRX87 8307 8500MHz  | \$2526 |
| CRX87 8307 8550MHz  | \$2540 |
| CRX87 8307 8600MHz  | \$2554 |
| CRX87 8307 8650MHz  | \$2568 |
| CRX87 8307 8700MHz  | \$2582 |
| CRX87 8307 8750MHz  | \$2596 |
| CRX87 8307 8800MHz  | \$2610 |
| CRX87 8307 8850MHz  | \$2624 |
| CRX87 8307 8900MHz  | \$2638 |
| CRX87 8307 8950MHz  | \$2652 |
| CRX87 8307 9000MHz  | \$2666 |
| CRX87 8307 9050MHz  | \$2680 |
| CRX87 8307 9100MHz  | \$2694 |
| CRX87 8307 9150MHz  | \$2708 |
| CRX87 8307 9200MHz  | \$2722 |
| CRX87 8307 9250MHz  | \$2736 |
| CRX87 8307 9300MHz  | \$2750 |
| CRX87 8307 9350MHz  | \$2764 |
| CRX87 8307 9400MHz  | \$2778 |
| CRX87 8307 9450MHz  | \$2792 |
| CRX87 8307 9500MHz  | \$2806 |
| CRX87 8307 9550MHz  | \$2820 |
| CRX87 8307 9600MHz  | \$2834 |
| CRX87 8307 9650MHz  | \$2848 |
| CRX87 8307 9700MHz  | \$2862 |
| CRX87 8307 9750MHz  | \$2876 |
| CRX87 8307 9800MHz  | \$2890 |
| CRX87 8307 9850MHz  | \$2904 |
| CRX87 8307 9900MHz  | \$2918 |
| CRX87 8307 9950MHz  | \$2932 |
| CRX87 8307 10000MHz | \$2946 |

## HARD DRIVE SALE

Seagate

| MODEL            | SIZE   | SPEED | TYPE        | PRICE  |
|------------------|--------|-------|-------------|--------|
| ST225            | 20MB   | 45MS  | MFM Full HT | \$149  |
| ST406            | 40MB   | 28MB  | MFM Full HT | \$349  |
| ST251-1          | 42MB   | 28MS  | IDE 5.25"   | \$329  |
| ST351A (1 1/2")  | 42MB   | 28MS  | IDE 3.5"    | \$299  |
| ST3120A (1 1/2") | 105MB  | 18MS  | IDE 3.5"    | \$299  |
| ST3144A (1 1/2") | 130MB  | 16MS  | IDE 3.5"    | \$329  |
| ST3283A (1 1/2") | 240MB  | 12MS  | IDE 3.5"    | \$489  |
| ST1480N          | 42MB   | 45MS  | SCSI 5.25"  | \$199  |
| ST4120N          | 1037MB | 15MS  | SCSI/FH     | \$1499 |
| ST4766N          | 660MB  | 15MS  | SCSI/FH     | \$899  |

## CONNER

| MODEL             | SIZE  | SPEED | TYPE | PRICE  |
|-------------------|-------|-------|------|--------|
| CP300E (1 1/2")   | 40MB  | 19MS  | IDE  | \$129  |
| CP300E4E          | 80MB  | 19MS  | IDE  | \$219  |
| CP3010 (1 1/2")   | 120MB | 19MS  | IDE  | \$299  |
| CP3012AA (1 1/2") | 170MB | 17MS  | IDE  | \$349  |
| CP3024A           | 200MB | 15MS  | IDE  | \$419  |
| CP3544A           | 325MB | 15MS  | IDE  | \$1045 |
| CP3544            | 340MB | 15MS  | SCSI | \$1045 |

## Maxtor

| MODEL          | SIZE   | SPEED | TYPE | PRICE  |
|----------------|--------|-------|------|--------|
| 2850 (1 1/2")  | 80MB   | 17MS  | IDE  | \$249  |
| 7120A (1 1/2") | 130MB  | 15MS  | IDE  | \$283  |
| 1213A (1 1/2") | 213MB  | 15MS  | IDE  | \$389  |
| 1213S (1 1/2") | 213MB  | 15MS  | SCSI | \$429  |
| 12730A         | 340MB  | 15MS  | IDE  | \$619  |
| 12730S         | 340MB  | 15MS  | SCSI | \$659  |
| PANTHER (FH)   | 1000MB | 13MS  | IDE  | \$1489 |
| MAX1175 (FH)   | 1500MB | 13MS  | SCSI | \$1749 |

## FUJITSU

| MODEL          | SIZE   | SPEED | TYPE     | PRICE  |
|----------------|--------|-------|----------|--------|
| 2422A (3 1/2") | 330MB  | 12MS  | SCSI/IDE | \$845  |
| 2623A (3 1/2") | 420MB  | 12MS  | SCSI/IDE | \$899  |
| 2624A (3 1/2") | 520MB  | 12MS  | SCSI/IDE | \$949  |
| 2766S (FH)     | 1080MB | 14MS  | SCSI     | \$1149 |
| 2852S (FH)     | 1750MB | 14MS  | SCSI     | \$2099 |

## MICROPOLIS

| MODEL         | SIZE   | SPEED | TYPE     | PRICE  |
|---------------|--------|-------|----------|--------|
| 1624 (FH)     | 660MB  | 15MS  | SCSI     | \$1199 |
| 2850 (1 1/2") | 1050MB | 10MS  | SCSI/IDE | \$1149 |
| 1598 (FH)     | 1050MB | 14MS  | SCSI     | \$1199 |
| 1548 (FH)     | 1748MB | 14MS  | SCSI     | \$2299 |
| 1528-15 (FH)  | 1350MB | 14MS  | SCSI     | \$1749 |
| 1924 (FH)     | 2100MB | 14MS  | SCSI     | \$3299 |

## LAPTOP & NOTEBOOK HARD DRIVES

| MODEL | SIZE | SPEED | TYPE  | PRICE |
|-------|------|-------|-------|-------|
| 60MB  | 2.5" | 15MS  | \$319 |       |
| 85MB  | 2.5" | 15MS  | \$339 |       |
| 130MB | 2.5" | 17MS  | \$499 |       |

## Floppy Drives

| MODEL       | SIZE   | SPEED | TYPE | PRICE |
|-------------|--------|-------|------|-------|
| 360K 5.25"  | 1 1/2" | 16"   | \$29 |       |
| 720K 3.5"   | 1 1/2" | 16"   | \$34 |       |
| 1.2MB 5.25" | 1 1/2" | 16"   | \$38 |       |
| 1.44MB 3.5" | 1 1/2" | 16"   | \$58 |       |
| 5.25"       | 1 1/2" | 16"   | \$5  |       |

## Drive Controllers

| MODEL                               | PRICE |
|-------------------------------------|-------|
| 8Bit 4 Floppy                       | \$41  |
| 8Bit 4 Floppy High Density          | \$41  |
| 8Bit 2 Hard Drives MFM              | \$41  |
| 8Bit 2 Hard Drives RLL              | \$57  |
| 16Bit Hard Drive only               | \$24  |
| 16Bit Hard and Floppy 1.1 Interface | \$34  |
| SCSI IDIC 3280 (Supports 7 drives)  | \$139 |
| SCSI Adaptec 1542B                  | \$224 |
| ESDI ADIC282 24                     | \$149 |
| IDE Hard and Floppy                 | \$72  |
| IDE Hard and Floppy w/IO            | \$90  |
| IDE Hard Drive                      | \$50  |
| Cables Hard and Floppy              | \$30  |
| Cables Hard Drive                   | \$50  |
| Cables Hard and Floppy              | \$30  |

## MONITOR SALE

14" SVGA 1024X768  
With 28 Dot Pitch  
**\$279**

SVGA Interface, 1024x768,  
512K up to 1MBG  
**\$69**

## ZENITH Laptop Memory

| MODEL                      | PRICE          |
|----------------------------|----------------|
| Z-Notebook                 | PC-47-21 \$158 |
| Masterport 386SX, S/C, S/e | PC-49-21 \$488 |

# Micro-International Inc.

since 1984, world-wide distribution of quality computer systems and components



Intel CPU | 486X-25 | 486DX-33 | 486DX-50 | 486DX-66

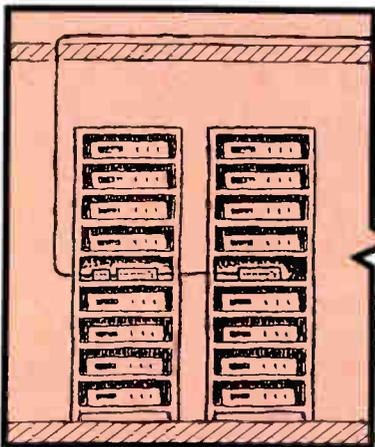
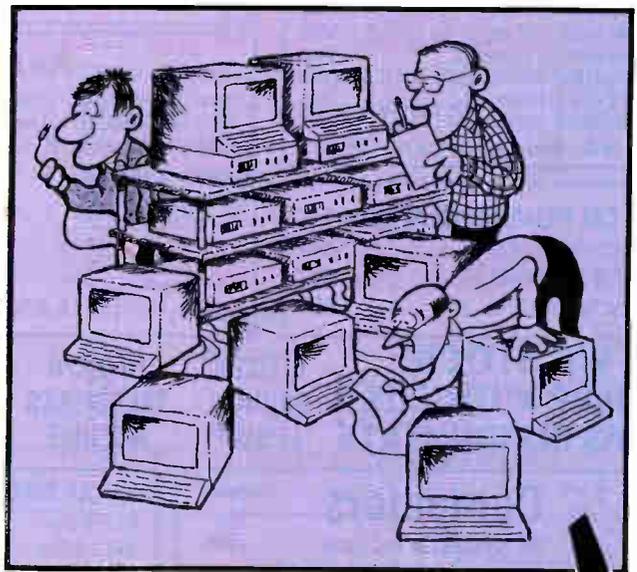
## CONTROL UP TO 96 PC FILE SERVERS WITH 1 KEYBOARD AND MONITOR USING...

# COMMANDER

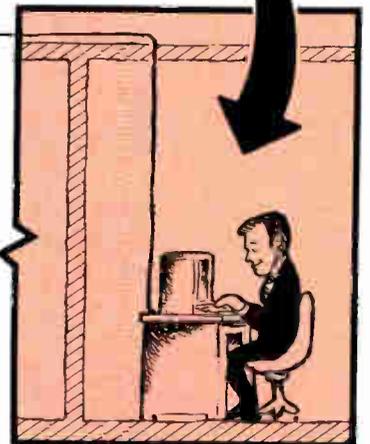
by cybex



- **Select via Keyboard**
- **Dual access up to 250 feet away (optional)**
- **No external power**
- **Mix PC, PC/XT, PC/AT and PS/2**
- **"AutoBoot™" Feature boots attached computers without operator intervention**
- **Shows PC power status**



- **PS/2 Mouse support available**
- **Each unit accommodates from 2 to 8 PCs**
- **Up to 12 units can be cascaded**
- **Mounting kit available for 19" and 24" rack installation**



Dealer Program Available

### Cybex Corporation

2800-H Bob Wallace Ave.  
Huntsville, Alabama 35805

(205) 534-0011

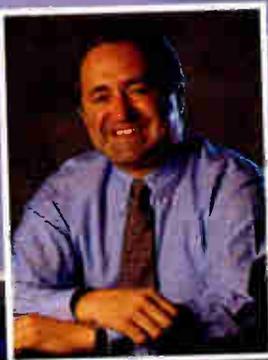
Fax (205) 534-0010

PC, PC/XT, PC/AT and PS/2 are trademarks of International Business Machines Corp.

# "The CAD Experts RAVE, Now I know Why..."

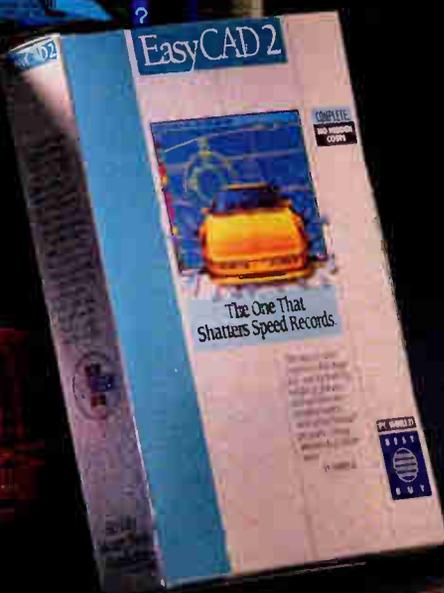
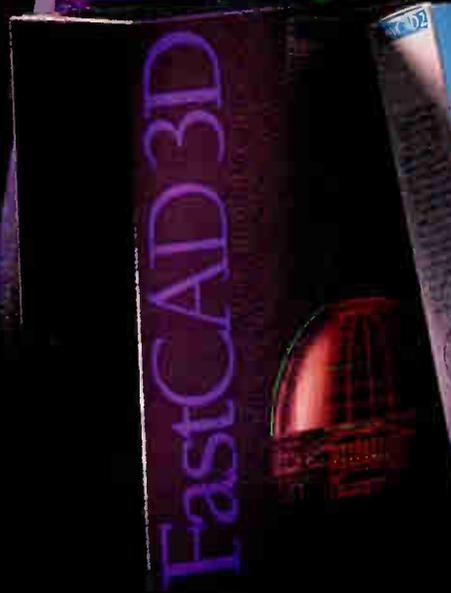
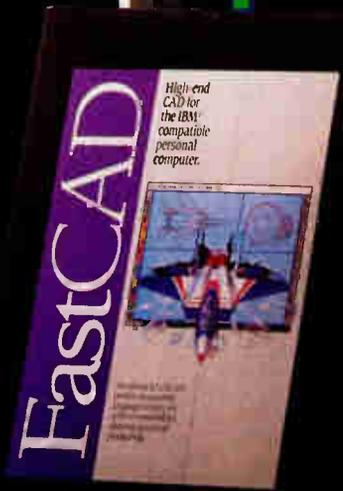
Jim Scalise finds FastCAD®'s speed and ease of use gives more than an increase in quality production time... "We found other systems difficult to learn, but FastCAD enabled us to get up and running in short order. Architects that need the fastest CAD system have to see this to believe it. FastCAD really lives up to its name. Without FastCAD it would be tough to compete and we wouldn't have time for the extensive detailed work we consider standard on all construction documents.

*Jim Scalise*  
**Jim Scalise**  
 Nickels + Scalise Architects



Plus, paper storage would be overwhelming and we'd still have 'draftsman's cramp' in our fingers and graphite on our forearms. After winning two National CAD Drawing Contests and elating our clients with FastCAD, it's as easy for me to endorse as it is to use."

If you want to be more competitive, but find yourself short on time, don't delay! Call Evolution Computing today for a free demo at 1-800-874-4028. Free technical support for registered users.



**FREE Hands-On Demo, Call 1-800-874-4028 Now!**

EasyCAD and FastCAD are registered trademarks of Evolution Computing © 1992 Evolution Computing.

Circle 554 on Inquiry Card.

World Radio History

**PC Sources** Kenosha Computer Center offers some of the Best Buys in Mail Order!

Join the thousands of satisfied customers who enjoy our combination of price, service, and speed of delivery.

• No Surcharge on MasterCard or Visa!  
• Kenosha Computer Center is now in its 6th year!

**EPSON**

|                             |                    |        |            |
|-----------------------------|--------------------|--------|------------|
| LX 810                      | .....\$169         | LQ570  | .....\$235 |
| FX 870                      | .....\$265         | LQ870  | .....\$425 |
| FX 1050                     | .....\$349         | LQ1070 | .....\$349 |
| FX1170                      | .....\$349         | LQ1170 | .....\$569 |
| EPL8000                     | .....\$1065        | LQ2550 | .....\$849 |
| Action 3250                 | .....\$189         |        |            |
| Action 1000 6 PPM, 14 fonts | .....\$689         |        |            |
| Action 1500 6 PPM, PLC5     | .....\$889         |        |            |
| DFX 5000/DFX 8000           | .....\$1269/\$2139 |        |            |

Call For Options

**KENOSHA COMPUTER CENTER**  
SALES LINE OUTSIDE WISCONSIN  
**1-800-255-2989**

Shipping, customer service & technical assistance call  
**414-697-9595 • FAX 414-697-0620**  
VISA, MASTERCARD, AMERICAN EXPRESS ACCEPTED

**TEXAS INSTRUMENTS**

|                                  |             |
|----------------------------------|-------------|
| Travelmate 3000-WINSX            | .....\$1749 |
| Travelmate 4000 SX-80mg          | .....\$2199 |
| Travelmate 4000 WINSX 25-120     | .....\$2349 |
| Travelmate 4000 WINDX 120mg      | .....\$2879 |
| Travelmate 4000 Win SLC/25       | .....\$1749 |
| Travelmate 4000 Win DX2/50       | .....\$3399 |
| Travelmate 4000 Win SX/25 Color  | .....\$3199 |
| Travelmate 4000 Win DX2/40 Color | .....\$3899 |

Call For Accessories

**OKIDATA**

|                          |                    |
|--------------------------|--------------------|
| ML320/ML321              | .....\$299/\$419   |
| ML380/ML590              | .....\$219/\$419   |
| ML591/ML393              | .....\$569/\$909   |
| OL 400 Laser/OL 810      | .....\$589/\$1029  |
| OL 820 Laser/OL 830      | .....\$1219/\$1279 |
| Okilaser 400 2MG upgrade | .....\$119         |

**Panasonic**  
Office Automation

|                               |                    |
|-------------------------------|--------------------|
| 1123/1124i                    | .....\$195/\$275   |
| 2180/2123                     | .....\$179/\$229   |
| 1624/1654                     | .....\$339/\$519   |
| 2124/2624                     | .....\$299/\$359   |
| 4410/4430                     | .....\$599/\$859   |
| 4450i/4451                    | .....\$1059/\$1379 |
| 2mg. Upgrade for 4420 & 4450i | .....\$139         |

**HEWLETT-PACKARD**

|                        |             |                  |                  |
|------------------------|-------------|------------------|------------------|
| Laserjet IV w/toner    | .....\$1399 | Deskjet 500/500C | .....\$399/\$509 |
| Laserjet IV M w/toner  | .....Call   | Deskjet 550C     | .....\$729       |
| Laserjet III P w/toner | .....\$979  | Deskjet Portable | .....\$249       |
| Laserjet II P+ w/toner | .....\$809  | Laserjet III si  | .....\$3249      |
| 1 MB Upgrade           | .....\$69   | 4 MB Upgrade     | .....\$159       |
| 2 MB Upgrade           | .....\$99   | Options          | .....Call        |

**Canon**

|  |            |  |             |
|--|------------|--|-------------|
| BJ 10 EX   | .....\$245 | BJ 330   | .....\$555  |
| 360 DPI, 37K Buffer, 142 CPS, 6 fonts, IBM & Epson Emulation |            | Wide carriage. Version of BJ 300   |             |
| BJ 20  | .....\$359 | BJC 800  | .....\$1779 |
| Detachable cutsheet feeder, 188 CPS, 360 DPI                 |            | Color Bubblejet, 360 DPI, 7K Buffer, Epson Emulation LQ2550, 600 CPS, Built-in auto cut sheet feeder |             |
| BJ 300   | .....\$329 | BJ 200   | .....\$325  |
| 600 CPS, 30K Buffer, 3 Fonts, Epson IBM Emulation            |            | 496 CPS, 360 DPI, cut sheet feed, Epson & IBM Emulation  |             |

**MODEMS & FAX MODEMS**

|                            |                  |
|----------------------------|------------------|
| PRACTICAL PERIPHERALS      |                  |
| FAX ME for plain paper fax | .....\$169       |
| PRACTICAL PER 9600 INT/EXT | .....\$199/\$229 |
| PRACTICAL PER 14.4 INT/EXT | .....\$329/\$279 |
| HAYES                      |                  |
| HAYES OPTIMA 9600          | .....\$329       |
| HAYES OPTIMA 14.4          | .....\$399       |
| HAYES OPTIMA 14.4 W/FAX    | .....\$439       |
| HAYES ULTRA 14.4           | .....\$619       |
| U.S. ROBOTICS              |                  |
| USR 9600 V.32 bis          | .....\$469       |
| HST 16.9 Int/Ext           | .....\$499/\$549 |
| USR SPORTSTER 14.4 Int/Ext | .....\$309/\$309 |
| USR SPORTSTER 14.4 W/FAX   | .....\$328       |
| USR DUAL STD EXT           | .....\$729       |
| World Port 96/96 Fax Modem | .....\$439       |

Intel Satisfaction Below

**Kcc Computers**

|  |             |
|--|-------------|
| KCC 386 SX-33 w/1.2MB floppy, 2 MG RAM, 40 MG Hard Drive, SVGA Card & Monitor, DOS 5.0, Windows & Mouse                      | .....\$1249 |
| KCC 386-DX-40 w/64K Cache, 1.2 MG floppy, 4 MG RAM, 106 MG Hard Drive, SVGA Card and Monitor, DOS 5.0, Windows 3.1 and Mouse | .....\$1499 |
| KCC 486-DX-33 w/64K Cache, 1.2 MG floppy, 4 MG RAM, 211 MG Hard Drive, SVGA Card and Monitor, DOS 5.0, Windows 3.1 and Mouse | .....\$1999 |

All KCC systems come with a 30 day money-back guarantee. Toll-free technical support. One Year Limited Warranty.

**HARD DRIVES & TAPES**

|                      |                  |
|----------------------|------------------|
| SEAGATE 120 MB 3144A | .....\$279       |
| SEAGATE 245 MB 3283  | .....\$399       |
| MAXTOR 120 MB        | .....\$279       |
| MAXTOR 200 MB        | .....\$379       |
| MAXTOR 340 MB        | .....\$639       |
| CONNER 40 MB         | .....\$189       |
| CONNER 120/170 MB    | .....\$269/\$289 |
| CONNER 200/250 MB    | .....\$399/\$419 |

**MICROSOLUTIONS**

|   |                  |
|---|------------------|
| 40 MB or 100 MB   | .....\$399/\$489 |
| External Parallel port hard drive. Perfect for Laptops, PS II's & XT's. |                  |

**HARD CARDS**

|                       |            |
|-----------------------|------------|
| Plus Hard card 50XL   | .....\$239 |
| Plus Hard card 105 MG | .....\$339 |

**TAPE BACK UP**

|                               |            |
|-------------------------------|------------|
| Colorado Jumbo 120            | .....\$189 |
| Colorado Jumbo 250            | .....\$249 |
| Colorado Tracker 120 Portable | .....\$339 |
| Colorado Tracker 250 Portable | .....\$399 |
| Mountain, Maynard, others.    | .....CALL  |

**MONITORS**

|                            |             |
|----------------------------|-------------|
| Mitsubishi EGA             | .....\$239  |
| Mitsubishi Diamond Pro 17" | .....\$1069 |
| Mitsubishi HL 6955 20"     | .....\$1779 |
| NEC Multisync III FGX      | .....\$609  |
| NEC Multisync IV FGX       | .....\$709  |
| NEC Multisync VFGX         | .....\$1245 |
| NEC 6FG                    | .....\$2249 |
| Samsung 14" Sync Master 2  | .....\$249  |
| Samsung 14" Sync Master 3  | .....\$299  |
| Samsung 15" Sync Master 15 | .....\$479  |
| Samsung 17" Sync Master 4  | .....\$799  |

**SOFTWARE**

|                            |                  |
|----------------------------|------------------|
| Lotus 2.4/3.1              | .....\$299/\$359 |
| Microsoft Word for Windows | .....\$299       |
| Microsoft Windows 3.1      | .....\$79        |
| Microsoft DOS 5.0          | .....\$69        |
| DBase IV                   | .....\$419       |
| Word Perfect 5.2           | .....\$269       |
| C.A. Cricket Paint         | .....\$89        |
| C.A. SuperCalc             | .....\$89        |
| C.A. Simply Accounting     | .....\$125       |
| C.A. Clipper               | .....\$495       |
| C.A. BPI Value Pak         | .....\$359       |
| C.A. db Fast               | .....\$329       |

**BATTERY BACKUP & UPS**

|               |                  |
|---------------|------------------|
| 250/400       | .....\$109/\$165 |
| 450/600       | .....\$199/\$259 |
| 900/1200VX    | .....\$375/\$729 |
| SMART UPS 400 | .....\$309       |

**TRIPPLITE**

|            |            |
|------------|------------|
| BC 250     | .....\$105 |
| BC 400     | .....\$159 |
| BC 500 LAN | .....\$195 |
| BC 600 LAN | .....\$259 |
| BC 900 LAN | .....\$359 |

**GRAPHICS CARDS**

|                             |            |
|-----------------------------|------------|
| ATI VGA Wonder XL 24 1MB    | .....\$149 |
| ATI Graphics Ultra 1MB      | .....\$279 |
| ATI Graphics Ultra Pro 1MB  | .....\$439 |
| ATI Graphics Ultra + 1MB    | .....\$295 |
| Diamond Speedstar 24X w/1MB | .....\$175 |
| Diamond Stealth w/1MB       | .....\$219 |
| Orchid Fahrenheit 1280      | .....\$269 |
| Trident SVGA 1MB            | .....\$79  |
| Monochrome Boards           | .....\$35  |

No charge for MasterCard or Visa. We will ship COD on a cash or cashier's check basis only. Shipping & handling 3% - \$6 minimum; AK and HI slightly higher. 15% restocking charge on returned items. Purchase orders accepted from Fortune 1000, Government institutions, schools and universities. 2% shipping discount available on orders over \$2000 if prepaid by check.

Prices and availability subject to change.

**MULTIMEDIA & CD ROMS**

|  |            |
|--|------------|
| Media Fusion 16  | .....\$499 |
| Soundblaster Pro   | .....\$189 |
| Videoblaster   | .....\$329 |
| Imports video & audio from VCRs, cameras and video discs into VGA graphics |            |
| Soundblaster Pro   |            |
| Multimedia Upgrade kit   | .....\$539 |
| With Soundblaster Pro, midi kit, CD Rom drive & software                   |            |
| NEC CDR 74 w/gallery   | .....\$629 |
| NEC CD Express   | .....\$419 |

**NETWORKING**

|                              |             |
|------------------------------|-------------|
| NETWARE 2.2 5 USER           | .....\$489  |
| NETWARE 2.2 10 USER          | .....\$1079 |
| NETWARE 2.2 50 USER          | .....\$2099 |
| NETWARE 3.11 5 USER          | .....\$589  |
| NETWARE 3.11 10 USER         | .....\$1359 |
| NETWARE 3.11 50 USER         | .....\$2699 |
| NE 2000                      | .....\$139  |
| LANTASTIC 10MPS STARTER KIT  | .....\$449  |
| LANTASTIC 10MPS ADAPTER      | .....\$199  |
| LANTASTIC FOR WINDOWS        | .....\$165  |
| 3 COM ETHERLINK II           | .....\$185  |
| 3 COM ETHERCARD              | .....\$279  |
| INTEL ETHER 16               | .....\$119  |
| INTEL ETHER 16 20 PAK        | .....\$1975 |
| SMC ETHER + ELITE 16         | .....\$145  |
| SMC ETHERNET 8 BIT COAX      | .....\$95   |
| XIRCOM POCKET ADAP COAX      | .....\$299  |
| XIRCOM POCKET ADAP 10 BASE T | .....\$299  |

**HOUSTON INSTRUMENTS PLOTTERS & SUMMAGRAPHICS DIGITIZERS**

|                       |             |
|-----------------------|-------------|
| Image Maker A&B 11x17 | .....\$699  |
| DMP-52 C&D 1 Pen      | .....\$1979 |
| DMP-161 A to D 8 Pen  | .....\$2749 |
| DMP-162 A to E 8 Pen  | .....\$3475 |
| DMP-162R A to E 8 Pen |             |
| Roll Feed             | .....\$4749 |
| Summasketch II 12x12  | .....\$279  |
| Summasketch II 12x18  | .....\$479  |

**KENOSHA COMPUTER CENTER**  
2133 91st Street  
Kenosha, Wisconsin 53140

**KENOSHA COMPUTER CENTER**  
**1-800-255-2989**  
World Radio History  
Circle 557 on Inquiry Card.

# That's It!

It's an exhibition, with new products, new ideas, and new solutions. It's a conference, an educational forum which can open your eyes to new ways of solving problems. It's a meeting place where you can exchange thoughts with your peers. It's an industry forum where DEC can connect to IBM, McIntosh, Hewlett-Packard and many other systems. That's it. That's DEXPO and it's your best opportunity to make your DEC system compatible with the world. DEXPO.

**Come see exhibitors and their products at DEXPO Spring '93.**

DEXPO Spring is well on its way to filling the Inforum in Atlanta, GA with the exhibitors you want to meet. They'll be there to answer your questions, to provide solutions, to help you make your systems more efficient and your companies more profitable. That's it.

**Open Systems Conference debut's at DEXPO Spring '93.**

Today's information manager has two things on their mind - increased productivity and profitability without added expense. DEXPO has added a world class conference to open your eyes to new ideas in making your DEC and DEC compatible products work more effectively together. Topics include:

#### **Achieving Enterprise-Wide Open Systems**

#### **A Guide to DEC-Other Vendor Integration**

- IBM, HP, Sun, Unisys, Pcs, Unix System V

#### **DEC and the Issues of the 90's**

- Open Systems
- Operating Systems
- Network Management
- NAS
- Application Development
- DEC's Software Vision

To obtain registration information for DEXPO Spring '93 fill out the form and return either by mail or fax.

**DEXPO Spring  
Exhibition & Open Systems Conference  
June 8 -10, 1993  
Inforum  
Atlanta, GA**



**Mail to:** Registrar  
DEXPO Spring  
13760 Noel Road, Suite 500  
Dallas, TX 75240

**Fax to:** 214/385-9003

**Yes, I'm interested. Please send more information on:**

Attending       Conference       Exhibiting

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City/State/Zip \_\_\_\_\_

Phone \_\_\_\_\_

Fax \_\_\_\_\_

B

# DEXPO<sup>®</sup>

**No one serves the DEC market better, no one can.**

Produced by Miller Freeman, Inc.-A member of the United Newspaper Group ©1993 Miller Freeman, Inc.

**Circle 555 on Inquiry Card.**

MARCH 1993 • BYTE 224NE-3

# Enter The Ultimate Performance Zone!

## With Ultra Computers

1-800-755-7518  
3129 Main Street Weirton WV 26062

| SYSTEM           | BASIC SYSTEM | BASIC 40MB HD SVGA Card & Monitor | BASIC 80MB HD SVGA Card & Monitor | BASIC 170 MB HD SVGA Card & Monitor | BASIC 210 MB HD SVGA Card & Monitor | BASIC 340 MB HD SVGA Card & Monitor |
|------------------|--------------|-----------------------------------|-----------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| 486-50 EISA      | \$1,099      | \$1,499                           | \$1,569                           | \$1,659                             | \$1,739                             | \$1,939                             |
| 486-33 EISA      | \$839        | \$1,239                           | \$1,309                           | \$1,399                             | \$1,479                             | \$1,679                             |
| 486-66 DX2       | \$979        | \$1,379                           | \$1,449                           | \$1,539                             | \$1,619                             | \$1,819                             |
| 486-50 Local Bus | \$949        | \$1,349                           | \$1,419                           | \$1,509                             | \$1,589                             | \$1,789                             |
| 486-33 Local Bus | \$719        | \$1,119                           | \$1,189                           | \$1,279                             | \$1,359                             | \$1,559                             |
| 486-50 ISA       | \$919        | \$1,319                           | \$1,389                           | \$1,479                             | \$1,559                             | \$1,759                             |
| 486-33 ISA       | \$689        | \$1,089                           | \$1,159                           | \$1,249                             | \$1,329                             | \$1,529                             |
| 486-25 SX        | \$439        | \$839                             | \$908                             | \$999                               | \$1,079                             | \$1,279                             |
| 386-33/40        | \$399        | \$749                             | \$869                             | \$959                               | \$1,039                             | \$1,239                             |
| 386-33SX         | \$309        | \$700                             | \$779                             | \$869                               | \$949                               | \$1,149                             |

| PRINTERS                      |         |
|-------------------------------|---------|
| HP IV                         | \$ 1460 |
| HP IIIIP                      | 1010    |
| DESKJET 800                   | 396     |
| DESKJET 600C                  | 639     |
| OKIP 11801                    | 169     |
| OKIP 1123                     | 199     |
| OKIP 11241                    | 279     |
| OKIP 4410                     | 439     |
| OKIP 2123                     | 239     |
| NEC POS                       | 1429    |
| VIDEO CARDS                   |         |
| Mono Card w/Video Port        | \$ 11   |
| VGA 256K (800X600 14bit)      | 29      |
| 1Mb VGA (1280X1024)           | 89      |
| Speedstar Plus 1Mb (1024X768) | 104     |
| Speedstar 256K (1024X768)     | 166     |
| Speedstar 1Mb VRAM            | 319     |
| ATI Ultra 1MBG                | 369     |
| S-3 EISA                      | 209     |
| S-74000 Local Bus             | 148     |
| Paradise 1Mb 1280 X 1024      | 109     |
| Nickel SVGA CARD              | 84      |
| MOTHERBOARDS                  |         |
| 384X-33                       | \$ 112  |
| 384DX-33 64K Cache            | 169     |
| 384DX-40 64K Cache            | 164     |
| 448DX-33 8K Cache             | 330     |
| 484X-33 8A 256K Cache         | 478     |
| 484X-80 8A 256K Cache         | 791     |
| 484-D22-44 8A 44K Cache       | 759     |
| 484DX-60 8BA 256K Cache       | 569     |
| 484DX-64 8BA 256K Cache       | 940     |
| 484DX-33 Local Bus 256K Cache | 610     |
| 484DX-90 Local Bus 256K Cache | 729     |
| 484DX-44 Local Bus 256K Cache | 786     |
| TAPE BACK-UPS                 |         |
| 120Mb Colorado Tape Back-Up   | \$ 199  |
| 250 Mb Colorado Tape Back-Up  | 266     |
| MONITORS                      |         |
| 14" Mono Monitor              | \$ 104  |
| 14" Mono VGA                  | 130     |
| 14" SVGA (1024X768 .39)       | 227     |
| 14" SVGA (1024X768 .38)       | 268     |
| 14" SVGA (1024X768 .38) N/I   | 304     |
| 14" Sony 1304                 | 699     |
| 18" MAG                       | 678     |
| 18" NEC 3F6X                  | 649     |
| 17" SVGA N/I                  | 680     |
| 17" SONY 1604                 | 1039    |
| NETWORKING                    |         |
| NOVELL V3.11 & USER           | \$689   |
| NOVELL V3.11 10 USER          | 1499    |
| NOVELL V3.11 20 USER          | 1994    |
| NOVELL V3.11 100 USER         | 4369    |
| ARCNET 8/16 (STAR)            | 49769   |
| ARCNET 8/16 (BUS)             | 64769   |
| ACTIVE HUB 4/8 PORTS          | 79/139  |
| NE-1000 COMPAT (COAX/TP)      | 90/110  |
| NE-2000 COMPAT (COAX/TP)      | 100/130 |
| MEMORY                        |         |
| 1 MEG X 9 70 NS SIMM          | \$ 37   |
| 256K X 9 70 NS SIMM           | 12      |
| 4 MEG X 9 70 NS SIMM          | 143     |
| IIT CO-PROCESSORS             |         |
| 3873X-26                      | \$ 69   |
| 387DX-26                      | 69      |
| 387DX-33                      | 76      |
| 387DX-40                      | 90      |

Basic Systems Include : ~ Motherboard & CPU ~ 101 Enhanced Keyboard ~ 1.2 Meg or 1.44 Meg Floppy Drive ~ 2 Hard/2 Floppy IDE Controller ~ 2 Serial/1 Parallel/1 Game Ports ~ Internal Clock Calendar ~ Coprocessor Socket ~



**386-16SX NoteBook**  
2Meg RAM 40Mag. HD  
1.44 FD \$799.00

**Special**  
1024 X 768 SVGA .28  
\$255.00

Ask About  
Our 2 Year  
Extended Warranty

Panasonic 2124  
\$299

Accept only  
the finest...

**Caviar**

WESTERN DIGITAL

### Why Ultra

Satisfied Government & Corporate Customers  
- Pentagon  
- General Electric  
- Mellon Bank  
- Sigma Software

No hassle return policy  
- Intel  
- NEC

1 Yr. Parts & 5 Yr. Service Warranty  
On-site Service Warranty Available  
48 Total System Burn-in  
Piece of mind knowing the Quality and Reliability that only a Ultra Computer Can Bring.  
Manufactured Direct to you Right here in the United States

Knowledgeable Sales and Technical Personnel

| FLOPPY/HARD DRIVES |       |
|--------------------|-------|
| 1,271.44 Mb FD     | \$ 82 |
| 40 Mb/28 ms IDE    | 149   |
| 80 Mb/16 ms IDE    | 209   |
| 106 Mb/17 ms IDE   | 236   |
| 170 Mb/16 ms IDE   | 299   |
| 210 Mb/16 ms IDE   | 372   |
| 340 Mb/12 ms IDE   | 678   |
| 536 Mb/16 ms IDE   | 1019  |
| 210 Mb/16 ms SCSI  | 469   |
| 340 Mb/16 ms SCSI  | 732   |
| KEYBOARDS          |       |
| 101 ENHANCED       | \$ 26 |
| 101 LITE-ON CLICK  | 36    |
| 104 FOCUS 2001     | 40    |
| 111 FOCUS 8000     | 44    |
| 130 FOCUS 9000     | 79    |
| MOUSE              | 13    |

| CONTROLLERS                        |         |
|------------------------------------|---------|
| IDE 2FD/2HD                        | \$ 12   |
| IDE 4FD/2HD                        | 29      |
| IDE 2FD/2HD w/2B/1P/1G             | 20      |
| AT 1/0 25/1/1G                     | 15      |
| MFM 2FD/2HD 1:1                    | 40      |
| RL 2FD/2HD 1:1                     | 40      |
| UltraStar 125 EBDI 32K Cache (ISA) | 159     |
| UltraStar 148 SCSI 64K Cache (ISA) | 239     |
| UltraStar 24F                      | 449     |
| UltraStar 22F/22C EBDI (EISA)      | 488/639 |
| UltraStar 18C IDE Cache (ISA)      | 199     |
| CD ROMS/MULTIMEDIA                 |         |
| MITSUMI CRMC                       | \$ 179  |
| TEXEL /W CONTROLLER                | 469     |
| SOUNDBLASTER                       | 79      |
| SOUNDBLASTER PRO                   | 199     |
| 7 CD-ROM TITLES                    | 139     |

| SCANNERS                       |        |
|--------------------------------|--------|
| HP SCANJET 3P                  | \$ 890 |
| HP SCANJET 2C                  | 1445   |
| MODEMS                         |        |
| 2400B Modem                    | \$ 39  |
| 9600B SEND/RECEIVE FAX         | 79     |
| 9600B w/V.32 & V.42 BIS        | 229    |
| CASES W/POW'R SUPPLY           |        |
| Mini Tower 200W Digital        | \$ 49  |
| Mini Desk 200W                 | 78     |
| PS2 Style 200W                 | 79     |
| MidTower 200W Digital w/7 Bays | 89     |
| FullTower 230W w/11 Bays       | 117    |

Prices subject to change without notice. All returns must be made in 30 days and accompany an RMA number. Shipping, Insurance & COD charges are extra and non-refundable. All prices reflect a 3% discount for cash. Ultra Computers is not responsible for Typographical or Photographical errors. \$3.00 charge for orders under \$100.00. California residents subject to sales conformation. Tech. Support 1-304-748-1891 Fax 1-304-748-0276

# FREE On-Site Service Nationwide For One Year!



|   |                  |
|---|------------------|
| 386DX 40 64K Cache 4 Meg .....                                  | <b>\$1175</b>    |
| 486DX 33 256K Cache 4 Meg .....                                 | <b>\$1575</b>    |
| 486DX2 50 256K Cache 4 Meg .....                                | <b>\$1625</b>    |
| 486DX 50 256K Cache 4 Meg .....                                 | <b>\$1775</b>    |
| 486DX2 66 256K Cache 4 Meg .....                                | <b>\$1775</b>    |
| 486 VESA Local Bus<br>w/24 bit 16 Million true color video..... | Add <b>\$100</b> |

## All Systems Include:

- 130 Meg hard disk (14.5 ms)
- 1.44 Meg floppy drive
- 1.2 Meg floppy drive
- SVGA 1024 X 768 .28 14" color monitor
- SVGA card (trident) 1 Meg
- 220 Watt desktop or mini tower
- 2 serial, 1 parallel, 1 game, IDE 2HD/2FD
- 101-Key enhanced keyboard
- 1 year parts and 5 years labor
- **1 YEAR ON-SITE SERVICE**
- **FCC B AND UL APPROVED**

**P.S. Personal Solution**  
COMPUTERS

One Hollywood Drive  
North Grafton, MA 01536  
508-839-3289 fax 508-839-6236

**800-685-3981**

Monday-Friday: 10am-10pm  
Saturday: 10am-6pm  
Sunday: Noon-6pm  
Circle 558 on Inquiry Card.

No surcharge for credit cards.



# EISA-VESA-ISA

## ALL IN ONE SYSTEM



**Poly 486-66EV \$2750**

8 x 32-bit EISA slots with  
 3 VESA Local Bus  
 Upgradeable to P24T (586SX)  
 256K Cache, Option: 512K  
 8MB RAM, Expandable 256MB  
 213MB High Speed IDE Hard disk  
 32-bit VESA IDE with 2MB Cache  
 1.2MB and 1.44MB Floppy Drives  
 VESA Video Accelerator with 2MB

**FAST AND EXPANDABLE**

Call for other model and configuration!

**800-999-1278**

**TEL 415-583-7222**

**FAX 415-583-1974**

**Polywell**

Computers, Inc.

817 Alameda Boulevard  
 San Francisco, CA 94080

## ❖ ADVERTISERS ❖

Run a full- or half-page 4-color ad  
 reaching a portion of **BYTE's U.S.** readers  
 at unbelievably low rates — right here in this section!

Call today to learn more about **BYTE's** unique *Regional Advertising Section*, located in our prominent *Buyer's Guide*.



**(603) 924-2651 or (603) 924-2637**

Ask for your copy of the ACP Computer Hotline

# ACP-The Superstore with Super Deals!

CALL 1-800-FONE-ACP TOLL-FREE ORDERS

### Hard Drives

Western Digital High performance "Caviar" series with 1" height. Cache Flow™ and 32K buffer.

|              |              |     |      |
|--------------|--------------|-----|------|
| AC280 80Mb   | 1" 3.5" 14ms | IDE | Call |
| AC2120 125Mb | 1" 3.5" 14ms | IDE | Call |
| AC2200 200Mb | 1" 3.5" 14ms | IDE | Call |
| AC2340 340Mb | 1" 3.5" 14ms | IDE | Call |

### Maxtor

|               |                     |      |      |
|---------------|---------------------|------|------|
| 7080A 80Mb    | 1" 3.5" 15ms        | IDE  | Call |
| 7120A 120Mb   | 1" 3.5" 15ms        | IDE  | Call |
| LX713A2 131Mb | 1" 3.5" 15ms        | IDE  | Call |
| MX1240 1.2Gb  | 1" 3.5" 15ms        | IDE  | Call |
| Panther 1.2Gb | 5Call Panther 1.7Gb | Call |      |

### Conner Peripherals

|             |           |     |      |
|-------------|-----------|-----|------|
| 30104 120Mb | 3.5" 19ms | IDE | Call |
| 3204 200Mb  | 3.5" 16ms | IDE | Call |

### Hard Drive Specials

|  |        |
|--|--------|
| Seagate ST3283 249Mb IDE   | 499.95 |
| Samsung 100Mb IDE  | 299.95 |
| Seagate 700 340Mb ESDI   | 599.95 |
| Brand Tech 200Mb IDE   | 379.95 |
| Call for Quantum, Micropolis, Seagate, Controllers from Ultrastar, Always, WD etc. |        |

### Backups

Colorado

|                                |     |
|--------------------------------|-----|
| DJ10 120Mb Tape Drive Internal | 199 |
| DJ20 250Mb Tape Drive Internal | 268 |
| Trakker 120 Tape Backup        | 358 |
| Trakker 250 Tape Backup        | 428 |

### Syquest (with cartridge)

|                                       |     |
|---------------------------------------|-----|
| 44Mb kit S6555, S6400, S601 (16 bit)  | 419 |
| 44Mb external                         | 499 |
| 88Mb kit S65110, S6080, S601 (16 bit) | 529 |
| 88Mb external                         | 629 |

### GrassRoots Floptical

|                            |      |
|----------------------------|------|
| Floptical 21 Mb (external) | Call |
| Floptical 21 Mb (internal) | Call |

### Floppy Disk Drives

Toshiba

|                 |          |          |    |
|-----------------|----------|----------|----|
| NDD4DG 360K     | 5.25" HH | PC/XT    | 59 |
| NDD8DEG 1.2Mb   | 5.25" HH | PC/AT    | 72 |
| ND3561GR 1.44Mb | 3.5" HH  | w/AT Kit | 72 |

### ACP

|                       |                     |      |
|-----------------------|---------------------|------|
| 1.2 Mb 5.25" .66      | 2.88Mb 3.5"         | Call |
| 1.44Mb 3.5" .67       | All in One 3.5/5.25 | 149  |
| Compaq 1/3 ht. Floppy |                     | Call |

### Multimedia

#### Creative Labs

Complete all-in-one MPC compatible upgrade kit includes: Panasonic CD Drive, Sound Blaster Pro, five CD's, Microsoft Multimedia Kit Int/Ext. 539/599

Sound Blaster Rng/Pro/16 ..... 85/148/218

### MediaVision

|                           |     |
|---------------------------|-----|
| CDPC Subsystem (external) | 998 |
| Pro 16 Multimedia System  | 968 |
| Pro Audio Spectrum 16     | 194 |

NEW! MediaVision Fusion CD ext. CD ROM with Sound, Speaker and 4 CD's: Compton's Carmen, Ultima, Wing Comm ..... 429

### Compton's Encyclopedia CD

|                           |     |
|---------------------------|-----|
| Standard version          | 169 |
| Interactive version, NEW! | 249 |

### CD ROM Special

|                              |     |
|------------------------------|-----|
| Mitsumi MPC compatible (int) | 188 |
|------------------------------|-----|

### Input Devices

Advanced Trackman Port ... 98

|                      |                   |            |    |
|----------------------|-------------------|------------|----|
| 3-button Mouse 14.95 | MicroSoft         |            |    |
| 84/101 keys          | 48/58 Mouse       | 73         |    |
| Mouse/Windows 88     | Ballpoint         | 98         |    |
| Logitech             | Mouse/Windows 148 |            |    |
| Mouseman             | 78                | MicroSpeed |    |
| Trackman             | 78                | PC Trac    | 78 |
| Cordless Mouse       | 88                |            |    |

### Video Graphics Cards

#### ATI

|                              |         |              |    |
|------------------------------|---------|--------------|----|
| Graphics Ultra Pro w/1Mb/2Mb | 428/518 |              |    |
| Graphics Ultra+ w/1Mb/2Mb    | 288/328 |              |    |
| Graphics Ultra 512K/1Mb      | 248/288 |              |    |
| Graphics Vantage 512K/1Mb    | 188/218 |              |    |
| VGA Wonder XL24 w/512K/1Mb   | 128/148 |              |    |
| VGA Integra                  | 83      | VGA Basic 16 | 65 |

Diamond SpeedSTAR Stealth w/1Mb ..... 218

Speedstar 24X 24-Bit Color w/1Mb ..... 165

Orchid Fahrenheit 1280 w/1Mb ..... 258

Paradise Windows Accelerator w/1Mb ..... 178

### Advanced Cards

|                       |       |
|-----------------------|-------|
| Mono/Color            | 38/48 |
| EGA                   | 48    |
| VGA (800 x 600)       | 53    |
| VGA (1024 x 768) 512K | 68    |
| VGA (1024 x 768) 1Mb  | 88    |

### Chips and SIMM's

RAM Chips

|                  |       |     |      |      |
|------------------|-------|-----|------|------|
| 41256-100 256K   | 100ns | DIP | 1.49 | 1.35 |
| 41256-80 256K    | 80ns  | DIP | 1.59 | 1.49 |
| 414256-80 256Kx4 | 80ns  | DIP | 4.79 | 4.59 |
| 1Mb-100 1Mb x 1  | 100ns | DIP | 4.05 | 3.95 |
| 1Mb-80 1Mb x 1   | 80ns  | DIP | 4.49 | 4.39 |

Call for VIDEO RAMS & CACHE RAMS  
Over 20,000,000 IC's in-stock including  
We Specialize in 486DX/25 & 33 Upgrades

### NEW Low Prices!

#### SIMM Memory Modules

|                   |     |              |     |
|-------------------|-----|--------------|-----|
| 1 x 9-70 (3-chip) | 37  | 1 x 36-70    | 138 |
| 1 x 9-70 (9-chip) | 39  | 2 x 36-70    | 288 |
| 4 x 9-70          | 129 | 4 x 36-70    | 538 |
| 1 x 8-70 (Mac)    | 36  | 8 x 8 (Mac)  | 324 |
| 4 x 8-80 (Mac)    | 124 | 16 x 8 (Mac) | 408 |

### Math Coprocessors

| Intel         | Cyrix              |     |
|---------------|--------------------|-----|
| 8087          | 387SX (16-25)      | 73  |
| 80287-10      | 387DX (20-33)      | 88  |
| 80387SX (all) | 387DX/40           | 108 |
| 80387DX (all) | 80287 (all)        | 78  |
| 387SL         | Overdrive 486DX/33 | 649 |
| Rapid CAD     | Overdrive 486SX/25 | 489 |

### Memory Upgrades

#### Notebooks

|                            |                         |
|----------------------------|-------------------------|
| Compaq Contura, 4Mb \$ 198 | Toshiba 4400/16Mb \$999 |
| Compaq Lite, 4Mb           | 228                     |
| HP95LX Palmtop, 2Mb        | Call                    |
| IBM CL575X, 4Mb            | 345                     |
| Everex Carrier, 2Mb        | 118                     |
| Toshiba T4000, 4Mb         | 188                     |
| Toshiba T4400, 4Mb         | 188                     |
| Zenith Z-Note, 2Mb         | 168                     |

Apple Powerbook 40, 1Mb \$149 \$275

### Laser Printers-'O'K Books

|                              |             |             |       |
|------------------------------|-------------|-------------|-------|
| HP II/III/IIIP/IIIP+/II/IIID | 49.95       |             |       |
| Panasonic 4410/30 or 4420/10 | 69.95/49.95 |             |       |
| Oki 400                      | 49.95       | Oki 800/20  | 59.95 |
| Oki 830/40                   | 79.95       | IBM 4019/29 | 49.95 |
| NEC                          | 69.95       | QMS 410     | 69.95 |

### Computer Upgrades

|                          |        |
|--------------------------|--------|
| AST Bravo 3/255, 8Mb     | \$ 318 |
| IBM PS/2 90, 95, 2Mb     | 88     |
| Dell 420/25/33/50SE, 4Mb | 208    |

Call for NEC, HP, Zenith, Leading Edge.

### Motherboards

#### Advanced

|               |        |
|---------------|--------|
| 286 -12MHz    | 69.95  |
| 386SX -25MHz  | 119.95 |
| 386DX -40MHz  | 199.95 |
| 486SX -20MHz  | 199.95 |
| 486DX2 -50MHz | 699.95 |
| 486DX2 -66MHz | 999.95 |
| 486DX2 -50MHz | Call   |

#### Micronics

|                            |      |
|----------------------------|------|
| ISA BUS                    |      |
| 486DX/33 w/256K cache      | 799  |
| 486DX2/50 w/256K cache     | 999  |
| ISA-VBUS                   |      |
| 486DX2/50 w/64K cache      | 1399 |
| 486DX2/50 w/64K cache      | 1049 |
| MVC4000B/1Mb Video Adapter | 199  |
| EISA BUS                   |      |
| 486DX2/33 w/256K cache     | 1099 |
| 486DX2/50 w/256K cache     | 1449 |

**Now Shipping!**

## PIGEON

A Dynatech Company

### Memory Upgrades

COMPAQ PROLINER

|                    |     |
|--------------------|-----|
| Mod 4/33 50 4Mb    | 158 |
| Mod 3/25 3C.25 2Mb | 89  |

Call for other models...

COMPAQ LTE, Lite, Contura\*

|                 |     |
|-----------------|-----|
| 2400/9600 w/SFW | 169 |
| 9600/9600 w/SFW | 439 |
| 144/9600 w/SFW  | 529 |

TOSHIBA Notebooks\*

|                 |     |
|-----------------|-----|
| 2400/9600 w/SFW | 169 |
| 9600/9600 w/SFW | 439 |
| 144/9600 w/SFW  | 549 |

\*Cellular ready.

### PC6881C SHARP

#### Color 386SL/20 Notebook

• Only 4.9 LBS.!

- 2Mb RAM
- 80Mb IHD

**\$3199.95** also NEW!

6785 w/80Mb ..... \$ 1799.95

### Advanced Computers • with AMD High Performance CPU's • plus SEIKO Trinitron Monitors

...All Advanced Systems include:

- OPTI or ACC Chipsets
- 1 Year Warranty
- AMI BIOS
- Enhanced 101 Keyboard
- IDE Interface
- Free Accounting Software

### Advanced Computers

#### 486/33 Complete Color System

Includes:

- 486DX/33
- w/256K Cache
- 4 Mb RAM
- 512K VGA Card
- 105 Mb HardDrive
- 1.44 Mb Floppy Disk
- IDE Controller
- 101 Keyboard
- 14" SVGA 28 Color Monitor

ACP's Sale Price **\$1499**

Call for additional configurations... Local Bus, 386SX, 486DX/50 and Seiko Trinitron Monitors

|  |   |   |
|--|---|---|
| <h3>386DX/25 &amp; 100Mb HD Desktop System</h3> <p>2Mb RAM • 100Mb HD • 64K Cache<br/>3.5/5.25 Dual Floppies • SVGA/512K Mouse • DOS 5.0 • Windows 3.1 • Works</p> <p>Unreal Deal <b>\$799</b> at ACP!!!</p> | <h3>Hi-speed CD-ROM Toshiba 2200</h3> <p>FREE Lotus 1-2-3 CD with purchase, 200ms ACCESS w/adaptor.</p> <p><b>\$799</b></p> | <h3>386SX/20 Notebook</h3> <p>40 Mb Hard Drive<br/>1 Mb RAM • VGA LCD</p> <p><b>\$999</b></p> |
|--|---|---|

### Call ACP for Notebooks... AST • COMPAQ MITAC • TOSHIBA

BELOW COST! **\$269**

80286 • 3.5" Floppy • 1 Mb • 101 Keyboard

### Software Sale...up to 90% Off! 100's of Titles! Now only 99¢!

|                   |      |                      |      |
|-------------------|------|----------------------|------|
| CompuServe        | 9.95 | Combase              | 9.95 |
| Life & Death      | 9.95 | Computer Comic       | 9.95 |
| Desert Storm      | 9.95 | Complete Craps       | 9.95 |
| Personal Biz Base | 9.95 | Pro Football Analyst | 9.95 |
| Stickbreaker      | 9.95 | Hdc Window Apps      | 9.95 |
| Dvorak on Typing  | 9.95 | 30 Min. Negotiator   | 9.95 |
| Bible Trivia      | 9.95 | Retirement Planner   | 9.95 |

Call for a complete list...

### IBM OS/2 Special Purchase...

04G1049 OS/2 Extended w/server. List 1995 ACP 1159

04G1051 OS/2 Lanserver List 1995 ACP 429

04G1091 OS/2 Ext. Admin Kit. List 165 ACP 97

10G 5999 OS/2 2.0 Upgrade List 149 ACP 79

All 4 for only \$499!

### Windows Accelerator Increases Performance!

## Diamond

Computer Systems, Inc.

### Speed Star 24X

...make your 386 perform like a 486

- Windows Accelerator
- 15X faster than SVGA
- 1Mb RAM
- WD90C31 Chip
- 5 Year Warranty
- 24 bit color for 16.7 million colors

**ACP only \$165**

### SII Seiko CM 1450

New low price on an incredibly sharp SVGA flicker-free, non-interlaced multi-scanning monitor. Features finest quality Trinitron high-contrast black tube. 25mm operature grille and 1024x768 resolution.

|                     |        |
|---------------------|--------|
| CM 1450 14"         | \$ 424 |
| CM 1760 17" (.25mm) | 1097   |

or try Seiko's new 20" CM 2070 LR 20" ..... 1825

### TOSHIBA Notebooks

|                       |      |
|-----------------------|------|
| T1850 386SX-25/80Mb   | 1899 |
| T1850C Color/80Mb     | 2835 |
| T4400SX 486SX-25/80Mb | 2299 |

### Hayes

### New! OPTIMA\* 24+FAX 96

Now you can get a 2400bps V.24bis data modem plus a 9600 bps FAX with Hayes superior performance and compatibility. All at a great price. Also includes SmartCom EZ and SmartCom FAX software.

|                      |        |
|----------------------|--------|
| OPTIMA* 24 + FAX 96  | \$ 148 |
| OPTIMA* 96 + FAX 96  | 368    |
| OPTIMA*144 + FAX 144 | 475    |

### Canon

Canon® Authorized Reseller... NEW LOW PRICES!

|                       |           |
|-----------------------|-----------|
| BJ 10E Portable       | \$ 299.95 |
| BJ200 Inkjet          | 348.95    |
| LBP-45X Laser Printer | 988.95    |
| BJ330 Printer (B/W)   | 548.95    |
| BJC 800 (Color)       | 1895.95   |
| BJC 820 (Color)       | 2075.95   |
| BJ 300 BubbleJet(B/W) | 449.95    |
| BJ 20 Portable        | 328.95    |

# TRAVEL LIGHT, TRAVEL NEAT, TRAVEL SMART...

## ABC BICOM B260i



- Weight less than 1 kg
- PCMCIA 2.0 Interface
- 60 Mb Hard Disk
- 2 Mb RAM
- No adapters needed



**ABC** COMPUTERS®

1-800-336-2280

ABC Computer (USA) Corp.  
2531 237th Street, Suite 122, Torrance CA 90505  
310-325-4005 Fax 310-325-6369



226 B Y T E • MARCH 1993

- Weight 2.2 lbs. (Bicom and Battery)
- Dimension 8.78" x 6.36" x 1.22"
- True 16 bit AMD Lonestar Processor, 386SX Class Performance
- 5 "AA" size NiMH Batteries
- 60 MB Hard Disk Drive
- 2MB RAM expandable to 4MB on board and 16MB with memory card
- PCMCIA 2.0/JEIDA standard port for memory card and I/O card
  - 640 x 400 resolution LCD screen supports CGA, AT&T mode and all Windows graphics
    - 64-key keyboard
    - 1 parallel (bi-directional)/ 1 serial
  - External FDD port for optional Floppy Drive
  - DR-DOS 6.0, File Transfer Software & Serial Download Cable
- Built-in Personal Data Manager software
- Built-in Programmable Power Management Software
- Universal AC/DC adaptor
- Carrying Case

Options: External Floppy Drive, SRAM Memory Cards, 9624 IC Card Fax/Modem, Mini-trackball, External Keyboard, extra batteries.



30-Day Money Back Guarantee

All brand names are registered trademarks of their respective owners.

Circle 188 on Inquiry Card (RESELLERS: 189).

NEVADA  
COMPUTER

# MEMORY SALE

## SOFTWARE LIQUIDATION WORDSTAR

### Wordstar 2000 Rel. 3.5

This is not a major sale. These are the exact same ones selling for over \$300.00 from our competitors.

We have thousands in stock  
FOR SALE BELOW  
DISTRIBUTOR

COSTI LIST \$495.00 ea

DEALERS WELCOME  
RETAIL BOXED & FACTORY SEALED

**100 FOR \$55 EACH**

**\$69**



## COMPUTER PERIPHERALS, INC.

### MODEMS

**2400 Internal** 1/2 Card for IBM PC, XT, AT and compatibles. CMTT V.22bis, V.22 and Bell 212A. Auto dial/Auto answer. Supports Canon 1-4/RR2 2-5. Software included. \$39

**2400 External**, same as above plus LED status lights, requires serial port. \$69

### FAX MODEM

**9600 BPS Group B** Facsimile, 2400 BPS Hyper Compatible Modem, True Background Send and Receive, Menu Driven, Command Line, Normal and Fine Modes.

Half Card

One Year Warranty

**\$68**

## intel CPU's

|             |       |
|-------------|-------|
| 80486 DX/25 | \$299 |
| 80486 DX/33 | \$339 |
| 80486 DX/50 | \$359 |
| 80486 DX/66 | \$399 |
| 80486 DX/75 | \$419 |
| 80486 DX/83 | \$439 |

## RAMDRAM CPU UPGRADES

Windows 3.0, OS/2 and 386 software. S/W NOW improved system performance by up to 30%. Available for: HP 82386/72 & ES 8, EPSON EQUITV Ie & II, IBM ORIGINAL AT & XT/286, ACI 1800A, 1800B, 1800C, AST/PERMIA/286, BRAVO 286, COMWAG PORTABLE III, DESKTOP 286, NEC POWERMATE 286+ & PDR TABLET, IBM PS/2, 25/286, 30/286, 50, 50Z, 60

**2 MB DRAM / NOW \$349**

**3 MB DRAM / NOW \$399**

**4 MB DRAM / NOW \$499**

**8 MB DRAM / NOW \$899**

## intel COPROCESSORS

|          |       |
|----------|-------|
| 80387    | \$49  |
| 80387-1  | \$59  |
| 80387-2  | \$69  |
| 80387-3  | \$79  |
| 80387-4  | \$89  |
| 80387-5  | \$99  |
| 80387-6  | \$109 |
| 80387-7  | \$119 |
| 80387-8  | \$129 |
| 80387-9  | \$139 |
| 80387-10 | \$149 |
| 80387-11 | \$159 |
| 80387-12 | \$169 |
| 80387-13 | \$179 |
| 80387-14 | \$189 |
| 80387-15 | \$199 |
| 80387-16 | \$209 |
| 80387-17 | \$219 |
| 80387-18 | \$229 |
| 80387-19 | \$239 |
| 80387-20 | \$249 |
| 80387-21 | \$259 |
| 80387-22 | \$269 |
| 80387-23 | \$279 |
| 80387-24 | \$289 |
| 80387-25 | \$299 |

## Overdrives

|             |       |
|-------------|-------|
| 80486 SX/25 | \$499 |
| 80486 SX/33 | \$599 |
| 80486 SX/50 | \$699 |
| 80486 SX/66 | \$799 |
| 80486 SX/75 | \$899 |
| 80486 SX/83 | \$999 |

## Cyrix COPROCESSORS AND CPU'S

Plug compatible with Intel. These lines laster 5 year warranty.

|                        |       |
|------------------------|-------|
| CYRIX 80387-33MHz      | \$88  |
| CYRIX 80387-40MHz      | \$104 |
| CYRIX 80387-50MHz/5333 | \$119 |
| CYRIX 80486DX-33       | \$148 |
| CYRIX 80486DX-33       | \$195 |
| CYRIX 80486SX-25       | \$119 |

## HARD DRIVE SALE



### Seagate

| MODEL                 | SIZE   | SPEED | TYPE        | PRICE  |
|-----------------------|--------|-------|-------------|--------|
| ST3225                | 20MB   | 63MS  | MF/M 5.25"  | \$149  |
| ST3409                | 30MB   | 63MS  | MF/M Full/H | \$179  |
| ST3251                | 42MB   | 28MS  | MF/M 5.25"  | \$239  |
| 33351A (1 1/2" high)  | 42MB   | 28MS  | IDE 5.25"   | \$179  |
| ST3120A (1 1/2" high) | 105MB  | 18MS  | IDE 3.5"    | \$269  |
| ST3144A (1 1/2" high) | 130MB  | 18MS  | IDE 3.5"    | \$299  |
| ST3283A (1 1/2" high) | 140MB  | 12MS  | IDE 3.5"    | \$499  |
| ST3120B (1 1/2" high) | 140MB  | 14MS  | SCSI 3.5"   | \$399  |
| ST41200N              | 1107MB | 15MS  | SCSI/FH     | \$1499 |
| ST4206N               | 460MB  | 15MS  | SCSI/FH     | \$899  |

## CONNER

| MODEL                 | SIZE  | SPEED | TYPE | PRICE  |
|-----------------------|-------|-------|------|--------|
| CP2000 (1 1/2" high)  | 40MB  | 19MS  | IDE  | \$169  |
| CP3008E               | 80MB  | 19MS  | IDE  | \$228  |
| CP3104 (1 1/2" high)  | 120MB | 19MS  | IDE  | \$278  |
| CP3174A (1 1/2" high) | 170MB | 17MS  | IDE  | \$349  |
| CP3202A               | 200MB | 15MS  | IDE  | \$459  |
| CP3546A               | 525MB | 15MS  | IDE  | \$1045 |
| CP3540                | 540MB | 12MS  | SCSI | \$1045 |

## Maxtor

| MODEL                | SIZE   | SPEED | TYPE | PRICE  |
|----------------------|--------|-------|------|--------|
| 2825 (1 1/2" high)   | 100MB  | 17MS  | IDE  | \$249  |
| 2712GA (1 1/2" high) | 130MB  | 15MS  | IDE  | \$283  |
| 2713A (1 1/2" high)  | 213MB  | 15MS  | IDE  | \$389  |
| 2713S (1 1/2" high)  | 213MB  | 15MS  | SCSI | \$429  |
| LXT180A              | 340MB  | 15MS  | IDE  | \$648  |
| LXT360S              | 340MB  | 16MS  | SCSI | \$698  |
| PANTHER (FH)         | 1000MB | 13MS  | IDE  | \$1489 |
| MX1175 (FH)          | 1300MB | 13MS  | SCSI | \$1729 |

## FUJITSU

| MODEL            | SIZE   | SPEED | TYPE     | COST   |
|------------------|--------|-------|----------|--------|
| 2622A/5 (3 1/2") | 330MB  | 12MS  | SCSI/IDE | \$845  |
| 2623A/5 (3 1/2") | 420MB  | 12MS  | SCSI/IDE | \$899  |
| 2624A/5 (3 1/2") | 520MB  | 12MS  | SCSI/IDE | \$949  |
| 22665 (FH)       | 1090MB | 14MS  | SCSI     | \$1449 |
| 26525 (FH)       | 1750MB | 11MS  | SCSI     | \$2699 |

## MICROPOLIS

| MODEL         | SIZE   | SPEED | TYPE     | COST   |
|---------------|--------|-------|----------|--------|
| 1624 (FH)     | 660MB  | 15MS  | SCSI     | \$1099 |
| 2112 (3 1/2") | 1050MB | 10MS  | SCSI/IDE | \$1849 |
| 1598 (FH)     | 1050MB | 14MS  | SCSI     | \$1599 |
| 1548 (FH)     | 1748MB | 14MS  | SCSI     | \$2299 |
| 1528 15 (FH)  | 1350MB | 14MS  | SCSI     | \$1749 |
| 1924 (FH)     | 2100MB | 11MS  | SCSI     | \$3099 |

## LAPTOP & NOTEBOOK HARD DRIVES

| MODEL | SIZE | SPEED | TYPE | PRICE |
|-------|------|-------|------|-------|
| 60MB  | 2.5" | 15MS  |      | \$319 |
| 85MB  | 2.5" | 15MS  |      | \$339 |
| 130MB | 2.5" | 17MS  |      | \$499 |

## Floppy Drives

| MODEL       | SIZE     | PRICE |
|-------------|----------|-------|
| 360K 5.25"  | 1/2 H    | \$29  |
| 720K 3.5"   | 1/2 H    | \$34  |
| 1.2MB 5.25" | 1/2 H    | \$38  |
| 1.44MB 3.5" | 1/2 H    | \$38  |
| 5.25"       | MOUNTING | \$5   |

## Drive Controllers

| MODEL                              | PRICE |
|------------------------------------|-------|
| 8 Bit 4 Floppy                     | \$9   |
| 8 Bit 4 Floppy High Density        | \$49  |
| 8 Bit 2 Hard Drives MF/M           | \$49  |
| 8 Bit 2 Hard Drives RLL            | \$54  |
| 16 Bit Hard Drive only             | \$29  |
| 16 Bit Hard and Floppy 1 Interface | \$39  |
| SCSI DDC 2280 (Supports 7 drives)  | \$139 |
| SCSI Adaptec 1542B                 | \$224 |
| SDC DTC2682 2x                     | \$149 |
| IDE Hard and Floppy w/I/O          | \$129 |
| IDE Hard and Floppy w/I/O          | \$39  |
| Cables Hard Drive                  | \$9   |
| Cables Hard/Floppy                 | \$14  |

## MONITOR SALE

14" SVGA 1024X768  
With .38 Dot Pitch  
**\$279**  
SVGA Interface, 1024X768,  
512K step up 1MBG

**\$69**

## ZENITH Laptop Memory

| MODEL                       | PRICE              |
|-----------------------------|--------------------|
| Z-Notebook                  | 2MB PC-4721 \$158  |
|                             | 8MB PC-49-21 \$488 |
| Masterport 386S, Sic 5.0    | 2MB Z444 \$99      |
| Masterport 386SX            | 2MB Z43601 \$118   |
| SuperPort SX 286e, SlimPort | 2MB ZA180-64 \$134 |
| SuperPort 286, 286e         | 1MB ZA180-66 \$94  |
| SuperPort 286e, SlimPort    | 4MB ZA 80-71 \$279 |
| TurboPort 386, 386e         | 1MB ZA3034ME \$86  |

## Largest selection of Memory! We won't be undersold!

### IBM PS/2 Memory

| MODEL #   | MEMORY | PRICE          |
|---|--------|----------------|
| PS/1 and 386/SX   | 2MB    | \$299.95 \$78  |
|   | 4MB    | \$299.95 \$118 |
|   | 8MB    | \$299.95 \$158 |
| PS/2 30/286, Adpt Brd 1497259   | 512K   | 306 \$348 \$35 |
| PS/2 30/286, 15, 405K, 70-E61; CS1; 121   | 2MB    | 306 \$348 \$89 |
| Adpt Brd 6450609; 34F3011; 34F3077  |        |                |
| Xstation 120 & 130  | 1MB    | 6450603 \$49   |
| PS2 50, 50Z, 55SX, 60, 65SX   | 2-8MB  | 1497259 \$259  |
|   | 2-16MB | 6450609 \$308  |
| PS/2 55SX, 15, 405K, 50Z, 55SX; 15; 65SX; 15; 70-E61; 061; 121 Adpt Brd 6450609 | 2MB    | 6450604 \$74   |
| 34F3011; 34F3077 Xstation 120 & 130   | 2MB    | 6450608 \$84   |
| PS/2 70-A21; A61; B21; B61  | 4MB    | 6450608 \$74   |
| PS/2 35SX, 15, 405K, 55SX; 51SL; 651S; 655X                                     | 4MB    | 34F2933 \$138  |
| Adpt Brd 6450609; 34F3011; 34F3077  | 8MB    | 6450129 \$289  |
| Xstation 120 & 130  | 2-8MB  | 6450605 \$249  |
| PS/2 70 55X, 15, 405K   | 2-14MB | 34F3077 \$289  |
| PS/2 70's and 80's  | 4-16MB | 34F3011 \$388  |
|   | 4MB    | 6450104 \$198  |
| PS/2 80-A21; A31; A61   | 1MB    | 6450375 \$68   |
| PS/2 80-041   | 1MB    | 6450379 \$89   |
| PS/2 80-111; 311; 121; 321; 081; 161  | 2MB    | 6450128 \$138  |
| PS/2 90, 95 (install in port) P95; S6; S7                                       | 4MB    | 6450128 \$138  |
| (all models) PS/1 Pro 386SX M2123   | 2MB    | 6450130 \$298  |

### IBM Laptops

| MODEL                     | MEMORY | PRICE         |
|---------------------------|--------|---------------|
| PS/2 140SX; N335X Laptop  | 2MB    | 79F099 \$79   |
|                           | 4MB    | 79F100 \$134  |
|                           | 8MB    | 79F101 \$274  |
| PS2 CL575X Color Notebook | 8MB    | \$399         |
|                           | 4MB    | 07G1879 \$169 |
|                           | 4MB    | 07G1880 \$239 |
|                           | 8MB    | 07G1881 \$399 |

### ZENITH Memory

| MODEL                          | MEMORY | PRICE            |
|--------------------------------|--------|------------------|
| 486/33ET                       | 4MB    | ZA-4200-W2 \$188 |
|                                | 16MB   | ZA-4200-W8 \$198 |
| Z-386/20, 25, 33, 33E          | 1MB    | ZA-3800-ME \$49  |
| Z-386/20, 25, 33, 33E; 486/25E | 4MB    | ZA-3800-WK \$148 |
| Z-248, Z286P; Z386SX           | 2MB    | Z-605-1 \$99     |

### AST COMPUTER Memory

| MODEL                     | MEMORY | PRICE                     |
|---------------------------|--------|---------------------------|
| Pre. Exec. Notebook       | 1MB    | N/A \$68                  |
|                           | 4MB    | N/A \$128                 |
| Brovo 386-SX, WS/286, 386 | 2MB    | 500510-002 \$88           |
|                           | 4MB    | 500510-008 \$169          |
| Brovo 386/25; 33; 33T     | 1MB    | w/WPB 500780-003,002 \$58 |
| Premium II 4/33; 486/25   | 1MB    | w/WPB 500780-004 \$118    |
| Premium II, TE;           | 2MB    | w/WPB 500780-005 \$118    |
| Server SE 4/33            | 1MB    | 500780-004 \$118          |
|                           | 2MB    | 500780-005 \$118          |
| Premium II (All)          | 4MB    | w/WPB 500780-004 \$139    |
| Premium 386/33T           | 4MB    | w/WPB 500780-004 \$139    |
| All Premium 386/33T       | 4MB    | w/WPB 500780-004 \$139    |
| 486/33T, Server SE 4/33   | 4MB    | w/WPB 500780-004 \$139    |
| Brovo 486                 | 8MB    | w/WPB 500780-001 \$279    |

### NEC Memory

| MODEL                             | MEMORY  | PRICE             |
|-----------------------------------|---------|-------------------|
| Powermate 286/12; SX/16 and SX/20 | 2MB Kit | OP-410-8103 \$94  |
| Powermate 386/20; 25              | 2MB Kit | APC-4655 \$284    |
|                                   | 8MB     | APC-4656 \$658    |
| Powermate 386/33E, 486/25E        | 2MB     | OP-410-5101 \$188 |
| NEC LAPTOPS                       |         |                   |
| UltraLite II, SL/25C              | 2MB     | PC4721 \$148      |
|                                   | 4MB     | PC4722 \$248      |
| UltraLite SL/20, SL/20P           | 2MB     | PC4721 \$148      |
|                                   | 4MB     | PC4722 \$248      |
| ProSpeed 386, 386SX-16            | 1MB     | PC2121 \$104      |
|                                   | 2MB     | PC2122 \$118      |
| ProSpeed 386                      | 2MB     | PC3121 \$118      |
|                                   | 8MB     | PC3122 \$428      |

### TOSHIBA Laptop & Notebook Memory

| MODEL       | MEMORY      | PRICE         |
|-------------|-------------|---------------|
| TI000 SE/1E | 2MB CARD    | PA8311U \$99  |
| TI000 SE/1E | 2MB CARD    | PA8312U \$99  |
| TI000 SE/1E | 4MB CARD    | PA8314U \$148 |
| TI000 SE/1E | 8MB CARD    | PA8315U \$198 |
| TI000 SE/1E | 16MB CARD   | PA8316U \$248 |
| TI000 SE/1E | 32MB CARD   | PA8317U \$298 |
| TI000 SE/1E | 64MB CARD   | PA8318U \$348 |
| TI000 SE/1E | 128MB CARD  | PA8319U \$398 |
| TI000 SE/1E | 256MB CARD  | PA8320U \$448 |
| TI000 SE/1E | 512MB CARD  | PA8321U \$498 |
| TI000 SE/1E | 1024MB CARD | PA8322U \$548 |
| TI000 SE/1E | 2048MB CARD | PA8323U \$598 |

# Micro-International Inc.

since 1984, world-wide distribution of quality computer systems and components



| Intel CPU  | 486X-25 | 486DX-33 | 486DX2-50 | 486DX-66 |
|------------|---------|----------|-----------|----------|
| Monochrome | \$2,160 | \$2,410  | \$2,560   | \$2,720  |
| Color      | \$3,060 | \$3,310  | \$3,460   | \$3,620  |

Don't be misled by cheap, low-performance 486SLC designs. With the real Intel 486 power, this notebook computer is the only system you'll ever need in the office or on the road.

## HCP Power Notebook Standard Features

- VGA graphics with CCFT backlit LCD screen  
Mono – 32 gray scale  
Color – 256 colors
- 4 MB RAM installed (16 MB capacity)
- 120 MB hard disk, 15 ms access time
- 1.44 MB floppy drive
- Nickel-cadmium quick-rechargeable battery
- Carrying case
- Built-in trackball (COLOR System Only)
- Serial mouse (MONO System Only)
- Licensed Microsoft Windows 3.1
- Licensed DR-DOS 6.0
- One parallel and two serial ports
- External VGA and keyboard connections
- External numeric keypad
- AC adapter/charger included

## Optional Features

- Docking station with 2 x 16 bit slot \$160
- Auto cigarette adapter \$ 40
- Memory upgrade to 16 MB \$380
- Memory upgrade to 8 MB \$160
- Pocket fax modem (24/96) \$130
- Upgrade hard drive to 210 MB \$200
- Upgrade hard drive to 450 MB \$720
- Additional battery \$ 90
- Battery charger \$ 30
- Additional AC adapter/charger \$ 50

## Micro-International, Inc.



10850 Seaboard Loop  
Houston, Texas 77099



National Sales 800/967-5667 Houston 713/495-9096

Hours: 9:00 a.m. to 5:00 p.m. Monday-Friday (Central Time)

All systems and components include a one-year warranty and 30-day money-back guarantee.

Price reflects cash or credit card payment. Major corporation purchase orders accepted.



|                         |      |
|-------------------------|------|
| N45SL-120 meg, notebook | 1995 |
| N51SX-80 meg, notebook  | CALL |
| ThinkPad 700-120        | 2750 |
| ThinkPad 700C-120       | 4050 |
| PS/2 9 57-160 meg       | 2370 |

**Manager's Special**

|                                       |      |
|---------------------------------------|------|
| IBM ValuePoint 486 DX2/66, 212 MB     | 2450 |
| IBM ValuePoint 486DX66, 212 MB, 8 RAM | 2435 |

**Notebook Memory**

|                              |         |
|------------------------------|---------|
| Compaq Contura 4/8MB         | 215/430 |
| Toshiba T4400 4/8MB          | 235/460 |
| AST Exec. 4MB                | 290     |
| Texas Instruments TM4000 4MB | 225     |

**TOSHIBA NOTEBOOKS**

|                         |      |
|-------------------------|------|
| Toshiba 1850, 80 meg    | 1895 |
| Toshiba 4400c, 120 meg  | 3625 |
| Toshiba 6400sc, 120 meg | CALL |
| Toshiba 3300sl, 80 meg  | CALL |
| Toshiba 4500, 120 meg   | CALL |
| Toshiba 4500C, 200 meg  | CALL |

Call for pricing on other brand name models

**CD ROM/Multi Media**

|                   |     |
|-------------------|-----|
| NEC CD ROM 36M    | 570 |
| NEC CD ROM 74M    | 680 |
| Sound Blaster Pro | 205 |

**BRAND NAMES**

**LOW  
PRICES  
LEADER  
SINCE 1983**

**We export to Europe, Asia****SPECIAL OF THE MONTH**

|                              |        |
|------------------------------|--------|
| Toshiba 1200XE, 40 MB        | \$850  |
| AST Premium 386/33           | \$850  |
| AST Premium II 486SX20, 4MB  | \$950  |
| AST Premium II 386/25, 2MB   | \$895  |
| MAC 2C 5MB/40MB              | \$1500 |
| Toshiba Printer 321SLC Color | \$390  |

**AST**

|                               |      |
|-------------------------------|------|
| Power Exec 386SL/25, 60 meg   | 2185 |
| Power Exec 386SL/25, 120 meg  | 2555 |
| Power Exec 386SL/25C, 80 meg  | 3195 |
| Power Exec 386SL/25C, 120 meg | 3575 |
| Power Exec 486SL25            | CALL |
| Power Exec 486SL25C           | CALL |
| Power Premium 4/50            | 2290 |
| Power Premium 4/33            | 1995 |

(HARD DISK & MONITOR EXTRA)



|                               |      |
|-------------------------------|------|
| ProLinea 3/25s, 84 MB         | 909  |
| ProLinea 4/25s, 240 MB        | 1595 |
| Prolinea 4/50, 240 MB         | 2275 |
| DESKPRO 3/25I, 120 MB         | 1695 |
| DESKPRO 4/25Is, 120 MB        | 1810 |
| DESKPRO 4/66I, 210 MB         | 2675 |
| DESKPRO 386/33M, 120 MB       | 2335 |
| DESKPRO 486/33M, 340 MB       | 3520 |
| DESKPRO 50M, 340 MB           | 3995 |
| DESKPRO 66M, 510 MB           | 4730 |
| Portable 486, 210 MB          | CALL |
| Portable 486c (color), 210 MB | CALL |
| Contura 386SL/25, 120 MB      | CALL |
| LTE Lite/25, 120 MB           | CALL |
| LTE Lite/25c, (color), 120 MB | CALL |
| LTE Lite 4/25                 | CALL |

**SYSTEMPRO/LT**

|                    |      |
|--------------------|------|
| 486/33, 1020 MB    | 7552 |
| 486DX2/50, 1020 MB | 9350 |

\*Call for other models - Monitor Extra \*

**NOVELL SPECIALS****Netware 386 V.3.11  
Authorized Dealer**

|           |      |
|-----------|------|
| 5 users   | 695  |
| 10 users  | 1395 |
| 20 users  | 1895 |
| 100 users | 3795 |
| 250 users | CALL |

**WE STOCK  
SHARP NOTEBOOK  
TEXAS INSTRUMENTS****CITIZEN  
OKIDATA  
EPSON****HITACHI  
TALLGRASS  
ARCHIVE****NEC  
ALR  
WYSE****HOUSTON INSTRUMENTS  
MICROSOFT  
SUMMAGRAPHIC****INTEL  
PC MOUSE  
CALCOMP****ACS Computers**

All systems include

Made  
in  
USA

- Intel CPU with 4 meg RAM
- Desktop or tower case
- 2 serial, 1 parallel, 1 game (joystick) ports
- 101 AT enhanced keyboard
- 1.2 (5.25") & 1.44 (3.5") TEAC floppy drives
- SVGA card w/1 meg & SVGA 0.28mm monitor
- MS DOS 5.0 (complete w/manuals)
- MS Windows 3.1 (complete w/manuals) & mouse

|                         |      |
|-------------------------|------|
| 486/50 with 200 meg HD  | 2150 |
| 486/33 with 120 meg HD  | 1860 |
| 386/40 with 120 meg HD  | 1390 |
| 386SX/25 with 40 meg HD | 950  |

One year limited warranty

**LAN BOARDS**

|                   |     |
|-------------------|-----|
| 8 bit Arcnet      | 75  |
| 16 bit Arcnet     | 160 |
| Novell NE 1000    | 160 |
| Novell NE 2000    | 175 |
| 8 port Active Hub | 325 |
| Token Ring Card   | 399 |
| Tokenhub 4-port   | 355 |

Call for other  
LAN Accessories

**SVGA Monitors**

|                   |      |
|-------------------|------|
| NEC 3FGX, 14"     | 665  |
| NEC 4FG, 16"      | 825  |
| Viewsonic 4E, 14" | 365  |
| Viewsonic 8, 17"  | 1785 |
| Aamazing, 14"     | 335  |

**PRINTERS**

|                 |      |
|-----------------|------|
| Panasonic 2180  | 289  |
| Panasonic 2624  | 390  |
| OKIDATA ML320   | 315  |
| OKIDATA ML390   | 460  |
| HP DeskJet 500  | 399  |
| HP DeskJet 550c | 699  |
| HP PaintJet     | 705  |
| Epson, Citizen  | CALL |

**HARD DISKS****CONNER**

|                 |      |
|-----------------|------|
| CP30104 120 meg | CALL |
| CP3204F 220 meg | CALL |

**QUANTUM**

|                   |      |
|-------------------|------|
| Pro Drive 120 meg | CALL |
| Pro Drive 240 meg | CALL |

**MAXTOR, SEAGATE  
MICROPOLIS, MICRONET  
CALL FOR ALL MODELS****LASER PRINTERS**

|                      |      |                    |      |
|----------------------|------|--------------------|------|
| HP LaserJet IIISI    | 3595 | OKI OL 400, 800    | CALL |
| HP LaserJet IIID     | CALL | OKI OL 840 P.S.    | 1720 |
| HP LaserJet IV       | 1495 | Panasonic 4450     | 1295 |
| HP LaserJet IIP      | CALL | NEC Model 95       | 1395 |
| HP LaserJet IIP Plus | CALL | NEC Model 97       | CALL |
| HP Laser 4M          | 1995 | Compaq Pagemarq 20 | 4295 |

**Computerlane inc.**Corporate Accounts  
Welcome**Call for Discounts  
on Volume**And  
Consultant Orders**Outside California: 1-800-526-3482****Inside California: 818-884-8644 • FAX: 818-884-8253**

7500 Topanga Canyon Boulevard, Canoga Park, CA 91303

**Hours: Monday - Friday 9 -6, Saturday 10-5**

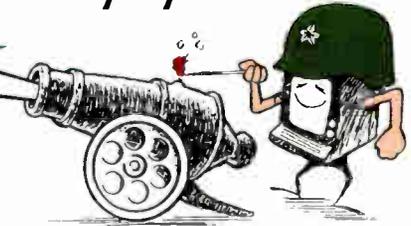
Compaq is a Registered Trademark of Compaq. IBM is a Registered Trademark of International Business Machines.

ALL QUOTED  
PRICES REFLECT  
A 5% CASH DISCOUNTVisa, MasterCard  
and  
American Express  
also acceptedPrices subject to change without notice.  
\*Quantities are limited

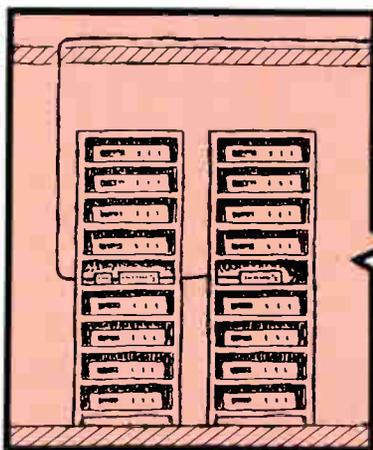
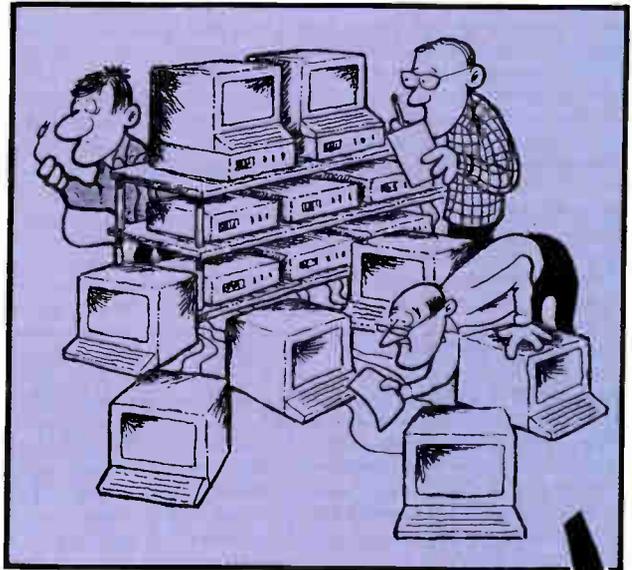
# CONTROL UP TO 96 PC FILE SERVERS WITH 1 KEYBOARD AND MONITOR USING...

## COMMANDER

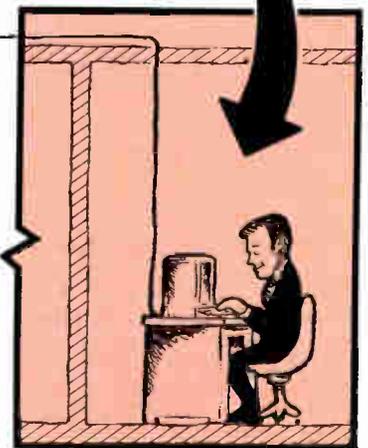
by cybex



- **Select via Keyboard**
- **Dual access up to 250 feet away (optional)**
- **No external power**
- **Mix PC, PC/XT, PC/AT and PS/2**
- **"AutoBoot™" Feature boots attached computers without operator intervention**
- **Shows PC power status**



- **PS/2 Mouse support available**
- **Each unit accommodates from 2 to 8 PCs**
- **Up to 12 units can be cascaded**
- **Mounting kit available for 19" and 24" rack installation**



Dealer Program Available

### Cybex Corporation

2800-H Bob Wallace Ave.  
Huntsville, Alabama 35805

(205) 534-0011

Fax (205) 534-0010

PC, PC/XT, PC/AT and PS/2 are trademarks of International Business Machines Corp.

# "The CAD Experts RAVE, Now I know Why..."

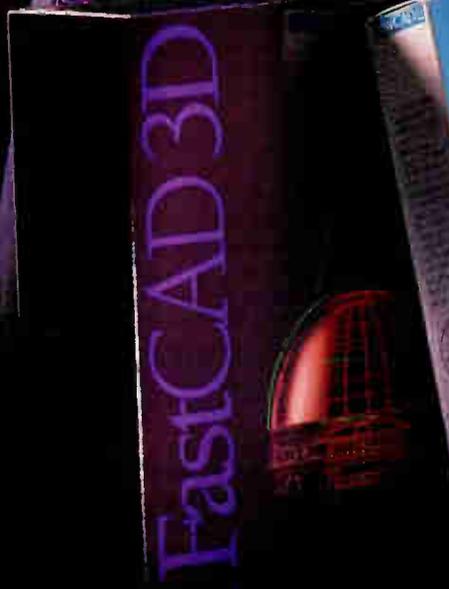
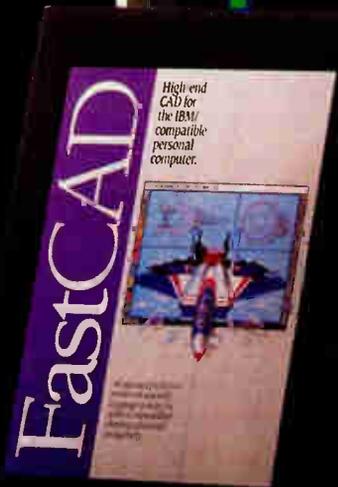
Jim Scalise finds FastCAD®'s speed and ease of use gives more than an increase in quality production time... "We found other systems difficult to learn, but FastCAD enabled us to get up and running in short order. Architects that need the fastest CAD system have to see this to believe it. FastCAD really lives up to its name. Without FastCAD it would be tough to compete and we wouldn't have time for the extensive detailed work we consider standard on all construction documents.

*Jim Scalise*  
**Jim Scalise**  
 Nickels + Scalise Architects



Plus, paper storage would be overwhelming and we'd still have 'draftsman's cramp' in our fingers and graphite on our forearms. After winning two National CAD Drawing Contests and elating our clients with FastCAD, it's as easy for me to endorse as it is to use."

If you want to be more competitive, but find yourself short on time, don't delay! Call Evolution Computing today for a free demo at 1-800-874-4028. Free technical support for registered users.



**FREE Hands-On Demo, Call 1-800-874-4028 Now!**

EasyCAD and FastCAD are registered trademarks of Evolution Computing. © 1992 Evolution Computing.

Circle 554 on Inquiry Card.

World Radio History

**PC Sources** Says...  
**Kenosha Computer Center** offers some of the Best Buys in Mail Order!

Join the thousands of satisfied customers who enjoy our combination of price, service, and speed of delivery.

- No Surcharge on MasterCard or Visa!
- Kenosha Computer Center is now in its 6th year!

**EPSON®**

|                                   |               |              |       |
|-----------------------------------|---------------|--------------|-------|
| LX 810 .....                      | \$169         | LQ570 .....  | \$235 |
| FX 870 .....                      | \$265         | LQ870 .....  | \$425 |
| FX 1050 .....                     | \$349         | LQ1070 ..... | \$349 |
| FX1170 .....                      | \$349         | LQ1170 ..... | \$569 |
| EPL8000 .....                     | \$1065        | LQ2550 ..... | \$849 |
| Action 3250 .....                 | \$189         |              |       |
| Action 1000 6 PPM, 14 fonts ..... | \$689         |              |       |
| Action 1500 6 PPM, PLC5 .....     | \$889         |              |       |
| DFX 5000/DFX 8000 .....           | \$1269/\$2139 |              |       |

Call For Options

**KENOSHA COMPUTER CENTER**  
 SALES LINE OUTSIDE WISCONSIN  
**1-800-255-2989**

Shipping, customer service & technical assistance call  
**414-697-9595 • FAX 414-697-0620**  
 VISA, MASTERCARD, AMERICAN EXPRESS ACCEPTED

**TEXAS INSTRUMENTS**

|  |        |
|--|--------|
| Travelmate 3000-WINSX .....            | \$1749 |
| Travelmate 4000 SX-80mg .....          | \$2199 |
| Travelmate 4000 WINSX 25-120 .....     | \$2349 |
| Travelmate 4000 WINDX 120mg .....      | \$2879 |
| Travelmate 4000 Win SLC/25 .....       | \$1749 |
| Travelmate 4000 Win DX2/50 .....       | \$3399 |
| Travelmate 4000 Win SX/25 Color .....  | \$3199 |
| Travelmate 4000 Win DX2/40 Color ..... | \$3899 |

Call For Accessories

**OKIDATA®**

|                                |               |
|--------------------------------|---------------|
| ML320/ML321 .....              | \$299/\$419   |
| ML380/ML590 .....              | \$219/\$419   |
| ML591/ML393 .....              | \$569/\$909   |
| OL 400 Laser/OL 810 .....      | \$589/\$1029  |
| OL 820 Laser/OL 830 .....      | \$1219/\$1279 |
| Okilaser 400 2MG upgrade ..... | \$119         |

**Panasonic**  
 Office Automation

|                                     |               |
|-------------------------------------|---------------|
| 1123/1124i .....                    | \$195/\$275   |
| 2180/2123 .....                     | \$179/\$229   |
| 1624/1654 .....                     | \$339/\$519   |
| 2124/2624 .....                     | \$299/\$359   |
| 4410/4430 .....                     | \$599/\$859   |
| 4450i/4451 .....                    | \$1059/\$1379 |
| 2mg. Upgrade for 4420 & 4450i ..... | \$139         |

**HEWLETT-PACKARD**

|                              |        |                        |             |
|------------------------------|--------|------------------------|-------------|
| Laserjet IV w/toner .....    | \$1399 | Deskjet 500/500C ..... | \$399/\$509 |
| Laserjet IV M w/toner .....  | \$979  | Deskjet 550C .....     | \$729       |
| Laserjet III P w/toner ..... | \$979  | Deskjet Portable ..... | Call        |
| Laserjet II P+ w/toner ..... | \$809  | Laserjet III si .....  | \$3249      |
| 1 MB Upgrade .....           | \$69   | 4 MB Upgrade .....     | \$159       |
| 2 MB Upgrade .....           | \$99   | Options .....          | Call        |

**Canon**

|  |       |  |        |
|--|-------|--|--------|
| <b>BJ 10 EX</b> .....  | \$245 | <b>BJ 330</b> .....  | \$555  |
| 360 DPI, 37K Buffer, 142 CPS, 6 fonts, IBM & Epson Emulation |       | Wide carriage. Version of BJ 300   |        |
| <b>BJ 20</b> .....   | \$359 | <b>BJC 800</b> .....   | \$1779 |
| Detachable cutsheet feeder, 188 CPS, 360 DPI                 |       | Color Bubblejet, 360 DPI, 7K Buffer, Epson Emulation LQ2550, 600 CPS, Built-in auto cut sheet feeder |        |
| <b>BJ 300</b> .....  | \$329 | <b>BJ 200</b> .....  | \$325  |
| 600 CPS, 30K Buffer, 3 Fonts, Epson IBM Emulation            |       | 496 CPS, 360 DPI, cut sheet feed, Epson & IBM Emulation  |        |

**MODEMS & FAX MODEMS**

|                                  |             |
|----------------------------------|-------------|
| <b>PRACTICAL PERIPHERALS</b>     |             |
| FAX ME for plain paper fax ..... | \$169       |
| PRACTICAL PER 9600 INT/EXT ..... | \$199/\$229 |
| PRACTICAL PER 14.4 INT/EXT ..... | \$329/\$279 |
| <b>HAYES</b>                     |             |
| HAYES OPTIMA 9600 .....          | \$329       |
| HAYES OPTIMA 14.4 .....          | \$399       |
| HAYES OPTIMA 14.4 W/FAX .....    | \$439       |
| HAYES ULTRA 14.4 .....           | \$619       |
| <b>U.S. ROBOTICS</b>             |             |
| USR 9600 V.32 bis .....          | \$469       |
| HST 16.9 Int/Ext .....           | \$499/\$549 |
| USR SPORTSTER 14.4 Int/Ext ..... | \$309/\$309 |
| USR SPORTSTER 14.4 W/FAX .....   | \$328       |
| USR DUAL STD EXT .....           | \$729       |
| World Port 96/96 Fax Modem ..... | \$439       |

Intel Satisfaction Below

**Kcc Computers**

|  |        |
|--|--------|
| KCC 386 SX-33 w/1.2MB floppy, 2 MG RAM, 40 MG Hard Drive, SVGA Card & Monitor, DOS 5.0, Windows & Mouse .....                      | \$1249 |
| KCC 386-DX-40 w/64K Cache, 1.2 MG floppy, 4 MG RAM 106 MG Hard Drive, SVGA Card and Monitor, DOS 5.0, Windows 3.1 and Mouse .....  | \$1499 |
| KCC 486-DX-33 w/64K Cache, 1.2 MG floppy, 4 MG RAM, 211 MG Hard Drive, SVGA Card and Monitor, DOS 5.0, Windows 3.1 and Mouse ..... | \$1999 |

All KCC systems come with a 30 day money-back guarantee. Toll-free technical support. One Year Limited Warranty.

**HARD DRIVES & TAPES**

|                            |             |
|----------------------------|-------------|
| SEAGATE 120 MB 3144A ..... | \$279       |
| SEAGATE 245 MB 3283 .....  | \$399       |
| MAXTOR 120 MB .....        | \$279       |
| MAXTOR 200 MB .....        | \$379       |
| MAXTOR 340 MB .....        | \$639       |
| CONNER 40 MB .....         | \$189       |
| CONNER 120/170 MB .....    | \$269/\$289 |
| CONNER 200/250 MB .....    | \$399/\$419 |

**MICROSOLUTIONS**

40 MB or 100 MB .....

External Parallel port hard drive. Perfect for Laptops, PS II's & XT's.

**HARD CARDS**

|                             |       |
|-----------------------------|-------|
| Plus Hard card 50XL .....   | \$239 |
| Plus Hard card 105 MG ..... | \$339 |

**TAPE BACK UP**

|                                     |       |
|-------------------------------------|-------|
| Colorado Jumbo 120 .....            | \$189 |
| Colorado Jumbo 250 .....            | \$249 |
| Colorado Tracker 120 Portable ..... | \$339 |
| Colorado Tracker 250 Portable ..... | \$399 |
| Mountain, Maynard, others .....     | CALL  |

**MONITORS**

|                                  |        |
|----------------------------------|--------|
| Mitsubishi EGA .....             | \$239  |
| Mitsubishi Diamond Pro 17" ..... | \$1069 |
| Mitsubishi HL 6955 20" .....     | \$1779 |
| NEC Multisync III FGX .....      | \$609  |
| NEC Multisync IV FGX .....       | \$709  |
| NEC Multisync VFGX .....         | \$1245 |
| NEC 6FG .....                    | \$2249 |
| Samsung 14" Sync Master 2 .....  | \$249  |
| Samsung 14" Sync Master 3 .....  | \$299  |
| Samsung 15" Sync Master 15 ..... | \$479  |
| Samsung 17" Sync Master 4 .....  | \$799  |

**SOFTWARE**

|                                  |             |
|----------------------------------|-------------|
| Lotus 2.4/3.1 .....              | \$299/\$359 |
| Microsoft Word for Windows ..... | \$299       |
| Microsoft Windows 3.1 .....      | \$79        |
| Microsoft DOS 5.0 .....          | \$69        |
| DBase IV .....                   | \$419       |
| Word Perfect 5.2 .....           | \$269       |
| C.A. Cricket Paint .....         | \$89        |
| C.A. SuperCalc .....             | \$89        |
| C.A. Simply Accounting .....     | \$125       |
| C.A. Clipper .....               | \$495       |
| C.A. BPI Value Pak .....         | \$359       |
| C.A. db Fast .....               | \$329       |

**BATTERY BACKUP & UPS**

|                     |             |
|---------------------|-------------|
| 250/400 .....       | \$109/\$165 |
| 450/600 .....       | \$199/\$259 |
| 900/1200VX .....    | \$375/\$729 |
| SMART UPS 400 ..... | \$309       |

**TRIPPLITE**

|                  |       |
|------------------|-------|
| BC 250 .....     | \$105 |
| BC 400 .....     | \$159 |
| BC 500 LAN ..... | \$195 |
| BC 600 LAN ..... | \$259 |
| BC 900 LAN ..... | \$359 |

**GRAPHICS CARDS**

|                                   |       |
|-----------------------------------|-------|
| ATI VGA Wonder XL 24 1MB .....    | \$149 |
| ATI Graphics Ultra 1MB .....      | \$279 |
| ATI Graphics Ultra Pro 1MB .....  | \$439 |
| ATI Graphics Ultra + 1MB .....    | \$295 |
| Diamond Speedstar 24X w/1MB ..... | \$175 |
| Diamond Stealth w/1MB .....       | \$219 |
| Orchid Fahrenheit1280 .....       | \$269 |
| Trident SVGA 1MB .....            | \$79  |
| Monochrome Boards .....           | \$35  |

No charge for MasterCard or Visa. We will ship COD on a cash or cashier's check basis only. Shipping & handling 3% - \$6 minimum; AK and HI slightly higher. 15% restocking charge on returned items. Purchase orders accepted from Fortune 1000, Government Institutions, schools and universities. 2% shipping discount available on orders over \$2000 if prepaid by check.

Prices and availability subject to change.

**MULTIMEDIA & CD ROMS**

|  |       |
|--|-------|
| Media Fusion 16 .....  | \$499 |
| Soundblaster Pro .....   | \$189 |
| Videoblaster .....   | \$329 |
| Imports video & audio from VCRs, cameras and video discs into VGA graphics |       |
| Soundblaster Pro   |       |
| Multimedia Upgrade kit .....   | \$539 |
| With Soundblaster Pro, midi kit, CD Rom drive & software                   |       |
| NEC CDR 74 w/gallery .....   | \$629 |
| NEC CD Express .....   | \$419 |

**NETWORKING**

|                                    |        |
|------------------------------------|--------|
| NETWARE 2.2 5 USER .....           | \$489  |
| NETWARE 2.2 10 USER .....          | \$1079 |
| NETWARE 2.2 50 USER .....          | \$2099 |
| NETWARE 3.11 5 USER .....          | \$589  |
| NETWARE 3.11 10 USER .....         | \$1359 |
| NETWARE 3.11 50 USER .....         | \$2699 |
| NE 2000 .....                      | \$139  |
| LANTASTIC 10MPS STARTER KIT .....  | \$449  |
| LANTASTIC 10MPS ADAPTER .....      | \$199  |
| LANTASTIC FOR WINDOWS .....        | \$165  |
| 3 COM ETHERLINK II .....           | \$185  |
| 3 COM ETHERCARD .....              | \$279  |
| INTEL ETHER 16 .....               | \$119  |
| INTEL ETHER 16 20 PAK .....        | \$1975 |
| SMC ETHER + ELITE 16 .....         | \$145  |
| SMC ETHERNET 8 BIT COAX .....      | \$95   |
| XIRCOM POCKET ADAP COAX .....      | \$299  |
| XIRCOM POCKET ADAP 10 BASE T ..... | \$299  |

**MEMORY PRODUCTS**

|  |       |
|--|-------|
| 2 MB IBM 30-286 .....  | \$89  |
| 2 MB IBM 55SX .....  | \$89  |
| 1 & 4 MB SIMMS .....   | Call  |
| BOCCA RAM AT 2 MB .....  | \$179 |
| 4 MB TI 4000 .....   | \$199 |
| Ast Premium 4 MB .....   | \$165 |
| Toshiba, Nec, Zenith, AST, IBM, Compac, Other Manufacturers & Products ..... | Call  |

**LASER PRINTERS**

|                                    |            |
|------------------------------------|------------|
| 2 MB EPSON ALII .....              | \$139      |
| 2 & 4 MB H-P III .....             | \$99/\$159 |
| 2 MB OKI 400 .....                 | \$119      |
| 2 MB OKI 830/840 .....             | Call       |
| 2 MB Panasonic 4450i .....         | \$125      |
| 2 MB Panasonic 4410/4430 .....     | \$125      |
| Other Models & Manufacturers ..... | Call       |

**HOUSTON INSTRUMENTS PLOTTERS & SUMMAGRAPHICS DIGITIZERS**

|                             |        |
|-----------------------------|--------|
| Image Maker A&B 11x17 ..... | \$699  |
| DMP-52 C&D 1 Pen .....      | \$1979 |
| DMP-161 A to D 8 Pen .....  | \$2749 |
| DMP-162 A to E 8 Pen .....  | \$3475 |
| DMP-162R A to E 8 Pen ..... |        |
| Roll Feed .....             | \$4749 |
| Summasketch II 12x12 .....  | \$279  |
| Summasketch II 12x18 .....  | \$479  |

**KENOSHA COMPUTER CENTER**  
 2133 91st Street  
 Kenosha, Wisconsin 53140

**KENOSHA COMPUTER CENTER**  
**1-800-255-2989**  
 World Radio History

Circle 557 on Inquiry Card.

# That's It!

It's an exhibition, with new products, new ideas, and new solutions. It's a conference, an educational forum which can open your eyes to new ways of solving problems. It's a meeting place where you can exchange thoughts with your peers. It's an industry forum where DEC can connect to IBM, McIntosh, Hewlett-Packard and many other systems. That's it. That's DEXPO and it's your best opportunity to make your DEC system compatible with the world. DEXPO.

Come see exhibitors and their products at DEXPO Spring '93.

DEXPO Spring is well on its way to filling the Inforum in Atlanta, GA with the exhibitors you want to meet. They'll be there to answer your questions, to provide solutions, to help you make your systems more efficient and your companies more profitable. That's it.

Open Systems Conference debut's at DEXPO Spring '93.

Today's information manager has two things on their mind - increased productivity and profitability without added expense. DEXPO has added a world class conference to open your eyes to new ideas in making your DEC and DEC compatible products work more effectively together. Topics include:

#### Achieving Enterprise-Wide Open Systems

#### A Guide to DEC-Other Vendor Integration

- IBM, HP, Sun, Unisys, Pcs, Unix System V

#### DEC and the Issues of the 90's

- Open Systems
- Operating Systems
- Network Management
- NAS
- Application Development
- DEC's Software Vision

To obtain registration information for DEXPO Spring '93 fill out the form and return either by mail or fax.

**DEXPO Spring  
Exhibition & Open Systems Conference  
June 8 -10, 1993  
Inforum  
Atlanta, GA**



Mail to: Registrar  
DEXPO Spring  
13760 Noel Road, Suite 500  
Dallas, TX 75240

Fax to: 214/385-9003

Yes, I'm interested. Please send more information on:

Attending       Conference       Exhibiting

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City/State/Zip \_\_\_\_\_

Phone \_\_\_\_\_

Fax \_\_\_\_\_

B

## DEXPO®

No one serves the DEC market better, no one can.

Produced by Miller Freeman, Inc.-A member of the United Newspaper Group ©1993 Miller Freeman, Inc.

Circle 555 on Inquiry Card.

MARCH 1993 • B Y T E 224NE-3

# Enter The Ultimate Performance Zone!

## With Uita Computers

1-800-755-7518  
3129 Main Street Weirton WV 26062

| SYSTEM           | BASIC SYSTEM | BASIC 40MB HD SVGA Card & Monitor | BASIC 80MB HD SVGA Card & Monitor | BASIC 170 MB HD SVGA Card & Monitor | BASIC 210 MB HD SVGA Card & Monitor | BASIC 340 MB HD SVGA Card & Monitor |
|------------------|--------------|-----------------------------------|-----------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| 486-50 EISA      | \$1,099      | \$1,499                           | \$1,569                           | \$1,659                             | \$1,739                             | \$1,939                             |
| 486-33 EISA      | \$839        | \$1,239                           | \$1,309                           | \$1,399                             | \$1,479                             | \$1,679                             |
| 486-66 DX2       | \$979        | \$1,379                           | \$1,449                           | \$1,539                             | \$1,619                             | \$1,819                             |
| 486-50 Local Bus | \$949        | \$1,349                           | \$1,419                           | \$1,509                             | \$1,589                             | \$1,789                             |
| 486-33 Local Bus | \$719        | \$1,119                           | \$1,189                           | \$1,279                             | \$1,359                             | \$1,559                             |
| 486-50 ISA       | \$919        | \$1,319                           | \$1,389                           | \$1,479                             | \$1,559                             | \$1,759                             |
| 486-33 ISA       | \$689        | \$1,089                           | \$1,159                           | \$1,249                             | \$1,329                             | \$1,529                             |
| 486-25 SX        | \$439        | \$839                             | \$908                             | \$999                               | \$1,079                             | \$1,279                             |
| 386-33/40        | \$399        | \$749                             | \$869                             | \$959                               | \$1,039                             | \$1,239                             |
| 386-33SX         | \$309        | \$700                             | \$779                             | \$869                               | \$949                               | \$1,149                             |

| PRINTERS                       |         |
|--------------------------------|---------|
| HP IV                          | \$ 1450 |
| HP IIII                        | 1010    |
| DESKJET 500                    | 395     |
| DESKJET 500C                   | 539     |
| IOXP 11001                     | 169     |
| IOXP 1123                      | 199     |
| IOXP 11241                     | 279     |
| IOXP 4410                      | 639     |
| IOXP 2123                      | 239     |
| NEG P98                        | 1429    |
| VIDEO CARDS                    |         |
| Mono Card w/Printer Port       | \$ 11   |
| VGA 256K (800X600 16bit)       | 39      |
| 1Mb VGA (1280X1024)            | 59      |
| Speedstar Plus 1Mb (1024X768)  | 104     |
| Speedstar 24X (1024X768)       | 144     |
| Speedstar Smooth VRAM          | 219     |
| ATI Ultra 1M5C                 | 269     |
| S-3 EISA                       | 329     |
| E-14000 Local Bus              | 145     |
| Parade 1Mb 1280 X 1024         | 199     |
| Trident SVGA CARD              | 54      |
| MOTHERBOARDS                   |         |
| 384X-33                        | \$ 112  |
| 384X-33 44K Cache              | 149     |
| 384X-40 64K Cache              | 164     |
| 486X-33 8K Cache               | 230     |
| 486X-33 8K 256K Cache          | 478     |
| 486X-50 8K 256K Cache          | 701     |
| 486-DX2-48 8K 44K Cache        | 789     |
| 486X-60 EISA 256K Cache        | 849     |
| 486X-66 EISA 256K Cache        | 940     |
| 486X-33 Local Bus 256K Cache   | 510     |
| 486X-80 Local Bus 256K Cache   | 729     |
| 486X-66 Local Bus 256K Cache   | 755     |
| TAPE BACK-UPS                  |         |
| 120Mb Colorado Tape Back-Up    | \$ 199  |
| 250 Mb Colorado Tape Back-Up   | 245     |
| MONITORS                       |         |
| 14" Mono Monitor               | \$ 104  |
| 14" Mono VGA                   | 120     |
| 14" SVGA (1024X768 .39)        | 227     |
| 14" SVGA (1024X768 .38)        | 255     |
| 14" SVGA (1024X768 .38) N/I    | 304     |
| 14" Sony 1304                  | 899     |
| 15" MAG                        | 874     |
| 18" NEC 3F6X                   | 649     |
| 17" SVGA N/I                   | 650     |
| 17" RONY 1604                  | 1039    |
| NETWORKING                     |         |
| NOVELL V3.11 6 USER            | \$ 659  |
| NOVELL V3.11 10 USER           | 1499    |
| NOVELL V3.11 20 USER           | 1994    |
| NOVELL V3.11 100 USER          | 4249    |
| ARCNET 8/16 (STAB)             | 49789   |
| ARCNET 8/16 (BUS)              | 44794   |
| ACTIVE HUB 4/8 PORTS           | 79/129  |
| NE-1000 COMPAT (COAX/TP)       | 90/110  |
| NE-2000 COMPAT (COAX/TP)       | 100/130 |
| MEMORY                         |         |
| 1 MEG X 9 70 NS SIMM           | \$ 37   |
| 250K X 9 70 NS SIMM            | 12      |
| 4 MEG X 9 70 NS SIMM           | 143     |
| IIT CO-PROCESSORS              |         |
| 387X-25                        | \$ 69   |
| 387DX-25                       | 69      |
| 387DX-33                       | 76      |
| 387DX-40                       | 90      |
| SCANNERS                       |         |
| HP SCANJET 3P                  | \$ 890  |
| HP SCANJET 2C                  | 1445    |
| MODEMS                         |         |
| 2400B Modem                    | \$ 39   |
| 9600B SEND/RECEIVE FAX         | 79      |
| 9600B w/V.32 & V.42 BIS        | 239     |
| CASES W/POW'R SUPPLY           |         |
| Mini Tower 200W Digital        | \$ 49   |
| Mini Desk 200W                 | 49      |
| P32 Style 200W                 | 78      |
| MidTower 200W Digital w/7 bays | 89      |
| FullTower 230W w/11 bays       | 117     |

Basic Systems Include : ~ Motherboard & CPU ~ 101 Enhanced Keyboard ~ 1.2 Meg or 1.44 Meg Floppy Drive ~ 2 Hard/2 Floppy IDE Controller ~ 2 Serial/1 Parallel/1 Game Ports ~ Internal Clock Calendar ~ Coprocessor Socket ~



**386-16SX NoteBook**  
2Meg RAM 40Meg. HD  
1.44 FD \$799.00

**Special**  
1024 X 768 SVGA .28  
\$255.00

Ask About  
Our 2 Year  
Extended Warranty

Panasonic 2124  
\$299

Accept only  
the finest...

**Caviar**

WESTERN DIGITAL

### Why Uita

Satisfied Government & Corporate Customers ~ Pentagon ~ General Electric ~ Mellon Bank ~ Sigma Software

No hassle return Policy  
Name brand Parts  
Teac  
Segate  
Intel  
NEC

1 Yr. Parts & 5 Yr. Service Warranty  
On-site Service Warranty Available  
48 Total System Burn-in

Piece of mind knowing the Quality and Reliability that only a Uita Computer Can Bring.

Manufactured Direct to you Right here in the United States

Knowledgeable Sales and Technical Personnel

| FLOPPY/HARD DRIVES |       |
|--------------------|-------|
| 1,271.44 Mb FD     | \$ 62 |
| 40 Mb/25 ms IDE    | 149   |
| 80 Mb/16 ms IDE    | 209   |
| 106 Mb/17 ms IDE   | 236   |
| 170 Mb/16 ms IDE   | 299   |
| 210 Mb/16 ms IDE   | 372   |
| 340 Mb/12 ms IDE   | 676   |
| 636 Mb/16 ms IDE   | 1019  |
| 210 Mb/16 ms SCSI  | 449   |
| 340 Mb/16 ms SCSI  | 732   |
| KEYBOARDS          |       |
| 101 ENHANCED       | \$ 26 |
| 101 LITE-ON CLICK  | 35    |
| 108 FOCUS 2001     | 40    |
| 111 FOCUS 8000     | 44    |
| 130 FOCUS 9000     | 79    |
| MOUSE              | 13    |

| CONTROLLERS                        |         |
|------------------------------------|---------|
| IDE 2FD/2HD                        | \$ 12   |
| IDE 4FD/2HD                        | 29      |
| IDE 2FD/2HD w/2S/1P/1G             | 29      |
| AT I/O 2S/1/1G                     | 15      |
| MFM 2FD/2HD 1:1                    | 40      |
| RL 2FD/2HD 1:1                     | 40      |
| UltraStar 128 ESDI 32K Cache (ISA) | 159     |
| UltraStar 148 SCSI 64K Cache (ISA) | 239     |
| UltraStar 24F                      | 449     |
| UltraStar 23F/23C ESDI (EISA)      | 488/639 |
| UltraStar 16C IDE Cache (ISA)      | 199     |
| CD ROMS/MULTIMEDIA                 |         |
| MITSUMI CRMC                       | \$ 179  |
| TEXEL /W CONTROLLER                | 489     |
| SOUNDBLASTER                       | 99      |
| SOUNDBLASTER PRO                   | 199     |
| 7 CD-ROM TITLES                    | 139     |

Prices subject to change without notice. All returns must be made in 30 days and accompany an RMA number. Shipping, Insurance & COD charges are extra and non-refundable. All prices reflect a 3% discount for cash. Uita Computers is not responsible for Typographical or Photographical errors. \$3.00 charge for orders under \$100.00. California residents subject to sales conformation. Tech. Support 1-304-748-1891 Fax 1-304-748-0276

# FREE On-Site Service Nationwide For One Year!



- 386DX 40 64K Cache 4 Meg .....\$1175
- 486DX 33 256K Cache 4 Meg .....\$1575
- 486DX2 50 256K Cache 4 Meg .....\$1625
- 486DX 50 256K Cache 4 Meg .....\$1775
- 486DX2 66 256K Cache 4 Meg .....\$1775
- 486 VESA Local Bus  
w/24 bit 16 Million true color video.....Add \$100

## All Systems Include:

- 130 Meg hard disk (14.5 ms)
- 1.44 Meg floppy drive
- 1.2 Meg floppy drive
- SVGA 1024 X 768 .28 14" color monitor
- SVGA card (trident) 1 Meg
- 220 Watt desktop or mini tower
- 2 serial, 1 parallel, 1 game, IDE 2HD/2FD
- 101-Key enhanced keyboard
- 1 year parts and 5 years labor
- **1 YEAR ON-SITE SERVICE**
- **FCC B AND UL APPROVED**

**P.S. Personal Solution**  
COMPUTERS

One Hollywood Drive  
North Grafton, MA 01536  
508-839-3289 fax 508-839-6236

**800-685-3981**

Monday-Friday: 10am-10pm  
Saturday: 10am-6pm  
Sunday: Noon-6pm  
Circle 558 on Inquiry Card.

No surcharge for credit cards.



# EISA-VESA-ISA

## ALL IN ONE SYSTEM



**Poly 486-66EV \$2750**

8 x 32-bit EISA slots with  
3 VESA Local Bus  
Upgradeable to P24T (586SX)  
256K Cache, Option: 512K  
8MB RAM, Expandable 256MB  
213MB High Speed IDE Hard disk  
32-bit VESA IDE with 2MB Cache  
1.2MB and 1.44MB Floppy Drives  
VESA Video Accelerator with 2MB

**FAST AND EXPANDABLE**

Call for other model and configuration!

**800-999-1278**

**TEL 415-583-7222**

**FAX 415-583-1974**

**Polywell**

Computers, Inc.

611 Airport Boulevard  
San Francisco, CA 94080

## ❖ ADVERTISERS ❖

Run a full- or half-page 4-color ad  
reaching a portion of **BYTE's U.S.** readers  
at unbelievably low rates — right here in this section!

Call today to learn more about **BYTE's** unique *Regional Advertising Section*, located in our prominent *Buyer's Guide*.



**(603) 924-2651 or (603) 924-2637**

Ask for your copy of the ACP Computer Hotline

# ACP-The Superstore with Super Deals!

CALL 1-800-FONE-ACP TOLL-FREE ORDERS

### Hard Drives

Western Digital High performance "Caviar" series with 1" height, Cache Flow™ and 32K buffer.

|              |              |     |      |
|--------------|--------------|-----|------|
| AC280 80Mb   | 1" 3.5" 14ms | IDE | Call |
| AC2120 125Mb | 1" 3.5" 14ms | IDE | Call |
| AC2200 200Mb | 1" 3.5" 14ms | IDE | Call |
| AC2340 340Mb | 1" 3.5" 14ms | IDE | Call |

### Maxtor

|                |              |      |      |
|----------------|--------------|------|------|
| 7080A 80Mb     | 1" 3.5" 15ms | IDE  | Call |
| 7120A 120Mb    | 1" 3.5" 15ms | IDE  | Call |
| LX71213A 213Mb | 1" 3.5" 15ms | IDE  | Call |
| MX1240 1.2Gb   | 1" 3.5" 15ms | IDE  | Call |
| Panther 1.2Gb  | 5" 1/4" 17Gb | Call | Call |

### Conner Peripherals

|             |           |     |      |
|-------------|-----------|-----|------|
| 30104 120Mb | 3.5" 19ms | IDE | Call |
| 3204 200Mb  | 3.5" 15ms | IDE | Call |

### Hard Drive Specials

|                          |        |
|--------------------------|--------|
| Seagate ST3283 249Mb IDE | 499.95 |
| Samsung 100Mb IDE        | 299.95 |
| Seagate Wren 340Mb ESDI  | 599.95 |
| Brand Tech 200Mb IDE     | 379.95 |

Call for Quanta, Micropoint, Seagate Controllers from Ultrastor, Always, WD etc.

### Backups

Colorado

|                                |     |
|--------------------------------|-----|
| DJ10 120Mb Tape Drive Internal | 199 |
| DJ20 250Mb Tape Drive Internal | 268 |
| Trakker 120 Tape Backup        | 358 |
| Trakker 250 Tape Backup        | 428 |

### Squest (with cartridge)

|  |     |
|--|-----|
| 44Mb kit S6555, S6400, S6011 (16 bit)  | 410 |
| 44Mb external                          | 429 |
| 88Mb kit S65110, S6800, S6011 (16 bit) | 599 |
| 88Mb external                          | 629 |

### GrassRoots Floptical

|                            |      |
|----------------------------|------|
| Floptical 21 Mb (external) | Call |
| Floptical 21 Mb (internal) | Call |

### Floppy Disk Drives

Toshiba

|                 |          |          |    |
|-----------------|----------|----------|----|
| ND04DG 360K     | 5.25" HH | PC/XT    | 59 |
| ND08DEG 1.2Mb   | 5.25" HH | PC/AT    | 72 |
| ND3561GR 1.44Mb | 3.5" HH  | w/AT Kit | 72 |

ACP

|                       |      |                         |      |
|-----------------------|------|-------------------------|------|
| 1.2 Mb 5.25"          | 66   | 2.88Mb 3.5"             | Call |
| 1.44Mb 3.5"           | 67   | All in One 3.5/5.25 149 | Call |
| Compaq 1/3 ht. Floppy | Call |                         | Call |

### Multimedia

#### Creative Labs

Complete all-in-one MPC compatible upgrade kit includes: Panasonic CD Drive, Sound Blaster Pro, five CD's, Microsoft Multimedia Kit Int/Ext. 539/599

Sound Blaster Reg/Pro/16 ..... 85/148/218

#### MediaVision

|                           |     |
|---------------------------|-----|
| CDPC Subsystem (external) | 998 |
| Pro 16 Multimedia System  | 968 |
| Pro Audio Spectrum 16     | 194 |

NEW! MediaVision Fusion CD ext. CD ROM with Sound, Speaker and 4 CD's: Compton's Carmen, Ultima, Wing Comm ..... 429

#### Compton's Encyclopedia CD

|                           |     |
|---------------------------|-----|
| Standard version          | 169 |
| Interactive version, NEW! | 249 |

#### CD ROM Special

|                              |     |
|------------------------------|-----|
| Mitsumi MPC Compatible (int) | 188 |
|------------------------------|-----|

### Input Devices

Advanced

|                      |                   |
|----------------------|-------------------|
| Trackman Port        | 98                |
| 3-button Mouse 14.95 | Microsoft         |
| 84/101 Keyb          | 48/58             |
| Mouse&Windows 88     | Ballpoint         |
| Logitech             | Mouse&Windows 148 |
| Mouseman             | 78                |
| Trackman             | 78                |
| PC Trac              | 78                |
| Cordless Mouse       | 88                |

### Video Graphics Cards

#### ATI

|                              |         |
|------------------------------|---------|
| Graphics Ultra Pro w/1Mb/2Mb | 428/518 |
| Graphics Ultra+ w/1Mb/2Mb    | 288/328 |
| Graphics Ultra 512K/1Mb      | 248/288 |
| Graphics Vantage 512K/1Mb    | 188/218 |
| VGA Wonder XL24 w/512K/1Mb   | 128/148 |
| VGA Integra                  | 83      |
| VGA Basic 16                 | 65      |

#### SpeedSTAR

|                                 |     |
|---------------------------------|-----|
| Stealth w/1Mb                   | 218 |
| Starcard 24X 24-Bit Color w/1Mb | 165 |

#### Orchid

|                       |     |
|-----------------------|-----|
| Fahrenheit 1280 w/1Mb | 258 |
|-----------------------|-----|

#### Paradise

|                           |     |
|---------------------------|-----|
| Windows Accelerator w/1Mb | 178 |
|---------------------------|-----|

### Advanced Cards

|                       |       |
|-----------------------|-------|
| Mono/Color            | 38/48 |
| EGA                   | 48    |
| VGA (800 x 600)       | 53    |
| VGA (1024 x 768) 512K | 68    |
| VGA (1024 x 768) 1Mb  | 88    |

### Chips and SIMM's

RAM Chips

|                  |       |     |      |      |
|------------------|-------|-----|------|------|
| 41256-100 256K   | 100ns | DIP | 1.49 | 1.35 |
| 41256-80 256K    | 80ns  | DIP | 1.59 | 1.49 |
| 414256-80 256Kx4 | 80ns  | DIP | 4.79 | 4.59 |
| 1M1b-100 1Mb x 1 | 100ns | DIP | 4.05 | 3.95 |
| 1M1b-80 1Mb x 1  | 80ns  | DIP | 4.49 | 4.39 |

Call for VIDEO RAMS & CACHE RAMS  
Over 20,000,000 IC's in-stock including  
We Specialize in 486DX/25 & 33 Upgrades

New Low Prices!

### SIMM Memory Modules

|                   |     |              |     |
|-------------------|-----|--------------|-----|
| 1 x 9-70 (3-chip) | 37  | 1 x 36-70    | 138 |
| 1 x 9-70 (9-chip) | 39  | 2 x 36-70    | 288 |
| 4 x 9-70          | 129 | 4 x 36-70    | 538 |
| 1 x 8-70 (Moc)    | 36  | 8 x 8 (Moc)  | 324 |
| 4 x 8-80 (Mac)    | 124 | 16 x 8 (Moc) | 408 |

### Math Coprocessors

|                |                    |     |
|----------------|--------------------|-----|
| Intel          | Cyrix              |     |
| 8087           | 387SX (16-25)      | 73  |
| 80287-10       | 387DX (20-33)      | 88  |
| 80387SX (coll) | 387DX/40           | 108 |
| 80387DX (coll) | 80287 (coll)       | 78  |
| 387SL          | Overdrive 486DX/33 | 649 |
| RealPC AD      | Overdrive 486SX/25 | 489 |

### Memory Upgrades

#### Notebooks

|                          |       |
|--------------------------|-------|
| Compaq Contura 4Mb S 198 | 49.95 |
| Compaq Lite 4Mb S        | 228   |
| HP951X Palmtop, 2Mb      | Call  |
| IBM CL575X, 4Mb          | 345   |
| Everex Carrier, 2Mb      | 118   |
| Toshiba T4400, 4Mb       | 188   |
| Toshiba T6400, 4Mb       | 188   |
| Zenith Z-Note, 2Mb       | 168   |

Toshiba 4000 16Mb/160 \$999

Apple Powerbook 1400 170-20Mb \$275

### Laser Printers - "O" K Cards

|                                  |             |
|----------------------------------|-------------|
| HP III/IIID/IIP/IIP/IIIP/II/IIID | 49.95       |
| Panasonic 4410/30 or 4420/10     | 69.95/49.95 |
| Oki 400                          | 49.95       |
| Oki 830/40                       | 79.95       |
| NEC                              | 69.95       |

### Computer Upgrades

|                          |        |
|--------------------------|--------|
| AST Bravo 3/255, 8Mb     | \$ 318 |
| IBM PC/2 90, 95, 2Mb     | 88     |
| Dell 420/25/33/50SE, 4Mb | 208    |

Call for NEC, HP, Zenith, Leading Edge.

### Motherboards

#### Advanced

|                |        |
|----------------|--------|
| 286 - 12MHz    | 69.95  |
| 386SX - 25MHz  | 119.95 |
| 386DX - 40MHz  | 199.95 |
| 486SX - 20MHz  | 199.95 |
| 486DX2 - 50MHz | 699.95 |
| 486DX2 - 66MHz | 999.95 |
| 486DX - 50MHz  | Call   |

#### Micronics

ISA BUS

|                        |     |
|------------------------|-----|
| 486DX/33 w/256K cache  | 799 |
| 486DX2/50 w/256K cache | 999 |

ISA-VLBUS

|                            |      |
|----------------------------|------|
| 486DX2/66 w/64K cache      | 1399 |
| 486DX2/50 w/64K cache      | 1049 |
| MVC400LB/1Mb Video Adapter | 199  |

EISA BUS

|                        |      |
|------------------------|------|
| 486DX2/33 w/256K cache | 1099 |
| 486DX2/50 w/256K cache | 1449 |

Now Shipping!

## PIGEON

A Dynatec Company

### Memory Upgrades

COMPAG PROLINER

|                    |     |
|--------------------|-----|
| Mod 4/33.50 4Mb    | 158 |
| Mod 3/25 SC.25 2Mb | 89  |

Call for other models...

### COMPAQ

LITE, Lite, Contura

|                 |     |
|-----------------|-----|
| 2400/9600 w/SFW | 169 |
| 9600/9600 w/SFW | 439 |
| 144/9600 w/SFW  | 529 |

### TOSHIBA Notebooks

|                 |     |
|-----------------|-----|
| 2400/9600 w/SFW | 169 |
| 9600/9600 w/SFW | 439 |
| 144/9600 w/SFW  | 549 |

\* Cellular ready.

### PC6881C SHARP

#### Color 386SL/20 Notebook

- Only 4.9 LBS.1
- 2Mb RAM
- 80Mb IHD

**\$3199.95** also NEW!

6785 w/80Mb ..... \$ 1799.95

### Advanced Computers

with AMD High Performance CPU's  
plus SEIKO Trinitron Monitors

...All Advanced Systems include:

- OPTI or ACC Chipsets
- 1 Year Warranty
- AMI BIOS
- Enhanced 101 Keyboard
- IDE Interface
- Free Accounting Software

### Advanced Computers

#### 486/33 Complete Color System

Includes:

- 486DX/33 w/256k Cache
- 4 Mb RAM
- 512K VGA Card
- 105 Mb Hard Drive
- 1.44 Mb Floppy Disk
- IDE Controller
- 101 Keyboard
- 14" SVGA 28 Color Monitor

ACP's Sale Price **\$1499**

Call for additional configurations... Local Bus, 386SX, 486DX/50 and Seiko Trinitron Monitors

|  |   |   |
|--|---|---|
| <h3>386DX/25 &amp; 100Mb HD Desktop System</h3> <p>2Mb RAM • 100Mb HD • 64K Cache<br/>3.5/5.25 Dual Floppies • SVGA/512K Mouse • DOS 5.0 • Windows 3.1 • Works</p> <p>Unreal Deal at ACP!!! <b>\$799</b></p> | <h3>Hi-speed CD-ROM Toshiba 2200</h3> <p>FREE Lotus 1-2-3 CD with purchase, 200ms ACCESS w/adaptor.</p> <p><b>\$799</b></p> | <h3>386SX/20 Notebook</h3> <p>40 Mb Hard Drive<br/>1 Mb RAM • VGA LCD</p> <p><b>\$999</b></p> |
|--|---|---|

Call ACP for Notebooks...  
**AST • COMPAQ MITAC • TOSHIBA**

BELOW COST! **\$269**  
80286 • 3.5" Floppy • 1 Mb • 101 Keyboard

### IBM OS/2 Special Purchase

04G1049 OS/2 Extended w/server, List 1995 ACP 1159

04G1051 OS/2 Lanserver List 795 ACP 429

04G1091 OS/2 Ext. Admin kit, List 165 ACP 97

10G 5999 OS/2 2.0 Upgrade List 149 ACP 79

All 4 for only **\$499!**

### Software Sale...up to 90% Off!

100's of Titles! Now only 99¢!

|                   |      |                      |      |
|-------------------|------|----------------------|------|
| CompuServe        | 9.95 | Combase              | 9.95 |
| Life & Death      | 9.95 | Computer Comic       | 9.95 |
| Desert Storm      | 9.95 | Complete Craps       | 9.95 |
| Personal Biz Base | 9.95 | Pro Football Analyst | 9.95 |
| Stickbear         | 9.95 | Hdc Window Apps      | 9.95 |
| Dvork on Typing   | 9.95 | 30 Min. Negotiator   | 9.95 |
| Bible Trivia      | 9.95 | Retirement Planner   | 9.95 |

Call for a complete list...

### Intel® Satisfaction

Model 100 48 FAX/24 Modem ..... 88

Model 200 96 FAX/24 Modem ..... 288

Model 400 144 FAX/144 Modem 388

### TOSHIBA® Notebooks

|                       |      |
|-----------------------|------|
| T1850 386SX-25/80Mb   | 1899 |
| T1850C Color/80Mb     | 2835 |
| T4400SX 486SX-25/80Mb | 2299 |

### PC Windows Accelerator Increases Performance!

### Diamond Computer Systems, Inc.

#### Speed Star 24X

...make your 386 perform like a 486

- Windows Accelerator
- 15X faster than SVGA
- 1Mb RAM
- WD90C31 Chip
- 5 Year Warranty
- 24 bit color for 16.7 million colors

ACP only **\$165**

### Hayes

#### New! OPTIMA® 24+FAX 96

Now you can get a 2400bps V.24bis data modem plus a 9600 bps FAX with Hayes superior performance and compatibility. All at a great price. Also includes SmartCom EZ and SmartCom FAX software.

|                       |        |
|-----------------------|--------|
| OPTIMA® 24 + FAX 96   | \$ 148 |
| OPTIMA® 96 + FAX 96   | 368    |
| OPTIMA® 144 + FAX 144 | 475    |

## Advanced Computer Products, Inc.

1310 E. Edinger, Santa Ana, CA 92705 • FAX 714-558-8849 • Toll-Free 1-800-FONE ACP • Sales 714-558-8813

Prices subject to change without notice. No surcharge on credit card. Credit cards not charged until we ship. 100% risk free return guarantee! If you are not 100% satisfied just return insured within 15 days complete with all materials in new resalable condition with original invoice. ACP will immediately exchange product or issue ACP credit less shipping for future purchase. No Returns on software Special Purchase

Circle 190 on Inquiry Card (RESELLERS: 191).

# TRAVEL LIGHT, TRAVEL NEAT, TRAVEL SMART...

## ABC BICOM B260i



- Weight less than 1 kg
- PCMCIA 2.0 Interface
- 60 Mb Hard Disk
- 2 Mb RAM
- No adapters needed

- Weight 2.2 lbs. (Bicom and Battery)
- Dimension 8.78" x 6.36" x 1.22"
- True 16 bit AMD Lonestar Processor, 386SX Class Performance
- 5 "AA" size NiMH Batteries
- 60 MB Hard Disk Drive
- 2MB RAM expandable to 4MB on board and 16MB with memory card
- PCMCIA 2.0/JEIDA standard port for memory card and I/O card
  - 640 x 400 resolution LCD screen supports CGA, AT&T mode and all Windows graphics
  - 64-key keyboard
  - 1 parallel (bi-directional)/ 1 serial
  - External FDD port for optional Floppy Drive
  - DR-DOS 6.0, File Transfer Software & Serial Download Cable
- Built-in Personal Data Manager software
- Built-in Programmable Power Management Software
- Universal AC/DC adaptor
- Carrying Case

Options: External Floppy Drive, SRAM Memory Cards, 9624 IC Card Fax/Modem, Mini-trackball, External Keyboard, extra batteries.

**ABC** COMPUTERS®

1-800-336-2280

ABC Computer (USA) Corp.  
2531 237th Street, Suite 122, Torrance CA 90505  
310-325-4005 Fax 310-325-6369



**NOW ONLY  
\$795**

**30-Day Money Back Guarantee**

All brand names are registered trademarks of their respective owners.

# If You're Only Using Windows For Work, It's Time You Sought Professional Help.

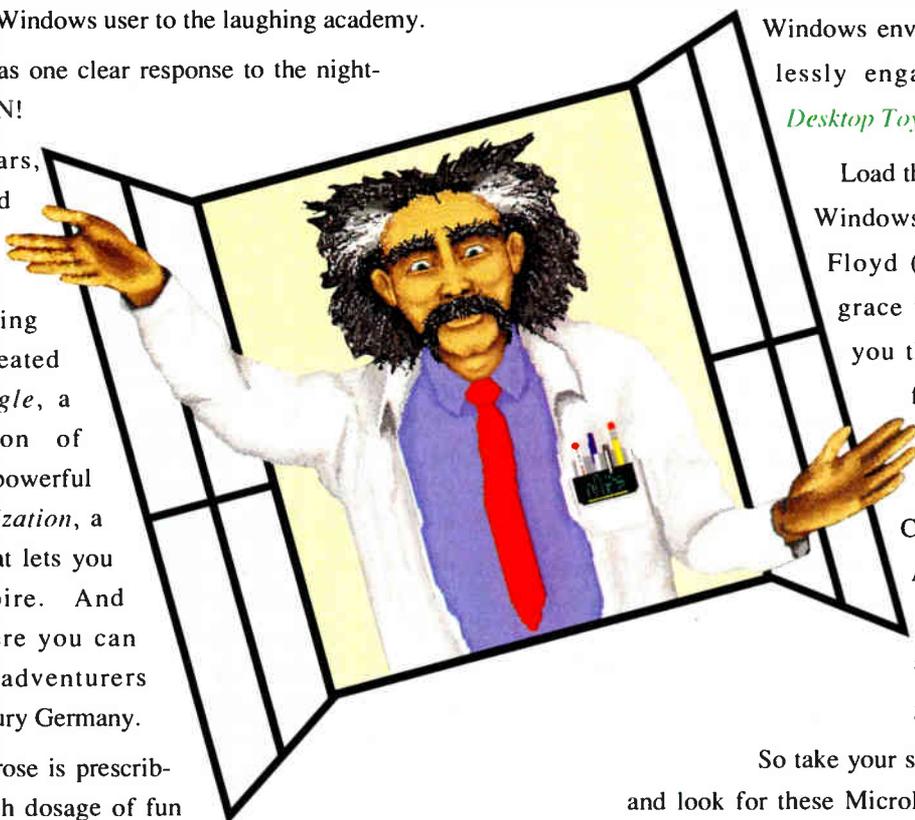
## MICROPROSE HAS THE REMEDY.

Spreadsheets. Multi-tasking. Sales forecasts. It's enough to drive a Windows user to the laughing academy.

MicroProse has one clear response to the nightmare of work! FUN!

For 10 years, we've relieved computer owners of workday grief with spine-tingling software. We created *F-15 Strike Eagle*, a flight simulation of America's most powerful jet fighter. *Civilization*, a strategy game that lets you build an empire. And *Darklands*, where you can lead a band of adventurers through 15th century Germany.

Now MicroProse is prescribing this same high dosage of fun for Windows users. And it all starts with *The MicroProse Entertainment Pack Vol. #1*.



## SOMEBODY CALL A DOCTOR!

Our first offering for the Windows environment is the endlessly engaging *Dr. Floyd's Desktop Toys*.

Load this package onto your Windows and the wacky Dr. Floyd (whose good looks grace this ad) will escort you through six wonderfully addictive games. Games like Snark Hunt. Web Spinners. Cryptograms. And KYE. All designed to transport your thoughts far away from the daily grind of work.

So take your shoulder off the wheel and look for these MicroProse games arriving soon at your favorite software retailer. And open your Windows to a whole new world of fun.

**MICROPROSE**  
ENTERTAINMENT • SOFTWARE  
**SERIOUSLY FUN SOFTWARE**

© 1992 MicroProse Software, Inc. ALL RIGHTS RESERVED.

Circle 200 on Inquiry Card.

To get our free catalog, call **1-800-879-PLAY**.  
(Mon. - Fri., 8:30 am-5:00 pm EST.)

Or fill out the coupon and mail it to: MicroProse Software, Inc.  
180 Lakefront Drive • Dept. D-10 • Hunt Valley, MD 21030-2245

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

NAI

# MEMORY !! MEMORY !! MEMORY !!

|  |             |
|--|-------------|
| ACER 486sx - 16MB SIMM (4M X 36)             | \$ 529.00   |
| 32MB SIMM (8M X 36)                          | \$ 1,599.00 |
| AMI EZ-FLEX - 64MB KIT (4 SIMMS)             | \$ 2,799.00 |
| AMIGA 2000 - 16MB SIMM                       | \$ 469.00   |
| AST BRAVO 486LC - 16MB SIMM                  | \$ 469.00   |
| COMPAQ SystemPro - 32MB MODULE               | \$ 1,199.00 |
| DELL 486's - 16MB KIT (2 SIMMS)              | \$ 538.00   |
| 32MB KIT (2 SIMMS)                           | \$ 1,088.00 |
| MAC IIfx - 16MB SIMM                         | \$ 479.00   |
| MAC QUADRA 950 - 16MB SIMM                   | \$ 469.00   |
| MAC IIfci,IIfcx,IIfsi,QUADRA 900 - 16MB SIMM | \$ 469.00   |
| MAC QUADRA 700 & SE/30 - 16MB SIMM           | \$ 529.00   |
| NeXT TURBO - 16MB SIMM                       | \$ 469.00   |
| SUN IPX,ELC - 16MB SIMM                      | \$ 499.00   |
| SUN SPARC SERVER - 256MB KIT                 | CALL        |

## OTHER MEMORIES AVAILABLE

### IBM

|                         |        |
|-------------------------|--------|
| PS/1 - 2MB              | \$ 68  |
| 4MB                     | \$ 149 |
| M30 - 2MB               | \$ 79  |
| M50Z,55sx,65sx,70 - 1MB | \$ 45  |
| 2MB                     | \$ 79  |
| M55sx,65sx,70 - 4MB     | \$ 135 |
| M70-A21,A61,121 - 2MB   | \$ 79  |
| M40sx,35sx - 8MB        | \$ 269 |
| M57sx,90,95 - 4MB       | \$ 135 |
| 8MB                     | \$ 269 |
| M80-041 - 1MB           | \$ 65  |
| M80-111,121,311 - 2MB   | \$ 99  |
| M80-A21,A31 - 4MB       | \$ 180 |
| 16-BIT OK Exp Board     | \$ 128 |
| 32-BIT OK Exp Board     | \$ 128 |

### AST

|                         |        |
|-------------------------|--------|
| PREM. 386/20C - 1MB KIT | \$ 65  |
| PREM. 386/25 - 1MB      | \$ 45  |
| PREM. 486/25 - 1MB      | \$ 45  |
| PREM. II 486 - 1MB      | \$ 41  |
| 4MB                     | \$ 139 |
| 8MB KIT                 | \$ 278 |
| PREM. II 1MB Exp Board  | \$ 469 |

### COMPAQ

|                         |        |
|-------------------------|--------|
| DP 386/20,20E,25 - 1MB  | \$ 66  |
| 4MB                     | \$ 159 |
| DP 386S/16 - 1MB        | \$ 66  |
| 4MB                     | \$ 159 |
| DP 286N,386N,S/20 - 4MB | \$ 135 |
| M-SYSTEMS - 2MB         | \$ 79  |
| 4MB                     | \$ 135 |
| 8MB                     | \$ 299 |
| DP 386/33,486/25 - 2MB  | \$ 96  |
| SystemPro - 8MB         | \$ 269 |
| OK Exp Brd              | \$ 335 |
| DP 386S/16 1MB Exp Brd  | \$ 105 |
| DP 386/20,20E,25,25E    |        |
| 1MB Exp. Board          | \$ 105 |

### DELL

|                       |        |
|-----------------------|--------|
| 325D,P,333D,P - 1MB   | \$ 41  |
| 4MB                   | \$ 135 |
| 420,425,433 - 2MB KIT | \$ 82  |
| 4MB KIT               | \$ 158 |
| 8MB KIT               | \$ 270 |
| 450DE,450SE - 2MB KIT | \$ 82  |
| 4MB KIT               | \$ 158 |
| 8MB KIT               | \$ 270 |

### HP

|                          |         |
|--------------------------|---------|
| Vectra QS-16 - 2MB KIT   | \$ 129  |
| 4MB KIT                  | \$ 229  |
| Vectra 486 - 2MB         | \$ 79   |
| 4MB                      | \$ 135  |
| 8MB                      | \$ 269  |
| X-Station 700 Ser. - 2MB | \$ 89   |
| 4MB                      | \$ 149  |
| 8MB                      | \$ 299  |
| 9000/400t,425t - 8MB KIT | \$ 495  |
| 16MB KIT                 | \$ 999  |
| 32MB KIT                 | \$ 1869 |
| 9000/425e - 8MB KIT      | \$ 428  |
| 16MB KIT                 | \$ 828  |

### APPLE

|                              |         |
|------------------------------|---------|
| II,SE,SE/30 - 1MB            | \$ 32   |
| Classic - 1MB Exp. Board     | \$ 54   |
| SE/30,IIfci,IIfcx,IIfsi,LC & |         |
| Quad. 700,900 - 4MB          | \$ 115  |
| Quad. 700,900 - 32MB KIT     | \$ 1120 |
| IIfx - 16MB KIT              | \$ 499  |
| IIfx - 32MB KIT              | \$ 1156 |
| Quadra 256K V-RAM            | \$ 27   |
| LC 512K V-RAM                | \$ 44   |

### LAPTOPS

|                          |        |
|--------------------------|--------|
| AST EXEC. NB - 4MB       | \$ 119 |
| COMPAQ LTE386 - 4MB      | \$ 209 |
| SLT386 - 4MB             | \$ 168 |
| DELL 316,320 LT - 2MB    | \$ 99  |
| EVEREX TEMPO - 2MB       | \$ 78  |
| IBM L40sx - 4MB          | \$ 135 |
| MAC POWERBOOK - 2MB      | \$ 104 |
| NEC P.S. 286,386sx - 4MB | \$ 200 |
| P.S. 386 - 8MB           | \$ 429 |
| P.S. SX/20 - 4MB         | \$ 200 |
| PANASONIC CF170 - 1MB    | \$ 55  |
| T.I. TRVL-MT 3000 - 2MB  | \$ 80  |
| TOSHIBA 1000 - 2MB       | \$ 108 |
| 2000SX - 8MB             | \$ 388 |
| 3200SXC - 4MB            | \$ 160 |
| 5200 - 8MB               | \$ 315 |

### PRINTERS

|                        |        |
|------------------------|--------|
| EPSON 6000 - 4MB       | \$ 229 |
| HP IIf,II,IIID,P - 2MB | \$ 108 |
| IIfsi - 4MB            | \$ 135 |
| IBM 4019,4029e - 3.5MB | \$ 129 |
| 4029 - 4MB             | \$ 135 |
| OKIDATA 400 - 2MB      | \$ 129 |

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

### OTHER MEMORIES FOR:

ACER, ALTIMA, APPLE, AST, CHAPLET, COMPAQ, DELL, EPSON, EVEREX, HP, LEADING EDGE, IBM, NEC, NCR, OKIDATA, PACKARD-BELL, PANASONIC, PHILIP, SAMPO, SHARP, SILICON GRAPHICS, SUN MICROSYSTEMS, TANDON, TI, TOSHIBA, TULIP AND ZENITH.

CALL FOR OUR COMPLETE CATALOG



TERMS: C.O.D. CASH, VISA OR MASTERCARD.  
COMPANY AND UNIVERSITY P.O.'S ACCEPTED UPON CREDIT APPROVAL.

414 CLOVERLEAF DR., UNIT B, BALDWIN PARK, CA 91706  
TEL. (818)855-5688 FAX (818)855-5687

Circle 206 on Inquiry Card.

ALL PRODUCT NAMES, TRADEMARKS AND REGISTERED TRADEMARKS ARE THE PROPERTY OF THEIR RESPECTIVE COMPANIES.

# Become a legend before your own time.

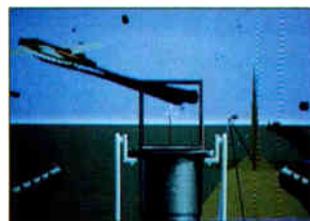
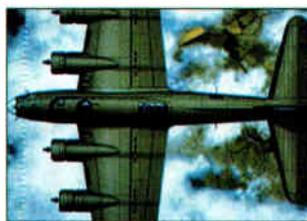


What becomes a legend most? Find out for yourself as you pilot the legendary **B-17 Flying Fortress** and lead a 10-man crew through the same flak-infested skies that menaced the legendary flyboys of the *Memphis Belle*.

The most complete and accurate bomber simulation ever produced, the **B-17 Flying Fortress** will have you negotiating 25 perilous daylight missions over Nazi-occupied Europe.

You'll allocate crew members to their specific tasks. You'll devastate strategic targets in dangerous bombing runs. You'll take control of crew positions from pilot to bombardier. And you'll even customize your own Flying Fortress with historically accurate nose art.

So pick up your copy of **B-17 Flying Fortress** today. And experience a flight simulation of legendary proportions.



Actual screens may vary.

**MICRO PROSE™**  
ENTERTAINMENT • SOFTWARE

For IBM PC compatibles!

For more information about exciting MicroProse products,  
call **1-800-879-PLAY**

© 1992 MicroProse Software, Inc. ALL RIGHTS RESERVED.

Circle 201 on Inquiry Card.

MARCH 1993 • BYTE 229

# MEMORY AND MORE...

**30 Day**  
Money Back Guarantee  
Buy with confidence!

**First Source International**  
"The Only Source for Computer Upgrades"

## Personal Computer Memory

|  |                              |   |                                   |
|--|------------------------------|---|-----------------------------------|
| <b>IBM</b>   |                              | <b>Zenith</b>   |                                   |
| PS/1 286, 386SX  | 4MB 92F9935 \$79             | Z-300/400 Series 2-420/SX, 2-425/SX, 2-433/OK, 2-433/SX   | 4MB ME-100 \$159                  |
| PS/1 Consultant, Essential & Expert models x43, x44 & PS/Valuepoint all models except Cxx series                     | 4MB PN NA \$159              | Z-Server 425SE, 433DE, 4500E                              | 16MB ME-90 \$599                  |
| PS/1 Consultant, Essential & Expert models x76   | 16MB KIT PN NA \$579         | 4MB ME-432 \$179  | BMB ME-102 \$319                  |
| PS/2 25/286, 30/286, & memory adapter 1497259  | 2MB KIT \$89                 | 16MB ME-442 \$629   | 32MB ME-92 \$1199                 |
| PS/2 35SX; LS, 40SX, 50X, 55SX; LS, 65SX; LS, 70, & XStation   | 1MB 30F5360 \$59             | Z-Station 3255n, 4205Eh; Sh; Sn, 4255h, 4330Eh; Dh, 50XEn | 1MB ME-70 \$49                    |
| 1MB 6450603 or 90X8624 \$49  | 2MB 6450604 or 90X8625 \$79  | Zenith 2-386/20; 25; 33 & 33E                             | 4MB ME-100 \$149                  |
| PS/2 70-A21; A61; B21; B61, PS/1 Consultant, Essential & Expert models x11, x15 & x14, PS/Valuepoint Cxx series      | 2MB 6450608 \$79             | 1MB ZAS300ME \$49   | 4MB ZAS300MK \$149                |
| PS/2 35SX; LS, 40SX, 50X, 55SX; LS, XStation, PS/Valuepoint Cxx series & adapter board 34F3011 or 34F3077            | 4MB 34F2933 or 87F9977 \$149 | Zenith 2-386SX/20, 286LP+, Z-LS                           | 2MB KIT 2-605-1 \$99              |
| PS/2 35SX; LS, 40SX, PS/Valuepoint Cxx series  | BMB 6450129 \$309            | Zenith 486/33ET; 25E                                      | 4MB ZAA200M2 \$189                |
| PS/2 90 XP, 95 XP, P75 (pairs), 56, 57 (all), PS/1 Pro 2125  | 2MB 6450902 \$89             | <b>AST</b>  | 16MB ZAA200M8 \$619               |
| PS/2 90, 95 XP, P75 (pairs), 56, 57 (all), PS/1 Consultant, Essential, Expert x11, x15 & x14, PS/1 Pro 2125, MS/6000 | 4MB 6450128 \$149            | Bravo 386-SX, WS/286, 386                                 | 2MB 500510-002 \$89               |
| Expansion boards for 50, 502, 555X, 60, 65SX   | 2-BMB W/2MB 1497259 \$269    | Bravo 5/255   | 2MB 500710-004 \$99               |
| Expansion boards for all models 70 & 80  | 2-14MB W/2MB 34F3077 \$529   | Bravo 5/355   | 2MB 500962-001 \$75               |
| <b>Compaq</b>  |                              | <b>Hewlett-Packard</b>                                    |                                   |
| ProLinea 3/255; 3/255i   | 2MB 141738-001 \$289         | Vectra 386/16M, 386/20M, 386/25M PC                       | 2MB D2406A \$99                   |
| ProLinea 4/255, 4/33, 4/50   | 1MB 11682-001 \$49           | 2MB D2406A \$99   | BMB D2404A \$519                  |
| DeskPro 386-20, 20e & 25   | 4MB 116890-001 \$149         | Vectra 486PC; 25T; 33T; 486S/20; 486/25M; 53M; 50M; 66M   | 2MB D2581A \$89                   |
| DeskPro 386-20, 20e & 25   | 4MB 115152-001 \$169         | 4MB D2151A or D2156A \$169                                | 2MB D2581A \$89                   |
| DeskPro 386S/16  | 4MB 112554-001 \$169         | Vectra 386/25; 486/25S; 486/33U; 486/50U; 486/66U         | 2MB D2581A \$89                   |
| DeskPro 286N, 386N; Series 386SX/20; 20N; Portable 486C; M Series expansion boards; SystemPro LT Series              | 1MB 118688-001 \$49          | 2MB D2581A \$89   | BMB D2152A \$309                  |
| DeskPro 386-33, 486-33 & SystemPro   | 2MB 118690-001 \$149         | 16MB 02676A \$599   |                                   |
| DeskPro 386M, 486M, SystemPro LT (32-Bit Exp. board)   | 2MB 115144-001 \$59          | <b>NEC</b>  |                                   |
| 2-64MB W/2M 129160-001 \$359   | 2MB 118690-001 \$149         | PowerMate 286/12; 5X/16 & 5X/20                           | 2MB KIT OP-410-8105 \$99          |
| DeskPro 386/33i, 486/33i, SystemPro  | 2MB 115144-001 \$59          | PowerMate 5X/20   | 2MB CPU Upgrade OP-410-8101 \$189 |
| 6 Socket Bnd W/2MB 116569 + 115144-001 \$389   | 2MB 118690-001 \$149         | PowerMate Exp. Board OP-410-8102+8103 \$209               | PowerMate 386/33E & 486/25E       |
| <b>DELL</b>  |                              | 2MB OP-410-5101 \$199                                     |                                   |
| Power Desktop 325D & P, 353D & P, 433P, 486P & 486D  | 1MB 310-2505 \$59            | <b>DEC</b>  |                                   |
| PowerLine Workstation 420; 25; 33; 50; 450DE/2 & 466DE   | 2MB 310-2466 \$99            | DECStation 3 series 5X; C; Plus; & 425C                   | 2MB PCLAM-CD \$99                 |
|  | BMB 310-2468 \$319           | DEcpc 400ST Series  | 4MB PCTAM-CC \$189                |
|  |                              | 4MB PCTAM-CC \$189  | BMB PCTAM-CD \$299                |

We stock memory for most discontinued systems!

## Kingston TECHNOLOGY CORPORATION

**386 & 486 Processor Upgrades for your system!**

Now you can use Windows in enhanced mode, get true multitasking & background operation for Windows 3.1, OS/2, & other 386 specific software. Processor upgrades offer dramatically increased system performance & easy installation & improves your systems performance by up to 35%.

**CPU Upgrades (CPU socket)**

**From 286 to 386SX**

|                            |       |
|----------------------------|-------|
| 25MHz SX/Now!              | \$269 |
| 33MHz SX/Now!              | \$299 |
| Add a math coprocessor for | \$75  |

**From 386 to 486**

|                  |       |
|------------------|-------|
| 25MHz 486SX/Now! | \$429 |
| 33MHz 486DX/Now! | \$769 |

**MicroMaster Upgrades (expansion slot)**

**From 286 & 386 to 486**

|                         |        |
|-------------------------|--------|
| 25MHz 486SX MicroMaster | \$829  |
| 33MHz 486DX MicroMaster | \$1299 |

**MicroMaster with 32-bit 70ns Memory**

|                      |        |
|----------------------|--------|
| 25MHz 486SX with 4MB | \$999  |
| with 8MB             | \$1179 |
| with 16MB            | \$1519 |
| 33MHz 486DX with 4MB | \$1439 |
| with 8MB             | \$1619 |
| with 16MB            | \$1959 |

- 30 Day Money Back Guarantee
- 100% compatible in form, fit, & function
- All products user installable
- Installation instructions included
- Toll-free technical support
- Thousands of items in stock
- Manufacturer's warranties
- Corporate PO's, APD/FPO's welcome
- Government & Educational pricing
- International orders welcome
- Special volume pricing
- 24-hour fax line
- Same day shipping
- Overnight delivery available



• Visa, MC, AMEX, & Discover accepted

• No surcharge on credit cards

• Call for any items not listed

• We'll meet or beat any advertised price

## Laptop & Notebook Memory

|  |             |                                  |             |
|--|-------------|----------------------------------|-------------|
| <b>AST</b>                             |             | <b>Texas Instruments</b>         |             |
| PowerExec 3/255L, 3/255L-C             | 4MB \$179   | TravelMate 2000                  | 1MB \$89    |
| Premium Exec 386SX/25, 25C             | 16MB \$1299 | TravelMate 3000, WinSX           | 2MB \$79    |
|  | 4MB \$129   | TravelMate 4000                  | 4MB \$219   |
| <b>Compaq</b>                          |             | <b>Yoshida</b>                   |             |
| Contura 3/20, 3/25 & 25c               | 4MB \$189   | T1400SE/LE/NE; 2000; 2000SX/SXc; | 2MB \$85    |
|  | 8MB \$329   | T2200 & T1800 Satellite Series   | 4MB \$169   |
| LTE 286                                | 2MB \$99    | T1200XE, 1600, & 3100E           | 2MB \$85    |
|  | 4MB \$199   | T3100SX, 3200SX, & SKC Portables | 2MB \$85    |
| LTE 386S/20                            | 2MB \$199   | T3200                            | 4MB \$149   |
|  | 4MB \$319   | T3300S1 Notebook                 | 2MB \$179   |
| LTE 286; 25; 25c                       | 1MB \$99    | T4400 & T6400, SX, SKC Notebook  | 2MB \$129   |
|  | 2MB \$219   |                                  | 4MB \$189   |
| SLT 286                                | 1MB \$89    |                                  | 8MB \$349   |
|  | 4MB \$279   |                                  | 2MB \$89    |
| SLT 386S/20                            | 1MB \$89    |                                  | 2MB \$92    |
|  | 4MB \$199   |                                  | 8MB \$299   |
| <b>IBM</b>                             |             | <b>Zenith</b>                    |             |
| ThinkPad 500                           | 2MB \$159   | 2-Note Notebook (all models)     | 2MB \$159   |
|  | 8MB \$459   | 2-Sport 3255                     | 8MB \$499   |
| PS/2 (CL75X & ThinkPad 700; 700C)      | 8MB \$349   | 2-Sport 420S & 425S              | 2-6MB \$139 |
|  | 8MB \$669   | MastersPort 386SL, 51C, 51e      | 4MB \$189   |
| NS1 Notebook (All)                     | 2MB \$179   | MastersPort 386SX                | 2MB \$99    |
|  | 4MB \$249   | SupersPort SK, 286e, SlimsPort   | 2MB \$159   |
| LAOSX & N53SX Laptop                   | 4MB \$135   | SupersPort 286e; SlimsPort       | 4MB \$279   |
| LAOSX                                  | 8MB \$285   |                                  |             |
| <b>NEC</b>                             |             | <b>Grid</b>                      |             |
| UltraLite & Cellular Workstation 286F  | 1MB \$139   | 1450x1                           | 2MB \$149   |
|  | 4MB \$369   | <b>Magnavox or Packard Bell</b>  |             |
| UltraLite & Cellular Workstation SX/20 | 2MB \$179   | 286 & 386SX Notebook             | 4MB \$179   |
|  | 8MB \$599   | <b>SHARP</b>                     |             |
| UltraLite III, SL/25C                  | 2MB \$149   | PC-6220 Notebook                 | 1MB \$409   |
|  | 4MB \$249   | <b>Seiko or Zeos</b>             |             |
| UltraLite SL/20, SL/20P                | 2MB \$149   | Notebook Memory                  | 2MB \$79    |
|  | 4MB \$299   | <b>EVEREX</b>                    |             |
| ProSpeed 286, 386SX/16                 | 1MB \$109   | Tempo LX Notebook                | 2MB \$79    |
|  | 4MB \$209   | Tempo Carrier Notebook           | 2MB \$119   |
| ProSpeed 386                           | 2MB \$149   |                                  |             |
| <b>Panasonic</b>                       |             |                                  |             |
| CF-170, CF-270, CF-370                 | 1MB \$54    |                                  |             |

## Megahertz CORPORATION

**Laptop & Notebook FAX/Modems**

for AST, Compaq, IBM, Sharp, TI, Toshiba, Zenith and many other Laptop & Notebook Systems.

Megahertz modems include:

- Send & Receive Fax capability
- Easy installation with illustrated user's guide
- Software Included
- Full 5-year warranty
- Hayes compatible

PCMCIA 2.0 FAX/Modems with XJACK

|  |        |
|--|--------|
| 14,000bps FAX/Modem, Cellular, Autosync    | \$Call |
| 24/9600bps FAX/Modem                       | \$Call |
| Internal FAX/Modems w/MNP-5 & V.42/V.42bis | \$549  |
| 14,000bps FAX/Modem, Cellular, Autosync    | \$549  |
| 96/9600bps FAX/Modem                       | \$499  |
| 24/9600bps FAX/Modem                       | \$499  |
| 2400bps Modem                              | \$149  |

External Pocket Modems for any RS-232 Serial Port

|   |       |
|---|-------|
| 14,000bps FAX/Modem, Cellular, Autosync | \$399 |
| 9600bps FAX/Modem                       | \$359 |
| 24/9600bps FAX/Modem                    | \$189 |

## Laser Memory

|   |                      |                       |
|---|----------------------|-----------------------|
| Compaq PAGEMARK 1S & 20                       | BMB 126361-001 \$329 | 16MB 126361-001 \$649 |
| Hewlett Packard LaserJet III, 4, 4M & XL300   | 4MB C2065A \$149     | 8MB C2066A \$299      |
| Hewlett-Packard LaserJet IIP, III, IIIP, IIID | 2MB 354758 \$95      | 4MB 354778 \$159      |
| Hewlett-Packard LaserJet II & HD              | 2MB 33444B \$99      | 4MB 33445B \$159      |
| Hewlett Packard DeskJet 500, 500C             | 256K 227078 \$59     |                       |
| IBM Laser 4029 All Models                     | 4MB 1185355 \$129    |                       |
| Canon LBP-4, 4Lite, 4Plus                     | 1MB 563-2230 \$119   | 2MB N/A \$169         |
| Canon LBP-III & IIIi Plus                     | 2MB 563-2350 \$249   | 3MB 563-2360 \$299    |
| Panasonic 4410 & 4450                         | 2MB IX-P441 \$119    | 4MB N/A \$189         |
| Panasonic 44501 & 4420                        | 2MB IX-P441 \$109    | 4MB N/A \$179         |
| OKiLaser 400                                  | 1MB 70014701 \$79    | 2MB OKI N/A \$99      |
| Texas Instruments MicroLaser & XL             | 1MB 255379-0001 \$49 |                       |
| Epson EPL 6000                                | 2MB IBS401 \$99      | 4MB N/A \$169         |
| Epson ActionLaser II, EPL-8000                | 2MB N/A \$169        | 4MB N/A \$259         |

Toll free from anywhere in the United States or Canada

**800/446-9866**

International

**714/588-9866**

Facsimile

**714/588-9872**

Business Hours

Monday-Friday, 8AM-5PM

Saturday, 10AM-3PM, P.S.T.

The Only Source

**FIRST SOURCE INTERNATIONAL**

For Computer Upgrades

Mail orders to:

First Source International, Inc.  
36 Argonaut, Suite 140  
Aliso Viejo, California 92656 USA

Terms & Conditions

Memory products are third party, manufacturer's part numbers are for your convenience. Freight charges are non-refundable. A 20% restocking fee will be charged on all non-defective returns, unopened, & refused or cancelled orders. Items must be returned within 15 days with original documentation & packaging. A Returned Merchandise Authorization number is required. Prices & availability are subject to change without notice. Purchase prices at the time of order are final. First Source International cannot be responsible for errors in typographical or photographic. We will meet any advertised price valid only on identical brands, offer not good for SIMMs or DRAM. Trademarks & registered trademarks are of their respective companies.

**CALL THE UPGRADE EXPERTS TOLL FREE 800/446-9866**

# You Can Rely on Ralin For all Your PC System Upgrades!

## MODEM UPGRADES

### Zoom Telephonics

All Zoom modems are backed by a 7-year warranty and are made in the USA.



|  |                                |                      |                      |
|--|--------------------------------|----------------------|----------------------|
| 2400 bps w/ v.42bis and MNP 2-5  | (AMC)<br>(AMX)                 | internal<br>external | \$ 49.00<br>\$ 65.00 |
| 2400 bps w/ v.42bis and MNP 2-5<br>9600 send & 4800 receive Fax                      | (AFC)<br>(AFX)                 | internal<br>external | \$ 59.95<br>\$ 79.95 |
| 9600 bps modem w/ v.32, v.42bis, MNP2-5  | (VP-V32)<br>(VX-V32)           | internal<br>external | \$199.00<br>\$199.00 |
| 14,400 bps modem w/ v.32bis, v.32, v.42bis,<br>MNP 2-5 and 9600 bps send/receive Fax | (VFP-V32bis*)<br>(VFX-V32bis*) | internal<br>external | \$229.00<br>\$269.00 |
| 2400 bps modem w/.42 bis and MNP 2-5,<br>9600 bps send and 4800 bps receive Fax      | PKT Pocket/Fax Modem           |                      | \$ 99.00             |

\*WINFAX software option available for \$15 if purchased with VFP-V32bis or VFX-V32bis modem.

Call a corporate sales expert today and find out how Ralin can maximize your purchasing dollars by upgrading your existing computer equipment.

Ralin stocks: • Motherboards • SIMM Memory • Controllers • Printers • Monitors  
Hard Drives • MPC Products • Computer Cases • Keyboards and much more

# CALL 1-800-752-9512

### Ralin Policies

- Prices and availability subject to change.
- Purchase orders are accepted, subject to approval.
- We do not charge your card until order is processed.
- Incomplete returns are subject to a service charge.
- All returns other than exchanged items incur a 10% re-stocking fee.

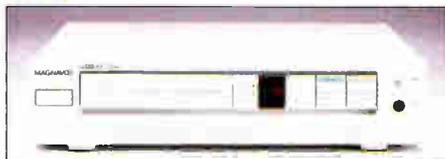
To insure your shipment arrives when you need it, Ralin uses only the most reputable modes of transportation available:



WE ACCEPT:



## MPC UPGRADES



### Philips CDD-462 BK \$325.00

- External MPC CD-ROM and CD Audio player.
- Kodak Photo CD compatible
- 680 Meg.

- Dealer Inquiries Welcome.
- Purchase Orders Accepted.
- International Orders Welcome.

**CALL FOR A CATALOG TODAY**



### WHOLESALE, INC.

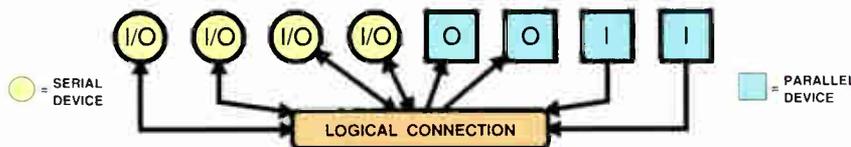
P.O. Box 450, Orchard Park, NY 14127

Hours: 8:00 am to 6:00 pm Mon-Fri

Customer Service: 716-674-6267

Fax: 716-674-2108

# LOCAL PRINTER SHARING



### LCX-1000 1Mb \$595

4 serial I/O, 57,600 bps  
2 parallel in, 2 parallel out

### LC-512Kb \$495

4 serial I/O, 19,200 bps  
2 parallel in, 2 parallel out

**Many New Features!**

### LC Jr.-256Kb \$239

Up to 115,200 bps  
4 serial in, 1 parallel out

### LC-41PAS \$90

Smart-switch  
4 in / 1 out, all parallel  
Requires no power supply

### SPPS \$60

Up to 115,200 bps  
Serial / Parallel Converter  
Requires no power supply

### PB-42PP-256Kb \$250

4 in / 2 out, all parallel  
Upgradable to 4Mb

Logical Connection, Inc.  
4660 Portland Road NE #108  
Salem, OR 97305-1697

Customer Support:  
(503) 390-9375  
FAX: (503) 390-9372

# 800-238-9415

# CAD AT THE SPEED OF THOUGHT.

**PLAIN TALK ABOUT YOUR NEED FOR SPEED**

**AND THE DIFFERENCE BETWEEN ISA, EISA AND VL-BUS**



**FAST:**  
ISA transfers data up to 3MB/second on an 8 bit wide databus



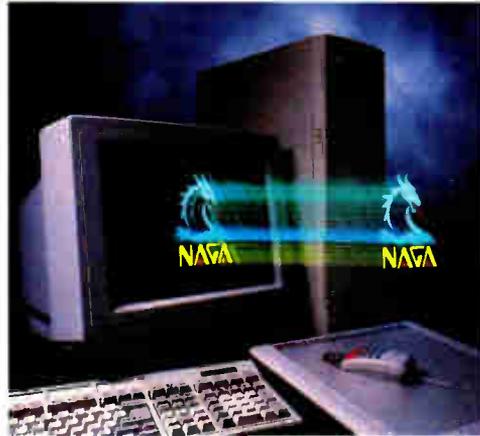
**FASTER:**  
EISA offers 32MB/second transfer rates on a 16 bit wide databus



**FASTEST:**  
NAGA's VL-Bus™ system is capable of transferring raw data on a 32 bit wide databus at the rate of 132MB/second

**SYSTEM BOTTLENECKS CAUSE LENGTHY REDRAWS**

Redraws take a long time because data displayed on your monitor is bottlenecked. The databus, peripherals and CPU aren't operating on the same bandwidth—the number of bits able to pass through the system's narrowest bottleneck—causing delays



**Y**ou've looked at a zillion ads. It seems like everyone's selling the same thing. You want the fastest 486 or 386 available at the lowest price. And now, everyone's talking ISA, EISA and VL-Bus™. And how much more speed you need.

**CAD, IMAGING OR GRAPHIC DESIGNERS: WORK 50 TIMES FASTER AND SMARTER.**

For CAD, imaging or graphic design users, VL-Bus' speed advantages are incredible! Without all the wasted time spent waiting for screen redraws, you'll work up to 50 times faster—and smarter.

VESA® VL-Bus, transparent to operating systems and software, is truly the new standard of performance—which more than 120 manufacturers of systems, chipsets and peripheral boards have adopted for their most powerful products.

**NAGA'S QUALITY COMMITMENT TO YOU**

- 2-Year Warranty on ALL Components
- Lifetime 800 Number for Service & Support
- FREE! 12-Month On-Site Service Contract\*\*
- Next-Day Replacement Part Warranty
- 45-Day Money-Back Satisfaction Guarantee—No Questions Asked
- 24-Hour BBS Technical Support



**FREE! OVER A \$1,200 VALUE CAD SOFTWARE SOLUTION WITH ANY CAD VL SYSTEM!**

- Autodesk Generic CADD 6.0: PC Magazine's Editors' Choice CAD package for superior 2D CAD design, layouts and drawings.
- Silver Screen 2.2: a true 3D CAD and solid modeling software solution.
- AutoPack Tutor for AutoCAD: an interactive tutorial for beginning and advanced AutoCAD ver. 11 or 12 users.

**CAD ELITE SOLUTION 486-EISA/VL**

- Intel 80486 Processor (Integrated Math Coprocessor)
- 8MB RAM (exp. to 256MB)
- 256K RAM Cache (exp. to 512K)
- 210MB <15 ms IDE Hard Disk
- Teac 1.2 & 1.44 Floppy Drive
- 32 Bit VL/IDE I/O Controller
- 32 Bit VL-Bus 2MB
- 20" Flat N/I SVGA (1280x1024)
- 101 Enhanced Keyboard
- Vertical Case with 250W Power & 2nd Fan
- CalComp 12x12 Digitizer
- CAD SOFTWARE BUNDLE

486DX-33 MHz **\$3,695**  
486DX-50 MHz **\$3,795**  
486DX-66 MHz **\$3,995**

**CAD SOLUTION 486-VL**

- Intel 80486 Processor (Integrated Math Coprocessor)
- 8MB RAM (exp. to 32MB)
- 64K RAM Cache (exp. to 256K)
- 210MB <15 ms IDE Hard Disk
- Teac 1.2 & 1.44 Floppy Drive
- 32 Bit VL/IDE I/O Controller
- 32 Bit VL-Bus 2MB
- 15" Flat N/I SVGA (1280x1024) (For 17" monitor, add \$500)
- 101 Enhanced Keyboard
- Vertical Case with 250W Power & 2nd Fan
- CalComp 12x12 Digitizer
- CAD SOFTWARE BUNDLE

486DX-33 MHz **\$2,695**  
486DX-50 MHz **\$2,795**  
486DX-66 MHz **\$2,995**

ORDER TODAY TOLL FREE  
**1-800-568-6242**

Fax orders: 602/820-3153  
Direct & international line:  
602/820-3294

Hours 7am to 7pm, Mon-Fri.  
9am to 4pm, Sat. & Sun., MST

Purchase orders accepted from Fortune 1,000 Companies & Universities.  
Commercial leasing available.



Member of VESA Drivers, American Express and DDI

**Circle 215 on Inquiry Card (RESELLERS: 216).**

\*Commercial leasing based on 10% purchase option plus applicable sales tax. Leasing not available in certain states. Lease programs available for business less than two years old.  
\*\*12 month on-site service may not be available in certain remote locations. Intel is a trademark of Intel Corporation. Other brand names are trademarks of their respective companies.  
Prices, configurations and components (orders) subject to change without notice. Prices do not include shipping or applicable sales tax. AutoCAD is a registered trademark of Autodesk.



1520 West Mineral Road  
Tempe, AZ 85283

**1 - 8 0 0 - 5 6 8 - 6 2 4 2**



Serving you since 1979

# JDR Microdevices®

2233 Samaritan Drive, San Jose, CA 95124

BUY WITH CONFIDENCE FROM JDR!

- 30-DAY MONEY BACK GUARANTEE
- 1 YEAR WARRANTY
- TOLL-FREE TECH SUPPORT



## UPRIGHT CASE

**\$99<sup>95</sup>**

- Mounts 3 floppy and 4 hard drives
- Accommodates std. & mini motherboards
- 2 digit LED display

|                                |       |          |
|--------------------------------|-------|----------|
| CASE-100A                      | ..... | \$99.95  |
| CASE-200A Super Deluxe Upright | ..... | \$349.95 |
| PS-250TW 250W p. supply        | ..... | \$129.95 |
| PS-300TW 300W p. supply        | ..... | \$149.95 |
| CASE-130 Mid-upright case      | ..... | \$99.95  |
| CASE-120                       | ..... | \$199.95 |

Mini-upright case w/200W power supply



## POWER SUPPLIES

- U/L approved
- 110/220V AC, 50/60Hz

|                             |       |          |
|-----------------------------|-------|----------|
| PS-150 8088 150 watt        | ..... | \$69.95  |
| PS-200X 8088 200 watt       | ..... | \$89.95  |
| PS-200 286/386/486 200 watt | ..... | \$89.95  |
| PS-300 286/386/486 300 watt | ..... | \$149.95 |



## ENHANCED KEYBOARD

**\$49<sup>95</sup>**

BTC-5339 101/102-key enhanced layout ..... \$49.95



## NON-INTERLACED 1024 x 768 MONITOR

VGA-MON-1024N .28 dot pitch ..... \$379.95

|  |       |          |
|--|-------|----------|
| VGA-MON-17N 1024x768 17" NI, 0.26mm        | ..... | \$999.00 |
| VGA-PKG-1024N Non-interlaced Super VGA pkg | ..... | \$469.95 |
| VGA-PKG-1024+ 1024x768 interlaced VGA pkg. | ..... | \$449.95 |
| VGA-PKG 640x480 .39mm dot pitch VGA pkg.   | ..... | \$299.95 |

## 2400 BAUD MODEM

**\$49<sup>95</sup>**

- Internal data modem
- Hayes compatible
- Config. as COM1-COM2

MCT-241 ..... \$49.95



## 14,400 BPS INTERNAL FAX/MODEM

|   |       |          |
|---|-------|----------|
| VIVA-1441F 14,400 baud external version | ..... | \$229.95 |
| VIVA-144EF 14,400 baud external version | ..... | \$299.95 |
| VIVA-96E 9600 baud internal modem only  | ..... | \$269.95 |

## FAX/MODEM/PHONE SWITCH

- Save phone line charges!
- Supports fax, modem, phone and answering machine from 1 phone line

FAXM-SWITCH ..... \$89.95

FAX-SWITCH Without modem connection ..... \$59.95



## PORTABLE IC TESTER

- Tests the following 14 to 20-pin devices: 74 series TTL, 40 & 45 series CMOS & 41-44 series DRAM up to 1Mb
- Identifies unknown part numbers

MOD-NIC ..... \$149.95



## WIRE-WRAP PROTOTYPE CARDS

|  |       |         |
|--|-------|---------|
| JDR-PR2 8-bit with I/O decode layout   | ..... | \$29.95 |
| JDR-PR10 16-bit with I/O decode layout | ..... | \$34.95 |

## SOLDERLESS PROTOTYPE CARDS

|   |       |         |
|---|-------|---------|
| PDS-601 8-bit breadboard-on-a-card w/I/O decode | ..... | \$79.95 |
| PDS-611 16-bit version                          | ..... | \$89.95 |

## MOTHERBOARDS

MODULAR CIRCUIT TECHNOLOGY

**25MHZ 386SX**

**\$199<sup>95</sup>**

NEW LOWER PRICE!



- 25MHz Intel 80386SX CPU • Expandable to 16Mb on-board • Uses 256K, 1M or 4M x 90ns SIMMs (ØK installed) • Six 16-bit and two 8-bit slots

|                                 |       |           |
|---------------------------------|-------|-----------|
| MCT-M386SX-25                   | ..... | \$199.95  |
| MCT-M486-50E 50MHz EISA w/cache | ..... | \$1195.00 |
| MCT-M486-50 50MHz cache 486     | ..... | \$999.00  |
| MCT-M486-33 33MHz cache 486     | ..... | \$799.00  |
| MCT-M486SX-25 25MHz cache 486SX | ..... | \$399.95  |
| MCT-C386-40 40MHz cache 386     | ..... | \$379.95  |
| MCT-C386-33 33MHz cache 386     | ..... | \$349.95  |
| MCT-M286-16 16MHz 286           | ..... | \$149.95  |
| MCT-M286-12 12MHz 286           | ..... | \$129.95  |

## 16-BIT VGA CARD

**\$49<sup>95</sup>**

- 8/16-bit 8088 and 286/386/486 compatible
- 640 x 480 in 16 colors 320 x 200 in 256 colors
- 256Kb video RAM

|  |       |          |
|--|-------|----------|
| MCT-VGA-1000                             | ..... | \$49.95  |
| MCT-VGA-4000 1024x768, 1Mb DRAM          | ..... | \$129.95 |
| MCT-VGA-5000 Windows Accelerator         | ..... | \$149.95 |
| SPEEDSTAR-24X 24-bit color, 1280x1024    | ..... | \$199.95 |
| STEALTH-VRAM Windows acceler., 1280x1024 | ..... | \$249.95 |



## 3-BUTTON MOUSE

**VALUE \$14<sup>95</sup>**

- Accuracy 290-1450 DPI
- Opto-mechanical design
- Windows 3.1 compatible

JDR-MOUSE-3 ..... \$14.95  
MOUSE-PAD ..... \$4.95



## POST CODE DISPLAY CARD

- 286/386/486 compatible
- Displays power on self-test code
- Works when software won't even boot

PCODE ..... \$49.95



## EPROM PROGRAMMER

**\$199<sup>95</sup>**

- Programs devices up to 512K bits, plus 27C100, 27C101, 27C301, 27C1000, 27C1001, 27C2001, 27C4001 and more
- Includes dedicated 8-bit 8088 and 286/386/486 PC compatible card
- ZIF socket accepts 0.6"W DIP IC's to 32 pins

|  |       |          |
|--|-------|----------|
| MOD-MEP-1A                             | ..... | \$199.95 |
| MOD-MEP-4A As above with 4 ZIF sockets | ..... | \$269.95 |
| MOD-EMUP Universal programmer/tester   | ..... | \$699.00 |



## EPROM ERASER

**\$39<sup>95</sup>**

- Quickly and simultaneously erases up to 4 standard EPROMs

DATABASE II ..... \$39.95



## CONNER

**120Mb DRIVE PACKAGE \$299**

NEW LOWER PRICE!

- CP-30104 120Mb, 19ms IDE hard drive, 16-bit floppy/hard disk controller, cables and instructions



## IDE HARD DRIVES

| PART #   | BRAND   | CAP.  | SPD. | TYPE     | PRICE |
|----------|---------|-------|------|----------|-------|
| CP-3000  | Conner  | 42Mb  | 28ms | 3.5" IDE | \$159 |
| ST-351A  | Seagate | 42Mb  | 28ms | 3.5" IDE | \$169 |
| CP-30084 | Conner  | 84Mb  | 19ms | 3.5" IDE | \$239 |
| ST-3096A | Seagate | 88Mb  | 16ms | 3.5" IDE | \$259 |
| CP-30104 | Conner  | 120Mb | 19ms | 3.5" IDE | \$279 |
| ST-3144A | Seagate | 131Mb | 16ms | 3.5" IDE | \$319 |
| CP-30204 | Conner  | 212Mb | 12ms | 3.5" IDE | \$429 |

## FLOPPY DRIVES

|  |       |          |
|--|-------|----------|
| FDD-1.44A 1.44Mb, 3.5", Beige          | ..... | \$79.95  |
| FDD-1.44X 1.44Mb, 3.5", Black          | ..... | \$79.95  |
| FDD-1.2 1.2Mb, 5.25", Beige            | ..... | \$89.95  |
| FDD-360 360Kb, 5.25", Black            | ..... | \$89.95  |
| FDD-2.88A 2.88Mb 3.5" drive, Beige     | ..... | \$149.95 |
| FD-505 5.25" & 3.5" combo drive, Beige | ..... | \$149.95 |



## MULTI I/O CARD WITH IDE FLOPPY/HARD CONTROL

- 16-bit 286/386/486 compatible
- Supports 2 IDE hard drives & 2 floppy drives (360Kb-1.44Mb)
- 2 serial, 1 parallel & 1 game port

|   |       |          |
|---|-------|----------|
| MCT-IDEIO                                       | ..... | \$69.95  |
| MCT-IDEIO+ As above w/16550 compatibility       | ..... | \$99.95  |
| MCT-IDEFH 16-bit IDE hard/floppy controller     | ..... | \$29.95  |
| MCT-CIDEFH 16-bit IDE CACHE controller          | ..... | \$169.95 |
| MCT-IDE-8 8-bit IDE controller                  | ..... | \$79.95  |
| MCT-FDC-HD 1.44Mb floppy controller             | ..... | \$49.95  |
| MCT-FDC-HD4 1.44Mb floppy controller (4 drives) | ..... | \$59.95  |
| MCT-FDC-ED 2.88Mb intelligent floppy controller | ..... | \$79.95  |
| MCT-AIO+ Serial/parallel/game port card         | ..... | \$49.95  |
| MCT-AIO+ Two NS16550 serial/par/game port       | ..... | \$89.95  |
| GATEKEEPER PC security card                     | ..... | \$49.95  |
| RAMPAT+ 8/16-bit 16Mb RAM card (w/ØKb)          | ..... | \$139.95 |
| SOUNDBLASTPRO 8-bit MIDI sound board            | ..... | \$199.95 |



## DYNAMIC RAM

| PART #       | SIZE     | SPEED | TYPE | PRICE  |
|--------------|----------|-------|------|--------|
| 41256-80     | 256K x 1 | 80ns  | DIP  | 1.69   |
| 414256-80    | 256K x 4 | 80ns  | DIP  | 5.49   |
| 1M8-80       | 1M x 1   | 80ns  | DIP  | 4.99   |
| 1M8-60       | 1M x 1   | 60ns  | DIP  | 5.49   |
| 41256A98-80  | 256K x 9 | 80ns  | SIMM | 14.95  |
| 41256A98-60  | 256K x 9 | 60ns  | SIMM | 16.95  |
| 421000A98-80 | 1M x 9   | 80ns  | SIMM | 39.95  |
| 421000A98-60 | 1M x 9   | 60ns  | SIMM | 45.95  |
| 424000A98-80 | 4M x 9   | 80ns  | SIMM | 149.95 |
| 424000A98-60 | 4M x 9   | 60ns  | SIMM | 159.95 |

## MATH CO-PROCESSORS intel

| PART #   | SPEED | PRICE  | PART #    | SPEED   | PRICE  |
|----------|-------|--------|-----------|---------|--------|
| 8087-2   | 8MHz  | 129.95 | 80387-SXP | ≤ 25MHz | 79.95  |
| 8087     | 5MHz  | 89.95  | 80387-DXP | ≤ 33MHz | 89.95  |
| 80287-XL | 12MHz | 89.95  | 80487-SX  | ≤ 25MHz | 389.95 |

## CALL FOR YOUR FREE JDR CATALOG TODAY!

FOR PC'S, SOFTWARE, MONITORS, DISK DRIVES, KEYBOARDS, MODEMS, CABLES, CONNECTORS, ICs, COMPONENTS, PROGRAMMERS, TEST EQUIPMENT, TOOLS & MORE!



HOW ORDER 24 HOURS A DAY!

**800-538-5000**

Toll-free Fax Ordering 800-538-5005

Local 408-559-1200 BBS 408-559-0253

TERMS: For shipping & handling include \$5.00 for ground & \$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 is a trademark of JDR Microdevices, Inc. Copyright 1993 JDR MICRODEVICES.

KEY CODE 1039



# ANNUAL MULTI-MILLION SPRING CLEANING SALE



We Carry

- ALPS**
  - BASF** brother.
  - Canon**
  - CENTRONICS**
  - CITIZEN**
  - CONNER**
  - CREATIVE LABS INC.**
  - CURTIS** Dataproducts
  - Dysart**
  - EPSON** **EXABYTE**
  - FACIT** **FUJITSU**
  - GRAHAM MAGNETICS**
  - GENCOM**
  - HEWLETT PACKARD** **IBM**
  - MEGA** **KYOCERA**
  - 3M** **M. TALLY**
  - maxell** **MICROSOFT**
  - Nashua** **NEC**
  - OCLI** **OKIDATA**
  - olivetti** **OLYMPIA**
  - OTC** **PACIFIC DATA**
  - Panasonic**
  - Polaroid** **QMS**
  - Qume** **RICOH**
  - Seagate**
  - SEIKOSHA** **SMITH CORONA**
  - SONY.**
  - SYQUEST**
  - TEAC.**
  - TEXAS INSTRUMENTS** **TOSHIBA**
  - TRIPPLITE**
  - Verbatim**
- and many more  
OEM supplies!

## DISKETTES

| DESCRIPTION  | TDK     | BASF | MAXELL | 3M   |
|--------------|---------|------|--------|------|
| 5 1/4" DS/DD | \$ 2.75 | 3.35 | 3.55   | 3.75 |
| 5 1/4" DS/HD | 4.95    | 5.35 | 5.65   | 5.95 |
| 3 1/2" DS/DD | 4.35    | 5.35 | 5.65   | 5.85 |
| 3 1/2" DS/HD | 6.95    | 8.55 | 8.75   | 9.35 |

## FORMATTED

### BULK DISKS

|              |         |
|--------------|---------|
| 5 1/4" DS/DD | \$ 0.20 |
| 5 1/4" DS/HD | 0.29    |
| 3 1/2" DS/DD | 0.34    |
| 3 1/2" DS/HD | 0.53    |

(Above Inc. Sleeves & Tabs)

## DATA CARTRIDGES

| DESCRIPTION | 3M       | MAXELL | DYSAN |
|-------------|----------|--------|-------|
| DC-2120     | \$ 13.95 | 12.95  | 11.95 |
| DC-6150     | 14.95    | 13.95  | 12.95 |
| DC-6250     | 20.95    | 17.95  | 16.95 |
| DC-6525     | 24.95    | 21.95  | 19.95 |

## STREAMER CASSETTES

| MAXELL    |          | TEAC   |                    |
|-----------|----------|--------|--------------------|
| CS-600 HD | \$ 11.25 | 60 MB  | CT-600H.. \$ 11.75 |
| CS-600X0  | 12.25    | 150 MB | CT-600N.. 16.75    |
| CS-600SX  | 19.25    | 600 MB | CT-600F.. 23.75    |

## 4 MM & 8 MM CARTRIDGES

| DESCRIPTION   | TDK     | SONY  | EXABYTE |
|---------------|---------|-------|---------|
| 4MM 60 Meter  | \$ 6.75 | 8.95  | —       |
| 4MM 90 Meter  | 8.75    | 10.95 | Call    |
| 8MM 112 Meter | 6.75    | 10.25 | 12.25   |

## OPTICAL DISKS

| DESCRIPTION       | MAXELL   | BASF  | SONY  |
|-------------------|----------|-------|-------|
| 3 1/4" 512/128MB  | \$ 36.00 | 37.00 | 39.00 |
| 5 1/4" 512/600MB  | 76.00    | 83.00 | 89.00 |
| 5 1/4" 1024/650MB | 76.00    | 83.00 | 89.00 |

## CASH FLOW PROBLEMS?

- ARE YOU OVER-STOCKED?
  - DO YOU HAVE SLOW MOVING INVENTORY?
  - DO YOU EVER COME UPON A PEP PERIOD WITH TOO MUCH STOCK?
- CALL ME WHEN A SPIFF/PROMOTION IS BEING OFFERED. I WILL BUY THOSE EXCESS INVENTORIES. HELP YOU INCREASE YOUR SPIFF DOLLARS. WHILE YOU OBTAIN THOSE BIG PEP CHECKS! I AM NOT MR. ROSS PEROT ... BUT WE HAVE PLENTY OF CASH TO HELP YOU!

## RICOH

|                |          |
|----------------|----------|
| TONER 6000 +   | \$ 12.95 |
| TONER 80 PLUS  | 27.95    |
| TONER 150 PLUS | 27.95    |
| OPC KIT 80     | 96.95    |
| OPC KIT 81     | 96.95    |
| OPC KIT 150    | 93.95    |

## KYOCERA

|           |          |
|-----------|----------|
| TONER     | \$ 25.00 |
| DEVELOPER | 106.00   |
| DRUM      | 111.00   |
| FUSER     | 156.00   |

## DIGITAL

|                      |          |
|----------------------|----------|
| LN03X-AC TONER KIT   | \$ 28.75 |
| LN03X-AD OPC KIT     | 101.75   |
| TK-50 TAPE CARTRIDGE | 16.75    |
| TK-70 TAPE CARTRIDGE | 26.75    |
| TK-85 TAPE CARTRIDGE | 27.75    |
| RA60-P DISK PACK     | 550.00   |

Dec Ribbons & other supplies  
Please call for the lowest prices.

## IOMEGA

|                           |          |
|---------------------------|----------|
| 3.5" FLOPTICAL DISK 21 MB | \$ 17.00 |
| OPTICAL DISKS 512/1024    | 194.00   |
| 44 MB GOLD BERNOULLI CART | 83.00    |
| 90 MB GOLD BERNOULLI CART | 124.00   |

## SyQUEST (5-year warranty)

|                     |           |
|---------------------|-----------|
| 10MB DISK CARTRIDGE | \$ 114.00 |
| 44MB DISK CARTRIDGE | 62.00     |
| 88MB DISK CARTRIDGE | 93.00     |

## CANON

|                       |          |
|-----------------------|----------|
| BC-01 INK CARTRIDGE   | \$ 15.95 |
| BJI-481 INK CARTRIDGE | 10.95    |
| BJI 642 INK CARTRIDGE | 14.95    |
| BJ-10e PRINTER        | 249.00   |
| BJ-20 PRINTER         | 369.00   |
| BJ-300 PRINTER        | 439.00   |
| BJ-330 PRINTER        | 559.00   |

## KODAK

| MICRO/THERMAL FILMS      |           |
|--------------------------|-----------|
| MICROFILM P/N 8161218    | \$ 199.00 |
| MICROFILM P/N 1298546    | 55.00     |
| THERMAL FILM P/N 3597630 | 17.00     |

(For other Microfilming products please call with the P/N)

## GENIUS

|                            |          |
|----------------------------|----------|
| CLIX MOUSE ES              | \$ 13.50 |
| GM-D321 W/9-PIN            | 19.50    |
| GS-4500 GENISCAN w/CAT OCR | 100.00   |

(For other MICE & SCANNERS please call for the lowest prices.)

## HARD DRIVES

| BRAND   | 80MB      | 120MB  | 200MB  |
|---------|-----------|--------|--------|
| CONNER  | \$ 209.00 | 279.00 | 379.00 |
| MAXTOR  | 189.00    | 279.00 | 369.00 |
| SEAGATE | 189.00    | 269.00 | 349.00 |
| W.D.    | 199.00    | 279.00 | 359.00 |

## FLOPPY DRIVES

| BRAND   | 1.2MB    | 1.44MB |
|---------|----------|--------|
| CHINON  | \$ 47.00 | 43.00  |
| EPSON   | 44.00    | 41.00  |
| MITSUMI | 45.00    | 42.00  |
| TEAC    | 49.00    | 44.00  |

## FAX/MODEM

|                                 |          |
|---------------------------------|----------|
| 2400 INTERNAL W/MNP SOFTWARE    | \$ 33.00 |
| 2400 EXTERNAL W/MNP SOFTWARE    | 54.00    |
| 9600 SEND/4800 REC.INT. FAX     | 47.00    |
| 9600 SEND/REC. FAX POCKET MODEM | 99.00    |

## MOTHER BOARDS

|                        |           |
|------------------------|-----------|
| 386-33SX MOTHER BOARD  | \$ 114.00 |
| 386-33DX 64K CACHE MB  | 179.00    |
| 486-33DX 256K CACHE MB | 589.00    |
| 486-50DX 256K CACHE MB | 799.00    |

## MULTI MEDIA

|                            |           |
|----------------------------|-----------|
| SONY INT., SCSI CONTROLLER | \$ 299.00 |
| MULTI MEDIA KIT W/CD ROM   | 549.00    |
| SOUND BLASTER CARD         | 95.00     |
| SOUND BLASTER PRO          | 189.00    |
| NEC CDR 84 INTERNAL        | 519.00    |

## VIDEO GRAPHIC CARDS

|                              |           |
|------------------------------|-----------|
| ATI GRAPHICS ULTRA PRO W/2MB | \$ 489.00 |
| ATI VGA WONDER XL W/1MB      | 129.00    |
| ATI GRAPHICS VANTAGE W/1MB   | 209.00    |
| ATI GRAPHICS ULTRA W/1MB     | 299.00    |
| ORCHID FAHRENHEIT 1280 W/1MB | 259.00    |

## HEWLETT PACKARD

| INK JETS |         | TRANSPARENCY/PAPER |       |
|----------|---------|--------------------|-------|
| HP51604A | \$ 7.65 | HP51630Z           | 14.95 |
| HP51606A | 19.65   | HP51630S           | 42.95 |
| HP51606C | 22.65   | HP51636G           | 36.95 |
| HP51625A | 22.65   | HP92261K           | 48.95 |
| HP51626A | 20.65   | HP17703T           | 34.95 |

## LASER TONERS

| LASER TONERS |          | RIBBONS  |        |
|--------------|----------|----------|--------|
| HP92275A     | \$ 54.95 | HP92151H | 4.25   |
| HP92285A     | 69.95    | HP92155A | 12.25  |
| HP92291A     | 96.95    | HP92155L | 13.95  |
| HP92295A     | 68.95    | HP92156S | 8.45   |
| HP92298A     | 89.95    | HP92154B | 109.00 |

We carry a complete line of HP Products  
Please call for the lowest prices.

PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL LOGOS ARE THE PROPERTY OF THEIR RESPECTIVE COMPANIES.

### P.O.S./ATM SUPPLIES

RIBBONS, ROLLERS AND OTHER CHECK PROCESSING SUPPLIES FOR OMRON, IBM, ICL, TEC, DIEBOLD, EPSON, SWEDA AND NCR. (TO QUOTE PRICES, WE NEED P/N)



5575 Magnatron Blvd., Suite G  
San Diego, CA 92111 USA

TEL: 619-278-2600  
FAX: 619-278-2780

TLX: 15779  
ANS: STARTECH

Order your **FREE ON-DISK CATALOG**

Just fill out this form and Mail it to:

**STARTECH INTERNATIONAL**

5575 Magnatron Blvd., Suite G  
San Diego, CA 92111 USA

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

CITY: \_\_\_\_\_ STATE: \_\_\_\_\_

ZIP CODE: \_\_\_\_\_ COUNTRY: \_\_\_\_\_

TEL: ( ) \_\_\_\_\_

FAX: ( ) \_\_\_\_\_

## SSD-2HD Intelligent Solid-State Disk

- 1.44MB max. FLASH/EPROM Disk w/auto-boot
- 1.44MB max. SRAM Disk w/battery backup
- Auto-sense installed FLASH/EPROM /SRAM memory types
- Auto-configure Solid State Disk Drive
- Software protection key(PARAKEY) designed to protect a specified software application from unauthorized use.



**ACI**

1-800-886-ACI-3

**U.S.A.**  
TEL:617-938-8020  
FAX:617-938-8037

**International**  
TEL:886-2-7690128(Taiwan)  
FAX:886-2-7602154

Circle 376 on Inquiry Card (RESELLERS: 377).

## WINDOWS™ ACCELERATOR HIGH SPEED, BATTERY BACKED RAM DISK

- Ideal for disk intensive application such as Windows, CAD and Imaging
- Replaces a hard disk in PC/AT™
- Expandable Memory  
2MB-96MB DRAM SIMMs
- Memory mapped to I/O space, not memory space
- RAM Disk access time  
<2 microseconds (170 ns)
- Autoboot option available



TURBODISC



Computer Modules, Inc.  
2350A Walsh Ave.  
Santa Clara, CA 95051  
Tel: (408) 496-1881  
Fax: (408) 496-1886

Circle 333 on Inquiry Card.

## Experience the Power

### Parallel Processing

For the professional, student or hobbyist who wants to come up to speed with parallel processing. All kits include one or more 20-MHz 32-bit transputer processors, each with 1MB of DRAM • Occam2, C, and assembler • examples and demos • complete set of manuals • schematics. Requires IBM-compatible PC.

**4 Processors: \$1,284 1 Processor: \$396**

The Transputer Education Kit is outstanding. You would be hard pressed to find as valuable and inexpensive a tool.

R. Eckhouse, IEEE Computer, Sept. 92, page 97

#### Computer System Architects

15 N.100 E., #100  
Provo, Utah 84606

800-753-4CSA  
or 801-374-2300  
FAX 801-374-2306

VISA • MasterCard  
American Express



Circle 334 on Inquiry Card.

## SCSI • IDE • FLOPPY HOST BUS ADAPTER/CONTROLLER

### STANDARD FEATURES

- Drivers for Fixed, Optical and Removable Drives
- Internal and External SCSI Connectors
- SCSI and IDE Cables
- On-Board Diagnostics
- Complete Documentation
- Lifetime Warranty
- 30 Day Return Policy
- Made in the USA

### SUPPORTS

- Up to 7 SCSI Devices
- Up to 2 IDE Drives
- Up to 4 Floppy Drives
- 7 ROM Addresses
- 2 I/O Addresses

### OPTIONS

- CD ROM & UNIX Drivers
- ASPI Manager
- 3rd & 4th Floppy Driver

**\$150.00**  
(16-BIT HBA /Ctrl)

**\$175.00**  
(16-BIT HBA /Ctrl w /Option Pkg.)

CONTROL CONCEPTS INC.  
(703) 876-6444 • (703) 876-6416 Fax



Government, Educational and Corporate Discounts Available  
Dealer Inquiries Welcome



Circle 390 on Inquiry Card.

Your GUI Accelerator will be obsolete...  
when you upgrade to a Multi-tasking OS!



An intelligent graphics coprocessor is required to maintain high GUI performance in multi-tasking environments like UNIX, OS/2 and NT.

- 1280 x 1024 x 256 colors
- 100K Xstones Performance
- SCO, USL, AIX, SunSoft
- ISA, EISA, MCA

**IEE/FIELD GRAPHICS, INC.**

OEMs choice since 1984!

800-334-4922 or 503-626-9393  
fax: 503-641-9333

9825 SW Sunshine Ct., Beaverton, OR 97005

Starting at \$895.

Circle 344 on Inquiry Card.

## Direct Stepper Drive from PC

- No external DC supply or translators required
- Free 2D/3D interpolation software
- Free HPGL converter

SA703 \$199  
Drives two 1/2 amp motors  
SA704 \$599  
Drives two motors up to 6 amps



P.O. Box 188, ELGIN, Ontario,  
CANADA K0G 1E0

**STRADA  
AUTOTECH INC.**

## Portable Bar Code Readers



TimeWand<sup>®</sup> I      DuraWand      TimeWand II

Data collection is fast, easy, and extremely accurate when using Videx portable bar code readers. Cordless operation, compact size, and light weight allow you to take the wands wherever the work needs to be done. Call Videx today for your free information kit: 503-758-0521. Prices starting at:



- TimeWand I ..... \$298
- DuraWand ..... \$495
- TimeWand II ..... \$698

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

TimeWand, DuraWand, and Videx are registered trademarks of Videx, Inc. GCO355

Circle 365 on Inquiry Card.

## Access your old PC's disks from your new PC

### Introducing: InfiniStor!

InfiniStor™ from Infinicon™ makes your old PC's disk drives appear to be internal to your newer PC. What's more, those disks will perform almost as fast as if they were mounted inside. InfiniStor consists of a pair of half-size add-in cards (one for your old PC and one for your new one), a thin 12 ft. cable (which can be increased to 50 feet or more), and easy-to-use software which takes less than 10 minutes to install.



InfiniStor Add-In Cards and Cable

And you'll get **Super PC-Kwik™** disk caching software (to speed things up even more) and **Stacker™** file compression software (to double the size of your old PC's hard disk), both bundled **FREE** with InfiniStor.

**Only \$129<sup>95</sup>** (introductory offer)

**Warning!** InfiniStor is not a network product, and as such Infinicon cannot promise that you will encounter the typical network software installation difficulties. Furthermore, you won't have to deal with the usual cabling problems, and you won't have to become a master of complexity.

InfiniStor uses only 4K bytes of memory, appears transparent when in use, and is compatible with all your favorite software (including Microsoft Windows™ and computer networks). And if you're not totally satisfied, just return it within 30 days for a complete refund on the purchase price.

**For info or to order, call toll-free: (800) 374-3880**  
Or: (801) 374-8880  
Fax: (801) 370-3880

VISA • MasterCard • AMEX

INFINICON • 15 North 100 East, Suite 106 • Provo, UT 84606

Circle 389 on Inquiry Card.

## PC/AT Four Port Com. Coprocessor

### GMM Sync4/CCP™

- High Performance 16 MHZ 16 bit CPU.
- 80X86 code compatible.
- 4 Sync/Async Ports (2 Serial Ports with Full Duplex DMA).
- Uses Zilog 85C30, 85230 SCC chip.
- 512K Dual Ported Ram (STD)
- (1, 2, or 4 MEG Dual Port Ram - optional).
- 8k, 16k, 32k, 64k Window Size (Programmable).
- 8 Software Selectable and Shareable Interrupts.
- RS232/RS422/RS485
- Source Code Debugger Kit Available.



GMM Products Are All Made in USA.

PC/AT Dual Port Com. Coprocessor also available GMM Sync2/CCP™

Other PC/AT & PS/2 8530 based products available. Extremely competitive pricing.

(714)752-9447 Fax (714)752-7335  
18092 Sky Park South - Unit E, Irvine CA 92714



Circle 341 on Inquiry Card.

## LET YOUR COMPUTER DO THE TALKING!

### Integrated Voice/Fax Mail

integrates major voice/fax applications plus program control into one full-featured high performance software. PC-AT/386/486 based. Menu driven. Easy to use. Full support for Rhetorex, New Voice, Dialogic, TTI and Intel voice and fax hardware. Supports up to 24 voice lines and up to 8 fax lines.

**Hardware + Software 4 voice lines package starts at \$950**

Tel: (818) 368-6132 Fax: (818) 368-7859

### SigmaTech Software

24 hours demo lines: 818-368-4566 or 818-368-8848

10801 Bismarck Ave., Northridge, CA 91326 USA

(Resellers Dealers OEMs Private labels are welcome)

- Auto-Attendant
- Unlimited Audiotex
- Voice Mail
- Call Processing
- Telemarketing
- Fax Mail
- Fax-on-Demand
- Fax Broadcasting
- Party/Chat lines
- Talking Yellow pages

Circle 380 on Inquiry Card (RESELLERS: 381).

## Light-Speed Serial Communications

### PCSS-8FX Intelligent Serial Coprocessor

- Better than 1Mbyte/second transfer rate.
- No load on Host Processor!
- I/O Mapped - No host memory used.
- NEW - Supports DMA transfer. Faster than Dual Ported Memory!
- Looks like IBM Uart with Huge QUEUE!
- 8 ports per card. RS-232, 422, 485.



**ORDER TOLL-FREE 800-282-4835**



GTEK, INC. • DEVELOPMENT HARDWARE & SOFTWARE • P.O. Box 2310 Bay St. Louis, MS 39521-2310 USA • Mississippi & Technical Support 601-467-8048 Fax: 601-467-0935 • OEM & Dealer Inquiries Welcomed!

Circle 342 on Inquiry Card.

Multi-Line Voice Mail Plus...

# FAX ON DEMAND!

**FAX ON DEMAND • VOICE MAIL  
CALL PROCESSING • TELEMARKETING**

VOICE PLUS gives you professional VOICE MAIL & AUTO TRANSFER while it pounds out Fax'd Hard Copy non-stop 24-hours a day. Give it to them - NOW! Complete Package with Hardware and FAX Software. 2 year warranty. Requires PC/AT/386/486.

**VOICE PLUS ..... only \$695**  
**Basic Voice Mail ..... from \$295**

For Sales and Information Call:  
**1-800-685-4884**  
510-522-380 • FAX: 510-522-5556

**TALKING TECHNOLOGY, INC.**  
1125 Atlantic Ave., Alameda CA 94501

(Developer/OEM package specialists)  
(VISA-MC-AMEX-COD)

Circle 359 on Inquiry Card.

# AT Systems in ROM



## Run DOS in ROM

Develop code on a PC. Use 'C' and standard PC tools. Burn DOS and .exe code in ROM. Run disk-less on our battery-backed single board computers.

## PC Compatible

Our CPU cards are PC compatible. They run all PC software and drive standard PC expansion cards (VGA, A/D, etc.) on a passive backplane.

| CPU Card       | KS-6   | KS-3   |
|----------------|--------|--------|
| Base price     | \$ 299 | \$ 224 |
| CPU chip       | V53    | V40    |
| Equivalent to  | 286    | 186    |
| Runs PC code   | yes    | yes    |
| Bus            | AT     | XT     |
| Max DRAM       | 4M     | 512K   |
| Max ROM        | 2M     | 512K   |
| Max SRAM       | 512K   | 256K   |
| Serial ports   | 5      | 3      |
| Parallel ports | 2      | 2      |
| Real clock     | yes    | yes    |
| Flop, Keybd.   | no     | yes    |
| Size           | 4"x8"  | 4"x6"  |
| Power 5v       | 400mA  | 250mA  |

We provide complete support to implement ROM based PC systems. Development kits with source code samples and DOS utility disk are available.

For Catalog Call **303-444-7737**  
or fax **303-786-9983**

# KILA

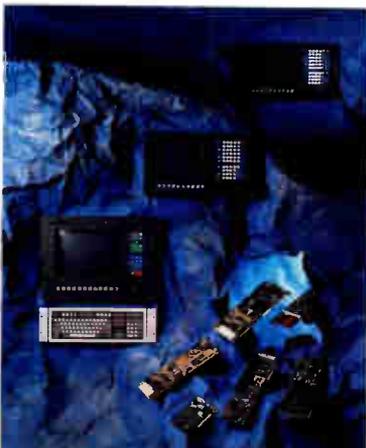
655 Hawthorn Avenue, Boulder CO 80304 USA

Circle 350 on Inquiry Card.

# GLOBAL INDUSTRIAL PRODUCTS AND RESOURCES

## RELIABLE, RUGGED & INTEGRATED

- ▲ 10"/14" VGA Color Industrial Workstation
- ▲ 17" Rack Mount Monitor Enclosure with Touch Screen
- ▲ 286/386SX-33/386DX-40 /486DX2 A11-in-one Slot Board Computer
- ▲ A11-in-one EISA bus CPU Card
- ▲ Dual Drive RAM/ROM/FLASH Disk
- ▲ 19" Rack-Mount Chassis with 14 Slots
- ▲ 6-Slots heavy-duty Node Chassis



MITAC Inc.  
16TH FL., 51 SEC. 3, MING SHENG E. RD., TAIPEI, TAIWAN, R.O.C.  
TEL: 886-2-501-5180 FAX: 886-2-509-0979

**RHINO** (U.S.A. DISTRIBUTOR)

101 N. ALLOY DRIVE FENTON, MI 48430, U.S.A.  
TEL: 1-800-648-2248 FAX: 313-750-1836



Circle 385 on Inquiry Card.

## Rackmount Solutions

RACKMOUNT COMPONENTS - Qty 25 PRICING  
Rackmount Chassis 19"x7"x17" \$183  
Rackmount VGA Monitors \$531  
Rackmount Monitor Shelf \$113  
Rackmount Keyboard Shelf \$88

RACKMOUNT PLATFORMS - Qty 1 Pricing  
RMS486-33EISA \$1799 RMS386-40 \$814  
RMS486-33 \$1443 RMS386SX-25 \$693  
System Platforms include 7" Rackmount Chassis, 200W Power Supply, Motherboard, 1.0MB Memory, IDE, FDC, 2-Ser, Par, 1.2MB or 1.44MB Floppy Disk Drive. 1 Year Warranty

RACKMOUNT CHASSIS - 15 Models up to 20 Board Slots  
SLOT CPU BOARDS - 486, 386, 386SX

RACKMOUNT MONITORS - Super VGA and Monochrome  
RACKMOUNT CABINET - Modular from 21" to 96" high



2468 Armstrong Street, Livermore CA 94550  
(510) 447-2030 FAX: (510) 447-4559



Circle 370 on Inquiry Card.

FREE, 288 PAGE

## 1993 DATA ACQUISITION CATALOG AND REFERENCE GUIDE

IBM PC/XT/AT, PS2, MICROCHANNEL COMPUTERS AND COMPATIBLES



- A/D Boards
- Signal Conditioning
- Communication
- PC Instruments
- Scientific Software

**KEITHLEY METRABYTE**  
DATA ACQUISITION

SEND TODAY FOR YOUR FREE CATALOG OR CALL 1-300-348-0033, FAX: 508-880-0179

Circle 353 on Inquiry Card.

## The Intelligent Solution For Data Acquisition



DAP 2400<sup>em</sup> Data Acquisition Processor<sup>TM</sup>

- |                                      |                                      |
|--------------------------------------|--------------------------------------|
| ANALOG I/O                           | Digital Signal Processing at 16 MIPS |
| DIGITAL I/O                          | 20 MHz CPU with DRAM to 1024K        |
| • Inputs to 312K samples per second  | 32 MHz DSP with SKAM to 96K          |
| • Outputs to 312K samples per second | DAPT <sup>TM</sup> Operating System  |
| • Simultaneous fast input/output     | • 100+ standard commands             |
| FFT and FIR-filtering                | • Custom commands in C               |

Send for FREE catalog and demo diskette.  
Or call us at (206) 453-2345.

**MICROSTAR LABORATORIES**  
2265 116th Avenue NE  
Bellevue, WA 98004  
FAX (206) 453-3199

Circle 354 on Inquiry Card.

## PS/2 Hard Drives

PS/2 50 50z 55sx 60 70 80 P70

INTERNAL DRIVES - May be used as a high performance replacement or to co-exist with original IBM drive. Compatible with DOS 3.3, 4.01, 5.0, OS/2 2.0 and Novell. Includes IDE or SCSI-2 microchannel controller, hard drive, mounting kit, ribbon & power cable, manual, and hardware.

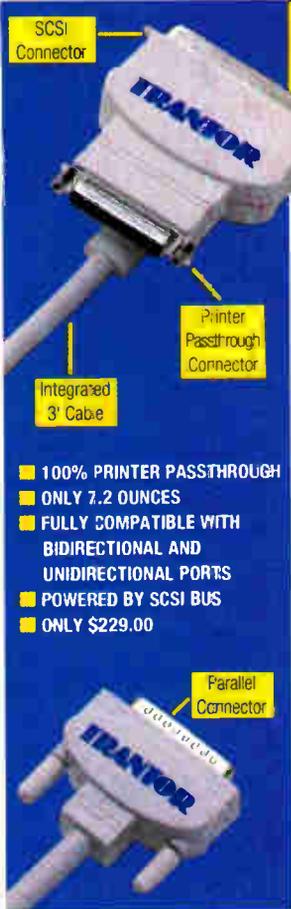
|  |                 |
|--|-----------------|
| 85mb, 17ms, Internal Western Digital IDE Drive Kit | \$449           |
| 125mb, 15ms, Internal Maxtor IDE / SCSI Drive Kit  | \$543/\$565     |
| 200mb, 15ms, Internal WD IDE/Maxtor SCSI Drive Kit | \$669/\$699     |
| 340mb, 13ms, Internal Maxtor IDE / SCSI Drive Kit  | \$969/\$979     |
| 512mb, 12ms Internal Fujitsu IDE / SCSI Drive Kit  | \$1,313/\$1,369 |
| 1.05gb, 10ms Internal Microplus SCSI Drive Kit     | \$2,184         |

PS/2 Model 25, 30, 30-286 External SCSI drives available from 125 mb to 1.75 gb. Includes SCSI-2 controller, external case with drive installed and configured, 6' SCSI cable. Free drives for CD-Rom drives or Novell 286 & 386.

**General Technics** 1 Year Warranty 10 Day Money Back Guarantee  
1-800-GT-SALE-8  
1-800-487-2538  
Tel: (516) 981-9473 38 Raynor Ave. Open 9am to 6pm  
Fax: (516) 981-5038 Ronkonkoma, NY 11779 EST, Mon-Fri

Circle 386 on Inquiry Card.

Disk & Optical Drives • Diskettes/Duplicators



**MiniSCSI<sup>plus</sup>**  
HIGH PERFORMANCE  
PARALLEL-TO-SCSI ADAPTER

**Transform Your Parallel Port – Connect up to 7 SCSI devices to your parallel port and still use your printer!**

Up to twice as fast as our original MiniSCSI, the MiniSCSI Plus lets you run a CD-ROM, tape drive, SCSI hard disk, SyQuest, Bernoulli or other SCSI device from almost any parallel port. For most notebook users, it's the only way to use SCSI CD-ROMs and tape drives. Plus, its integrated cable makes it a snap to move and share SCSI devices between desktops and notebooks.

**Call For Details!  
800-872-6867  
(800-TRANTOR)**



Trantor Systems, Ltd.  
5415 Randall Place  
Fremont, CA 94538-3151  
TEL: (510) 770-1400 • FAX: (510) 770-9910

© 1992 Trantor Systems Ltd. MiniSCSI and MiniSCSI Plus are trademarks of Trantor Systems Ltd. All other product names are trademarks of their respective companies.

Circle 369 on Inquiry Card.

- 100% PRINTER PASSTHROUGH
- ONLY 7.2 OUNCES
- FULLY COMPATIBLE WITH BIDIRECTIONAL AND UNIDIRECTIONAL PORTS
- POWERED BY SCSI BUS
- ONLY \$229.00

Keyboards • Laptops & Notebooks • Multimedia

Money Back Guarantee & 1 Yr. Warranty

**Popular Space-Saver Keyboard \$98.00**



Saves 60% desk space. Foot-print 27.3 x 15.2 cm. 100 full-travel tactily responsive keys. Standard left-right spacing for easy touch typing. IBM XT/AT PS 2 compatible. Many language versions available.

**Call Toll Free To Order: 1-800-DATALUX**

**DATALUX**

155 Aviation Dr. • Winchester, VA 22602  
Tel 1-703-662-1500 • FAX 1-703-662-1682  
Auto-FAxed Specs FAX 1-703-662-1675

– VISA, MC, AmX –

Circle 337 on Inquiry Card.



**Universal Keypad for Portable Computers**

Available in Ivory or Black

*Boost data entry speed, accuracy and convenience with Genovation's Micropad,™ the innovative numeric keypad for portable computers.*

TO COMPUTER



TO PRINTER

(800) 822-4333  
17741 Mitchell, North  
Irvine, CA 92714 USA  
TEL (714) 833-3355  
FAX (714) 833-0322

Is the unhandy numeric section of your portable computer's keyboard dragging you down?...Give your productivity a boost by using our Micropad. The ergonomically designed Micropad is ideal for spreadsheet and accounting applications that require fast and accurate entry of numeric data.

The Micropad attaches to the parallel port of any MS-DOS computer while providing a clean pass through connection to the printer. Power usage is negligible. Lightweight and compact, the Micropad is fully programmable and is also available with connectors to fit keyboard and serial ports.

**GENOVATION<sub>U</sub>**

Circle 340 on Inquiry Card.

**STAND ALONE DISKETTE DUPLICATOR**  
OVER 300 DISKS PER HOUR  
5.25" and 3.50" Models



SIMPLE AND FAST FROM \$1799 US

TEL: (416) 602-9270  
FAX: (416) 602-9279



Circle 330 on Inquiry Card (RESELLERS: 331).

**Desktop Video**



Motion Capture

VGA-TV Converter



- Real-time & motion video capture
- 8, 16, 24-bit color
- DOS & Windows support
- S-VHS & Composite input
- Free development kit
- Sound Blaster compatible

- Sharp & Flicker-free
- TV & Monitor display simultaneously
- S-VHS & Composite output
- Windows support
- MRVP/NTSC also for Mac
- Hor. Over/Under-scan switch

US\$ 299

US\$ 149 (MR VV Plus)

US\$ 349 (MR VP)



**DISPLAY RESEARCH LABORATORY**

Capital Automation Inc.  
Tel.: 1-800-CAPITAL  
Fax: 704-596-9595

International inquiry:  
Int'l Tel.: (852) 420 1165  
Int'l Fax: (852) 415 2739



Circle 391 on Inquiry Card (RESELLERS: 392).

# Make Your Image Fly ! ...to Everyone Worldwide.

**VIDEO Conferencing by VidCALL™** \$99  
 Conferencing via Modem, VideoBlaster & Camera  
 Receive Motion Video Calls via Modem Only  
 Full Support for Local-Area-Networks

**IMAGE PLUS Utility Software**  
 Capture and Index Images within Any Applications  
 Display Images upon Command & LAN Support

**VGA / TV CONVERTER** \$129

**TOUCH SCREEN PANELS**  
 for 14", 17" and 19" VGA Monitors  
 w/Demo, Setup & Utility Software

**OPTICAL DISK DRIVES**  
 650 Mbyte/19ms & 256 Mbyte/35ms  
 Magneto Optical, Re-Writable Drives

**CD-ROM MultiMedia Upgrade Kits** \$469  
 540 Mbyte CD-ROM with MultiMedia Interface  
 Windows 3.1 & MPC Compatible

**SOUND BLASTER PRO** \$149  
 OPL 3 stereo FM Music Synthesizer  
 Digital-Analog Mixer

**Video Blaster - Display & Image Capture Board** \$329  
 Live Video, True Color, Windowing Display  
 Image Capture & Sound Mixer,  
 Developer Kit Available for \$95

**Video Spigot - Live Video Display & Capture Boards**  
 Full Motion Video Display w/Stereo Sound Mixer  
 Live Motion Video Capture & Storage  
 Video Editing & Presentation Utilities

Call Toll Free  
 for Orders or Catalogs ONLY

**800-446-1967**

**EMPIRE COMPUTECH**

9668 Hermosa Ave  
 Rancho Cucamonga, CA 91730  
 Tel: 909-466-1400 Fax: 909-466-1409

VARs,  
 Consultants &  
 Dealers Welcome

Circle 379 on Inquiry Card.

# STAND-ALONE LCD MONITOR

## New Touch Screen Option Available



**\$995** This 10" black on white monitor is easy-to-read, yet compact. Resolution is 640x480 for sharp, flicker-free image. Fast response, high refresh rate twisted nematic technology with backlighting provides a bright low radiation screen with a wide viewing angle. The adjustable monitor base is only 29x14 cm. It lets you mount the LCD monitor on vertical surfaces or fold for transport. Comes with 1.5 m cable and controller card. No external power required. IBM AT compatible.

**\$1,495** New Touch Screen Option. Capacitive technology from MicroTouch™. Provides high resolution, fast response, all glass scratch proof optically clear touch sensor. Complete with controller and software. DOS Windows compatible.

To Order Call Toll-Free: **1-800-DATALUX**

**DATALUX**

Tel: 1-703-662-1500  
 FAX: 1-703-662-1682  
 AutoFAXed Specs:  
 1-703-662-1675

155 Aviation Drive • Winchester, VA 22602

Circle 336 on Inquiry Card.

## Memory Superstore . . . your direct source.

...For the absolute best prices on laptop, desktop and workstation memory, call now! 800-800-7056.

| Standard SDRAM  |                          | Workstation Memory   |                                      |
|---|--------------------------|--|--------------------------------------|
| 4MB x 9-80/70***  | \$110.00                 | Sun EPC/IPX***   | 16MB \$470                           |
| 4MB x 9-60  | \$114.00                 | Dell 486   | 16MB \$495                           |
| 256K x 9-80/70  | \$11.00                  | IBM RS6000   | 16MB \$620                           |
| 1MB x 9-80/70 (9 chip)  | \$34.50                  | HP Apollo  | 16MB \$675                           |
| 1MB x 9-80/70 (3 chip)  | \$31.00                  | Silicon Graphics   | 16MB \$620                           |
| 1MB x 36-70*  | \$136.00                 | Next   | 16MB \$470                           |
| 2MB x 36-70*  | \$262.00                 |  |                                      |
| 4MB x 36-70***  | \$499.00                 |  |                                      |
| Call for best price on a 30-pin & 72-pin Modules, 2, 4, 8 & 16MB                      |                          |  |                                      |
| *used in PS/2, Compaq, Dell & other high-end systems (386 & 486)<br>**4 piece minimum |                          |  |                                      |
| LaserPrinter Memory   |                          | Laptop/Credit Card/Flash Memory                              |                                      |
| Canon   | 1MB \$118.00             | Apple Power Book*  | 4MB \$230                            |
| LBP 8I/8IIR/8IIT  | 4MB \$190.00             | AST Premium Exec.  | 4MB \$160                            |
| Epson Action Laser  | 2MB \$125.00             | AT&T Safari  | 4MB \$345                            |
| Action Laser II   | 2MB \$138.00             | Bondwell B310  | 1MB \$136                            |
| HP LaserJet IIP, IIPPIs, IIL, IIO, IIP, II, IIO, IISi                                 | 2MB \$99.00 4MB \$172.00 | Compaq   |                                      |
| HP DeskJet  | 256K \$78.00             | LTE386s/20   | 1MB \$82 4MB \$259                   |
| IBM 4029***   | 4MB \$140.00             | LTElite/20.5   | 2MB \$140 4MB \$240                  |
| Sharp_X9500PS   | 1MB \$75.00              |  | 8MB \$578                            |
| DKI Laser DL400   | 2MB \$116.00             | LTE/286  | 1MB \$88 2MB \$138                   |
| DL800/820   | 2MB \$135.00             | SLT/286  | 1MB \$88 4MB \$240                   |
|   | 4MB \$210.00             | Goldstar GS520   | 4MB \$330                            |
| Panasonic   | 2MB \$135.00             | HP 95LX, Pojet PC, Grid Pad                                  |                                      |
| KXP4420, 4450I  |                          | SRAM Card  | 256K \$122                           |
| KXP4455   | 2MB \$175.00             |  | 512K \$149                           |
| KXP4410   | 4MB \$215.00             | Flash Memory   | 1MB \$238                            |
|   |                          |  | 2MB \$309                            |
| IBM & Compaq Memory   |                          | Packard Bell, Magnavox, Mitsuba***                           |                                      |
| PS/2: 25SX/LS, 40SX, 50Z, 55SX/LS, 57SX, 65SX/LS, 70, 70A21, B21, B61, 90, 95         |                          | 2MB \$150 4MB \$290  |                                      |
|   |                          | Toshiba - T1000SE/LE/XE, T2000SX, T1000LE, T2200-SX, T2000SX |                                      |
| 2MB \$89 4MB \$136 8MB \$268  |                          |  | 1MB \$80 2MB \$109                   |
| DeskPro386/20.E, 25, S/16, N, SX20, 33M   |                          |  | 4MB \$230 8MB \$430                  |
| 2N, B \$89 4MB \$136 8MB \$268  |                          |  | Toshiba - T1200XE 2MB \$88           |
|   |                          |  | Toshiba - T4400 SX/SXC, T3300, T6400 |
|   |                          |  | 2MB \$182 4MB \$329                  |
|   |                          |  | 6MB \$469 8MB \$670                  |
|   |                          |  | Zenith Masters SL 2MB \$122          |

**Memory Superstore** (800) 800-7056

OR (805) 339-0305  
 FAX (805) 339-0353

Prices subject to change. P.O.s welcome. OAC  
 Volume Discounts for Corporations,  
 VARs, Government and Universities.  
 Shipping worldwide Fed Ex and UPS.

Circle 372 on Inquiry Card.

# SMART PRINTER BUFFER

Allows automatic sharing of printer(s) by several computers.

- simultaneous input on all ports
- compatible with all printers, Lasers and CAD plotters
- Pop-up Menus
- Free Technical Support
- 30 day money-back guarantee & full-year limited warranty

**Nobody waits!**



**STANDARD 1 MB memory** • memory sizes thru 8 MB  
 • Fast - data rates to 100 KB/S • multiple copies • multiple outputs

**NEW**

**1 MB 6-Port Parallel \$199.95**

**Single User Parallel \$99.95**

9-Port Parallel \$249.95  
 12-Port Parallel \$299.95  
 8-Port Serial + 3-Port Parallel \$269.95  
 16-Port Serial + 3-Port Parallel \$399.95

512 Kbytes - unit is expandable to 4 MB  
 Serial or Converting buffers available

Other Models also available - Call! Extra Memory: \$50 per Megabyte

**Technologic SYSTEMS**

**513-644-2230** • FAX 644-2232 Made in USA

204 EAST FOURTH STREET, MARYSVILLE, OHIO 43040

Receive FAX Info On-Demand: (805) 650-3299 - Item # 700

Circle 360 on Inquiry Card (RESELLERS: 361).

**Programmable Hardware**

## PLC

**"High speed scan rate at a fraction of the cost!"**

**HARDWARE:**  
 DIGITAL CONTROLLER • 8 optically isolated digital inputs at 120 VDC • 8 isolated relay outputs rated up to 3A continuous at 120 VAC with a 10 A surge • Timers • counters • pulsars • data storage  
 • sequencers • serial communications optional RS-485 or RS-232 • up to 1ms per K of Boolean logic  
 ANALOG CONTROLLER • 8 10 bit analog inputs • 4 analog outputs • 2 digital inputs • 2 relay outputs  
 • 2 transistor outputs • RS485 on board • PID loops • 8K RAM • OPERATOR INTERFACE • 24 character by 2 line display • 4 by 4 keypad • 9K RAM • easy to use keyboard and display functions • RS485 on board

**SOFTWARE:** • programmable with IBM XT/AT/386/486 compatible and EPROM programmer  
 • easy to use ladder logic compiler with text annotation and integrated editor • Software package includes functions for all systems

Price list:  
 Basic PLC Digital controller \$199.00    DWC PLC RS485 interface \$59.00  
 Basic Analog controller \$269.00    DWC PLC RS232 interface \$59.00  
 Basic Operator Interface \$259.00    DWC Network Node \$199.00  
 Basic Ladder Logic Compiler software \$89.00  
 Basic EPROM programmer development adapter \$18.00  
 Special offer for first time buyers software \$49.00 with any purchase of above.

1-800-888-2707 tel: (519) 850-0637 fax: (519) 660-1602

# DAVISON • WORTH

C O R P O R A T I O N

Circle 383 on Inquiry Card (RESELLERS: 384).

**Programmable Hardware**

## EMBEDDED COMPUTERS

**Everything you want ....**

- Powerful Hitachi H8/532 16-bit processing
- Drives graphics LCDs and keyboard
- Collects 10-bit analog data from 8 channels
- Stores information on PCMCIA Cards
- 16K Forth and ready-made solution library
- High level interrupts and multitasker
- \$325 qty 10+ \$249 qty 100+



.... to make life easier

For more information contact:  
**The Saelig Company** Tel (716) 425-3753 Fax (716) 425-3835  
 Outside USA & Canada: **Triangle Digital Services Limited**  
 223 Lea Bridge Road, London Tel 081-539 0285 Fax 081-558 8110

Circle 362 on Inquiry Card.

## LOW COST COMPACT PLC PICOLOG

**The Easiest Logic I/O For your PC!!**

**ONE OF THE CHEAPEST P.L.C.'s IN THE WORLD!**

**HARDWARE:** • 16 opto-isolated digital inputs, • 8 relay outputs @125 VAC, • I/O status indicator LED's, • Watch-dog and power failure circuits, • standard RS232 interface, • single 5/12/24 VAC/VDC power supply (under 3W), • 24 Kb battery back-up SRAM, • 10x170 mm.

PROGRAMMABLE with any compatible PC thru RS232 in our powerful remoter program. • Real time variables debug, • C, BASIC compilers and assemblers available. • SOFTWARE DRIVERS enable your PC applications to remote control PICOLOG I/O thru RS232. • EXTENSION MODULES AVAILABLE.

ladder logic using our powerful remoter program. • Real time variables debug, • C, BASIC compilers and assemblers available. • SOFTWARE DRIVERS enable your PC applications to remote control PICOLOG I/O thru RS232. • EXTENSION MODULES AVAILABLE.

Phone 39 142 451987 Fax 39 142 451988  
 s.r.l. • ITALY BBS 39 142 453165

Circle 382 on Inquiry Card.

## UNIVERSAL PROGRAMMER, EMULATOR, & TESTER

|         |          |     |
|---------|----------|-----|
| TUP-400 | \$745.00 | NEW |
| TUP-300 | \$575.00 |     |

- New Improved hardware and software.
- The most complete PC-based Universal Programmer, Programs PLD (PAL, GAL, FPL, EPLD, PEEL, MAX, MACH...), E(E)PROM, (up to 16Mbit), Flash EPROM, BFPROM, Special PROM, MPU (87XX, 68XX, Z8, PSD30L, PIC16XX, TMS320EXX, UPD75P00X, HD63700X...)
- Covers DIP, PLCC, QFP, SOP, and PGA with 8 to 84 pins. Gang Programming adapters available also.
- EPROM EMULATION capability.
- Tests digital ICs and DRAMs (SIMM/SIP adapter available)
- Free software updates and new device added upon request.
- IC Manufacturers' approval.
- 1-year warranty, 30-day money-back guarantee.

CALL TODAY FOR MORE INFORMATION.  
 Distributors are welcome!

**Tribal Microsystems Inc.** Tel (510) 623-8859  
 44388 S. GRIMMER BLVD., FREMONT, CA 94538 FAX (510) 623-9925

Circle 363 on Inquiry Card (RESELLERS: 364).

## For Your Development Needs!

### MODEL 9000 EPROM PROGRAMMER

- QuickPulse and intelligent algorithms.
- Programs Eproms (up to 4Mb), EEproms & MPU's.
- Up to 57K baud.
- Ultra Fast!

ORDER TOLL-FREE  
**800-282-4835**

OEM & Dealer Inquiries Welcome!  
**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

Circle 343 on Inquiry Card.

## SUPERPRO® \$549 Universal Programmer

Over 2,000 devices, desktop programmer for your IBM PC with high speed & reliability

- Easy to use menu driven Software.
- Universal programming for E(E)PROM, Flash E(E)PROM, Bipolar PROM, PAL, FPL, PEEL, GAL, E(E)PLD, & Microcontroller, etc.
- Test TTL/CMOS logic ICs, & memory (DRAM/SRAM).
- Life time free Software updates on BBS & technical support.
- 1 year Hardware warranty & 30 day money back guarantee.
- Developed & made in U.S.A.
- Call for demo disk.

Distributors are welcome!!

• E(E)PROM programmer to 4-Mbit  
 • ROM MASTER: \$149  
 • E(E)PROM programmer 4 gang version  
 • ROM MASTER/4: \$239  
 757 N. Pastoria Avenue, Sunnyvale, CA 94086  
**(408) 524-1929**  
 FAX (408) 245-7084 BBS (408) 245-7082

**XELTEK**

Circle 367 on Inquiry Card.

## IEEE 488/Serial Converters & Controllers

Connect IEEE 488 (HP-IB/GPIB) and serial (RS-232 or RS-422) computers, plotters, and instruments



**IOtech** the smart approach to instrumentation  
 IOtech, Inc. • 25971 Cannon Road • Cleveland, Ohio 44146  
 (216) 439-4091 • Fax (216) 439-4093

Circle 347 on Inquiry Card.

## NEW! Little PLC™ Program It In C \$195!

New Little PLC™ measures only 4.33 x 2.85 inches and costs \$195! This miniature controller includes 8 optically isolated inputs, 8 relay driver outputs, two RS-485 serial ports, battery backed memory and time/date clock, programmable timers, and watchdog. Low cost expansion cards increase digital and analog I/O. With easy to use Dynamic C™ \$195 development system, you can write programs in an hour or develop major applications with 20,000 lines of C language.



**Z-World Engineering (916) 757-3737**  
 1724 Picasso Ave., Davis, CA 95616 • FAX: (916) 753-5141  
 24 hr. Data Sheet Retrieval from YOUR fax: (916) 753-0618

Circle 368 on Inquiry Card.

**9 Track/3480 Tape Subsystems**  
**1/4" DAT 8mm Optical**  
 New Windows Software Available

- Best Quality
- Lowest Prices

800/1600/3200/6250 BPI

**CALL 1-800-859-8856**



**Laguna Data Systems**

23151 Alcalde Drive, Suite B-3, Laguna Hills, CA 92653  
 Tel: 714-586-3010, Fax: 714-586-5538



Circle 352 on Inquiry Card.

**FOR ALL YOUR TAPE NEEDS**

**3480 ■ 9-Track ■ 1/4" ■ 4mm ■ 8mm**

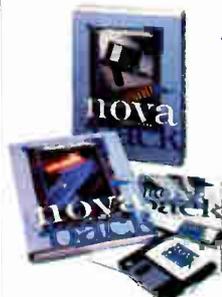
**Tape to Tape Copy**  
**Tape Backup/Restore**  
**Conversion**  
**Data Interchange**

**NovaStor Corp.**

30961 Agoura Rd., Suite 109  
 Westlake Village, CA 91361

**Phone (602) 396-3616**

or 818-707-9900 • Fax: 818-707-9902



Circle 373 on Inquiry Card.

**9-Track for PCs**

Mainframe to PC data interchange

Rock solid solutions, rock bottom prices.  
 Direct from the manufacturer. 1600 & 6250 bpi.  
 Subsystems include drives and software.

**800-729-8725**

**OVERLAND DATA®**

Since 1980

**3480 Now  
with IDRC!**

See us at CeBIT '93  
 Tel: 619-571-5555 • FAX: 619-571-0962

Europe: Tel: (+49) 6172-35027 • FAX: (+49) 6172-35028

**Ask about 3480 tape drives too**

Circle 356 on Inquiry Card.

**Desktop 9-Track Tape Subsystem**  
**#1-selling 9-track system on desktop.**



Qualstar's low cost 1/2-inch 9-track Streaming tape systems bring full ANSI data interchange to IBM AT, PS/2 or Macintosh, giving your micro the freedom to exchange data files with nearly any mainframe or minicomputer in the world

Systems include DOS or Xenix compatible software, coupler card and cables. High reliability 1600 or 6250 BPI capability may be used for disk backup as well as data interchange.

**QUALSTAR®**

**Call us today! For details and to order: Fax (818) 882-4081 Phone (818) 882-5822**

9621 Irondale Ave., Chatsworth CA 91311

©1989 Qualstar Corp. All product and company names and trademarks are the exclusive property of their respective owners.

Circle 358 on Inquiry Card.

**Electronic archiving/  
retrieval software!**

- Stores scanned images & existing files
- Designed for multuser networks
- Supports desktop and E-size scanners
- Safe, secure, protected
- Multiple optical drives (either 5.25" or 12")

**V.O.I.C.E. outperforms the competition in cost & features!**

V.O.I.C.E. was designed specifically for multuser networks like Novell and Lantastic. Use V.O.I.C.E. with any IBM compatible PC with a VGA or EGA

monitor. V.O.I.C.E. archives and retrieves scanned images, drawings, Word Perfect, AutoCad, and Lotus 1-2-3 electronic files, and has multiple levels of security.

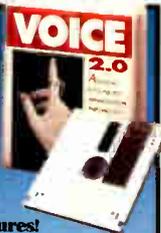
**indus**

Tools for the microinformation age  
 340 South Oak Street  
 West Salem, WI 54669 USA

Place an order by calling:

**1-800-843-9377**

All company and product names are trademarks of their respective owners



Circle 345 on Inquiry Card (RESELLERS: 346).

**Program Your Business For Success**

**MicroBuz**  
 AUTOMATE YOUR BUSINESS

**COMPUTERIZE YOUR  
BUSINESS & WATCH  
YOUR PROFITS GROW!**

- Increase Control
- Increase Profits & Sales
- Work smarter, not harder
- Lower Costs & Reduce Inventory

**We Provide Software That Is:**

- ✓ Affordable & Functional
- ✓ Easy to use
- ✓ Tested & Stable
- ✓ Unparalleled In Technical Support

**800-637-8268**

Main Phone: (914) 425-9500  
 Fax: (914) 425-4598  
 BBS: (914) 425-6440  
 Fax on demand: (914) 426-6064  
 Dealers Welcome: 800-SELL-POS



**CALL TODAY FOR A FREE CATALOG**

Circle 387 on Inquiry Card (RESELLERS: 388).

**9-Track for PCs**

Mainframe to PC data interchange

Rock solid solutions, rock bottom prices.  
 Direct from the manufacturer. 1600 & 6250 bpi.  
 Subsystems include drives and software.

**800-729-8725**

**OVERLAND DATA®**

Since 1980

**3480 Now  
with IDRC!**

See us at CeBIT '93  
 Tel: 619-571-5555 • FAX: 619-571-0962

Europe: Tel: (+49) 6172-35027 • FAX: (+49) 6172-35028

**Ask about 3480 tape drives too**

Circle 356 on Inquiry Card.



**HiWIRE II Schematic  
and PCB Software**

With support for expanded and extended memory, HiWIRE II can handle your most demanding schematic and PCB designs. The unique HiWIRE II editor allows you to display and edit schematics and PCBs simultaneously, using the same commands for each. HiWIRE II is \$995, and is guaranteed.

Call (800) 742-6809  
 or (317) 448-1903

**WIRTEK**

Wintek Corporation  
 1801 South Street  
 Lafayette, IN 47904

**(800) 742-6809**

Circle 366 on Inquiry Card.

**Desktop 9-Track Tape Subsystem**  
**#1-selling 9-track system on desktop.**



Qualstar's low cost 1/2-inch 9-track Streaming tape systems bring full ANSI data interchange to IBM AT, PS/2 or Macintosh, giving your micro the freedom to exchange data files with nearly any mainframe or minicomputer in the world

Systems include DOS or Xenix compatible software, coupler card and cables. High reliability 1600 or 6250 BPI capability may be used for disk backup as well as data interchange.

**QUALSTAR®**

**Call us today! For details and to order: Fax (818) 882-4081 Phone (818) 882-5822**

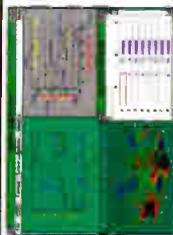
9621 Irondale Ave., Chatsworth CA 91311

©1989 Qualstar Corp. All product and company names and trademarks are the exclusive property of their respective owners.

Circle 358 on Inquiry Card.

**Plot-IT**

SCIENTIFIC PROGRAMMING  
 P.O. Box 669  
 Haslett, MI 48840  
 (517) 339-9859

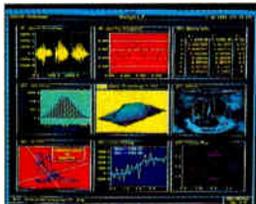


**Scientific Graphs and Statistics**

PlotIT 3.0 for Windows is the next generation of a proven high-powered scientific graphing and statistical analysis package for scientists, engineers, and others who need quality, user-designed 2D, and SPCC graphs, or need to perform sophisticated data analysis. PlotIT 3.0 has the features you need to make those complex scientific graphs seem simple.

- Multiple Axes and Curves per graph; multiple graphs per page; user Axis and Data labels; Linear, Log, Prob, and Percentage scales.
- Nearly 100 statistical functions, including AOV, Regr, Distribution, Trends, Group stats, curve fitting, and basic stats available within the full-featured PlotIT worksheet, with support of up to 16375 rows of data.
- 3D graphs: surfaces, contours, histograms, scatter-plots; with floor and wall ray tracing, color ranges, and postings.
- 2D graphs: Standard Error, curve fitting and data analysis; line, point, bar, and pie, triangle, and Control charts.

Circle 374 on Inquiry Card (RESELLERS: 375).



### If you work with DATA... DADiSP is for you!

- Collect, analyze, and display data in a multi-window graphical environment
- Point and Click menu driven operation
- Data reduction and editing
- Series and scalar math
- Matrix math
- Statistics
- Peak analysis
- FFTs and Convolutions
- Digital filtering
- XY plots
- 3-D/4D graphics
- Spreadsheet environment to create programs and templates, without any programming

DADiSP is currently in use in engineering, laboratory data collection, matrix processing, manufacturing, science, signal processing, chemical and mechanical applications in automotive, aerospace, defense, medical, and other industries.

**CALL 1-800-777-5151**

for your free DADiSP Trial Kit for SUN, HP, IBM, NeXT, DEC, Concurrent, and Silicon Graphics workstations, and of course, PCs under Windows™.



One Kendall Square  
Cambridge, MA 02139

tel: 617-577-1133  
fax: 617-577-8211

Circle 339 on Inquiry Card.

## dBASE Data Entry



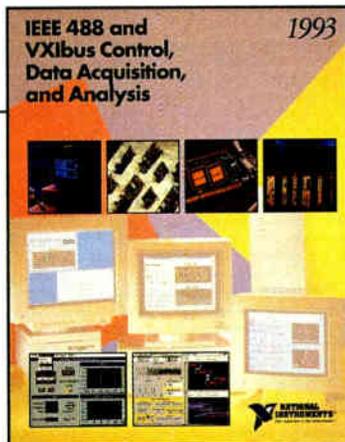
The TransTerm 5 is a work station data entry/display terminal for on-line shop floor data collection into PC/AT/PS-2 systems. The unit is one of a family of such terminals which feature LC displays for operator prompting and data entry via sealed touch keys or an optional barcode scanner or badge reader (Code39, UPC+). A multi-terminal network controller (up to 250 stations) and a dBASE IV compatible software package are also available. System costs start below \$300 per station. Options include display backlighting, barcode scanning, counter inputs, control output.

# COMPUTERWISE®

302 N. Winchester • Olathe, KS 66062

913-829-0600 • 800-255-3739 • FAX 913-829-0810

Circle 335 on Inquiry Card.



## Data Acquisition and Instrument Control

Free 1993 catalog of measurement and instrumentation products for PCs, workstations, and more. Features new LabVIEW software for Windows and Sun, and LabWindows. Describes IEEE 488.2 interfaces, plug-in data acquisition boards, VXIbus controllers, DSP hardware and software, and signal conditioning accessories. Training classes also detailed. Includes tutorials and glossary.

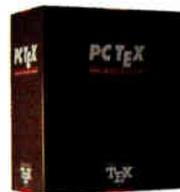
### National Instruments

6504 Bridge Point Parkway, Austin, TX 78730  
(512) 794-0100  
(800) 433-3488 (U.S. and Canada)  
Fax (512) 794-8411

Circle 355 on Inquiry Card.

## PCTEX Typesetting Software

$$\int_{-\infty}^{nZ} \frac{Xv \cdot z dt}{X - tY} = \sum_{i=1}^n \left( \frac{(x^4 - i)^3}{\sqrt{z^3 + y^{10}}} \right)$$



*This complete typesetting system makes  
your books, manuals, articles, & math formulas  
look their best!*

**For a FREE CATALOG & DEMO DISK, call 415/388-8853**

Personal TgX, Inc. 12 Madrona Street Mill Valley, CA 94941 Fax: 415/388-8855

Circle 357 on Inquiry Card.

## BASIC Compiler 8051/52 & Derivatives

### BXC Version 4.0 New Release!

- 100% BASIC-52 compatible & in line assembly
- Full floating point, integer, byte and bit variables
- Compatible with any RAM or ROM memory mapping
- Compile BXC program into CALLable subroutine
- Compile program to coexist with BASIC-52 interpreter
- DS/5000 chip support and extensions
- Dynamic length variables and many string functions
- Advanced run-time error trapping & buffered serial I/O

**BXC51 \$295**

**Call now! 508-369-9556 or FAX 508-369-9549**



**Binary Technology, Inc.**

P.O. Box 541 • Carlisle, MA 01741



Circle 332 on Inquiry Card.

**APL** Complete APL system \$60.

**J** Ken's new APL for teaching and research. Shareware and documentation \$24. Source \$90.

NEW! True Windows 3.1 versions. GUI programming for APL and J

**Iverson Software Inc.**

33 Major St., Toronto, Ontario, Canada M5S 2K9  
Phone (416) 925-6096 Fax (416) 488-7559

Circle 378 on Inquiry Card.

**REAL TIME VISION**  
DDE-Driven Dynamic Graphics

MICROSOFT WINDOWS™ COMPATIBLE

Toolbar contains tools for creating real-time display screens with animated graphics

Charts and graphs show changing data as the changes occur

Knobs and buttons allow operator interface and control

Real time means you see changes as they occur, not after the fact. **VISION** provides you with the real-time information needed for success in today's quickly changing business climate.

**VISION** includes all software needed to immediately start monitoring PC performance, network performance, and changes in dBase files.

**VISION** displays dynamic data from DDE-enabled Windows applications. Examples include:

- Microsoft Excel
- Lotus 1-2-3
- Borland Quattro Pro
- Visual BASIC
- databases
- accounting packages

|                     | List Price | Intro |
|---------------------|------------|-------|
| Realtime VISION     | \$395      | \$99  |
| Developer's Edition | \$995      | \$495 |

(for royalty-free distribution of applications)

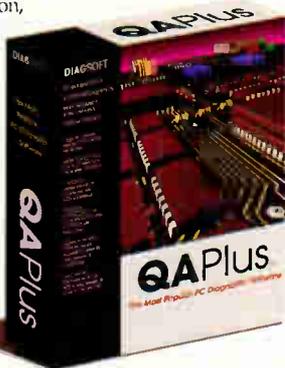
**1-800-TRY-LABTECH** (508) 657- 5400  
FAX (508) 658-9972

Circle 351 on Inquiry Card.

**PC Diagnostics and System Information**

**QAPlus** Over 3 Million users

- ❑ New Version 4.7 now includes Reachout™ Host remote control software and Novi™ Scan virus detection software
- ❑ Both novices and expert PC users can quickly solve common computer problems
- ❑ Reports hardware configuration, interrupts, performance benchmarks and more
- ❑ Includes LAN features for networked PC support and management



For More information call:

1-800-DIAGSOFT

Also from DiagSoft: **QAPlus WIN** for tuning and troubleshooting Windows and **QAPlus/FE** for power-users and service/support professionals.

Available from Egghead Discount Software, Comp USA, Biz Mart, Fry's Electronics and other fine resellers.

DiagSoft, Inc., 5615 Scotts Valley Drive, Suite 140, Scotts Valley, California 95066 • 1-408-438-8247 • FAX 1-408-438-7113  
Suggested Retail: \$159.95

Circle 338 on Inquiry Card.

**Programming for Microsoft Windows doesn't have to be a Pain** for **C++**

*Object-Menu 2.0*

object-Menu provides an object-oriented architectural framework for your C++ application with a dazzling look and feel. Seamlessly port your product between DOS graphics and Microsoft Windows using our interface objects. Our intuitive architecture and natural programming syntax increase your productivity more than you ever thought possible. Our goals are to simplify GUI design for the novice while providing the power and flexibility needed by an expert.

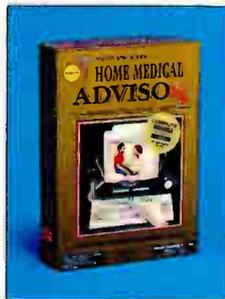
Call today for a free demo!

7 Mountain Rd, Burlington MA 01803  
Tel: (617)273-0421 Fax (617)270-4437  
BBS (617)270-9552



Circle 348 on Inquiry Card (RESELLERS: 349).

**IS THERE A DOCTOR IN THE HOUSE?**



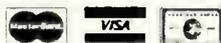
Nominee Compute Choice Award  
Best Adult Discovery Software  
**WINDOWS VERSION**



- **Dr. Schueler's Home Medical Advisor** gives updated info on diseases, injuries, medical tests, drugs, poisons, nutrition, diets, fitness, and health/travel tips.
- Q/A format analyzes your symptoms, shows you anatomical displays, and makes over 400 diagnoses.
- Hypertext and SCAN features make finding any topic FAST.
- Low cost updates to all registered users.
- Developed by over 40 physician specialists.

Available in WINDOWS or DOS versions \$99.95 Retail  
WINDOWS Special: **\$79.95**  
DOS Special: **\$69.95**

To order, Call: **1-800-788-2099, Dept. B**  
or see your software dealer



**PIXEL PERFECT INC.**

10460 S. Tropical Tr.  
Merritt Island, FL 32952

Circle 371 on Inquiry Card.

# THE BUYER'S MART

## A DIRECTORY OF PRODUCTS AND SERVICES

THE BUYER'S MART is a unique classified section organized by product category to help readers locate suppliers. Each ad has Inquiry numbers to aid readers requesting information from advertisers.  
**AD FORMAT:** Each ad will be designed and typeset by BYTE. Do NOT send logos or camera-ready artwork. Advertisers should furnish typewritten copy. 2"x1 1/2" ads can include headline (23 characters maximum), descriptive text (300 characters is the maximum recommended) plus company name, address, tele-

phone and fax number. 2"x2 1/2" ad has more space for descriptive text (850 characters is the maximum recommended).  
**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: Margot Gnade at 603-924-2656. FAX: 603-924-2683.

### RATES (Jan. 1993)

|                  | 3-5 issues | 6-11 issues | 12 issues | 13 issues |
|------------------|------------|-------------|-----------|-----------|
| <b>2"x1 1/2"</b> |            |             |           |           |
| 1 ad             | \$663      | \$636       | \$557     | \$530     |
| 2 ads/issue      | -          | -           | 530       | 504       |
| 3 ads/issue      | -          | -           | 504       | 477       |
| <b>2"x2 1/2"</b> |            |             |           |           |
| 1 ad             | \$1,326    | \$1,272     | \$1,114   | \$1,060   |
| 2 ads/issue      | -          | -           | 1,060     | 1,008     |
| 3 ads/issue      | -          | -           | 1,008     | 954       |

## 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 2.9  
 • WINDOWS, Plot • Background • Cosmic Rays • Clouds • Foods  
 Call/Write for PC MAGAZINE review. • TSR • GM Tube  
 VISAMC/EURO Phone orders: Not satisfied? Full refund.  
**800-729-5397 or Tel/Fax: (302) 655-3800**  
**Aware Electronics Corp.**  
 P.O.Box 4299, Wilmington, DE 19807 **\$149.50**

### KEYBOARD, VIDEO, MOUSE, AUDIO

Extend signals from PC with EXTENDER  
 Split signals with COMPANION/PC EXPANDER  
 Switch signals among PCs with COMMANDER  
 Boosts signals up to 600 feet. Control up to 96 PCs with one keyboard, monitor and mouse.  
**CYBEX CORPORATION**  
 2800H Bob Wallace Ave., Huntsville, AL 35805  
**Phone: 205-534-0011 Fax: 205-534-0010**

Inquiry 701.

### CUSTOM KEYBOARDS AND TERMINALS Engineering, Development and Production

- Point-of-Sale • Special purpose • Harsh environment
- Access control • Data collection • Operator input
- Unique • Industrial • Any interface, key style or size
- No minimum quantity required

#### GENOVATION, Inc.

17741 Mitchell North, Irvine, CA 92714  
**(800) 822-4333 (714) 833-3355 FAX (714) 833-0322**

Inquiry 702.

## BAR CODE

### Portable Reader Simple, Powerful, Easy-to-use

- ▶ AA Battery Operated, with backup coin battery
- ▶ 2 x 16 Supertwist LCD Display
- ▶ 32 Raised Rubber Keys
- ▶ Real-time Clock Built-In for Date/Time Stamps
- ▶ 2 Built-In Inventory Programs
- ▶ 3 User Defined Programs, & 3 User Data Files
- ▶ Wand, CCD, or Laser Scanner Input
- ▶ Doubles as Non-Portable Reader
- ▶ Serial Interface and Keyboard Interface
- ▶ Reads 2of5, UPC/EAN, 128, Code 39, etc.
- ▶ Uploads with furnished Programs or Xmodem
- ▶ 64K Complete with Steel Wand - \$799

#### Worthington Data Solutions

Swiss Office 3004 Mission Street  
 Rütistrasse 6 Santa Cruz, CA 95060  
 CH 9050, Appenzell Switzerland 408-458-9938  
 071 87 51 17 FAX  
 071 87 51 15 Phone **800-345-4220**

## BAR CODE

### Bar Code Readers For PC, XT, AT, PS/2, Macintosh and Serial Terminals

- ▶ Attaches as 2nd Keyboard or to any ADB port
- ▶ Reads 2of5, 128, UPC/EAN, Code 39, etc.
- ▶ External or internal attachment on PC
- ▶ Wand, CCD, Slot Badge, Magstripe or Laser
- ▶ Two Scanners per Reader
- ▶ 100+ Configurable Options
- ▶ 2 Year Warranty, 30 Day \$ Back Guarantee
- ▶ Direct From Manufacturer
- ▶ Top Rated by Independent Review
- ▶ Complete with Laser Scanner - \$1399
- ▶ Complete with Stainless Steel Wand - \$399

#### Worthington Data Solutions

Swiss Office 3004 Mission Street  
 Rütistrasse 6 Santa Cruz, CA 95060  
 CH 9050, Appenzell Switzerland 408-458-9938  
 071 87 51 17 FAX  
 071 87 51 15 Phone **800-345-4220**

### Labeling Software

On EPSON, IBM, OKI, or LaserJet. Easy WYSIWYG design. Any format/size. Up to 120 fields per label. 18 text sizes to 3" -readable at 100', AIAG, KMart, Sears, MIL-STD, Pennys, 2of5, 128, UPC/EAN, Code 39. File Input & Scanned PCX graphics - \$279. Other programs from \$129.

#### Worthington Data Solutions

**(408) 458-9938 800-345-4220**

### BAR CODE READERS

Keyboard emulation for PC/XT/AT & PS/2s, 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**

### PORTABLE BAR CODE READER

Battery operated, handheld reader with 64K RAM, 54 key keyboard, real-time clock, 2X16 LCD display, and built-in calculator. Supports WAND, CCD, and LASER. Built-in program generator supports multiple programs and data files. Interfaces to PC & PS/2 keyboards. RS-232 terminals, and Hayes compatible modems. 30-DAY MONEY-BACK GUARANTEE.

#### AMERICAN MICROSYSTEMS

2190 A Regal Parkway, Euless, TX 76040  
**(800) 648-4452 (817) 571-9015 FAX (817) 685-6232**

## BAR CODE

### BAR CODE PRINTING SOFTWARE

- MS/PC DOS Systems • Import/Export ASCII files • 9 & 24 pin dot matrix • H-P LaserJet/Plus/Series II
- Menu-driven or Memory Resident • Most Label Sizes
- Multiple Densities • Variable Graphic Heights • Code 39, I 2/5, UPC A/E, EAN 8/13, 128, 93, 11, MS1/PLE-SEY, POSTNET (ZIP+4).

#### AMERICAN MICROSYSTEMS

2190 Regal Parkway, Euless, TX 76040  
**(800) 648-4452 (817) 571-9015 FAX (817) 685-6232**

### BAR CODE "SPECIALS"

- Wedges/Portables/Multi On-Line readers with HP wands
- Spectra-Physics lasers \$899. PSC & Symbol in stock
- 3" CCOs \$468. Mag stripe encoders/readers \$1485
- Software: print bar codes \$99 & read bar codes \$159
- P.O.S. - cash drawers \$199/receipt printers \$399...
- 30-day \$3 Back / 1 Year Warranty \*Spanish Dept. available
- OEM/VAR/Dealer discounts

#### BARCODE INTERNATIONAL SYSTEMS

9190 Palm Canyon Drive, Corona, CA 91719  
**(714) 277-1917 • (800) 653-4252 • FAX: (714) 277-1005**

Inquiry 703.

### I. T. S. Bar Code Solutions

Bar codes are easy using our FULL line of readers & printers. They plug and 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 704.

### EASY BAR CODE PRINTING

The leader in PC Postal bar coding software now provides same easy & flexible barcoding for Code 39.

- ☐ **BARZ OUT** - PC memory resident with easy menu select & load. Use with your current programs.
- ☐ **MAKE BARZ** - Easy menu creation of bar code labels. Save \$70 - Limited Time Offer - Both \$129
- 30 day \$3BACK (Call about UNIX, WINDOWS, Other Codes.)

#### POSTSAVER SYSTEMS

2731 S. Adams Rd. STE 102, Rochester, MI 48309-3103  
**(800) 879-6820 (313) 299-5050 FAX (313) 299-5052**

Inquiry 705.

### PC BAR CODE SPECIALISTS

Bar code readers designed for fast, reliable, cost-effective data entry. They emulate your keyboard, so data looks just like it was typed in! Choose from stainless steel wand, laser gun, CCD, and magnetic stripe scanners. Also, powerful label printing software. Great warranty. Generous reseller discounts. 30-DAY MONEY-BACK GUARANTEE.

#### Seagull Scientific Systems

15127 N.E. 24th, Suite 333, Redmond, WA 98052  
**1-800-758-2001 206-451-9666**

## BAR CODE

### 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 706.

### 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, Kilmtron terminals  
• Bar code and label printing software  
• Full two-year warranty  
• 30-Day Money-Back Guarantee  
• Extensive VAR/Dealer Discounts  
46560 Freemont Blvd., Suite 206/Freemont, CA 94538/(510) 440-2870  
800-666-4BAR FAX: (510) 440-2873

Inquiry 707.

## CAD

### PCB & SCHEMATIC CAD-\$195

"EASY-PC" for single-sided and multilayer boards to 17"x17" with up to 1500 ICs including surface mount. Phenomenally fast and easy to use. Over 13,000 copies sold. Needs PC/XT/286/386 HERC/CGA/EGA/VGA. Output to laserjet/linkjet/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 directly.

### NUMBER ONE SYSTEMS LTD.

Harding Way, St. Ives, Huntingdon, Cambs, England, PE17 4WR  
Tel: 011-44-480-61778 Fax: 011-44-480-494042

Inquiry 708.

## CAD/CAM

### CONTOURING MOTION CONTROL FROM A PRINTER PORT!

Indexer LPT™ software \$249 VISA/MC  
**NEW VERSION 3**  
• Controls up to six step motors simultaneously.  
• Linear and Circular Interpolation.  
• New features to accommodate machine control.  
• Easy-to-use DOS device driver. Super Manual.  
• CAD-CAM interface available.  
Ability Systems Corporation, 1422 Arnold Ave.  
Roslyn, PA 19001 (215) 657-4338  
FAX: (215) 657-7815

Inquiry 709.

## CAT-SCANNERS

### INPUT SLIDES & NEGATIVES with FOTOVIX III-S

New high-resolution S-video version of Tamron's popular 35mm film to video converter. Perfect for input of film to any computer equipped with a video capture board. Crop 35mm images with 3x zoom. Color balance and exposure correction controls. List price \$929.00

### Tamron Industries Inc.

99 Seaview Blvd., Port Washington, NY 11050  
1-800-827-8880

Inquiry 710.

## CD-ROM

Simtel MSDOS Shareware CDROM, 640 Meg, Dec. 92.....\$24.95  
CICA MS Windows Shareware CDROM, Nov. 92.....\$24.95  
OS/2 Shareware CDROM, Nov. 92.....\$24.95  
Source Code CDROM, 600 Meg, Mar. 92.....\$39.95  
INFO-MAC Macintosh SW, 4000+ files, Aug. 92.....\$39.95  
CDROM Caddies.....\$4.95

### WALNUT CREEK CDROM

1547 Palos Verdes Mall, Ste 260, Walnut Creek, CA 94596  
(800) 786 9907 (510) 947 5996 FAX: (510) 947 1644

Inquiry 711.

## COMMUNICATIONS

### X.25, HDLC, SDLC, BSC

SDLA card and software provides 'plug-in' synchronous link support for PCs which is inexpensive, easy to use and robust. Coprocessor architecture ensures reliable communications under any operating system at line speeds to 180kbps. Packages include protocol analyser, test and development software. OEM enquiries welcome.  
Full function SNA emulation packages also available.

**Sangoma Technologies Inc.**  
(416) 474-1990 1-800-388-2475

Inquiry 712.

## COMPUTER BOOKS

### COMPUTER BOOKS at a discount

We specialize in ADVANCED books for developers, programmers, computer professionals, and academics. 15% discount. Latest books from over 50 publishers. Free catalog. UPS & international shipping. Personal service. MC/VISA/AMEX. CompuServe 70007,1333. GO CBK Windows, C++, O/S 2.0, UNIX, Mac, OOP

### CompuBooks

Rt. 1, Box 271-D, Cedar Creek, TX 78612 USA  
800-880-6818, 512-321-9652 voice & FAX

Inquiry 713.

## COMPUTER INSURANCE

### INSURES YOUR COMPUTER

SAFWARE Computerowner's 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.

**TOLL FREE 1-800-848-3469**

**SAFWARE, The Insurance Agency Inc.**

PO Box 02211, 2929 N. High St., Columbus, OH 43202

Inquiry 714.

## COMPUTER SYSTEMS

### LOW-LOW-LOW

Computer Systems/Notebooks/Network Solutions  
IBM Apple-Compaq-AST-ALR-Everex-&others  
SURAH 386/486 ISA/EISA-AMI/Mylex Motherboards  
• CD ROMS • Tape Backup • Pocket FAX Modem LAN Cards • Hard Drives/Floppy Drives • Memory/Upgrades  
• DRAMS, SIMM Modules • Laser Printers/Scanners  
• Plotters & Digitizers • Software  
44912 Osgood Road, Fremont CA 94539 USA  
Phone: (510) 651-5101 Fax: (510) 651-5241  
**SURAH inc.**  
1-800-543-1001 Nationwide Orders

Inquiry 715.

## CROSS ASSEMBLERS

**Cross Assemblers \$50**  
**Simulators \$100**  
**Disassemblers \$100**

### PseudoCorp

716 Thimble Shoals Blvd. Newport News, VA 23606  
(804) 873-1947 Fax (804) 873-2154

Inquiry 716.

## DATA CONVERSION

### TAPE CONVERSION & DUPLICATION

• DC2000 • 1/4" Cartridge (AS/400)  
• TEAC • 4mm DAT  
• 8mm EXABYTE • DEC TKxx media  
• 1/2" Tape • 3480 & 3490  
Mainframe, Mini or Micro - popular or obscure.  
Fixed price quote by return. Standard turnaround 24 Hours.  
TEL 1 800-392-5373 FAX: 405-321-2741  
TEL 44+ (0) 734-890042 FAX: 44+ (0) 734-890040  
Vogon Enterprises Ltd.  
Unit 5, Forrest Court, Oaklands Park, Fishponds Road,  
Wokingham, Berks., RG11 2FD, England

Inquiry 717.

## DATA RECOVERY

### Ontrack DATA RECOVERY

• Professional service recommended by major hard drive manufacturers • Expertise in virtually every operating system & media storage device  
• 24-hour support with weekend, priority, & on-site service available • For fast, successful results, call:

CA: 1-800-752-7557 • MN: 1-800-872-2599  
2400 Main Street, Suite 200, Irvine CA 92714  
6321 Bury Drive, Eden Prairie MN 55346

Inquiry 718.

### Now we're Ontrack in London, too. ONTRACK DATA RECOVERY EUROPE, LTD.

0800-24-39-96 • 44-81-974 5522

Surrey House, 34 Eden St., Kingston upon Thames, Surrey KT1 1ER U.K.

Inquiry 719.

### TAPE DATA RECOVERY

- DC2000
- TEAC
- 8mm EXABYTE
- 1/2" Tape
- 1/4" Cartridge (AS/400)
- 4mm DAT
- DEC TKxx media
- 3480 & 3490

Whatever the Hardware, Software & Problem... if there is data on a tape we will recover it.

TEL 1 800-392-5373 FAX: 405-321-2741  
TEL 44+ (0) 734-890042 FAX: 44+ (0) 734-890040  
Vogon Enterprises Ltd.  
Unit 5, Forrest Court, Oaklands Park, Fishponds Road,  
Wokingham, Berks., RG11 2FD, England

Inquiry 720.

## 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 FAX: (612) 588-8783  
1-800-745-7571

Inquiry 721.

### IBM PC ← TO → HP FILE COPY

✓ New Interface ✓ BDAT2ASCII  
Allows IBM PCs, PS/2, compatibles to interchange files with Hewlett-Packard Series 70, 80, 200, 300, 1000, (LIF media).

### Oswego Software

Box 310 708/554-3567  
Oswego, IL 60543 FAX 708/554-3573  
CALL FOR A FREE DEMO!

Inquiry 722.

### CONVERSION SERVICES

Convert any 9-track magnetic tape to or from over 5000 formats including 3 1/2", 5 1/4", 8" disk formats & word processors. Disk-to-disk conversions also available. Introducing CD-ROM conversions. Call for more info.

### Pivar Computing Services, Inc.

165 Arlington Hgts. Rd., Dept. #B  
Buffalo Grove, IL 60089 (800) Convert

## DATABASE

**THE NERD SHOP**  
FOR  
**SUPERBASE 2**  
800-448-NERD

Inquiry 723.

**dBASE, Fox & Clipper from Visual Basic**  
Get complete database management power and dBASE, FoxPro and Clipper file compatibility from VB Win and VB DOS. Get CodeBasic! Fully multi-user and only \$195. Comes with a 90 day money-back guarantee. FREE demo available.

**Sequiter Software**  
#209, 9644-54 Ave., Edmonton, AB, Canada T6E 5V1  
Tel (403) 437-2410 Fax (403) 436-2999

Inquiry 724.

## DIAGNOSTIC

**"..PINPOINT ANY PC FAILURE."**  
John C. Dvorak, PC Magazine 6/30/92  
Top-rated PocketPOST Power On Self-Test card with diagnostic software for ISA/EISA/Micro-Channel. 180-page book. Hones your trouble shooting skills. CALL NOW.

**DATA DEPOT, Inc.**  
1710 Drew Street #5, Clearwater, FL 34615  
**1-800-275-1913**  
813-446-3402 FAX 813-443-4377

Inquiry 725.

## DISK DRIVES

**21MB 3.5" Floptical Disk Drive for \$399!**  
EchoDrive SCSI Floptical disk drive not only reads and writes to 21MB 3.5" Floptical diskettes but also:

- reads and writes to 720K and 1.44MB floppy diskettes
- runs under OOS, Windows, or on the Macintosh
- is available as an external or internal drive
- provides amazing floppy speed! WOW!
- It's GREAT for backup, file archival, and transporting files.

**Second Wave, Inc.** • 9430 Research Blvd. II-260  
Austin, TX 78759 • (512) 343-9661 • FAX: (512) 343-9663

Inquiry 726.

## EDUCATION

**LEARN COMPUTERS!**  
**BUILD SOLID COMPUTER USER SKILLS**  
Approved home study. At last—understand the PC! Learn word processing, database, spreadsheets, data communications. Free Literature.  
**CALL TODAY: 800-223-4542**  
School of Computer Training, Dept. KB691  
2245 Perimeter Park, Atlanta, Georgia 30341

Inquiry 727.

## ELECTRONIC MAIL

**ELECTRONIC MAIL—Novell MHS**

- Stand alone computers, Laptops, Netware, Lantastic
- Set up your own hub
- International network
- Workgroups, privacy, use your regular phone line
- \$100.00 per computer station — unlimited phone support and design assistance.

**Selections & Functions, Inc.**  
Call for a brochure (617) 826-1553  
25 Washington Street, Hanover, MA 02339

## 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. 12,000 sold. PC or Mac.  
Still only \$195!  
Free Flyer: 800/284-8112, 916/477-7481  
**California Scientific Software**

Inquiry 728.

## FLOWCHARTS

**FLOW CHARTING 3**

FRIENDLY

FAST

FLEXIBLE

- High resolution print outs... dot matrix or laser
- Multi-page charts... portrait or landscape
- Import/export capabilities
- 35 shapes, 10 fonts, 4 line styles

ONLY \$250

Call for free demo disk!  
**PATTON & PATTON** 800-525-0082 ext. 1317  
Software Corporation 485 Cochran Cr. Morgan Hill, CA 95037  
See our ad on page 82

Inquiry 729.

## WINDOWS FLOWCHARTER \$129

RFFlow 2.0 is a professional drawing tool for flowcharts & org. charts. Requires Microsoft Windows. 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

## FRAMEWORK/FRED

**The Framework Magazine**  
Framework enhancement programs, 12 issues \$29.90  
Unlimited Framework and FRED support. Access undocumented powers of Framework & FRED.

**fBase for Framework \$190.90**  
The fastest disk database access in existence. dBase file Index optimization and compression.

**Selections & Functions, Inc.**  
(617) 826-1553  
25 Washington Street, Hanover, MA 02339

## GRAPHICS

**THE NERD SHOP**  
FOR  
**HARVARD GRAPHICS**  
800-448-NERD

Inquiry 730.

## Sirlin's CAD ++ ENGINE

- Read and Write AutoCAD DWG and DXF files.
- Object oriented, modular, database-like access to CAD data.
- View, Print (rasterize), Plot (vectorize), and Pick (Interact) modules.
- Available for C/C++ for DOS, Extended DOS, Windows, Sun and other Unix systems.

**Sirlin Computer Corporation**  
25 Orchard View Dr., Ste 14, Londonderry, NH 03053  
Phone: (603) 437-0727 • Fax: (603) 437-0737

Inquiry 731.

## GRAPHICS SOFTWARE

**3D RenderLib for Windows**  
3D Graphics Dynamic link library  
— More than 300 functions callable from MSC and BC++  
— Wireframe, Flat, Prong and Gouraud shading — Renders in any window or creates own windows — Unlimited number of colored Point, Direction and Spot lights — Clipping planes and Double-buffering — Hierarchical object oriented data storage — 350 pages long manual!

**\$450.00** (\$1450.00 royalty free distribution)  
**3rd Floor Graphics Software**  
P.O. Box 4105, 9701 EC Groningen, The Netherlands  
fax: (+31) (0)50 184190

Inquiry 732.

## HARDWARE

**Pre-Owned Electronics, Inc<sup>TM</sup>**  
THE Independent Provider, serving the Dealer, Professional, Corporate, Government, and Educational Buyer since 1985

**APPLE II<sup>®</sup> & MACINTOSH<sup>®</sup> 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 733.

## HEWLETT PACKARD

Buy — Sell — Trade

|                        |             |
|------------------------|-------------|
| LaserJet               | ColorPro    |
| DeskJet                | DraftPro    |
| RuggedWriter           | DraftMaster |
| Electrostatic Plotters |             |
| • Monochrome and Color |             |

HP 9000 Workstations and Vectras also available.  
**T. E. Dasher & Associates**  
4117 Second Ave., S. Birmingham, AL 35222  
Phone: (205) 591-4747 Fax: (205) 591-1108  
(602) 638-4833

Inquiry 734.

## HARDWARE/COMPUTERS

**SC/FOX<sup>™</sup> 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<sup>™</sup>  
VME Master/Slave System Controller SBC: 18 MIPS avg 70 MIPS burst, uses RTX 2000 cpu, SCSI, 2 ser, 1 ptr ports, to 640K bytes.  
Stand-Alone Single Board Computers: 18 MIPS avg 60 MIPS burst, 3U or 100x100mm Eurocard-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 735.

## INDUSTRIAL COMPUTING

**Complete RealTime Operating System**  
For your 386/486 PC only  
**\$995!**

- POSIX Compliant
- Full Networking
- X Windows
- Realtime Tasks
- Development Tools
- Source Available

**RTMX-UniFLEX** Call: 1-919-493-1451  
800 Eastowne Dr., Ste 111 • Chapel Hill, NC 27514

Inquiry 736.

## LANs

**LANLINK PROFESSIONAL • PC-MOS**

- Use ethernet and/or serial/parallel ports for LAN connections
- Connect DOS, Windows & PC-MOS clients & servers
- Share one PC up to 33 users with PC-MOS multuser DOS
- LAN as low as \$99 per node, PC-MOS as low as \$33 per user

**THE SOFTWARE LINK**  
3577 Parkway Lane, Norcross, GA 30092  
**1-800-766-LINK • (404) 448-5465**

Inquiry 737.

## LANS

### The \$25 Network Try the 1st truly low-cost LAN

- Connect 2 or 3 XT's, AT's, 386's, 486's
- Uses serial ports and null modem cable
- Runs at 115K baud - approx 8500 bytes/sec
- Runs in background, totally transparent
- Share disks and printers, etc.
- Needs only 15K of RAM

### Little Big LAN

The most flexible network

- Peer to Peer LAN to 250 nodes
- \$75 total software cost, not per node!
- Link via serial, parallel, or Arcnet
- Link via Ethernet or Modems soon
- Mixed mode routing
- Typically only 35K of RAM

Skeptical? We make believers!

### Information Modes

P.O. Drawer F, Denton, TX 75202

Tech 817-387-3339 Orders 800-628-7992  
Hours 1-5 Mon/Wed, 9-5 Tue/Thu/Fri CST

Inquiry 738.

## LAPTOP COMPUTERS

### USED COMPUTERS

#### MAJOR BRANDS - WIDE SELECTION IBM - COMPAQ & OTHERS

Computers from \$99 Color Printers \$199  
Mono Monitors from \$25 CGA Color Monitors \$129  
IBM 5140 LAPTOP \$349

IBM PCjr & CONVERTIBLE PARTS & ACCESSORIES  
HARD-TO-FIND ITEMS FOR OLDER PCs

### FREE CATALOG COMPUTER RESET

P.O. Box 461782, Garland, TX 75046

Phone (214) 276-8072 & FAX BBS (214) 272-7920

Inquiry 739.

## LAPTOP PERIPHERALS

### LAPTOP PERIPHERALS

NEW LOW PRICES ON:

- Battery Powered Printers
- Portable Hard Drives
- Laptop Expansion Systems
- Backlites AND MORE!

Call for free catalog

**AXONIX CORPORATION**  
(800) 866-9797

Inquiry 740.

### Auto Adapters

- 12V battery systems
- Small package with high efficiency
- Plugs between computer and lighter receptacle
- \$99 to \$129

In stock for Apple PowerBook (10-30V Input), Canon BJ printer, Commodore, Everex Tempo LX, IBM, Kodak Diconix printer, Sanyo, Sharp, Toshiba, Zeos

Custom adapters designed for OEM's. Serial interface cards for Toshiba and Sanyo.

**EMPIRE ENGINEERING**  
California USA

tel 805/543-2816 fax 805/543-2820

Inquiry 741.

## LOCALIZATION

### Software Developers! Localization Managers!

Now you can manage software translation more efficiently and simply, with IDOC's new XL8™ software. Call for a demo disk today.

**IDOC**, an International Documentation Company  
1-800-336-9898, ext. XL8

Inquiry 742.

## PROGRAMMERS TOOLS

**INCORPORATE SOUND BLASTER & ADLIB INTO YOUR SOFTWARE**  
The WORX programmers toolkit will allow you to easily incorporate sound and music into your software without having to struggle with low level code and compatibility problems. Plays back standard MIDI files and VOC sample files fully in the background. This toolkit is a linkable library which takes less than 32K of code, and requires no driver or TSR. Autodetects Sound Blaster configuration. No royalties, and updates are always free. WORX 1.6 for Turbo C, Pascal and Microsoft C. \$49 Resource manager for WORX (C only): \$29

### MYSTIC SOFTWARE

1504 Encinal Avenue, Ste D, Alameda, CA 94501  
Voice: (510) 865-9189 Demos/BBS: (510) 865-3856

Inquiry 743.

### Boost Your BASIC with ProBas!

- ProBas5 adds 938 new commands to QB/PDS
- Written in assembly for speed
- Gives your programs a professional look
- Easy to use, money back guarantee, \$195
- Other add-ons for BASIC, C & Visual Basic avail.

FREE DEMO Disk AND BOOKLET

**TeraTech** (800) 447-9120 x1030

Dept 1030, 100 Park Ave., Suite 360, Rockville, MD 20850

Int'l +1(301) 424-3903 Fax (301) 762-8185 BBS (301) 762-8184

Inquiry 744.

### Structograms

Software Documentation made quick and easy with PANORAMA

- Structograms (Nassi-Shneidermann) automatically from the source code in a flash
- Hierarchie-trees of modules, procedures
- Headers of modules, procedures
- Software-Metrics: McCabe complexity, LOC and more Available for: Turbo Pascal, C, Modula-2, Fortran-77, PL/M, dBase PANORAMA Standard (Pascal, C, Modula-2): \$495 PANORAMA Lite: \$295

### Wuest Informatik AG

Schuetzenstrasse 111, CH-8245 Fuertalen, Switzerland  
Int'l (+41 53) 29 31 32 FAX: (+41 53) 29 31 43  
Call or Fax for Information and free demo.

Inquiry 745.

## PROJECT BILLING

### CLIENT PROJECT

A Time and Billing System that accounts for charges to over 100,000 projects (or matters). Regular price \$299, current price with limited time discount \$159, demo available.

### MICRO BILLING SYSTEMS, INC.

117 W. Harrison, Ste# 624M, Chicago IL 60605

Tel: (312) 939-1869 Fax: (312) 939-1351

Inquiry 746.

## SECURITY

### FIGHT PIRACY!

★ EVERLOCK 3.0 ★

### SOFTWARE COPY PROTECTION

New Option Board Safe-New Remote Registration

New CPU LOCK-CD ROM LOCK and more

★ EVERKEY HARDWARE LOCKS ★

### Az-Tech Software, Inc.

Call for a 201 East Franklin, Richmond, MO 64085

FREE (816) 776-2700

Demo (800) 227-0644 FAX (816) 776-8398

Inquiry 747.

### THE ULTIMATE SOFTWARE SECURITY

- STOPCOPY family - UNCOPIABLE copy protection
- STOPVIEW software encryption
- NETLIMIT network license metering
- DOS, Windows, Macintosh, OS/2, support
- No source code changes required - for ANY of our products in ANY environment
- Our products destroy ALL of our competition
- Call for FREE demo disk, or to discuss our products' MANY options

### BBI Computer Systems, Inc.

14105 Hentage Lane, Silver Spring, MD 20906

800/TRY-ABBI • 800/879-2224 • 301/871-1094 • FAX: 301/460-7545

Inquiry 748.

## SECURITY

### Cop's CopyLock II

The professional software protection with TRUE Machine Install. Option Board safe. OS/2, Networks, Windows, and Trace 1020.

### LINK Computer

Int'l: + 45 31232350 Fax: + 45 31238448

US/CAN: 800-344-2545 FAX: 408-923-7061

### KEY-LOK™ SECURITY

Piracy survival over 10 years proves effectiveness of powerful multilayered security. Algorithmic response. Programmable memory. Very economical. Device transparent to PARALLEL/SERIAL port, Counters/Real-Time-Clock, Multi-product/feature licensing. DOS/UNIX/VMS/etc. Also, access control system and diskette drive locks.

### MICROCOMPUTER APPLICATIONS

3167 E. Otero Circle, Littleton, CO 80122

(303) 770-1917

Inquiry 749.

## SHAREWARE

### NEW NEW NEW

### Rocket "93" HQ CD ROM

600 megs of High Q. Shareware \$39.95+ Latest Shareware on floppies \$1.98 ea.+

Lowest Prices - Highest Quality  
Catalog Available

### ROCKET SHAREWARE

1-612-934-4775

Inquiry 750.

### FREE SOFTWARE FOR IBM/CLONES

Try us! Get 5/2.5" or 3/3.5" disks full of the latest software - FREE! Choose from General Interest, Games, Windows, Kid's, Clip Art or Fonts. Pay only a small service charge of \$2.95 per package. Credit Cards only. CALL TODAY!

### SOFTWARE OF THE MONTH CLUB

(619) 931-8111, EXT. 511

Inquiry 751.

## SOFTWARE/ACCOUNTING

### dBASE BUSINESS TOOLS

- GENERAL LEDGER
- ORDER ENTRY
- JOB COSTING
- BILL OF MATLS
- PAYROLL
- PURCH ORD/INVENTORY
- ACCOUNTS RECEIVABLE
- JOB ESTIMATING
- SALES ANALYSIS
- ACCOUNTS PAYABLE

\$99/\$198 ea. + S&H

### dATAMAR SYSTEMS Cred. Card-Check-COD

6969-D Corte Santa Fe, San Diego, CA 92121

(619) 452-0044 (800) 223-9963

Inquiry 752.

## 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.

PCs from \$395 LAN version available

FREE 30 day trial

Computer Keyes Tel: 206/776/6443

21929 Makah Rd., Fax: 206/776-7210

Woodway, WA 98020 USA: 800/356-0203

# THE BUYER'S MART

## SOFTWARE/DATA ANALYSIS

### ADVANCED DATA ANALYSIS... at a click!

CLICK-X™ software, the most user friendly data analysis - ever! • Edit Graph/Data • Analyze • Advanced Math / Regression / Engineering / Statistics • Import/Export. FREE demo disk. Custom software available.

#### SoloSoft

P.O. Box 2548, Stamford, CT 06906-0548  
Phone: (203) 977-8161 Fax: (203) 977-8237

Inquiry 753.

## SOFTWARE/DATA GRAPHICS

### OPTICAL GRAPH RECOGNITION (OGR) SOFTWARE

SCAN-X™ software imports, converts and manipulates data from scanned plots, pictures, graphs on paper, or captured screens into data files for comparing/analyzing/plotting/exporting. FREE demo disk. Service available.

#### SoloSoft

P.O. Box 2548, Stamford, CT 06906-0548  
Phone: (203) 977-8161 Fax: (203) 977-8237

Inquiry 754.

## SOFTWARE/ENGINEERING

### Mixed Mode Simulation

- NEW IsSpice 3 with Analog/Digital simulation
- Draws waveforms as the simulation runs
- PC and Macintosh Versions
- Filter Design
- Schematic Entry
- Extensive Model Libraries
- Waveform Analysis
- Full SPICE programs starting at \$95. Complete systems from \$990.

Call for your Free Demo and Information kit.

P.O. Box 710, San Pedro, CA 90733-0710  
310-833-0710, FAX: 310-833-9658

**intusoft**

Inquiry 755.

### SAUNA: 3D THERMAL ANALYSIS

• Models: PCBs, plates, heatsinks, enclosures, multiboard enclosures • All heat transfer modes: convection, radiation, conduction • Interactive menu-driven • Thermal parameters library • Fast "what if": dimension, mat'l, finish, analyses • Easy to learn & use • IBM PC & Macintosh II

Call for free evaluation program

#### Tatum Labs, Inc.

1287 N. Silo Ridge Drive, Ann Arbor, MI 48108  
313-663-8810

Inquiry 756.

## SOFTWARE/GRAPHICS

### TIFF, PCX, TARGA, GIF, DIB, BMP, DCX, EPS, WMF, WPG, PICT, JPEG AccuSoft Image Format Library 3.0

"The most comprehensive raster support library on the market!" Import, export, convert, display, and print all above formats! DOS & Windows versions included in one package. No royalties. Includes several sample programs with source code. Supports all languages. Format compatibility guaranteed! G3, G4, TIFF-F, multi-page images etc. Rotate, scale, color reduction, sharpen etc. 30 day satisfaction guarantee. \$495

#### AccuSoft Corporation

160 E. Main St., P.O. Box 1261, Westboro, MA 01581  
(800) 525-3577 (508) 898-2770 FAX (508) 898-9662

Inquiry 757.

### Develop CAD/CAM, GIS, A/E/C Products ON TIME and UNDER BUDGET with the "CAD/CAM Developer's Kit" Series

The CCDKs are libraries of C functions which support routines for DXF input/output, graphical display, line/arc/ellipse/NURB spline construction/editing, and much more than can be described here.

#### Building Block Software, Inc.

371 Moody Street, Waltham, MA 02154  
Voice (617) 899-4350 Fax (617) 899-4399

## SOFTWARE/GRAPHICS

### "The Ultimate CAD/CAM/CAE Programming Engine"

Slash your development time, with your CAD programming companion. TG-Professional v.4.0, the most complete C/C++ toolbox of 2D & 3D geometric routines available today! Over 800 routines including NURBS DXF, Graphics, Surfacing, Hidden Line, Transforms, Perspectives, Polygon (In/Union/Diff), Clipping, Tangents and more. Routines for drawing using BGI or MSC Graphics. Full source & 30 day guarantee. USA \$500.00. Use MSC, Borland C/C++, WATCOM C/86 or Metaware High C/C++. Call 1-800-635-7760 or Fax/Phone 214-423-7288 for free 30 page technical paper.

#### Disk Software Inc.

109 S. Murphy Rd., Plano, TX USA 75094

Inquiry 758.

## SOFTWARE/GUI

### GUI TOOLKIT ONLY \$249

Full source code included

TEGL Windows Toolkit lets you create DOS based GUI apps that are completely standalone. Over 500 functions. Menus, mouse & keyboard support, dialogues, and more. Includes TEGL graphics interface which has drivers for most popular video modes. Supports most C and Pascal compilers. Protected mode version is only \$499. No royalties.

#### TEGL Systems Corporation

P.O. Box 580, Stn. A, Vancouver B.C. V6C 2N2  
(604) 669-2577 FAX (604) 688-9530

Inquiry 759.

## SOFTWARE/MATHEMATICS

### OPERATIONS RESEARCH @ \$149 for your IBM or Compatible

LP88-Linear Programs up to 3000 by 15000  
BLP88-Linear Programs with Bounded Variables.  
MILP88-Mixed-Integer Linear Programs.  
MLP88-Large Model Mixed-Integer LP.  
TS88-Transportation/Transshipment Problems.  
NLP88-Nonlinear Objective Programs.  
Student/Demo-Reduced capacity versions for students.  
Turbo Pascal Units-Object modules for developers.

#### Eastern Software Products, Inc.

P.O. Box 15328, Alexandria, VA 22309  
(703) 360-7600, Fax (703) 360-7654

Inquiry 760.

## SOFTWARE/PACKAGING

### FREE SOFTWARE PACKAGING CATALOG

Everything you will need to Package, Distribute, and Ship Your Software! From manuals and binders to mailers and shippers

#### LABELS • LABELS • LABELS

For your diskettes, plain or custom printed dot matrix or laser printer... free samples

#### •••FREE CATALOG•••

#### Hice & Associates

8586 Monticello Dr., West Chester, OH 45069  
Phone/Fax: 513-777-8586

Inquiry 761.

### STOCK PACKAGING

to help you  
market your software  
ask for catalog 92 S

Call 708 390-7744

or fax 708 390-9886

#### PolyQuick Co.

1243 Rand Road, Des Plaines, IL 60016

Inquiry 762.

## SOFTWARE/SCIENTIFIC

### COOK EXCEL SPREADSHEETS

XSolver optimizes spreadsheet models using simulated annealing. It can find the best solutions to "what if" problems with multiple solutions. Requires Windows 3.x and Microsoft Excel 4.0 for Windows. Only \$150.

#### Exatech Software

6547 N. Academy Blvd., Suite 527, Colorado Springs, CO 80907  
(719) 599-8727

Inquiry 763.

## SOFTWARE/SCIENTIFIC

### Volume Visualization

VoxelBox is a volume renderer for Windows. Volume rendering is the most direct method of visualizing 3D data. VoxelBox is fast, powerful and easy to use. It features raytracing, color/alpha mapping, lighting, keyframe animation support and much more. Price \$495

#### Jaguar Software, Inc.

573 Main St., Suite 9B, Winchester, MA 01890  
(617) 729-3659

Inquiry 764.

### NEW! MathViews™ for Windows

MATLAB compatible interpreter for Windows

- Matrix and Array Algebra
- Complex Numbers and Signal Processing
- 2D and 3D Graphics with Clipboard Support
- Written in C++ / Available for OEM
- Affordable at \$295.00

#### The MathWizards

(619) 457-2971 FAX (619) 458-5849

Trademarks are the properties of their respective owners.

Inquiry 765.

### VT<sub>E</sub>X 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.

Call now for a FREE DEMO DISK

#### MicroPress, Inc.

68-30 Harrow Street, Forest Hills, NY  
Tel (718) 575-1816 Fax (718) 575-8038

Inquiry 766.

## 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:

# 1-801-943-0290

MicroMath, Salt Lake City, UT 84121-0550

Inquiry 767.

## 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, Windows \$149. OS/2, XENIX, UNIX \$249.

(702) 588-3737

#### Opt-Tech Data Processing

P.O. Box 678 - Zephyr Cove, NV 89448

Inquiry 768.

## SOFTWARE/VOICE/FA

### 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

## STATISTICS

### The AIM Estimator™ Outperforms Neural Nets & Regression!

AIM combines the best of neural nets & regression to automatically learn polynomial networks that ESTIMATE or PREDICT any numeric value, such as: prices, probabilities, fuzzy values, inventories, sensor readings, control settings, and costs. ANYONE can learn AIM within 30 minutes and quickly achieve more accurate results.

**Order \$20 Demo Package Today!**  
**AbTech Corporation**

508 Dale Ave. Tel: 804-977-0686  
Charlottesville, VA 22903 Fax: 804-977-9615

Inquiry 769.

### 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 770.

### PsychStat MAX 2.2 - \$59.95

Frequency • descriptives • chi-square • Fisher's exact test • ttests • multiple regression • weighted & unweighted ANOVAs • correlation • repeated measures • intraclass corr • ANCOVA • right-wrong & Likert Item analysis • Cronbach's Alpha • point-biserial • corrected item-total • coprocessor support • ASCII • 25500 variables • satisfaction or money back.

### PsychStat

1003 Justin Lane 2118

Austin, TX 78757 512-451-8152

Inquiry 771.

## UTILITIES

### PEN PLOTTER EMULATOR

FPLOT turns your printer into an HP pen plotter. Fast hi-res, no jagged lines. Vary line width, color. Screen preview - zoom, pan. Works with most CAD programs. Supports most printers. Requires DOS 2.1 or higher. \$119+\$3 S&H. VISA/MC/Chk/MO.

### FPLOT Corporation

24-16 Steinway St., Suite 605, Astoria, NY 11103

718-545-3505

Inquiry 772.

## VOICEMAIL/FAX

### FAX-ON-DEMAND

Voice Mail System/Applications Generator  
**\$595** List price for complete Hardware/Software V-Mail and F.O.D. solution. Dealer Inquiries welcomed.

Voice/Fax/Modem card. Windows 3.1 application. Background operation. Intuitive GUI. Multi-level tree structure configured and displayed on screen. Configure for Auto-Attendant/Message Center. F.O.D/Information Center, message forwarding/paging, fax-scanner, voice/fax auto-detection, and much more. Call our F.O.D. line to receive more information instantly by fax.

Edens Technology Corp.

309 W. Beaufort, Suite 8, Normal IL 61761

TEL (309) 862-1704 FAX/F.O.D. Demo (309) 862-1804

Inquiry 773.

## WINDOWS

### HyperPhoto db - A HyperImage/document management system under MS-Windows™ 3.x

Displays multiple windows of images and documents in true color or with color matching. Associates text info, images or symbols to any pixel inside an image. Easily switches from image to image through successive levels of detail. Finds a point inside an image by entering its name e.g. address. Organize images and files in a network/relational database. Users can design their own information templates and search with multiple keys. Include a powerful editor. File security & Treeresearch. Link to clipboard. Pan and zoom within images. Work with PCX, BMP, TIF, GIF, Postscript file Formats. Network Vers. Avail. **Introductory offer - \$185.**

**Friendly Information Systems, Inc.**

34 Bow Avenue, Dedham, MA 02026  
(508) 486-0003 or (617) 329-1620

Inquiry 774.

# BYTE BACK ISSUES FOR SALE

1989 1990 1991 1992 1993

January

February

March

April

May

June

July

August

September

October

November

December

Special

Issues

Issues Available

|                | 1989 | 1990 | 1991        | 1992        | 1993 |
|----------------|------|------|-------------|-------------|------|
| January        |      |      |             |             |      |
| February       |      |      |             |             |      |
| March          |      |      |             |             |      |
| April          |      |      |             |             |      |
| May            |      |      |             |             |      |
| June           |      |      |             |             |      |
| July           |      |      |             |             |      |
| August         |      |      |             |             |      |
| September      |      |      |             |             |      |
| October        |      |      |             |             |      |
| November       |      |      |             |             |      |
| December       |      |      |             |             |      |
| Special Issues |      |      |             |             |      |
|                | IBM  | IBM  | Outlook '92 | Windows     |      |
|                |      |      |             | Portability |      |

**Windows - Portability** U.S. Delivery \$3.00, Foreign Delivery \$4.00

**1988 thru 1989** U.S. Delivery \$3.00, Foreign Delivery \$4.00

**1990 thru 1992** U.S. Delivery \$6.00, Foreign Delivery \$8.00, Canada & Mexico \$6.50

European customers please refer to Back Issue 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, N.H. 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 delivery.

# YOUR DIRECT LINK

## ADVERTISER CONTACT INFORMATION

To order products or request FREE information, call advertisers directly or send in the Direct Link Card by mail or fax! Let them know you saw it in **BYTE!**

| Inquiry No. | Page No.                          | Phone No. | Inquiry No.            | Page No. | Phone No.                     | Inquiry No. | Page No.              | Phone No. |                                 |                                |                        |                  |
|-------------|-----------------------------------|-----------|------------------------|----------|-------------------------------|-------------|-----------------------|-----------|---------------------------------|--------------------------------|------------------------|------------------|
| <b>A</b>    |                                   |           |                        |          |                               |             |                       |           |                                 |                                |                        |                  |
| 61-62       | ABACUS SOFTWARE                   | 95        | 800-451-4319           | 195-196  | DISTRIBUTED PROCESSING TECH   | 218         | 407-830-5522          | 100-101   | LOGITECH INC                    | 167                            | 800-231-7717           |                  |
| 188-189     | ABC COMPUTER                      | 226       | 310-325-6369           | 418      | DR HUGGLE & PARTNER GMBH      | 180IS-1     | +49-241-403117**      | <b>M</b>  |                                 |                                |                        |                  |
| 401-402     | ACER INCORPORATED                 | 88IS-2-3  | +886-3-489-3188        | 185      | DSP DESIGNS INT'L / NASCOM    | 130         | 508-975-4392          | 463       | MAGIC / MSE                     | 164IS-1                        | +972-3-751-1901**      |                  |
| 376-377     | ACI / ACQUIRE                     | 235       | +886-2-760-2154**      | 339      | DSP DEVELOPMENT CORP          | 242         | 800-777-5151          | 459       | MANNESMANN TALLY                | 128IS-3                        | +44-0628-527782**      |                  |
| 190-191     | ADVANCED COMPUTER PROD            | 225       | 714-558-8813           | <b>E</b> |                               |             |                       | 103       | MATHSOFT INC                    | 171                            | 800-628-4223           |                  |
| 65          | ADVANCED MICRO DEVICES            | 14-15     | 800-222-9323           | 444      | ECG                           | 128IS-2     | +31-4937-96808**      | 104-105   | MAYNARD, AN ARCHIVE CO          | 159                            | 800-755-0535           |                  |
| 63          | ALADDIN KNOWLEDGE SYS             | 86        | 800-223-4277           | 419      | ELIASHIM MICROCOMP            | 208IS-9     | +972-4-528613**       | *         | MCGRW HILL NRI (N.A.)           | 164A-B                         |                        |                  |
| 403         | ALADDIN KNOWLEDGE SYS             | 208IS-2   | 800-223-4277           | *        | ELONEX                        | 72IS-2-3    | +44-81-452-6422**     | 106       | MEDIA CYBERNETICS               | 190                            | 800-992-HALO           |                  |
| 175-176     | ALLMICRO                          | 93        | 800-653-4933           | 382      | ELSIST                        | 240         | +39-142-451988**      | 429       | MEGADATA                        | 180IS-1                        | 516-589-6858**         |                  |
| 66          | AMERICAN POWER CONV               | 135       | 800-800-4APC Dept. A2  | 225-226  | EMBARC / MOTOROLA (N.A.)      | 121         | 800-EMBARC4 ext. 350  | 372       | MEMORY SUPERSTORE               | 239                            | 800-800-7056           |                  |
| 67          | AMERICAN SMALL BUSI COMP          | 131       | 918-825-4844           | 379      | EMPIRE COMPUTECH              | 239         | 800-446-1967          | 430       | MICRO DESIGN INT'L              | 72IS-4                         | 407-677-8333           |                  |
| 571         | APPRO INT'L INC                   | 224MW-4   | 408-732-6091           | 420      | EUTRON                        | 120IS-4     | +39-35-692-229**      | 108-109   | MICRO SOLUTIONS COMP PROD       | 77                             | 815-756-3411           |                  |
| 566         | APPRO INT'L INC                   | 224SO-3   | 408-732-6091           | 554      | EVOLUTION COMPUTING           | 224NE-1     | 800-874-4028          | 387-388   | MICROBIZ                        | 241                            | 800-637-8268           |                  |
| 330-331     | AXIOMATIC                         | 238       | 416-602-9270           | 561      | EVOLUTION COMPUTING           | 224PC-2     | 800-874-4028          | 344       | MICROFIELD GRAPHICS, INC        | 235                            | 503-626-9393           |                  |
| 184         | AXIS COMMUNICATIONS               | 255       | +46-46136130**         | <b>F</b> |                               |             |                       | 207-208   | MICRO-INTERNATIONAL, INC        | 222                            | 800-967-5667           |                  |
| <b>B</b>    |                                   |           |                        |          |                               |             |                       |           | 107                             | MICROPOLIS CORP                | 99                     | 800-395-3748     |
| 332         | BINARY TECHNOLOGY INC             | 242       | 508-369-9556           | 421      | FAST ELECTRONIC GMBH          | 188IS-3     | +49-89-533-401**      | 200       | MICROPROSE SOFTWARE             | 227                            | 800-879-PLAY           |                  |
| 68-69       | BITWISE DESIGNS INC               | 192       | 800-367-5906           | 441-442  | FIRST INT'L COMPUTER          | 196IS-5     | +886-2-717-4500**     | 201       | MICROPROSE SOFTWARE             | 229                            | 800-879-PLAY           |                  |
| 450         | BIX                               | 180       | 617-491-3342           | 197-198  | FIRST SOURCE INT'L            | 230         | 714-588-9866          | *         | MICROSOFT CORP                  | 17                             | 800-426-9400           |                  |
| 171-172     | BLINK INC                         | 109       | 804-355-4444           | 422-423  | FUTURESOFT ENGINEERING        | 128IS-4     | 713-496-9400          | 354       | MICROSTAR LABORATORIES          | 237                            | 206-453-2345           |                  |
| 465-466     | BOCA RESEARCH INC (INT'L)         | CIH       | 407-997-6227           | <b>G</b> |                               |             |                       | 567-568   | MICROTECH COMPUTER              | 224SO-5                        | 800-342-6508           |                  |
| 70-71       | BORLAND INT'L                     | 13        | 800-336-6464 ext. 5202 | *        | GATEWAY 2000                  | CI, 1       | 800-846-2000          | *         | MICROWAY                        | 186                            | 508-746-7341           |                  |
| *           | BYTE SUB MESSAGE                  | 182       |                        | *        | GATEWAY 2000                  | 62-63       | 800-846-2000          | 440       | MICROWAY                        | 211                            | 508-746-7341           |                  |
| 404         | B&C MICROSYSTEMS                  | 128IS-4   | 408-730-5511           | 386      | GENERAL TECHNICS              | 237         | 800-487-2538          | 458       | MINICOM LTD                     | 208IS-10                       | +972-2-637576**        |                  |
| <b>C</b>    |                                   |           |                        |          |                               |             |                       |           | 450                             | MINISTRY OF INDUSTRY AND TRADE | 208IS-6                | +972-2-669-388** |
| 405         | CATHAY COMPUTER & TECHNOLOGY      | 196IS-12  | +886-2-506-8929**      | 84-85    | GENOA SYSTEMS                 | 125         | 408-432-9090          | 431       | MINOLTA GMBH                    | 72IS-1                         | +49-511-779089**       |                  |
| 406         | CHERRY MIKROSCHALTER GMBH (INT'L) | 178-179   | +49-964-318-262**      | 340      | GENOVATION, INC               | 238         | 800-822-4333          | 121       | MINUTEMAN                       | 75                             | 214-446-7363           |                  |
| 460-461     | CHICONY                           | 196IS-3   | +886-3-323-5743**      | 424      | GFK HAMBURG                   | 188IS-1     | +49-40-231-789**      | 385       | MITAC                           | 237                            | +886-2-509-0979**      |                  |
| 206         | CITITRONICS                       | 228       | 818-855-5688           | 86-87    | GLENCO ENGINEERING            | 141         | 800-562-2543          | 112       | MKS / MORTICE KERN SYS          | 193                            | 519-884-2251           |                  |
| 73-74       | COLORADO MEMORY SYS               | 43        | 800-346-9881           | 345      | GMM RESEARCH CORP             | 236         | 714-752-9447          | 437-438   | MOTOROLA UDS                    | 180IS-4                        | +33-1-4117-4130**      |                  |
| 75          | COMMODORE                         | 21        | 800-66-AMIGA           | 421      | GREY MATTER LTD               | 188IS-4     | +44-0364-53071**      | 452-453   | MOTXA                           | 196IS-11                       | +886-2-910-1231**      |                  |
| 407-408     | COMPEX INC                        | 120IS-3   | 714-630-7302           | 342      | GTEK INC                      | 236         | 800-282-4835          | 463       | MULTIVENTURE                    | 196IS-7                        | +886-2-703-1380**      |                  |
| 77          | COMPUTER ASSOCIATES               | 38-39     | 800-CALL-CAI           | 343      | GTEK INC                      | 240         | 800-282-4835          | 112       | MYLEX CORP                      | 18-19                          | 510-796-6100           |                  |
| 76          | COMPUTER ASSOCIATES               | 122       | 800-CALL-CAI           | <b>H</b> |                               |             |                       | 215-216   | NAGA SYSTEMS CORP               | 232                            | 800-568-6242           |                  |
| 78          | COMPUTER FRIENDS                  | 54        | 800-547-3303           | 88       | HAUPPAUGE COMP WORKS          | 115         | 800-443-6284          | 114-115   | NANAO USA CORP (N.A.)           | 89                             | 310-325-5202           |                  |
| 333         | COMPUTER MODULES                  | 235       | 408-496-1881           | 426      | HONEYWELL KEYBOARD DIV        | 180IS-3     | 800-445-6939          | 116       | NATIONAL INSTRUMENTS            | 9                              | 800-433-3488           |                  |
| 410         | COMPUTER QUICK                    | 120IS-4   | 415-861-8330           | 89       | HUMMINGBIRD COMMUNICATIONS    | 205         | 416-470-1207          | 355       | NATIONAL INSTRUMENTS            | 242                            | 800-433-3488           |                  |
| 334         | COMPUTER SYS ARCHITECT            | 235       | 800-753-4CSA           | <b>I</b> |                               |             |                       | *         | NATIONAL INSTRUMENTS            | 128IDRC-2                      | 512-794-0100**         |                  |
| 192         | COMPUTERLANE UNLTD                | 223       | 800-526-3482           | 91       | IBM - THINK PAD               | 10-11       | 800-IBM-2YOU          | 117       | NEC - LAPTOPS                   | 69                             | 800-NEC-INFO           |                  |
| 335         | COMPUTERWISE                      | 242       | 800-255-3739           | 110-111  | IBM - THINK PAD               | 33-36       | 800-IBM-2YOU X213BYTE | 199       | NEVADA COMPUTER                 | 221                            | 800-454-7762           |                  |
| 186-187     | CONSENSYS CORP                    | 104       | 416-940-2903**         | 345-346  | INDUS                         | 241         | 800-843-9377          | 118-119   | NEWGEN SYSTEMS CORP             | 163                            | 714-436-5100           |                  |
| 390         | CONTROL CONCEPTS                  | 235       | 703-876-6444           | 389      | INFINICON                     | 236         | 800-374-3880          | 373       | NOVASTOR CORP                   | 241                            | 602-396-3616           |                  |
| 79          | COREL SOFTWARE                    | 47        | 800-836-SCSI           | 457      | INFOMEDIA                     | 208IS-8     | +972-52 507 490**     | 120       | NSTL                            | 189                            | 215-941-9600           |                  |
| 456         | CPS COMPUTER DISTRIBUTION GMBH    | 164IS-4   | +49-40-656-7969**      | 92       | INTEGRAND RESEARCH            | 210         | 209-651-1203          | <b>O</b>  |                                 |                                |                        |                  |
| 455         | CPS COMPUTER DISTRIBUTION GMBH    | 172IS-4   | +49-40-656-7969**      | 427      | INTEGRIX INC                  | 128IS-4     | 805-375-1055          | 213-214   | OCEAN OFFICE AUTOMATION LTD     | 219                            | +852-305-1800          |                  |
| 170         | CREATIVE LABS INC                 | 27        | 800-998-LABS           | 93       | INTERFACE GROUP               | 66-67       |                       | 467       | OLIVETTI                        | 164IS-2-3                      |                        |                  |
| 80          | CURTIS INC                        | 182       | 612-631-9512           | 347      | IO TECH                       | 240         | 216-439-4091          | 443       | ON TIME MKT / KARSTEN PETERSEN  | 172IS-4                        | +49-40-435-196**       |                  |
| 454         | CYBERDYNE SYSTEMS / COMPUTERS UK  | 188IS-2   | +49-6174-24749**       | 94       | IOMEGA                        | 22-23       | 800-777-4045          | 356       | OVERLAND DATA INC               | 241                            | 800-729-8725           |                  |
| 193-194     | CYBEX CORP                        | 224       | 205-534-0010**         | 348-349  | ISLAND SYSTEMS                | 243         | 617-273-0421          | 432       | OXFORD ELECTRONIC PUBLISHING    | 88IS-1                         | +44-865-56646**        |                  |
| 411-412     | CYBEX CORP (INT'L)                | CIV       | 205-534-0010**         | 445      | ITALIAN S/W AGENCY            | 120IS-2     | +39-323-925208**      | <b>P</b>  |                                 |                                |                        |                  |
| <b>D</b>    |                                   |           |                        |          |                               |             |                       |           | *                               | PACIFIC DATA PRODUCTS          | 153                    | 619-625-3593     |
| 183         | DALLAS SEMICONDUCTOR              | 106       | 800-258-5061           | 220-221  | ITERATED SYSTEMS              | 196         | 404-840-0633          | 122       | PATTON & PATTON                 | 82                             | 800-525-0082 ext. 112  |                  |
| 81-82       | DATA ACCESS CORP                  | 203       | 800-451-FLEX           | 378      | IVERSON SOFTWARE, INC         | 243         | 416-925-6096          | 123-124   | PC POWER & COOLING              | 49                             | 800-722-6555           |                  |
| 337         | DATALUX CORP (INT'L)              | 238       | +44-306-876718         | <b>J</b> |                               |             |                       | 125-126   | PERCEPTIVE SOLUTIONS            | 150                            | 800-486-3278           |                  |
| 336         | DATALUX CORP (INT'L)              | 239       | +44-306-876718         | 95       | JAMECO ELECTRONICS            | 117         | 800-831-4242          | 127       | PERSOFT INC                     | 204                            | 800-368-5283           |                  |
| 337         | DATALUX CORP (N.A.)               | 238       | 800-DATALUX            | *        | JDR MICRODEVICES              | 233         | 800-538-5000          | 553       | PERSONAL SOLUTION COMP          | 224MW-3                        | 800-685-3981           |                  |
| 336         | DATALUX CORP (N.A.)               | 239       | 800-DATALUX            | *        | JNL OF OBJ ORIENT PROGRAMMING | 128IDRC-2   | 212-274-0640          | 558       | PERSONAL SOLUTION COMP          | 24NE-5                         | 800-685-3981           |                  |
| 413         | DATAMAN LTD                       | 180IS-2   | +44-0300-21012**       | 96       | KEA SYSTEMS LTD               | 76          | 800-663-8702          | 570       | PERSONAL SOLUTION COMP          | 224SO-1                        | 800-685-3981           |                  |
| 414         | DATAPRO INT'L                     | 172IS-1   | +44-0628-773628**      | 353      | KEDWELL SCIENTIFIC            | 172IS-3     | 603-433-4777          | 571       | PERSONAL TEX                    | 242                            | 415-388-8853           |                  |
| 415-416     | DATATRONICS TECH                  | 196IS-11  | +886-2-782-0305**      | 552      | KEITHLEY METRABYTE            | 237         | 508-880-3000          | 128       | PHAR LAP SOFTWARE INC           | 85                             | 617-661-1510           |                  |
| 383-384     | DAVISON-WORTH CORP                | 240       | 800-668-2707           | 557      | KENOSHA COMPUTER CTR          | 224MW-1     | 800-255-2989          | 129-130   | PIRACLE MICRO                   | 6-7                            | 714-727-3300           |                  |
| *           | DELL COMPUTER CORP (N.A.)         | CIH       | 800-626-8260           | 564      | KENOSHA COMPUTER CTR          | 224PC-3     | 800-255-2989          | 371       | PIXEL PERFECT / MEDICAL ADVISOR | 243                            | 800-788-2099           |                  |
| *           | DELL COMPUTER CORP (N.A.)         | CIV       | 800-626-8260           | 569      | KENOSHA COMPUTER CTR          | 224SO-2     | 800-255-2989          | 131       | PKWARE INC                      | 206                            | 414-354-8699           |                  |
| 551         | DEXPO / MILLER FREEMAN, INC       | 224MW-2   | 800-87-DEXPO           | 350      | KILA                          | 237         | 303-444-7737          | 464       | POLYWELL COMPUTERS, INC         | 188IS-2                        | 800-999-1278           |                  |
| 555         | DEXPO / MILLER FREEMAN, INC       | 224NE-3   | 800-87-DEXPO           | <b>L</b> |                               |             |                       | 556       | POLYWELL COMPUTERS, INC         | 224NE-6                        | 800-999-1278           |                  |
| 562         | DEXPO / MILLER FREEMAN, INC       | 224PC-4   | 800-87-DEXPO           | 351      | LABTECH                       | 243         | 800-879-5228          | *         | PROGRAMMER'S PARADISE           | 55                             | 800-445-7899           |                  |
| 565         | DEXPO / MILLER FREEMAN, INC       | 224SO-4   | 800-87-DEXPO           | 352      | LAGUNA DATA SYSTEMS           | 241         | 800-859-8856          | 102       | PROGRAMMER'S PARADISE           | 56-57                          | 800-445-7899           |                  |
| 338         | DIAGSOFT INC                      | 243       | 800-DIAGSOFT           | 97       | LAHEY COMPUTER SYSTEMS        | 133         | 800-548-4778          | *         | PROGRAMMER'S SHOP               | 78-79                          | 800-421-8006           |                  |
| 417         | DIETRICH POS EQUIPMENT            | 172IS-4   | +49-761-5-68-81**      | 148-149  | LANDMARK RESEARCH INT'L CORP  | 103         | 800-683-6696          | *         | PROGRAMMER'S SHOP               | 80                             | 800-421-8006           |                  |
| 83          | DIGITAL VISION                    | 74        | 800-346-0900           | 204      | LODE STAR COMPUTER            | 214-215     | 800-875-7568          | 132-133   | PROGRESS SOFTWARE               | 207                            | 800-4PROGRESS          |                  |
| 391-392     | DISPLAY RESEARCH LAB              | 238       | +852-877-8810**        | 428      | LOGIC PROGRAMMING ASSOCIATES  | 180IS-1     | +44-81-874-0449**     | <b>Q</b>  |                                 |                                |                        |                  |
|             |                                   |           |                        |          |                               | 212         | 800-238-9415          | 98-99     | OMS                             | 139                            | 800-422-2769 ext. 2997 |                  |

# YOUR DIRECT LINK

## ADVERTISER CONTACT INFORMATION

| Inquiry No. | Page No.               | Phone No. | Inquiry No.              | Page No. | Phone No.                   | Inquiry No. | Page No.          | Phone No. |
|-------------|------------------------|-----------|--------------------------|----------|-----------------------------|-------------|-------------------|-----------|
| 134         | QNX / QUANTUM S/W SYS  | 191       | 800-363-9001<br>ext. 101 | 147      | STRATEGIC MAPPING           | 194         | 800-442-8887      |           |
| 136         | QUA TECH INC           | 212       | 800-553-1170             | 174      | SUNSOFT                     | 2-3         | 800-227-9227      |           |
| 358         | QUALSTAR CORP          | 241       | 818-882-5822             | 173      | SUPRA CORP                  | 107         | 800-727-8647      |           |
| 446-447     | QUANTUM CORP (INT'L)   | 198       | +41-38-337722            | 150-151  | SYSTAT INC                  | 81          | 708-864-5670      |           |
| 135         | QUARTERDECK OFFICE SYS | 101       | 310-392-9851             | 433      | SZKI RECOGNITA CORP (INT'L) | 89          | +361-201-7607**   |           |
| <b>R</b>    |                        |           | <b>T</b>                 |          |                             | <b>V</b>    |                   |           |
| 137         | RAIMA CORP             | 65        | 800-327-2462             | 359      | TALKING TECHNOLOGY INC      | 236         | 800-685-4884      |           |
| 138-139     | RAINBOW TECHNOLOGIES   | 61        | 800-852-8569             | 360-361  | TECHNOLOGIC SYSTEMS         | 239         | 513-644-2230      |           |
| 209         | RALIN WHOLESALERS      | 231       | 800-752-9512             | 436      | TECHPOWER COMPANY LTD       | 196IST-8    | +886-2-753-1940** |           |
| 202-203     | RECORTEC INC           | 217       | 800-729-7654             | 152      | TEKTRONIX                   | 53          | 800-835-6100      |           |
| 140         | RETIX INC              | 151       | 800-255-2333             | 153      | TEXAS INSTRUMENTS           | 83          | 800-527-3500      |           |
| 141         | ROSE ELECTRONICS       | 8         | 800-333-9343             | 155      | TEXAS MICROSYSTEMS          | 104A-B      | 800-627-8700      |           |
| <b>S</b>    |                        |           | <b>U</b>                 |          |                             | <b>W</b>    |                   |           |
| 223-224     | SCEPTRE TECHNOLOGIES   | 45        | 800-788-2878             | 559-560  | ULTA COMPUTERS              | 224NE-4     | 800-755-7518      |           |
| 374-375     | SCIENTIFIC PROGRAMMING | 241       | 517-339-9859             | 158      | UNIPALM LTD                 | 154         | +44-0223-426868** |           |
| 142         | SEQUIETER SOFTWARE INC | 119       | 403-437-2410             | *        | UNIXWORLD                   | 148A-B      | 800-257-9402      |           |
| 143         | SIGMA DATA             | 87        | 800-446-4525             | *        | UNIXWORLD                   | 149         | 800-257-9402      |           |
| 380-381     | SIGMA TECH SOFTWARE    | 236       | 818-368-6132             |          |                             |             |                   |           |
| 144         | S'N'W ELECTRONICS      | 54        | 800-874-1235             |          |                             |             |                   |           |
| 434         | SOFTLINE CORP          | 88IS-4    | 718-438-6057             |          |                             |             |                   |           |
| 435         | SOFTWARE SECURITY INC  | 128IS-1   | 203-329-8870             |          |                             |             |                   |           |
| 222         | STARTECH INT'L         | 234       | 619-278-2600             |          |                             |             |                   |           |
| 145         | STATSOFT               | 175       | 918-583-4149             |          |                             |             |                   |           |
| 146         | STORAGE DIMENSIONS     | 147       | 800-344-4323             |          |                             |             |                   |           |
| *           | STRADA AUTOTECH, INC   | 235       |                          |          |                             |             |                   |           |
| 160         | VALITEK INC            | 84        | 800 VALITEK              |          |                             |             |                   |           |
| 177         | VIDEO MAKER / VITEC    | 127       | +33-146-29-03-04**       |          |                             |             |                   |           |
| 365         | VIDEX, INC             | 236       | 503-758-0521             |          |                             |             |                   |           |
| 161-162     | VIEWSONIC              | 31        | 714-869-7976             |          |                             |             |                   |           |
| 563         | VORTEX COMPUTERS       | 224PC-1   | 800-548-7839             |          |                             |             |                   |           |
| <b>X</b>    |                        |           | <b>Z</b>                 |          |                             |             |                   |           |
| 367         | XELTEK                 | 240       | 408-524-1929             |          |                             |             |                   |           |
| 218-219     | XLI CORP               | 160-161   | 617-932-9199             |          |                             |             |                   |           |
| 164-165     | XVT SOFTWARE INC       | 195       | 800-678-7988             |          |                             |             |                   |           |
| 448-449     | ZECKS                  | 196IST-12 | +886-2-280-1351**        |          |                             |             |                   |           |
| *           | ZENITH DATA SYSTEMS    | 72A-H     | 800-523-9393             |          |                             |             |                   |           |
| 169         | ZEOS INTERNATIONAL     | 70-71     | 800-423-5891             |          |                             |             |                   |           |
| 368         | Z-WORLD ENGINEERING    | 240       | 916-757-3737             |          |                             |             |                   |           |
| 178-179     | ZYXEL USA              | 145       | 714-693-0808             |          |                             |             |                   |           |

\* Correspond directly with company.  
\*\* Indicates FAX Number

### BYTE ADVERTISING SALES STAFF

Liz Coyman, Inside Advertising Sales Director, One Phoenix Mill Lane, Peterborough, NH 03458, Tel. (603) 924-2518

#### NEW ENGLAND

ME, NH, VT, MA, RI, CT, ONTARIO  
CANADA & EASTERN CANADA  
(617) 860-6344  
Patricia Payne (603) 924-2654  
McGraw-Hill Publications  
24 Hartwell Avenue  
Lexington, MA 02173  
FAX: (617) 860-6899

#### EAST COAST

NY, NYC, NJ, DE, PA  
Kim Norris (212) 512-2645  
Jonathan Sawyer (603) 924-2665  
McGraw-Hill Publications  
1221 Avenue of Americas—28th Floor  
New York, NY 10020  
FAX: (212) 512-2075

#### SOUTHEAST

NC, SC, GA, FL, AL, TN, MS, AR, LA,  
KY, DC, MD, VA, WV  
MaryAnn Goulding (404) 843-4782  
Barry Echavarría (603) 924-2574  
McGraw-Hill Publications  
4170 Ashford-Dunwoody Rd., Suite 520  
Atlanta, GA 30319  
FAX: (404) 252-4056

#### MIDWEST

IL, MO, KS, IA, ND, SD, MN,  
WI, NE, IN, MI, OH  
Kurt Kelley (312) 616-3328  
Ed Ware (603) 924-2664  
McGraw-Hill Publications  
Two Prudential Plaza  
180 North Stetson Ave.  
Chicago, IL 60601  
FAX: (312) 616-3370

#### SOUTHWEST

ROCKY MOUNTAIN  
CO, OK, TX  
Jennifer Walker (214) 701-8496  
Larry Levine (603) 924-2637  
McGraw-Hill Publications  
14850 Quorum Dr., Suite 380  
Dallas, TX 75240  
FAX: (214) 991-6208

#### SOUTH PACIFIC: Los Angeles, CA

LOS ANGELES COUNTY, AZ, NM,  
Alan El Faye (213) 480-5243  
Larry Levine (603) 924-2637  
McGraw-Hill Publications  
3333 Wilshire Boulevard #407  
Los Angeles, CA 90010  
FAX: (213) 480-5249

#### NORTH PACIFIC

NORTHERN CA, OR, ID, MT, WY, UT  
Roy J. Kops (415) 513-6861  
Joseph Mabe (603) 924-2662  
SILICON VALLEY, HI, WA, AK,  
W. CANADA  
Bill McAfee (415) 513-6862  
Jonathan Sawyer (603) 924-2665  
SILICON VALLEY, NV  
Barbara Holmes (415) 513-6945  
Barry Echavarría (603) 924-2574  
McGraw-Hill Publications  
1900 O'Farrell Street, #200  
San Mateo, CA 94403  
FAX: (415) 513-6867

#### SOUTH PACIFIC: Irvine, CA

ORANGE COUNTY  
SAN DIEGO COUNTY  
Beth Dudas (714) 753-8140  
Joseph Mabe (603) 924-2662  
McGraw-Hill Publications  
15635 Alton Pkwy., Suite 290  
Irvine, CA 92718  
FAX: (714) 753-8147

Peterborough, NH Office: Inside Sales FAX: 603-924-2683 Advertising FAX: 603-924-7507

#### Hardware/Software Showcase

Mark Stone (603) 924-2695  
Ellen Perham (603) 924-2598  
BYTE Publications  
One Phoenix Mill Lane  
Peterborough, NH 03458

#### The Buyer's Mart/Classifieds

Margot Gnade (603) 924-2656  
BYTE Publications  
One Phoenix Mill Lane  
Peterborough, NH 03458

#### BYTE Deck

Brad Dixon (603) 924-2596  
BYTE Publications  
One Phoenix Mill Lane  
Peterborough, NH 03458

#### EURO-OECK

James Bail (603) 924-2533  
BYTE Publications  
One Phoenix Mill Lane  
Peterborough, NH 03458

#### Regional & Buyer's Guide

Brian Higgins (603) 924-2651  
BYTE Publications  
One Phoenix Mill Lane  
Peterborough, NH 03458

#### BYTE International Direct Response Postcards

Ellen Perham (603) 924-2598  
BYTE Publications  
One Phoenix Mill Lane  
Peterborough, NH 03458

### INTERNATIONAL ADVERTISING SALES STAFF

#### GERMANY, SWITZERLAND, AUSTRIA

Jürgen Heise  
McGraw-Hill Publishing Co.  
Liebigstrasse 19  
D-6000 Frankfurt  
Germany  
Tel: +49 69 71407 140  
FAX: +49 69 71407 147

#### SCANDINAVIAN COUNTRIES

Zena Coupé  
A-Z International Sales Ltd.  
70 Chalk Farm Road  
London NW1 8AN  
England  
Tel: +44 71 2843171  
FAX: +44 71 2843174

#### FRANCE, UNITED KINGDOM, BENELUX

Gary Lucas (+44 81 545 6268)  
McGraw-Hill Publishing Co.  
Wimbleton Bndge House  
One Hartfield Road  
Wimbleton, London SW19 3RU  
England  
FAX: +44 81 5456294  
TELEX: 892191

#### ITALY

Zena Coupé, Amanda Blaskett  
A-Z International Sales Ltd.  
70 Chalk Farm Road  
London NW1 8AN  
England  
Tel: +44 71 2843171  
FAX: +44 71 2843174

#### ISRAEL

Dan Ehrlich  
Ehrlich Communication Int'l.  
P.O. Box 99  
Herzliya 46101, Israel  
Tel: +972 52 586245  
Tel: +972 52 586246  
FAX: +972 52 585685

#### AUSTRALIA

Rod Tremain  
Rod Tremain Media  
45 Pymble Ave.  
Pymble 2073, Sydney  
Australia  
Tel: +61 2 9983339  
FAX: +61 2 9983424

#### JAPAN

Masaki Mori  
Transworld Media Inc.  
4th Floor, 1-26-6 Kamme-guro  
Meguro-ku, Tokyo 153, Japan  
Tel: +81 3 57210761  
FAX: +81 3 57210762

#### KOREA

Young-Seoh Chinn  
JES MEDIA INT'L  
5th Floor, Banpo Bldg.  
40-7, Chamwon-Dong, Seocho-Gu  
Seoul 137-030, Korea  
Tel: +82 2 5458001  
Tel: +82 2 5458002  
FAX: +82 2 5498861

#### SINGAPORE

Derek Ng  
Stephen Tay  
Third Wave Publishing Corp.  
1123 Serangoon Road, #03-01  
Singapore 1232  
Tel: +65 296 6166  
FAX: +65 298 7551

#### HONG KONG

Candice Lo  
Third Wave Publishing Corp.  
Unit 2, 6F Hing Wah Center  
82-84 To Kwa Wan Road  
Kowloon, Hong Kong  
Tel: +852 764 3830  
FAX: +852 764 3857

#### MALAYSIA

Senex (Malaysia) Sdn. Bhd.  
H.K. Lin  
5th Floor, Bena Tower  
160, Jalan Ampang  
50450 Kuala Lumpur, Malaysia  
Tel: +60 3 2624592  
FAX: +60 3 2624591

#### THAILAND

Jack Hu  
Sahaviriya OA Group  
28/1 Prapawit Bldg., Surasak Rd.  
Silom, Bangkok 10500  
Thailand  
Tel: +66 2 2360295  
FAX: +66 2 2365960

#### TAIWAN

Liwen Lee  
Third Wave Publishing Corp.  
2nd Fl., No. 19-1, Lane 231  
Fu Hsing North Road  
Taipei 10445, Taiwan  
R.O.C.  
Tel: +886 2 7136959  
FAX: +886 2 7151950

#### INDIA, INDONESIA, PAKISTAN, PHILIPPINES, OTHER ASIAN AND PACIFIC COUNTRIES

K. T. Wu  
Third Wave Publishing Corp.  
2nd Fl., No. 19-1, Lane 231  
Fu Hsing North Road  
Taipei 10445, Taiwan  
R.O.C.  
Tel: +886 2 7136959  
FAX: +886 2 7151950



# YOUR DIRECT LINK

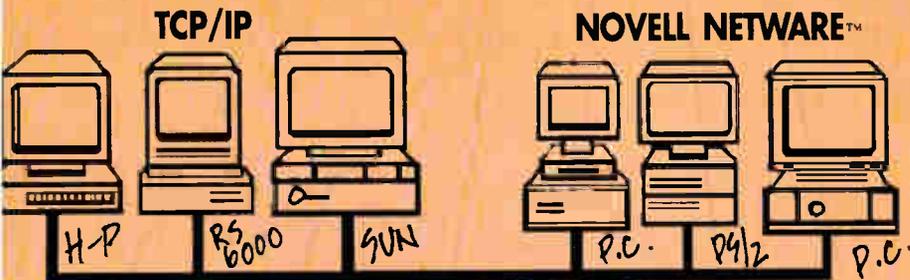
## PRODUCT CATEGORY INDEX

For FREE product information from individual advertisers, circle the corresponding inquiry numbers on your Direct Link Card!  
To receive information for an entire product category, circle the category number on your Direct Link Card!

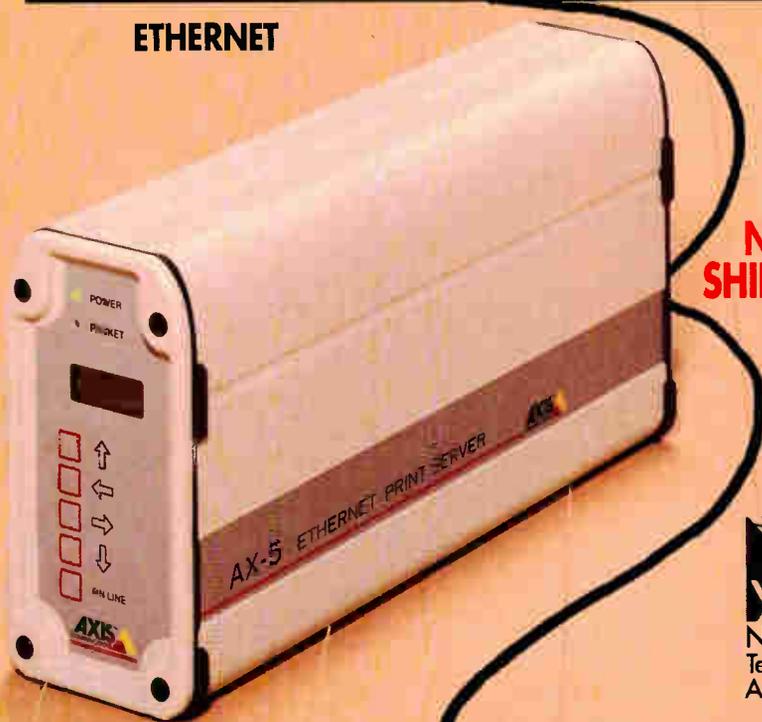
| Category No.<br>Inquiry No. |                                    | Page No.   | Category No.<br>Inquiry No. |                                    | Page No. | Category No.<br>Inquiry No. |                                 | Page No.   |
|-----------------------------|------------------------------------|------------|-----------------------------|------------------------------------|----------|-----------------------------|---------------------------------|------------|
| 382                         | ELISIST                            | 240        | <b>30</b>                   | <b>EDUCATIONAL</b>                 |          | <b>41</b>                   | <b>SECURITY</b>                 |            |
| 421                         | FAST ELECTRONIC GMBH               | 188IS-3    | 61-62                       | ABACUS SOFTWARE                    | 95       | 63                          | ALADDIN KNOWLEDGE SYSTEMS       | 86         |
| 343                         | GTEK INC                           | 240        | 93                          | INTERFACE GROUP                    | 66-67    | 403                         | ALADDIN KNOWLEDGE SYSTEMS       | 208IS-2    |
| 347                         | IO TECH                            | 240        | *                           | MCGRAW HILL NRI (N.A.)             | 164A-B   | 175-176                     | ALLMICRO                        | 93         |
| *                           | JDR MICRODEVICES                   | 233        | <b>31</b>                   | <b>ENGINEERING/SCIENTIFIC</b>      |          | 406                         | CHERRY                          |            |
| 362                         | TRIANGLE DIGITAL SERVICES          | 240        | 175-176                     | ALLMICRO                           | 93       | 454                         | MIKROSCHALTER GMBH (INT'L)      | 178-179    |
| 363-364                     | TRIBAL MICROSYSTEMS                | 240        | 418                         | DR HUGGLE & PARTNER GMBH           | 180IS-1  |                             | CYBERDYNE SYSTEMS /             |            |
| 367                         | XELTEK                             | 240        | 339                         | DSP DEVELOPMENT CORP               | 242      |                             | COMPUTERS UK                    | 188IS-2    |
| 368                         | Z-WORLD ENGINEERING                | 240        | 220-221                     | ITERATED SYSTEMS                   | 196      | 183                         | DALLAS SEMICONDUCTOR            | 106        |
| <b>22</b>                   | <b>SCANNERS/OCR/DIGITIZERS</b>     |            | 148-149                     | LANDMARK RESEARCH INT'L CORP       | 103      | 419                         | ELIASHIM MICROCOMPUTERS         | 208IS-9    |
| 567-568                     | MICROTECH COMPUTER                 | 224SO-5    | 103                         | MATHSOFT INC                       | 171      | 420                         | EUTRON                          | 120IS-4    |
| 433                         | SZKI RECOGNITA CORP (INT'L)        | 89         | 443                         | ON TIME MKT / KARSTEN PETERSEN     | 172IS-4  | 421                         | FAST ELECTRONIC GMBH            | 188IS-3    |
| <b>23</b>                   | <b>TAPE DRIVES</b>                 |            | 374-375                     | SCIENTIFIC PROGRAMMING             | 241      | 86-87                       | GLESCO ENGINEERING              | 141        |
| 73-74                       | COLORADO MEMORY SYSTEMS            | 43         | 166-168                     | WOLFRAM RESEARCH                   | 155      | 138-139                     | RAINBOW TECHNOLOGIES            | 61         |
| 352                         | LAGUNA DATA SYSTEMS                | 241        | <b>32</b>                   | <b>ENTERTAINMENT</b>               |          | 435                         | SOFTWARE SECURITY INC           | 128IS-1    |
| 104-105                     | MAYNARD, AN ARCHIVE CO             | 159        | 200                         | MICROPROSE SOFTWARE                | 227      | <b>43</b>                   | <b>SOFTWARE DUPLICATION</b>     |            |
| 373                         | NOVASTOR CORP                      | 241        | 201                         | MICROPROSE SOFTWARE                | 229      | 330-331                     | AXIOMATIC                       | 238        |
| 356                         | OVERLAND DATA INC                  | 241        | <b>33</b>                   | <b>GRAPHICS</b>                    |          | <b>45</b>                   | <b>UNIX</b>                     |            |
| 358                         | QUALSTAR CORP                      | 241        | 79                          | COREL SOFTWARE                     | 47       | 186-187                     | CONSENSYS CORP                  | 104        |
| 160                         | VALITEK INC                        | 84         | 106                         | MEDIA CYBERNETICS                  | 190      | 89                          | HUMMINGBIRD COMMUNICATIONS      | 205        |
| <b>24</b>                   | <b>UPS</b>                         |            | 114-115                     | NANAO USA CORP (N.A.)              | 89       | 112                         | MKS / MORTICE KERN SYSTEMS      | 193        |
| 66                          | AMERICAN POWER CONVERSION          | 135        | 152                         | TEKTRONIX                          | 53       | 174                         | SUNSOFT                         | 2-3        |
| 121                         | MINUTEMAN                          | 75         | <b>35</b>                   | <b>MAIL ORDER</b>                  |          | 166-168                     | WOLFRAM RESEARCH                | 155        |
| 123-124                     | PC POWER & COOLING                 | 49         | 63                          | ALADDIN KNOWLEDGE SYSTEMS          | 86       | <b>46</b>                   | <b>UTILITIES</b>                |            |
| <b>SOFTWARE</b>             |                                    |            | 410                         | COMPUTER QUICK                     | 120IS-4  | 63                          | ALADDIN KNOWLEDGE SYSTEMS       | 86         |
| <b>25</b>                   | <b>BUSINESS</b>                    |            | 425                         | GREY MATTER LTD                    | 188IS-4  | 403                         | ALADDIN KNOWLEDGE SYSTEMS       | 208IS-2    |
| 76                          | COMPUTER ASSOCIATES                | 122        | *                           | PROGRAMMER'S PARADISE              | 55       | 175-176                     | ALLMICRO                        | 93         |
| 345-346                     | INDUS                              | 241        | 102                         | PROGRAMMER'S PARADISE              | 56-57    | 454                         | CYBERDYNE SYSTEMS /             |            |
| 457                         | INFOMEDIA                          | 208IS-8    | *                           | PROGRAMMER'S SHOP                  | 78-79    |                             | COMPUTERS UK                    | 188IS-2    |
| 106                         | MEDIA CYBERNETICS                  | 190        | 434                         | PROGRAMMER'S SHOP                  | 80       | 338                         | DIAGSOFT INC                    | 243        |
| 387-388                     | MICROBIZ                           | 241        | <b>36</b>                   | <b>MATHEMATICAL/STATISTICAL</b>    |          | 148-149                     | LANDMARK RESEARCH INT'L CORP    | 103        |
| 432                         | OXFORD ELECTRONIC PUBLISHING       | 88IS-1     | 357                         | PERSONAL TEX                       | 242      | 131                         | PKWARE INC                      | 206        |
| 122                         | PATTON & PATTON                    | 82         | 145                         | STATSOFT                           | 175      | 146                         | STORAGE DIMENSIONS              | 147        |
| 147                         | STRATEGIC MAPPING                  | 194        | 150-151                     | SYSTAT INC                         | 81       | <b>47</b>                   | <b>WINDOWS</b>                  |            |
| 433                         | SZKI RECOGNITA CORP (INT'L)        | 89         | 166-168                     | WOLFRAM RESEARCH                   | 155      | 61-62                       | ABACUS SOFTWARE                 | 95         |
| 362                         | TRIANGLE DIGITAL SERVICES          | 240        | <b>37</b>                   | <b>MISCELLANEOUS SOFTWARE</b>      |          | 425                         | GREY MATTER LTD                 | 188IS-4    |
| <b>26</b>                   | <b>CAD/CAM</b>                     |            | 443                         | ON TIME MKT / KARSTEN PETERSEN     | 172IS-4  | 89                          | HUMMINGBIRD COMMUNICATIONS      | 205        |
| 67                          | AMERICAN SMALL BUSINESS COMP       | 131        | <b>38</b>                   | <b>ON-LINE SERVICES</b>            |          | 348-349                     | ISLAND SYSTEMS                  | 243        |
| 554                         | EVOLUTION COMPUTING                | 224NE-1    | 450                         | BIX                                | 180      | 96                          | KEA SYSTEMS LTD                 | 76         |
| 561                         | EVOLUTION COMPUTING                | 224PC-2    | <b>39</b>                   | <b>OPERATING SYSTEMS</b>           |          | 351                         | LABTECH                         | 243        |
| 366                         | WINTEK CORP                        | 241        | 428                         | LOGIC PROGRAMMING ASSOCIATES       | 180IS-1  | *                           | MICROSOFT CORP                  | 17         |
| <b>27</b>                   | <b>COMMUNICATIONS/NETWORKING</b>   |            | 134                         | QNX / QUANTUM SOFTWARE SYSTEMS     | 191      | 114-115                     | NANAO USA CORP (N.A.)           | 89         |
| 185                         | DSP DESIGNS INTERNATIONAL / NASCOM | 130        | 135                         | QUARTERDECK OFFICE SYSTEMS         | 101      | 432                         | OXFORD ELECTRONIC PUBLISHING    | 88IS-1     |
| 225-226                     | EMBARC / MOTOROLA (N.A.)           | 121        | <b>40</b>                   | <b>PROGRAMMING LANGUAGES/TOOLS</b> |          | 127                         | PERSOFT INC                     | 204        |
| 422-423                     | FUTURESOFT ENGINEERING             | 128IS-4    | 332                         | BINARY TECHNOLOGY INC              | 242      | 371                         | PIXEL PERFECT / MEDICAL ADVISOR | 243        |
| 440                         | MINICOM LTD                        | 208IS-10   | 171-172                     | BLINK INC                          | 109      | 147                         | STRATEGIC MAPPING               | 194        |
| 127                         | PERSOFT INC                        | 204        | 81-82                       | DATA ACCESS CORP                   | 203      | <b>48</b>                   | <b>WORD PROCESSING/DTP</b>      |            |
| 140                         | RETIX INC                          | 151        | 418                         | DR HUGGLE & PARTNER GMBH           | 180IS-1  | *                           | MICROSOFT CORP                  | 28-29      |
| 157                         | TRITON TECHNOLOGIES                | 143        | 425                         | GREY MATTER LTD                    | 188IS-4  | 432                         | OXFORD ELECTRONIC PUBLISHING    | 88IS-1     |
| 158                         | UNIPALM LTD                        | 154        | 378                         | IVERSON SOFTWARE, INC              | 243      | 433                         | SZKI RECOGNITA CORP (INT'L)     | 89         |
| 439                         | WALKER, RICHER & QUINN             | 120IS-1    | *                           | KEDWELL SCIENTIFIC                 | 172IS-3  | <b>49</b>                   | <b>BOOKS/PUBLICATIONS</b>       |            |
| <b>28</b>                   | <b>DATA ACQUISITION</b>            |            | 428                         | LOGIC PROGRAMMING ASSOCIATES       | 180IS-1  | 61-62                       | ABACUS SOFTWARE                 | 95         |
| 116                         | NATIONAL INSTRUMENTS               | 9          | *                           | MICROWAY                           | 186      | 414                         | DATAPRO INT'L                   | 172IS-1    |
| 355                         | NATIONAL INSTRUMENTS               | 242        | *                           | MICROWAY                           | 211      | 94                          | IOMEGA                          | 22-23      |
| *                           | NATIONAL INSTRUMENTS               | 128IDRC1-2 | 112                         | MKS / MORTICE KERN SYSTEMS         | 193      | *                           | JNL OF OBJ                      |            |
| <b>29</b>                   | <b>DATABASE</b>                    |            | 443                         | ON TIME MKT / KARSTEN PETERSEN     | 172IS-4  | *                           | ORIENT PROGRAMMING              | 128IDRC1-2 |
| 70-71                       | BORLAND INT'L                      | 13         | 128                         | PHAR LAP SOFTWARE INC              | 85       | *                           | UNIXWORLD                       | 148A-B     |
| 77                          | COMPUTER ASSOCIATES                | 38-39      | *                           | PROGRAMMER'S SHOP                  | 78-79    | *                           | UNIXWORLD                       | 149        |
| 335                         | COMPUTERWISE                       | 242        | *                           | PROGRAMMER'S SHOP                  | 80       | <b>51</b>                   | <b>MISCELLANEOUS</b>            |            |
| 418                         | DR HUGGLE & PARTNER GMBH           | 180IS-1    | 132-133                     | PROGRESS SOFTWARE                  | 207      | *                           | BYTE SUB MESSAGE                | 182        |
| 445                         | ITALIAN SOFTWARE AGENCY            | 120IS-2    | 163                         | WATCOM PRODUCTS INC                | 25       | 555                         | DEXPO / MILLER FREEMAN, INC     | 224NE-3    |
| 463                         | MAGIC / MSE                        | 164IS-1    | 164-165                     | XVT SOFTWARE INC                   | 195      | 562                         | DEXPO / MILLER FREEMAN, INC     | 224PC-4    |
| 137                         | RAIMA CORP                         | 65         |                             |                                    |          | 551                         | DEXPO / MILLER FREEMAN, INC     | 224MW-2    |
| 142                         | SEQUIER SOFTWARE INC               | 119        |                             |                                    |          | 565                         | DEXPO / MILLER FREEMAN, INC     | 224SO-4    |
|                             |                                    |            |                             |                                    |          | 458                         | MINISTRY OF INDUSTRY AND TRADE  | 208IS-6-7  |



# PRINT OFF BOTH TCP/IP and NOVELL NETWORKS SIMULTANEOUSLY!



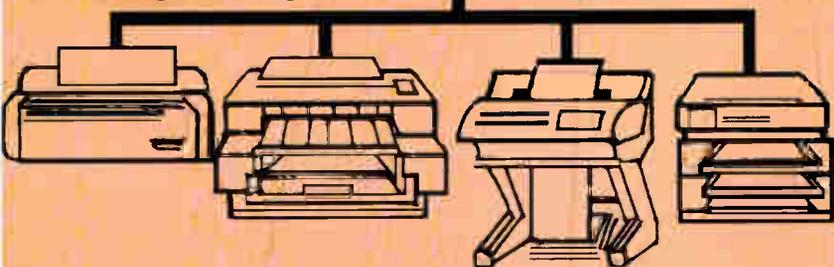
ETHERNET



**NOW  
SHIPPING!**



CONNECTS UP TO FOUR PRINTERS



**S**haring printers in mixed Ethernet network environments is now an affordable reality. The AXIS AX-5 Ethernet Print Server allows you to send print jobs concurrently from both TCP/IP and Novell Netware™ LAN platforms. For mixed environment networks, particularly where a variety of protocols are employed, the AX-5 is the ideal solution.

**The AX-5 features include:**

- Simultaneous Ethernet printing from shared TCP/IP & Novell networks
- Locate printers anywhere on the network
- Advanced accounting features
- Thin (10Base2), Thick (10Base5) or Twisted Pair (10BaseT) Ethernet supported
- Multiple Router Support
- Totally secure! Control user access with passwords. Support for Novell encrypted passwords
- Support of the FTP protocol
- No need to load diskettes or tapes in TCP/IP mode

With a parallel transfer rate of up to 60KB/second, the AX-5 delivers the high speed printing capabilities today's users demand. Installation is fast and easy. In TCP/IP environments, simply use FTP to edit the configuration file. In Novell, the AX-5 uses PCONSOLE for basic installation. For advanced installation, we provide software compatible with DOS and WINDOWS. Either way, you'll be printing off your Novell and TCP/IP networks in no time!

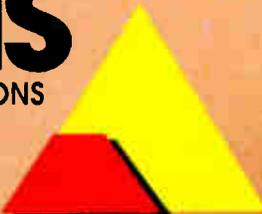
The AXIS AX-5 is the most advanced Ethernet print server available today. It is fast, versatile, easy to install and backed up by AXIS full One-Year Warranty. Call us today. We've got all the right connections.

**CALL +4646191800  
CALL 508-777-7957**

**AXIS™**  
COMMUNICATIONS

**AXIS - the intelligent choice**  
*More than just connectivity!*

AXIS COMMUNICATIONS AB,  
Scheelevagen 16, S-223 70 Lund, Sweden  
AXIS COMMUNICATIONS INC.,  
99 Rosewood Drive, Ste. 170, Danvers, MA 01923, USA



# STOP BIT

CLIFFORD A.  
PICKOVER

## FRACTAL FANTASIES

### Fractals can create an infinite playing field for board-game designs

Computer-generated fractal patterns are everywhere these days. From squiggly designs on computer-art posters to illustrations in the most serious of physics journals, interest continues to grow among scientists, artists, and designers.

Mathematician Benoit Mandelbrot coined the word *fractal* in 1975 to describe an intricate-looking set of curves, many of which were never seen before the advent

of computers, with their ability to quickly perform massive calculations. Fractals often exhibit *self-similarity*, which means that various copies of an object can be found within the original object at smaller

scales. The detail continues for many magnifications, like an endless nesting of Russian dolls within dolls. Some of these shapes exist only in abstract geometric space, but others can be used as models for complex natural objects like coastlines and blood-vessel branching.

Interestingly, fractals provide a useful framework for understanding chaotic processes and for performing image compression. The dazzling computer-generated images can be intoxicating, motivating students' interest in math more than any other mathematical discovery in the last century.

When most people hear the word *fractal* they rarely think of applications beyond the kinds just mentioned. Recently, however, I found myself drawn to their use in game playing. You might like to program software to play it or simply use a board drawn on paper.

The board for the Fractal Fantasy game consists of a fractal nesting of rectangles within rectangles interconnected with wiggly lines, as shown in the artwork above. There are always two rectangles within the rectangles that encompass them, and the degree of nesting can vary.

Beginners play with only a few nested rectangles, while grand masters play with many recursively positioned rectangles. One can imagine tournaments lasting for days, with breaks only for eating and sleeping. The playing board illustrated here is called a *degree 2* board, because it has two different sizes of rectangles within the large bounding rectangle. Beginners usually start with a *degree 1* board, and grand masters have been known to use a *degree 20* board. One player uses white playing pieces (or *stones*); the other uses black. Each player starts with a number of stones equal to two less than half the number of vertices (i.e., dots) on the board.

For the board here, each player gets 19 stones. With al-

ternate moves, the players begin by placing a stone at points on the black dots that are empty. As they place stones, each player attempts to form a row of three stones along any one of the vertical sides of any square. This three-in-a-row assembly of stones is called a *googol*. When all the stones have been placed, players take turns moving a stone to a neighboring vacant space along one of the wiggly or straight connecting lines.

When a player forms a *googol* (either during the alternate placement of stones at the beginning of the game or during alternate moves along lines to adjacent empty points), that player takes any one of the opponent's stones on the board and removes it from the board. (In some versions of this game, an opposing stone can't be taken from an opposing *googol*.) A player loses when he or she no longer has any stones or cannot make a move.

Mathematicians and philosophers will no doubt spend many years pondering a range of questions, particularly for boards with higher nesting. Computer programmers will design programs allowing the board to be magnified in different areas, permitting the convenient playing at different size scales. They'll all wish they had fractal consciousness, allowing the contemplation of all levels of the game simultaneously.

Is there a best opening move or overall strategy? If the large bounding square has a side 1 foot in length, what is the total length of lines on the board? If an ant were to start anywhere on the board and walk to cover all the lines, what would be the shortest possible route on the board? How many possible board arrangements are there? How large would a *degree 100* board have to be for the smallest squares to be seen? How many playing stones would be used? What length of time would be required to play such a bizarre game? I welcome comments and discoveries from readers. ■

*Clifford A. Pickover is an IBM research staff member at the IBM Thomas J. Watson Research Center in Yorktown Heights, New York. His latest book is Mazes for the Mind: Computers and the Unexpected from St. Martin's Press. You can reach him on BIX clo "editors" or on the Internet at cliff@watson.ibm.com.*

*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.*

**DELL CUTS  
PRICES.**

**IBM AND  
COMPAQ  
REACT  
WITH A FEW  
CHOICE  
WORDS.**

# FIVE EASY PIECES.

DELL INTRODUCES THE WORLD'S EASIEST PC TO TAKE APART. THAT LETS YOU SAVE TIME. SAVE ENERGY. SAVE FRUSTRATION. AND AS ALWAYS, SAVE A TON OF MONEY.

1.



The new Dell® 425s/L has embedded diagnostics that can identify a problem component just by pushing the reset button twice. Even if a major component like the monitor or hard drive isn't working, a video display or beepcode will show you the exact problem.



5.



If you want to get to your hard drive for easy maintenance or for an upgrade, just take out another screw, unplug two cables, and snap it out. And if there's a problem call us and we guarantee within five minutes you'll be talking to a trained specialist. A service which has helped make us a FORTUNE 500® company in seven short years. It's really that simple. Almost as simple as picking up the phone. So call us.

2.

The new Dell 425s/L then comes apart easily by first taking out two thumbscrews and removing the chassis cover. That's right, you don't need a hammer. Crowbar. Or a chainsaw.



**THE NEW DELL 425s/L  
i486™ SX 25 MHz SYSTEM  
NEW LOW PRICE  
\$1,499**

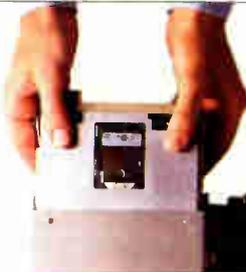
- LEASE®: \$55/MO.
- 4 MB RAM
- 170 MB (17 ms) HARD DRIVE
- 3 ISA EXPANSION SLOTS
- UPGRADEABLE PROCESSOR
- ACCELERATED LOCAL BUS VIDEO WITH 512 KB VIDEO RAM (UP TO 11 MILLION WINMARKS)
- SVGA 1024I MONITOR (14", 1024 X 768, 28mm)
- ONE FLOPPY DRIVE (3.5" OR 5.25")
- MS-DOS® 5.0



ALSO AVAILABLE WITH 33 MHz i486 SX, 33 MHz i486 DX AND 50 AND 66 MHz i486 DX2 AND THOUSANDS OF OTHER CONFIGURATIONS.



3.



Just push two buttons (you won't need an M.I.T. degree for this either), unplug two cables, and slide out your floppy drives for easy upgradeability. Service. Or to add a tape drive or CD-ROM drive.

4.

Then all you do is remove one tiny, little screw and pull out the entire card cage to add different user upgrade options like video memory. You can also add cache. Add Pentium™ technology. Change the processor. Or even swap out the systemboard. A child could do it. Or even your boss.



**DELL™**

800-365-9977

WHEN CALLING, PLEASE REFERENCE #11EC3.  
HOURS: 7AM-9PM CT MON-FRI, 8AM-4PM CT SAT, 10AM-3PM CT SUN.  
IN CANADA, CALL 800-668-3021. IN MEXICO CITY, 228-7811.

# OUCH! EEK! OOW! STOP! #@%!

When Dell cut prices up to \$300 on its new Performance Series, IBM and Compaq reacted with a few choice words. The price cuts aren't the only thing that they reacted to; these systems already offered up to 50% better performance than our previous systems, and at up to 25% lower prices. Yikes!

## DELL™

800-274-4635

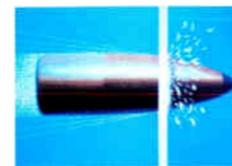
WHEN CALLING, PLEASE REFERENCE #11E93.  
HOURS: 7AM-9PM CT MON-FRI, 8AM-4PM CT SAT, 10AM-3PM CT SUN.  
IN CANADA, CALL 800-668-3021. IN MEXICO CITY, 228-7811.

\*Guarantees available in USA only for registered owners of Dell Performance Series systems purchased after 7/1/92. For a complete copy, please call our TechFax™ line at 1-800-950-1329 or write Dell USA L.P., 9505 Arboretum Blvd., Austin TX 78759-7299. Attention Guarantees. †Leasing arranged by Leasing Group, Inc. ‡On-site service provided by BancTec Service Corporation. On-site service may not be available in certain remote areas. WINMARKS test results obtained by running WINBENCH ver. 2.5 at 1024 x 768. The Intel Inside logo is a registered trademark and Pentium, 486 and i386 are trademarks of Intel Corporation. MS-DOS is a registered trademark and Windows is a trademark of Microsoft Corporation. UNIX is a registered trademark of UNIX System Laboratories, Inc. in the United States and other countries. FORTUNE 500 is a registered trademark of The Time Inc. Magazine Company. Dell disclaims proprietary interest in the marks and names of others. ©1993 Dell Computer Corporation. All rights reserved.



### THE NEW DELL 333s/L i386™ SX 33 MHz SYSTEM

- LEASE: \$44/MO.
- 2 MB RAM
- 120 MB (17 ms) HARD DRIVE
- 3 ISA EXPANSION SLOTS
- VGA 800 MONITOR (14", 800 X 600, .39mm)
- ONE FLOPPY DRIVE (3.5" OR 5.25")
- MS-DOS 5.0



### OUR FASTEST 386SX.

(Don't let it fool you. Actually, it's a lot faster than a speeding bullet.)



### GUARANTEED RESPONSE.

Amazingly easy to use, and includes comprehensive documentation. But if you ever have questions, call us. We guarantee you'll talk to an expert within 5 minutes, or if you prefer, we'll call back within an hour.\*



### READY TO ROCK 'N' ROLL.

Intel isn't the only thing in this system. Everything can be custom configured: modems, network adapters, and critical software.



### THE NEW DELL 425s/L i486 SX 25 MHz SYSTEM

- LEASE: \$55/MO.
- 4 MB RAM
- 170 MB (17 ms) HARD DRIVE
- 3 ISA EXPANSION SLOTS
- UPGRADEABLE PROCESSOR
- ACCELERATED LOCAL BUS VIDEO WITH 512 KB VIDEO RAM (UP TO 11 MILLION WINMARKS)
- SVGA 1024I MONITOR (14", 1024 X 768, .28mm)
- ONE FLOPPY DRIVE (3.5" OR 5.25")
- MS-DOS 5.0



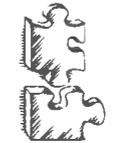
### UP TO 65% QUICKER MAINTENANCE.

It's easy to get into this computer. Just loosen a couple of thumbscrews for easy access to the modular chassis.



### UP TO 2.6 TIMES THE VIDEO PERFORMANCE.

With our new accelerated local bus video revving up your screen, who needs a VCR?



### GUARANTEED COMPATIBILITY.

Our computers are network-compatible with Novell, Banyan, and UNIX® systems. And we're the only company with a written compatibility guarantee.\*



### THE NEW DELL 433s/M i486 SX 33 MHz SYSTEM

- LEASE: \$74/MO.
- 4 MB RAM
- 170 MB (17 ms) HARD DRIVE
- 6 ISA EXPANSION SLOTS
- UPGRADEABLE PROCESSOR
- ACCELERATED LOCAL BUS VIDEO WITH 1 MB VIDEO RAM (UP TO 19 MILLION WINMARKS)
- SVGA 1024I MONITOR (14", 1024 X 768, .28mm)
- ONE FLOPPY DRIVE (3.5" OR 5.25")
- MS-DOS 5.0



### UP TO 160% FASTER VIDEO.

Faster PageMaker redraws and lightning-quick Windows® repaints. Speed freaks, rejoice.



### GREATER UPGRADEABILITY.

You can upgrade all the way to the top 486, the 66 MHz DX2. You'll even be able to add the Pentium technology from Intel.



### SYSTEM PERFORMANCE BOOSTED 29%.

With our new optimized cache as an option, you can give your system a boost whenever you want.



### THE NEW DELL 466/ME i486 DX2 66 MHz SYSTEM

- LEASE: \$111/MO.
- 4 MB RAM
- 170 MB (17 ms) HARD DRIVE
- 4 EISA EXPANSION SLOTS
- 2 ISA EXPANSION SLOTS
- UPGRADEABLE PROCESSOR
- ACCELERATED LOCAL BUS VIDEO WITH 1 MB VIDEO RAM (UP TO 29 MILLION WINMARKS)
- ULTRASCAN™ 14C MONITOR (14", 1024 X 768, .28mm, NII)
- ONE FLOPPY DRIVE (3.5" OR 5.25")
- MS-DOS 5.0



### UP TO FOUR TIMES FASTER DATA TRANSFER THAN ISA.

You get a 32-bit EISA expansion bus that transfers data at up to 33 megabytes a second. To understand what it does for your computer, drink about eight million cups of coffee.



### GUARANTEED ACCOUNTABILITY.

We're the only computer company to guarantee\*-in writing-compatibility, fast response to your questions, and quick service.† Two-thirds of the FORTUNE 500 companies rely on us. So should you.



### GOOD NEWS FOR THE POWER HUNGRY.

It's easy to upgrade to the top 486, the 66 MHz DX2. If you're still power hungry, you can add Pentium technology — the next generation from Intel.



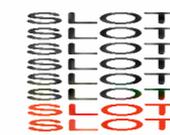
### THE NEW DELL 433/T i486 DX 33 MHz SYSTEM

- LEASE: \$91/MO.
- 4 MB RAM
- 230 MB (16 ms) HARD DRIVE
- 8 ISA EXPANSION SLOTS
- UPGRADEABLE PROCESSOR
- ACCELERATED LOCAL BUS VIDEO WITH 1 MB VIDEO RAM (UP TO 19 MILLION WINMARKS)
- SVGA 1024I MONITOR (14", 1024 X 768, .28mm)
- ONE FLOPPY DRIVE (3.5" OR 5.25")
- MS-DOS 5.0



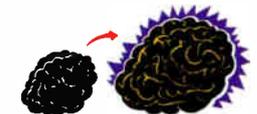
### UP TO 18% FASTER SYSTEM PERFORMANCE.

Good thing you don't have to worry about the highway patrol.



### 33% MORE SLOTS.

With eight slots, you can add the network and communication cards you need for a great low-cost server.



### UP TO 86% MORE DISK CAPACITY.

Our floor-standing model has a disk capacity of up to three gigabytes. Talk about mind-expanding performance...

Each system is custom-built. With 18 different models in our new 486 line — covering 25 MHz, 33 MHz, 50 MHz, and 66 MHz — you can configure just the system you need. In fact, with our complete line of storage, memory, graphics and connectivity products, we can build over 15,000 different configurations.

# DELL CUTS PRICES.

# IBM AND COMPAQ REACT WITH A FEW CHOICE WORDS.

# FIVE EASY PIECES.

DELL INTRODUCES THE WORLD'S EASIEST PC TO TAKE APART. THAT LETS YOU SAVE TIME. SAVE ENERGY. SAVE FRUSTRATION. AND AS ALWAYS, SAVE A TON OF MONEY.

1.



The new Dell® 425s/L has embedded diagnostics that can identify a problem component just by pushing the reset button twice. Even if a major component like the monitor or hard drive isn't working, a video display or beepcode will show you the exact problem.



2.

The new Dell 425s/L then comes apart easily by first taking out two thumbscrews and removing the chassis cover. That's right, you don't need a hammer. Crowbar. Or a chainsaw.



3.



Just push two buttons (you won't need an M.I.T. degree for this either), unplug two cables, and slide out your floppy drives for easy upgradeability. Service. Or to add a tape drive or CD-ROM drive.

4.

Then all you do is remove one tiny, little screw and pull out the entire card cage to add different user upgrade options like video memory. You can also add cache. Add Pentium™ technology. Change the processor. Or even swap out the systemboard. A child could do it. Or even your boss.



5.



If you want to get to your hard drive for easy maintenance or for an upgrade, just take out another screw, unplug two cables, and snap it out. And if there's a problem call us and we guarantee within five minutes you'll be talking to a trained specialist. A service which has helped make us a FORTUNE 500® company in seven short years. It's really that simple. Almost as simple as picking up the phone. So call us.

THE NEW DELL 425s/L i486™ SX 25 MHz SYSTEM

**NEW LOW PRICE \$1,499**

- LEASE\*: \$55/MO.
- 4 MB RAM
- 170 MB (17 ms) HARD DRIVE
- 3 ISA EXPANSION SLOTS
- UPGRADEABLE PROCESSOR
- ACCELERATED LOCAL BUS VIDEO WITH 512 KB VIDEO RAM (UP TO 11 MILLION WINMARKS)
- SVGA 1024I MONITOR (14", 1024 X 768, .28mm)
- ONE FLOPPY DRIVE (3.5" OR 5.25")
- MS-DOS® 5.0

ALSO AVAILABLE WITH 33 MHz i486 SX, 33 MHz i486 DX AND 50 AND 66 MHz i486 DX2 AND THOUSANDS OF OTHER CONFIGURATIONS.



**DELL™**

800-365-9977

WHEN CALLING, PLEASE REFERENCE #11EC3.

HOURS: 7AM-9PM CT MON-FRI. 8AM-4PM CT SAT. 10AM-3PM CT SUN.  
IN CANADA, CALL 800-668-3021. IN MEXICO CITY, 228-7811.