

BYTE

THE WORLDWIDE COMPUTING AUTHORITY

Multiprocessor Architecture:
How It Breaks Bottlenecks

Mac Centris 650: Faster
Than a Speeding Quadra

New Lotus 1-2-3 for Windows

Which Windows?

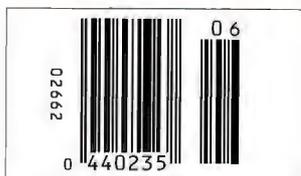
Microsoft is developing versions of Windows to control your PC, TV, server, PDA... Should you be worried?



OS/2 2.1 IBM's Impressive Upgrade

SPECIAL REPORT

Make the Most of Client/Server Technology



\$3.50 U.S.A./\$4.50 IN CANADA
A McGraw-Hill Publication/0360-5280

Gateway 2000's HandBook Is The First To Go The Distance!



It was the first time anyone ever took a portable all the way from Anchorage to Nome on a dogsled. Appropriately, the first portable PC to go the distance was the first product in an entirely new category of portables; the unique and innovative product that defined new standards for portable PCs: the HandBook, pioneered by Gateway 2000. At just 2.75 pounds, measuring only 6 x 10 inches yet including a 40MB hard drive, a backlit, use-it-anywhere screen and comfortable keyboard, the HandBook was the only choice for Iditarod musher Frank Teasley.

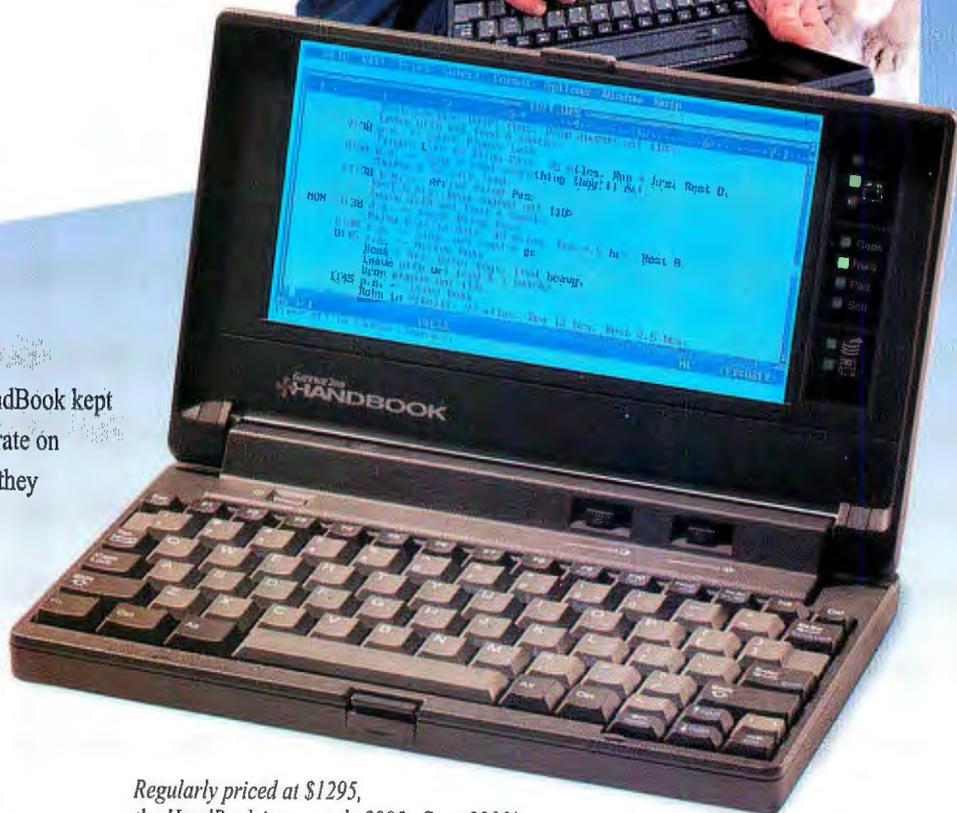
"I've always wanted a way to carry my racing strategy with me and to record my progress during the race," said Frank. "But I can't afford any extra weight on the dogsled, and you don't find many electrical outlets on the trail. The HandBook easily fit in the dogsled, and I used it at checkpoints to review details of

the trail ahead, information on my competition, and notes on my dogs." Because he couldn't recharge batteries on the trail, Frank ran his HandBook on AA batteries kept warm in his parka.

Frank said the HandBook's exclusive auto-resume feature was a big plus, too. Being able to open the HandBook and start working exactly where he left off made it effortless to use.

Although the dogs slept an average of 12 hours a day during the race, Frank was lucky to sleep 45 minutes daily. He was busy making straw beds, putting ointment on the dogs' feet, replacing their polar fleece booties, preparing their food, repairing harnesses and repacking while the dogs rested. "Sleep deprivation can be hazardous to a

Best Portable PC



her's ability to focus on details. The HandBook kept on top of my schedule so I could concentrate on dogs and they could concentrate on what they best: the race."

Frank concluded, "There's not another computer small enough or powerful enough to come through for us the way HandBook did."

It's a PC that's the perfect companion even in the most demanding situations, even when you never leave your office. Get the leader in the pack Gateway 2000's HandBook!

Regularly priced at \$1295,
the HandBook is now only \$995. Save \$300!

Leader Of The Pack



On March 6, 1993, 68 men and women, 1,253 dogs and one portable computer left the starting line in the 21st running of the Iditarod dogsled marathon. Not all of the men, women and dogs made it through nearly 1,100 miles of blinding snow, howling wind, mountainous terrain and sub-zero temperatures – but the HandBook did!



The Gateway 2000 HandBook®

- Weight: 2.75 lbs. (includes battery)
- Dimensions: 5.9" x 9.75" x 1.4"
- AC adapter/charger measuring 6.5" x 2.5" x 1.5" and weighing 1.25 lbs.
- NiMH 2.3Ah battery; approximately 4.5 hrs. battery life with power management
- Alkaline battery pack; 5 hrs. battery life with power management (AA batteries not included)
- Traveling weight: 4.0 lbs. (includes HandBook, battery & charger)
- C & T processor, 286-class performance
- 1MB RAM, upgradeable to 3MB
- 40MB hard drive
- Backlit 7.6" double-scan 640 x 400 resolution screen
- 1 parallel and 1 serial port
- 78-key keyboard; 101-key emulation, inverted-T cursor pad
- Microsoft® MS-DOS® 5.0, Interlink and your choice of WordPerfect® for DOS 5.1 or Microsoft Works™ for DOS 2.0
- Serial download cable

\$995

HandBook Options

- 2400bps data/9600bps send-and-receive fax/modem with software, \$165
- Citizen PN48 portable printer, \$380
- Extra AC adapter, \$75
- Extra 2.3Ah batteries (each), \$70
- RAM upgrade to 3MB, \$130
- Combo unit (1.44MB 3.5" external floppy drive with 1 parallel and 1 serial port), \$265
- Extended VIP warranty (24-hour factory service turnaround), \$100 (must be purchased at the time of sale)



8 0 0 - 8 4 6 - 2 0 5 8

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

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



INTERACTIVE™ UNIX®
OPERATING SYSTEM



INTERACTIVE™ UNIX®
OPERATING SYSTEM



Circle 163 on Inquiry Card.

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™ 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® 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

News & Views

Lotus Takes Another Run at Windows.....22

BY NICHOLAS JOHN DELONAS The new Windows version of 1-2-3 is a serious challenger to Microsoft Excel.

Amstrad's Affordable Pen Package.....24

BY DICK POUNTAIN The Pen Pad PDA600 may not offer the dazzle of Newton, but it's affordable and it works.



PostScript Level 2: Adobe Takes the Driver's Seat.....28

BY TOM THOMPSON You may already have a PostScript Level 2 printer, but now you can take advantage of it with Level 2 drivers.

Going to Extremes.....34

BY BEN SMITH With a powerful new graphics processor, Silicon Graphics' Indigo2 was born for data visualization.

HP Takes Color Mainstream.....38

BY ANDY REINHARDT Hewlett-Packard's DeskJet 1200C meets the demand of users who covet color.

WordPerfect Goes GUI with DOS Update.....42

BY PATRICK WAURZYNIAK It's taken WordPerfect more than three years to update its DOS word processor, but version 6.0 may be worth the wait.

A Peek at PowerOpen.....46

BY TOM R. HALFHILL The first PowerPC chip may not equal the Pentium's performance, but at one-fifth the price, you may not care.

Visual Basic 3.0 Strengthens Connectivity.....48

BY TOM R. HALFHILL The newest version of Visual Basic inherits Microsoft's Access database engine.

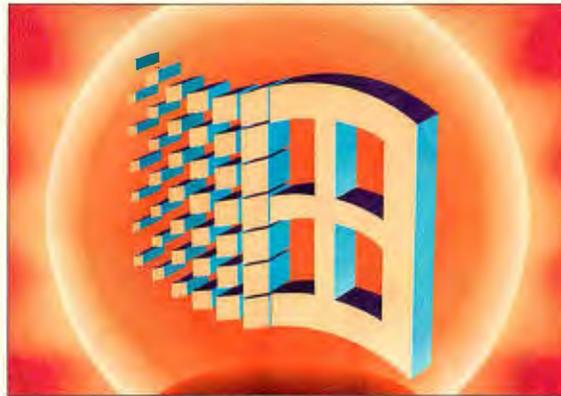
Report from Mexico.....49

BY D. BARKER Local programmers wait for a break.

What's New.....220

The Paperless 1 imaging system reduces paper consumption, the Raidion LT provides fault-tolerant disk-array storage for OS/2, and more.

Cover Story



COMPUTING ENVIRONMENTS

Windows, Windows Everywhere? 72

BY JON UDELL Microsoft wants you to someday use a version of Windows for every computing platform. The unique demands of each platform, however, might make this goal unrealistic.

The Mips Challenge—80 Windows Graphics—90
Many Processors, Many Threads—84 NT's Architects Speak—92

Features

ADAPTING TECHNOLOGY

Computers for the Disabled 59

BY JOSEPH J. LAZZARO Off-the-shelf products help you meet the needs of disabled workers.

PRODUCTS

Readers' Choice Awards 65

BYTE readers name their favorite products.

State of the Art

CLIENT/SERVER COMPUTING

OVERVIEW

Client/Server Frees Data 96

BY ELLEN ULLMAN Client/server brings data to your desktop.

Unix Database Servers Are Not for Everyone—102

Serving Mobile Clients—106



The Many Flavors of SQL 109

BY MARK CLARKSON

Market forces complicate the search for a database access standard. While vendors pitch their versions of SQL, users suffer.

Reviews



PAGE 129



PAGE 141



PAGE 146



Make Way for Data 113

BY PAUL KORZENIOWSKI

Middleware—such as remote procedure calls and message-passing systems—invisibly aids data exchange. With it, you can save development time implementing your client/server applications. Programmers don't have to modify applications to accommodate network protocols.

SYSTEMS

Apple's Midrange Mac a Heavy Hitter 129
 BY TOM THOMPSON Benchmark results and hands-on experience with two of Apple's newest Macs, the Centris 650 and PowerBook 165c.

PROGRAM DEVELOPMENT

Microsoft's Visual C++ 133
 BY JIM HURD Is Visual C++ a more powerful Visual Basic or a more graphical C++? Jim Hurd checks out its new tools and capabilities.

DATABASES

Two Roads to Windows Databases 136
 BY STAN MIASKOWSKI AND MARC SCHNAPP Paradox and FoxPro migrate to Windows: Borland's Paradox for Windows wraps its powerful features in an object-oriented package. Microsoft's FoxPro 2.5 for Windows maintains its solid Xbase underpinning and is built for speed.

Performance Comparisons—138

PRINTING

HP's Simple Laser 141
 BY HOWARD EGLowSTEIN HP's new LaserJet 4L brings laser-quality output to the desktop, along with low cost and simple operation. The BYTE Lab examines the speed, quality, and expansion trade-offs of the 4L series.

PROGRAM DEVELOPMENT

BASIC for the Rest of Us 143
 BY TOM THOMPSON Zedcor's FutureBasic provides a powerful development environment for the Macintosh that's actually easy to use. Thompson builds a project with FutureBasic and a helpful add-on, PG:PRO

PG:Pro—144

GRAPHICS

The Renaissance of Imaging 146
 BY RAYMOND GA CÔTÉ Kodak hopes to change the way graphics professionals process electronic images with Photo CD and supporting software. BYTE examines two of Kodak's flagship Photo CD software products, PhotoEdge and Renaissance.

UTILITY SOFTWARE

Windows Dressing 148
 BY STAN WSZOLA The Windows user interface isn't for everyone. The BYTE Lab examines 12 accessory packages that plug the gaps in the Windows user interface, including NewWave, Power Launcher, and Norton Desktop for Windows.

Table of Features—150 - 151

HANDS-ON TESTING

**BYTE Lab Report
 Desktop Dynamite: 116 Fast 486s** 156
 BY RICHARD FOX, ALAN JOCH,
 LEONARD PRESBERG, AND LESLIE REISZ



We tested 116 50- and 66-MHz 486s to tell you which is best for your DOS, Windows, and Unix applications.

How We Tested—167
 Poor Quality—169
 Bus Choices—170

Hands On



EISes Mine Your Data 121
 BY RANDALL D. CRONK Client/server computing revolutionizes executive information systems. EISes can help you find and analyze your data, but it's not always as easy as it might sound.



TECHNOLOGY

**Under the Hood
 The Multiprocessor
 Solution**185
 BY DICK POUNTAIN Multiprocessor architectures lead the charge to improve I/O performance.

OPERATING SYSTEMS

**Beyond DOS
 IBM Unleashes a New
 OS/2**193
 BY BARRY NANCE IBM delivers a full-featured successor to OS/2 2.0.

PROGRAMMING

**Some Assembly Required
 Animation for Windows
 Applications**197
 BY MICHAEL J. YOUNG The CSprite class forms the foundation for adding animation to Windows programs.

**Pournelle:
 Statistics Programs Help
 Businesses Work**201
 BY JERRY POURNELLE
 Mysteries revealed.

**Reviews: Books & CD-ROMs
 Computer Ruminations**51
 BY HUGH KENNER,
 RAYMOND GA CÔTÉ,
 HOWARD EGLowSTEIN, AND
 ROB MITCHELL
*Unix Power Tools, Things That
 Make Us Smart*, and other titles.

**Commentary:
 The Cuckoo's Egg
 Revisited**274
 BY CLIFFORD STOLL
 Five years after a hacker broke into a computer at Lawrence Berkeley Laboratory, the repercussions still echo across the Internet.

**Editorial:
 More Personal Pathways**10
 BY DENNIS ALLEN

Letters18
 Readers respond on E-mail, Mac accelerator boards, computing in Italy, and other topics.

READER SERVICE

Editorial Index by Company 272
 Alphabetical Index to Advertisers 268
 Index to Advertisers
 by Product Category 270
 Inquiry Reply Cards 268A

BUYER'S GUIDE

Mail Order 231
 Buyer's Mart

PROGRAM LISTINGS

From BIX: Join "listings/frombyte93" and select the appropriate subarea (i.e., "jun93").
 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.

BYTE (ISSN 0360-5280) is published monthly with additional issues in April and October by McGraw-Hill, Inc. U.S. subscriber rate \$29.95 per year. In Canada and Mexico, \$34.95 per year. European surface mail subscriptions \$60, airmail \$80. Non-European subscriptions, \$60 surface mail or \$85 airmail. All foreign subscriptions are payable in U.S. funds that can be drawn on a U.S. bank. Single copies \$3.50 in the U.S., \$4.50 in Canada. Executive, Editorial, Circulation, and Advertising Offices: One Phoenix Mill Lane, Peterborough, NH 03458. Second-class postage paid at Peterborough, NH, and additional mailing offices. Postage paid at Winnipeg, Manitoba. Registration number 9321. Registered for GST as McGraw-Hill, Inc., GST #123075673. Printed in the United States of America. **Postmaster:** Send address changes and fulfillment questions to BYTE Subscriptions, P.O. Box 552, Hightstown, NJ 08520.

This page presents the articles in this issue according to computing platform.

DOS and Windows

Lotus Takes Another Run at Windows22

With the new release 4 of 1-2-3, Lotus adds in-cell editing, OLE and ODBC support, and easy access to external data to its spreadsheet program.

WordPerfect Goes GUI with DOS Update42

Version 6.0 of its word processor gives DOS users a more graphical interface.

Visual Basic 3.0 Strengthens Connectivity48

The latest version adds tools for interacting with data in several formats.

Windows, Windows Everywhere?72

Is there another version of Windows in your future? Here's a look at NT, Win32s, Chicago, and other versions in the works, as well as some alternative operating systems.

Microsoft's Visual C++133

Big changes should make it easier for C and C++ developers working on Windows projects.

Two Roads to Windows Databases136

Borland's object-oriented Paradox for Windows offers you good multiuser support and native access to a wide range of database formats. FoxPro promises easy migration of DOS FoxPro applications to Windows.

Windows Dressing148

This review looks at utilities that let you change the way you work in Windows.

Animation for Windows Applications197

Using this C++ class, here's how to add movement to your Windows programs. This technique can also be helpful for adding drag-and-drop capability to your application.

OS/2

Ami Pro Burns the OS/2 Flame42

Lotus's new Ami Pro 3.0 for OS/2 is a full 32-bit word processor that is integrated with the Workplace Shell.

Windows, Windows Everywhere?72

OS/2's role as the glue between PCs and mainframes gives IBM's advanced OS an advantage over Windows NT.

IBM Unleashes a New OS/2193

Version 2.1 gives OS/2 users many things they've been asking for: more drivers, better handling of Windows programs, built-in multimedia support, and dual-threaded DOS session support.

Macintosh

PostScript Level 228

Printing from the Mac—especially color graphics and big images—will be faster with the latest version of Adobe's language.

A Peek at PowerOpen46

The PowerOpen operating system will enable users to run Unix applications concurrently with existing Macintosh software and cut and paste between Mac and Unix programs.

Apple's Midrange Mac a Heavy Hitter129

The new 68040-based Centris 650 outperforms a Quadra 700, yet it costs significantly less.

BASIC for the Rest of Us143

Zedcor's FutureBasic gives programmers the tools to quickly develop software for the Macintosh. Tom Thompson also looks at Staz Software's PG:PRO interface designer.

The Renaissance of Imaging146

A review of two Kodak tools for working with Photo CD pictures: PhotoEdge, an image editor, and Renaissance, a publishing package.

Unix

Going to Extremes34

Silicon Graphics' new Indigo2 workstation offers Unix users a system built for visualizing data.

Windows, Windows Everywhere?72

Windows NT might be moving into Unix territory, but Unix has superior networking and control of powerful graphics workstations.

Unix Database Servers Are Not for Everyone102

Database consultants warn that Unix isn't always the best way to go.

Lab Report156

What's the best high-speed 486 PC for running Unix applications? We tested 116 systems to find out.

Networks

Windows, Windows Everywhere?72

Microsoft wants some version of Windows to be controlling your network. But Unix still offers the best operating system for connectivity.

Serving Mobile Clients106

It's not quite here yet, but unfettered connectivity is on the way.

Make Way for Data113

Middleware—including RPCs and message-passing systems—is a breed of client/server software that helps move data between your computer and your network.

EISes Mine Your Data121

Executive information systems can help you understand the data you just pulled off the network, but that doesn't always mean easy access.

The Multiprocessor Solution185

Here's an inside look at the technology you ought to consider before buying your next server.

Client/Server

Client/Server Frees Data96

A giant retail outlet and the U.S. House of Representatives have turned to client/server computing. Not without headaches. But the headaches are outweighed by the mighty benefits.

The Many Flavors of SQL109

Here's a look at the different implementations of SQL, including ANSI SQL3, IBM's DRDA, Microsoft's ODBC, and Borland's IDAPI.

Make Way for Data113

Middleware can help move data through a client/server network. It also gives a programming team standard APIs that can save development time.

EISes Mine Your Data121

Client/server architecture, combined with executive information systems, is making it easier to find and analyze your data. Here's a look at the advantages, and problems, of today's EISes.

Adaptive technology59

Americans with Disabilities Act 59

Animation197, 224

BASIC48, 143

Books51, 201

C++133, 197

CD-ROM ...51, 129, 146, 201

Client/server23, 96, 109, 113, 121

Color printing28, 38

Communications48, 224

Databases48, 96, 102, 103, 109, 113, 121, 136, 226

Desktop publishing146

Document imaging222

DOS42, 72, 156, 193

Executive information systems 121

Graphics28, 34, 38, 90, 141, 146, 197, 227

Laser printers141, 222

Macintosh28, 46, 129, 143, 146, 226, 227, 229

Middleware113

Mobile computing106

Multiprocessing84, 185

Networking ...46, 54, 72, 96, 113, 121, 201, 220, 221, 222, 274

Operating systems46, 72, 113, 193

OS/242, 72, 193

PCMCIA220, 224

Pen computers24, 82, 220

Photo CD146

PostScript28, 141, 220

PowerOpen46

Printers28, 38, 141, 221, 222

Programming ...48, 133, 143, 197, 227, 228

Spreadsheets22, 226

SQL109, 136

Statistics201, 228

Systems24, 34, 59, 129, 156, 185, 201, 220

Unix34, 46, 52, 72, 96, 102, 103, 113, 156

Utilities148

Video221, 224

Windows22, 52, 65, 72, 121, 133, 136, 148, 193, 197, 201, 228

Word processing42

Workstations34

"It's a quality desktop replacement...
most powerful portable we've seen.
One of the lightest units in the entire test group."

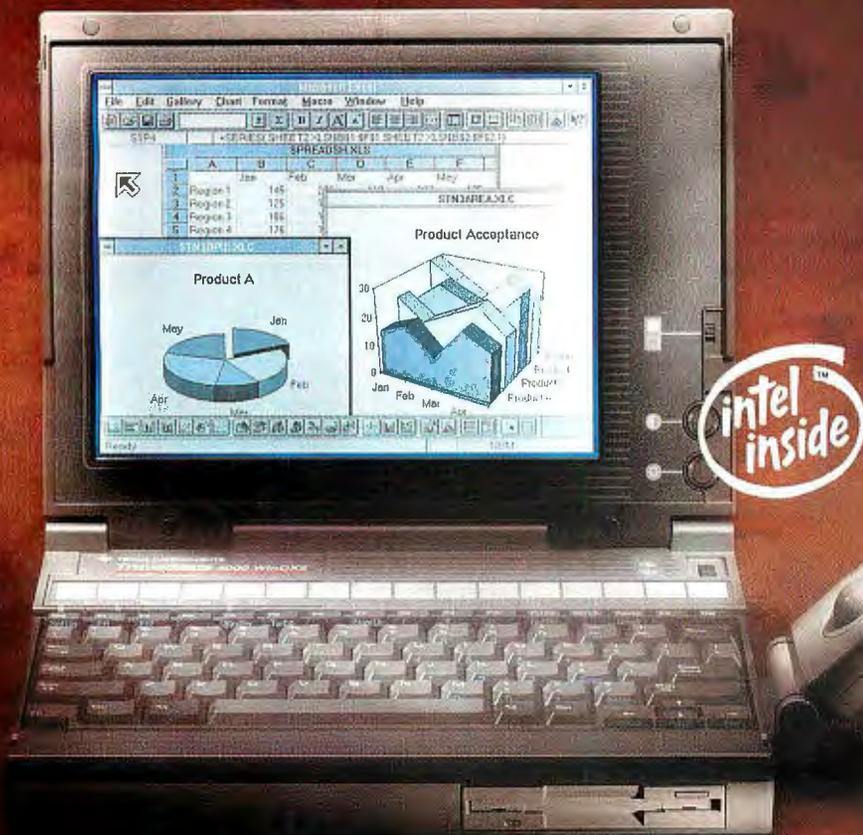
— PC Magazine, Mar. '93

"...in our battery tests, the TI 4000 WinDX2/50
achieved a magnificent 6 hours and 24 minutes"

— Portable Computing, Apr./May '93

"TI has done more to customize and optimize
Windows than the other notebook vendors."

— Windows Magazine, Feb. '93



TravelMate, WinDX2 and "Extending Your Reach With Innovation" are trademarks of Texas Instruments.
The Intel Inside logo is a trademark of Intel Corporation. © 1993 TI.

TI TravelMate 4000
WinDX2/50

OUR PERFORMANCE IS GETTING RAVE REVIEWS.

As well it should.

For starters, the TravelMate™
4000 WinDX2™/50 notebook computer
comes with a 486 DX2 50MHz processor
for increased speed and performance.

It's specifically designed around
built-in Windows, so it's able to power
up in just 30 seconds.

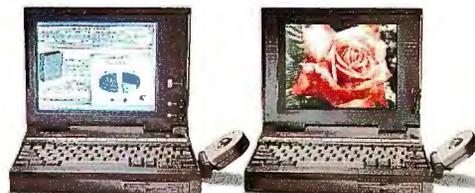
And its amazingly long battery
life is made possible by TI's superior
power management system.

For more information about the
incredible, lightweight, award-winning
TravelMate 4000 notebooks, simply
call 1-800-527-3500.

TravelMate 4000

486 WinDX2/50	486 WinDX2/40 COLOR
4 or 8MB RAM std. (20MB max.)	8MB RAM std. (20MB max.)
120 or 200MB HDD	200MB HDD
5.6 pounds	6.3 pounds

Battery life varies according to model and use.



EXTENDING YOUR REACH
WITH INNOVATION™

 **TEXAS
INSTRUMENTS**

Circle 146 on Inquiry Card.

TWIN

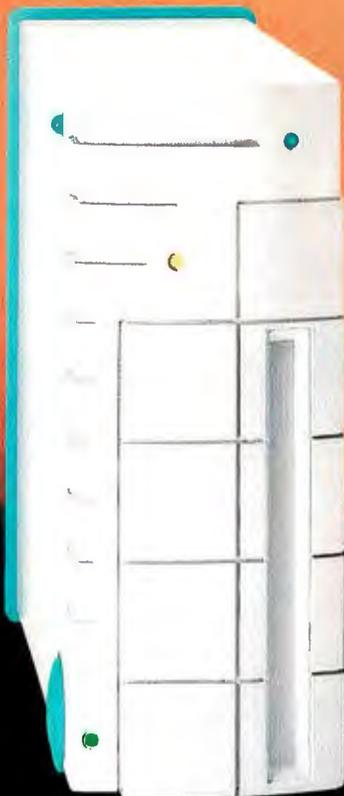
THE FIRST OPTICAL HARD DRIVE.

"It has a 19-millisecond access time and outperformed every other device we tested here..."

Stanley Wszola
Byte

"... the PMO-650 delivers unparalleled performance..."

John Quain
PC Magazine



TYPE: 3.5" OPTICAL
CAPACITY: 128 MB
SIZE: 6.9" (H) X 2.7" (W) X 8.3" (D)
WEIGHT: 4.11 LBS
MOUNTING: VERTICAL OR HORIZONTAL

First you bought a 40MB hard drive, then an 80MB, stepped up to a 150MB, made the move to a 300MB, and took out a loan to buy a 600MB. It never ends - until today.

Introducing the first line of optical drives that are lightning fast and have unlimited capacity. The PMO-130™ and PMO-650™ are the world's fastest optical drives with performance that rockets past most magnetic hard drives.

NSTL OPTICAL VS. HARD DISK				
Drive Tested	Pinnacle PMO-650™	Seagate® ST4766N 630MB	Fujitsu M2266SA 1.2GB	Maxtor® XT-8760SH 676MB
ELAPSED TIME IN SECONDS				
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

NATIONAL SOFTWARE TESTING LABORATORIES, Inc.

NSTL OPTICAL VS. OPTICAL					
Drive Tested	Pinnacle PMO-650™	Sony® SMO-E502	Maxoptix Tahiti™ II	Hewlett-Packard Corsair™	Ricoh RO-5031E
ELAPSED TIME IN SECONDS					
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

NATIONAL SOFTWARE TESTING LABORATORIES, Inc.

Trademark Owners: PMO-130, PMO-650, OHD, Optical Hard Drive, and Pinnacle Micro are Trademarks of Pinnacle Micro, Inc. ©1992. Trademarks and registered marks to their respective owners. All test results performed by NSTL 8/92. Retail prices acquired from dealer survey 10/92.

19 Technology • Irvine, CA 92718 • Int'l (714) 727-3300 • Fax (714) 727-1913

PEAKS

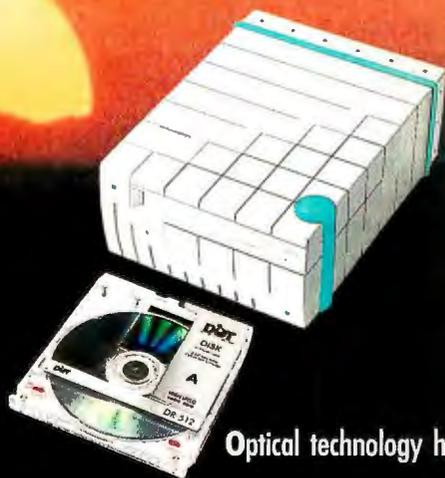
THE LAST DRIVE YOU'LL NEED.

"... the PMO-650 was a veritable rocket."

Christopher Stetson
PC Week

"The PMO-650 is the first rewritable optical drive we've ever tested that can get out and run neck and neck with hard disks"

Rex Farrance
PC World



TYPE: 5.25" OPTICAL
CAPACITY: 650/600 MB
SIZE: 7.3" (H) x 3.6" (W) x 10.0" (D)
WEIGHT: 7.4 LBS
MOUNTING: VERTICAL OR HORIZONTAL

Optical technology has many advantages—removability, reliability, infinite storage capacity, and a lower cost per megabyte over magnetic media. The PMO™ series are based on Pinnacle's own OHD™ (Optical Hard Drive) technology,

making Pinnacle the leader in performance and innovation. There is no higher source in the industry. The PMO-130™ and PMO-650™ are the Twin Peaks. Plug-n-play for PC and compatibles, PS/2, MAC, SUN, HP, DEC, and Silicon Graphics.

It's more than a hard drive - It's optical!

COST PER MEGABYTE COMPARISON

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

(800) 553-7070

PINNACLE MICRO

THE OPTICAL STORAGE COMPANY®

Circle 128 on Inquiry Card (RESELLERS: 129).

More Personal Pathways



Our new design makes it easier for you to find the technical information you expect from BYTE

No, it's not your imagination—this issue of BYTE does look different, and there's a reason for the change. We've redesigned BYTE, and this new design is much more than a simple face-lift to make the pages pretty. Oh, I'll admit, the pages do look pretty, and that's a nice benefit. But the real reason for the change is to improve how BYTE delivers information to you.

The truth is, BYTE has not been very user friendly, and we knew we could do a better job. We needed some help, though, and it came from the two folks I mentioned last month: Richard Saul Wurman and Ken Silvia.

While Wurman stepped in primarily to help us with our new lab reports, his ideas influenced us in many ways. He helped us think like readers and not so much like editors. Sometimes editors forget what it's like to be a reader, and the result is that important information gets buried so deep in an article that you might miss it. Reading BYTE shouldn't be a game of hide-and-seek, so we've made important information obvious. Silvia, our magazine designer, deserves most of the credit. He created the framework that makes it all possible.

The idea is simple: We want to help each BYTE reader find his or her "personal pathway" through BYTE. It all starts with the table of contents. We learned that some people want to read a particular type of article first—review, cover story, feature, or column. So we've organized the table of contents first by section. For readers who are more interested in a particular application, we've added labels to the table of contents to tell you which articles are about spreadsheets, CAD, program development, or whatever application.

We've also included listings and page numbers for individual products in group reviews and for the many text boxes used inside larger articles. For those of you who want to read about specific platforms, we've added a third page to our table of contents that recategorizes major articles by platforms.

The articles themselves are more lively and contain more information than before. (One of the great advantages of our new design is that we're able to fit more words on a page.) BYTE's editors worked hard to break

stories down into logical pieces and, whenever possible, to break those pieces down even further. So you'll see more text boxes and diagrams than ever before. You'll also see a greater use of call-outs and pointers in photos and screen shots to better explain the nuts and bolts of what's happening.

Many articles also have expanded "decks" to help you decide if the article is a must-read for you. If the subject matter is not for you, the deck will have provided you with some useful information, anyway. That's the whole idea—to help you decide which articles to read and to make important information jump off the page.

We've also changed our cover look to accommodate the issue-oriented nature of BYTE's cover stories. There you'll see art and photography play a lesser role than in the past. Instead, you'll see a bold headline with a descriptive deck to better convey what the story is all about. Still, we take the cover art very seriously, and that's why we commissioned Robert Tinney to illustrate this issue's cover. Many of you will remember when every BYTE cover was a Tinney illustration. While we'll still use photos and other illustrators, I'm particularly proud to have Tinney back for BYTE's new design debut.

Perhaps Tinney's art even serves as subtle notice that BYTE is getting back to its roots of being technically authoritative. It's a move that we began over a year ago, and one that you witnessed first in BYTE's cover stories. No other magazine has reverse-engineered low-cost PCs to tell you where manufacturers cut corners. No other magazine has done chip-level compatibility testing to help you decide whether a system really has to have an Intel chip inside. No other magazine has explained the technologies of CD-ROM, smart E-mail, and local-bus architectures at the level of detail as that in BYTE's cover stories. And while marketing-oriented magazines recently touted on their covers why you *must* buy MS-DOS 6, BYTE instead told you how to deal with the more immediate problem of fatware.

You can expect to see more and more of these kinds of stories. And expect to see greater technical depth as BYTE moves closer to its roots of being technically authoritative. Just don't expect BYTE to be dry and boring.

Meanwhile, let me know what you think about the changes.

A stylized, handwritten signature in black ink, consisting of several loops and a long horizontal stroke extending to the right.

DENNIS ALLEN, EDITOR IN CHIEF

OBJECT COMPUTING NOW!



Visual Reality

While the competition plays catch-up, Borland continues to lead with the most graphical C and C++ for Windows, DOS, and OS/2.

A more comfortable place to program

Borland® C++ gives you the most intuitive Integrated Development Environment (IDE) for DOS, Windows, and OS/2.® This ease of use, combined with the fastest C++ compilation speed, means you get your work done faster. And Borland C++ includes time-saving C and C++ code generation and Application Frameworks.™

To set standards you must meet standards

Borland C++ is the only popular compiler that meets the certified ANSI C* and AT&T C++ standards. You can be confident that as the language evolves to make programming easier and more powerful, your Borland C++ code will be ready to take advantage of future versions across all platforms. What's more, applications built

with Borland C++ will deliver faster because you'll have the most advanced features—like templates that make your code smaller, safer, and more reusable.

#1 for real-world application development

With more than one million copies in active use, Borland's C++ is proven, polished, and finely tuned to meet the needs of C and C++ programmers. And Borland has the C++ that's just right for you, from the new Turbo C++ Visual Edition for beginning programmers to powerful Borland C++ for professionals.



Special introductory offer
\$79.95
(regularly \$199⁰⁰)
Offer ends July 31, 1993

90-day, money-back guarantee!
**See your dealer or call now,
1-800-336-6464, ext. 5818**
In Canada call, 1-800-461-3327.

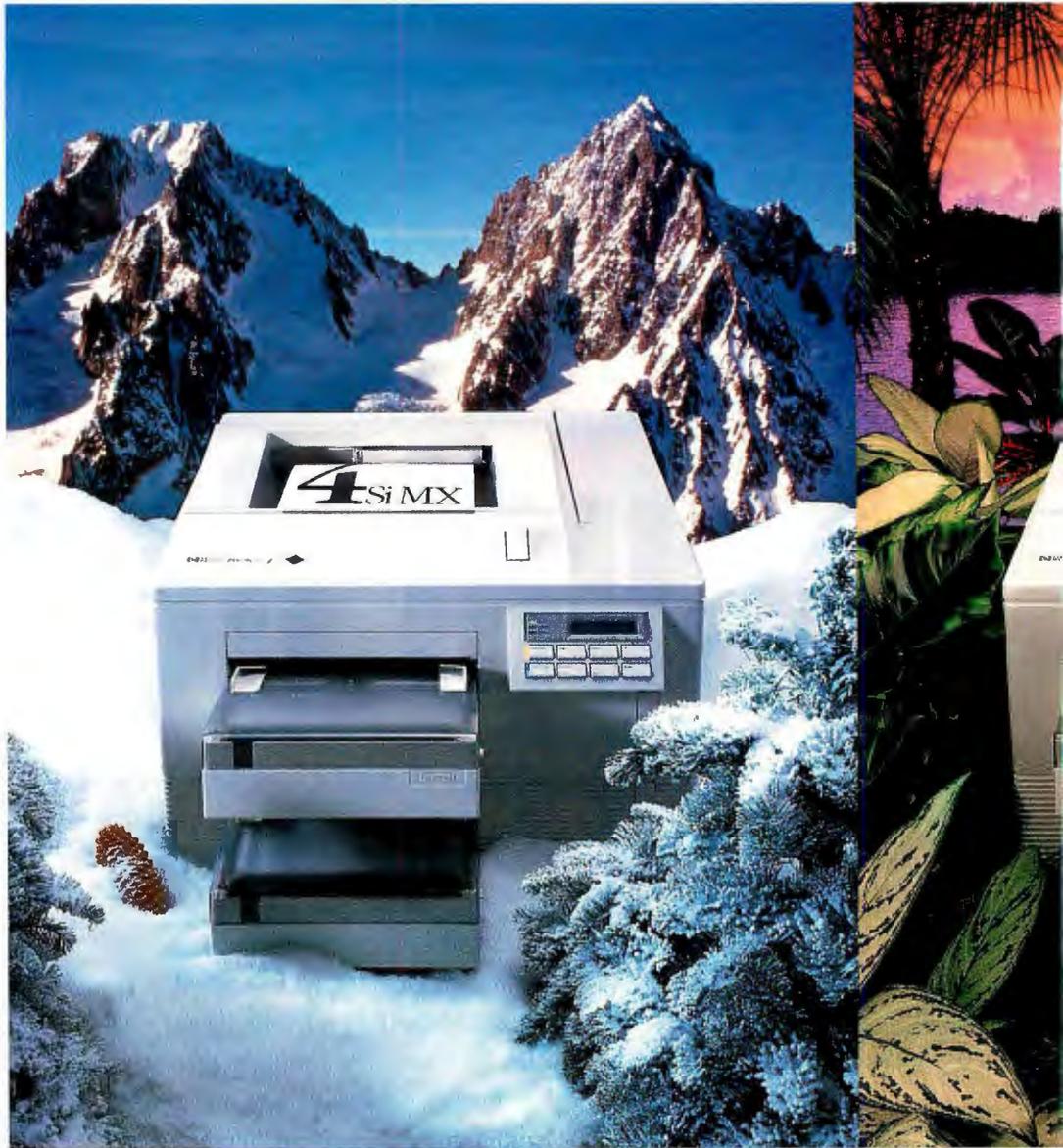
Special introductory offer
\$149.95
(regularly \$495⁰⁰)
Offer ends July 31, 1993

Borland

Power made easy

*ANSI C certified by the British Standards Institute. Copyright © 1993 Borland International, Inc. All rights reserved. All Borland product names are trademarks of Borland International, Inc. Offer good in the United States and Canada only. All prices in U.S. dollars. Dealer prices may vary. BI 5498

Announcing the first network printer



<i>Operating System</i>	<i>Topology</i>
<i>Novell Netware</i>	* <i>Ethernet</i> | <i>802.3</i> <i>Token Ring (4/16 Mbps)</i>
<i>Microsoft®</i>	* <i>802.3</i>
<i>LAN Manager</i>	<i>Token Ring (4/16Mbps)</i>
<i>Windows for</i>	* <i>802.3</i>
<i>Workgroups</i>	<i>Token Ring (4/16 Mbps)</i>
<i>Windows NT</i>	* <i>802.3</i> <i>Token Ring (4/16 Mbps)</i>
<i>IBM LAN Server</i>	* <i>802.3</i> <i>Token Ring (4/16 Mbps)</i>
<i>AppleTalk</i>	* <i>LocalTalk</i> <i>*EtherTalk</i>
<i>HP-UX**</i>	* <i>Ethernet</i>
<i>SunOS**</i>	* <i>Ethernet</i>
<i>Solaris**</i>	* <i>Ethernet</i>
<i>SCO UNIX®</i>	* <i>Ethernet</i>

*Standard in the HP LaserJet 4Si MX printer. **For operating HP-UX, SunOS or Solaris, a one-time purchase of \$199 in configuration software is required. Adobe and PostScript are trademarks of Adobe Systems Inc. which may be registered in certain jurisdictions. Microsoft is a U.S. registered trademark of Microsoft Corporation. UNIX is a registered trademark of UNIX System Laboratories Inc. in the U.S.A. and other countries. †In Canada call 1-800-387-3867, Ext. 7299. ©1993 Hewlett-Packard PE12353

Multiple environments are no longer worlds apart. Even if you have Novell Netware on one network, HP-UX on another and EtherTalk on a third, the new HP LaserJet 4Si MX printer easily connects across platforms. Automatically.

The HP LaserJet 4Si MX printer comes out-of-the-box preconfigured for multiple environments. There's nothing more to do than plug-and-play. All interfaces are simultaneously hot, making switching so seamless, end-users won't even notice.

What's more, HP's LaserJet 4Si MX printer is ready to handle whatever needs come down the

that adapts to multiple environments.



pike. More operating systems? No problem. As your network system continues to evolve, the capabilities of this printer are no longer just impressive. They're indispensable.

The HP LaserJet 4Si MX printer is loaded with features that define state-of-the-art. HP's enhanced PCL5 and genuine PostScript™ Level 2 software from Adobe™ come standard. Printer environments are saved while switching. Setup is a cinch with network software utilities and drivers included in the box. And, if you need any reassurance about trouble-free operation, you have it in our Simple Network Management Protocol (SNMP) support.

At 17 ppm, this is the fastest LaserJet ever, with I/Os and RISC-based formatter capabilities matched to support its speed. It delivers impeccable 600 dpi print quality—thanks to HP's microfine toner and Resolution Enhancement technology. Plus, it comes standard with two 500 sheet input trays.

But what if you don't need the full capabilities of the HP LaserJet 4Si MX printer right away? HP offers another printer that's probably a perfect fit. The HP LaserJet 4Si printer delivers the identical 17 ppm performance and superb 600 dpi print quality. It also has room to grow. The two MIO expansion slots let you add

HP JetDirect network interface or third party cards. And you can add on Adobe's genuine PostScript Level 2 software and SIMM memory modules, as you need them.

To find out more about the multiple-network HP LaserJet 4Si MX printer and the upgradable HP LaserJet 4Si printer just call 1-800-LASERJET, Ext. 7299.† Capabilities this advanced make a world of difference—in any environment.

 **HEWLETT
PACKARD**

Circle 91 on Inquiry Card.

EDITOR IN CHIEF

Dennis Allen

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,
 David L. Andrews, Carol Swartz
 Researcher: Martha Hicks
San Mateo/West Coast:
 Bureau Chief: Andrew Reinhardt
 Senior Editor: Tom Halfhill
 News Editor: Patrick Waurzyniak
 Editorial Assistant: Barbara J. Caravello
Los Angeles:
 Senior Editor: Gene Smarte
New York:
 News Editor: Ed Perratore

BYTE LAB

Director: Stephen Apiki
 (also: systems, networking)
 Technical Director: Rick Grehan
 Senior Editor: Alan Joch
 Technical Editor: Stanford Diehl: software,
 add-ins, peripherals, multimedia
 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

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

EDITORIAL ASSISTANTS

Office Manager: Peggy Dunham
 Assistants: Linda C. Ryan, June Sheldon,
 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
 Scheduling Manager: Wai-Chiu Li
 Operations Assistant: Lisa Jo Steiner

FINANCE

Senior Financial Analyst: Kenneth A. King
 Financial Analyst: Kathleen Degulise
 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: Julia Perron
 Copyrights Manager: Faith Kluntz
 Reader Service: Cynthia Sands
 Marketing Events Coordinator:
 Carol Sanchioni

CIRCULATION

Director: Glyn Standen
 Subscriptions Manager: Paul Ruess
 Assistant Manager: Lynn Lagasse
 Subscriptions Assistant: Christine Tourgee
 Newsstand Manager: Vicki Weston
 Assistant Manager: Karen Desroches
 Back Issues: Louise Menegus
 Direct Accounts Coordinator: Ellen Dunbar
 Telephone Sales Representative:
 Ellen Beguin

PUBLISHER

Ronald W. Evans

Publisher's Assistant: Donna Nordlund

ADVERTISING SALES

NEW ENGLAND
 David Richardson (617) 860-6344
 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 Echavarria (603) 924-2574

MIDWEST

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

SOUTHWEST, ROCKY MOUNTAIN

Jennifer Walker (214) 701-8496
 Brian Higgins (603) 924-2651

SOUTH PACIFIC

Beth Dudas (714) 753-8140
 Joseph Mabe (603) 924-2662
 Alan El Faye (213) 480-5243
 Brian Higgins (603) 924-2651

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 Echavarria (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) 924-2658

HARDWARE/SOFTWARE SHOWCASE

Elen Perham (603) 924-2596
 Mark Stone (603) 924-2695

REGIONAL & BUYER'S GUIDE

(603) 924-2518

BYTE DECK

Brad Dixon (603) 924-2596

EURO-DECK

James Bail (603) 924-2533

INTERNATIONAL ADVERTISING SALES STAFF

See listing on page 269.

PERSONNEL

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

How to Contact the Editors

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

MAIN OFFICE: One Phoenix Mill Lane,
 Peterborough, NH 03458, (603) 924-9281.

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 Hatfield 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 uunet, 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, copyrights manager, at (603) 924-
 2525. (Minimum quantity: 500.)

Subscription Customer Service

Inside U.S. (600) 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, £42 (US\$60) for fast
 surface delivery, £55 (US\$80) for air delivery.
 Non-European countries US\$60 for surface
 mail, or US\$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 4EU, U.K.

 Copyright © 1993 by McGraw-Hill,
 Inc. All rights reserved. BYTE and
 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
ToJery Exchange: Jerry Pournelle
WIX Exchange: Karen Kenworthy
Writers Exchange: Wayne Rash Jr.

DIRECTOR OF COMPUTER-RELATED SERVICES

Stephen M. Lallberte

MEMBER SERVICES MANAGER

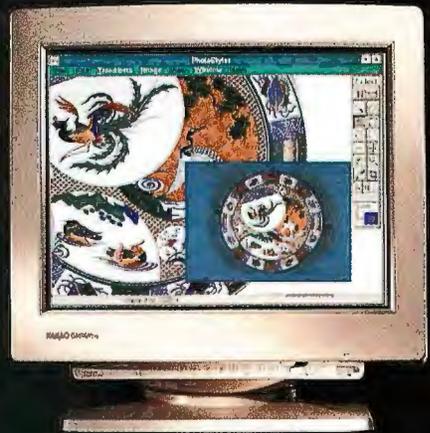
Kevin Plankey

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; Vice President/Group Publisher, Computer Magazines: Fritz Landmann.

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



© 1993 NANA O U.S.A. CORPORATION. All product names are trademarks of their respective companies.

SUPERIOR DISPLAYS ARE PART OF OUR HERITAGE.



June 30, 1992
FlexScan F550i



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 F340iW

NANA O®

Superior in every detail™

NANA O U.S.A. CORPORATION

23535 Telo Avenue, Torrance, CA 90505
(310) 325-5202

1-800-800-5202

Circle 116 on Inquiry Card (RESELLERS: 117).





**TO DESIGN OUR
NEW MOUSE, WE
STARTED BY
READING PALMS.**

In relentless detail, we studied hands of all dimensions.

We consulted professors of kinesiology, engineers, ergonomists and computer users. We used digital fiber optics to analyze the human hand. We followed it in motion.

The result is a new Microsoft® Mouse that is, well, anatomically correct. Uncommonly comfortable.

The palm is perfectly supported. Left or right handed, the grip is comfortable. Fingertips fall naturally into place. A click feels just right.

This mouse even looks good. Intriguingly asymmetrical. Yet it somehow reminds you of the gentle curves of a human form.

Did we mention that it also has some innovative new software features? They allow you to customize the mouse, so it works the way you like to work.

Try the new Microsoft Mouse. If you're not comfortable, we'll refund your money. Guaranteed. Details are on the box, which you can quickly get your hands on at a computer store near you.



Microsoft
Making it easier

Smarter E-Mail

The article "Smarter E-Mail Is Coming" in the March issue was very interesting. The example of E-mail-based expense reporting was of particular interest to me. I had just returned from a trip and prepared and signed my expense report on a Monday. On Thursday, I was notified via E-mail that within two working days the reimbursement would be deposited in my checking account.

We use a spreadsheet to prepare the expense report and print it. However, the report must be signed by the individual and a manager for payment to happen, and the appropriate receipts *must* be attached. Receipts are verified against what is listed. This has not yet been worked out for electronic means.

In your example, you had checks written. What happened to direct deposit? Let's go all the way.

Fred Stone
Orlando, FL

Please forgive my lack of knowledge, but in "Smarter E-Mail Is Coming," does the acronym API stand for application programming interface? This was a little amusing to me, because the sentence before the one that contained API referred to the "confusing alphabet soup of E-mail acronyms."

Perhaps for us novices, you should include a glossary in the back of the magazine of the more common acronyms not defined in the articles.

Bruce J. Benedict
Lynchburg, VA

"Application programming interface" is correct.—Eds.

A Taxing Review

Your cover proclaims BYTE to be "The Worldwide Computing Authority," and the March editorial mentions BYTE's recent "globalization." Given that, shouldn't your recent article on tax-preparation software ("How to Deal with Taxing Questions," March) have been described as "U.S. tax-preparation software for DOS, Windows, and the Macintosh"?

Paul Clapham
Vancouver, British Columbia, Canada

Computing in Italy

I was pleased to read "Computers Italian Style" (February). We have little software in the major applications areas. This is surely connected with having many small companies and few medium and large ones in the field.

As for piracy, it's here, and it's here to stay. A lot of users simply don't think computer programmers have to eat! The Business Software Association is doing a good job, but the real problem is that we lacked a law on software piracy until last December. Almost every European country had such laws long before Italy. On the other hand, "miracle" laws don't exist, so we must work harder to defeat pirates.

Daniele Russo
Catania, Italy

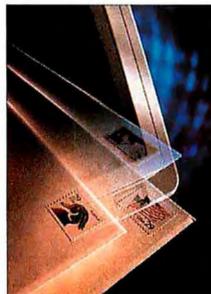
Faster Macs

Rick Grehan's accelerator-board roundup ("New Tricks for Slow Macs," February) offered a promising introduction to accelerator-board upgrades, but it includes misinformation regarding available options. Extreme Systems submitted its Impact 030 (for the Mac LC, Mac LC II, and Performa 400) and the 50-MHz Vandal (for the Mac SE). The Vandal, which offers substantial speed increases and large-screen video support, was omitted from the review. Installing Vandal would have caused Mr. Grehan to rethink his statement that "installation [of accelerator boards] can be an ordeal."

While the author brought up pertinent issues surrounding accelerator boards, he neglected to address power consumption. Excessive power consumption can wreak havoc, particularly on Mac LC and LC II systems. Apple's guidelines for the LC and LC II specify no more than 4 W.

The author recommended only one accelerator board. This is rather limiting, since the article discusses accelerator-board options for several Mac platforms. A recommendation for each category would have been more appropriate.

Steve Snyder
Director of Sales and Marketing
Extreme Systems
Tukwila, WA



We'd like to test every version of every accelerator board, but time and space considerations make that impossible. Perhaps in a later review we'll have the opportunity to examine the 50-MHz version of Vandal. The version of Vandal we did test didn't end up in our recommendations, but it did perform well overall.

My comments in the Action Summary "Dislikes" section may not have been clear. My point is that installing any board inside a Mac SE, Plus, or Classic is an ordeal. The difficulty in doing so is a function of the computer's construction, not of the accelerator-board design.

Your recommendation on adding power requirements is a good one. Thanks for your input.—Rick Grehan

Windows Bias

I am unhappy with the editorial policy outlined by Dennis Allen (see "The State of BYTE," March). I believe that you are demonstrating an excessive and uninteresting focus on Microsoft products, particularly Windows.

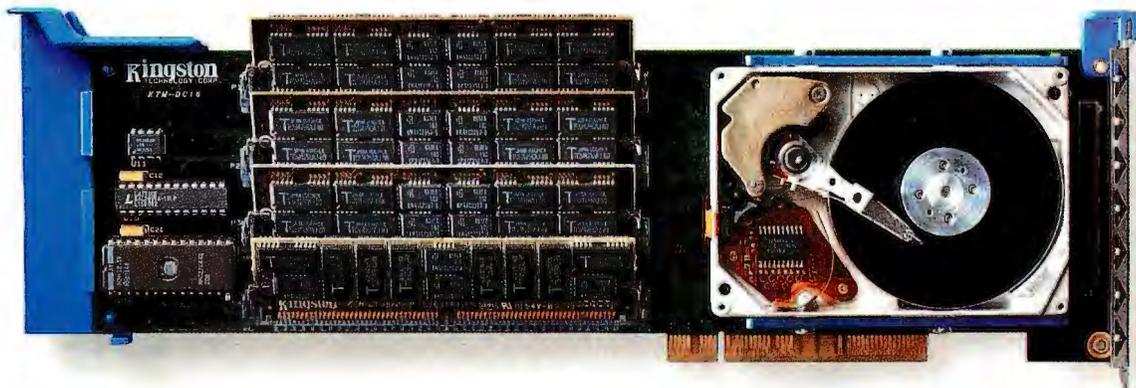
I use Macintosh, DOS, and OS/2 products extensively. I am interested in PenPoint, GEOS, Solaris, and even Windows NT, in moderation.

If I want to read about Windows, I can pick up any one of dozens of periodicals. I am not looking forward to two special Windows issues. Please reconsider your decision.

John Faughnan
Escanaba, MI

I appreciate your comments on this issue. Our Windows issues are extra issues—they are not part of our regular monthly editorial schedule—that allow BYTE to quickly cover this exploding market. It has never been our intent to focus BYTE's regular issues exclusively on Windows. BYTE will continue to cover a wide spectrum of computing platforms.—Dennis Allen

We want to hear from you. Address correspondence to Letters Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458, send BIX-mail c/o "editors," or send Internet Mail to letters@bytepb.byte.com. Letters may be edited.



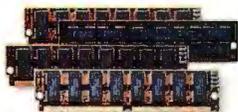
WITH BOTH STORAGE AND MEMORY, DATACARD IS THE SWISS ARMY KNIFE OF MICRO CHANNEL BOARDS.



DataCard Micro Channel Storage and Memory Upgrade.
DataCard is available with 85, 127 or 209MB of bootable 16 millisecond access storage plus four SIMM sockets that accommodate up to 64MB of system RAM. It's all the storage and memory needed for Windows or OS/2 for as little as \$545 suggested retail.

Multi-Function Expansion Slot Utilization.

DataCard features four IBM-standard SIMM sockets for up to 16MB in 16-bit systems or 64MB in 32-bit systems. Existing memory cards can be depopulated and replaced with DataCard.



Kingston Reliability.

DataCard users enjoy the same reliability customers have come to expect from Kingston memory and processor upgrades. Every product is individually tested prior to shipping and supported by free comprehensive technical assistance. DataCard is backed by a five-year warranty; the on-board drive is warranted for two years.



Turn Your PS/2 Into a Graphical Workstation.

Most PS/2 systems don't have nearly the storage or system RAM that graphical computing requires. DataCard is the complete solution to OS/2 and Windows hardware problems all on one Micro Channel card.

More Information.

If DataCard sounds like the storage and memory solution for you, contact your nearby Kingston dealer or call us at (800) 835-6575. We'll be happy to answer your questions about DataCard or

[800]

any of our other 625 upgrade products.



Individual Product Testing.

Every product is bench tested in the system for which it was designed. Testing with original equipment manufacturer system diagnostics assures absolute compatibility. This rare commitment to quality control leads to many years of reliable service.



THE INSIDE NAME IN UPGRADES

17600 Newhope Street, Fountain Valley, California 92708 (714) 435-2600 Fax (714) 435-2699

All Trademarks and Registered Trademarks are of their respective holders. Kingston and Kingston Technology are Registered Trademarks of Kingston Technology Corporation

Circle 103 on Inquiry Card (RESELLERS: 104).

BUY THE WRONG RISK LOSING MORE

When it comes to finding the best server, you not only need great performance at a great price, you need the most reliable, easy-to-manage system you can find.

After all, a single server nightmare can turn what looked like a good investment into a costly mistake.

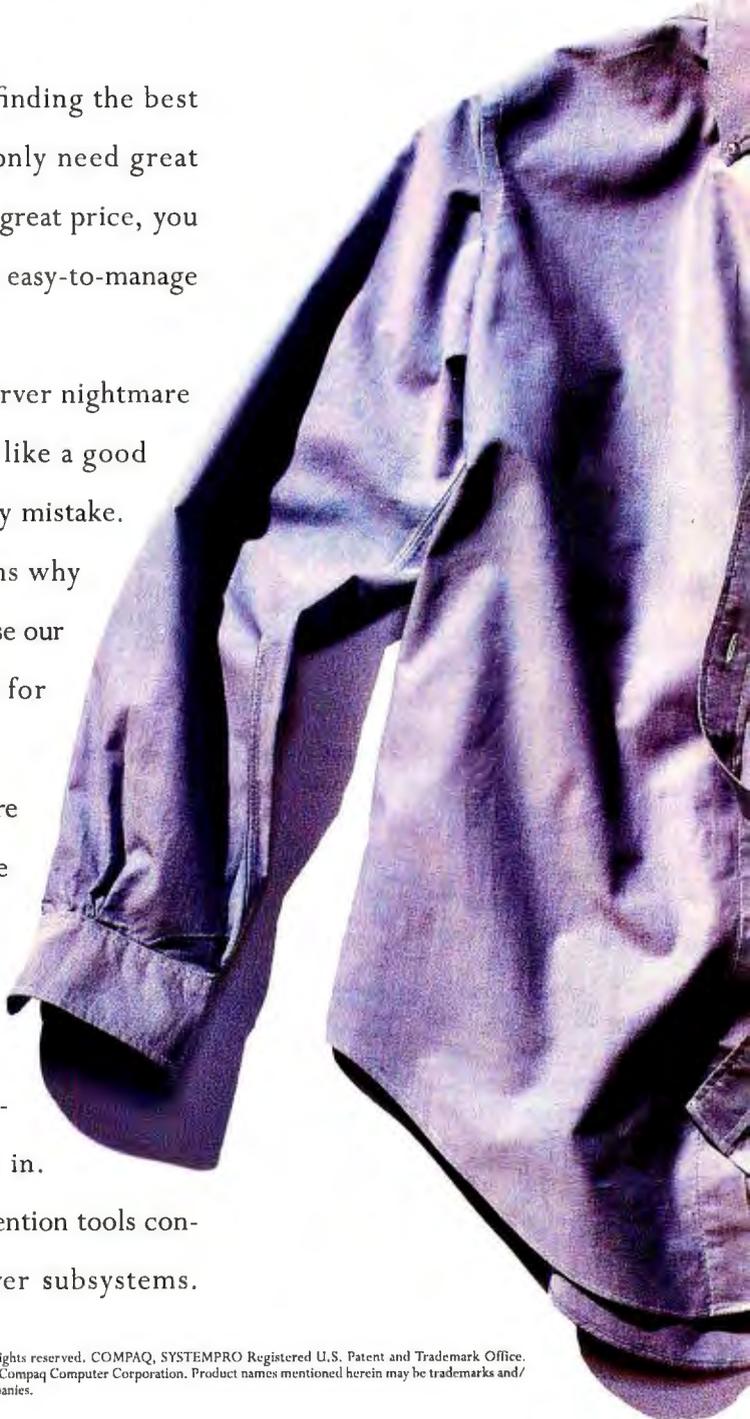
All of which explains why LAN Times readers chose our servers over all others for the third year in a row.

Because not merely are our servers leading the industry in price and performance, they're also the only servers with complete management capabilities built in.

Integrated fault prevention tools continually monitor server subsystems.



Using the latest processors, COMPAQ ProSignia and SystemPro/XL deliver industry-leading performance based on industry-standard benchmarks.



SERVER AND YOU THAN JUST YOUR DATA.



The COMPAQ Insight Manager then takes that information and alerts you to fluctuations, so you can avoid downtime. You can even program COMPAQ servers to reboot automatically, or to contact you off-site so you can diagnose and reboot from your location.

So while others may suggest they offer close to COMPAQ performance based on their own fabricated benchmarks, you'll never hear them claim to have a more reliable, easier to manage system.

Because they don't. Not IBM. Not Dell. Not anybody.

And in the end, that will save you a lot more than an occasional headache. For more information, and a free Novell Guide to NetWare 4.0, call 1-800-638-8258, ext. 45.



COMPAQ servers—and only COMPAQ servers—alert you to hardware problems before they become problems, allowing you to troubleshoot and avoid network downtime.



When you build more reliable products, you can offer a more extensive guarantee. Every COMPAQ server includes our free 3-year, on-site warranty.*

COMPAQ

*This service provided by Contracted Service Providers and may not be available in certain geographic locations. Certain restrictions and exclusions apply. Monitors, battery packs and certain options are covered by a one-year warranty. For further details on our limited warranty, contact the Compaq Customer Support Center. The Intel Inside logo is a registered trademark of the Intel Corporation. LAN Times Readers Choice Award 1991, 1992 and 1993.

News & Views

SPREADSHEETS

Lotus Takes Another Run at Windows

Lotus 1-2-3 release 4 for Windows packs more punch than the previous version and should challenge Microsoft Excel

NICHOLAS JOHN DELONAS

Lotus 1-2-3 release 4 for Windows (\$495) is a major upgrade that, based on the prerelease software I evaluated, may help Lotus 1-2-3 make up ground on Microsoft Excel, which now dominates the Windows spreadsheet market. Even though many of the improvements are features that should have been there in the first place, Lotus 1-2-3 release 4 for Windows isn't merely a catch-up product. It offers several outstanding capabilities that you won't find in other spreadsheets.

The most interesting new feature is Version Manager, which lets users and groups of users store different versions of a worksheet in the same file. The capabilities introduced in the Version Manager dialog box are exciting. In fact, Version Manager alone might justify choosing 1-2-3 over Excel or Quattro Pro for Windows. (See the text box "Infinite What-If Scenarios" for a more detailed look at Version Manager.)

When it comes to matching the major features found in Excel and Quattro Pro for Windows, release 4 does a good job. Lotus 1-2-3 now feels more like

a real Windows application, and less like a product that was quickly ported from DOS. For example, you can select whole columns and rows by clicking on the worksheet frame. There's also a draw layer that lets you add arrows, lines, and so on over the worksheet and any embedded graphical objects. A click of the left mouse button selects any such object or a range of cells. A click of the right mouse button pops up a short-menu dialog box, letting you make quick changes appropriate to your current selection.

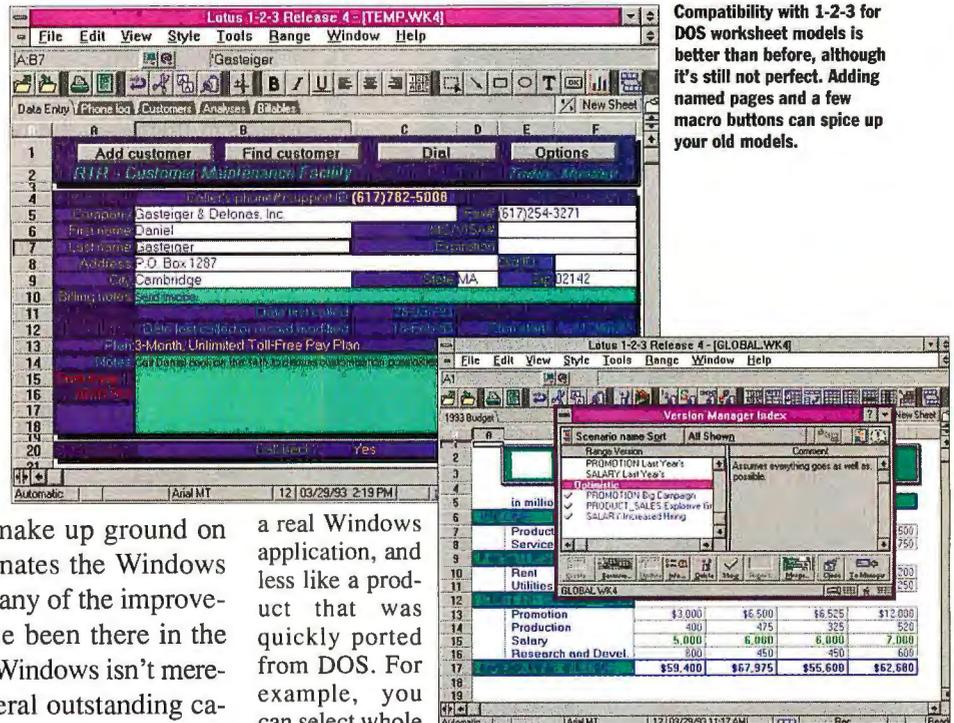
The new release for Windows also offers in-cell editing, one-step charting, on-the-sheet

chart editing, and a great "live" status bar (similar to the one found in Ami Pro) at the bottom of the screen that shows the current status of highlighted cells. In short, release 4 feels like it was meant to be a graphical spreadsheet.

Help for Macro Writers

Release 4 lets you add macro buttons to the worksheet, and you can choose from 250 new macro commands. Lotus has also added 110 new calendar, database, engineering, financial, logical, informational, lookup, mathematical, and statistical @functions. Lotus 1-2-3 now supports both client and server OLE and the ODBC

Compatibility with 1-2-3 for DOS worksheet models is better than before, although it's still not perfect. Adding named pages and a few macro buttons can spice up your old models.



Version Manager let me switch with ease between pessimistic and optimistic forecasts in this projected income statement.

(Open Database Connectivity) standard, which makes it easier for it to work with other applications.

For less-experienced users, many new features make release 4 accessible. Menus, SmartIcons, and dialog boxes are more context-sensitive than in the previous release, and there's even an animated on-line tutorial.

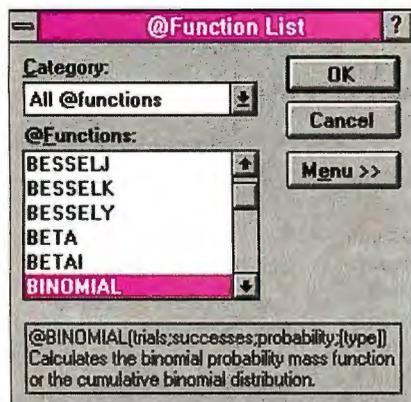
Have you forgotten the name of an @function or the

NEW FEATURES

- Version Manager
- In-cell editing
- Live Status Bar
- Support for OLE and ODBC
- Easy access to external data

order of the arguments? No problem. Just click on the @function SmartIcon to select from a pull-down list.

Have trouble understanding



The @function SmartIcon displays a dialog box that lets you peruse a list of @functions. Once one is selected, Lotus 1-2-3 release 4 for Windows walks you through the entry of the @function's arguments.

1-2-3's 3-D architecture? Take a look at what may be the best new ease-of-use feature—worksheet tabs. These tabs are analogous to the tabs you find in a file cabinet. They let you navigate between worksheets intuitively and assign meaningful names to those sheets, so you can easily see where you're going. Unfortunately, you can't drag and drop whole sheets, as you can in Quattro Pro for Windows. Even so, the new tabs are a welcome addition to 1-2-3.

Lotus 1-2-3 for Windows

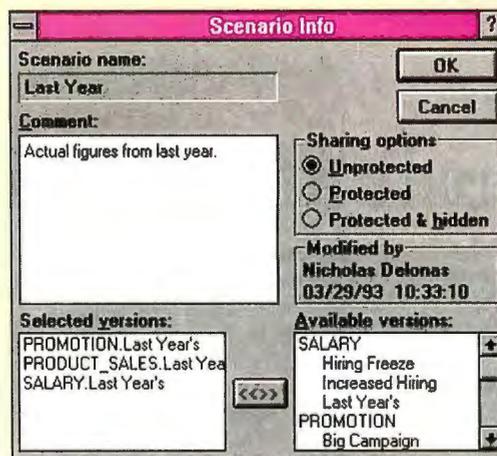
has always had more powerful database features than Excel or Quattro Pro, and now these features are also easier to use. There's no longer any need to create a criteria range in the spreadsheet. Instead, you specify criteria via simple dialog boxes. The process of connecting to external data is much easier than before. There's still one glaring deficiency, though: the lack of an external data browser.

The Big Picture

Other new features in release 4 include more flexible print compression to let you fit more of your spreadsheet on a single page, a spelling checker, mail-enabling capabilities, spiffy designer frames for boxing data, and a new file format (.WK4) to hold all these features in a single file. Although it's risky making recommendations based on beta software, Lotus 1-2-3 release 4 for Windows looks like a clear winner that should excel in the Windows spreadsheet market.

Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
(800) 343-5414
(617) 577-8500

INFINITE WHAT-IF SCENARIOS



You can create any number of complex scenarios. To create a scenario, you select from the list of available versions.

The idea behind Version Manager is simple enough. A *version* is a named data set that you can bring into a worksheet range as needed. For example, suppose you have a range named "revenues" that holds projected gross income for the coming year. You could enter one set of pessimistic data and name it "Pessimistic." Then you could enter optimistic data and name it "Optimistic." To switch between versions, you need only call up Version Manager and select the data set you want from a pull-down list.

Version Manager is great for what-if analyses and testing various scenarios. Better yet, Version Manager can manage the shared use of a single worksheet file. For example, a workgroup might work on a single budgeting model. Lotus 1-2-3 automatically stores each person's contribution as a time-stamped version and keeps track of who contributes what by storing each user's ID with that version. This eliminates the need to roll up data from various departments. To provide security, Version Manager automatically searches for the most authenticated name and ID (for Notes, cc:Mail, network log-on, or user supplied) it can find.

Finally, Version Manager lets you combine any number of versions into scenarios. For example, you might create a scenario called "Best Possible," which would include best-case versions of both revenues and expenses. This approach is definitely easier than Excel's Scenario Manager, and it's more powerful, too.

PRODUCT WATCH

Lotus Notes: The Next 1-2-3?

By the time you read this, Lotus should have released Notes 3.0, which the company hopes will do for groupware what Lotus 1-2-3 did for spreadsheets. The new Windows version of 1-2-3 could help Lotus improve its market share in the Windows spreadsheet category, which analysts say is currently dominated by Microsoft Excel for Windows. But Lotus officials admit that the spreadsheet category is a more mature market than that of groupware, thus offering less opportunity for growth. "In some of the more mature product areas, you'll do feature-leaping," Brenda Kelly, product marketing manager for Notes, says. "In a category such as Notes or groupware, what you're really doing is helping people understand the value,

the return on investment."

To help get the word out on Notes 3.0, Lotus created the Notes Open Education Program to expand the availability of Notes application development, installation, and administration training. Fifteen independent Notes training centers are scheduled to open in the U.S. this summer, with an equal number slated to open in Europe.

At the Notes 3.0 rollout, Lotus officials said that where 1-2-3 was the strategic product for the company in the 1980s, Notes will be its strategic product in the 1990s. Unlike 1-2-3, which was an instant money-maker, Notes, which was first introduced in 1989, has not yet generated a profit as a product.

— Dave Andrews and Dom Pancucci

NOTES 3.0

- Support for Mac, OS/2, and Windows clients
- Notes Server for Windows
- Remote administration
- Integration with 1-2-3 for Windows release 4's Version Manager
- Support for OLE
- Relational database queries from within Notes
- Support for Mac AppleTalk, OS/2 AppleTalk, Novell IPX/SPX, TCP/IP, X.25 Connect, IBM SNA, DECnet Pathworks, NetBIOS, and Vines
- Unix client and server, NetWare server due by the end of the year
- Windows NT version for Intel PCs in 1993 or 1994

LONDON

Amstrad's Affordable Pen Package



The Pen Pad weighs less than a pound and is solely pen-operated, with no external (or emulated) keyboard option.

U.K. computer maker Amstrad showed its Pen Pad PDA600, a PDA (Personal Digital Assistant) that may beat Apple's Newton, Tandy/Casio's Zoomer, and others to the punch by many months, and possibly by many dollars. The Pen Pad should now be on sale in the U.K. and worldwide for £299. Although no dollar price was announced, Amstrad's chairman Alan Sugar suggested that \$399 was the price he'd like to see.

The Pen Pad runs proprietary operating-system software developed by Amstrad and the

Eden Group, the U.K. electronics firm that also designed the hardware. An intuitive user interface is based on a Filofax page metaphor, which is similar to PenPoint from Go Corp., where you select functions with the pen by touching 12 icons around the page border. No menus are used. The software supports English, Spanish, German, French, and Italian.

Built-in applications are an address book and phone dialer, a diary/time manager, a to-do list, a world clock, a calculator, a scribble notepad, and a unit converter that supports

both built-in and user-defined functions. All applications except the notepad recognize handwritten characters for input, although you must enter characters singly into boxes. When you switch

on the Pen Pad, you train the character recognizer by writing out the alphabet. You can also retrain individual characters on the spot whenever a misrecognition occurs. Only one person's handwriting library can be stored at a time, lending a literal sense to the word *Personal* in PDA.

Rather than adopting a 32-bit RISC CPU, Amstrad/Eden has opted for a less-expensive but effective approach. The Pen Pad employs three 8-bit microcontrollers (Z80-compatible, mask-ROM devices from Siemens) as CPUs: one devoted to power management, one to character recognition, and one to data processing. Applications programmers will write to a function-call API that hides the details of this multiprocessing.

Amstrad is aiming the Pen Pad at the lower end of the PDA market. Sugar acknowledged that his competitors will soon offer higher-tech PDAs with built-in radio communications and other features that the Pen Pad lacks. But the affordable Pen Pad is here now, and it works.

—Dick Pountain

UPDATE



HP 100LX Computer

Hewlett-Packard recently updated its two-year-old HP 95LX hand-held computer with a new PC-compatible palmtop computer, the HP 100LX (\$749). While the new system features an improved screen and new or improved bundled applications—most notably Lotus's cc:Mail and a graphical PIM (personal information manager) written by HP—it sports the same form factor as the 95LX.

The 11-ounce 100LX has MS-DOS 5.0 in ROM. It bundles Lotus 1-2-3 release 2.4. The 100LX uses an Intel 7.91-MHz 80C186 microprocessor, which HP says offers 50 percent more speed than its predecessor. The 100LX's new screen has an enhanced 80-column by 25-row, CGA-compatible LCD with a zoom feature that lets you see the entire document page viewable on a desktop PC.

The 100LX features a new PCMCIA 2.0 plug-in slot for adding flash-memory cards or modems.

—Patrick Waurzyniak

HANNOVER, GERMANY

Apple's Newton Will Debut This Summer

Apple's Gaston Bastiaens bets his wine cellar on the Newton's shipping this summer.



At the CeBIT computer show, Apple Computer announced that its long-awaited PDA will be available this summer. When asked whether this projected delivery date would be more realistic than Apple's previous estimates, Gaston Bastiaens, general manager of Apple's PIE (Personal Interactive Electronics) Division, said, "I bet my wine cellar on this, and it's a great wine cellar."

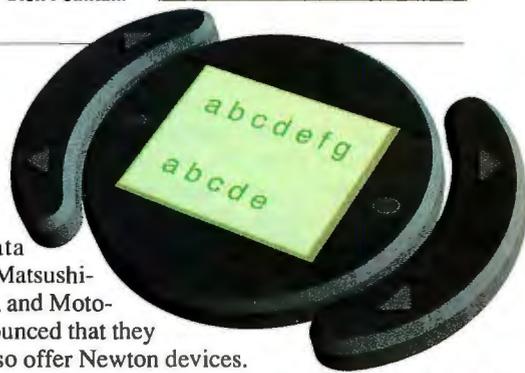
Apple's Newton will be but the first of a family of similar devices with varying sizes and capabilities available from several vendors. German electronics giant Siemens AG announced a version of the Newton called Notephone, which will include a cellular telephone and

a fax/data modem. Matsushita, Sharp, and Motorola announced that they would also offer Newton devices.

Apple sees a range of Newtons with various sizes of LCD screens. The products include an educational toy, a small "inventory watch" worn like a wristwatch, and an architect's sketch pad with a large screen. Apple says the wide range of possibilities is due to the low cost of the Newton's processor, the ARM610.

The Newton will take on a variety of forms and functions.

—Rich Malloy



BREAKTHROUGH!

Client/Server SQL Database for Windows Applications



WATCOM™ SQL for Windows is a high-performance SQL database engine for Windows applications. The package includes everything required to begin using WATCOM SQL immediately from many popular Windows applications, supporting interfaces ranging from ODBC and DDE to the Windows clipboard. Everything necessary for application development in C/C++ (using compilers from WATCOM, Microsoft or Borland) is also included.

Installation in Under 10 Minutes The easy installation and setup reduce the time and expense traditionally required by client/server technology. Further, WATCOM SQL lets you achieve high performance results right out of the package without the need for performance setup and tuning by expert personnel.

Performance and Reliability WATCOM SQL's cost-based query optimizer and efficient data representation combine to deliver high performance. Transaction processing and declarative referential integrity protect the consistency of your data. The client/server architecture reduces network traffic, resulting in increased performance for your multi-user applications.

Scalable SQL for Now and the Future WATCOM SQL applications can be designed to run without change in environments ranging from standalone PCs to large multi-user networks. The 32-bit WATCOM SQL Network Server Edition unleashes the power of 386/486 PC's to deliver high performance for large networks with many clients.

The Best Value in SQL Database Engines WATCOM™ SQL for Windows has a suggested retail price of \$795* but for a limited time you can get it at the introductory price of only \$395*. Even better, as a registered user of WATCOM SQL you'll be able to get a copy of the 6-user Network Server Edition for only \$99* (Suggested retail price: \$795*).

Royalty-Free Runtime for only \$99* As a registered user you can get royalty-free runtime support for just \$99*, enabling you to distribute our standalone single-user runtime SQL database engine with your applications royalty-free.

Highlights

- ▶ ODBC Level 2 support
- ▶ Built-in declarative referential and entity integrity
- ▶ Visual Basic Interface
- ▶ Bi-directional, scrollable, updatable cursors
- ▶ Row-level locking
- ▶ ANSI SQL and IBM SAA compatible
- ▶ Full transaction processing support with checkpoint log and forward transaction log
- ▶ Multiple simultaneous application connections
- ▶ Symmetric multi-threading of concurrent requests
- ▶ Import data from popular file formats including DBF
- ▶ Automatic use of expanded and extended memory to improve performance
- ▶ Static and dynamic embedded SQL interface for use with WATCOM's 16 and 32-bit C/C++ compilers, and other popular C/C++ compilers

Also available:

WATCOM™ SQL Developer's Edition for DOS
Complete Client/Server Development Tools Package for DOS including Standalone Single-user SQL Database Engine. Enables development and deployment of single-user standalone applications, and development of applications for use with the WATCOM SQL Network Server Edition.

WATCOM™ SQL Network Server Edition
High-performance Multi-user SQL Database Server for PC LANs. Supports multiple concurrent DOS or Windows clients in a network environment.

WATCOM

1-800-265-4555

The Leader in Development Tools

WATCOM, 415 Phillip Street, Waterloo, Ontario, Canada, N2L 3X2: Telephone: (519) 886-3700, Fax: (519) 747-4971. *Prices do not include freight and taxes where applicable. Authorized dealers may sell for less. WATCOM, and the Lightning Device are trademarks of WATCOM International Corporation. Other trademarks are the properties of their respective owners. Copyright 1993 WATCOM International Corporation.

Circle 155 on Inquiry Card.

Read my

PC
MAGAZINE

EDITORS' CHOICE

Couple its outstanding overall performance with a true optical resolution of 400 dots per inch, an excellent scanning software package (*DeskScan II*), and HP's well-earned reputation for solid, reliable products, and you have a winning combination.

It's blazingly

THE BEST
HARDWARE
& SOFTWARE
OF THE YEAR.

PC Magazine Labs' preference between the every test. In line-art the **HP ScanJet IIc** seconds, while five 115 seconds or more.

In general, you twice as long for a coarse scale. With a fast scanner, the set up to color more.

...top scoring product...

Publish

'92

READERS' CHOICE
AWARD

SUPERIOR PERFORMANCE

The ScanJet IIc performed well during all phases of PC Magazine Labs' testing. In terms of speed, this scanner led the field, ranking first in two of five speed trials and best overall. Some scanners,

as a whole, and a street price as low as \$1,450, and it's hard to imagine a better buy.

An excellent choice for any PC desktop

clips.

...y fast!

...scanner excellence), only one--
Hewlett Packard's ScanJet IIC
excelled in both categories.

...g showed considerable dif-
ference between the fastest and slowest machines on
the market. At 300 dpi, for instance,
HP ScanJet IIC scanned our text page in 22
seconds. Its competitors required
30 to 60 seconds to complete the same task.
You can expect to wait roughly
twice as long for graphics scale as for gray-
scale. However, this difference might
be a minute or so. With a slow scan-
ner, it could cost you 2 minutes or

PC
MAGAZINE
EDITORS'
CHOICE

April 14, 1992
HP ScanJet IIC

...has made scanning as simple as possible.

GRAPHICS

COLOR FLATBED SCANNERS

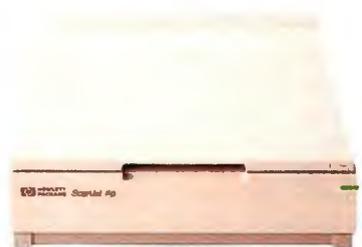
...but Hewlett-Packard Co. has gone
so far to make the ScanJet IIC an
enticing buy, no matter what the
application.

Past HP scanners have

PC Computing
MVP
WINNER



HP ScanJet IIC



HP ScanJet IIP

We'd hate to brag. So we'll let the PC press do it for us.

Both *PC Magazine* and *Publish* called the HP ScanJet IIC the *Best Color Scanner* for 1992. While *PC Computing* named the black & white/gray-scale HP ScanJet IIP the *Most Valuable Product* of the year.

Speed. Simplicity. And accuracy were all applauded. It's no wonder. HP's single-pass scanning delivers both lightning-fast speed and precise color registration. TWAIN support allows scanning without having to switch between applications. And HP AccuPage technology with 400-dpi resolution can tackle the toughest OCR challenges. What's more, capabilities this advanced are now even more affordable. List price on the HP ScanJet IIC has just dropped to \$1,599. The HP ScanJet IIP is just \$879.

Impressed? Don't just take our word for it, or even the PC press's. Attend one of our scanning seminars that will be held April through September, 1993. To find out more about the HP ScanJet IIC and IIP or seminars in your area, call 1-800-SCANJET, Ext. 7365*. And judge for yourself.



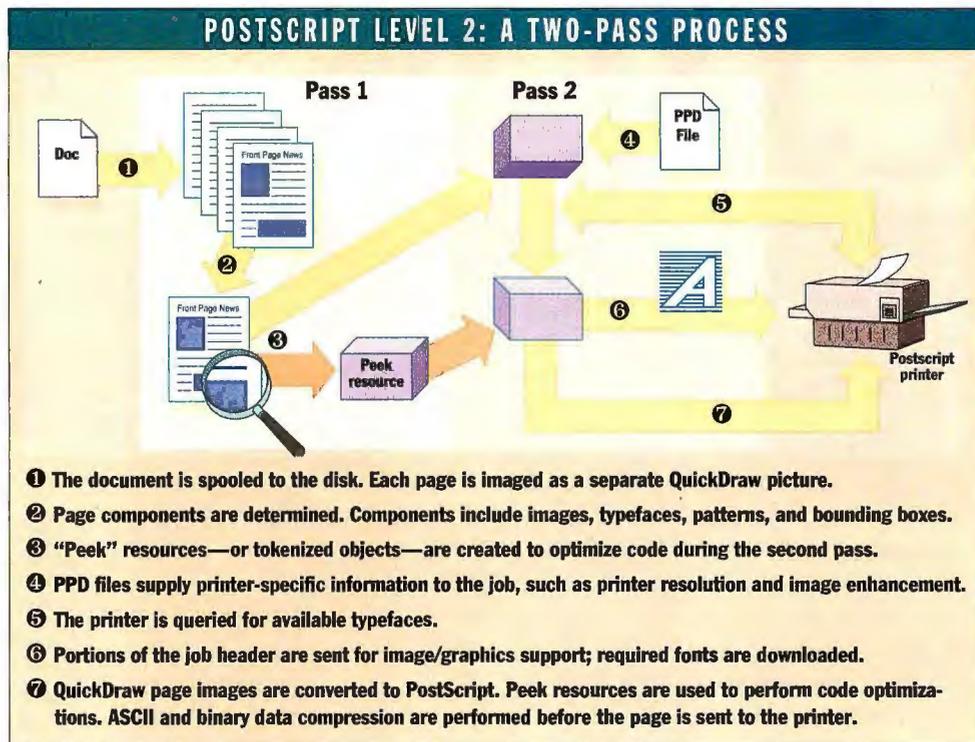
HEWLETT
PACKARD

PRINTERS

PostScript Level 2: Adobe Takes the Driver's Seat

PostScript Level 2 promises better memory management, more efficient (i.e., faster) operators, a pattern generator, and device-independent color support. The enhanced PostScript was introduced in 1990, and since then, numerous printers equipped with PostScript Level 2 interpreters have appeared on the market. However, they have not been able to reap the speed benefits of the new interpreter because a crucial component was missing from the printing process: There wasn't a Level 2 driver for the computers. Because PostScript Level 2 is a superset of the original PostScript language, the Level 2 printers worked fine with Level 1 drivers. Still, many printer owners probably wondered what the value of PostScript Level 2 was.

In April, Adobe finally released PostScript Level 2 drivers for both Macs and Windows. The reason for the delay was compatibility with existing software. On the Mac, some applications routinely made im-



proper or redundant calls to the driver. Adobe and Apple have fine-tuned the driver to operate with these "print felons."

I tested two prerelease versions of the Mac PostScript Level 2 driver. The software consists of a Chooser-selectable driver and a host of PPD (PostScript Printer Description) files. These PPD files contain device-specific information that the printer driver uses to optimize the PostScript code during printing.

I installed the driver on a Mac IICI using a DayStar Digital Turbo 040 accelerator board, a Quadra 950, and a Centris 650. The driver worked without problems with Claris MacWrite II, Microsoft Word 5.1, Aldus PageMaker 4.2,

Adobe Photoshop 2.5, Adobe Illustrator 3.2, Think C 5.0.4, Jasik Designs' MacNosy 2.98Q, and Zedcor's FutureBasic 1.04.

To see if the driver boosted performance, I timed how long it took to print several types of documents in the background to an Apple LaserWriter IIg and a Tektronix Phaser IISD color dye-sublimation printer. The host Mac was connected to the printer via a single, thin Ethernet cable, which eliminated network traffic. Overall, small jobs showed only a small time difference between the drivers. Bigger jobs produced bigger time savings. This is because the driver uses two passes to produce efficient code and compress image data. For binary data, run-length encoding is used for image compression. Some network spoolers can choke on binary data, so when ASCII hexadecimal is used to send the file to the printer, ASCII-85 encoding is used.

The driver is actually slower when you print with the background printing switched off. This is because the driver spools a QuickDraw image to disk first. The driver uses this image to perform its optimizations and data compression. For this reason, you lose any boost when you switch off background printing, or you get cornered into printing in the foreground when your application swallows all available memory. A future version will optimize on the fly, Adobe says, but for now PSprint is designed to work in the background. Based on the timing results, professionals making heavy use of color graphics and large image files stand to gain the most from PostScript Level 2.

—Tom Thompson

Adobe Systems, Inc., 1585 Charleston Rd., P.O. Box 7900, Mountain View, CA 94039, (415) 961-4400.

POSTSCRIPT LEVEL 2 PERFORMANCE

DRIVER	PS LEVEL 2	APPLE
Illustrator document	98	119
Four-page color document	395	657
10-page dummy article	669	778
Small Photoshop file	63	143
Large Photoshop file	304	948
Photoshop file (CMYK)	984	1699

Notes:

All times are in seconds based on beta versions 8.0b2c2 and 8.0b4c1.

The Illustrator file is 122 KB in size and uses a 24-bit graphic.

The four-page color document uses several color EPS files, several typefaces, and one 24-bit color scanned image.

The dummy article uses several gray-scale images and several typefaces.

The small Photoshop file is a 1.15-MB 24-bit image.

The large Photoshop file consists of an 11.3-MB 24-bit image. The CMYK file is a 15.1-MB 24-bit color Photoshop file printed to a Tek Phaser IISD.

See us at
COMDEX Booth 6832

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...



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.



Special Edition Tempra GIF and SHOW; for DOS.

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

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.



MacroMind Action! for Windows.

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.

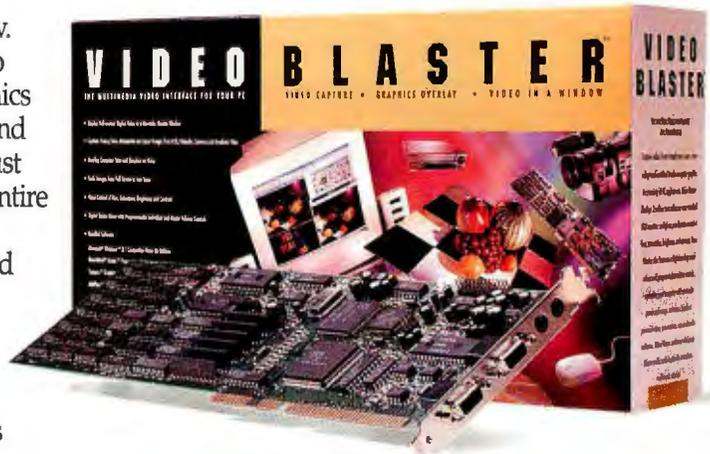
To add CD-quality 16-bit stereo sound and on-screen digital mixing, just plug in a Sound Blaster™ 16 ASP™ or other Sound Blaster audio card. Your presentations will sound as good as they look.

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

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.

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



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 268 on Inquiry Card.

(EXCEPT PERSONAL CLOTHING).
 Only packs, tents, and cooking gear, but not
 See enclosed packet for full details.
 ice axes, and so forth. To make sure your boots
 are suitable for these climbs, see full information in the enclosed
 MAPS.
 currency given
 packet for full details.
 for sightseeing in addition to mountain

You may join the tour at any time (cost is broken down by cou
 we recommend that to get the most out of the experience, you
 the entire excursion. Exotic Excursions will take care of these

- ❖ ALL OUTDOOR GEAR (EXCEPT PERSONAL CLO
 For example, we supply packs, tents, and cooking gear, b
 rain gear. See enclosed packet for full details.
- ❖ ALL CLIMBING GEAR.
 Ropes, crampons, ice axes, and so forth. To make sure yo
 suitable for these climbs, see full information in the encl
- ❖ LOCAL CURRENCY AND MAPS.
 All the maps you need, currency for the first day in any g
 Again, the

We've includ addition to moun
 so plan to bring any clothing and spending money that you wil
 casual travel. We hope you can join us - *it will be an adventur*

Automatic bullets

AUGUST

SUNDAY	MONDAY	TUESDAY	WEDNESDAY
		1 Leave New York for Paris	2 Rest one day at L'Hotel di Roi
6 Preparation	Lines and borders		9 Climb

Lines and borders

Enclosed is the information you requested a
 Our specialty is *adventurous travel by foot*
 will include climbs in France, Switzerland,
 planned itinerary for the trip.
 You may join the tour at any time (cost is
 However, we recommend that *to get the most*
 you should sign up for the entire excursion
 care of **One-step formatting**
ALL OUTDOOR GEAR (EXCEPT PERSONAL CLOTHING)
 For example, we supply packs, tents, and co

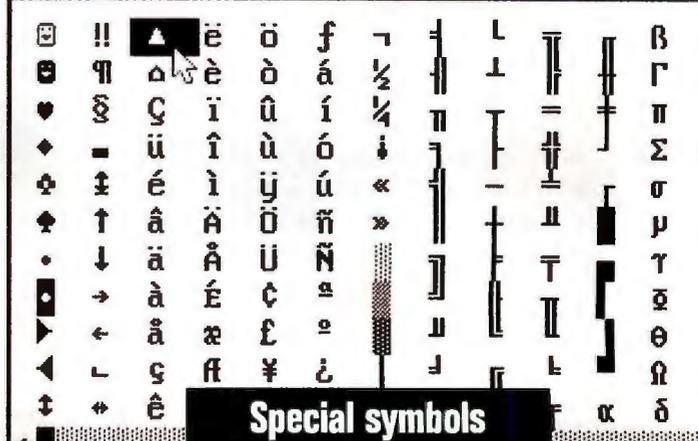
information you requested about EuroClimb!
 adventurous travel by foot and this year's
 ly. Here is the planned itinerary for t

DATES	COST (U.
AUGUST 1-14	2953
AUGUST 15-SEPTEMBER 3	2126
SEPTEMBER 4	
SEPTEMBER 24	473

Automatic tables

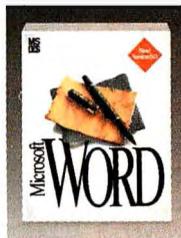
Symbols From: [Printer.....]
 Symbol: ▲

Special symbols



UPGRADE TO NEW MICROSOFT WORD 6.0 FOR MS-DOS FOR \$99. AND BECOME A MASTER OF MANIPULATION.

Make your word processing easier with new drag-and-drop text editing, one-step formatting ribbon, automatic bullets, automatic tables, lines and borders, and special symbols.



Take a few shortcuts and make your everyday tasks a whole lot easier. Just upgrade to new Microsoft® Word 6.0.

To start with, you can automatically add bullets to highlight key points. Or create a table with a single click on the new ribbon. Editing is a snap: use drag-and-drop editing to move text anywhere on the page. Then go back to the ribbon for one-step bold, italic, or underline formatting.

You can just as easily insert commonly used symbols like ©, ™, §, and ®. A few simple clicks and it's done. And with TrueType® fonts, the crisp text you see on your screen is the same text you'll get in your documents – on just about any printer.

Need more impact? Add lines, borders, and shading in one quick step. When all is said and done, run your work through the grammar checker to make sure it's all buttoned up.

With Word 6.0, you'll create polished and professional documents every time.

Right now you can upgrade to Microsoft Word 6.0 for MS-DOS® for \$99* and get a 90-day money-back guarantee.** Upgrade today. And see how Word 6.0 can help you become a master manipulator. So make the call.

To get a copy, see your local reseller.
For the name of a reseller near you,
or to order by phone, call
(800) 468-8899 and ask for Dept. JC2.

Microsoft®
Making it easier



Projected Benefits of Energy Star

The U.S. Environmental Protection Agency's Energy Star program has expanded from last year's original eight member companies that promised to develop energy-conserving computers to over 50 companies. This number is increasing on a weekly basis. Brian Johnson, the Energy Star program manager, says the EPA has added printer, system software, and monitor categories to the program. Companies can affix an Energy Star logo to products that can power down to 30 W when not in use. According to Johnson, a PC and monitor without a power-down mode will draw about 150 W, or 1300 kilowatt-hours per year, if the system is never turned off.

The EPA estimates that without the Energy Star program, computer systems (including monitors and printers) will consume 70 billion kWh of energy by the year 2000. This assumes that 70 million PCs and workstations will be in use. The EPA estimates that if 65 percent of all printers, monitors, and CPUs are Energy Star-compliant by the year 2000, the reduction in air pollution due to the reduced energy needs will be equivalent to taking 5 million cars off the road annually. Energy savings per Energy Star unit is estimated at 57 percent. The base cost per kilowatt-hour is estimated by the EPA at 7.5 cents. These numbers are the official U.S. estimates derived from several government agencies, including the Department of Energy and the EPA.

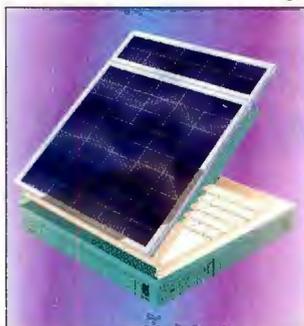
HANNOVER, GERMANY

Designing PCs That Age Gracefully

German computer giant Siemens Nixdorf (+49 821 804 2949) announced a new desktop system that takes environmental friendliness beyond just conserving energy. In addition to a sleep mode in which power consumption drops to just 5 W, the PCD-4L can be largely recycled.

Siemens says that 95 percent of the PCD-4L (starts at 3845 deutsche marks) can be recycled. The company admits that recycling is not a priority item on most computer buyers' checklists, but it expects that many governments will soon pass laws that require businesses that sell products to recycle them for their customers.

To help companies design products that are more easily recycled, the Microelectronics and Computer Technology Corp., a research consortium in



Zenith's prototype of a solar-powered notebook.

Austin, Texas, recently organized a Life Cycle Environmental Study conference in Washington, D.C. Presenters at the conference suggested that manufacturers should make circuit boards that are expandable to new processors and develop monitors so that the screen can easily be separated from the yoke and recycled.

At CeBIT, Zenith Data Systems (Langen, Germany, +49 6103 761 733) showed a rough

prototype of a solar-powered notebook system. The system will not make batteries obsolete, but it will extend the duty cycle of batteries from 3 hours to 6, 9, or even 12 hours, company officials said. A group of engineers tiled the top of a Z-Note notebook with an array of indigo-blue solar cells. Because the notebook was too small to hold enough cells to generate the required amount of electricity, ZDS engineers added a 2-inch-wide strip of cells (see diagram). The cells will function in both sunlight and regular room lighting.

Company officials say that it will take 12 to 18 months before the solar-cell-equipped notebook is available. The extra price required by the cells is estimated at DM 1000-1500 (\$650-\$1000).

—Rich Malloy and Peter Wayner

Nanao's New Power-Saving Monitors

Nanao USA's new 17-inch FlexScan F550iW (\$1599) and 21-inch FlexScan F760iW (\$2999) typify a new generation of color monitors. These power-saving models consume 120 and 160 W, respectively, during operation. However, 3 minutes after your computer's screen saver activates, the monitors enter the first-stage Power Saver mode, where the power draw is cut to approximately 12 and 16 W, respectively. You can set the Power Saver mode to last anywhere from a few seconds to 60 minutes. When the monitor enters the second stage, the Power Down mode, power consumption drops to about 8.5 and 11.5 W, respectively. When in the Power Down mode, it takes about the same amount of time to wake the FlexScan as it does to cold-start the monitor.

One problem with these monitors is that the Power Down mode will not activate unless your screen saver is mostly black (e.g., a blank screen). Nanao ((310) 325-5202) is negotiating with companies like Berkeley Software to solve this problem.

—Gene Smarte



GOING GREEN:

EASIER SAID THAN DONE

- Percentage of employees within top U.K. companies that would like their offices to be environmentally friendly 96
- Percentage who said they would buy only from an environmentally conscious supplier if its prices were competitive 75
- Percentage of respondents who would "go green" only if the action did not adversely affect profits 50
- Percentage of companies that use recycled paper for internal or external communications 30

Survey results from 304 executives, equipment purchasers, and office workers in a U.K. survey conducted by Network Research, an independent London-based market-research company.



Cross platforms easily.

New Timbuktu is the easiest way to network Macintosh and Windows computers, so you can share printers, files and screens.



Call today for a free demonstration video: 1-800-998-7760 ext. 4.

MacUser 
PC Week Labs Overall Score 4.2
Macworld ★★★★★
LAN Times 5 Nodes

Moving information between Macintosh® and Windows™ computers used to be quite a feat of skill. Let alone nerves.

But now there's Farallon's new Timbuktu® for Macintosh and Windows.

Timbuktu is the easiest way to create a peer-to-peer network. So, whether you're on a PC or Mac, you can share expensive peripherals like printers. And exchange files quickly and easily.

You also get a unique benefit—remote control. Timbuktu can send a real-time, full-color

picture of your screen over the network so you can control and view it from another Mac or Windows PC. This lets you use your network for new things like collaboration and user support.

Of course, Timbuktu is easy to use and install. You don't need a dedicated gateway or server. And it works with what you've got. Even other networks on NetWare or TCP/IP.

For a free Timbuktu product demo video, just call. It's that easy. **1-800-998-7760 ext. 4***



Farallon
Power to the network.™

*Call 1-800-678-5075 for upgrades from Timbuktu and PhoneNET PC (previously AppleShare PC and PhoneNET Talk). Upgrades also available for SitkaTOPS and Carbon Copy. A copy of Timbuktu is required on each machine on the network. Single- and multi-packs are available. All trademarks are property of their owners. ©1992 All rights reserved. For customer service, call (510) 814-5000. Or contact us on America Online® or AppleLink® ID: Farallon. CompuServe® ID: 75410, 2702. Internet ID: Farallon@farallon.com.

Circle 87 on Inquiry Card.

GRAPHICS WORKSTATIONS

Going to Extremes

Silicon Graphics stretches its low end with the Indigo2

The Indigo2 completes Silicon Graphics' effort to replace the Personal Iris line. For about the same price that you would have paid for the top-of-the-line Personal Iris model in 1990, the Indigo2 gives you 10 times the CPU performance and 20 times the graphics performance, making it an ideal platform for data visualization.

While the Indigo2 is the newest system in Silicon Graphics' most popular line, the only similarity to earlier Indigo systems is the name. The shape, bus, and processors are not what you will find in any other Indigo workstations.

The most impressive element of the Indigo2 is its Extreme graphics processor. This uses eight geometry engines and two raster engines.

The geometry engines are specialized floating-point processors dedicated to resolving

the solids modeling and surface lighting of the objects that are being displayed in a window. The geometry engines are also responsible for shading and some of the more specialized effects (e.g., motion blur and fog). Each geometry engine can perform 32 MFLOPS. Because the work done by the geometry engine is easily vectorized on separate surfaces, parallel processing produces faster throughput.

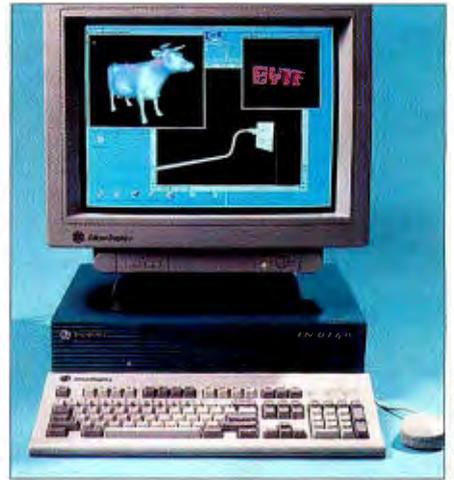
The raster engines determine the location where each screen pixel will reside in the physical screen memory. Despite the fact that a pixel's position and attributes can be expressed as a set of integer values, the engines do their processing using floating-point numbers as well. This ensures smooth and accurate motion.

The Extreme board's high performance requires Silicon Graphics' wider GIO64 64-bit bus to facilitate high data transfer between main memory and the graphics processor and other data-hungry peripherals (e.g.,

the high-performance multichannel audio-processing system). The GIO64 bus is the main system bus connecting the processor core, main memory, the I/O system, and the graphics board (it resides in one of the Indigo2's three GIO64/graphics slots).

The Indigo2 also has four 32-bit EISA slots running at 25 to 33 MHz. The EISA bus is fully implemented with its own bus controller, enhanced DMA functions and buffering, interrupt control, and clock. It is independent from the CPU bus and the GIO64 bus. This lets the processor core (i.e., the R4000), the Extreme graphics processor, and EISA devices each run independently at their most effective speed.

The Indigo2 that I tested had a 1-GB hard drive, 32 MB of RAM, the 50-MHz R4000 CPU, and an Extreme 24-bit



The teal-blue Indigo2 is far from attractive, but your eyes will focus on the impressive graphics rendering on-screen.

PAUL AVIS © 1993

color frame buffer and 24-bit z-buffer (1280- by 1024-pixel resolution) driving a 19-inch monitor. This is the base configuration (\$35,000).

You can order (or upgrade) your Indigo2 with a 75-MHz R4400. You get 50 percent higher performance for an extra \$6000.

Besides a faster clock, the R4400 gives you twice the on-chip data and instruction cache space (16 KB). The R4000 is rated at 16 MFLOPS, and the R4400 is rated at 22 MFLOPS. A preliminary run of the BYTE Unix benchmarks showed that even the R4000 processor gave eight times the performance of a Sun SparcStation 1+.

The Indigo2 with its Extreme graphics subsystem is an ideal platform for running applications built with Silicon Graphics' object-oriented graphics libraries, Iris Inventor and ImageVision. The Indigo2 bridges the graphics performance between the systems with Elan boards and those with the high-end graphics engines such as Silicon Graphics' Reality Engine (\$99,000, not including the computer).

— Ben Smith

*Silicon Graphics, Inc.
2011 North Shoreline Blvd.
Mountain View, CA 94034
(415) 960-1980*

EXPLORING DATA WITH VISUAL PROGRAMMING



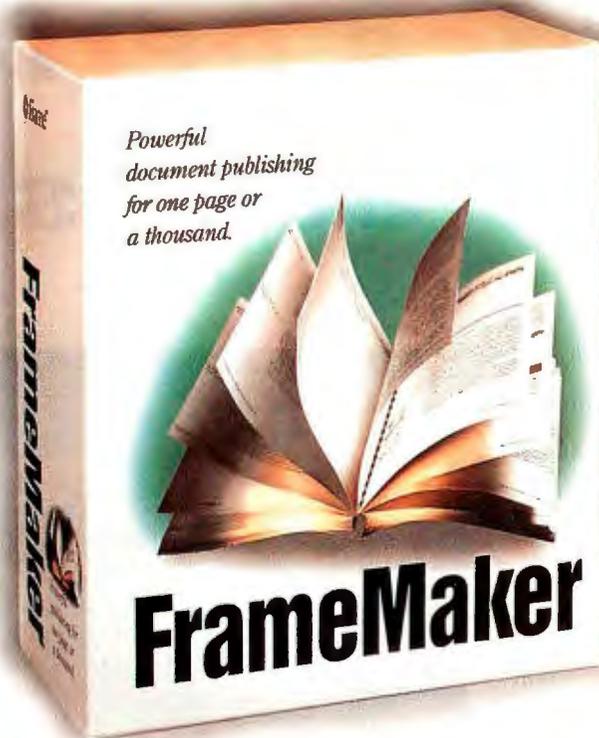
Iris Explorer's visual-programming interface is a simple way to take advantage of Silicon Graphics' rich data-visualization capabilities. You can rotate, walk through, and even fly through the virtual objects that represent your data. You can add color mapping, lighting, and surface characteristics to the data. Your data may not have any spacial characteristics of its own, but you can explore it as if it were an object in your hand.

Explorer is a graphical environment for manipulating and visualizing complex and large sets of data (see the "Visualization" State of the Art section in the April BYTE). You build the entire process of manipulating

and generating models from the data by tying together modules that run as separate processes on a single computer or even distributed over a network of computers. Explorer represents each module as an active icon-size block on a map. The process requires you to drag and drop modules onto the map and connect the inputs and outputs. To adjust the controls of a module, you click on the block, and the module launches its own controls window with knobs, dials, buttons, and so on.

The data source does not have to be limited to static arrays. It can be incoming, real-time dynamic data. Explorer comes with tools for describing and reading the incoming data stream and for building your own modules. The modules that come with Explorer are sufficient for many applications, so you can get started looking at your data as soon as you have the software installed. It's clear that no one knows how to take advantage of Silicon Graphics' hardware as well as its own software engineers.

▶ FrameMaker.



Ask your
dealer about
Frame's competitive
upgrade
offer.

FrameMaker 3.0. The highest scoring,* hardest working, and best looking document publishing package you ever saw.



▶ It's no wonder FrameMaker 3.0 is seen as *the* Document Publishing standard for thousands of users all over the world. Just look at its credentials: Awards of Excellence from *BYTE* and *Sun Observer*; Editors' Choice Awards from *MacUser* and *PC Magazine*; *Windows User* Editor's Choice Finalist; *BYTE*'s Reader's Choice; *PC Computing*'s Most Valuable Product Finalist; and *Windows*' Win 100 Award; to name a few.

▶ It even won *Software Digest*'s* top recommendation in an eight-way shoot-out of the top general publishing tools.*

▶ We're so delighted we've dressed FrameMaker 3.0 in a nifty new package. And inside you'll find the very best integrated solution for those really tough publishing jobs—the ones that word processors and DTP programs were never designed to handle.

▶ Sure, you'll find FrameMaker a cinch for whipping out memos and proposals but it's when you start constructing the bigger, tougher documents that you'll really get a feel for FrameMaker's power and ease of use.

▶ And you'll find FrameMaker completely file compatible across all major desktops: Windows, Macintosh® and UNIX.

▶ Call **1-800-U4-FRAME Ext. 974** for your *free* guide to integrated document publishing: "Introducing FrameMaker."

 **Frame**®

Exactly how fast is graphics performance on Image™ Series PCs?

Let's just say we developed Image Video™ technology expressly for all you high-performance speed demons. Fact is, we've engineered our Image™ Series PCs with a power-



NEC has the ultimate system for graphics applications: lightning-quick Image Series PCs with integrated SCSI II interface, legendary MultiSync® FG monitors, and our pioneering CD-ROM readers with MultiSpin™ technology.

ful combination of our second-generation local bus and graphics accelerator, allowing graphics information to travel directly between the CPU and video memory, so

Windows™ is a breeze and you can sprint through today's most demanding graphics applications.

Based on Intel's powerful 486 chip, each Image Series PC has OverDrive™ capability for easy processor upgradability. An on-board SCSI II interface means you can quickly connect to a wide variety of peripherals. And with our new OptiBus™ technology, your peripheral performance is up to 30% faster than ordinary systems. We've even made it easier for you to network



your PCs with an optional factory-integrated, high-performance 10BaseT Ethernet® adapter.

Plus, every Image Series PC is designed with True Color support of up to 16.8 million colors for photo-realistic images, as well as our exclusive ImageSync™ technology for flawless performance when connected to our award-winning

MultiSync® FG™ series monitors. The result? Clear, flicker-free images without any adjusting.

So call 1-800-NEC-INFO (in Canada, 1-800-343-4418), or NEC FastFacts™ at 1-800-366-0476 (#IMAGE). Then hold on to your spots.

Because  is the way you want to go.

NEC

the ce of NEC's



NEC



NEC Image 466



MADE IN THE SHADE

With the depletion of the ozone shield, suntans are out, and sun protection is in. A new program for PCs called UV B-Ware helps you monitor UV levels and peak sunburn times for over 525 locations worldwide. Based on NASA satellite ozone measurements, the program delivers specific UV and sunburn predictions tailored to your lifestyle, location, and schedule of outdoor activities.

Developed by Save the Planet Software ((303) 641-5035), the program can tell you the time the sun is strongest each day for a given location, hours of sunshine for any day of the year, and the percentage of increase or decrease of the particularly damaging UV B-type levels for locations relative to 1980 levels. The DOS-based program costs \$39.95. Windows and Mac versions are planned.



BETHANY GULLY © 1993

PRINTERS

HP Takes Color Mainstream



Hewlett-Packard announced in early May in Europe a new color ink-jet printer that the company says will help broaden the exploding market for color printers in the office. The DeskJet 1200C and PostScript-enabled 1200C/PS are aimed not only at traditional color users, such as marketing and design professionals, but also at general business users, who are increasingly demanding color output.

The new DeskJet 1200C straddles the line between black-and-white and color printers. Printing in black ink only, it can churn out documents at up to 7 pages per min-

ute. The 300-dpi print quality and capability to output to plain paper or transparencies make the 1200C a viable alternative to a laser printer.

When color is added to the mix, the speed drops to 1 ppm in draft mode or 2 minutes per page in normal or high-quality modes. (High-quality mode mimics 300- by 600-dpi printing using HP's Resolution Enhancement Technology.) Depending on the amount of color used, cost per page ranges from about 7 cents up to about 49 cents, HP estimates. The printer uses an enhanced version of HP's PCL (Printer Control Language) 5 with color sup-

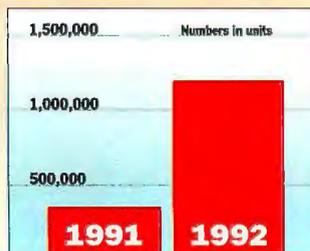
port and supports Adobe's PostScript Level 2.

North American pricing is yet to be announced, but the printer will sell in the U.K. for £1389 (non-Postscript) and £1939 (Postscript). That translates to roughly \$2040 and \$2865, respectively, although HP said that U.S. prices can be expected to be lower than those estimates.

—Andy Reinhardt

Hewlett-Packard Co., Direct Marketing Organization, P.O. Box 58059, MS511L-SJ, Santa Clara, CA 95051, (800) 752-0900, (208) 323-2551.

Nonimpact Color Printer Market



According to Hewlett-Packard and industry analysts, the market for nonimpact color printers increased 235 percent from 1991 to 1992. The overall color printer market jumped 109 percent.

JUST DIAL 1-900-SUPPORT

Notorious for provocative late-night advertisements, 900 numbers are becoming a vehicle for technical support at companies such as Apple, Aldus, Lotus, Microsoft, Novell, and Sun. Businessland, CompUSA, and other retailers, as well as VARs, are also exploring 900 numbers.

Although many companies are concerned about customer reaction, they are looking to 900 numbers as a way to make technical support pay for itself, according to Bill Rose, director of the Software Support Professionals Association. To encourage this trend, AT&T is reserving a business-to-business 900-services prefix that will allow companies that are currently blocking out all 900 numbers to unblock these business services and make them available to their employees.

Vari-A-Bill, another new AT&T service, lets technical-support operators either cut or increase the cost of a call while it is in progress. For example,



if a caller identifies an undocumented bug, he or she could be rewarded with a lower rate. Conversely, a caller who has questions that move to the next level of support would pay more.

Some third-party companies also see dollar signs. 900 Support (Lake Oswego, OR) provides 24-hour-a-day Novell NetWare support at \$4.99 for the first minute and \$2.99 for each additional minute. CompUSA offers support via 900 lines for hardware and software at \$2 per minute. Some companies, including 900 Support and Corporate Migrations (Dublin, Ireland), have moved into the international market, offering technical support in different languages for U.S. companies.

As systems and software prices continue to fall, technical support is becoming an industry of its own. One way or another, users will end up paying for it.

—Mike Franks



The Colorado Jumbo Tape Drive. Available in 120MB and 250 MB capacities

Look for these signs when going for a drive.

These signs mean you're headed for the best value in tape backup. Now, the world's most popular mini-data cartridge backup system, Jumbo 120[®] is only \$199 MSRP. And for your higher capacity needs, Jumbo 250[®] is a remarkable \$279 MSRP. Both drives include the new Colorado Backup software, at no additional cost.

These new low prices make Jumbo the affordable backup solution for practically any home or office PC system! And that means better data protection for everything you do on your computer.

Jumbo 120 was \$249	NOW \$199 MSRP
Jumbo 250 was \$349	NOW \$279 MSRP

Jumbo Tape Drives are easy to install and, at up to 9.3 MB/min. (Jumbo 250), easily the fastest in their class. Both are compatible with most popular networks, including Novell[®] NetWare[®] and LANtastic[®]. In addition, both offer support for UNIX[®]/XENIX[®] and OS/2[®]. And you get the added security of Industry-Standard QIC Recording Format.

With their high reliability, dozens of awards and new low prices, all signs point to Jumbo for the better backup solution. Call 1-800-451-0897, ext. 117 today for a free 76-page catalog, or visit your nearest dealer. Drive safely.



Colorado
Jumbo
TAPE BACKUP SYSTEMS

* 120 Megabyte capacity, using data compression ** 250 MB capacity, using data compression © 1993 Colorado Memory Systems, Inc. All rights reserved. Colorado and Jumbo are trademarks of Colorado Memory Systems, Inc. All other trademarks are property of their respective companies. JMS-01701335

Circle 71 on Inquiry Card (RESELLERS: 72).

“No more



Gary Slattery, Software Developer, Computer Associates

“The best platform for DOS and Windows.”

“I develop software applications for a living and I think OS/2® is a great way to do business.” A 32-bit, virtual memory operating system, OS/2 is the ideal platform for developing your DOS, OS/2, Windows™ and even host-based applications.

With OS/2 you can boost the power of your favorite DOS and Windows tools,

IBM and OS/2 are registered trademarks and Workplace Shell, C++, CommonView, C Set/2 and OS/2 Crash Protection are trademarks of International Business Machines Corporation. All other products are trademarks or registered trademarks of their respective companies. © 1993 IBM Corp.

plus take advantage of over 250 available OS/2 development tools and utilities.

“It’s a productivity thing.”

“I use CA Realizer to prototype new graphical interfaces. I write code using CA C++™ and CommonView™ (integrated with IBM’s C Set/2™ compiler) while I compile in the background. And when designing reports or planning schedules, I use CA-RET.”

OS/2’s pre-emptive multithreaded multitasking dynamically manages CPU time so you can run.



DOS, Windows and OS/2 apps concurrently in different sessions with maximum efficiency. That means you can edit in one window, compile in another, link in a third and test in a fourth. With OS/2 Crash Protection™, if one application goes down due to a bug, the rest you’re working on won’t. “There’s no limit to what you can do with this system.... It’s definitely made me more productive.”

The Development Platform of Choice

- Enhanced development platform for DOS, Windows and OS/2 apps.
- OS/2 Crash Protection for superior reliability.
- Pre-emptive multitasking for increased productivity.
- Virtual memory provides up to 512MB per session.
- Flat memory model eliminates wrestling with segments.
- Multiple virtual DOS machines for concurrent app testing.
- Object-oriented Workplace Shell is easy and intuitive.



arrested development.”

The object-oriented user interface—the Workplace Shell™ (WPS)—gives you easy control with direct manipulation of visual objects on your computer screen. And should you need assistance with anything, IBM's Worldwide Developer Assistance Program is always there to help.

“A developer's dream.”

With OS/2's 32-bit architecture, you can push your 386 and 486 hardware to the limit, and develop spectacular multimedia and enterprise-wide client-server applications. OS/2 lets you create the widest range of applications, for a variety of platforms, for almost any size computer. Here's your chance to develop truly revolutionary 32-bit applications. With OS/2, now there's nothing stopping you.

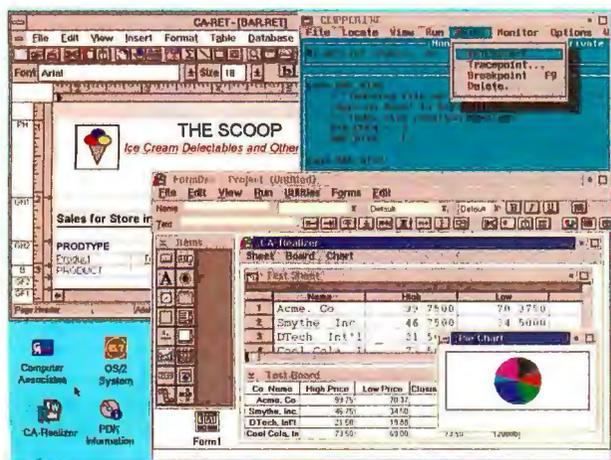
To learn more, call 1 407 982-6408 now, and get a free white paper on why OS/2 is the ideal platform for your development efforts.

Operate at a higher level.

1992
- WINNER -
PC Magazine Award
for Technical Excellence



PERIPHERAL SYSTEMS AND
SOFTWARE STANDARDS
OS/2, Version 2.0
IBM Corporation



Use OS/2 to increase productivity of DOS, Windows and OS/2 application development.



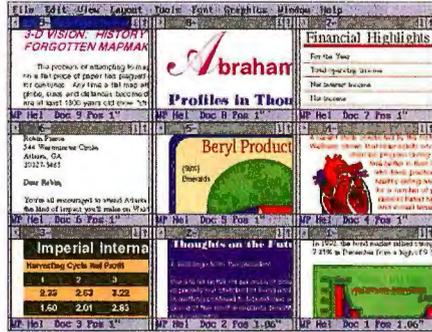
Circle 94 on Inquiry Card.

WORD PROCESSING

WordPerfect Goes GUI with DOS Update

Breathing some much-needed life into its flagship DOS word processor, WordPerfect recently unveiled a radically updated, GUI-like version of the WordPerfect program. The new WordPerfect 6.0 for DOS also includes portions of the company's PlanPerfect spreadsheet.

With its first major DOS word processor update in more than three years, WordPerfect is protecting its long-held lead in the DOS word processing wars. WP 6.0 for DOS substantially revamps the dated interface of WordPerfect 5.1, adding a slick GUI interface



that lets users edit up to nine documents simultaneously on the same screen. Users have the choice of toggling between the more traditional, faster, character-based text mode and the new, but slower, graphical mode that mimics the look of a Windows product.

"It's a DOS person's dream," says Chris Le Tocq, a senior analyst at InfoCorp (Santa Clara, CA). WP 6.0's capability to handle fonts on-screen without Windows and directly manipulate graphical text is "quite an engineering feat," he adds. "They've essentially written stuff that's in the guts of Windows."

WordPerfect did not stop at just adding a Windows-like interface to version 6.0; it also offers a host of new features, including the bulk of the functionality in WordPerfect's PlanPerfect spreadsheet. The interface has button bars similar to those used in WordPerfect 5.2 for Windows. It also offers mail enabling; full support of FaxBIOS technology, including drivers for Class 1, Class 2, or CAS-compliant (Communications Applications Specification) fax devices; color printing capability; and the use of scalable fonts with support for Type 1, Intellifont, TrueType, and Bitstream fonts.

Also included in WP 6.0 is QuickFinder technology, which lets you quickly index files, directories, or complete hard disks for doing fast searches on keywords. WordPerfect introduced the QuickFinder late last year in its WP 5.2 for Windows update. WP 6.0 for DOS also comes with a new help facility that's called the WordPerfect Coach.

While WP 6.0 will run on a 286 with DOS 3.0 or higher, 450 KB of free conventional memory, and a 7-MB hard drive, WordPerfect recommends a 386, DOS 5.0, 520 KB of free conventional memory, and a 15-MB hard drive.

WordPerfect says it plans to ship WP 6.0 by June for \$495; full upgrade, \$129; competitive upgrade, \$149.

—Patrick Waurzyniak

WordPerfect Corp., 1555 North Technology Way, Orem, UT 84057, (801) 225-5000.

Ami Pro Burns the OS/2 Flame

Lotus's Ami Pro 3.0 for OS/2 is a full 32-bit version that is designed to match the popular Windows version feature for feature. These features include a customizable most-recent-files list, text linking between Ami Pro documents, and true background printing.

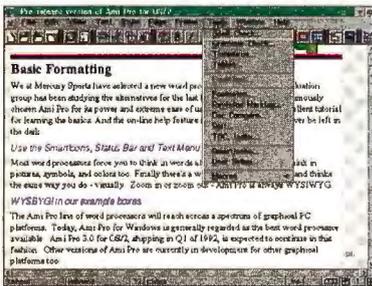
As with its OS/2 versions of 1-2-3 and Freelance Graphics,

integration, however, doesn't stop there. From an Ami Pro document, dynamic links with both Lotus 1-2-3 and Freelance Graphics for OS/2 will preserve dynamic links with spreadsheets and charts. And when Lotus Notes and cc:Mail for OS/2 ship, you can expect integration with Ami Pro.

SmartIcons speed a number of tasks for formatting text as well as objects you may want to incorporate (e.g., tables, bit-mapped images, and charts). Another speedup function is style sheets; a third, the macro facility, makes it easy to record and play back a quick step saver or a permanent macro, either of which you can set to execute automatically when you open a document.

—Ed Perratore

Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142, (800) 343-5414, (617) 577-8500.



Lotus has integrated Ami Pro with OS/2's Workplace Shell. This lets you drag and drop filenames onto the Ami Pro icon to launch the application, onto the printer to print, or onto the shredder for deletion. The

UPDATE

AUGUST

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Microsoft Word for DOS
 Keeping step with rival WordPerfect, Microsoft (Redmond, WA) previewed a new version of its DOS-based Microsoft Word at the CeBIT show held in March in Hannover, Germany. Microsoft Word 6.0 for DOS is designed more for its installed base of Word 5.5 users than to compete with DOS market leader WordPerfect, according to Microsoft. "For us to make this into a WordPerfect killer is a little crazy," says Taylor Collyer, Microsoft's product manager for Word MS-DOS.

Version 6.0 adds a number of new features to Word, including drag-and-drop text-editing capability, support for printing TrueType fonts, and a "ribbon" toolbar similar to that of Word for Windows. With its 3-D-style pull-down menus, dialog boxes, and buttons, the Word 6.0 for DOS update looks more like a Windows product than do previous Word versions. Word 6.0 also offers Reference Software's Grammatik 5. Word 6.0 requires DOS 3.0 or higher, 512 KB of RAM, and a 1.5-MB hard drive (5.5 MB for full installation). Retail price: \$450; upgrades are \$99.

—Patrick Waurzyniak



ALL-IN-ONE PACKAGE!

"CorelDRAW has six graphics packages in one stunning Windows program. And these are not watered down versions—they compete feature for feature against stand alone products."



VERSATILE CHARTS and GRAPHS!

"CorelCHART is the easiest charting package I've ever used, thanks to its intuitive design, ease of object editing, and the smooth integration with the rest of Corel's products."



POWERFUL PHOTO-EDITING!

"Corel PHOTO-PAINT is in a class by itself; no other product can match its image editing powers for close to its price range."



THOUSANDS OF CLIPART IMAGES AND SYMBOLS!

"Even if you only use a portion of the 256 fonts or 14,000 CD-ROM clipart images, you've likely recovered your investment."



COREL DRAW!

"The Graphics Super Star"



EASY TO USE!

"CorelDRAW remains the easiest-to-use graphics product on the market...The ultimate graphics bargain!"



VALUE-PACKED!

"CorelDRAW 3.0 for Windows delivers all the graphics applications you could ask for. The program's ease-of-use, coupled with its power, has users singing its praises."



DYNAMIC PRESENTATIONS!

"CorelSHOW, an extremely simple presentation program that makes displaying charts and drawings a snap."



GREAT TEXT HANDLING!

"CorelDRAW has what many other drawing packages lack: superb control over type...A sizzling best buy."



CorelDRAW has emerged as the ALL-IN-ONE graphics Super Star! Celebrated by top international industry publications, it has won over 90 awards for its exceptional ease of use, incredible value and outstanding features.

CorelDRAW 3.0 outshines the competition! There is no longer any need to buy separate illustration, charting, photo-editing and presentation software, because CorelDRAW 3.0 includes CorelCHART, Corel PHOTO-PAINT and CorelSHOW—all in one value-packed box.

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

WINNER OF OVER

90

FIRST PLACE AWARDS

Call now for a free demo disk and brochure!

1-800-836-DRAW

CDN TEL: (613) 728-8200 / FAX: (613) 761-9176

CorelDRAW is Network Ready and MULTIPLATFORM for corporate standardization: Windows, OS/2, UNIX, CTOS. Soon available on the Mac and in 20 languages!



KUP-0012

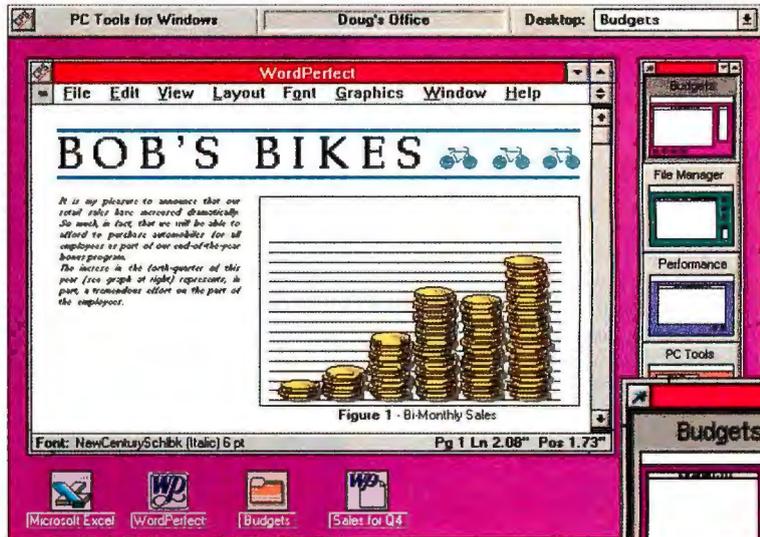
Circle 81 on Inquiry Card.

Introducing PC To Just think of it

[1]

Organize and simplify your work.

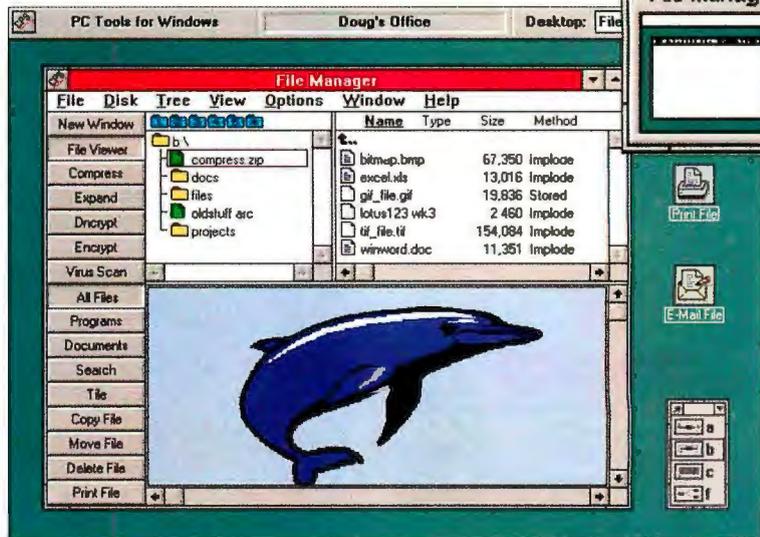
Our unique MultiDesk desktop manager lets you put related applications, folders and files into their own separate desktops. Set up as many desktops as you like, then switch between them instantly. It all adds up to a less cluttered, more productive Windows environment that works like you do.



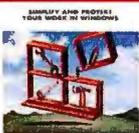
[2]

Improve the speed and efficiency of common tasks.

Our integrated File Manager has advanced drag-and-drop capabilities that let you quickly locate, view, copy and print files. With over 75 viewers, you can scan files (including compressed PKZIP data) without having to open their applications first. Hate to turn off your PC because you don't want to set everything up again? Our DeskSaver feature solves that problem too.



**CENTRAL POINT
PC TOOLS
FOR WINDOWS**



Windows® is a great product. And someday, it'll be even better. But why wait?

New PC Tools™ for Windows® is here right now. It saves you time, reduces clutter and gives you easy access to all the functions and files

you use most often. In fact, PC Tools for Windows is so innovative that after reviewing it, the editors of

PC/Computing asked, "Who needs Macs?"

For starters, there's our unique MultiDesk™ desktop. MultiDesk is an intuitive desktop manager that lets you organize your work by creating as many desktops as you need for your projects, tasks, or clients. So, if you spend the day switching between many different projects, you won't lose anything in the clutter.

Ever misplaced a file or couldn't remember its

ols™ for Windows.® as Windows 4.0.*



[3]
Enhance your
system's performance.

System Consultant™ performs over 400 system checks and provides recommendations for improving your PC's performance. Our Disk Optimizer can automatically defragment your hard disk at prescheduled intervals, or on command.

[4]
Automatically
protect your data.

We've included new Windows versions of Backup, Undelete, Anti-Virus and DiskFix®. They're all integrated in WinShield™, an automatic data-protection system that results in worry-free computing. Our Emergency Disk builds a bootable recovery disk to help get a crashed system up and running fast.

name? Our File Manager lets you quickly view files without having to load the program first. Tired of cryptic, abbreviated file names? Now you can attach long file names to your data to keep things clear and simple.

We also created Speed Keys™ so you can take shortcuts through Windows, and System Consultant that gives you specific tips for improving system performance.

PC Tools for Windows is at your nearest dealer.

For more information, a free demo disk, or to upgrade from PC Tools for DOS, call us at 1-800-967-9251. Your purchase is backed by our 60-day guarantee.

Find out for yourself why the editors are already heralding PC Tools for Windows as "The ultimate desktop." It may just be the best thing since, well... Windows.

Central Point Software INC.®

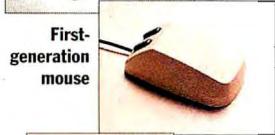
Central Point Software did not collaborate on this product, and this ad is not in any way sponsored by Microsoft. PC Tools for Windows does not replace Microsoft Windows or any future version thereof; it simply complements it. Names of other products mentioned herein are used for identification purposes only and may be trademarks of their respective companies.

Circle 70 on Inquiry Card.

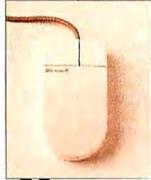
EVOLUTION OF THE MOUSE



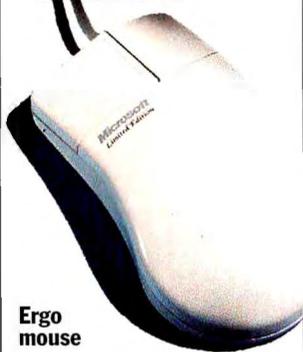
Wood mouse



First-generation mouse



"Dove bar" mouse



Ergo mouse

Mice have come a long way since the original wood mouse (pictured) that was developed by Doug Engelbart at Stanford Research Institute in 1963. Microsoft's first-generation mouse, introduced in June 1983, was based on a prototype made out of clay; the third-generation "Dove bar" mouse was introduced in 1987. Microsoft's newest mouse, developed with the help of an independent ergonomics consulting firm, is designed for either right- or left-handed use. A snap-to feature in the new mouse's software automatically snaps the cursor to the default-command button in a dialog box; screen wrap moves the cursor to the opposite side of the computer's screen when you move the cursor off the edge.

ERGO MOUSE: PAUL AVIS © 1993

UPGRADES

Novell's "Next-Generation" DOS

By the time you read this, Novell should be beta-testing Novell DOS 7, a major upgrade to the company's operating system that will support true preemptive multitasking, integrated NetWare client support, and peer-to-peer networking. Another new technology in Novell DOS 7 is called the DPMS (DOS Protected Mode Services) API, which Novell says will reduce the demand for conventional, upper, and expanded memory.

The DPMS SDK (\$195) will support both MS-DOS and Novell DOS. It lets software developers write device drivers and TSRs that reside in extended memory (instead of the high-memory area or conventional memory) and execute in protected mode on 286, 386, and 486 computers under DOS or Windows (MS-DOS requires developers to write a separate virtual device driver to execute in protected mode under Windows). Developers

can license and distribute DPMS applications without having to pay royalties.

Novell DOS (formerly called DR DOS) will ship with DPMS client components such as disk cache and compression drivers, a peer-to-peer server, and CD-ROM extensions.

Novell DOS 7 is expected to ship in late summer. The company says it has an installed user base of 8 million for Novell DOS.

—David Andrews

NEW PLATFORMS

A Peek at PowerOpen

When the first computers based on the new PowerPC chips debut early next year, they'll be able to run character-based Unix and graphical Motif applications concurrently with existing Macintosh programs. Multiple Mac sessions can run side by side in their own Motif windows, and the system Clipboard will let users cut and paste between the Mac and Unix environments. MS-DOS and Windows 3.x programs will run atop an optional software emulator from Insignia Solutions.

Details of the PowerPC's PowerOpen operating system were revealed at the March Uniform show in San Francisco. Seven companies—led by the original partners, IBM, Apple, and Motorola—formed the PowerOpen Association to promote the new RISC-based platform. Other founding members are Groupe Bull, Harris, Tadpole Technology, and Thomson-CSF.

Motorola officials say they expect the PowerPC 601 to deliver about the same integer performance and a 30 percent to 40 percent floating-point performance improvement over Intel's Pentium—at about one-third the price. In quantities of 20,000, the 50-MHz chip will cost \$280; the 66-MHz chip will sell for \$374.

PowerOpen's chief architect, Stephen P. Cummings of IBM, says hardware and software development are both on track. Tom Whiteside, manager of VLSI technology at IBM's Advanced Workstation Division, says the PowerPC 603 chip currently under development "is intended to be roughly the performance of the 601, but really, really cheap."

He did not disclose specific prices for the 603.

PowerOpen is built on AIX/6000 (IBM's Unix for RS/6000 workstations) and the X Window System. It natively runs Unix applications compiled for AIX, Groupe Bull's BOS/X, and Thomson-CSF's Uni/XT, as well as future programs for PowerOpen. It will

also support COSE (Common Open Software Environment), the "unified Unix."

Apple has ported the Mac OS Toolbox to the PowerPC, so that Toolbox calls execute natively. Because Mac programs typically spend most of their time in the Toolbox, this minimizes the usual performance penalty for software emulation.

—Tom R. Halfhill

"We're entering a new frontier...we intend to price the PowerPC aggressively."

—Tom Whiteside
(IBM)



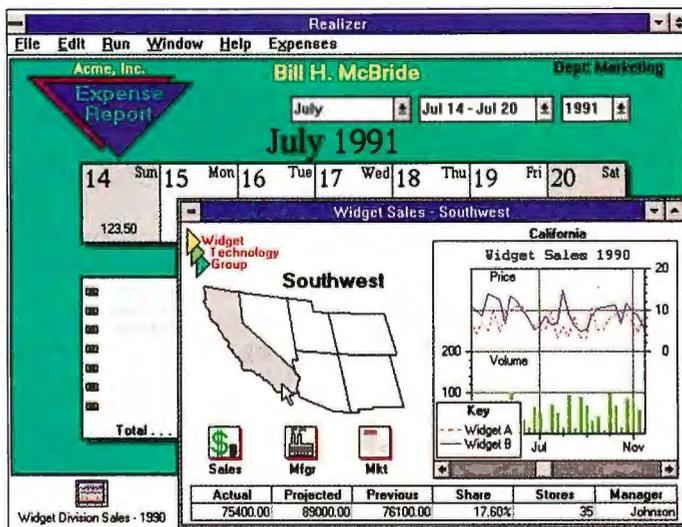
CA-REALIZER—Now For A Limited Time Only \$99.

Above And Beyond Basic.

INTRODUCING THE EASIEST BASIC DEVELOPMENT SYSTEM FOR WINDOWS.

Compared to Visual BASIC, CA-REALIZER® is half the cost and twice the product.

Develop applications using the familiar procedural language model and a large array of powerful tools. You don't need to learn all kinds of confusing new techniques. Just type in programs or design them visually with FormDev. It's an interactive



WYSIWYG, point and click tool that generates code. With a single command you can add Programmable Application Tools like spreadsheets, charts, text editors, animation, graphics tablets and user-friendly forms. And CA-REALIZER offers many features other BASICs don't, like automatic array processing.

Arrays are re-dimensioned and processed automatically. Algorithms can be written as formulae instead of complex looped expressions.

Once an application is complete, you can compile it into a stand-alone Windows application and distribute it

royalty-free with the runtime module that's included. And you can generate an installation disk with the push of a button.

PC Computing said, "No other Windows BASIC can match it for power and breadth of features."

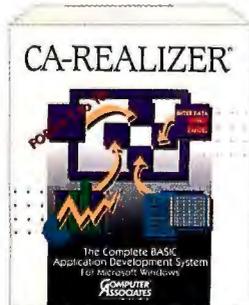
And at \$99, they can't match the price either.

So call 1-800 CALL CAI today for more information

and the name of your nearest dealer.

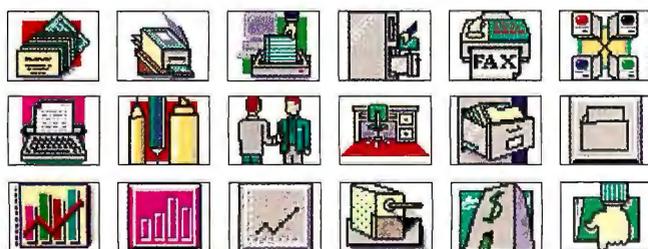
1992 W 100 WINDOWS MAGAZINE AWARDS WIN AWARD

1991 BEST OF SPRING AWARD 1991 BYTE AWARDS OF MERIT



and the name of your nearest dealer.

and the name of your nearest dealer.



	REALIZER	VisualBASIC
Interactive WYSIWYG Application & Form Designer	✓	✓
Generates User Accessible & Modifiable BASIC Code	✓	
Familiar Procedural Programming Model	✓	
Integrated Full-Featured Debugger	✓	
Single-Stepping, Call-Tree, Variable Display	✓	
Automatically Expandable Dynamic Arrays	✓	
Full Range Of Fast Array Operators & Functions	✓	
Mathematical, Statistical, Date-Time Functions	✓	
Dynamic Addition & Removal Of Form Objects	✓	
Fully-Integrated Programmable Application Tools:	✓	
Charts, Spreadsheets, Text Editors, Graphics, Animation, Scheduler	✓	
Ability To Run Multiple Applications Simultaneously	✓	
Full Support For DDE & DLLs	✓	✓
Direct MDI Support & Serial Communications Library	✓	
Import/Export Of 1-2-3, Excel, CA-SuperCalc Files	✓	
Extensive Context-Sensitive On-Line Help	✓	✓
Clip Art Library With Over 250 Bitmaps	✓	
QuickBASIC Version 7.0 Compatibility Libraries	✓	

Don't waste another day trying to figure out Visual BASIC. Leave that for your competition.

COMPUTER ASSOCIATES
Software superior by design.

CA-Realizer

© Computer Associates International, Inc., One Computer Associates Plaza, Islandia, NY 11788-7000. All product names referenced herein are trademarks of their respective companies. CA-REALIZER Release 1.0 and Visual BASIC Release 1.0 compared 10/92. Cost comparison based on Visual BASIC Release 1.0 Suggested Retail Price. PC Computing quote appeared 10/91, pg. 90.

COMMUNICATIONS

Digicom's Software-Upgradable Modem



PAUL AVIS © 1993

The benefit of soft-modem technology is that when you want to extend your modem's communications capabilities, you upgrade your software instead of installing new hardware. A new modem package from Digicom Systems called Connection 96+ (\$199) embodies the benefits of soft-modem technology. Connection 96+ consists of software and a daughtercard that fits into an ISA slot of a PC.

Digicom's soft-modem technology and card combine to deliver 1200- to 9600-bps transmission, v.42 and MNP 4 error correction, a 16550 UART (universal asynchronous receiver/transmitter), and extended AT command-set compatibility. When you purchase the Connection 96+, you are eligible for a free upgrade to 14,400-bps (V.32bis) transmission via Digicom's menu-driven BBS. After I installed the

modem and its software, I downloaded the free V.32bis upgrade. I used my new—and now improved—Connection 96+ to talk to a 14,400-bps modem I had at home. When I sent the same 68,992-byte file (which I had downloaded from Digicom's BBS) at 14,400 bps, the improvement in transmission speed was obvious. Data blocks zipped by at almost twice the speed as when I downloaded the file at 9600 bps.

Digicom also sells a 9600-bps send/receive fax upgrade (\$60). By the third quarter of this year, the company expects to release upgrades for V.32terbo (i.e., 19,200-/16,800-bps standard) and voice-messaging software. By the end of the year, Digicom ((408) 262-1277) plans to release a Mac model.

—Selinda Chiquoine

LONDON

WHEN YOU CAN'T WAIT FOR FAST, GO TERBO

Tired of waiting for the CCITT to complete its deliberations for the next international analog modem standard known as V.Fast, a group of 18 suppliers that includes AT&T Paradyne, Penril Datacomm, and National Semiconductor has introduced an interim modem standard called V.32terbo. The move followed frustration by vendors that the CCITT rejected a proposal to introduce an enhanced version of the existing V.32bis (i.e., 14,400-bps maximum) standard that would have been called V.32ter and offered a maximum transmission rate of 19,200 bps without data compression. The CCITT thought the proposed V.32ter enhancement represented too small of an improvement compared to V.Fast. The proposed V.Fast standard will offer top transmission of 28,800 bps but is not expected to be ratified for several months.

A U.K. start-up company called Sonix (Cirencester, +44 285 641651) claims to have shipped the first V.32terbo-compliant modem. Sonix's Volante modem (795 pounds) lets users upgrade the modem to V.32terbo from a PC disk. Multitech (Mounds View, MN, (612) 785-3500) says it plans to release a V.32terbo modem this summer. The Multimodem II will cost \$1199.

—Tony Dennis

Visual Basic 3.0 Strengthens Connectivity

More than 70 percent of all copies of Visual Basic are sold to corporations for developing in-house applications, and more than 90 percent of those custom programs interact with structured databases, according to Microsoft. So it's no surprise that the latest version of VB adds new tools for database connectivity.

Both Standard (\$199) and Professional (\$495) editions of

VB 3.0 now have the same database engine found in Access 1.1, Microsoft's RDBMS (relational database management system) for Windows. Thus, VB 3.0 can interact with databases stored in several common formats: Access, dBase, FoxPro, Paradox, and Btrieve.

A new visual data control in the toolbox lets VB programmers hook into these databases without writing any

of the code normally required. In addition, the textbox, checkbox, picture, label, and image controls have been made data-aware. A VB application can now easily access a personnel file that includes

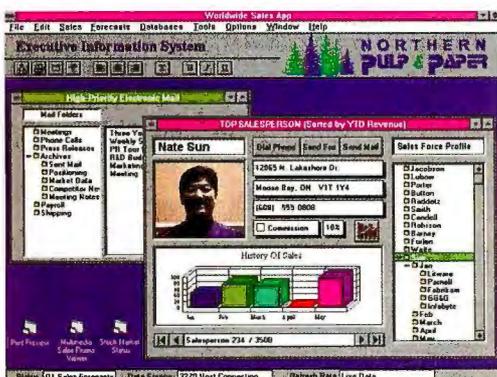
portraits of employees.

The Professional edition of VB 3.0 adds a programmatic object layer that provides complete control over the Access engine. While the Standard edition lets VB programs interact with existing databases, the Professional edition lets programmers write code that creates and manages databases in any of the supported formats. The Professional edition also has ODBC (Open Database Connectivity) drivers for SQL Server and Oracle.

VB 3.0 supports OLE 2.0 automation, so VB programs can communicate with and control other Windows applications that also support OLE 2.0.

—Tom R. Halfhill

Microsoft Corp., 1 Microsoft Way, Redmond, WA 98502, (206) 882-8080.



An advertisement for the Intel Pentium processor. The background is a dark, stormy sky with bright blue lightning bolts striking down. A red and white diamond-shaped kite is flying in the upper left. In the foreground, a computer motherboard is shown, with a large, glowing blue Pentium processor chip being held in place by a thin wire. The chip is illuminated with a bright blue light, and the text 'intel. pentium™ PROCESSOR © INTEL '92' is visible on its surface. The overall color palette is dominated by dark blues, bright blues, and reds.

INTEL TECHNOLOGY BRIEFING

PENTIUM™ PROCESSOR
DISCOVER POWER AGAIN

HOW WE'RE GIVING PCs ELECTRIFYING POWER.



pentium
PROCESSOR

There is a new source of computing power. It's capable of executing two instructions at once. It's produced

processing speeds over 100 MIPS. It's the next generation of compatible power. It's called the Pentium™ processor. And this brief will tell you how its technology is making PCs run faster.

THREE WAYS TO MAKE FASTER PCs.

Faster PCs start with faster microprocessors. And there are three ways to make faster processors:

1. Increase the number of transistors.

Today, the use of sub-micron components lets designers fit more than 3 million transistors on a single chip. So we can integrate components such as math coprocessors and caches right onto the CPU—dramatically cutting access time.

2. Increase the clock speed.

Twelve years ago the clock speed ticked

along at a measly 4.7 MHz. Today we can run at an astonishing 66 MHz—and we're still pushing for more.

3. Increase the number of executions per clock cycle.

Using new superscalar technology, our processors are now capable of executing two instructions per clock cycle.



WORKS IN PRINCIPLE AND IN PRACTICE.

Employing the techniques above, we've created the new Pentium processor. A processor that is over 300 times faster than the first PC microprocessor.

THE PENTIUM PROCESSOR. A MODEL OF EFFICIENCY.

The Pentium processor can be described as

a super-efficient

factory. Its

main assembly

line is its

superscalar

technology—

which enables

information to

be processed simul-

taneously through dual

pipelines. To accomplish

this, the pipelines divide

up an instruction, then

send it through five stages.

As it passes from one

stage to the next, the

pipeline is free to begin

another instruction.

Speeding up operations

substantially.

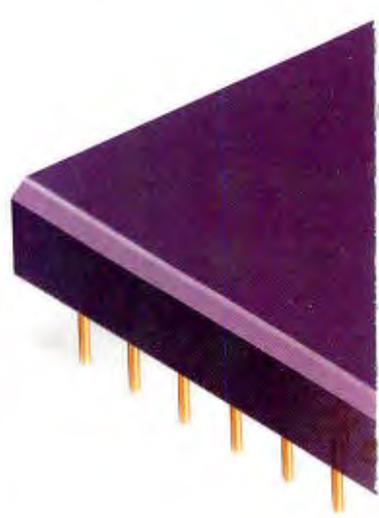


PUMPING DATA THROUGH.

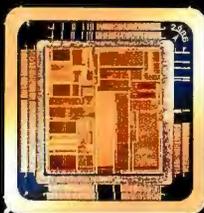
The rest of the features on the processor are designed to keep that main assembly line working at peak capacity (*see diagrams*). These features, along with the superscalar technology, help the Pentium processor to crunch more than 100 MIPS at a clock speed of 60 MHz.

HOW FAST DID YOU SAY?

Twice the performance of our own Intel486™ DX2 66 MHz processor. Plus, the redesigned floating-point unit on the Pentium processor offers up to five times the performance of the Intel486 DX2-66 CPU for math-intensive applications.



THE NEW PENTIUM PROCESSOR IS FULLY SOFTWARE COMPATIBLE WITH OUR X86 FAMILY.



THE LINE WIDTH OF EACH TRANSISTOR IS 1/100TH THE THICKNESS OF A HUMAN HAIR. OR 0.8 MICRONS TO BE EXACT. SO WE CAN PACK 3.1 MILLION TRANSISTORS INTO AN AREA THIS SIZE.

PENTIUM™ PROCESSORS

A PHOTOGRAPHIC MEMORY RIGHT ON BOARD.

NOW THERE ARE SEPARATE 8K CODE AND DATA WRITE-BACK CACHES THAT REDUCE CACHE CONFLICTS AND INCREASE SYSTEM PERFORMANCE. WITH AN ON-CHIP CACHE, WE KEEP ESSENTIAL INFORMATION WITHIN AN ARM'S REACH OF THE MAIN ASSEMBLY LINE. SO THAT INSTRUCTIONS AND DATA CAN BE FETCHED WITHOUT WASTING ANY TIME. AND A FULL 95% OF THE TIME, THE INFORMATION IS RIGHT AT HAND.

THINK OF IT AS A 64-LANE FREEWAY INSIDE YOUR CPU.

TO GET DATA REALLY MOVING, WE DOUBLED THE SIZE OF THE BUS ON THE FIRST PENTIUM PROCESSOR. THIS ALLOWS TWICE AS MUCH INFORMATION TO BE FETCHED AT ONCE. THERE IS EVEN A BURST MODE FOR HIGH-SPEED INFORMATION TRANSFER—SO MORE INFORMATION GETS TO WHERE IT'S GOING QUICKER. PLUS, AUTOMATIC DATA INTEGRITY CHECKING TO BE SURE THE RIGHT DATA IS BEING MOVED.

WE PROGRAMMED THE CHIP TO BE CLAIRVOYANT.

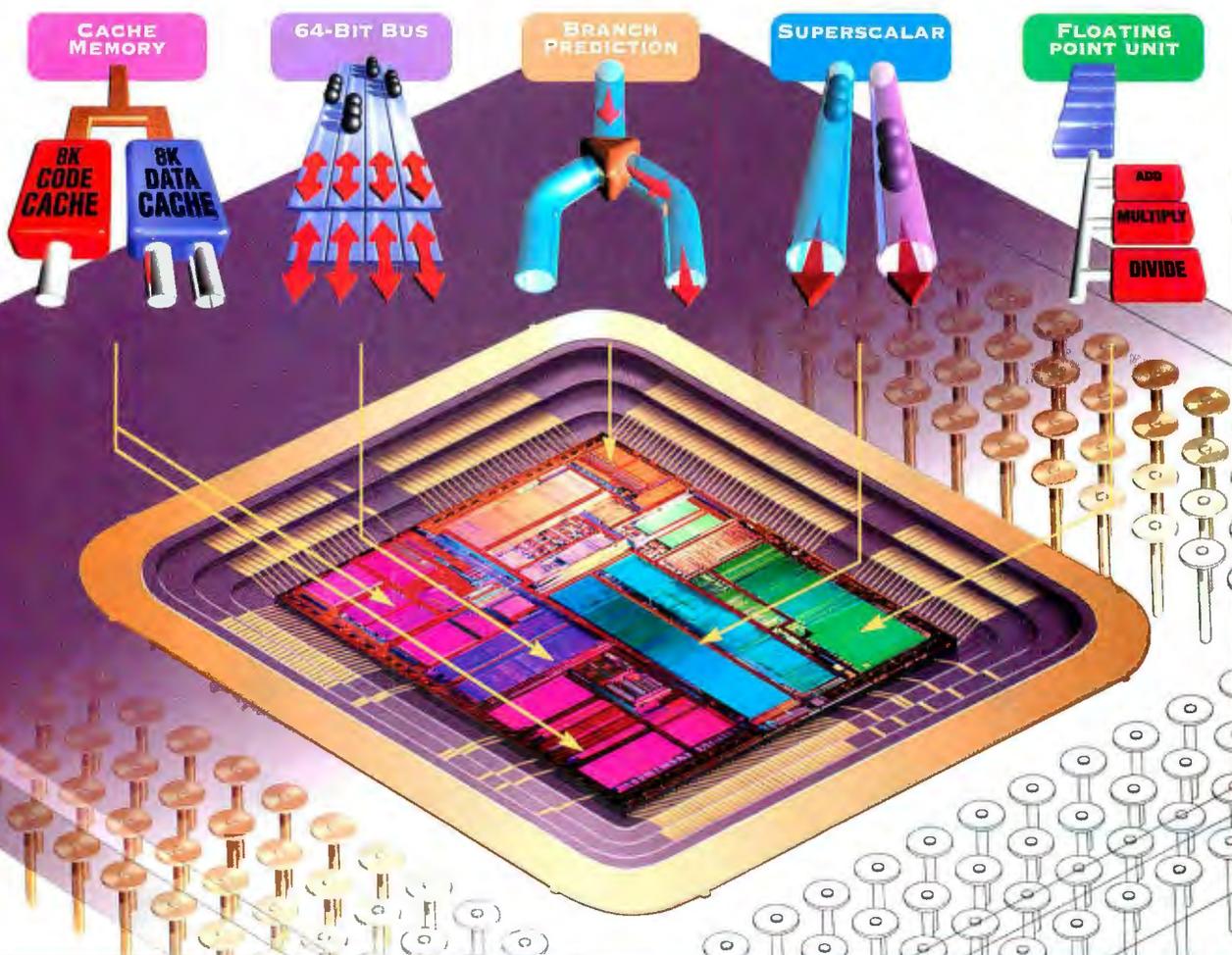
WE'VE GIVEN THE PENTIUM PROCESSOR AN INTELLIGENCE OF ITS OWN—A SMALL CACHE KNOWN AS THE BRANCH TARGET BUFFER, WHICH PREDICTS WHICH WAY AN EXECUTION WILL BRANCH. WHEN THE PREDICTION IS CORRECT (AND IT IS OVER 90% OF THE TIME), THE BRANCH IS EXECUTED WITHOUT DELAY—ENHANCING PERFORMANCE.

WHO SAID YOU CAN'T DO TWO THINGS AT ONCE?

THE FIRST PENTIUM PROCESSOR HAS TWO SIDE-BY-SIDE PIPELINES FOR INTEGER INSTRUCTIONS. THIS ENABLES THE PROCESSOR TO EXECUTE TWO INSTRUCTIONS AT ONCE. AFTER GRABBING AND PARTIALLY DECODING AN INSTRUCTION, THE PENTIUM PROCESSOR DETERMINES IF THE INSTRUCTION CAN BE EXECUTED IN PARALLEL WITH THE NEXT INSTRUCTION IN LINE. IF IT DOESN'T DETECT ANY DEPENDENCIES, THE TWO INSTRUCTIONS ARE SENT ALONG THE PARALLEL PIPES FOR EXECUTION.

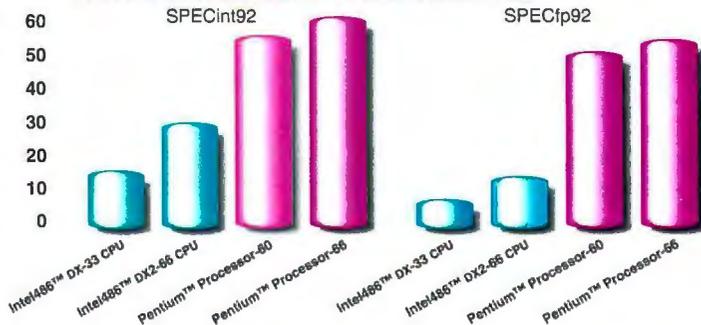
A BIG POINT OF DIFFERENCE IN MATH-INTENSIVE FUNCTIONS.

WE'VE ADDED SPECIALIZED PIECES OF HARDWARE TO SPEED UP THE THREE MOST COMMON FLOATING-POINT INSTRUCTIONS—A MULTIPLIER, A DIVIDER AND AN ADDER. WITH THESE FEATURES, MOST FLOATING-POINT INSTRUCTIONS CAN BE EXECUTED IN A SINGLE CLOCK CYCLE. GIVING YOU UP TO FIVE TIMES THE FLOATING-POINT PERFORMANCE OF INTEL486 DX2-66 CPU-BASED COMPUTERS.

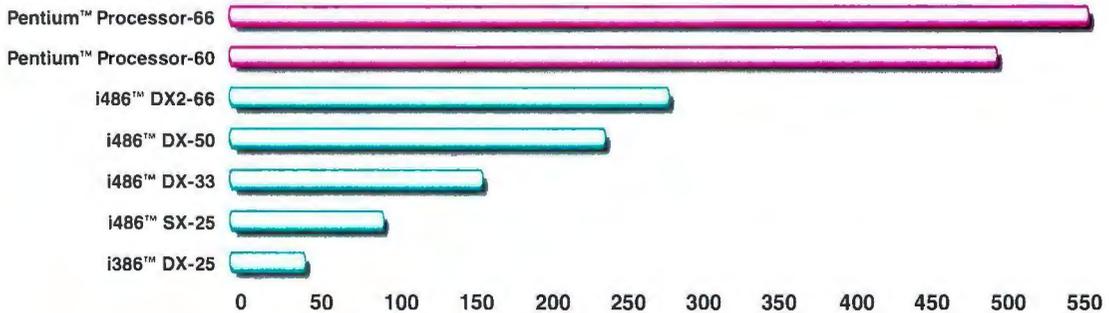


BASED ON SPEC 92, THE INDUSTRY STANDARD WORKSTATION BENCHMARK, THE PENTIUM PROCESSOR IS IN THE SAME PERFORMANCE CLASS AS THE BEST WORKSTATION. BUT THE PENTIUM PROCESSOR IS RUNNING AT ONLY HALF THE CLOCK FREQUENCY, AND SYSTEMS BASED ON THE PENTIUM PROCESSOR COST ONLY ONE-HALF AS MUCH.

THE PENTIUM PROCESSOR PROVIDES WORKSTATION CLASS PERFORMANCE



THE INTEL iCOMP™ RATING INDEX*



*The iCOMP index is an Intel microprocessor "horsepower" rating. It is a composite of selected performance measurements from SPEC 92, ZD Bench, and Power Meter. Source: iCOMP™: A Simplified Measure of Relative Intel Microprocessor Performance, Intel Corp., 1992.

WHAT DOES THIS TECHNOLOGY REALLY MEAN?

It means Pentium processor-based PCs are now as fast as workstations. It means faster Intel486 microprocessors, because our experience with Pentium processor technology allows us to improve them. It means new software horizons being brought to more and more users— such as

3-D design, multimedia, handwriting and voice recognition, virtual reality and more.

WHAT DO YOU NEED?

As you are reading, we are ramping up Pentium processor production. The question is, when will you need a system

based on one? If you're running power-hungry applications, the sooner the better. But for all but the most demanding users, the answer is still an Intel486 CPU-based system. Especially since many Intel486 DX2 processor systems can be upgraded to the same technology found in the Pentium processor with a future Intel OverDrive™ processor.

TECHNOLOGY YOU TRUST.

For over 20 years, Intel has led microprocessor design, development and manufacturing. So with Intel technology inside, you can be assured that you'll always have unprecedented power and unquestioned compatibility.



BESIDES RUNNING EVERYDAY APPLICATIONS BETTER, THE PENTIUM PROCESSOR PROVIDES THE POWER NECESSARY FOR NEW MULTIMEDIA APPLICATIONS LIKE DESKTOP VIDEO CONFERENCING.

FOR A FREE PENTIUM PROCESSOR POSTER,
CALL 1-800-955-5599.

Want more on our latest technology? Then call to receive additional information on Pentium processors and other Intel products that are making PCs better. Ask for literature package #67. The information is free. So is the call.

©1993 Intel Corporation. *One poster per response. Limited to supplies on hand.

D. BARKER

Software Lacks Local Flavor

Arturo Salcido Maese is a software developer looking for his big break. He studied computer science at the Instituto Tecnológico de Estudios Superiores de Monterrey and says had he been born in the U.S., he might have been another Bill Gates. He has written programs he sells, including a set of "Quick" utilities—QuickCalc, QuickInfo, and others—written in Turbo Pascal and priced at less than \$100. "I make software that is easy to use and doesn't cost much money," he says. He meets potential customers face-to-face; he doesn't have a marketing consultant or the luxury of PR. He wants to see homegrown software sold in Mexico.

But the software that gets sold and used here is mostly from the U.S.: Lotus 1-2-3, Excel, dBase, Word, and WordPerfect. At the recent Expo Comm Mexico computer-and-telecommunications show in Mexico City, the only native software company with a booth was Diagnostics Admvo Computaror, a developer of business programs, such as Paciolli 2000. The company is famous as one homegrown venture that's prospered beyond the borders of Mexico. Its U.S. affiliate is DacEasy, a Dallas-based company known for its series of accounting programs.

The lack of local software doesn't mean there's a lack of local talent. Mexican universities have long had programs in computer science, and hackers have roamed here since the

dawn of the Apple II. IBM recently moved a programming project from the U.S. to its plant in Guadalajara. But local developers have yet to place a hit on the best-seller list. They're competing with the likes of Microsoft. And, according to some observers, they are also dealing with a native suspicion of things Mexican.

When the Apple II made its debut here, interest was high. "People thought computers were magic," Arturo says. "We thought they would solve all our problems." But there was little software to go with it. Some people became disillusioned. Others realized that the magic of computers requires a certain sorcery on the part of mortals. These people, like Arturo, became programmers.

In some ways, the Mexican computer market is similar to what you find in other industrial countries: The big computer users are large corporations, banks, and government, and they have been replacing their mainframes and mini-computers with microcomputers and PC-based networks.

With an estimated population of 90 million, Mexico is potentially a gigantic market. But outside the urban areas, there are few signs of the computer revolution.

Even in the cities, there is virtually no home computer market. Systems are just too expensive. Those prices are coming down, however. Gama Computadores, which manufactures PCs in Mexico, now sells 386SXes for around \$800.

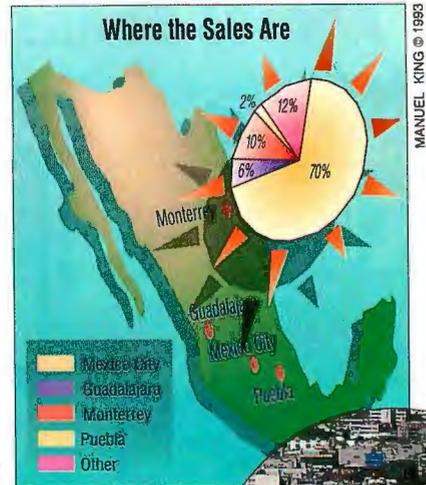
"A year ago, prices were too high for anyone outside business," says Javier Valverde Polin, Gama's director of operations. "But now, prices are becoming cheap enough for home and student markets."

While prices are dropping, Mexican salaries are still low. A good programmer can make about \$18,000 a year. This is certainly much more than most Mexicans make, but it's by no means the comfortable living of a programmer wrangling code north of the Rio Grande.

One problem with U.S. software coming into Mexico is the documentation. Either it's in English or it's translated in Spain, into Spanish Spanish rather than Mexican Spanish. There are anecdotes about neophytes reading the instruction "Insert DOS disk," translating DOS into its Spanish equivalent, and then trying to insert two disks into the PC. Terms like "Boot the computer" don't translate well, and the Mexican word for turning on an electronic device—*encienda*, to put fire into—would seem odd to a Spaniard.

When we met here in February, Arturo was hoping to soon find a partner who could handle the business side of marketing his software, who could get it on the shelves of computer stores. When he spoke again recently, he was still looking. ■

D. Barker is BYTE's managing editor. He can be reached on BIX as "dbarker."



MANUEL KING © 1993

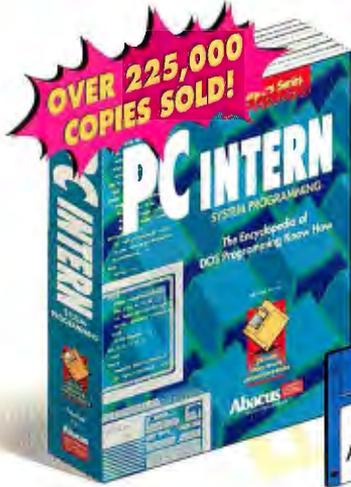


Three cities account for most of Mexico's computer market: Mexico City, Monterrey, and Guadalajara. These cities buy 85 percent of the computer products sold in Mexico. With 20 million people, projected to reach 27 million by the year 2000, Mexico City is a big market unto itself. One resident told a visitor, "Maybe computers can solve our traffic problems."

(Market information from Servicios de Estrategia en Electronica.)

We DELIVER COMPUTING KNOW HOW

Abacus Books will Keep You up to Speed



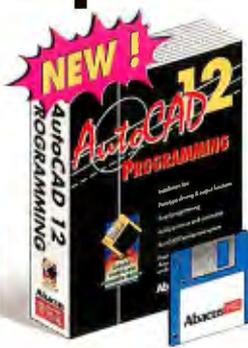
PC Intern

A literal encyclopedia of DOS knowledge. This book is a completely revised edition of our bestselling *PC System Programming* book which has been read by over 125,000 programmers worldwide. Whether you program in Assembly Language, C, Pascal or BASIC, you'll find dozens of practical, parallel working examples in each of these languages. Many of our readers say this book is worth its weight in gold. #B145. ISBN 1-55755-145-6. \$59.95 with companion disk.



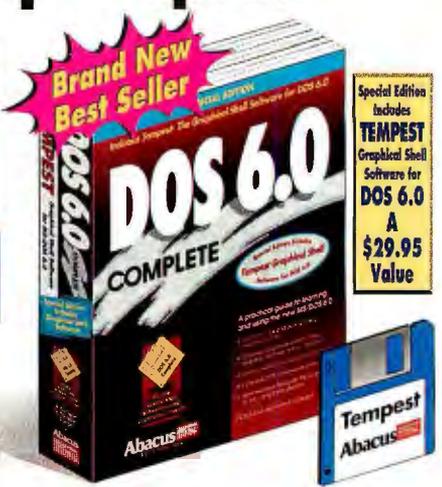
OS/2 Bible V2.1

Explains the many features and tools that are part of the OS/2 32-bit multitasking system, its special functions and the utilities that are part of the package. Whether you want to link simple DOS applications, run Windows programs under the Workplace Shell or understand the structure of OS/2 2.1, this book covers all of these topics. From installation, to the basics of the Presentation Manager, you'll learn how to take full advantage of OS/2 2.1. #B174. ISBN 1-55755-174-X. \$34.95 with companion disk.



AutoCAD 12 Programming

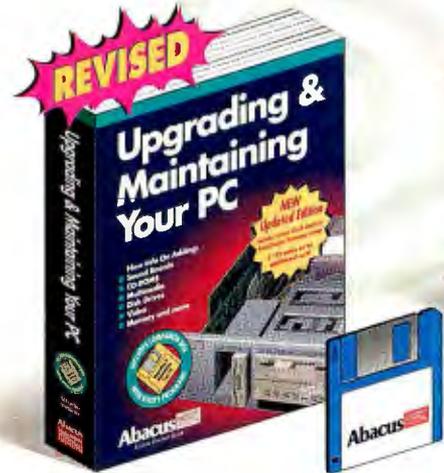
This book will teach you all about BATCH programming (for user defined startup of AutoCAD 12), creating Script files and programming custom commands with AutoLisp or ADS. Also covers prototype drawing and output functions, script programming, AutoLisp, menus and commands, the AutoCAD Development System and more. Disk includes programming examples and ready to use menus and tables. #B173. ISBN 1-55755-173-1. \$44.95 with companion disk.



DOS 6.0 Complete

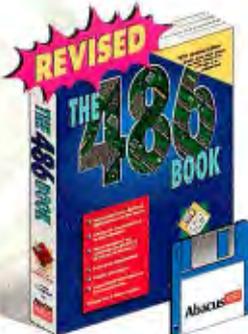
The practical user's guide to DOS 6.0. This book is loaded with helpful hints for outfitting any computer with the new MS-DOS 6.0, covering everything from installation to using the new file, directory and storage maintenance features. DOS 6.0 Complete includes a companion disk with dozens of powerful batch files, detailed explanations and Tempest - the new graphic shell for DOS 6.0. 1100 pages. #B182. ISBN 1-55755-182-0. \$39.95 with companion disk.

Special Edition includes TEMPEST Graphical Shell Software for DOS 6.0 A \$29.95 Value



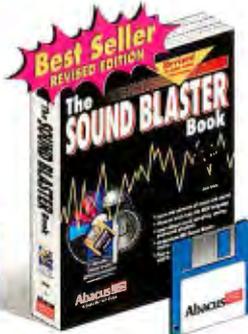
Upgrading & Maintaining Your PC

Turn your PC into a high performance screamer. Whether you're adding memory or a hard drive, CD-ROM or a sound board or upgrading an XT to a 386 or 486, this book shows you how. Includes companion diskette of utilities and System Sleuth™ diagnostic software. 598 pages. #B167. ISBN 1-55755-167-7. \$34.95 with companion disk.



The 486 Book

Explains the features that make this processor so advantageous—the memory capabilities, the math coprocessor, the specialized software that maximizes the CPU's performance and more. Find out why the 486 is replacing the earlier processors. PCINFO program and System Sleuth™ diagnostic software included on the companion diskette. #B183. ISBN 1-55755-183-9. \$34.95 with companion disk.



Sound Blaster Book

Newly revised, this book is your guide to *Sound Blaster*, from installation to custom programming. Includes an overview of the different *Sound Blaster* cards, many specific software products and much more. Also includes simple MIDI system to use with your *Sound Blaster*. #B181. ISBN 1-55755-181-2. \$34.95 with companion disk.



Multimedia Mania

This book removes the hype surrounding multimedia. Learn the basics from adding CD-ROMs and sound boards to making a MPC system. Includes CD-ROM with over 400 megabytes of sounds, graphics, animations, samples and techniques to get you deep into the world of multimedia. Also includes several commercial multimedia demonstrations. #B166. ISBN 1-55755-166-9. \$49.95 with companion CD-ROM.

Order Toll Free 1-800-451-4319

Available at B. Dalton, Crown Books, Egghead, Software Etc., Waldenbooks, Computer City, CompUSA and other retailers nationwide. In Canada, Classic Bookshops, Coles, W.H. Smith. In the UK, call Computer Bookshops 021-706-1188. In Australia call Pacronics 02-748-4700.

In US and Canada add \$5.00 postage. Foreign orders add \$13.00 postage per item. We accept Visa, Mastercard or American Express.

Abacus
Dept. B6, 5370 52nd Street SE, Grand Rapids, MI 49512
Phone: (616) 698-0330 • Fax: (616) 698-0325

Circle 61 on Inquiry Card (RESELLERS: 62).

Please rush me the following books:

- ___ PC Intern\$59.95 ea.
- ___ OS/2 Bible V2.1\$34.95 ea.
- ___ AutoCAD 12 Programming, \$44.95 ea.
- ___ DOS 6.0 Complete SE\$39.95 ea.
- ___ Upgrading & Maintaining ...\$34.95 ea.
- ___ The 486 Book\$34.95 ea.
- ___ Sound Blaster Book\$34.95 ea.
- ___ Multimedia Mania\$49.95 ea.

Subtotal: _____
MI orders include 4% sales tax _____
In US & Canada add \$5.00 shipping: _____
Foreign orders add \$13.00 per item: _____
Total amount (US funds): _____

For fast delivery Order Toll Free! 1-800-451-4319 ext. 26, or FAX (616) 698-0325

Or mail this coupon to: Abacus, 5370 52nd Street SE, Grand Rapids, MI 49512

Method of Payment: Visa Master Card Am. Express Check / M.O.

Card#: _____ Expires: ____/____/____

Name: _____

Company: _____

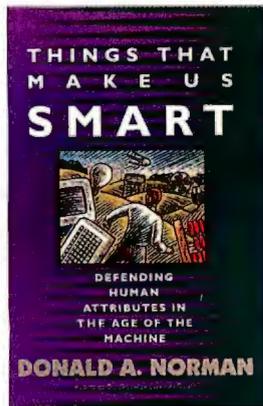
Address: _____

City: _____ State: _____ Zip: _____

Phone#: _____ Fax#: _____

Yes, please rush your free catalog of PC books and software.

Computer Ruminations



BEFORE THE COMPUTER by James W. Cortada
THINGS THAT MAKE US SMART by Donald A. Norman

Time was, when a rifle part wore out, the gunsmith fabricated a new one. The technology to mass-produce replacements that didn't need custom fitting was one by-product of the Civil War; that was the technology that, after 1865, made possible typewriters and cash registers and accounting machines. (No, it's no accident that "Remington" denotes both an office appliance and a gun.) James W. Cortada's intricate history of such artifacts is called *Before the Computer*, and, indeed, it's the computer that has

now pretty well subsumed them all. In their day they filled immediate needs, and no one dreamed that a century down the road lay a single supermachine.

Donald A. Norman's *Things That Make Us Smart* is a complementary account. Although Norman is an Apple Fellow ("the highest-level technical appointment at Apple"), his new book's attention to computers is intermittent at best. Still, they're never far below the horizon of his ruminations, subtitled "Defending Human Attributes in the Age of the Machine." (No, not that tired old tune, dehumanization; Norman's attention is on technology that gets in the way in its eagerness to be helpful.)

Take five pieces of software: dictionary, encyclopedia, thesaurus, spelling checker, and language translator. "Their function would be greatly enhanced if they could all be combined into one." As it is, they can't even intercommunicate, unless thanks to a complicated shell like Windows. Unimaginative programmers? A "tangled web of financial and copyright arrangements"? Norman guesses it's probably both.

Or consider the filing drawer. It was "a major revolution in handling information" when it was first introduced early in this century. It depended on carbon—later, xerographic—copies, and on standardized paper sizes; then, "courses on methods for filing" could become a booming industry. Before the filing drawer, there were desks with pigeonholes. (The holes and slots and drawers were of varying sizes because documents were. "Pending bills" might consist of many small envelopes, "bank records" of several large checkbooks.) And with 60 to 100 places where some item might have been stashed, a human memory with a span of only five to seven categories was a crippled access device indeed.

You can see with what caution all these metaphors need to be looked at as we "computerize." Early in the book, Norman offers an arresting analogy. Here's a game called 15. Its pieces are the nine counting digits. Each player in turn takes possession of a digit. The winner is the first player to get three digits that sum to 15. Try it. You'll discover that, "Though the arithmetic is simple, keeping track of all the possibilities...makes the game difficult."

And here's tic-tac-toe, at which any kiddie speedily becomes expert. And here's the killer: The two games are identical. What a difference the representation makes! And finally: A computer program written to solve tic-tac-toe spatially, the way we do, "would have to figure out whether the X's and O's were on a straight line," a problem in trigonometry. For fast computerization, convert the game to 15. ■

BEFORE THE COMPUTER

James W. Cortada,
 Princeton University Press,
 ISBN 0-691-04807-X

\$55

THINGS THAT MAKE US SMART

Donald A. Norman,
 Addison-Wesley,
 ISBN 0-201-58129-9

\$22.95

Hugh Kenner is Franklin and Callaway Professor of English at the University of Georgia. He writes for publications ranging from the New York Times to Art & Antiques. You can contact him on BIX as "hkenner."



OF HISTORICAL SIGNIFICANCE

CD SOURCEBOOK OF AMERICAN HISTORY, VOL. 1: FROM DISCOVERY TO WWI

Infobases International, Inc., 1875 South State St., Suite T100, Orem, UT 84058, (801) 224-2223, \$69.95

This seems just what the thesis director ordered, a computerization of such a library assignment as used to send graduate students flocking to the stacks in tight patterns. The idea was to get there before too many others got there, else every book would be checked out. But now, forget books! What we have here is a big database of American history texts, plus a fast search facility that handles AND, OR, and NOT—even things like "All paragraphs containing both *freedom* and *liberty* or both *peace* and *prosperity*."

The search works fine. The problem is what we're searching through. Here's a category called First-Hand Sources, amid which we pick the subhead Revolution, and then the document called The Defeat of Burgoyne at Saratoga. Bring up this document and find the following heading: "TITLE: The Defeat of Burgoyne at Saratoga/AUTHOR: Sir Edward Creasy/DATE: 1777/SOURCE: Great Epochs in American History, Vol. 3, Pg. 155-164." You'd expect DATE to be the date of the document, but no, it's the date of the event under scrutiny.

And the Creasy pages are from Sir Edward Shepherd Creasy's *Fifteen Decisive Battles of the World*, a classic published in 1852. *Great Epochs*? That's a 1992 catchall, edited by (it says here) Francis W. Halsey and available only via Infobases, which is also our source for the present CD Sourcebook. What it puts on your screen isn't print but facsimile typescript. As far as I can make out, running standard printed editions through a scanner was harder than just retyping their hundreds of pages in a uniform format (and no guarantees of accuracy). That's typical. And no thesis director would accept so amorphous a reference.

I'm sorry to report that something's been blown again. The idea is good, and the search engine is very good. But the realities under which someone will need this package have not been envisaged at all.

—Hugh Kenner

PROTECT YOUR SOFTWARE



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

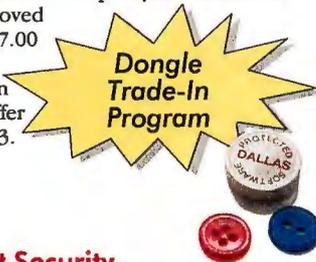
Button Type	Unique Serial #	Read/Write Memory	Password Protection	Expiration Timer	Decoy Responses
DS1420 ID Button	X				
DS1427 Time Button	X	4K bits		X	
DS1425 Multi Button	X	2K bits	X		X

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

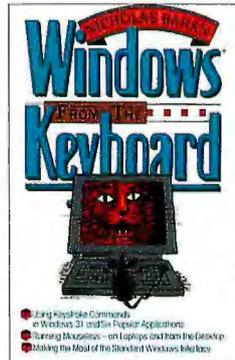
Reviews Books & CD-ROMs

THE KEY INGREDIENT

WINDOWS FROM THE KEYBOARD by Nicholas Baran
John Wiley & Sons, ISBN 0-471-59093-2, \$16.95

A mouse may be appropriate for a windowed environment, but is it required? Not according to Nicholas Baran. His *Windows from the Keyboard* is devoted to operating a Microsoft Windows environment totally from the keyboard. Baran, a BYTE consulting editor, doesn't propose that we should forgo the use of mice. Rather, there are times, such as when traveling with a portable, when it is worthwhile to be able to work without having a mouse attached to your system. Likewise, some people, such as touch-typists, want their hands at the keyboard as much as possible.

Windows from the Keyboard starts with an overview of operating the Program Manager, File Manager, and other system-level programs. It then explores keyboard control over six Windows applications: Ami Pro, Microsoft Word, WordPerfect, Microsoft Excel, Lotus 1-2-3, and Quattro Pro. Baran includes detailed instructions as well as useful summary pages that you can copy and place next to your computer. If you prefer working from the keyboard, this book will help you get the most efficient, flexible use from your Windows applications.



—Raymond GA Côté

UNIX WIZARDS

UNIX POWER TOOLS by Jerry Peek, Tim O'Reilly, and Mike Loukides
O'Reilly & Associates and Bantam Electronic Publishing, ISBN 0-553-35402-7, \$59.95

Behind every smoothly running Unix environment is a Unix wizard. You can identify them by their ability to utter mind-boggling keyboard incantations. As with wizards of old, their power comes not from some mystical source, but from hard-earned knowledge. Unfortunately for the uninitiated, this knowledge is locked within hundreds of books and thousands of articles.

Unix Power Tools unlocks the storehouses of knowledge and can make a wizard out of anyone willing to spend time getting comfortable with the tools. This 1168-page book is not designed for casual reading. Instead, graze through it for solutions and ideas. It starts with the administrative basics of maintaining user profiles, log-in scripts, passwords, and directory structures. Each chapter consists of terse solutions to specific problems (e.g., setting terminal types, seeing log-in messages just once a day, and configuring environment variables).

Moving on, you encounter techniques for navigating the file hierarchy, finding files, dealing efficiently with directories having thousands of files, and looking inside the found files. Once you find the files, you manipulate them with tools ranging from



Maybe they'd get more involved if your presentation had a higher I.Q.*

*Image Quality, that is.

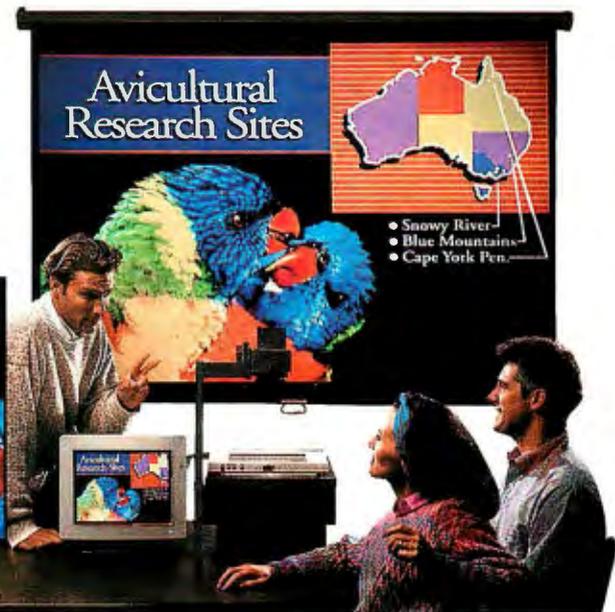
Introducing Proxima® Ovation.™ The fully portable family of LCD projection panels that provides the most vivid color images available today.

Showcase your computer or video images crisply and clearly, utilizing the latest LCD technology and up to 226,981 true colors.

Ovation offers a dynamic range of multimedia capabilities to move and motivate your audience. Project computer presentations, video recordings, computer animation, TV, even live images from camcorders.

Ovation projects whatever you can see on your PC or Macintosh monitor. Just place the Ovation panel on an overhead projector, connect the panel to your computer, VCR, camcorder, or other output device, and you're ready to impress your next audience. Make your presentation even more interactive with the Proxima Cyclops™ pointer system. It's like a cordless mouse. Point, click, and pull down menus—right from the projection screen.

There's a Proxima product for nearly every presentation and price range—from monochrome data projection to full-color animation and video. For the name of the dealer nearest you, call 1-800-447-7694 today. Ask for our booklet which explains the advantages of using today's LCD projection panels.



Ovation projects to the big screen the same color and clarity that you see on your computer monitor. Above right: Actual computer monitor image. Above: Actual projection screen image from Ovation LCD projection panel.

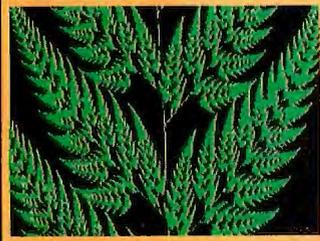
PROXIMA®

Proxima Corporation 6610 Nancy Ridge Drive
San Diego, CA 92121 (619) 457-5500

In Europe: contact Horsterweg 24, 6191 RX Beck,
The Netherlands, +31-(0)43 65 02 48. Ovation and Cyclops are trademarks of and
Proxima is a registered trademark of Proxima Corporation.
†Other brand and product names are trademarks of their respective owners.
©1991, Proxima Corp. All rights reserved.

Circle 161 on Inquiry Card (RESELLERS: 162).

fractal



image

compression

Adding images to your Windows applications? Avoid storage problems with fractal image compression, the technology that inspired PC Magazine to declare "The advantages of fractal compression are unmatched."

This technology is now available to Windows 3.x developers in **POEM ColorBox III**, which provides DLLs for:

- Ultra-high compression;
- Resolution independent images;
- Background compression; and
- FTC-III coprocessor support

For database, multimedia, archiving or other applications, **ColorBox III** is comprehensive, easy-to-use and at \$995, surprisingly affordable.

Call today for more information. Learn why **ColorBox III** can solve your image storage problems.



Iterated Systems, Inc.
5550-A Peachtree Pkwy., Suite 650
Norcross, GA 30092
Tel: 1-800-4FRACTL • Fax: (404) 840-0806

Reviews Books & CD-ROMs

simple editing with *vi* to industrial-strength manipulation with *emacs*, and a slew of automated manipulations, from *sed* through *Perl*. Every tool mentioned in the book is available in both source code and executable form on the accompanying CD-ROM.

Unix Power Tools is an encyclopedic work that belongs next to every serious Unix user's terminal. If you're already a Unix wizard, keep this book tucked under your desk for late-night reference when solving those difficult problems.

—Raymond GA Côté

HARDWARE HELPER

NETWORK INTERFACE TECHNICAL GUIDE, \$119.95

ENCYCLOPEDIA OF MAIN BOARDS, \$499.95

Micro House International, 4900 Pearl East Circle, Suite 101, Boulder, CO 80301, (303) 443-3388

The *Network Interface Technical Guide* and *Encyclopedia of Main Boards* are meant for technicians, computer magazine editors, or anyone who spends much time chasing down switch settings for obscure boards. The first book is an 800-page volume with switch and jumper settings for 330 network cards. Each entry includes a drawing of the card showing the key components, a table of possible settings, and a collection of applications notes. Just as I started looking at this book, I had to install a Novell NE2000 adapter. I quickly found it in the index, and within minutes I had the card configured and installed.

The four-volume *Encyclopedia of Main Boards* contains board layouts with switch and jumper settings for 980 system boards. I tried to spot-check a half dozen or so boards in PC clones at BYTE, without success. I was disappointed that this encyclopedia didn't show *any* of them, when there are over 3000 different system boards out there. Micro House plans to expand the set to six volumes, covering 400 additional system boards, this summer.

The encyclopedia includes a handy disk database of the system boards in the set. You can search by manufacturer, CPU, processor speed, and other criteria, and the process is much faster than leafing through the table of contents. It also includes a list of common acronyms and a glossary of computer terms. I found a few inaccuracies. The glossary incorrectly shows the 8086 processor as the one in the IBM XT, for example.

Both books could pay for themselves in time saved. Just make sure they cover the boards you have in your systems.

—Howard Eglowstein

THE CD-ROM AUTHORITY

CD-ROMS IN PRINT 1993, Meckler Publishing, ISBN 0891-8198, \$95

Meckler's definitive international guide to CD-ROMs is a 736-page book (it's also on CD-ROM). The entries appear alphabetically by title, with indexes on subject, publisher, distributor, and other categories. It's the reference for anyone who needs to quickly track down all titles for a given subject. ■

—Rob Mitchell

Ever seen a grown pirate cry? Just plug this in ... and watch



MEMOPLUG™

The amazing Software protection system based on a hardware plug. Contains read-write programmable memory. This system is practical and easy to use for both programmer and end-user. Supports various programming languages, operating systems and types of computers.

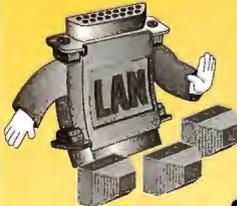
U-PLUG™

The premiere protection plug for UNIX systems that connects the standard serial port of computers and workstations.



LANPLUG™

Comprehensive network protection starts with a single plug. The LANPlug lets you operate protected software from any workstation on the network, while supervising a number of authorized simultaneous operation applications.



CLOCKPLUG™

This unique Time-limited software protection system is based on a plug containing a real-time clock. It allows users limited execution times for leasing and demonstration applications.

A password system allows you to rewind the clock by telephone



Design: Zmhir studio

U.S. office: Tel: 1 (800) 677 1587
Tel: (407) 682 1587 Fax: (407) 869 1409
South Africa: LionSoft Tel: 011 640 6002
Holland: M.H.P. Tel: (31) 440612916
France: C.T.I. Tel: (1) 47 38 16 17
Spain: Economic Data Tel: (34) 1 442 28 00
Czech Republic: PC Kompas Fax: (42) 2 43 11 88

EliaShim
MICROCOMPUTERS LTD
5 Haganim, P.O. Box 8691
Haifa 35022 ISRAEL
Tel: 972-4-516111, Fax: 972-4-528613

Currently looking for international distributors

Programmer's Paradise®

WATCOM™ SQL for Windows by WATCOM

WATCOM™ SQL for Windows is a complete client/server DBMS including a standalone single-user SQL database server. WATCOM SQL for Windows allows you to develop and deploy single-user standalone applications, and to develop applications for use within the WATCOM SQL Network Server Edition. WATCOM SQL for Windows includes support for the Microsoft Open Database Connectivity (ODBC) standard for database applications.



List: \$395 Ours: \$299
FAX_{cetera} # 1683-0013

Distinct TCP/IP for Windows by Distinct Corp.

INCLUDES WINDOWS SOCKETS. This award winning product is the professional programmer's choice for TCP/IP connectivity in the Windows environment. Windows Sockets, TCP/IP Kernel, RPC/XDR, Telnet, and FTP are the *smallest* and *fastest* DLLs available today. Applications developed with TCP/IP can coexist with LAN Manager, Vines, Pathworks and Novell thanks to Distinct's support for Packets, NDIS and ODI drivers.



SDK List: \$495 Ours: \$459
Applications List: \$395 Ours: \$359
FAX_{cetera} # 2994-0002

Multimedia Toolbook by Asymetrix

Complete Multimedia Authoring. Create your own multimedia applications for MS Windows. Simple interface and set of ready-to-use multimedia objects make it the fastest and easiest way to develop multimedia apps. This award-winning tool provides a complete package versatile enough to develop new applications or put a new face on existing ones, with no runtime fee.



List: \$695 Ours: \$529
FAX_{cetera} # 2776-0005

MATLAB® 4.0 for 386 Windows by Mathworks

A high-performance, interactive numeric computation and visualization environment that combines hundreds of advanced math & graphics functions with an easy-to-use and flexible high-level language. The open system architecture enables users to view the pre-packaged functions, cus-

tomize them as needed, or add new functions. MATLAB toolboxes are available to extend the power by providing leading-edge algorithms and functions developed by renowned experts for specific applications.

List: \$1695 Ours: CALL
FAX_{cetera} # 1269-0042



BEST SELLERS!

AceFile for Windows	\$120	ED for Windows	\$169
ADS Diagrammer 2.0	\$239	EDT+	\$199
Artful Two	\$266	Gauss-386i	CALL
AT BiosKit	\$129	IBM OS/2 Upgrade	\$99
Borland C++ & App. Framework	\$549	Iconic Query/W	\$199
Blinker	\$259	Logic Gem	\$83
BRIEF	CALL	Micro-Scope	\$399
C++/Views	\$449	MS Visual C++	CALL
Cache86	\$20	Multi-Edit	\$79
CA-Clipper Comp. Upg.	\$149	ProBas V5.0	\$149
CA-RET/Xbase for Windows	\$199	Rescue	\$50
CASEW for C/MFC/OWL	\$569	.RTLink Plus	\$399
CHARTIST-2	\$75	SitBack for Windows	\$50
Codewright	\$229	SGA: Manager-Win	\$799
DaDisp 105	\$899	SGA: Replay OS/2	\$50
Dan Bricklin's Demo II	\$214	Visual C++ Professional Version Upgrade	\$289 \$129
DataBoss C	\$359	Comp. Upgrade	\$189
DeScribe Word Proc. for OS/2	\$299	WATCOM C 9.0/386	CALL
Do-Dot	\$140		

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. For technical information call 314-334-6317, for orders call 800-445-7899.



List: \$149 Ours: \$79
FAX_{cetera} # 1873-0002

Q+E Database Library (QELIB) 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 formats: Oracle, dBASE, SQL Server, Sybase, DB2, Paradox, INGRES, AS/400 (SQL/400), Btrieve, Excel, INFORMIX, NetWare SQL, and many more. Gateways supported include: IBM DDCS/2, Micro Decisionware, Sybase Net-Gateway, and Gupta SQL Network.



List: \$399 Ours: \$359
FAX_{cetera} # 2625-0003

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.



List: \$595 Ours: \$449
w/MS VB Win. 2.0 List: \$794 Ours: \$569
w/MS VB Win. Pro 2.0 List: \$1090 Ours: \$739
FAX_{cetera} # 1005-0302

8

0

0

4

4

5

-

7

8

9

9



Guaranteed Best Prices!

Lahey F77L - FORTRAN Compiler by Lahey

Version 5.01 includes FORTRAN 90 features: ALLOCATABLE Arrays, CASE Constructs, Cycle and Exit, Construct Names, and many other new features. Package includes Editor, Make Utility, Profiler, Debugger, SLR Linker, Opus Make, Video Graphics, and Excellent Diagnostics. 386/486 users have the option of generating 32-bit instructions.

List: \$295 Ours: \$259
FAX_{cetera} # 1476-0001



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: \$169
FAX_{cetera} # 0233-0011



9
9
8
7
5
4
4
0
8



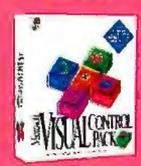
WindowsMAKER Professional 5.0 by Blue Sky Software

Next generation of the most powerful C/C++ Code Generator and Prototyper for Windows 3.1, NT & Win32s. The fastest way to create full-featured Windows apps. This product stands out, does everything—even a toolbar can be created with 1 click! Test run your design/make changes interactively, generate code for multiple platforms—ANSI C, MFC, OWL, etc.; widest compiler support in industry. TrueCode technology—user code is 100% preserved. Highly recommended!

List: \$995 Ours: \$695
FAX_{cetera} # 2602-0003

PRODUCT OF THE MONTH

Microsoft Visual Control Pack by Microsoft Corporation

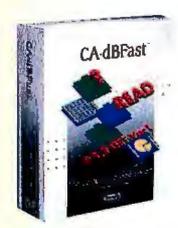


Offers 19 proven programming shortcuts for the Windows™ operating system, including quick access to 3D interfaces, charting, and serial communications. You can even add multimedia or Windows for Pen Computing functionality in a fraction of the time it would take you to create your own support. Just add any of the 19 custom controls to your Visual C++ or Visual Basic Toolbox. Use the sample code and documentation with Visual C++ and create your own custom controls.

List: \$150 Ours: \$99
FAX_{cetera} # 1269-0044

CA-dBFast Windows 2.0 by Computer Associates

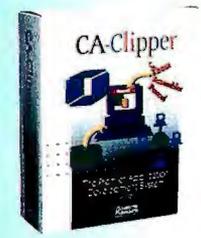
The complete standalone dBASE/Xbase development language for MS Windows. Create fast, powerful, easy-to-use graphical applications with over 200 extensions to the dBASE III PLUS language. It also includes an interactive editor, compiler, and linker. Challenge your creativity and imagination! Design multiple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



List: \$550 Ours: \$359
FAX_{cetera} # 1004-0003

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! And now when you buy, get your choice of dBFast, Clipper Tools or dBASE Compiler Kit—FREE!



List: \$199 Ours: \$149
FAX_{cetera} # 5400-0001



dGT Unlimited! by Blackhawk Data Corp.

PAINLESS PICTURES—The Database Graphics Toolkit (dGT Unlimited) turns any database into an image database, in three easy steps: 1) add a field to your database record; 2) add a line to your entry screen; and 3) RUN! Fast, powerful, reliable, flexible and now Royalty-Free up to 1000 copies, dGT Unlimited works with 40 different languages, runs on any VGA or EGA, supports images up to 1024x768, and can retrieve images from memo fields and BLOBs.

List: \$595 Ours: \$449
FAX_{cetera} # 3051-0004



OS/2 by IBM

OS/2 increases your operating system choices by providing you with DOS, Windows and OS/2 support. Because OS/2 was created for use with 386SX and above processors, it offers full 32-bit addressability and true concurrent multitasking. OS/2 also features an object-based user interface, enhanced file system, advanced memory technology and the ability to complete many processes within a task simultaneously.

List: \$195 Ours: \$126
FAX_{cetera} # 3142-0009

Programmer's Paradise

Programmer's Paradise
Italia
Phone: 39-2 480-16039
2-480-1653

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

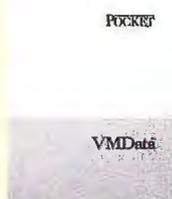
MetaWare, Inc. announces its newest product! The 32-bit High C/C++ compiler version 3.0 is a true compiler, not a C to C++ translator. "Incremental Strengths" let you specify the level of C++ compilation, allowing you to migrate from C to C++, one C/C++ block at a time. Included is a C++ tailored source-level 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_{cetera} # 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_{cetera} # 1987-0005

Allegro CL/PC by Franz Inc.

Object-oriented development system for MS Windows based on Common Lisp Object System (CLOS). Native 32-bit compiler and integrated programming environment including editor, debugger, profiler, DLL support. Avoid memory-related errors with unobtrusive garbage collector. Build interactive GUI applications with high-level interface to Windows API. Runtime generator permits royalty-free delivery. The most advanced OOP system for Windows!



List: \$545 Ours: \$499
FAX_{cetera} # 3010-0001



BASIC Network Library Network C Library by Automation Software Consultants, Inc.

The most comprehensive libraries available for NetWare software development, supporting all versions of advanced NetWare including 3.11. Over 450 C functions and 300 BASIC functions. Include any features from the NetWare command line utilities and menu utilities in your C or BASIC program. No licensing hassles. C library source code available.

BASIC Library List: \$265 Ours: \$229
C Library List: \$295 Ours: \$259
FAX_{cetera} # 1004-9201

WATCOM C/C++³² Optimizing Compiler and Tools V9.5 by WATCOM

C/C++³² is a professional, multi-platform C and C++ development system supporting 32-bit application development for extended DOS, OS/2 2.x, Windows 3.x, Windows NT, Win32s, and AutoCAD ADS/ADI. The C++ compiler provides comprehensive support for the AT&T version 3.0 language including templates plus exceptional handling. The C compiler is ANSI Standard and IBM SAA compatible.

List: \$599 Ours: \$349
FAX_{cetera} # 1683-0003



Multi-Edit Professional by American Cybernetics

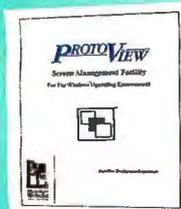
A richly featured, easy-to-use programmer's text editor. Multi-Edit's flexibility and sheer power combine to provide you with unparalleled productivity. Features include: intuitive user interface, mouse support, syntax highlighting, cross directory multiple file search AND replace, color templates, and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

that thinks like a programmer! Free demo disk available.

List: \$199 Ours: \$139
FAX_{cetera} # 1846-0001

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: \$89
FAX_{cetera} # 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_{cetera}®: 908 389-8173

Programmer's Paradise®

• All prices are subject to change without notice.

Circle 107 on Inquiry Card.

8
0
0
4
4
5
7
8
9
9

Available for:
DOS, Windows,
OS/2, & UNIX
Supports:
Microsoft C7.0
Borland C++, Zortech C++, UNIX, & C/Front



Stop struggling with big C++ applications.

Tired of Wrestling with Application Design?

You need more than streamable objects and simple persistence to get the most out of C++. Add muscle to your toolkit with Raima Object Manager, a powerful class library that simplifies your application and integrates easily into your C++ code.

Object Manager is a natural extension of C++ that makes storing and retrieving objects as easy as inheriting from our StoreObj class. And because Object Manager is built on our top-rated* Raima Database Manager engine, your executable is fast and efficient.

Simplify Complex Applications

Object Manager base classes let you easily navigate between objects and maintain "real world" relationships, no matter how complex. Whether you're working on a customer object with a complete list of transactions or a bitmap with related multimedia data, Object Manager handles your class relationships with ease.

Raima Object Manager™ *The object storage class library*

Raima Benelux 31 (2159) 44738 • Raima Deutschland 49 (7022) 9256 0 • Raima Italia 39 (49) 829 1285 • Raima U.K. Ltd. 44 (276) 685761 • Rhone-Alps 41 (21) 825 4800

* Benchmarks published in *Byte Magazine*, January 1992

** Reviewed in the "Toolkits" section of *PC Magazine*, November 10, 1992

© 1992 Raima Corporation. Raima Object Manager and Raima Database Manager are trademarks of Raima Corporation. Raima is a registered trademark of Raima Corporation. Other computer and software names are trademarks or registered trademarks of their respective holders. Raima Corporation, 1665 NW Sammamish Rd., Suite 200, Issaquah, WA 98027 USA

Overload It!

Object Manager takes advantage of C++ operator overloading to provide you with customized operators for navigating a table. For example,

```
for(salesOrder[FIRST]; !salesOrder.EOF(); salesOrder++)
```

uses our array notation operator to start at the beginning of a table and read each record until it reaches the end.

What could be easier?

Win the OOP Battle

If you're serious about object-oriented programming, find out why *PC Magazine* says "At a time when no one else—including Borland or Microsoft—has released an object-oriented database manager, C++ programmers have an excellent tool available: Raima Object Manager."***

- ✓ VLF and BLOB support
- ✓ Safe Type Checking
- ✓ Referential Integrity
- ✓ Container Classes
- ✓ Source Code Included

In the U.S. or Canada, call:

1-800-DB-RAIMA

In Washington state or international,
call 206-557-0200 Fax: 206-557-5200

RAIMA™

BY63SW

Computers for the Disabled

JOSEPH J. LAZZARO

Sal has all the makings of a good telemarketer: He's bright, outgoing, and persistent. He is also blind. Phyllis wants to hire him, but she has some concerns. How will he be able to use the company's database if he can't see the monitor? How will he read office correspondence? And more important, what will it cost the company to adapt the workplace to accommodate him?

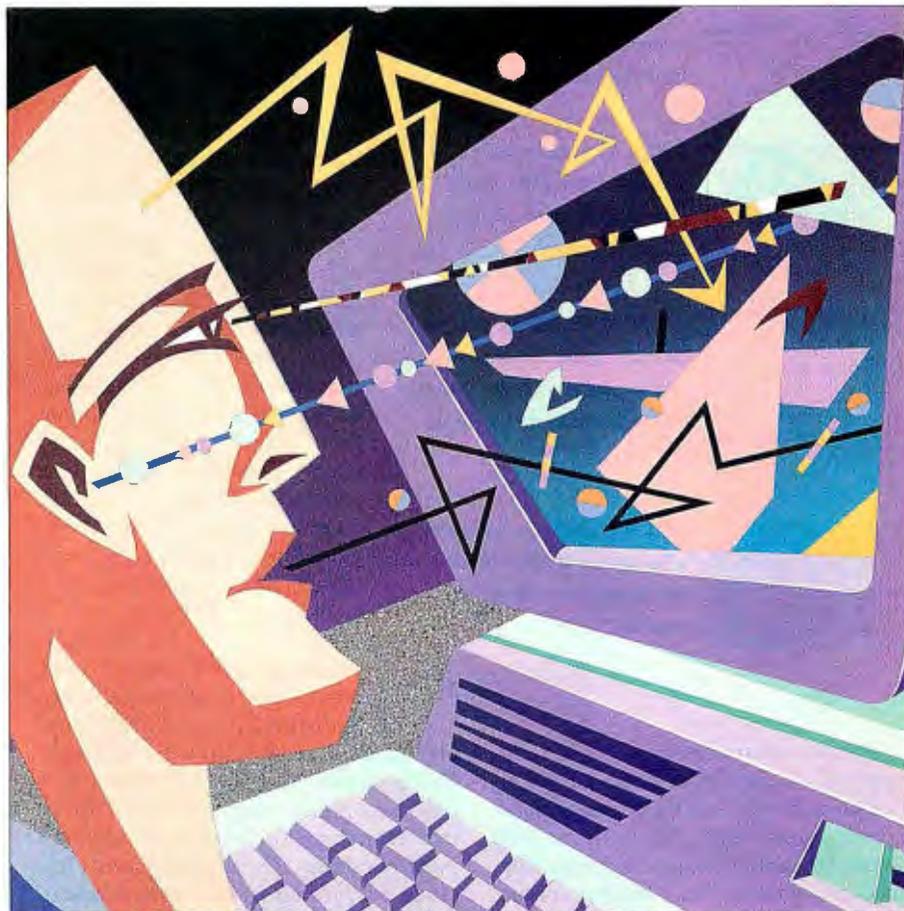
Phyllis *must* accommodate him, since her company is in the U.S., and therefore subject to the Americans with Disabilities Act, or ADA (see the box "For More Information"). But she needn't worry. The latest adaptive technology for personal computers provides a cost-effective way to allow Sal and workers with other disabilities to do their jobs with independence.

Getting Access

Personal computers are directly compatible with many adaptive hardware and software products. You simply install them as you would any other add-in board or application. The majority of adaptive products are developed for the platforms that are commonly used in business environments: MS-DOS, Windows, and the Macintosh. Fewer products are available for Unix, but development work is under way due to the influence of the ADA.

When adapting a personal computer, you should pay special attention to hardware requirements (see the box "Adaptation Needs"). Both PCs and Macs require at least 25 MHz of processing power to run many adaptive applications, such as OCR or speech-synthesis programs, in conjunction with mainstream programs, such as spreadsheets.

Memory is another major consideration. For adaptation, many systems require a minimum of 1 MB of RAM—4 MB if you're running Windows or if you're attached to a network. The number



ROBERT BURGER © 1993

Adapting desktop computers to meet the needs of disabled workers is easier than you might think

of expansion slots is also vital. For instance, if you have a machine with five slots, you can install a speech synthesizer and an optical scanner alongside your video and drive controllers and still have one slot free.

Another important issue is how many serial and parallel ports your computer has. Many adaptive devices interface to the computer through serial ports, using standard nine- or 25-pin connectors.

Analyze, Then Adapt

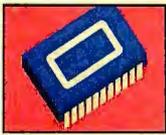
The first task in adding adaptive technology to a computer is to determine the specific needs of the disabled worker in question. "It's very important to analyze the job thoroughly," says John Robichaud, a rehabilitation engineer with the Occupational Rehabilitation Group (Cambridge, MA), "and this goes way beyond just the PC." Robichaud's company looks at each job in terms of its component tasks and all the systems at the site used to perform those tasks.

continued

Adaptation Needs



HARDWARE: Both PCs and Macs require at least 25 MHz of processing power to run many adaptive applications, such as speech-synthesis programs, in conjunction with mainstream programs, such as spreadsheets.



MEMORY: Many systems require a minimum of 1 MB of RAM—4 MB if you're running Windows or if you're attached to a network.



EXPANSION SLOTS: With five slots, you can install a speech synthesizer and an optical scanner alongside your video and drive controllers and still have one slot free.



PORTS: Many adaptive devices interface to the computer through serial ports, using standard nine- or 25-pin connectors.

dot/ASCII modem is a logical investment. For a motor-disabled user, an adapted keyboard or a Morse-code entry system is feasible.

To assist with adaptive technology, mainstream companies are providing consulting services and adaptive equipment to comply with the ADA. The SNAP (Special Needs Access Program) is a joint project of AT&T and NCR. It offers engineering consulting services and adaptive hardware and software for fees ranging from \$75 to \$125 per hour.

Cortez Martin, civil rights manager for the FAA Technical Center at the Atlantic City International Airport, used the SNAP to help accommodate a visually impaired worker. "We gave the consultants a real thumbs-up for their efforts and the approximately 20 hours of training they provided," he says. "The software and hardware they suggested made [our] employee more productive and more efficient."

DEC is using its DECTalk speech-synthesis system to help blind people to read and nonverbal people to speak. DEC has

software (i.e., programs that electronically lock and hold the Shift, Ctrl, and Alt keys).

Adapting to a Specific Need

To work effectively, most vision-impaired users need to have their computers adapted with technologies such as speech synthesis, magnification, braille, and OCR. Speech-synthesis systems interface to a



A PC for a blind user, equipped with an Oscar optical scanner and a braille printer, both by TeleSensory. The optical scanner converts text into ASCII code or into proprietary word processing format. Files saved on disk can then be translated into braille and sent to the printer. Visually impaired users can also enlarge the text on the screen by loading a TSR software magnification program.

The next step is to focus on the employee's abilities. If he or she has no vision, then a speech or braille output package is recommended. For someone with limited but usable vision, a software magnification package may be appropriate. For a hearing-impaired worker, a Bau-

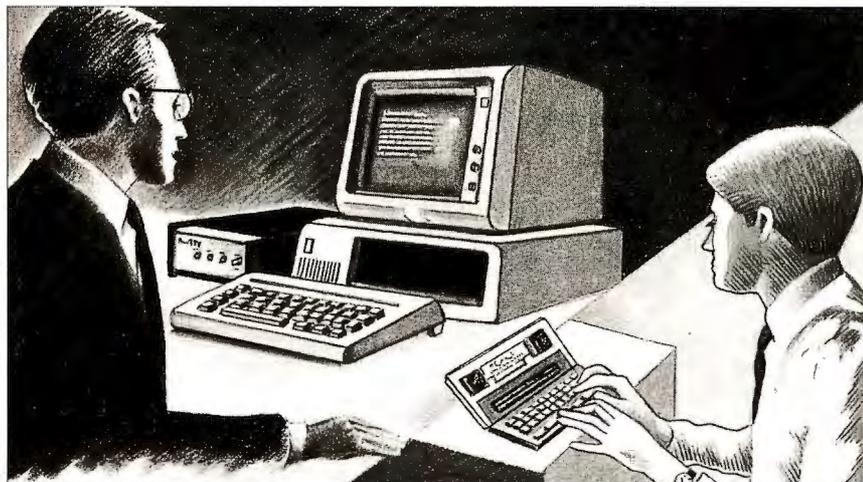
also created an Assistive Technology Group. In addition, Apple Computer and IBM have produced and sponsored assistive technology for their respective computer platforms. Their developments include everything from graphics-based speech-synthesis systems to sticky-key

computer through 8- or 16-bit slots or through standard RS-232 serial ports. They rely on TSR packages, known as screen readers, to drive them.

One example of a speech-synthesis system is VertPro from TeleSensory (Mountain View, CA). This \$1795 product can read MS-DOS-based word processors, databases, spreadsheets, and other text-based software. Window Bridge from Syntha-Voice (Hamilton, Ontario, Canada) is a \$695 Windows-based screen reader. This product can verbalize both MS-DOS- and Windows-based applications, and it will drive most speech synthesizers.

Magnification software can enlarge text appearing on the screen by up to 16 times. ZoomText Plus (\$595) from AI Squared (Burlington Center, VT) and Magic Deluxe (\$295) from MicroSystems Software (Framingham, MA) can both enlarge text on MS-DOS and Windows applications. Berkeley Systems (Berkeley, CA) markets inLarge, a \$195 Mac-based software package that magnifies most commercial applications.

For braille output, the Juliet printer

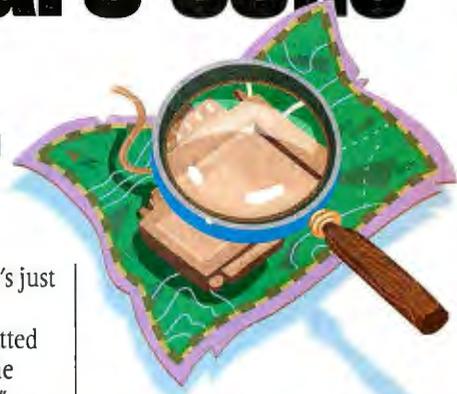


This deaf user's PC is connected to a telephone via an Ultratec Intel-Modem Baudot/ASCII modem. The user is sending and receiving messages to and from someone at a remote site who is using a telecommunications device for deaf people (right).

ROBERT BURGER © 1993

DRAWINGS: TOM CENTOLA © 1993

Why some software sells more than others.



Success. All software developers strive 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," explained Don.

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, Windows, OS/2, Macintosh, 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 — 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.

© 1993 Rainbow Technologies, Inc. All product names are trademarks of their respective owners.

Circle 134 on Inquiry Card (RESELLERS: 135).



The best place to get your photos printed.

You don't need a photo lab to get computer output like this. A Phaser™ IISD color printer from Tektronix will do just fine. It's the dye sublimation printer that gives you detailed, photorealistic images and crisp, clear text, too—thanks to TekColor™ Photofine technology. For just \$9995 you'll get stunning 300 dpi print quality, true Adobe® PostScript™ Level 2, a 24MHz RISC processor for speedy image processing, and a printer that's ready to go to work with PCs, Macs and workstations. Practically speaking, it's like having a darkroom on your desktop.

For a free photo-print sample call the leader in desktop color printers at 1-800-835-6100 Dept. 25C. Or call (503) 682-7450, ask for Document 1222 and we'll immediately fax you information.



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.

Circle 145 on Inquiry Card.

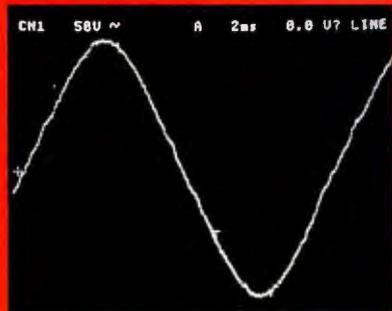
screen readers exist, but few GUI screen readers are available. The use of multimedia could prevent blind users from accessing the information servers of the future unless a method can be found to translate animation into either speech output or braille. Pen-based computers could prevent the use of adaptive equipment for two reasons: They lack expansion slots for specialized hardware, and the heavily visual operating system isn't friendly to blind users.

Another problem is the long stretches

of time between the appearance of mainstream products, such as spreadsheets and word processors, and those products' ability to interact with adaptive equipment. Ideally, this lag time will decrease as companies consider adaptive access early on in the design stage.

On July 26, 1994, companies with as few as 15 employees will be mandated to comply with the ADA. This criterion will make the ADA applicable to many more businesses. Because of the implementation of this new law, and the ever-increas-

Oscilloscope Readings Don't Lie. Tripp Lite Outperforms American Power.



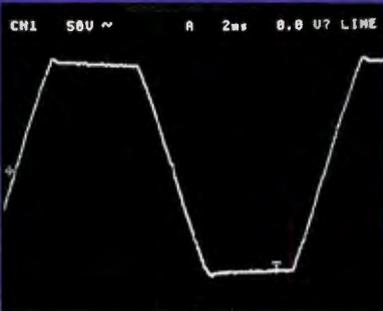
Model: Tripp Lite Unison[®] PS 6.0

Tripp Lite Unison Claims: Sine Wave Output, On-Line UPS

Oscilloscope Shows: Pure Sine Waveform

Transfer Time: 0 ms. (on-line)

Unison provides pure sine wave output at all times, regardless of battery voltage level or size of the load it is supporting. There is less than 4% total harmonic distortion (THD) exhibited.



Model: APC Smart-UPS[®] 600

APC Claims: Sine Wave Output Line Interactive UPS

Oscilloscope Shows: Flat-topped trapezoidal waveform

Transfer Time: 2-4 ms. (standby)

The APC Smart-UPS is a standby UPS that produces a trapezoidal waveform with approximately 20% total harmonic distortion (THD) ...

Not Sine Wave!

SEE THE FACTS before you buy a sine wave UPS system. APC claims their Smart-UPS[®] outputs sine wave power. But when viewed on an oscilloscope you'll see a different story.

APC's Smart-UPS[®] only provides a flat-topped waveform while supporting its load. The only time Smart-UPS[®] produced a sine wave was when nothing was plugged into it!

Smart-UPS[®] does not produce sine wave power under load!

A flat-topped waveform produces increased levels of total harmonic distortion (THD). This causes heating of electronic components and impaired performance of sensitive equipment.

Why would APC claim to have something they don't? Call it marketing genius or just plain clever. The answer is that the UPS technology to produce a pure sine wave form is expensive. APC chooses

to cut corners, giving your computer much less than a pure sine wave and certainly less than what you paid for.

If you want true sine wave power from a UPS, then trust us. Our Tripp Lite UNISON[®] on-line, sine wave power UPSs provide pure sine wave power, plus unmatched performance and value.

FIND OUT more about the differences between sine wave power and all other waveforms, call us and we'll send you Technical Note #17.



100 N. Orleans • Chicago • Illinois 60610-4188 • Tel: 312/329-1601 • Fax: 312/644-6505
France: (1) 40 74 35 22 • UK: (0272) 308660

Tests were performed on a Tektronix Model 2430 digital oscilloscope; scale 1 div = 50 volts; vert. 1 div = 2 ms.; horizontal. The ambient test environment was 68-72°F and 15-45% relative humidity. Both UPSs tested were rated at 600 VA. A 47 ohm load (300 watts nominal) was used. All UPS batteries were brought to a full state of charge before testing. Oscilloscope photographs were all taken at the same point in the battery cycle. Date of test: February 25, 1993. All UPS systems were purchased through commercial sources. Models used: Unison[®] 6.0A and Smart-UPS[®] 600. Smart-UPS[®] is a trademark of American Power Conversion.

For More Information

- By calling the toll-free hot line at The National Institute on Disability Rehabilitation and Research (NIDRR) in Washington, D.C., at (800) 949-4232, you will be directly connected to your nearest ADA technical assistance center.
- You can obtain a free handbook (in either hard-copy or electronic form) about how to add adaptive technology to personal computers from the Clearinghouse on Computer Accommodation (COCA) of the Information Resources Management Service, General Services Administration. Write to: Susan A. Brummel, Director, COCA, c/o GSA, Room 2022, KGDO, 18th and F Sts. NW, Washington, DC 20405.
- State rehabilitation agencies, which are usually located in your state capital and listed in the phone directory, are a source of free information on ways to comply with the ADA.
- DOS-Abledata is a CD-ROM database from the Trace Center in Madison, Wisconsin. You can purchase this CD-ROM directly from the Trace Center for \$25. You can also access its contents via the Massachusetts Commission for the Blind's BBS at (617) 451-5327 or via Project Enable (a disability-oriented BBS) at (304) 766-7842.
- The Internet has at least two newsgroups covering disability-related issues. These groups are called misc.handicap and alt.education.disabled. On-line services such as GEnie, BIX, CompuServe, and Delphi also have forums dedicated to adaptive technology.
- The Department of Justice runs a BBS dedicated to providing information on the ADA. To access it by modem, call (202) 514-6193.

ing pervasion and decreasing costs of PCs, the future of adaptive technology is on a rising curve.

The payoff of the availability of adaptive equipment benefits everyone. "Building access for disabled people is the same as building better interfaces for all users," says Janina Sajka, project manager of the World Institute on Disability Network (Oakland, CA). "By studying the needs of disabled workers, we have the opportunity to build better access for everyone." ■

Joseph J. Lazzaro is director of the Adaptive Technology Program at the Massachusetts Commission for the Blind in Boston. He is the author of Adaptive Technologies for Learning and Work Environments (American Library Association, forthcoming). You can contact him on BIX as "lazzaro@bix.com" or on the Internet at lazzaro@world.std.com.

PULL
HERE

Don't Open
Until 1994



To: PC Buyers
From: Your friends at
Gateway 2000

More Reasons To Go Hog-Wild During

Need a reason to celebrate? We're making this the best summer ever to buy a Gateway PC! During our 486 Fest, you'll find better-than-ever buys on all the fabulous systems in our product line. You'll think you died and went to hog heaven! Buy some fiesta goodies, invite a few party animals over and call us. We'll give you lots of reasons to party!

Party Reason — *Choosing a 486 system shows you're a smart buyer!*

A less astute buyer might go for a 386 or Pentium™ system, but you know where the real value is. Gateway 2000's desktop and Nomad PCs are now all 486 systems for good reason. With our great prices on 486 technology, 386 systems are no longer a smart buy. And first-generation Pentium systems are not a good value.

Even if you were willing to pay the steep premium other manufacturers are charging for Pentium systems, you'd have trouble getting one because availability is extremely limited. Our engineers say the Pentium systems in our lab run so hot, you could use one to heat a hog barn. Besides, Pentium systems on the market today will be outperformed quickly by improvements in Pentium technology. That's why we're not selling Pentium systems yet. At Gateway, we won't sell anything unless it's a good value for you.

In today's market a 486 machine is the way to go, especially now that all of our desktop ISA systems are Pentium technology ready and guaranteed to be upgradeable.

Party Reason — *If you pick a mini desktop, you'll save enough to invite the whole barnyard to your party.*

Gateway's mini-desktop systems — 4SX-25, 4SX-33 and 4DX-33 — are petite but powerful, based on an integrated design that incorporates many subsystems on the motherboard for the best price-performance ratio. All mini desktop systems include: 4 to 8MB RAM; a large and fast hard drive, operating on the local bus for even faster drive performance; a fast video chipset with 1MB; a brilliant, crisp display from the standard 14-inch CrystalScan™ non-interlaced, .28mm dot pitch color monitor; and more available expansion slots than you find in most small-footprint PCs. The combination of these features makes a cool Windows™



Gateway's 486 Fest!

machine for an unbeatable price. Now that's cause for celebration!

Party Reason — *You'll be wallowing in ecstasy if you buy a local bus system.*

Go ahead and splurge on our 4DX2-50V or 4DX2-66V models. We put ATI's™ Graphics Ultra Pro video card with 1MB VRAM on our VESA® local bus for results that will be the hit of your party.



Plus, these systems have a hefty 8 or 16MB RAM with cache, and party-hearty hard drives running on the local bus. You get an extra VESA local bus expansion slot, a 15-inch flat, square CrystalScan color monitor, and more free choices of application software than you'll find anywhere else.

Party Reason — *You'll get the CD-ROM drive you always wanted.*

It's included with our 4DX2-66 systems! Or you can upgrade any other standard configuration with a CD-ROM. We supply a free system CD when you purchase a PC with a CD-ROM drive. The CD includes Microsoft's® Multimedia Pack,™ designed to let you explore the value of multimedia technology. You get an interactive user's guide to Windows and a collection of sound, animation and video clips to use in business presentations and documents.

Party Reason — *You can have it your way at Gateway.*

We custom build each Gateway 2000 computer to your order. We'll gladly provide you with a quote on a special configuration. Call our sales department!

Party Reason — *You'll save money!*

Check the configurations and prices on the back page of this ad. We've gone hog-wild for 486 Fest!

Party Reason — *The wrappings!*

Your Gateway system comes in a black-and-white cow-spotted box. Some people use our boxes for end tables and playroom furniture. It will certainly be a conversation-starter at your party.

Party Reason — *Get our 486 Fest Best Buy!*

Check the back page of this ad for an unbelievably good buy on a smart 4DX2-66 local bus system configuration including 8MB RAM, 340MB hard drive and CD-ROM for only \$2495!

The Gateway 2000 4DX2-50V at \$2295 is a favorite with our three little pigs.

 **GATEWAY2000**

8 0 0 - 8 4 6 - 2 0 5 8



We Ki



With Gateway's Pentium™ Technology Guarantee, You Have A Good Reason To Celebrate!

If you've been worried about keeping up with technology now that Intel's® Pentium processor has been announced, relax! Kick back and join the Gateway 2000 486 Fest, featuring great buys on 486 systems and our Pentium Technology Guarantee. It's a Gateway-exclusive offer that allows you to keep up with technology *and* save big bucks when you buy a Gateway 486 Pentium technology ready system this summer!



Guaranteed Upgradeability

We *guarantee* you can upgrade your Gateway 486 Pentium technology ready system to future Pentium processor technology products in 1994. This next-generation OverDrive processor will easily plug right into the ZIF (zero insertion force) socket already installed on your upgradeable Gateway 2000 system with no modifications. And, unlike many manufacturers, we've already had our systems heat tested for use with Pentium technology processors.

Guaranteed Performance

We *guarantee* your upgrade to Pentium technology will accelerate overall system performance by 50 to 100%. It's likely that your upgraded 486 system will outperform Pentium systems on the market today.

ew You Couldn't Wait, You Party.



Party On With Value-Priced Portables

Keep counting the reasons to celebrate during Gateway's 486 Fest! You'll find plenty when you look at our Nomad notebook PCs and computer peripherals!

Nomad Notebooks

Party Reason — *You'll get 486 desktop performance in a lightweight portable when you buy a Nomad.*

Why settle for a 386 notebook when you can get a powerful 486 Nomad in the same price range? All three Gateway 2000 Nomad models are 486 systems with snappy performance that's still rare in notebooks. Plus, they're smaller than many notebooks, weighing just 5.6 pounds and measuring 8.5" x 11" x 1.8". No other notebook this size can beat the Nomad 450DXL's combination of performance and battery life! In *PC Magazine's* Battery Rundown Test, Nomad systems operated up to six hours on a single battery with power management enabled.

Party Reason — *No more squinting at a dim and fuzzy display!*

Nomad screens are big and brilliant — a full 10" VGA backlit display with 64 gray scale. You can use your Nomad in all lighting conditions.

Party Reason — *Three cheers for a great keyboard and mouse!*

Nice feel! The 79-key touch-type keyboard is comfortable, quiet and fast. Nomad 450DXL models now also include Microsoft's® Ballpoint™ portable mouse with Quickport™ standard.

We have lots of options for our Nomads, too. Call for details!

Peripherals

Party Reason — *You'll save money on connectivity tools!*

TelePath™ Fax/Modem. It's everything you ever wanted in an internal fax/modem, including a great price! The Gateway 2000 TelePath is a 14,400bps modem, V.32bis, with 9,600bps fax capability. It's compatible with the standard AT command set and is downwardly compatible with

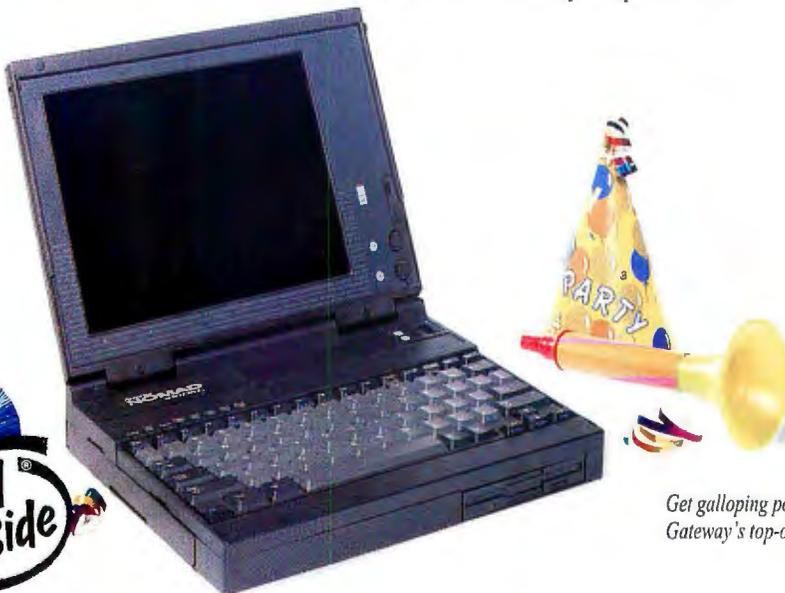
lower modem speeds. Package includes software — WinFax Pro®, Crosstalk™ for Windows and Qmodem — plus a free CompuServe® trial membership. **\$195**

Network Cards. Call for a selection of Ethernet cards and Token Ring adapters, installed and configured.

Microsoft Windows™ for WorkGroups. Networking made easy! Share files and printers, send electronic mail, schedule group meetings with the click of your mouse — and get everything you need in one inexpensive package. That's the beauty of Windows for Workgroups. Even a beginner can set up and configure a network with this fantastic product. Price includes an Ethernet adapter and software. Hardware and software are factory-installed. **\$159**

Party Reason — *You'll save money on multimedia software and peripherals!*

CD-ROM Kit. You'll enter a whole new world of possibilities with your PC when you add a CD-ROM drive, giving you access to exciting new applications, databases and entertainment programs. With applications continually getting bigger, wouldn't it be convenient to get software on a single CD rather than piles of floppy disks?



Get galloping portability on your road trips with Gateway's top-of-the-line Nomad 450DXL.

And Peripherals!

Comparable CD-ROM drives usually retail for over \$400. Manufactured specially for Gateway 2000, this kit includes CD-ROM, interface card and everything you need to add MPC-compliant CD-ROM to your PC. **\$225**

Microsoft Windows Sound System.™

Here's the sound system designed for business, complete with a headset for private office use. You can "speak" commands to your PC for hands-free operation. Let your PC read numbers back to you for proofing spreadsheets. Embed audio messages in Windows OLE applications. Add audio to screen savers. Play your Ad Lib® and Sound Blaster™ games — and more! Our special Gateway price includes soundboard, microphone, headset and software. **\$149**

Party Reason — *You'll save money on all kinds of extras from Gateway!*

Colorado Memory Systems™ TBU.

250MB internal automatic tape backup unit copies up to 9.5MB per minute with high-speed data compression. Reads previously formatted Archive™ tapes, too. Comes with easy-to-use DOS software, one tape and cable. 486 Fest price: **\$195!**

CrystalScan™ 15-Inch Monitor.

Non-interlaced color monitor with flat, square screen. If the system you want is advertised with a 14-inch monitor, you can upgrade at the time of purchase to a 15-inch monitor for only **\$100.**

Panasonic® KXP2123 Color-Capable Printer. Add color to your documents with this 24-pin dot matrix printer. Includes Adobe Type Manager.® Call for 486 Fest price!

Texas Instruments® MicroLaser™ Plus

Laser Printer. Never before has such a small, Postscript® laser printer offered so much speed and economy. The MicroLaser Plus is only 13.4" x 14.2", yet it prints 9 pages per minute at 300dpi. Call for 486 Fest price!

Gateway 2000

486
F e s t

We offer many other system options and upgrades, including 17" and 20" monitors, tape backup units, bigger hard drives, other software and more! Call today!

The software and peripherals listed here are sold only with the purchase of a system. For details on our complete line of extras for Gateway customers, ask for our special add-on components division when you call.



 **GATEWAY2000**

8 0 0 - 8 4 6 - 2 0 5 8

Celebrate! We Give You More Software

That's right! We have even more reasons to party during Gateway's 486 Fest! We offer more free choices of application software with our systems than any other manufacturer. Plus, all software is pre-installed and ready to run the moment your system arrives. Hooray! No installation hassles!

With Nomad, mini desktop and our 4DX2-66 Best Buy systems, you get Works, one of the best integrated software packages on the market.

Party Reason — Microsoft Works for Windows.™

Works for Windows is the single program that combines all the tools you need to run a business: word processor, spreadsheet, database and electronic communications. It's simple to use yet provides power and functionality for advanced users.

With desktop and tower systems that include "choice of application software," you can select one of the following software packages. All applications are the latest versions.

Party Reason — Microsoft Excel for Windows.™

Microsoft Excel gives you unprecedented power and analytical functions, outstanding reporting and presentation tools, and easy charting. Includes faster ways to work. Reviewers consistently choose Excel as the best spreadsheet for Windows. It's an *InfoWorld* Product of the Year!



Party Reason — Microsoft Word for Windows.™

The original word-processing application for Windows is still the best selling! Drag and drop text and graphics around the page for easy creation of professional-looking documents. Existing WordPerfect® files (and other file

formats) are usable in Word. You can even type a WordPerfect command and see Word's equivalent command automatically demonstrated on-screen!

Party Reason — Microsoft Word and Bookshelf 92,® CD-ROM Edition.

The most popular word processor for Windows now becomes the ultimate writing tool with an entire electronic reference library full of multimedia sights and sounds! Includes dictionary, encyclopedia, thesaurus, atlas, quotations, and more.

Party Reason — Microsoft PowerPoint for Windows.™

For easy, professional on-screen slide shows, overhead transparencies or 35mm slide presentations. Fast and flexible word processing, graphing, outlining and drawing tools give you more time to master your content instead of wrestling with your software.



Choices To Crow About!

Party Reason — *Microsoft Project for Windows.*[™]

Project management is easier and more flexible than ever! This program gives you the power and versatility to manage your schedules and resources more efficiently. That's why *PC Magazine*, *PC Week*, *PC World* and *Software Digest* call Project the best program in its category!

Party Reason — *The MS Entrepreneur Pack.*

Four great software packages in one! Microsoft Works,[™] Publisher,[™] Money[™] and an Entertainment Pack.

Party Reason — *Borland Paradox*[®] for Windows.

Paradox for Windows is the relational database that makes a powerful database easy to use. Now you have complete access to data, plus all the tools you need to create graphical applications in no time. Paradox

for Windows works with existing Paradox for DOS and dBASE files without modification.

Party Reason — *The Windows Programmer Pack.*

Get everything you need to create programs for Windows: Microsoft QuickC for Windows,[™] Visual Basic for Windows,[™] Windows Control Development Kit,[™] Windows Help Compiler[™] and Windows Programmer's On-Line Reference.[™]

Party Reason — *Upgrade to the CD-ROM Edition of Microsoft Office.*[™]

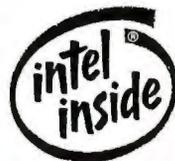
You can upgrade from a choice of application software to Microsoft Office, CD-ROM version, for only \$99! This single package has all the leading Windows applications: Word, Excel and PowerPoint.

The standard edition of MS Office is also available as an upgrade from a choice of application software for \$175, or \$499 as a second application.

Party Reason — *Upgrade from Works to choice of application.*

If the system you want comes with MS Works for Windows, you can upgrade to a choice of application software for only \$100.

Software shown here is sold only with the purchase of a system. Software sold with systems includes the identical applications contained in retail packages but will not include the retail box. You get all master diskettes and manuals, shrink-wrapped and packaged in a Gateway 2000 box.



Everyone's flocking to check out the life of the party, Gateway's 4DX2-66 Best Buy system shown with optional Labtec speakers.



8 0 0 - 8 4 6 - 2 0 5 8



The Whole Herd Is Dedicated To Pro

Yes, this is the whole gang at Gateway 2000. We now number in excess of 2,000 people. We gathered everyone together for this 486 Fest kick-off photo so you could see all the friends you have in the business, and so we could renew our commitment to your complete satisfaction.

Despite some blustery weather, Ted, our president and founder, gave us an inspiring pep talk about customer satisfaction and value. He reminded us that we will be the best in this industry only as long as we remember the guiding principles of our company, best described in our mission statement:

We are Gateway 2000.

We care about and respect you, our customers.

We pledge to you that we will be honest, courteous and friendly.

If we make a mistake, we will admit it.

If you're unhappy about something, we'll do everything in our power to make it right.

We'll treat you as an individual and take special care to see that your individual situation is handled fairly.

We have fun working together, striving to be the most knowledgeable, productive and successful team in the world. We blend our talents to continually offer higher quality, more innovative and useful products, at a value unmatched by competitors.

We will always be happy but we will never be satisfied. And we will continually improve everything we do.

We will succeed, together as a team.

We are Gateway 2000.

We are the only logical choice!



Gateway 2000
486
F e s t



ding You With The Best Service!

Party Reason — *You'll like doing business with people who care about you!*

Each and every person in this photo rededicated his or her efforts to achieving these goals. Like a married couple going through a second wedding ceremony after many years of marriage, our energies were refocused on what's important. And what's important to us is *you!*

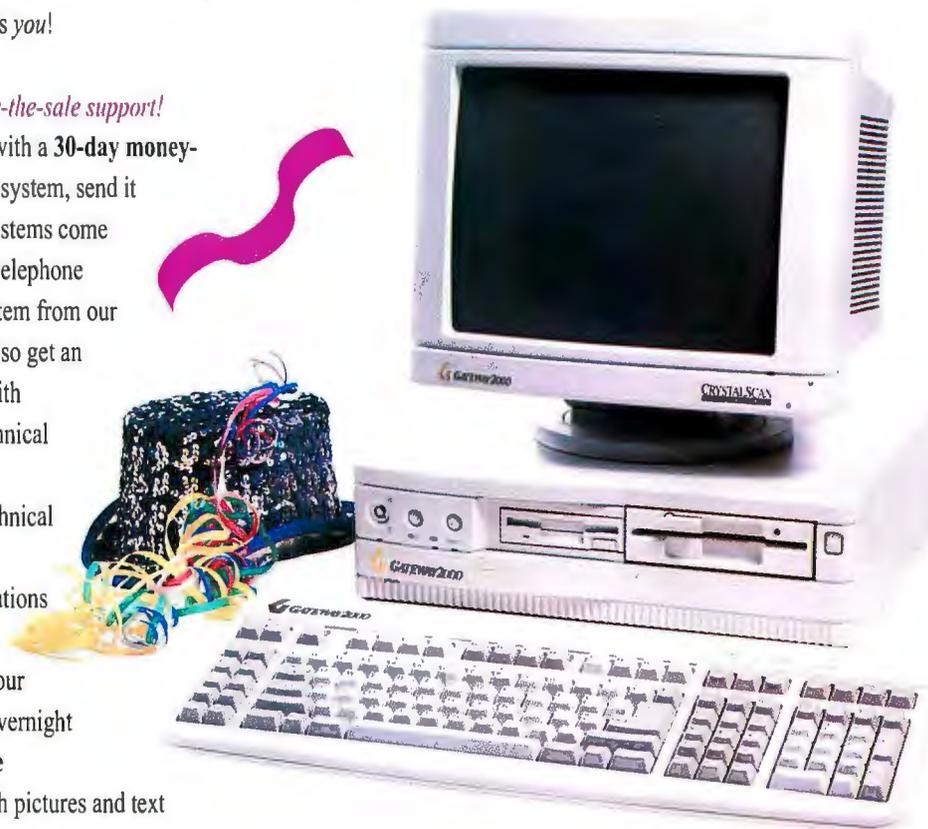
Party Reason — *You get excellent after-the-sale support!*

Every Gateway 2000 system comes with a **30-day money-back guarantee**. If you don't like your system, send it back within 30 days for a refund. All systems come with a **one-year limited warranty** and telephone **technical support** for the life of the system from our award-winning tech department. You also get an **automated fax service** to supply you with detailed documentation on over 150 technical subjects, and a **lifetime BBS membership** for additional technical support and online forums.

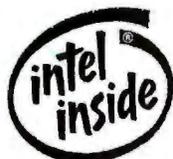
We offer **on-site service** to most locations in the country (factory service only for notebooks). **Replacement parts** leave our factory as quickly as possible; we pay overnight shipping. Plus we now have **interactive documentation** on desktop systems with pictures and text right on your hard drive (in addition to comprehensive hardware and software manuals).

Party Reason — *It's so easy! Just give us a call!*

We make it easy for you to buy a Gateway PC, with convenient payment options including major credit cards and C.O.D. terms. Net 30-day terms and leasing options are also available to qualified commercial customers.



For a truly celebrated value, the choice is black-and-white: Gateway's 4DX-33.



8 0 0 - 8 4 6 - 2 0 5 8

Gateway 2000's Party List

4SX-25

- 25MHz 486SX Intel® Processor
- 4MB RAM
- 3.5" Diskette Drive
- 80MB 17ms IDE Hard Drive
- Local Bus IDE Interface
- Intel Pentium™ Technology Ready
- Windows Accelerated Video w/1MB DRAM
- 14" Color CrystalScan™ 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey™ Keyboard
- MS-DOS® 6, Diags, Windows™ & Mouse
- MS Works for Windows™ 2.0

\$1295

4SX-33

- 33MHz 486SX Intel Processor
- 4MB RAM
- 5.25" & 3.5" Diskette Drives
- 170MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Intel Pentium Technology Ready
- Windows Accelerated Video w/ 1MB DRAM
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS 6, Diags, Windows & Mouse
- MS Wrks for Windows 2.0

\$1495

4DX-33

- 33MHz 486DX Intel Processor
- 8MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 212MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Intel Pentium Technology Ready
- Windows Accelerated Video w/ 1MB DRAM
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS 6, Diags, Windows & Mouse
- MS Works for Windows 2.0

\$1895

4DX2-50V

- 50MHz 486DX2 Intel Processor
- 8MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 212MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Intel Pentium Technology Ready
- ATI™ Ultra Pro Video w/1MB VRAM on VL-Bus™
- 15" Color CrystalScan 1572FS
- Desktop Case (Tower Upgrade)
- 7 16-Bit ISA Slots, 2 on VL-Bus
- 124-Key AnyKey Keyboard
- MS-DOS 6, Diags, Windows & Mouse
- Choice of Application Software

\$2295

4DX2-66 BEST BUY

- 66MHz 486DX2 Intel Processor
- 8MB RAM, 64K Cache
- 3.5" Diskette Drive
- CD-ROM Drive
- 340MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Intel Pentium Technology Ready
- Windows Accelerator w/1MB DRAM on VL-Bus
- 14" Color CrystalScan 1024NI
- Desktop Case (Tower Upgrade)
- 7 16-Bit ISA Slots, 2 on VL-Bus
- 124-Key AnyKey Keyboard
- MS-DOS 6, Diags, Windows & Mouse
- MS Multimedia Works, CD-ROM Edition

\$2495

4DX2-66V

- 66MHz 486DX2 Intel Processor
- 16MB RAM, 256K Cache
- 3.5" Diskette Drive
- CD-ROM Drive
- 340MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Intel Pentium Technology Ready
- ATI Ultra Pro Video w/1MB VRAM on VL-Bus
- 15" Color CrystalScan 1572FS
- Desktop Case (Tower Upgrade)
- 7 16-Bit ISA Slots, 2 on VL-Bus
- 124-Key AnyKey Keyboard
- MS-DOS 6, Diags, Windows & Mouse
- 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 w/ 1MB DRAM
- 14" Color CrystalScan 1024NI
- Tower Case
- 8 32-Bit EISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS 6, Diags, Windows & Mouse
- Choice of Application Software

\$3495

NOMAD 425SXL

- 25MHz 486SX Intel Processor
- 4MB RAM
- 3.5" Diskette Drive
- 120MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Gray Scale
- 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 and Windows
- MS Works for Windows

\$1995

NOMAD 450DXL

- 50MHz 486DX2 Intel Processor
- 3.5" Diskette Drive
- Backlit 10" VGA Screen, 64 Gray Scale
- 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 & MS Ballpoint
- MS-DOS, Windows & Works for Windows

\$2495

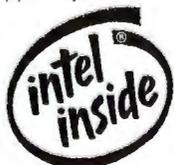
(With 4MB RAM and 120MB Hard Drive)

\$2995

(With 8MB RAM and 200MB Hard Drive)



Printed on recycled paper with soy inks



8 0 0 - 8 4 6 - 2 0 5 8

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)

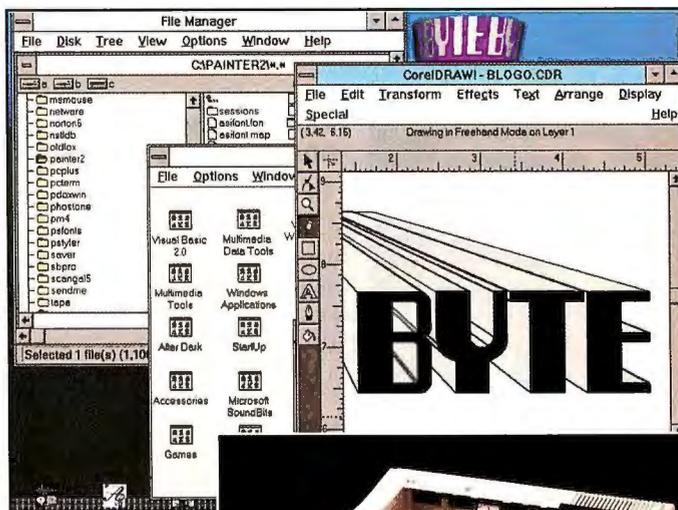
All hard drive sizes are manufacturer's specified capacities. Microsoft MS-DOS 6 can increase hard drive capacity through software compression.



Readers' Choice Awards

The votes are in. BYTE readers have once again picked their favorite hardware and software products. Some of the winners are perennial favorites; some are surprises. Some won by a nose. IBM's ThinkPad, for example, unseated the Mac PowerBook, last year's winner in the notebook category, by a slim three votes. Some mighty products slid out of the top three slots altogether: It's still the market leader, but Lotus 1-2-3 was the fourth pick of our readers, with only half the votes of Quattro Pro for DOS. This year, we've added a new category: Company That Provides the Best Service to Its Customers.

These awards are important because they come from you, our readers. You use these products every day to do real work, in real working environments. The true test of a product's value isn't how many editors' awards it wins or how many boffo review blurbs it has in its ads, but how well it suits the needs of users. The winners on these pages are winners because they work for you; they help you get the job done.



Microsoft Windows 3.1



HP LaserJet 4

HARDWARE PRODUCT OF THE YEAR

HP LaserJet 4,

Hewlett-Packard

RUNNERS-UP:
PowerBook Duo,

Apple Computer
Gateway 4DX2-66V,
Gateway 2000

DESKTOP COMPUTER — PC

Gateway 4DX2-66V,
Gateway 2000

RUNNERS-UP:
Compaq ProLinea,
Compaq Computer
Dell 466/T, *Dell Computer*

DESKTOP COMPUTER — MACINTOSH

Mac Quadra series,
Apple Computer

RUNNERS-UP:
Mac IIvi, IIci,
Apple Computer

WORKSTATION

IBM RS/6000,
IBM

RUNNERS-UP:
HP 9000, *Hewlett-Packard*
Iris Indigo, *Silicon Graphics*

LAPTOP/NOTEBOOK COMPUTER

IBM ThinkPad,
IBM

RUNNERS-UP:

Mac PowerBook,
Apple Computer
Mac PowerBook Duo,
Apple Computer

HAND-HELD/PALMTOP COMPUTER

Gateway HandBook,
Gateway 2000

RUNNERS-UP:
HP 95LX, *Hewlett-Packard*
Wizard, *Sharp Electronics*

MONITOR

MultiSync FG series,
NEC Technologies

RUNNERS-UP:
FlexScan T560i, *Nanao USA*
ViewSonic 7, *ViewSonic*

LASER PRINTER

HP LaserJet 4,
Hewlett-Packard

RUNNERS-UP:
HP LaserJet IIIsi,
Hewlett-Packard
HP LaserJet IIIP,
Hewlett-Packard

MODEM

Practical Modem 9600SA,
Practical Peripherals

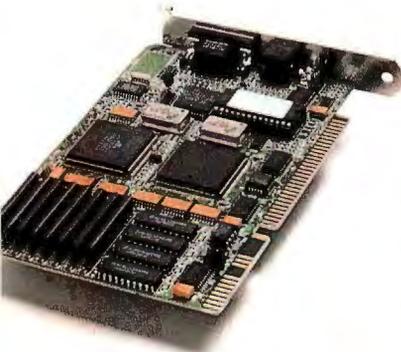
RUNNERS-UP:
Satisfaction 400e, *Intel*
Optima 144+, *Hayes*
Microcomputer Products



MultiSync FG



Gateway 4DX2-66V



ATI Graphics Ultra

VIDEO BOARD — DOS/WINDOWS

ATI Ultra series,
ATI Technologies

RUNNERS-UP:
Stealth VRAM,
Diamond Computer Systems
VGA Wonder XL,
ATI Technologies

VIDEO BOARD — MACINTOSH

Radius PrecisionColor,
Radius

RUNNERS-UP:
Apple 24-Bit Color,
Apple Computer
Thunder/24,
SuperMac Technology



Gateway HandBook



Mac Quadra 900

SOFTWARE PRODUCT OF THE YEAR

Microsoft Windows 3.1,

Microsoft

RUNNERS-UP
OS/2 2.0, IBM
Quattro Pro for Windows,
Borland International

WORD PROCESSOR — DOS/WINDOWS

Word for Windows,
Microsoft

RUNNERS-UP:
WordPerfect 5.1,
WordPerfect
Ami Pro,
Lotus Development

WORD PROCESSOR — MACINTOSH

Word for Macintosh,
Microsoft

RUNNERS-UP:
WordPerfect, WordPerfect
MacWrite II, Claris

CAD PROGRAM — DOS/WINDOWS

AutoCAD release 12,
Autodesk

RUNNERS-UP:
Generic CADD,
Autodesk Retail Products
DesignCAD 3D, American
Small Business Computers

CAD PROGRAM — MACINTOSH

Claris CAD,
Claris

RUNNERS-UP:
DesignCAD for the Mac,
American Small Business
Computers
Vellum, Ashlar

CONTACT MANAGERS/ PIMS

Lotus Organizer,
Lotus Development

RUNNERS-UP:
PackRat, Polaris Software
ACT, Contact Software
International

DATABASE MANAGER — DOS/WINDOWS

Paradox,
Borland International

RUNNERS-UP:
FoxPro, Microsoft
Access, Microsoft

DATABASE MANAGER — MACINTOSH

FileMaker Pro,
Claris

RUNNERS-UP:
4th Dimension, Acius
Omnis, Blyth Software

DATABASE CLIENT/SERVER

NetWare SQL,
Novell

RUNNERS-UP:
SQL Server, Microsoft/Sybase
Oracle Server, Oracle

DESKTOP PUBLISHING PROGRAM — DOS/WINDOWS

PageMaker,
Aldus

RUNNERS-UP:
Ventura Publisher for
Windows, Ventura Software
FrameMaker for Windows,
Frame Technology

DESKTOP PUBLISHING PROGRAM — MACINTOSH

PageMaker,
Aldus

RUNNERS-UP:
QuarkXPress, Quark
Ventura Publisher,
Ventura Software

DESKTOP PUBLISHING PROGRAM — UNIX

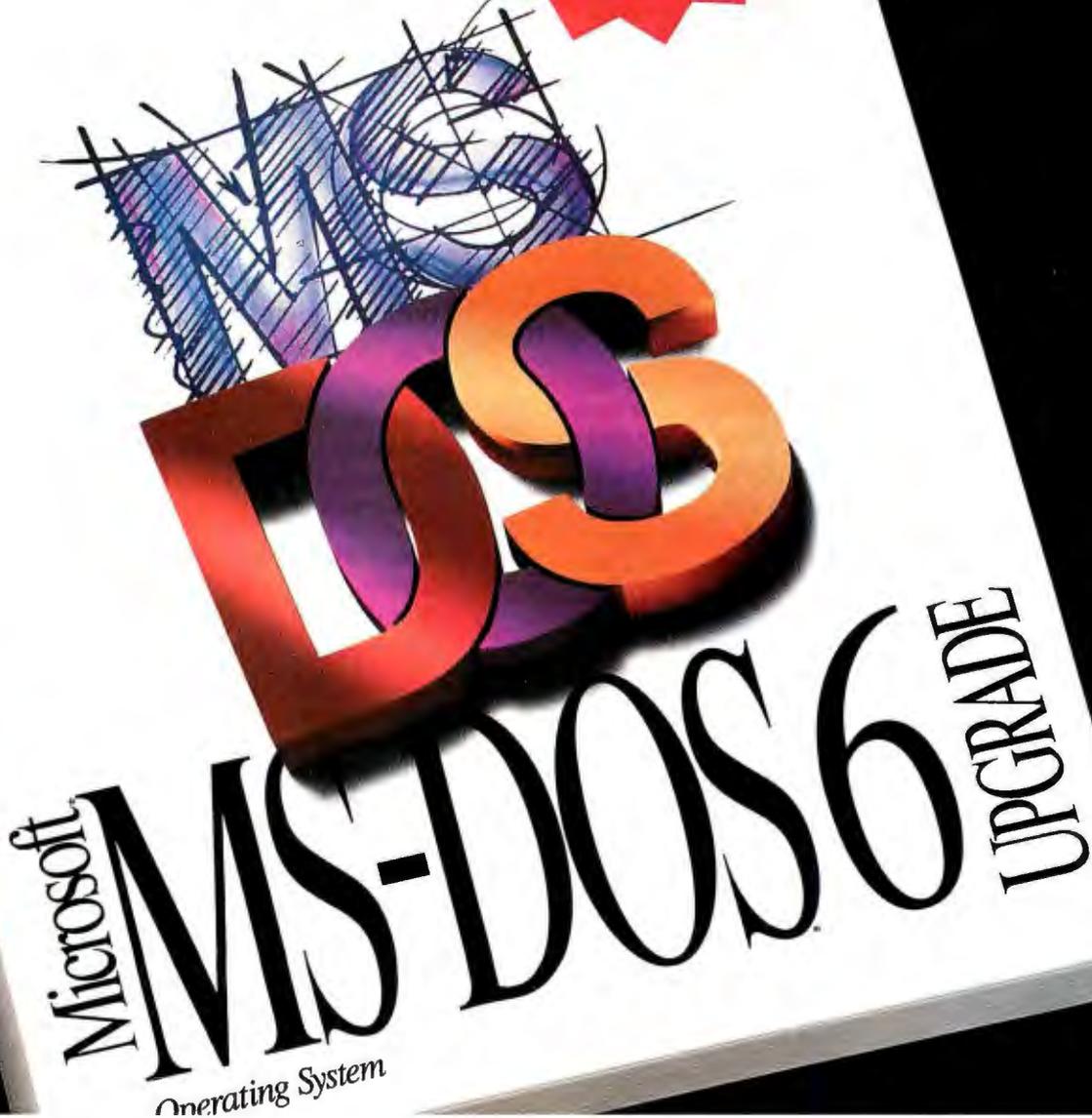
FrameMaker,
Frame Technology

RUNNERS-UP:
Interleaf, Interleaf
Island Write, Draw &
Paint,
Island Graphics

Package contains 5.25" high-density disks
and a coupon for low-density disks

**MS
DOS**

The
easy way to
double your
disk



Microsoft
MS-DOS 6
UPGRADE
Operating System

**YOUR HARD DISK
JUST GOT DOUBLE
THE ELBOW ROOM.**

dbl space

Simply type it in
and your disk has
double the space.*

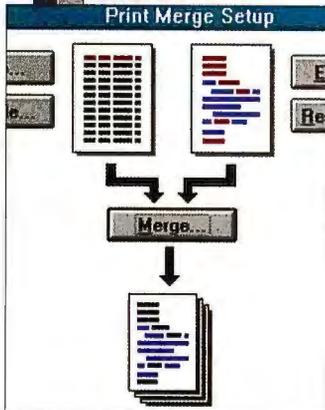
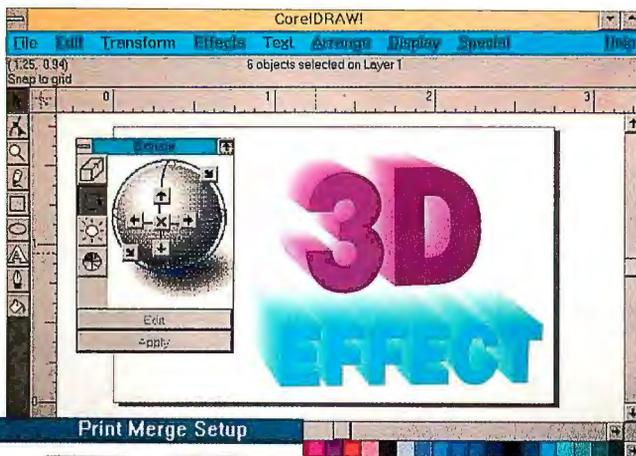
All those files and applications
you've accumulated won't cramp
your style anymore. Now our integrat-
ed disk compression doubles your
disk space. Easily. Invisibly. Safely.

And our im-
proved memory
management lets you extend your
memory with just a few keystrokes.
We've even added great new features

like backup, anti-virus and undelete
tools for users of both MS-DOS®
and Microsoft® Windows.™

So if you need more space, inte-
grated disk compression in the
MS-DOS 6 Upgrade operating sys-
tem makes it easy to stretch out.

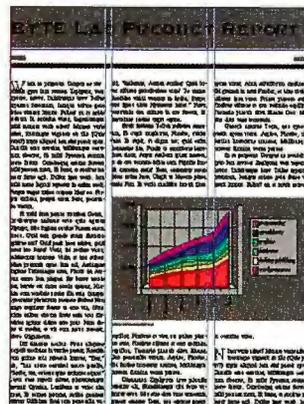
Microsoft
Making it easier



Microsoft Word for Windows



Borland C++



PageMaker 4.2

CorelDraw

E-MAIL AND WORK-GROUP SOFTWARE — DOS/WINDOWS

Microsoft Mail, Microsoft

RUNNERS-UP:
cc:Mail, Lotus Development WordPerfect Office, WordPerfect

E-MAIL AND WORK-GROUP SOFTWARE — MACINTOSH

cc:Mail, Lotus Development

RUNNERS-UP:
Microsoft Mail, Microsoft QuickMail, CE Software

GRAPHICS PROGRAM — DOS/WINDOWS

CorelDraw, Corel Systems

RUNNERS-UP:
Adobe Illustrator, Adobe Systems Designer, Micrografix

GRAPHICS PROGRAM — MACINTOSH

Adobe Illustrator, Adobe Systems

RUNNERS-UP:
MacDraw Pro, Claris Canvas, Deneba Systems

NETWORK OPERATING SYSTEM — PC

NetWare, Novell

RUNNERS-UP:
Windows for Workgroups, Microsoft LANtastic, Artisoft

NETWORK OPERATING SYSTEM — MACINTOSH

NetWare, Novell

RUNNERS-UP:
AppleShare, Apple Computer MacTOPS, Sitka

PRESENTATION GRAPHICS — DOS/WINDOWS

Lotus Freelance Graphics, Lotus Development

RUNNERS-UP:
PowerPoint, Microsoft Harvard Graphics, Software Publishing

PRESENTATION GRAPHICS — MACINTOSH

Persuasion, Aldus

RUNNERS-UP:
PowerPoint, Microsoft Cricket Presents, Computer Associates International

OPERATING SYSTEM/ ENVIRONMENT

Microsoft Windows 3.1, Microsoft

RUNNERS-UP:
MS-DOS 5.0, Microsoft OS/2 2.0, IBM

PROGRAMMING LANGUAGE — DOS/WINDOWS

Borland C++, Borland International

RUNNERS-UP:
Visual Basic, Microsoft Turbo Pascal, Borland International

PROGRAMMING LANGUAGE — MACINTOSH

Think C, Symantec

RUNNERS-UP:
Zortech C++, Zortech HyperCard, Claris

PROJECT MANAGEMENT

Project for Windows, Microsoft

RUNNERS-UP:
Time Line, Symantec Harvard Project Manager, Software Publishing

SPREADSHEET — DOS/WINDOWS

Excel, Microsoft

RUNNERS-UP:
Quattro Pro for Windows, Borland International Quattro Pro, Borland International

SPREADSHEET — MACINTOSH

Excel, Microsoft

RUNNERS-UP:
Lotus 1-2-3 for Macintosh, Lotus Wingz, Informix

UTILITIES — DOS/WINDOWS

Norton Utilities, Symantec

RUNNERS-UP:
PC Tools Deluxe, Central Point Software Norton Desktop for Windows, Symantec

UTILITIES — MACINTOSH

Norton/Symantec Utilities for Macintosh, Symantec

RUNNERS-UP:
Mac Tools Deluxe, Central Point Software SUM II, Symantec

COMPANY THAT PROVIDES THE BEST SERVICE

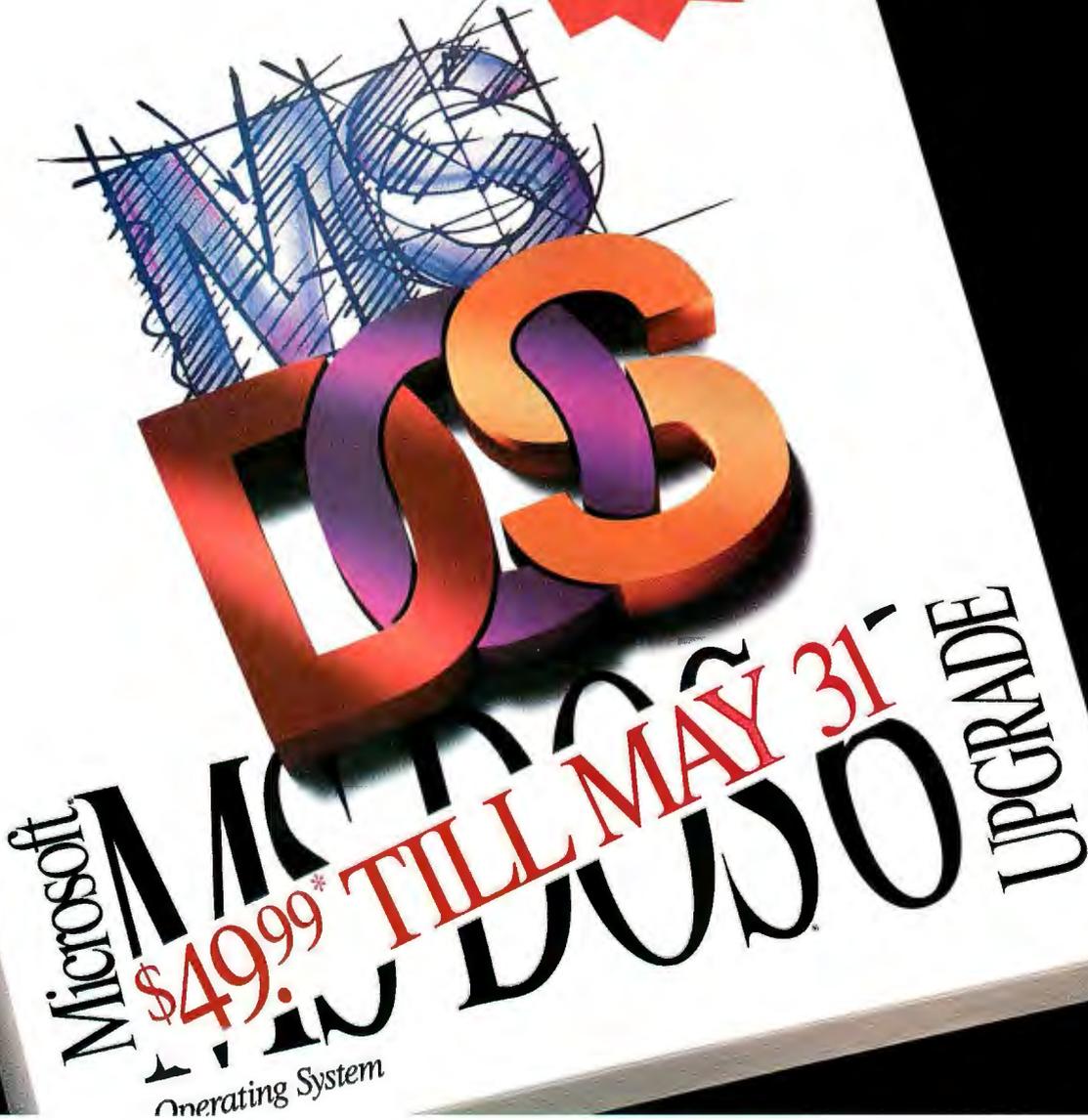
Gateway 2000

RUNNERS-UP:
WordPerfect Microsoft

MS
DOS

Package contains 5.25" high-density disks
and a coupon for low-density disks

The
easy way to
double your
disk



**FOR A LIMITED
TIME YOU'LL HAND
OVER A LOT LESS.**

This is your one chance to grab the MS-DOS[®] 6 Upgrade operating system at a price that's simply untouchable. Till May 31 you can get disk compression and improved memory management all for \$49.99.

Now integrated disk compression easily doubles the space on your hard disk.** And our improved memory management gives you

more free memory. In a snap.

To get information about this fantastic deal, call (800) 228-7007, Dept. RX3. Better yet, pick up the MS-DOS 6 Upgrade at your nearest reseller. Before this opportunity slips through your fingers.

Microsoft
Making it easier

*Offer good only in the 50 United States. Reseller prices may vary. **Compression results may vary depending on system configuration. © 1993 Microsoft Corporation. All rights reserved. Printed in the USA. For more information: In the 50 United States, call (800) 228-7007, Dept. RX3. For information only: Customers in Canada, call (800) 563-9048; outside the 50 United States and Canada, contact your local Microsoft subsidiary or call (206) 936-8661. Microsoft and MS-DOS are registered trademarks of Microsoft Corporation.

WE HAVE LAURELS AT TOSHIBA, WE JUST DON'T



PRESENTING THE T44

REST ON THEM.



1992
- W I N N E R -
PC Magazine Award
for Technical Excellence



PORTABLES
Toshiba T4400SXC
Our T4400C's
forefather, the legendary
T4400SXC, captured
PC Magazine's
Technical Excellence
and Editors' Choice
Awards, PC World's
World Class Award,
and Bytes Award
of Excellence.



The new T4400C
is available with a
blazing 25 MHz
486DX processor.



With our T4400C,
you have a choice of either
a 200MB or 120MB
hard drive.



Our T4400 series
features our MaxTime
power management
system that gets the
maximum out of every
battery charge.

Immediately after capturing the "Editors' Choice" award from *PC Magazine* for our T4400SXC, we asked our engineers to better it.

They responded with the T4400C. A notebook that redefines what is possible in 486 color technology.

Take for example its TFTLCD active matrix color screen. We pioneered this technology and now we've advanced it even further by enlarging the screen to a full 9.5 inches. Amazingly, it provides an eyeball-popping 256 simultaneous colors at 640 x 480 resolution from a palette of 185,193 colors, making it the best TFT color display on the market.

If you think that's impressive, check what's under the hood. You'll find a choice of either a blistering new 25 MHz 486DX processor with a massive 200MB hard drive or the renowned 25 MHz 486SX with a 120MB hard drive. And both offer 4MB RAM expandable to 20MB.

Of course, if your needs are more modest, we offer a T4400SX with a large 9.5" monochrome LCD screen, a not-so-modest 25 MHz 486SX microprocessor and 120MB hard drive.

Our engineers even extended battery life. By offering such MaxTime™ power management features as automatic display and hard drive shut down, AutoResume and AutoSave.

To test-drive the T4400C yourself, feel free to call the number below for the location of your nearest Toshiba dealer.

Our operators don't like resting either.

In Touch With Tomorrow
TOSHIBA

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

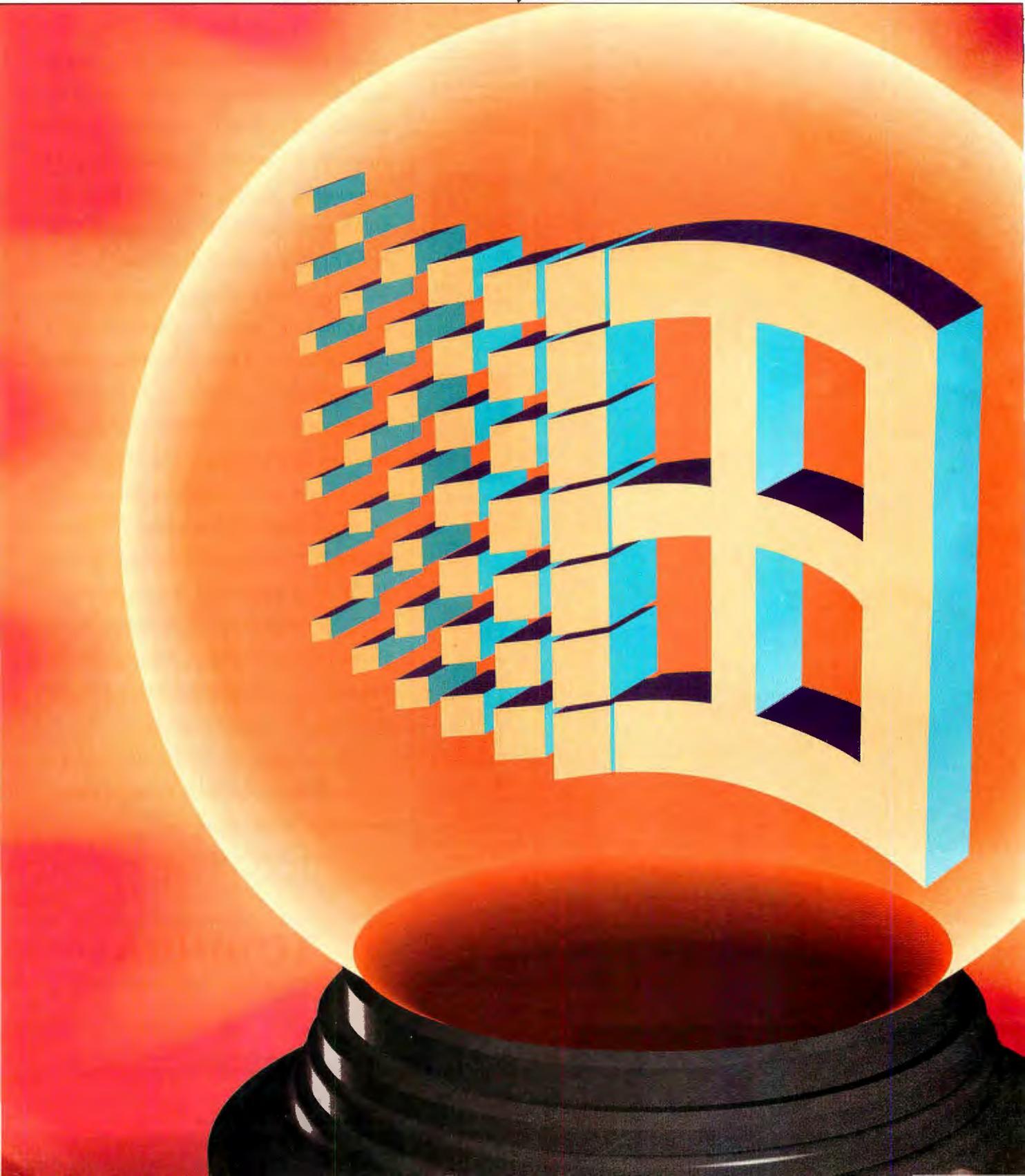
© 1993 Toshiba America Information Systems, Inc. The Intel Inside logo is a trademark of Intel Corporation. All products indicated by trademark symbols are trademarked and/or registered by their respective manufacturers.

Circle 148 on Inquiry Card.

0 0 C

Cover Story

WINDOWS, WINDOWS



EVERYWHERE?

If Microsoft has its way, one or another of its growing family of Windows operating systems will control everything from your cable TV box to your desktop PC, to your LAN, to your company's RISC-based multiprocessing superserver. The question Microsoft wants you to ask is not "Should I use Windows?" but rather "Which Windows should I use?"

JON UDELL

The chorus of voices asking the latter question swelled with the impending release of Windows NT. NT's advanced features are by now well known: microkernel architecture, portability, threaded symmetric multiprocessing, object-based security, and multiple operating-system personalities (see "Windows NT Up Close," October 1992 BYTE). Ironically, despite NT's considerable strengths, it could well be that a Windows 3.1 extender called Win32s (now shipping) or a more advanced 32-bit Windows-cum-DOS called Chicago (on the drawing board) will matter most to you.

In this article, I'll answer the question Microsoft wants you to ask: Which of the 16- and 32-bit variants of Windows are best for which purposes? But I'll also answer the question that Microsoft doesn't want you to ask: When might Unix, or OS/2, or NetWare, or the Macintosh be a better choice than Windows?

Redefining the PC

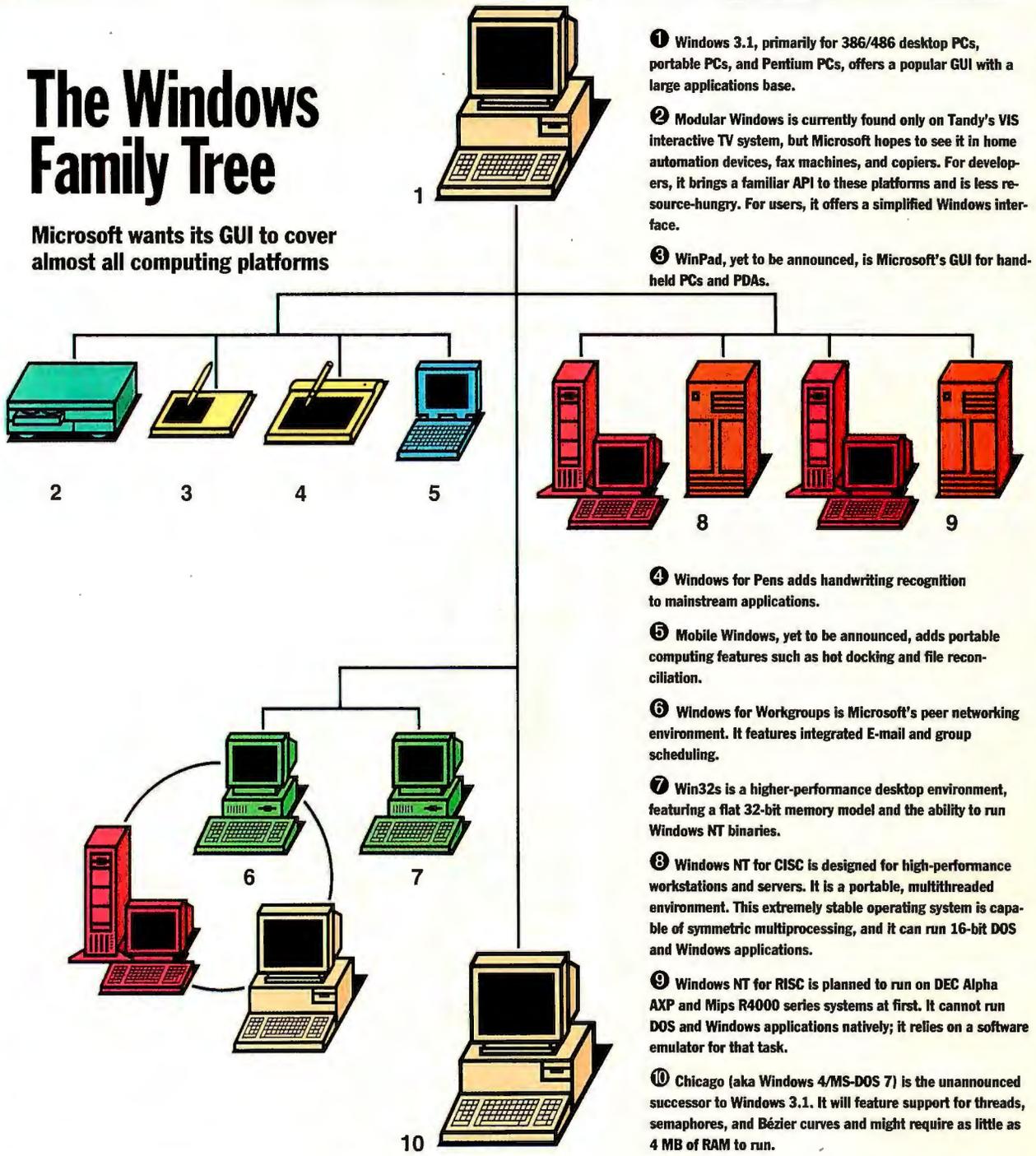
The PC industry achieved startling progress in its first decade thanks to a pair of de facto standards—the IBM PC and MS-DOS. The term *personal computer* was, for most computer users, a synonym for an Intel 80x86-based machine that ran DOS. That definition began to change in 1990 when Windows 3.0 switched into 386 protected mode and delivered extended memory to the masses. Today the term *personal computer* is increasingly used to describe not a DOS machine but a Windows machine.

What hasn't changed—until now—is the Intel chip at the heart of a Windows machine. But when you use Windows NT to run Windows applications on a personal computer built around a Mips R4000 or a DEC Alpha AXP CPU, you're riding the next wave of PC hardware and software evolution. Systems designers, liberated by NT's HAL (hardware abstraction layer), are avidly exploring RISC and multiprocessor technologies along with innovative I/O architectures.

"The PC industry has been in a quandary because the only competitive weapon was price," says Bill Glazier, director of Windows NT marketing for Mips Technologies (Mountain View, CA). Glazier helped Mips launch the Open Design Center, which licenses design kits to vendors who want to build R4000-based PCs. Can this new species of RISC-based clone survive even as Darwinian forces thin the ranks of conventional clone makers? Yes, proponents argue, by evolving in directions that systems built for

The Windows Family Tree

Microsoft wants its GUI to cover almost all computing platforms



- ❶ Windows 3.1, primarily for 386/486 desktop PCs, portable PCs, and Pentium PCs, offers a popular GUI with a large applications base.
- ❷ Modular Windows is currently found only on Tandy's VIS interactive TV system, but Microsoft hopes to see it in home automation devices, fax machines, and copiers. For developers, it brings a familiar API to these platforms and is less resource-hungry. For users, it offers a simplified Windows interface.
- ❸ WinPad, yet to be announced, is Microsoft's GUI for handheld PCs and PDAs.
- ❹ Windows for Pens adds handwriting recognition to mainstream applications.
- ❺ Mobile Windows, yet to be announced, adds portable computing features such as hot docking and file reconciliation.
- ❻ Windows for Workgroups is Microsoft's peer networking environment. It features integrated E-mail and group scheduling.
- ❼ Win32s is a higher-performance desktop environment, featuring a flat 32-bit memory model and the ability to run Windows NT binaries.
- ❽ Windows NT for CISC is designed for high-performance workstations and servers. It is a portable, multithreaded environment. This extremely stable operating system is capable of symmetric multiprocessing, and it can run 16-bit DOS and Windows applications.
- ❾ Windows NT for RISC is planned to run on DEC Alpha AXP and Mips R4000 series systems at first. It cannot run DOS and Windows applications natively; it relies on a software emulator for that task.
- ❿ Chicago (aka Windows 4/MS-DOS 7) is the unannounced successor to Windows 3.1. It will feature support for threads, semaphores, and Bézier curves and might require as little as 4 MB of RAM to run.

DOS and 16-bit Windows can't follow. The hardware competition that NT engenders—and, for users, the freedom of choice that it confers—goes far beyond the matter of RISC versus CISC. NT's arrival coincides with a generation of processors (including the Pentium, the R4000, and the Alpha series) designed to be yoked together in SMP (symmetric multiprocessing) systems. Built from the ground up to exploit SMP hardware, NT spells relief for the compute-bound Windows

application. Database engines and other server applications are obvious candidates for this treatment. "After porting our server to a stand-alone NT system," says Stuart Read, senior director of desktop marketing for Oracle (Redwood Shores, CA), "we were impressed that the same binary ran on NCR's eight-processor 3550." Don't assume that SMP matters only for servers. Compute-intensive applications have put high-performance Unix workstations on the desktops of many en-

gineers and scientists. Now the vendors of those applications are drooling at the prospect of moving them onto high-performance Windows workstations. NT's performance curve extends on a long, graceful arc through the Pentium and the R4000 to the world's fastest RISC CPU, the DEC Alpha AXP, and beyond that into the realm of SMP. A dual-processor system won't automatically run twice as fast as a uniprocessor machine, for the same reason that a 32-bit

IF THERE WERE ONLY ONE KIND OF COMPUTER SYSTEM, YOU'D ONLY NEED ONE KIND OF PROTECTION.



MINUTEMAN LANMASTER SOFTWARE

Bi-directional Communication Power Monitoring Shutdown Software

MINUTEMAN CP SERIES TRUE ON-LINE

500VA to 10KVA Starting at \$899

MINUTEMAN POWERMIND SERIES LINE-INTERACTIVE

600VA to 1250VA Starting at \$579

MINUTEMAN ALLIANCE SERIES STANDBY AND LINE-INTERACTIVE

300VA to 750VA Starting at \$159

MINUTEMAN AUTOMATIC VOLTAGE REGULATOR

650VA to 1800VA Starting at \$149

All models available in 120V, 220V, 50Hz or 60Hz versions

Too many companies go out into the hazardous world of business with the wrong UPS protection, or none at all. At MINUTEMAN, we know that different systems face different dangers.

That's why MINUTEMAN offers five different safeguards, the most comprehensive line in the industry.

Like the new MINUTEMAN LANMASTER power monitoring shutdown software. It combines all the features of similar competitive products and features the most sophisticated diagnostic techniques available.

Or the MINUTEMAN LINE-INTERACTIVE MODELS, the most economical protection of their kind on the market. Each comes with a MINUTEMAN Platinum Protection Plan covering up to \$25,000 and a two-year warranty.

So call MINUTEMAN today. Our skilled professionals worldwide are ready to answer your questions and help you find the perfect UPS for your system.

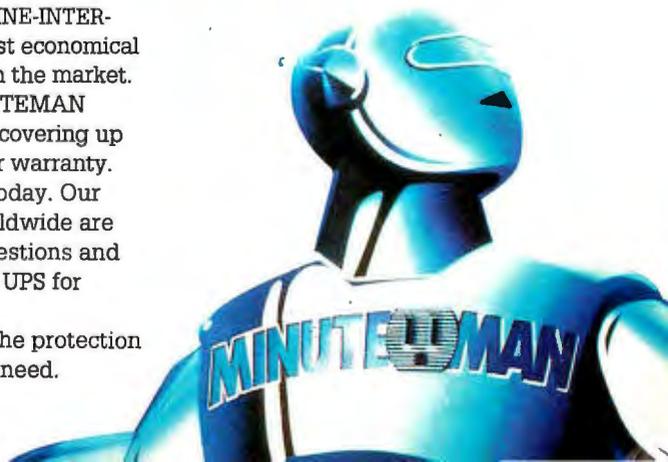
MINUTEMAN. It's all the protection you need. Whatever you need.

MINUTEMAN

UNINTERRUPTIBLE POWER SUPPLIES
(800) 238-7272

See us at COMDEX Booth #1000

© 1993 Para Systems, Inc.
1455 LeMay Drive,
Carrollton, Texas 75007
(214) 446-7363 fax (214) 446-9011



Circle 123 on Inquiry Card.

SO
ADVANCED,
IT EVEN
TAKES OUT
THE TRASH.



Curiously, some of what's stored on your floppy disks would be better lost than saved. Tiny bits of dirt and debris can enter a disk uninvited, only to threaten your most precious data.

Sony designed its new Super Cleaning Mechanism to better preserve your data. It's a dirty job, but someone had to do it.



But, a revolutionary disk with a new Super Cleaning™ Mechanism has taken the chore out of trash removal. Compliments of Sony, the inventor of the 3.5" floppy.

Never one to halt progress, Sony engineered sweeping changes to create a floppy disk that cleans while it protects your data.



At the heart of this waste management system is a new pressure-balanced metal lifter, providing greater contact between the disk liner and magnetic surface, to make debris pick-up routine.

SONY.

For the finishing touch, Sony's Super Cleaning Mechanism uses rows of very fine cross-flow ribs, molded into the disk's shell, to trap invading particles before they can turn into messy problems.

Keep your data dirt and error free with the disk that leaves everything else in the dust. To find out more, call 201-476-8199.



While you may not like taking out the trash, to this floppy it's all in a day's work. From the inventors at Sony.



program won't automatically double the speed of a 16-bit one. Performance can't scale linearly unless CPU throughput does, and processors already tend to leave their I/O subsystems in the dust. Fortunately, NT's clean separation from its supporting hardware encourages the sort of innovative design needed to break that logjam.

All in the Win32 Family

I have been writing Windows programs portably since Windows 3.1 came out. Originally that meant you could compile a single source file one way for Windows 3.1 and another way for Windows NT. Then a third target appeared: Win32s. Like the Windows extenders offered by Watcom and Rational Systems, Win32s gives Windows programs running on the 3.1 kernel access to linear 32-bit memory. Unlike these other extenders, however, Win32s runs NT binaries. It can't supply all the advanced NT features—threads, security, Bézier curves—that are missing from DOS and Windows 3.1. In fact, apart from the Win32 memory management APIs, it supplies virtually none of those advanced features.

Despite this deficiency, for which its name apologizes (the *s* denotes *subset*), Win32s will find many more users this year than will Windows NT. To see why, consider Spatial Technology's (Boulder, CO) ACIS, a 3-D modeling and rendering engine that grew up in the 32-bit Unix environment. Spatial is developing the Windows version of ACIS on Windows NT, but founder Dick Sowar is clear about where his market is. "We'll have some NT sales, but our primary focus is Windows 3.1," he notes. "We run a lot faster on 32s than we do under NT on the same hardware. And it's an environment that's immediately available to more than 10 million Windows 3.1 users. We'll ship ACIS on 32s as soon as it's available." Mathcad from MathSoft (Cambridge, MA) will be another early Win32s adopter.

Who needs NT, then? Consider another Unix-based engineering application being readied for NT, Pro/Engineer from Parametric Technology (Waltham, MA). Win32s does provide linear memory, says vice president of development Mike Payne, "but to handle our 17 MB of code you need a real virtual memory manager, not the poor excuse you find in Windows 3.1." Payne says the Win32 version of Pro/Engineer performs well under a beta version of NT on both Intel and R4000 hardware, and he expects it will take a growing share of sales relative to the Hewlett-Packard, Silicon Graphics, and Sun versions.

NT has more going for it than a better virtual memory manager. After running it for many months, I've concluded it's the most robust system I've used since VMS. That's no coincidence, since NT lead architect David Cutler ran the VMS development effort while at DEC and then brought his team with him to Microsoft. A company that's betting its business on an application probably shouldn't construct it on a sandy DOS/Windows foundation. The choice then becomes Unix, OS/2, or NT. All have the credentials to handle the job.

The lure of NT is source and binary compatibility with Windows 3.1. NT handles Windows binaries better than the others, because it maps Windows API calls directly into the Win32 subsystem. That means 16-bit binaries spend a fair chunk of their time running in native Win32 mode on CISC or RISC platforms. If you decide to convert a Windows 3.1 program into a Win32 program (and if you've followed some simple portability guidelines), you'll spend more time writing a new make file than you'll spend editing code.

A PC in a Workstation

While Windows itself is arguably no better a GUI than X/Motif or OS/2's Presentation Manager, moving a line-of-business application onto a capable Windows platform such as NT offers distinct advantages. Companies that deploy workstations today typically find PCs popping up alongside those workstations. Why? When they are not trading stocks or doing finite element analysis or designing circuit boards, these people want to write letters and run personal schedulers—and they seem to want to do these things in Windows.

That's one reason Intergraph (Huntsville, AL) is porting NT to its RISC-based Clipper workstation line, as well as porting its entire suite of CAD/CAM applications from Intergraph's proprietary Unix to Windows. "It's interesting that the solution to merging the functions of a workstation and a PC into one box is turning out to be a down-market approach [Windows] instead of an up-market one [Unix]," says public relations director Jim Ruester.

The move to NT does a number of other important things for the world's fifth-largest workstation maker. NT opens up

Intergraph's Clipper, which has been labeled a closed and proprietary RISC architecture. It also radically simplifies Intergraph's mission to move its software onto Intel and alternative RISC platforms. The reliable sameness of NT means Intergraph can diversify its hardware platforms without hacking through a forest of differing Unix APIs.

Moreover, Windows' rich environment will be fertile ground for Intergraph's software. "All kinds of useful spin-offs can happen when you put the engineering software side by side with the business and personal productivity applications," says Tom Steele, Intergraph's executive vice president of software systems. "An OLE that's attached to

a spreadsheet is very interesting to us." He adds that the messaging and peer-networking technology that NT shares with Windows for Workgroups will slide neatly underneath the workflow features in Intergraph's applications suite.

Chicago and the Fear of OS/2

Lurking offstage is an even newer Windows sibling, an integrated DOS/Windows system called Chicago (aka Windows 4/MS-DOS 7) that will run yet another variant of the Windows API, Win32c. Details are sketchy; Microsoft understandably doesn't want to sabotage NT's moment of glory. Sources reveal, however, that Chicago is precisely the sort of "NT Lite" that Microsoft claims it is not.

Indications are that Win32c will occupy a midpoint along a curve that connects Win32s to Win32, supporting threads, semaphores, and Béziers but not Unicode or security. By sacrificing portability and the SMP option, this new 32-bit Windows will target 80x86 processors and the Pentium in configurations as lean as 4 MB.

For some software developers who were badly burned by Microsoft's handling of OS/2, Windows NT (in light of Chicago) creates a disturbing sense of déjà vu. "OS/2 was the direction," says one prominent tool vendor, "and then they made Windows better and killed it. Now NT's the direction, and here they go making Windows better again."

But other observers relish the prospect of an API that's fuller than Win32s and bound to a more capable low-end Windows. Spreading Windows more smoothly

Who Needs Windows NT?

Power users

who need a stable platform on which to multitask 32-bit Windows applications and 16-bit DOS and Windows applications

LAN administrators

who need a robust, scalable platform for use with 32-bit server applications

WHY OKIDATA RE-INVENTED THE LASER PRINTER.



Conventional laser printers rely on a multi-part system of moving laser beams, rotating mirrors and focusing lenses to create each page of output. Sound complicated? It is. That's why Okidata engineers replaced it with a solid-state LED printhead producing 2,560 precise points of light.

Okidata's no-moving-parts printhead comes with a 5-year warranty – the industry's longest. But it's only one reason to choose the Okidata OL400 4 ppm printer for professional-quality

THE OKIDATA® OL400

output in any home or small business application.

The OL400 also comes with 17 resident fonts, full compatibility with all major software, and a 200-sheet paper tray. You can add extra fonts, extra memory, even specialty paper trays.

Most important, the OL400 offers the legendary Okidata reliability that makes it one of today's best entry-level printer values. All of which means buying your first page printer doesn't have to be complicated. Not since Okidata made it simple.

OKIDATA®
a Division of Oki America, Inc.

CALL 1-800-OKI-TEAM EXT. 261 FOR THE DEALER NEAREST YOU.

OKIDATA is a registered trademark of Oki Electric Industry Co., Ltd.

Circle 122 on Inquiry Card.

Mips Challenges Intel on Its Own Turf

TOM R. HALFHILL

Mips Technologies (Mountain View, CA), a relatively small chip-design house owned by Silicon Graphics, hopes Windows NT will enable its highly regarded RISC processors to challenge Intel's decade-long grip on the mass market for PCs. Raw speed isn't a problem for Mips processors. The clock-doubled 50-/100-MHz R4000, which costs about the same as a 33-MHz Intel 486 (around \$400 in 1000-piece quantities), runs two to four times as fast. The 75-/150-MHz R4400, scheduled for volume production in June, costs about the same as a 66-MHz Pentium (less than \$1000) and runs about twice as fast as Intel's flagship processor.

Today, Mips's processors are a trickle in the torrent of 80x86-compatible chips entering the PC market every year. Intel's high-volume manufacturing facilities ensure a healthy supply of chips, and its competitors (AMD and Cyrix) help keep prices in check. Mips has responded by licensing production of the R4000 series to six independent suppliers: Integrated Device Technology, LSI Logic, NEC Electronics, Performance Semiconductor, Siemens Components, and Toshiba.

Even if Mips can get supply and price under control, it's going to be hard to convince PC clone makers that a RISC PC is viable. Designing new systems around high-speed RISC chips is a daunting task. Many PC vendors weakened by last year's price wars can no longer afford major R&D efforts.

Mips Sowing Seeds

To seed the development of R4000-based systems, Mips recently founded the ODC (Open Design Center) in Mountain View. The ODC sells design kits that enable cloners to jump from using an 80x86 to using the R4000. One kit includes a reference motherboard for building systems specifically tuned to Mips processors; another has an under-\$20 pair of ASICs (application-specific ICs) that allow vendors to adapt the

R4000 to existing 486 motherboards. Either way, just add memory, peripherals, and Windows NT, and you've got a complete R4000 system that Mips suggests will be a Pentium killer.

One of the ODC's first customers is Carrera Computers, a start-up company in Laguna Hills, California. In February, Carrera began selling R4000 motherboards based on one of the ODC's reference designs. Sized to fit standard AT cases and intended for high-performance workstations or servers, the \$4995 board includes a 1280- by 1024-pixel local-bus video controller, 2 MB of VRAM (video RAM), SIMM slots for memory expansion to 256 MB, four EISA slots, a SCSI-2 connection, an Ethernet port, parallel and serial ports, and PS/2-standard keyboard and mouse ports.

Carrera founder and chairman Bruce Faust believes that PC vendors will adopt RISC because it is economically sound and technically painless. While Carrera's motherboard complies with the ARC (Advanced RISC Computing) specification, he says that in the long run "ARC won't matter a hill of beans." ARC features, such as an EISA bus, SCSI, and built-in networking, can be omitted from the kind of bare-bones boxes that PC clone vendors like to sell. In fact, Carrera is working on a lower-priced R4000 motherboard that does just that. Faust claims that by the end of this year you'll be able to buy a \$3500 RISC PC that delivers four times the performance of a 66-MHz 486DX2.

Acer Develops PICA

Ronald Chwang, CEO of Acer America (San Jose, CA), makes a similar claim. Acer, however, is taking a very different approach. Rather than adopting a Mips reference design, the company has developed a new system architecture called PICA (Performance-Enhanced I/O and CPU Architecture). "As CPU power continues to increase," says Chwang, "you must innovate to bring I/O bandwidth into balance with it. NT encourages us to do that."

At the core of Acer's minicomputer-like design is a 64-bit, 200-Mbps bus connecting the R4000, memory, video,

and a 64-bit, four-channel I/O processor that gives each channel independent DMA and bus-mastering capability. Integral Ethernet and SCSI I/O attached to those channels goes faster than it would on an EISA bus, and the design eliminates the prohibitive cost of EISA bus-mastering logic. A standard AT-bus controller does, however, support ISA cards.

PICA chip sets and motherboards not only will be found in Acer systems, but also will be licensed to other vendors through the ODC. A typical configuration may include a 50-/100-MHz R4000 chip, 16 MB of RAM, a 200-MB SCSI hard drive, a CD-ROM drive, a floppy drive, an accelerated video card on the video bus, built-in Ethernet, and a SCSI-2 port. The cost of such a configuration will be around \$3500 (not including monitor).

PICA will compete with another new post-AT architecture—Intel's PCI (Peripheral Component Interconnect). Not simply a rival to the VL-Bus local-bus standard, PCI is actually a sweeping next-generation system architecture that just happens to support ISA and EISA for backward compatibility with old expansion boards. Like Acer, Intel offers a complete chip set that makes it easier for PC vendors to implement the new architecture; like Mips and the ODC, Intel is offering a reference motherboard that anyone can copy or modify.

A significant difference between PCI and PICA is that Intel's PCI supports any microprocessor, even non-80x86 and non-Intel chips. The current version of Acer's PICA works only with the Mips R4000 series, although Acer says future versions could support other chips as well. What PCI and PICA have in common is high performance, backward compatibility with the familiar AT bus, and a balanced approach to system architecture.

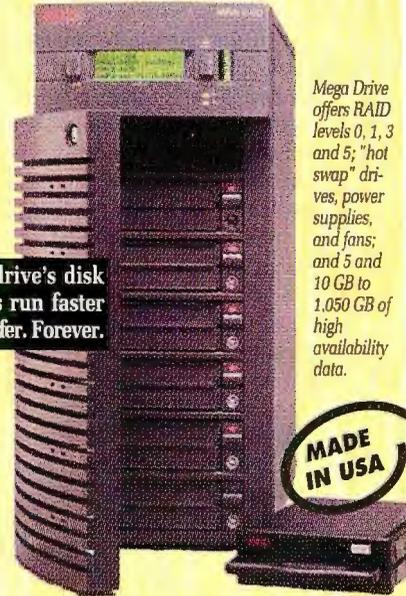
Windows NT is shaping up as the battleground not only for next-generation microprocessors, but also for next-generation PC system architectures.

Tom R. Halfhill is a BYTE senior news editor. You can reach him on BIX as "thalphil."

Circle 112 on Inquiry Card.

Storage RAIDers

Introducing Megadrive's RAID disk arrays and removable drives. 85 MB to 1 Terabyte of superfast, supersafe data



Megadrive's disk arrays run faster and safer. Forever.

Mega Drive offers RAID levels 0, 1, 3 and 5; "hot swap" drives, power supplies, and fans; and 5 and 10 GB to 1,050 GB of high availability data.

MADE IN USA

Megadrive introduces MR/RAID, a bulletproof, fault tolerant disk array. MR/RAID gives you instant access to Gigabytes of data, Fast SCSI-2 speeds, and billion-hour reliability. On all your PC, Mac, Sun, RS/6000, DEC computers, and Novell servers.

MR/RAID series, Fault Tolerant Disk Arrays	
• Capacity Range	5 GB to 1,050 GB
• Max Throughput	20 MB/sec.
• Performance	600+ IO's/sec.
• Format	RAID 0, 1, 3, 5
• Interface	Fast & Wide SCSI-2
• Support	PC, Mac, Workstation

Better yet, MR/RAID offers you enhanced RAID 0, 1, 3 & 5 performance.

And gives you loads of features, like redundant and "hot swap" drives, power supplies and fans; a 20 MB/sec superfast RAID architecture; failure notification paging; a touch-button monitoring LCD screen; and key locks. With MR/RAID, your mission critical data is truly secure, from 5 GB to 1,050 GB of data.

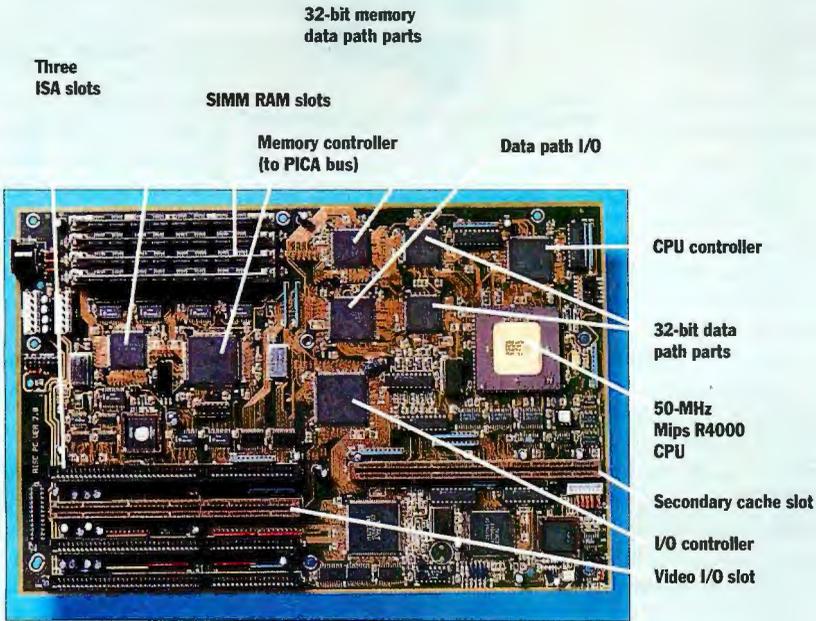
To top it off, our Mercury internal and external removable drive systems offer you blazing speed, sub-10ms SCSI-2 performance, 84 MB to 30 GB of high security data, and MR/RAID support.

Megadrive Systems
489 S. Robertson Blvd.
Beverly Hills, CA 90211
Tel.: (310) 247-0006
Fax: (310) 247-8118

FOR MORE INFORMATION CALL
(800) 322-4744



Patents pending on Mercury and MR/RAID products. The Megadrive logo, Mercury and MR/RAID are trademarks of Mega Drive Systems, Inc. All other brand and product names are trademarks of their respective owners. Specs subject to change without notice. © 1991-93 Mega Drive Systems, Inc. All rights reserved.



Three ISA slots

32-bit memory data path parts

SIMM RAM slots

Memory controller (to PICA bus)

Data path I/O

CPU controller

32-bit data path parts

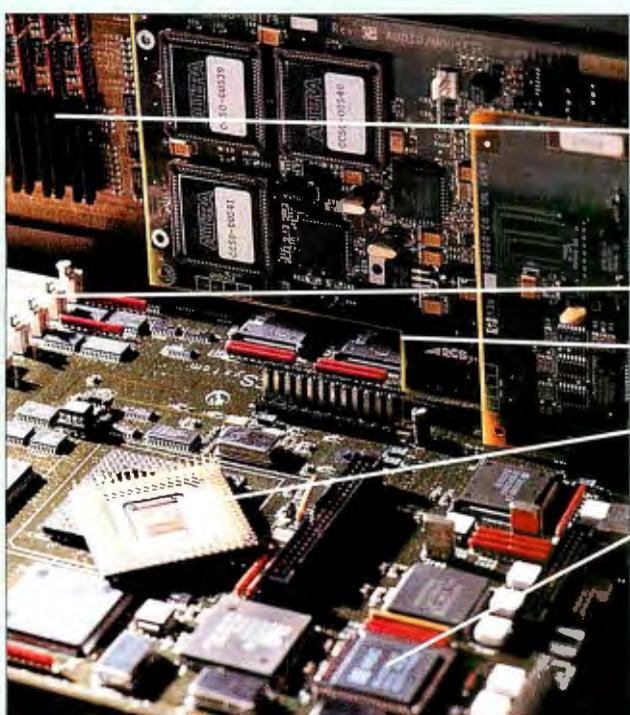
50-MHz Mips R4000 CPU

Secondary cache slot

I/O controller

Video I/O slot

The PICA Mips motherboard.



Video controller

SIMM RAM

Four EISA expansion slots

50-MHz Mips R4000 CPU

Audio/sound, I/O, keyboard/mouse, floppy drive, SCSI-2, and Ethernet controllers

The ODC/Carrera Mips reference-design motherboard.

across the hardware spectrum will only enhance NT's prospects, according to this view. "We were tickled to hear about Chicago," says one developer, "although we can understand their need to downplay it right now, because it sure might confuse people about NT."

Choosing Appropriate Technology

The "Windows everywhere" strategy, insofar as it unites systems ranging from laptops to superservers, makes a great deal of sense. DOS and Windows will continue to dominate at the low end. They're appropriate technologies for today's laptops and for some desktop systems. On the desktop, however, the boundaries will blur. Windows 3.1 (with or without Win32s), Chicago, and NT will each find a niche, determined by your hardware resources and your needs and preferences.

My 8-MB 386/25 runs Windows for Workgroups and Win32s nicely, and I expect it will handle Chicago just fine also, but I wouldn't burden it with NT. My 16-MB 486/50, on the other hand, is a good NT machine. Using it as a workstation, I appreciate its stability and responsive multitasking. I also use it as a file server and as a platform for SQL Server.

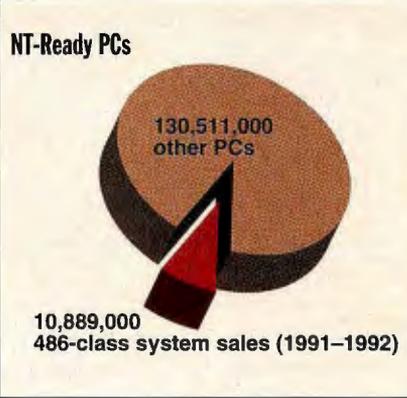
A beta version of SQL Server runs on my NT machine now, but for some months before it was available I ran the shipping version of SQL Server 4.2, which is an OS/2 application—and a demanding one, too. I never really expected that NT's OS/2 emulator could rise to the occasion. Amazingly, it did, and I then used that configuration to test a series of SQL Server clients. Microkernel theory says that if memory management, thread scheduling, synchronization, and other services are imple-

mented correctly, the microkernel can support any advanced operating system in a robust manner. My experience with NT's OS/2 subsystem suggests that the theory is correct, and it hints at the power and flexibility of NT.

So is NT for workstations or for servers? I say both. Clearly it's a server platform. But I also believe that my mission is as critical as a server's. Therefore, I'll use NT (hardware permitting), because when Windows 3.1 suffers from one of its unpredictable seizures, I waste time reestablishing my context and sometimes lose data. Obviously, NT's appetite for hardware—on Intel platforms, you'll want 12 to 16 MB of RAM and a 486—precludes that choice for most users today.

Even if you can run NT, however, you might opt to trade its stability (which costs you system overhead) for the speed you could wring out of Windows 3.1 running Win32s applications on the same hardware. The point isn't which one you choose, but simply that you have a choice. A wide selection of Windows applications will be available everywhere, because their common API invites them to migrate freely among Windows platforms.

Microsoft argues, with some justification, that the common API will also ease the development of client/server applications. Today such applications often



Dataquest estimates that nearly 11 million 486-class PCs were sold during 1991 and 1992. This represents a mere 7.7 percent of the installed base of PCs still in use that could be NT-ready. An undetermined number of those 486 systems, however, are unable to run Windows NT without memory or storage upgrades.

span Unix, OS/2, or NetWare servers and Windows clients. That forces developers to grapple with two hairy APIs instead of one. "It's not an issue if you are using packaged server software," says Oracle's Read, noting that many TCP/IP products for Windows support the use of Unix-based Oracle servers. "But if you are doing your own client/server development,

then yes, the common API will save you headaches."

Pen Computing with Windows

When was the last time you saw someone using a pen-based system on an airplane? The typical user of a pen system today might be walking along a highway inspecting power lines for Detroit Edison or taking inventory in a K-Mart warehouse. The system of choice for these mobile data-collection tasks is a GridPad running PenDOS.

Waiting in the wings are two elegant solutions in search of a problem: Microsoft Windows for Pens, and PenPoint from Go Corp. Microsoft's rather nifty extension to Windows 3.1 defines an evolutionary path from mainstream Windows applications to pen-enabled ones, to fully pen-centric ones. Go's revolutionary PenPoint forgoes continuity with the desktop and invents its own arguably superior notebook user interface. Unfortunately, neither approach matters much to a Detroit Edison power-line inspector, whose reaction to the Microsoft mantra "Windows everywhere" would probably be "Huh?"

There may yet be a role for pen or tablet systems that run mainstream text, graphics, spreadsheet, and database applications, as distinct from PDAs (Personal Digital Assistants) used for scheduling and communication. Think of the pen system as a yellow legal pad and the PDA as a pocket calendar; you have one of each and use them at different times for different purposes. If pen systems go horizontal, Windows for Pens stands to benefit enormously from its family connections. It adds value to standard Windows software running on a pen system, and it offers developers of pen-centric applications a familiar

Windows Weaknesses

WEAKNESS	No distributed global directory service to track network resources	GUI not fully integrated with operating system	Lacks vector and polygon primitives and 2-D/3-D programming abstractions	Not yet well-integrated for portable systems
WHO DOES IT BETTER?	NetWare, Vines, Unix	Mac	Specialized Unix workstations	Mac

When protecting your software 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

- ✓ 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

HASP® 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.
- ✓ Several HASP keys can be connected (daisy-chained) one behind the other.

NETHASP- THE ULTIMATE 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.

WHAT OTHERS ARE SAYING ABOUT US:

In all the products we tested, except the HASP, we could see through the encrypting and questioning procedures... and crack them.

CT Magazine (Germany) May '90

MemoHASP: ...of all the protection devices tested is without any doubt, the one which combines the best features.

PCompatible (Spain) Dec. '90

Trying to crack a program... that was protected utilizing all of HASP's features - is like searching for the Holy Grail.

Micro Systems (France) Dec. '90

PC dongles... come with varying claims as to their transparency. The majority suffer from problems when a printer is connected... the DESkey and HASP-3 are not affected...

Program Now (Britain) May '92

Of all keys tested, HASP is the most ambitious one... the quality of HASP manufacturing seems excellent.

PC Compatible (France) June '92



OPERATING ENVIRONMENTS

- ✓ **PC:** DOS, WINDOWS, OS/2, SCO UNIX, SCO XENIX, INTERACTIVE UNIX, AIX, AUTOCAD, DOS EXTENDERS, LANS
- ✓ **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. There are no hidden costs! Since 1984, HASP has enabled thousands of software producers in more than 40 countries, including several Fortune 500 companies, to protect their software.

Please call us for our HASP evaluation package.



ALADDIN
SOFTWARE
SECURITY INC.

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, Tel: 4 5666014 ■ **Poland** Systherm Tel: 61 475 065 ■ **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

Circle 63 on Inquiry Card.

Many Processors, Many Threads

BOB RYAN

What one processor can do, two can do faster, and three can do even faster than that. That's multiprocessing theory. Between theory and working multiprocessor systems, however, lies a gulf that can be bridged only by some complex and expensive technologies. Shared memory buses and cache-coherency protocols have been in use for many years and have found their way into a number of commercial computers, but as yet multiprocessing hasn't had much of an impact on the marketplace.

Windows NT may well change all that. According to Tom Hiel, systems engineer of NCR's multiprocessing product group, "The key enabler of multiprocessing is an operating system that delivers it." NCR, which was to unveil a line of Pentium-based multiprocessing machines in May, expects healthy competition. AST Research, Compaq, Sequent, Siemens Nixdorf, and Wyse are among the companies that will introduce NT-based symmetric multiprocessing systems. These companies and others expect NT to jump-start the multiprocessor market.

For NT, a uniprocessor machine is a degenerate case. Built from the ground up for SMP (symmetric multiprocessing), the NT kernel simply allocates threads to as many processors as are available. In a four-processor machine, the four highest-priority threads will always be running simultaneously. The kernel tracks threads that are ready to run along with their associated priorities, and it automatically handles multiprocessor load balancing.

This approach differs from how Unix systems—except Mach-based ones—deliver multiprocessing sup-

port. SCO Unix and Unix System V release 4.0 achieve multiprocessing by means of kernel extensions. According to Mike Flanary, senior product manager for the Workstation Division at NCR, NT's built-in multiprocessing ports more readily and runs faster than

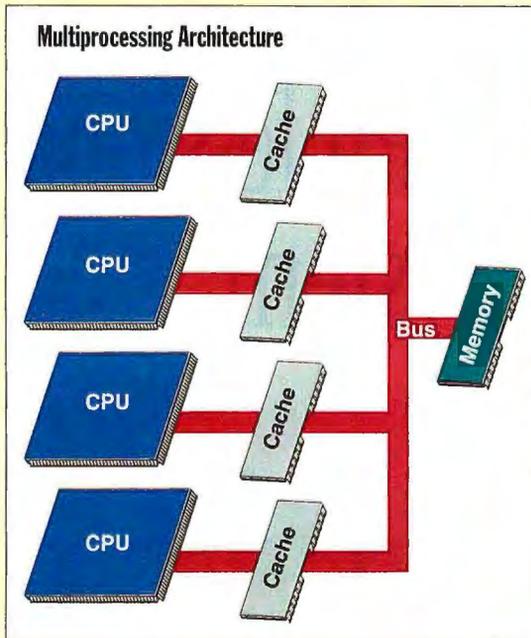
tiprocessors only. The system must support cache coherency at the hardware level, and individual processors must be able to run any thread and service any interrupt or exception. This latter condition has an interesting side effect. Even if your application is not multi-threaded, it can still get a boost from multiprocessing hardware, because NT system threads such as I/O service routines can run in parallel with the application code.

What's involved in writing a HAL? According to Becker, it takes about 20,000 lines of C code. NCR's Flanary says that writing HAL code is the majority of the work required to port NT.

Most multiprocessing systems will be sold as expensive high-performance servers. Sequent, for example, will play prominently in that market. Some companies, however, see an important role for multiprocessing desktop machines. NCR in particular plans to target compute-bound desktop applications, such as CAD, imaging, and desktop publishing, with its Pentium multiprocessors. Wyse also sees a role for SMP on the desktop, especially in engineering workstations. "The final nail in the coffin of workstation/PC differentiation is a local-bus [multiprocessing] PC running NT," says Becker.

The multiprocessor vendors believe they can compete against hot uniprocessing workstations. The Alpha series, Mips R4x00MC, and Pentium chips all accommodate multiprocessor designs, so "it all comes down to cost/performance," says NCR's Flanary. NT gives multiprocessing vendors a platform that lets them innovate for performance while maintaining compatibility with a large software base.

Bob Ryan is a BYTE technical editor. You can reach him on BIX as "b.ryan."



Multiprocessing NT systems employ a shared-memory architecture where each CPU has equal access to the common memory store. Cache-coherency protocols ensure that processors accessing the same memory locations have the most up-to-date version of the common data in their caches.

the bolt-on kind.

The key to NT's multiprocessing support is its HAL (hardware abstraction layer). The HAL provides the kernel with a consistent view of the hardware, whether the system has one processor or 10. Different hardware doesn't require a different kernel, only a different HAL. All NT applications that run on a uniprocessor system will run on a multiprocessor system. "The HAL is the device driver for the box," says Dave Becker, manager of server marketing at Wyse (San Jose, CA).

NT can't handle all multiprocessing hardware; it supports symmetrical mul-

programming environment. However, in a pen market dominated by field data collection, these synergies aren't very compelling.

Let's Get Small

Synergies are even harder to nail down in the case of the junior member of the Windows family, Modular Windows. Execut-

ing in a megabyte of ROM on Tandy's Video Information System (a 286-based CD-ROM player), Modular Windows displays on your TV and takes input from an

The New Generation 17" Monitor

Low Radiation



Advancing into the future is the powerful, new generation ViewSonic 17 ... with crispness and clarity unheard of before now. So, if a high-contrast, extremely bright, sharply focused screen is important to you, this is the answer! Plus, this remarkable monitor runs at 76Hz refresh at an astonishingly high 1,280 x 1,024 and beyond, which will give you a flicker-free image.

Our unique ViewMatch™ color control is an easy-to-use system that takes the guess work out of printing by adjusting colors to closely match printer output. Brighten the red. Lighten the blue. No problem; it works. And the ViewSonic 17 even has an ergonomically designed drop-down control panel that's as simple to use as a typewriter. More great features include digital controls and advanced anti-reflection

coating ... all adding up to make this everything a 17" monitor should be. With its big screen display and edge-to-edge image, this is the monitor of choice for Windows, desktop publishing and CAD/CAM applications.

For safety and vision protection, the monitor meets strict MPR-II and ISO 9241-5 standards.

Call 800-888-8583 for more information on our products, including our new line of 15" through 21" monitors. Welcome to the New Generation.

ViewSonic®

20480 Business Pkwy Walnut, CA 91789
Tel. (909) 869-7976 Fax (909) 869-7958

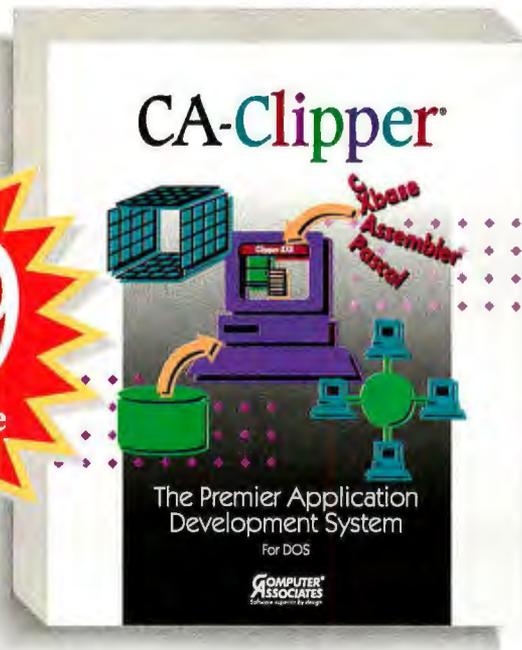
All products and brand names are registered trademarks of their respective companies.

Circle 153 on Inquiry Card (RESELLERS: 154).

Outrageous

New Competitive Upgrade Paradox, Access And AR

\$199
Competitive Upgrade
Offer!



The Complete, Professional Programming Environment For Xbase.

CA-Clipper® 5.2 is a robust language, an efficient linker, a flexible pre-processor and a high-performance compiler. It includes: an editor, debugger and make utility, forming a comprehensive system for creating and distributing PC and LAN-based applications.

Faster Access, Faster Screen Writes, Faster Performance.

Address up to 32 megabytes of mem-

ory – with shorter access times. New Expanded Memory System (EMS) capabilities including LIM 4.0 support, plus a Virtual Memory Manager that uses

dynamic overlays to let you exceed available RAM. You also get faster screen writes, thanks to RSIS compliance.

Feature	CA-Clipper	FoxPro	dBASE IV
Lexical Variable Scoping	YES	NO	NO
User-defined Commands	YES	NO	NO
Code Blocks	YES	NO	NO
Nested Multidimensional Arrays	YES	NO	NO
Predefined Object Classes	YES	NO	NO
Variables Modifiable in Debugger	YES	NO	NO
Customizable Reactive Error Handling	YES	NO	NO
Reads and Writes FoxPro (.CDX) Files	YES	YES	NO
Reads and Writes dBASE IV (.MDX) Files	YES	NO	YES
Reads and Writes Paradox (.DB/.PX) Files	YES	NO	NO

Comparison based on FoxPro Version 2.5 for DOS and dBASE IV Version 1.5.

Enhanced Source-Level Debugger For Improved Stability.

It's one of the most powerful debuggers in the Xbase world. Easy to use and completely interactive.

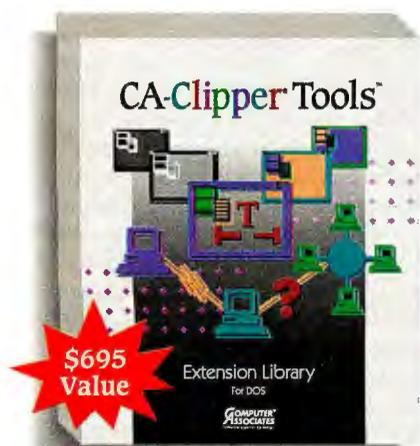
New RDDs For FoxPro, Paradox and dBASE IV.

Replaceable database drivers for all the most popular development systems.

s Upgrade.

Can Save dBASE, FoxPro, AGO Users Up To \$1,291!

\$199 Includes Your Choice Of Any One Of These Products Absolutely FREE!
Offer Good For Users Of Any Competitive DBMS – Call Today!



Over 550 time-saving, problem-solving functions in one high-performance package. Raise your productivity with this valuable library.



Compile almost any dBASE IV application in three easy steps – and produce executable (.EXE) files with the speed and efficiency of CA-Clipper.



dBASE apps come alive with new CA-dBFast 2.0 – the first dBASE-compatible database and language for Windows.

Open Architecture Gives You Freedom To Grow.

Customize Clipper with user-defined commands and functions. And seamlessly integrate modules from languages such as C, Assembly, dBASE and Pascal.

No runtime fees, no additional licenses, no LanPaks. Enjoy free distribution of your applications by producing executable (.EXE) files.

This Offer Is Good For A Limited Time – Call Today.

This special Competitive Upgrade Offer is good for a limited time only, so don't

delay. Call right now and save a fortune while you upgrade to the new standard in Xbase application development.

COMPUTER ASSOCIATES
Software superior by design.

**SEE YOUR LOCAL DEALER TODAY
OR CALL 1-800 CALL CAI EXT. 176.**

Operators are standing by to take your order. Offer good for a limited time only, so don't wait. Call today!



DBA readers rated CA-Clipper 5.01 Best Development Language, Best Xbase Compiler and Best Development Product.



PC Magazine Editor's Choice for Xbase Development.



DBMS Reader's Choice winner for client/server development system.

New CA-Clipper® 5.2.

eight-button hand controller. It jettisons large chunks of Windows, including Program Manager, multitasking, overlapped windows, and menus, in order to meet two requirements: stuff Windows into a megabyte, and simplify its GUI for the interactive TV user. What's left is about two-thirds of the Windows API plus an assortment of user-interface controls (cartoon-like buttons and scroll bars) and APIs (for managing the hand controller, direct video access, and the Tandy VIS memory cartridge).

A Modular Windows program bears a family resemblance to a regular Windows program, but the two are cousins once removed. The Modular Windows Software Development Kit comes with a version of the Reversi game that compiles for both platforms, but only thanks to large chunks of conditional code that are specific to Modular Windows. The adapted Visual Basic included with the SDK can help smooth over the differences, and Microsoft's latest multimedia authoring toolkit will build reference titles for Modular Windows, Windows 3.1/MPC, and Sony's MMCD Player from a single set of assets. Despite these aids, however, developers targeting the home entertainment market may ultimately find Modular Windows' relationship to Windows less useful than Microsoft claims, just because TVs and computers are still very different animals.

The value of the relationship gets even more tenuous if you imagine, as Microsoft does, that Modular Windows will be used to control intelligent cable boxes, high-end fax machines and copiers, and home automation systems. Microsoft won't say who's experimenting with Modular Windows for these purposes, and none of the likely candidates are talking, either.

Even though these kinds of devices won't run anything that's remotely like standard Windows applications, Craig Mundie, Microsoft's general manager for advanced consumer technologies, claims their relationship to Windows is critical.

He cites familiar programming tools and procedures as factors that will speed Modular Windows-based software's time to market. Perhaps, but Windows has by no means yet proved that it can effectively serve that market. "We have a hard enough time even getting our customers to consider DOS," says Vincent D'Amico, director of software development for MicroTouch (Wilmington, MA), a touchscreen manufacturer focused on gaming and point-of-sale applications.

While the lone example of the Tandy VIS running Modular Windows isn't much support for sweeping claims about Windows' downward scalability, Microsoft is pursuing a series of initiatives to further shrink Windows and adapt it for nomadic use. There's no time to lose. It is hardly an accident that the Mac PowerBook has become the mobile machine of choice for the traveling businessperson. With its compelling combination of ROM-resident software, elegantly built hardware, and easy-to-use fax and remote networking, the PowerBook defines what the portable Windows machine has yet to achieve.

Microsoft reportedly has yet other versions of Windows for portable systems in the works. Mobile Windows, or MobiWin for short, is targeted at notebooks and sub-notebooks. It will add features such as hot docking, which automatically synchronizes

the configurations of both the computer and the docking station, and file reconciliation to the standard Windows, according to Gerry Purdy, vice president and chief analyst for mobile computing at Dataquest (San Jose, CA).

WinPad is a GUI for hand-held PCs. It

uses what Purdy describes as "elevators and floors." For example, on the desktop you have the real estate to manage tiling Windows. When the screen gets small, you don't have that luxury. So, instead, you stack the windows, one on top of the other, and select them by choosing "elevator" buttons.

Cracks in the Continuum

What "Windows everywhere" mostly means, for now, is that Windows runs both workstation and server applications. Microsoft also wants Windows to run your network, but that's easier said than done.

Despite the nifty workgroup capabilities of Windows for Workgroups and Windows NT, you can't get full-blown enterprise networking with just one stop at the Microsoft shop.

What's missing? Most notably, a distributed global directory service that tracks all of an organization's human, hardware, and software resources. Also, Windows has no directory service. Even the advanced NT server, which will implement LAN Manager-style replicated administrative domains and support authentication between "trusted domains," won't match the capabilities of Novell's NetWare Directory Service, Banyan's StreetTalk, or the ONC-style (Open Network Computing) and DCE-style (Distributed Computing Environment) directory services sweeping the Unix community.

"NT will have a domain-based name service," says Jamie Lewis, an analyst for the Burton Group (Salt Lake City, UT), "but not a true global directory." NT's support for DCE RPCs (remote procedure calls) enables developers to distribute services across a mixture of NT and Unix platforms, but how will those services be advertised and located? NT won't initially support the DCE directory service. Cairo, a future version of Windows that's being designed to weave OLE, RPCs, and the NT file system into a distributed object system, won't solve the directory problem anytime soon.

Add to this technical challenge Microsoft's historical inability to sell network software to corporations, which is shown once again by WFW's lackluster sales performance. In fact, WFW is an under-

"If I had a gun I'd shoot my PC; it can't even do a 20-page newsletter without having a spasm. I grew up with real systems, like VMS. If that's what Microsoft has in NT, I'm all for it."

**Nina Lytton, editor,
Open Systems Advisor
(Boston, MA)**



"As Microsoft crams more and more of the network into the operating system, the distinction between client and server gets harder and harder to tell. This is threatening to Novell. The camel's nose is in the tent."



**Paul Giraldi,
vice president
of sales,
Valinor, Inc.
(Fort Lee, NJ)**

A Solid Case for Real Power.

POWER SUPPLIES

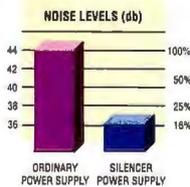
"The premier power-supply maker"
John Dvorak, *PC Magazine*, March 30, 1993
"The only company to go to for a power supply"
Jerry Pournelle, *Byte*, April 1993

STANDARD UNITS

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

STANDARD 205 SLIM \$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. They're cooled by custom, high-efficiency 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, super-tight regulation, ultra-clean output, a high-capacity **ThermaSense** 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 300 SLIM/BABY \$169
TURBO-COOL 300 AT/TOWER \$189
TURBO-COOL 450 AT/TOWER \$349

SOLID-STEEL CASES



Give your computer a professional, high-tech look with one of our premium-quality, **American-made** all-steel cases. They're rigid—unlike light-weight imports—so motherboards, cards, and drives are always properly aligned and grounded. And, with up to 18 drive bays, they offer real expandability! Ideal for commercial and industrial applications.

CASE SPECIFICATIONS

	Desktop	Tower	Monster
Motherboard Capacity:	1	1	2
Power Supply Capacity:	1	1	2
Exposed Drive Bays:	3	6	13
Total Drive Bays:	5	8	18
Cooling Fans:	2	3	6
Filtered Air Inlet:	Yes	Yes	Yes
Lockable Front Door:	Yes	No	Yes
Professional Controls:	Yes	Yes	Yes
All-Steel Construction:	Yes	Yes	Yes
Beige or Black Finish:	Yes	Yes	Yes
Meets FCC-B Specs:	Yes	Yes	Yes
Made in USA:	Yes	Yes	Yes

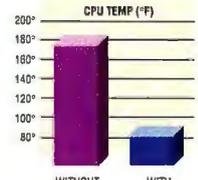
SOLID-STEEL DESKTOP CASE \$295
SOLID-STEEL TOWER CASE \$395
SOLID-STEEL MONSTER CASE \$895

CPU COOLER



It's a fact. 486 chips run hot, often exceeding 185°F! Now, you can cool your 486 to a safe 85°-95°F with our popular **CPU-Cool**. It prevents random system errors and other heat-related problems. Consists of a mini-fan embedded in a sculptured heat sink that easily mounts on the CPU. Powered by a spare drive connector. Effective, inexpensive insurance!

- cools CPU 70° - 100°F
- prevents system errors
- adds years to CPU life
- thinner, quieter, and better-built than cheap imported imitations.
- safe, simple installation



CPU-COOL \$39

REDUNDANT POWER

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 your 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.

- 900 watts peak power
- 100X more reliable than a single-unit
- load-sharing design
- hot-swap capability
- allows dual UPS
- monster-case compatible



TWIN-POWER 900 \$995

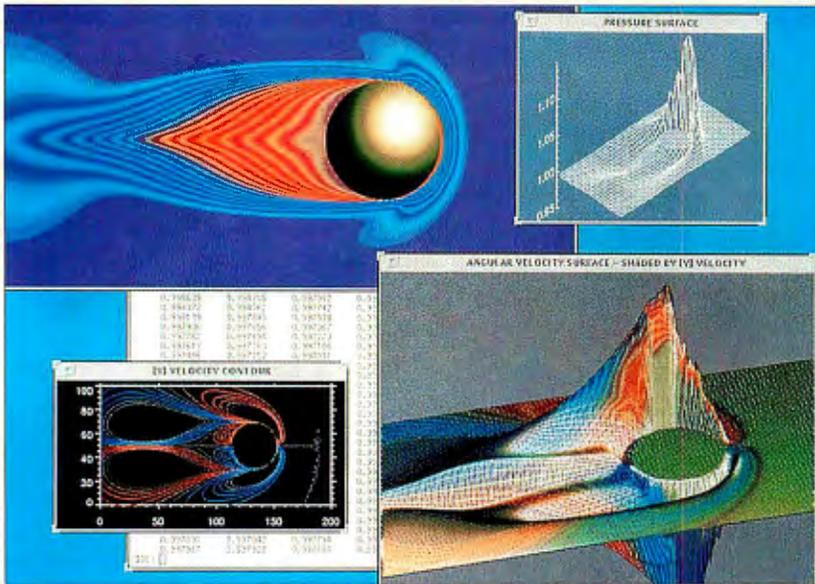
PC POWER & COOLING, INC.

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, TwinPower and CPU-Cool models guaranteed for 2 years. All other products guaranteed for 1 year. Hours: 7 a.m. - 5 p.m. (PT) Mon. - Fri. Silencer, Turbo-Cool, ThermaSense, TwinPower, and CPU-Cool are trademarks or registered trademarks of PC Power & Cooling, Inc. ©1993 PC Power & Cooling, Inc.

Circle 124 on Inquiry Card (RESELLERS: 125).

Windows graphics still lag, but not for long



The Windows GDI is not well suited for applications such as this simulation of airflow around a sphere, shown running on a RISC platform. (Photo courtesy of Research Systems, Boulder, CO)

Despite Windows' graphical face, its raster-based GDI (Graphical Device Interface) lacks the vector and polygon primitives and the 2-D/3-D programming abstractions necessary for advanced illustration, CAD/CAM, and visualization applications. Such primitives and abstractions serve two purposes: They simplify programming, and they create hooks for vastly better hardware support than today's local video buses and Windows accelerators can provide.

NT's GDI enhancements—paths, Bézier curves, 2-D transforms—help only slightly. Windows can enter the 3-D graphics workstation arena riding

on the shoulders of NT, but to compete successfully there, it needs to grow a better graphics API.

The good news is that Microsoft has licensed Silicon Graphics' renowned OpenGL. The bad news is that it won't be included in the first release of NT. Microsoft and Silicon Graphics are working to integrate OpenGL with GDI, but that's a complex task that will probably occur in stages. Some vendors can't wait. "We'll have an OpenGL interface in our first release," says Intergraph's Tom Steele. NEC Technologies (Boxborough, MA) will also offer OpenGL support for its forthcoming

R4000-based NT workstation.

Mike Mitsch, group manager of computer systems marketing for NEC, sees a strong need for commercial OpenGL-based software, even on hardware that doesn't have a graphics pipeline. "Brokers want to visualize the behavior of hundreds of stocks along multiple dimensions, and GDI just wasn't built that way," he says.

Win32 applications that adopt OpenGL will be able to do such things with relative ease, and on platforms that accelerate OpenGL, they'll do them in real time. Board-level OpenGL accelerators for RISC PCs are one likely development. If GDI and OpenGL do merge successfully—and Bill Glazier of Mips emphasizes that "we're not going to accept any kludged solution"—NT could well become a highly strategic operating system for Silicon Graphics workstations.

The fact remains that NT won't deliver high-performance graphics in its first release. But no one's complaining bitterly, either. System builders and software developers think that the Microsoft/Silicon Graphics relationship is taking NT graphics in the right direction.

appreciated gem. MIS people who gave it a bad rap, fearing the peer server would compromise centralized data management, missed the point completely. The server is an optional convenience.

The real value of WFW lies in the workgroup pieces, such as Mail, Schedule+, and MAPI (Messaging API), that can add complementary (and centrally manageable) services to an existing server-based LAN such as NetWare. Why wasn't this message ever heard? No one delivered it. Microsoft lacks Novell's army of resellers and Sun Microsystems' battalion of direct salespeople.

In the case of NT, the message is even more compelling. The basic product, for example, bundles a remote-access service

that handles asynchronous and even X.25 connections. The X.25 support is particularly important to any company that wants to export network services worldwide using a packet-switched network. "But no matter how good NT's networking may be," says Lewis, "Microsoft won't make a dent in Novell's business until it builds its own channel."

United Unix

Leading Unix vendors, including HP, IBM, The Santa Cruz Operation, Sun, and Univel, recently linked arms and proclaimed an end to the windowing and network wars that have splintered the Unix community. All these vendors now promise to ship X Window System 11 and Motif, along with

ONC, DCE, and the NetWare client protocols. "We'll finally be dealing from the same source base," says Dave Taber, group marketing manager for SunSoft (Mountain View, CA). It may be ironic that only the specter of NT could precipitate this long-overdue move, but the fact remains that a united Unix—if it materializes—will be a force to reckon with.

NT lacks Unix's multiuser foundation and its ability to export both character-mode and graphical interfaces through asynchronous and network connections. A third party, Citrix Systems (Coral Springs, FL), will add these capabilities to NT—as it has already done admirably for OS/2—but they're not part of the basic NT product. Although NT does maintain

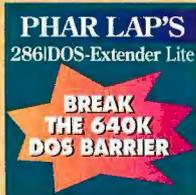
Discover how easy it is to break the 640K DOS barrier with Phar Lap's 286|DOS-Extender™

FREE
IN VISUAL C++
286|DOS-
EXTENDER LITE!

Try out Extended-DOS programming — 286|DOS-Extender Lite.

Here's some great news for DOS developers: every copy of Microsoft®'s new Visual C++™

Professional Edition includes a FREE trial-sized Phar Lap® DOS extender! Phar Lap's 286|DOS-Extender™ Lite is a special version of Phar Lap's award-winning 286|DOS-Extender. With 286|DOS-Extender Lite, you can write DOS programs that break the 640K barrier, access up to 2 MB of memory, and run under DOS, DESQview™, Windows™ and OS/2®. It's the easiest introduction you'll find to Extended-DOS programming.



Build multi-megabyte, full-featured DOS programs — 286|DOS-Extender SDK.

Professional developers can purchase Phar Lap's full-featured 286|DOS-Extender SDK for \$495. With the 286|DOS-Extender SDK, you can access up to 16 MB of memory — with the standard Microsoft or Borland tools you already use! The new Version 3.0 of 286|DOS-Extender now supports Visual C++ as well as Microsoft C/C++, Borland® C++ and Microsoft Fortran. You can even use Microsoft's CodeView® or Borland's Turbo Debugger® to debug your Extended-DOS programs. 286|DOS-Extender



programs will run on any DOS-based 80286, 386, 486 or Pentium PC. There's no special programming required to use a Phar Lap DOS extender; your program can access extended memory just as if it were conventional (below 640K) memory.

286|DOS-Extender is one of the most widely used 16-bit DOS extenders available. If you'd like to know why, take a look at what our customers and other industry experts have to say about the 286|DOS-Extender SDK. Then find out for yourself by trying the free 286|DOS-Extender Lite — or get started right away on your multi-megabyte DOS applications with the professional 286|DOS-Extender SDK!

What the experts say about Phar Lap's 286|DOS-Extender SDK:

"Great tools for Visual C++ programmers who need more memory"

- Denis Gilbert, Microsoft Corp.

"A no-compromise solution for Borland C++ developers"

- Paul Gross, Borland International

"An excellent product technically"

- Glenn Axworthy, Brøderbund Software

"Gives our customers the memory they need"

- Bert Love, Galacticom, Inc.

"A superb way of utilizing all available memory"

- Dave Jewell, Program NOW, August 1991

New virtual memory support.

In addition to Visual C++ support, 286|DOS-Extender, Version 3.0 now includes Phar Lap's 286|VMM virtual memory manager. 286|VMM is completely integrated into 286|DOS-Extender (you invoke 286|VMM with a command-line switch) and enables you to transparently access more memory than is physically available in your computer. 286|VMM can improve the performance of applications that previously relied on loading and unloading dynamic link libraries (DLLs). And it's fully DPMI-compatible, so programs running under Windows automatically use the virtual memory provided by Windows.

NEW
VERSION
3.0

386|DOS-Extender — Your 32-bit DOS development solution.

If you want 32-bit speed and power; as well as megabytes of memory for your DOS applications, Phar Lap's award-winning 386|DOS-Extender™ is your solution. With 386|DOS-Extender, your programs can access all available memory and run in a workstation-like, unsegmented 32-bit address space. 386|DOS-Extender programs will run on any DOS-based 80386, 486 or Pentium PC. 386|DOS-Extender supports a wide range of 32-bit compilers, including Microsoft's 32-bit Windows NT™ C/C++ compiler. It runs the NT compiler under DOS (no NT system required) to build 32-bit Extended-DOS programs — the only 32-bit Microsoft DOS development solution available.



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. Visual C++, Windows and Windows NT are trademarks 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 127 on Inquiry Card.

a database of users to support its role as a peer server, Citrix's multiuser version of NT is a major undertaking that upgrades NT's user and session management, optimizes its scheduler, and implements protocols for character-mode and graphics terminals.

If Microsoft can fairly claim that Unix wasn't built from the ground up for symmetrical multitasking, Unix vendors can with equal fairness point out that NT wasn't built to support multiple users logged in from remote terminals. If you think that's irrelevant in the 1990s, try selling your local video store an upgrade from Xenix to a Windows LAN.

Unix also owns the high ground in networking and distributed computing. NT owes its favorable reception among network cognoscenti largely to its adoption of Unix network protocols such as TCP/IP, sockets, and DCE RPCs. However, Windows networking is still biased toward the non-routable NetBEUI protocol, and it has a long way to go before it can match the sophistication and worldwide reach of Unix networking.

The IBM Factor

Like Microsoft, IBM will field a family of nonportable and portable operating systems. "With such a wide range of hardware available," says John Soyring, director of software development programs, "no single operating system can cover them all." DOS and OS/2 are highly tuned for Intel processors, he says, while AIX couples tightly with the RS/6000. But IBM also sees the need for a portable, microkernel-based system, and it will begin to beta-test one later this year.

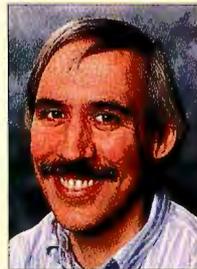
The forthcoming Workplace OS, built on a Mach 3.0 derivative, sounds a lot like NT. It will integrate multiple personalities—at least DOS, 16-bit Windows, OS/2, and AIX—under a future version of the Workplace Shell. The System Object Model, which is the innovative object technology that powers the extensible Workplace Shell, will support distributed objects that communicate using TCP/IP sockets or DCE RPCs. Meanwhile, IBM continues to im-

NT'S ARCHITECTS SPEAK

Dave Thompson and Lou Perazzoli are key architects of Windows NT: They're the development managers for networking and the base system, respectively. Both had been working with DEC's VMS operating system prior to moving to Microsoft. Perazzoli, in fact, was part of the VMS development team headed by David Cutler, who is now NT's chief architect at Microsoft. BYTE's West Coast bureau chief Andy Reinhardt interviewed them for this article.

BYTE: I'm interested in the notion that you were able to look back at the history of midrange and large systems and select which operating-system features to migrate down.

PERAZZOLI: In fact we did that. We looked at the Unix standards and some of the things people did on mainframes with databases. We had done a lot of this at DEC, because at DEC we were designing a new operating system and we knew what limitations they had with VMS and what limitations they had in their Unix operating systems. We gained a whole lot of knowledge in what people wanted.



Lou Perazzoli

We have had an interesting opportunity to do things from the ground up, to write everything from scratch. We got to take code from current projects at Microsoft when we felt it was a good idea, or we could rewrite stuff when we thought that was a good idea.

BYTE: Did you have a sense when you started on this project that you were working on a historic operating system?

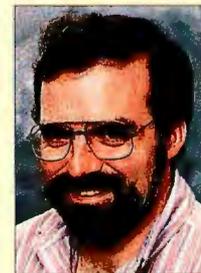
PERAZZOLI: One of the things we wanted to do was bring a high-end operating system to PCs. We thought this would go over really big, because we saw demand for it. We saw the downsizing trend happening, and we saw that the minicomputer would be replaced by PCs. It seemed to us this was the logical thing. Plus client/server was just starting to become viable; a lot of the groundwork had been laid, and people were now thinking about client/server as a model for running their business. So what we wanted to do was design something that was robust and had the features people wanted and

had client/server capabilities.

THOMPSON: I think my perspective may be a little different than Lou's because I came from the outside. My background was really more VMS-oriented than Unix or even PC, and it was clear to me that the PC needed a high-end, robust operating system. It was clear to me that if anybody was to supply that, Microsoft was in the best position. So I certainly sensed the potential from the very beginning.

BYTE: Is NT, as it stands today, relatively Cairo-ready? Is it architected in a way that makes the transition to a more object-oriented model fairly easy?

PERAZZOLI: Yes. In fact, there's a group here at Microsoft doing the development work, and essentially all they're doing is adding an object-oriented file system. NT already has four file systems [FAT, NTFS, HPFS, and CD-ROM], so adding another layered file system is not a hard thing to do. Most of the other things in Cairo are user-mode—for example, OLE 2.0 enhancements that they're making to applications.



Dave Thompson

BYTE: What's next for you guys?

THOMPSON: In the case of networking, there is a never-ending series of requests for connectivity on the system. There are a number of major ways in which systems are connected, and clearly one of the things we need to do is expand our support for them. So I think on the networking side our work is pretty much cut out for us.

prove OS/2. Version 2.1, which is likely to ship before NT does, adds 32-bit graphics, badly needed video and CD-ROM drivers, and snappy Windows 3.1 support.

The dilemma for IBM is that main-

stream Presentation Manager applications that exploit OS/2's advanced features remain scarce. As a result, users tend to evaluate OS/2 as a platform for running DOS and Windows software. Unfortunately,



Guaranteed Top Quality
 Products tested & backed by 30-day money-back guarantee.

Over 5000 Products in Stock

20 YEARS OF EXCELLENCE
 1973-1993

20 Years of Full-Service
 Product selections & customer service based on solid business experience.



24-Hour Toll-Free Ordering
 Shop day or night by phone or FAX.



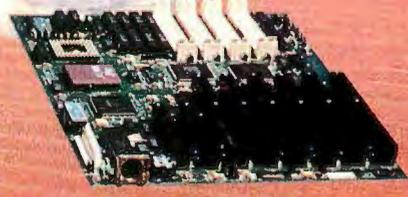
Computer & Printer Repair
 ServiceLine quick-turn repairs, parts installation & tech assistance.
 Jameco ServiceLine!TM
 1-800-831-8020

20 Years of Jameco Quality, Value and Service. You Get it All.



Select these products or any of the 5000 in our Catalog:

- KEYBOARDS** Fujitsu 101-key enhanced keyboard Part No.6B17128 **\$79.95**
- FLOPPY DISK DRIVES** Toshiba 1.44MB 3.5" Internal Drive Part No.6B40774 **99.95**
- COMPUTER CARDS** Jameco 16-Bit VGA card Part No.6B67459 **59.95**
- CABLES** Jameco 6' parallel printer cable Part No.6B28716 **7.95**
- HARD DRIVES (IDE)** Conner 120MB, 19ms Part No.6B14074 **299.95**
- POWER SUPPLIES** Jameco 150W 8088 Part No.6B19465 **69.95**
- MEMORY** SIMM Module 1MB 80ns Part No.6B41769 Product No.421000A9B-80 **47.95**
 18-pin DIP 1MB 80ns Part No.6B42251 Product No. 511000P-80 **4.99**
- DIGITAL MULTIMETERS** Metex 4.5 digit w/frequency, capacitance & data hold Part No.6B27158 **99.95**
- EPROM** 128K EPROM Part No.6B39984 Product No. 27128A-25 **3.75**



JAMECOTM
 ELECTRONIC COMPONENTS
 COMPUTER PRODUCTS

Call for your free Jameco Catalog
1-800-637-8471



1355 Shoreway Road, Belmont, CA 94002
 Sales: 1-800-831-8020
 FAX: 1-800-257-6948
 International Sales: 1-415-591-8697
 International FAX: 1-415-591-2505

Same-Day Shipping
 Priority orders before 2:00PM PST are shipped the same day.



Circle 101 on Inquiry Card.

V.I.P.#6B3

Always Prompt Courteous Service
 Jameco phone staff quickly connect you with the products and services you seek.
 Technical Support:
 1-800-831-0084



Windows is a rapidly moving target. Because OS/2 2.1 doesn't support Windows VxDs (virtual device drivers), it won't be able to run Win32s applications. In theory, the Workplace OS could grow a Win32 personality, enabling it to run such programs in much the same way as NT does. Soyering hints that that may be the "fallback plan," but he maintains that "we won't encourage the development of Win32 software."

Although IBM's hold on the desktop

market is shaky, says Anders Vinberg, senior vice president of development with Computer Associates (Islandia, NY), Microsoft's grasp of corporate information services is even weaker. "People in the PC industry have holes in their perspective when it comes to CICS [Customer Information Control System] and transaction processing," he says.

However, OS/2's role as the glue between PCs and mainframes remains a crucial advantage. In this realm, it's IBM that

looks like the innovator. Microsoft is taking a conventional approach, bundling a DLC (Data Link Control) protocol and a simple 3270 emulator with NT and separately offering SNA (Systems Network Architecture) and NetView services. IBM, already on top of these things, is raising the stakes by readying a DCE product suite for OS/2. More complete than NT's DCE offering, it will enable distributed transaction processing that harnesses OS/2, AIX, and mainframe resources.

Place Your Bets

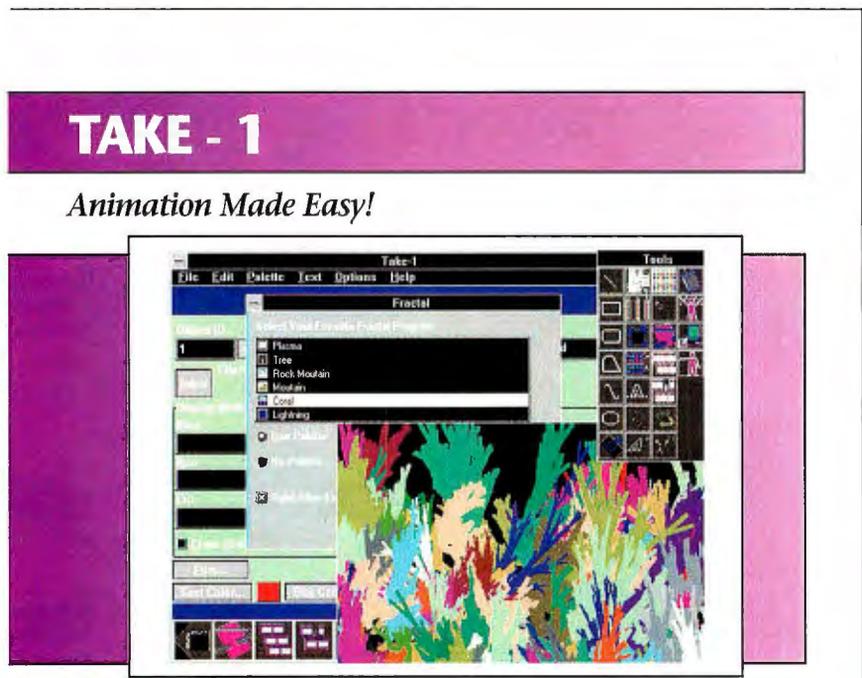
For an objective view of the operating-system race, talk to a tool vendor who supports them all. The Universal Component System from Software Transformations, Inc. (Cupertino, CA), enables developers to build applications for Windows, the Mac, OS/2, and many flavors of Unix. "One hundred percent of our users are interested in Windows," says STI's vice president of engineering Doug Donzelli. "For a second platform, the choices are Unix, the Mac, and, finally, OS/2."

Almost no one can afford to ignore the power and mass appeal of a family of compatible Windows operating systems. As a result, many fear that Microsoft will achieve the kind of control that IBM once wielded. Others argue that while that will surely happen, it won't be such a bad thing for users. IBM's iron rule, after all, gave us a reliable infrastructure for banks, airline-reservation systems, and other essentials of modern life. Maybe we need that kind of standard again, and maybe Windows is it.

But fortunately or unfortunately, things aren't going to be so simple. The ascension of Windows has got everyone's competitive juices flowing. Portable, microkernel-based operating systems are all the rage, and while Windows NT is running at the head of the pack, it's not as far out in front as Microsoft would like you to believe. NetWare, OS/2, Solaris, NextStep, and the Mac are all emigrating to new hardware platforms and influencing Windows as much as it influences them. The "Windows everywhere" game holds much profit for developers and users, but it won't be the only game in town. ■

Editor's note: *BYTE* news editors Ed Perrotore, Patrick Waurzyniak, and Dave Andrews, senior news editor Tom R. Halfhill, West Coast bureau chief Andy Reinhardt, and executive editor Rich Malloy also contributed to this article.

Jon Udell is a *BYTE* senior technical editor at large. You can reach him on BIX as "judell."



TAKE - 1

Animation Made Easy!

Add audience-captivating animation to presentations, training, advertising, and more — and do it on the first take!

Announcing **Take-1**, the new interactive animation authoring tool that combines Graphics, Text, Video, Voice and Music, to create incredible animation sequences, instantly and with ease. Here's a sampling of the features that make Take-1 the most powerful product of its kind:

Animation Effects: Looping, ping pong, forward and reverse. 3-D path design. Straight, curved, elliptical and interactive path layouts. Onion Skin, wipes, dissolves, fades, and many, many more.

Paint and Background: Create dazzling Fractal scenery backgrounds, automatically. Plus, fountain fills, a full set of drawing tools, powerful graphics handling capabilities, and support for up to 16 million colors (24-bit True Color).

Object Linking and Embedding (OLE): Link to Word, PowerPoint, Excel, CorelDRAW!, Persuasion, Harvard Graphics and all Windows applications that support OLE.

Interactive Controls: Support for Media Control Interface (MCI) controls sound, video, CD-ROM and more. Add custom menus and buttons, control volume and speed, and create event-driven presentations that let you branch out to different scenarios.

Call 800-732-3002 for complete information and a dealer near you.

Suggested Retail \$395

Take-1 is a trademark of Pacific Gold Coast Corporation. All other product names are trademarks of their respective holders.



Take - 1



Pacific Gold Coast Corporation
 15 Glen Street, Glen Cove, NY 11542
 (800) 732-3002 • (516) 759-3014 Fax
 (516) 759-3011 Outside US & Canada

HP LaserJet 4

\$1759

600 dpi

- PCL standard
- Adobe PostScript software optional
- 8 ppm printing speed
- 11.7"H x 16.4"W x 15.9"D
- Weight: 35 lbs.



TI microLaser PS17

\$1199

300 dpi

- PCL and Adobe PostScript software std.
- Easy to use front control panel
- 9 ppm printing speed
- 10.9"H x 13.4"W x 14.2"D
- Weight: 30 lbs.



BY THE WAY,
OURS ALSO HAS
POSTSCRIPT,
MORE SPEED AND
IS EASY TO USE.

TI vs. HP.

Both offer advanced graphics capabilities. Superior flexibility with type. Superior paper handling. And more.

But there's one expensive difference. TI microLaser™ PS17 lists for over \$500 less than the HP LaserJet® 4.

Better still, TI microLaser PS17 comes standard with the industry graphics preference, PostScript® software from Adobe®. HP LaserJet 4 doesn't. We print 9 pages per minute, they print 8.

We're also easy to use with all of your major software programs, including Word®, WordPerfect®, Excel®, Lotus® 1-2-3® and Windows®.

TI microLaser PS17. It can extend your reach without over-extending your budget. For information and a dealer near you, call 1-800-527-3500.



"Extending Your Reach With Innovation" and microLaser are trademarks of Texas Instruments. LaserJet is a registered trademark of Hewlett-Packard, Inc. Excel, Word and Windows are registered trademarks of Microsoft Corp. Lotus and 1-2-3 are registered trademarks of Lotus Development Corp. WordPerfect is a registered trademark of WordPerfect Corp. Adobe, PostScript and the PostScript logo are registered trademarks of Adobe Systems, Inc. © 1993 TI

EXTENDING YOUR REACH
WITH INNOVATION™

 **TEXAS
INSTRUMENTS**

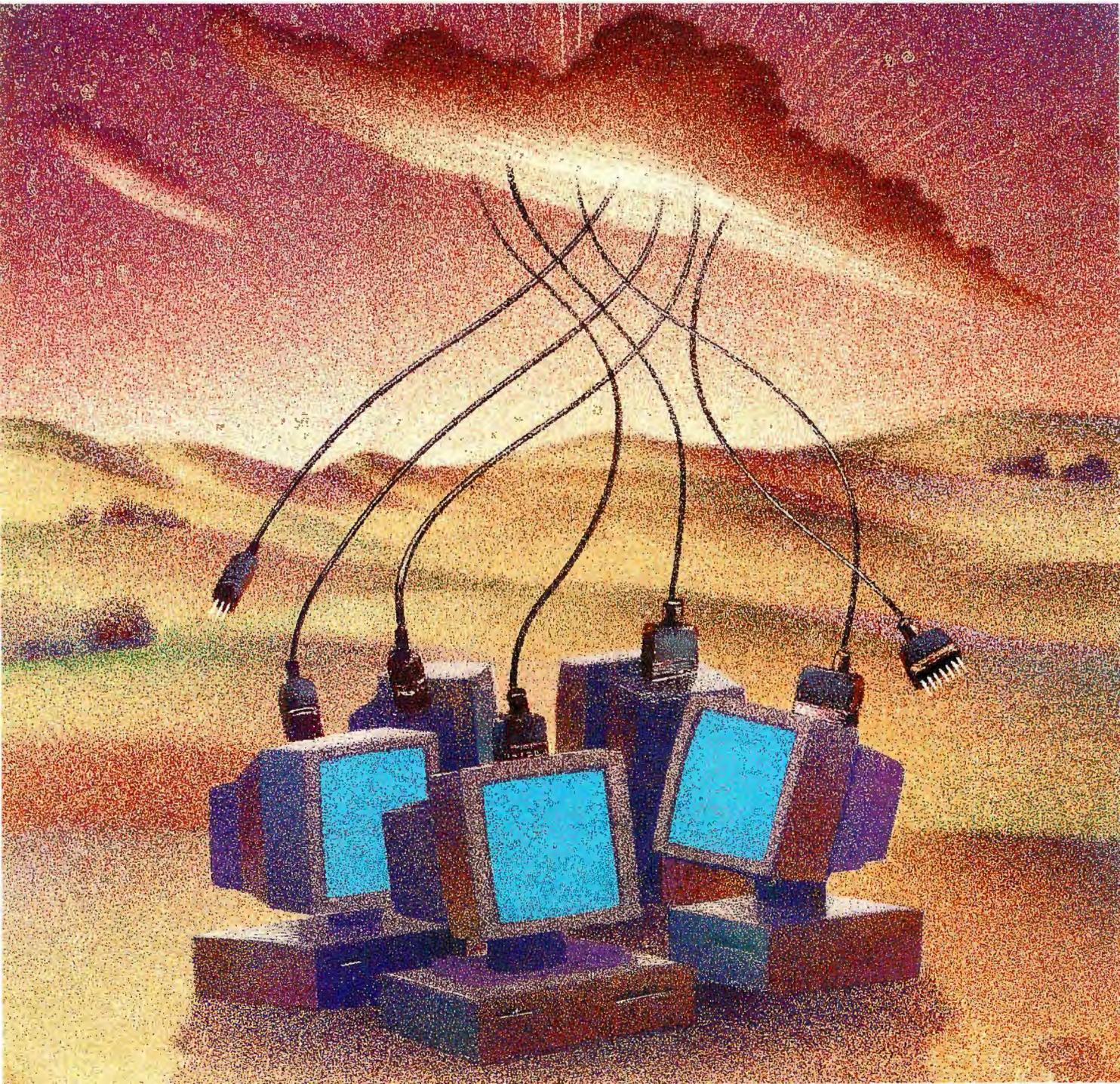
Circle 147 on Inquiry Card.

State of the Art

CLIENT/SERVER FREES DATA

Data access and distribution change forever with client/server architecture, but it isn't all roses. When it comes to getting the pieces to work together, you are often on your own.

ELLEN ULLMAN



Early in February, an old Honeywell mainframe rolled out of the Burlington Coat Factory's (Burlington, NJ) door, ending an era. Burlington, a retail outlet chain, would never see mainframe-based computing again. From then on, it would rely on client/server systems.

The U.S. House of Representatives also uses client/server technology, but it has no intention of scrapping its mainframe. Jim Daley, the database administrator for House Information Systems, describes his IBM ES/9000 as "solid as a rock." The House's client/server system functions as a front end to the ES/9000, which serves as a large database repository.

Burlington and the House of Representatives are typical of the early adopters of client/server computing. Every day they learn a little more about how to safely and efficiently move huge blocks of data off the big iron and onto networks of small, powerful computers.

If you move to client/server computing, it will change forever the way your enterprise accesses, distributes, and uses data. With this approach, data is no longer under the tutelage of the MIS department; it is readily available to you through your network. Consequently, you don't have to wait for the MIS staff to run your report. You can grab the data yourself and run it through a spreadsheet from your desktop using the brand of computer and the software tools that you're most comfortable with and that get the job done your way.

But getting client/server computing to work isn't all that easy. For example, it's up to you to find or develop print managers, console monitors, and other maintenance tools that came standard with mainframes. Your programming staffs, accustomed to writing large COBOL programs, may initially be mystified by Windows programming. And because client/server systems are complexes of hardware

and software from different manufacturers, finding and squashing bugs can be a nightmare.

Still, these headaches pale when you consider client/server computing's potential to revolutionize your enterprise. Not only is data more available to you, but it's available through a system that can grow and change with you as your needs evolve. Further, because client/server systems are open and modular, you can tailor your system for your own particular applications, picking and choosing the most cost-effective hardware and software components for your tasks.

Specializing Platforms

A lot of companies make the move to client/server computing to cut costs. Burlington, for instance, replaced its mainframe, a machine with 4 or 5 MIPS of processing power, with a battery of six series 2000/750 Sequent computers, with a total of 1500 MIPS, and with Sun Microsystems ELC or SLC machines, the aggregate power of which Burlington can't even calculate. Each Burlington retail store now has a Sun computer with a SPARC processor, a 200-MB hard disk, and 16 MB of memory, "all for \$3995 [each] in quantity," says Mike Prince, Burlington's director of information services. "[Client/server is] overwhelmingly more cost effective."

But what may best define client/server computing, says J. Neil Weintraut, a senior technology analyst at the investment banking concern of Hambrecht & Quist (San Francisco, CA), is that it lets you pick and choose among platforms. "Anyone looking for *the* client or server is missing

the point of client/server," he says, "which is the ability to easily and rapidly customize relatively low-cost platforms for specific applications."

Because of the ability to specialize your platforms, you can get exactly the type of software you need to satisfy your requirements. For example, Burlington's Prince plans to choose between Solaris from SunSoft (Mountain View, CA) and Windows NT from Microsoft (Redmond, WA) based on performance (see "Windows Windows Everywhere?" on page 72). Daley at the House of Representatives sees products such as 4th Dimension from Acius (Cupertino, CA), a Macintosh software development tool, as "more contemporary" tools that let him deliver "more sophisticated" applications to end users.

Further, analyst Weintraut sees client/server technology becoming more versatile in the future. He envisions a new breed of "tactical" client/server applications, which he describes as applications that you can dynamically modify to meet rapidly changing business situations. "Previously, changes would queue up for months or years in the MIS backlog," he says, "precluding any consideration of modifying applications in a pedestrian manner."

Enterprise Changes

Client/server architecture gives you as many access points to your data as you have workstations on your network. It also lets you bring to your enterprise more tools to manipulate data.

At Burlington, Prince says that this ability has changed the way people can work

What's in a Name?

Client

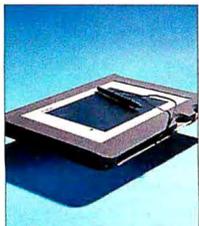
A computer or workstation attached to a network that you use to access network resources.

Server

A machine that furnishes clients with such things as huge disk drives, databases, or connections to a network. Servers can be mainframes, minicomputers, large workstations, or LAN devices. More than one server can supply services to clients.

Client/Server Frees Data

Client/server computing gives enterprise-wide access to data **96**



The Many Flavors of SQL

The SQL standard proves to be a moving target..... **109**



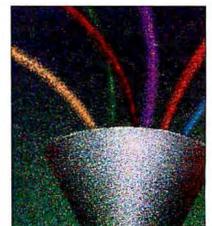
Make Way for Data

Middleware eases data exchange on multiplatform client/server networks..... **113**

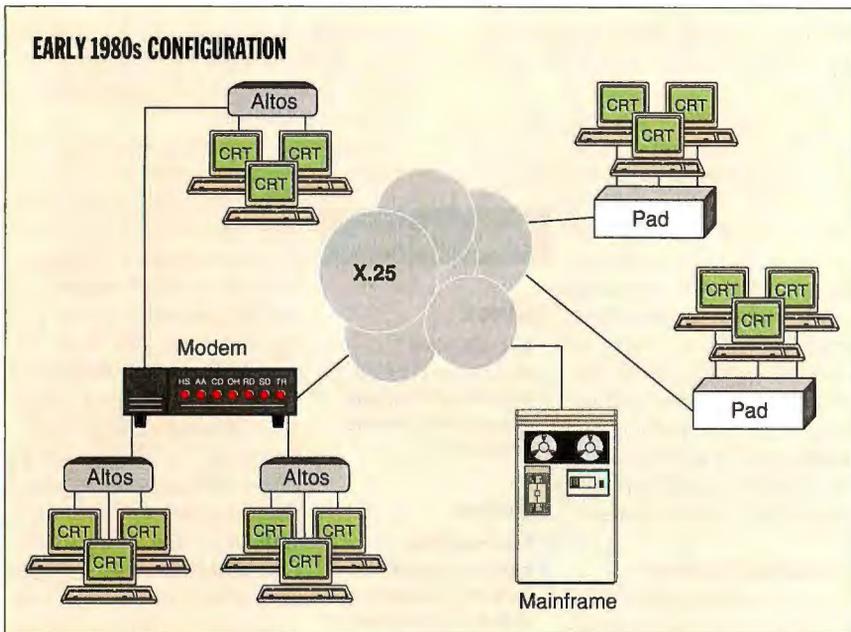


EISes Mine Your Data

EISes help you detect links between seemingly unrelated data..... **121**



State of the Art Client/Server Frees Data



Before the Burlington Coat Factory switched to client/server computing, store transactions were typed into a small, multiuser Altos. Transactions were sent via modem to an X.25 network and then to the mainframe at headquarters. Dumb terminals connected to network pads enabled data queries.

with data. Users no longer have to ask for MIS reports, because client/server computing empowers them to access Oracle databases at will. Users can feed information from the databases into spreadsheets or word processors on their desktop systems, seamlessly integrating the remote data with local tools. They couldn't do this on a mainframe, which limited access to computing resources. "People were discouraged from using [the computer]," he says. "Now they are encouraged to use it."

Burlington now runs its entire operation—190 retail stores, distribution centers, and headquarters—off its client/server system. The system handles everything from conveyor-belt scanners that generate database transactions to graphical workstations on which decision-makers enter queries.

In a typical Burlington retail store, the cash registers are NCR 7052s, which are DOS-based machines using the PC Network File Standard for network file services. The cash registers are connected by an Ethernet LAN to the main store processor, a Sun ELC or Classic. The Sun system acts as a file server for the registers and as a communications gateway to the central host computers.

Burlington stores communicate with various hosts on a network across a small satellite unit known as a VSAT (very small aperture satellite terminal) link via TCP/IP through X.25 protocols. From there, data

moves to several destinations, such as a gateway to VISA/MasterCard for credit-card transactions.

Store transactions pass over the satellite link and through front-end processing that switches them from a batch paradigm to transactions that can be stored in and processed by Oracle databases residing on

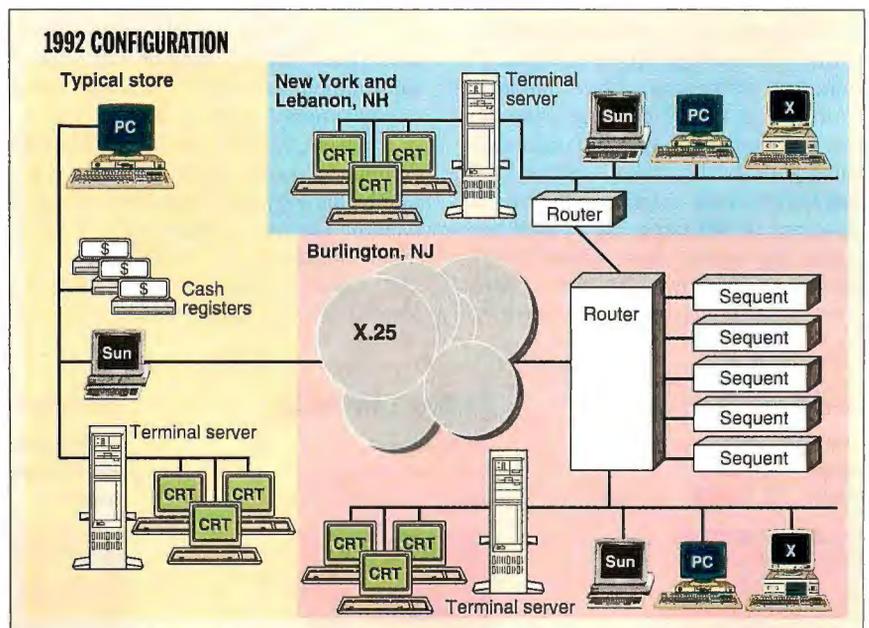
several Sequent computers at the Burlington headquarters. A Tuxedo on-line transaction-processing system from Unix System Laboratories (Summit, NJ) is used to coordinate data updates. Tuxedo uses the cooperative resources of the network by concurrently running processes on several machines. Previously, transactional processing occurred on a mainframe in a time-sharing setup. An added benefit of spreading transactional processes across the network is that work no longer comes to a screeching halt when part of the network goes off-line.

Wide-Open Growth Potential

The client/server concept grew out of the competitive world of open systems. "When people say client/server now, you can almost substitute the phrase *open systems*," says Roger Sippl, a founder of database vendor Informix (Menlo Park, CA). "Open systems gave entrepreneurs the opening to solve particular problems, which benefits the users."

Client/server's openness means that you can choose from various vendors' products. "The flexibility it [gives us] is pretty much endless," says Frank Pellegrino, associate director of computer services for the Public Broadcasting Service (Alexandria, VA).

PBS's client/server system comprises a database from Ingres (Alameda, CA)



Today, Burlington's client/server system links all of its stores and distribution centers to headquarters. Store transactions enter network-ready cash registers linked to Sun computers, which also serve as communications gateways. Transactions are routed to a series of Sequent computers for processing. Terminal servers enable data entry and queries from workstations.

Beauty And dBASE.



NEW UPGRADE 2.0

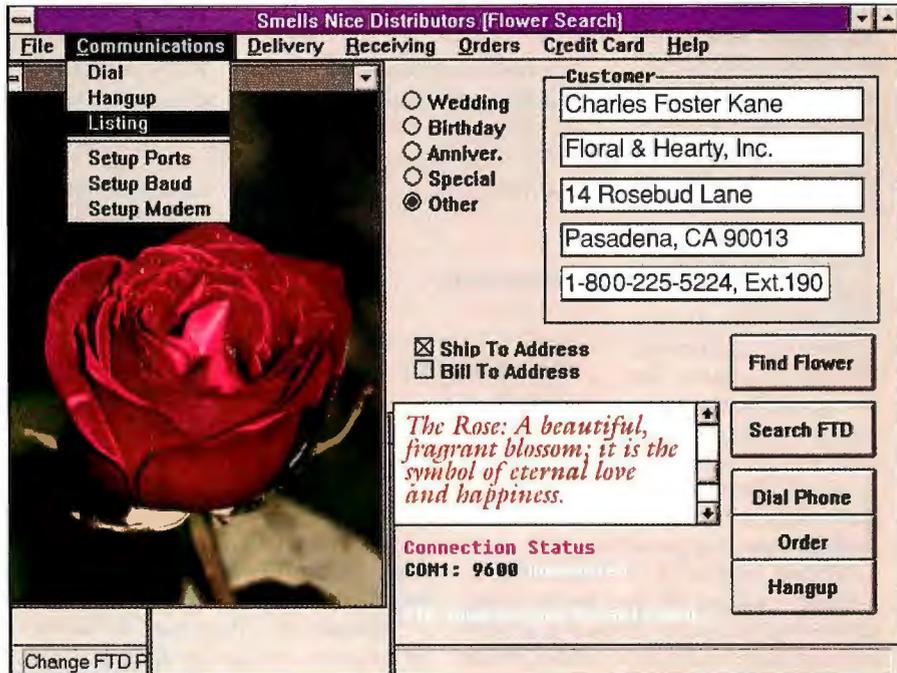
For millions of dBASE developers, this is a fairy tale come

true: new CA-dBFast 2.0, the first and only dBASE-compatible database and language for Windows.

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



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

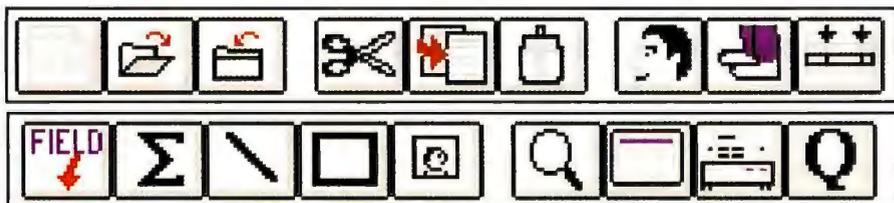
debugger that's so advanced it lets you watch your source code execute at run time - even Single Step through execution.

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, there's only one way to marry Windows beauty and Xbase power.

Check out CA-dBFast today.



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 (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

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 and labels is as easy as using a word processor.



New CA-dBFast Release 2.0.

© Computer Associates International, Inc., One Computer Associates Plaza, Islandia, NY 11789-7000. All product names referenced herein are trademarks of their respective companies.

Circle 79 on Inquiry Card.

connected over an Ethernet backbone network to VAX and Mac clients. PBS has begun moving the Ingres database from the VAX to HP9000 machines. Meanwhile, two VAX-based databases—Datatrieve and VAX DBMS—remain in use.

On the client side, PBS still uses character-based applications. Ninety percent of the front ends still run on the VAX with character-cell interfaces.

The Mac clients are used mainly for database queries, but PBS plans to deploy more features on them. The Macs use GQL (Graphical Query Language) from Andyne Computing (Kingston, Ontario, Canada) for writing database queries. PBS is still looking for easy-to-use tools that will let it use the Mac as a platform for full-function database-update applications.

PBS has implemented two client/server-based applications. The first is its operations log. The Ingres database maintains information on broadcast schedules, which are automatically fed via satellite to PBS affiliates. The database also holds data used by automated broadcast switching equipment. In the second application, the database stores data about PBS programs, such as content, broadcast history, and right-to-broadcast information.

Previously, PBS employees requested this sort of information from a department that handled program data analysis, says Pellegrino. Now the client/server system, coupled with the Mac's ease of use, empowers people to do their own Ingres inquiries, and the data-analysis department is free to perform its other duties.

Adapts to Needs

Pellegrino's users want and can use the latest technology. "They are used to the mouse," he says. "They are used to point-and-click." Client/server computing gives Pellegrino the ability to equip one group of clients with

Client/Server Advantages

FEATURE	BENEFIT
Networked webs of small, powerful machines	If one machine goes down, your business stays up.
Computer arrays with thousands of MIPS; clients' aggregate MIPS beyond calculation	The system provides the power to get things done without monopolizing resources. End users are empowered to work locally.
Some workstations are as powerful as mainframes but cost one-tenth less	By giving you more power for less money, the system offers you the flexibility to make other purchases or to increase your profits.
Open systems	You can pick and choose hardware, software, and services from various vendors.
Systems grow easily	It's easy to modernize your system as your needs change.
Individual client operating environments	You can mix and match computer platforms to suit the needs of individual departments and users.

a Macintosh GUI while preserving the rigor and security of a centralized Ingres database for the computer services department.

"Whether it's [Windows] NT or Unix on the server, it makes no difference to the user," says Bob Epstein, founder of the database manufacturer Sybase (Emeryville, CA). "On the desktop, there is no such thing as one environment. A user can choose the Mac, Windows, or Presentation Manager."

Thus, as new tools become available, you can change your client software without disturbing your server. The House of Representatives built its clients using Sybase APT, an applications development environment on Unix, and SuperCard, a scripting language from Silicon Beach Software (San Diego, CA) on the Mac. Unix and Mac computers served as front ends to the database. Later, the House of Representatives decided to switch to JAM, a VT-100 emulator from JYACC (New York, NY), and Acius' 4th Dimension development tool. "We had to redo the client side," says Daley. "But there was no change to the server side."

This modularity allows the system to expand to meet your growing needs. "You can grow by adding capacity to the servers or by adding more servers to the network," says Burlington's Prince. "You can add more clients. You can segment the network if [it] starts to become a bottleneck. There's no upward limit to the scalability."

As new computing platforms emerge, you can evaluate new environments and system components in a modular fashion.

For example, Burlington is debating future server platforms. For Intel architectures, it's looking at Windows NT, SunSoft's Solaris, and Next Computer's NextStep. Prince says that he believes in Unix, which will probably remain his choice for large database servers. Some consultants who focus on LANs, however, find difficulties with Unix databases (see the text box "Unix Database Servers Are Not for Everyone" on page 102).

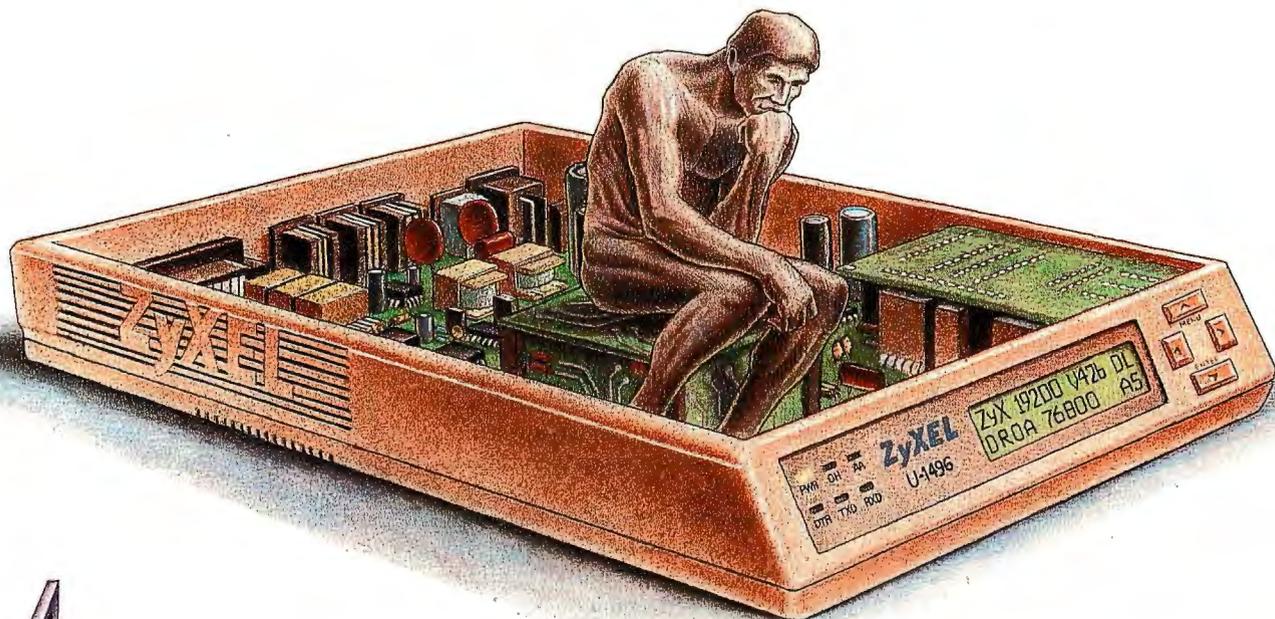
Downsizing Downsides

Although PBS's Pellegrino enjoys the benefits of client/server computing, he still has to deal with its downside. For instance, Pellegrino had a hard time finding a bug in a

Client/Server Headaches

DOWNSIDE	WHAT IT MEANS FOR YOU
Maintenance nightmares	Parts don't always work together. There are several possible culprits when something goes wrong.
Support tools lacking	With the client/server architecture, you locate or build support tools yourself.
Retraining required	The software development philosophy for the Mac or Windows is different from that for COBOL or C.

WHY OUR INTELLIGENT MODEMS ARE A WISE INVESTMENT.



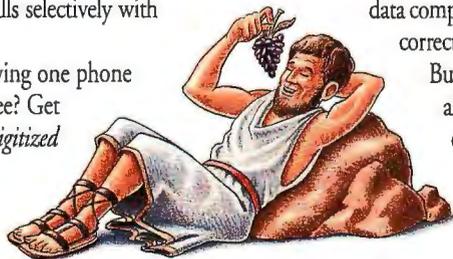
With the ZyXEL U-Series modems, you're sure to save. Time. Effort. Money.

The savings begin with the U-Series' ultra-high speed—16.8Kbps data, 14.4Kbps fax (send and receive). And our new PLUS Series runs at 19.2Kbps.

But what keeps you saving are the U-Series' intelligent features—features that save you effort and ensure reliable communications.

Like *Fast Retrain* with *Auto Fall-Forward/Fall-Back*. And multi-level security features *Call-Back Security* and *Password Protection*. You can even answer calls selectively with *Caller ID*.

Want to save by having one phone line do the work of three? Get the U-Series. It adds *Digitized*

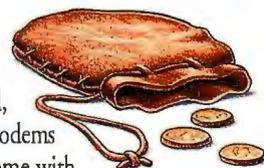


Voice Capability with Speech Compression to its fax and data capability. And, *Distinctive Ring* and *Auto Data/Fax/Voice Detection** for intelligent access to all three.

And now there's a *Cellular Option* for our PLUS Series.

Everyone can save with the U-Series modems. Because they're smart enough to work in all environments including DOS[™], Windows[®], OS/2[®], Macintosh[®], NeXT[®], UNIX[®], and Amiga[™]—and with async/sync systems. The U-Series modems support V.32bis/V.32, as well as industry-standard data compression and error correction protocols.

But in case you believe all this intelligence is expensive... relax.



The U-Series are the lowest-priced, high-performance modems around. And they come with free ZFAX software and a 5-year warranty.

Which means now is the perfect time for smart people to save—by getting the ZyXEL U-Series modems.

To start your wise investment, just call today for the name of your nearest ZyXEL dealer.

(800) 255-4101



ZyXEL
The Intelligent Modem

Unix Database Servers Are Not for Everyone

PAULINA BORSOOK

Many companies are satisfied with the results of implementing Unix database servers on a network, but some industry consultants strongly advise against considering this option. Robert Bolt, president of Database Server Systems (South San Francisco, CA), questions whether Unix's vaunted performance advantage is true for many configurations. It has been demonstrated by vendors, notes Bolt, that "a dual-processor Unix box running SCO Unix will not outperform a single processor box running Novell's NetWare."

Bolt has implemented client/server databases on more than three dozen different configurations. On LANs, NetWare database implementations "run circles around equivalent Unix boxes," he says. "A symmetric multiprocessor SCO Unix box is slower than or on par with NetWare," in Bolt's experience. A NetWare version of a database, he

points out, has been streamlined to maximize I/O. It doesn't have the graphics, user shells, preemptive multitasking, or scheduling that slow down Unix versions.

Other industry experts believe that maintaining and troubleshooting LAN-based Unix database servers is too time-consuming. Michael Booth, database consultant with 4GL (fourth-generation language) vendor Cognos (Burlington, MA), says that when Unix database servers are installed on LANs, system managers must decide whether or not they want to take on the added responsibilities of making GUIs, networks, servers, relational databases, applications tools, and various front- and back-end machines work together. "Users may be screaming for GUIs," says Booth, "but the increase in support costs may counterbalance any hardware savings."

Because client/server systems are commonly built with components from many vendors, havoc can ensue when you try to update a piece of hardware or software. For example, if you upgrade

your software, "you're forced to synchronize releases of many operating systems across dozens of vendors," says Richard Finkelstein, president of Performance Computing (Chicago, IL), a consulting firm that specializes in database issues. "Any error can proliferate problems throughout your network."

So what's the bottom line? Bolt argues that you should watch out for technical overkill. If you've exceeded the capacity of your LAN and need to go from 30 to 50 users, he believes that you won't need a Unix box; a 50-MHz 486 will suffice. But if you must accommodate 500 users, Unix is a more reasonable choice, he says.

If you are set on installing a Unix server, Finkelstein suggests working toward a homogeneous environment. That way if a problem pops up, it's easier to pinpoint where the responsibility lies.

Paulina Borsook is a freelance writer based in San Francisco, California. You can contact her on BIX c/o "editors" or on the Internet at loris@well.sf.ca.us.

GQL query. "Not only did it blow up my software," says Pellegrino, "but it blew up my hardware."

His query tried to multiply a character value, but none of the four pieces of software involved in the process noticed that he had formulated an invalid query. "You never know if it's something behind the scenes with Sequelink [client/server middleware] and the server," he says, "or something that's happening with the GQL." Often, it's not a fundamental bug in any one product, but a failure of the parts to agree on a division of labor.

Jim Daley at the House of Representatives considers the IBM ES/9000 he runs to be an excellent machine, and he knows exactly how to keep it running. But when there's a problem in his client/server system, there is a long list of things he has to check. "If you're sitting at a Mac, [a database query] goes from there to the Sybase database on Unix. From there, it could go to an IBM RS/6000, which then runs it up to [the] mainframe. The mainframe turns

around and sends it all back through. It's gone through several different products that [I] haven't even mentioned. [They all] come from several different vendors. Then again, it may be a hardware problem."

This typifies what might be the biggest challenge to successful client/server computing: You have to put together a complex system of hardware and software from multiple vendors. And when snarls develop, you have to determine which piece caused the problem. For many, this can be a rude awakening. "You no longer have one dominant vendor holding your hand," says Sippl. "IBM is not there saying, 'Don't worry.'" Just as personal computer users learned to get out their screwdrivers and plug in components, so, too, must client/server network managers learn how all the pieces fit together.

Mainframes came with prosaic but necessary support tools (e.g., printer managers, console and security monitors, and database tuning tools), but with client/server systems, you must hunt for the tools.

The early client/server users, says Burlington's Prince, "had to invent things themselves to do the basic functions that in a mainframe environment you would just procure from a vendor."

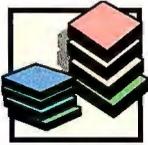
Another problem is that client/server systems require about one maintenance person per 50 workstations. "The labor required to keep the system operational must be reduced by a factor of 10," says Sybase's Epstein. Telephone companies are his model of excellence. "How many people does it take to keep a phone system operational? One for every 500 phones? One for every 1000?"

Client Conundrums

GUIs, and the Windows environment in particular, pose support problems, says Epstein. You can manage many more Mac clients than Windows clients because Macs are highly standardized, he says. Windows clients don't have the built-in consistency of configuration from one desktop to the next that Mac clients have.

Unix Database Implementation Tips

Separate protocol stacks. If you are using Windows, separate LAN Manager TCP/IP applications from those using FTP software or PC Network File Standard TCP/IP implementations.



Don't introduce new applications until you have stabilized your hardware, software, and networking.



Link client/server applications only to other client/server applications. Keep them separate from routine LAN services, such as printing and file-sharing.



The cornucopia of client platforms available to you also means that you'll have to maintain several versions of the front-end software. The House of Representatives, for example, maintains clients with three separate development tools: 4th Dimension, JAM, and Advanced Revelation from Revelation Technologies (Stamford, CT). Although it's working on a Windows client, the House of Representatives will not consider any tool that requires a separate code base for Windows. It's only looking at tools that allow conversions from existing client systems. "As far as Windows tools go," says Daley, "we're only looking at ports. We have enough clients."

But your biggest obstacle in bringing up a client/server system is that you must relearn and retrain. Client/server computing is relatively new, and its development tools are different from those that large enterprises are accustomed to. Many corporate developers have been writing big, batch-oriented COBOL programs or interactive, character-based C programs.

In moving to graphical systems like the Mac or Windows, programmers' problems are not so much technical as they are philosophical, says Pellegrino of PBS. His team had to learn how Mac programs are supposed to look, feel, and operate. "We were C programmers on dumb terminals," says Pellegrino, and not familiar with GUI programming. But it could have been worse, he says: "We could have been a COBOL shop."

Such concerns may be an indication that client/server computing has left its pioneering phase and is in an early stage of maturity. Sybase's Epstein notes that prospective customers now evaluate products with questions about system management, not with a feature list in hand. Thus, you can expect vendors to respond to market demands by offering maintenance and development tools.

Tools Trickle In

Early on, database companies neglected client/server software development tools, but they are working to fill the void now. In March, Oracle (Redwood Shores, CA) announced its Cooperative Development Environment, a set of applications development tools—portable among Unix, Windows, and Mac systems—that provides integrated development from design to maintenance.

Notably, Sybase and Oracle, known primarily as manufacturers of database engines, report that a growing portion of their revenues comes from development tools, support, and consulting. Sybase claims that 30 percent of its revenues comes from applications tools, and Oracle reports that more than half its revenue growth in 1992 came not from selling servers but from selling system integration services.

Independent vendors are jumping on the bandwagon and creating applications for the client/server architecture. For example, Sippl left Informix and has helped found Proactive Software (Mountain View, CA), which provides customer-support packages that can be customized and are designed to run on a variety of client and server platforms. Another new company, PeopleSoft (Walnut Creek, CA), offers financial and human resources software for Windows-based clients attached to several database servers. And Frank Dodge, of the McCormack and Dodge mainframe software firm, has formed the Dodge Group (Waltham, MA) to develop soft-

ware for the client/server architecture.

Still, there is a need for everyday system management tools. PBS, for example, is looking for a good network monitor. And the House of Representatives wants what Daley calls an end-to-end debugging tool—something that could trace a problem through a maze of products on various platforms.

Despite the need for such system-management tools, it's unlikely that you'll see them soon, because all the client/server vendors would have to agree on an interface standard. Burlington's Prince is so adamant about the need for management tools that he is part of an association called MOSES (Massive Open Systems Environment Standards), a user-manufacturer community working to arrive at interoperation standards for systems tools (see the text box "MOSES To Set Standards" on page 104).

The desired utility programs are crucial to the long-term success of any client/server platform, according to analyst Weintraut. He believes that the lack of utility software for new platforms like Windows NT will slow their widespread adoption. Weintraut estimates that it takes about three years for such utility software to evolve in response to end-user needs.

Ever-Changing Future

Even as you learn to handle your client/server system, new trends will change the

"You go to these client/server conferences, and the magnitude of the attendance surprises everyone. The people there are listening to anecdotes from customers who have deployed client/server systems successfully. It's as if they're listening to the pioneers who visited America and returned to Europe to tell how great the new world was."



— J. Neil Weintraut,
senior technology analyst
at Hambrecht & Quist

State of the Art Client/Server Frees Data

computer industry's face. Because client/server computing is not an object but an architecture, each of its pieces—client, network, and server—will evolve in tandem with wider industry trends.

On the client side, the influence of multimedia could be the biggest factor for change. Gary Morgenthaler, a principal of the venture capital firm Morgenthaler Ventures (Menlo Park, CA) and a founder of Ingres, sees a "huge groundswell" coming from multimedia-capable desktop systems. He predicts that in five years a majority of personal computers will have digital audio and video capabilities.

With multimedia, a new paradigm for applications is possible. Sybase's Epstein envisions expansive customer-oriented applications, such as on-line catalog shopping, electronic banking, and stock trading. And PBS has "grand plans for multimedia," says Pellegrino. He envisions the PBS program database storing digitized film clips with descriptive alphanumeric data. Burlington also intends to deploy a range of multimedia applications in the future: videoconferencing, video and voice at-

tachments to mail-enabled applications, and pictures of merchandise and fabric swatches attached to spreadsheets and database tables.

Before these kinds of multimedia tools can come to client/server computing, changes in other server components are necessary. Networks, for example, will have to offer wider bandwidth to support multimedia video, because at 60 12-KB frames per second, video hogs resources (see "Hitting Warp Speed for LANs," March BYTE).

Servers will have to be modified to handle multimedia objects, which have different structures than the alphanumeric, tabular data in SQL databases (see "The Many Flavors of SQL" on page 109). "Imagine multimedia-capable PCs by the millions connected to aging networks and SQL databases," says Morgenthaler. "People are going to be clamoring for new technologies to make it work."

"You no longer have one dominant vendor holding your hand. IBM is not there saying, 'Don't worry.'"

—Roger Sippl,
founder of Informix



months Oracle will release a relational/object-oriented database that is used in conjunction with a language called SQL++. With extensions to standard SQL, the language will permit a user to evoke methods on objects. Because

some of the retrieval logic will reside in the database itself (i.e., in the methods) and not in the query statement, queries can be shorter and simpler, and that will be a boon to users.

Shorter and simpler queries are also foreseen by Setrag Khoshafian, the principal designer of Intelligent SQL and chief scientist and vice president of R&D at Portfolio Technologies (Newark, CA), a manufacturer of client/server products. Khoshafian sees trends toward object servers in which an object's data storage and database operations are encapsulated together at the point where object services are acquired through database operations. Khoshafian thus agrees that a database object will not be just a data type but a data type *and* its operations. When precompiled operations such as queries are stored with data, says Khoshafian, end users will spend less time writing queries.

Several benefits of hybrid relational and object-oriented databases are foreseen by Ellison, Morgenthaler, and Sippl. For one thing, your applications interface will be simplified. To get an invoice, for example, you would send a brief message to your database in place of a long SQL query. Another benefit would be that the message/result paradigm of the object model would reduce network traffic.

Hybrid databases could also integrate all the types of data that people want to store: text, images, voice, and video (see "Relating to Objects," December 1992 BYTE). On this point, Sybase's Epstein is not so sure. He thinks that tables, which are transactional data, should be kept in separate repositories from applications objects, which are not transactional and do not often change. But if people are going to use multimedia, notes Khoshafian, "they will want and need to insert and delete multimedia data, [as well as] perform some modifications of the data. Therefore, it will be desirable to have the updates of the multimedia data under transaction control."

continued

MOSES To Set Standards



MOSES (Massive Open Systems Environment Standards) association is a loose alliance of client/server users and manufacturers. Members of MOSES seek to pool their knowledge to create client/server management standards. Some of the items on its agenda include creating interoperability standards for systems tools and identifying policy procedures and internal practices that facilitate mission-critical client/server-based operations. "We're trying to put our heads together to come up with solutions to the problems we're all facing," says Mike Prince, director of information services for the Burlington Coat Factory (Burlington, NJ).

MOSES intends to produce white papers on such issues as how a system should behave, how to best archive data, and how to maintain client/server system security. Client/server users will be able to use the information in these white papers as a measure to compare against prospective approaches to these issues.

Among the members of MOSES are the Burlington Coat Factory, British Telecomm, Millipore, Oracle, Sequent Computer Systems, and US West Communications. To get on the MOSES distribution list, send E-mail via the Internet to inmoses@us.oracle.com.

Crossbreeding Databases

Servers may have to undergo dramatic changes. SQL databases, which are based on the relational database model, are optimized for alphanumeric data stored in 2-D tables. However, multimedia objects do not conform well to the model of the 2-D array. The question confronting the database industry becomes: Can a 20-year-old database model accommodate the new uses it will be asked to perform?

Morgenthaler, Sippl, and Larry Ellison, Oracle's president and CEO, say no. They foresee new databases that merge relational and object technologies. Sippl believes that more object orientation is inevitable because "people are beginning to store data that doesn't look anything like IBM punch cards." By the time this story goes to press, Morgenthaler Ventures hopes to announce its investment in a company creating just such a hybrid database.

Ellison says that within 24

THE WORLD'S FASTEST 3.5-INCH GIGABYTE DISK DRIVE WITH AN AT/IDE INTERFACE

Easy Upgrade

Now it's easy to upgrade your PC to handle today's capacity hungry applications with a 3.5-inch IDE disk drive

Super-Capacity™

Get 560 megabytes of formatted storage, or even a gigabyte, without the need to change interface or use up a SCSI slot

Plug-And-Play

The 2100 Series uses the Industry Standard Command Set for easy drive installation



Super Fast Performance

10 ms Average Seek & 5.56 ms Average Latency – There's no faster IDE drive

512 K Buffer

with multi-segmented, Read-Ahead Cache permits multiple seeks to be serviced from the buffer without the delay of mechanical seeks and latency

Fast Command Processing

cuts command processing time to as low as 180 microseconds for increased throughput

Get the benefits of Super-Capacity with a Micropolis 2100 Series IDE Drive.
Call for the name of your nearest distributor: 1-800-395-3748

MODEL NUMBER	CAPACITY (Formatted)	AVERAGE LATENCY	AVERAGE SEEK	TRANSFER RATE (MB/s)	5-YEAR WARRANTY
2105 A	560 MB	5.56 ms	10 ms	5 max	Yes
2112 A	1,050 MB	5.56 ms	10 ms	5 max	Yes

MICROPOLIS®

For complete warranty details see your Authorized Micropolis Distributor.

Circle 113 on Inquiry Card.

More To Come

Other trends are less controversial. For example, servers will become more intelligent. Ellison expects servers to hold both data and applications logic. Epstein sees clients and servers storing business rules, which will determine the integrity of transactions.

Servers also must be modified for the mobile user (see the text box "Serving Mobile Clients" on the right). Ellison and Morgenthaler imagine servers that download programs on demand to the mobile user, who then uploads the resulting data. Epstein foresees "dynamically partitioned systems" in which you download data that you can change and send back to the server. It will be the server's job to resynchronize the database.

Location transparency is also a feature that you'll find in future fixed-site client/server systems, according to Khoshafian. He points out that as global networks evolve, client/server systems will have the capacity to converse with one another regardless of their physical location. The challenge, according to Khoshafian, will be to provide users with integrated access to the remote systems in a manner that meets users' needs. This, he says, will be accomplished through integrator objects that combine, filter, and integrate services from multiple objects.

Faster, More Robust

Even though many support tools are missing and components can fail to work in complete harmony with one another, client/server architecture is changing the way organizations work. It's opening up tremendous, enterprise-wide repositories of data, logic, and business objects while empowering users to take advantage of this data through tools tailored both for the job and the user.

As part of an economic trend variously called downsizing, rightsizing, resizing and reengineering, more and more companies are eyeing client/server architecture as their next logical step. Setting up a client/server system is no cakewalk. It's a time-consuming, difficult trek. But as Burlington's Prince points out, compared to what came before, client/server computing is "faster, more accurate, and more robust." ■

Ellen Ullman is a software engineer and consultant with Neologica (San Francisco, CA). She is also a BYTE consulting editor. You can reach her on BIX as "ullman" or on the Internet at ullman@bix.com.

Serving Mobile Clients

DANIEL MEZICK

Wireless communications has the potential to expand client/server computing far beyond the limited range of your local Ethernet segment. With wireless communications, you'll be able to access and manipulate your databases and other resources on your client/server system in real time from such remote sites as your home, a customer's office, or a building site. But before you can achieve unfettered mobile connectivity, tomorrow's client applications, called *ultimate clients*, will have to interact with servers in dynamic new ways.

To a client/server application, a wireless connection should be indistinguishable from its hard-wired cousins. However, one of the fastest wireless communications setups, WaveLan from NCR (Dayton, OH), offers bandwidth that's only 20 percent of the specified 10-Mbps Ethernet maximum. Further, the maximum broadcast range of wireless client/servers is a cramped 800 feet, restricting their use to small groups within an office or a small building. You are most likely to find wireless client/server applications in ad hoc workgroups performing such tasks as managing a political campaign or producing a sporting event.

The mobile client may not be here yet, but mobile computing is (see "Wireless Mobile Communications," February BYTE). The only option available for dealing with roving users and mobile data is to place a subset of your server's database schema directly on your mobile device. This approach introduces redundancy and coherency problems, requiring reconciliation when the subset is reintegrated with the server database. Companies such as Norand (Cedar Rapids, IA) and Proxim (Mountain View, CA) hope to introduce solutions to some roving-client problems soon.

Another obstacle to using mobile

client/server applications is the capacity of the mobile devices. Large RDBMSes (relational database management systems) can eat up to a half megabyte of disk before you can even begin to store data. This is a burden for mobile computing devices, but small, fast, full-featured RDBMSes are emerging to address this need.

For example, Quadbase-SQL from Quadbase Systems (Sunnyvale, CA) is a fully relational database manager compliant with the ANSI-86 SQL standard. It consumes minimal disk space while providing support for data import and export.

Quadbase-SQL has such big iron features as outer join, correlated subqueries, and declarative referential integrity, allowing for complex database applications to be supported in a mobile computing application.

Finally comes the question of data security. Servers must be able to authenticate clients, ensure that messages are transmitted without error, and secure communications because wireless signals are easier to intercept than wired communications (see "Seeking Security," May BYTE). Securing wireless communications will involve encryption, although that incurs processing overhead.

Developments in cellular and radio communications are raising high expectations for wireless, ad hoc, on-demand data. Although the autonomous and mobile client has to wait for higher bandwidth communications, better software, and more security, vendors are beginning to meet the demand for wireless access to data. The truly mobile client and ultimate client applications are still two or three years away, but when they arrive, anywhere/anytime access to data will be just like another day at the office.

Daniel Mezick is the pen product manager for Linc Systems (Bloomfield, CT). You can contact him on BIX c/o "editors" or on the Internet at dmezick@world.std.com.



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

Wide Turning Angle



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

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 171 on Inquiry Card (RESELLERS: 172).



Jim Watts' regular workouts helped prevent permanent heart damage.

EXERCISE PA...

The good news, doctors, thanks to his long-standing fitness regimen, his heart and cardiovascular system were well conditioned. Even though Jim had a blocked coronary artery, his efficient heart was receiving sufficient blood supply to prevent permanent damage. If not for his years of exercising, Jim's only "warning" might have been a heart attack.

The moral? These days, Jim Watts doesn't walk, he bikes up the hills, anywhere. He rides up. He also uses a stationary bike and other cardiovascular equipment at FitCenter everyday, without fail, for an hour, and doesn't let anything interfere with his daily workouts. Thanks to his checking out of lunch everyday to FitCenter—which a stress the stress from his office—Jim's heart stays getting stronger, as does his message: "If shortness of breath is a part of your life in any way, don't dismiss it, warns Watts. "Let a doctor decide if it's nothing." Get a stress test. I was a walking time bomb, and didn't even recognize my own and only symptoms as a symptom."

He's also giving a wellness message to his employees. Richard & Watts has been providing the FitCenter Wellness Benefit to their employees for the last four years.

FITCENTER PROFILE:

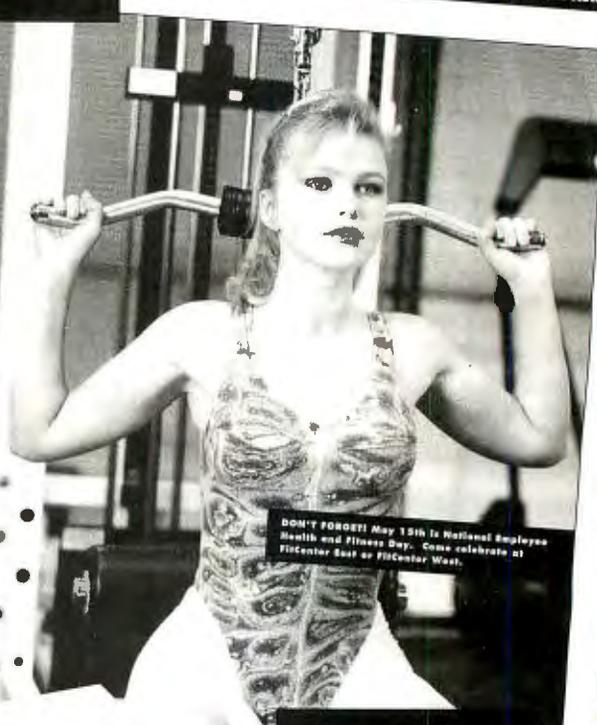
Jim Watts— from walking "time bomb" to running inspiration.

Jim Watts has been a FitCenter member for the last 10 years. But it's in the last few months that he's become an even

troubled became short of breath during exercise. As a matter of course during his regular bike ride, he'd dismount the bike at bottom of hills and walk up. "I dismissed it as just getting wind ed," recalled the 35 year old Watts during a phone interview from the offices of his downtown law firm, Matzelli Richard & Watts.

Luckily for Jim, his wife/bike riding companion did not dismiss the symptom, instead steering her husband to the doctor's office for a stress test. On the treadmill and hooked up to an ECG, Jim became "winded" again. Only this time, doctors detected a blockage in his heart. A time bomb that gave no signs or symptoms. More than Watts, seemingly time passed without breath, the condition was bypass surgery. Immediately

ANNUAL DEATHS FROM HEART DISEASE



DON'T FORGET! May 15th is National Employee Health and Fitness Day. Come celebrate at FitCenter East or FitCenter West.

2400 dpi

\$6995.



NO OTHER PRINTER MEASURES UP.

Introducing the Image Xpert™ 5000. Windows™ output that's bigger and a whole lot better. No other laser printer even comes close to matching XLI's Image Xpert 5000 for quality, performance—or price. It delivers superb PostScript® font quality of 1200 x 1200 dpi, amazingly detailed halftones at 2400 dpi equivalents with 256 gray levels, all in an 11" x 17" format.

That means you can easily produce side-by-side page masters or full-bleed single pages with crop marks, all with incredible resolution produced by XLI's acclaimed SUPER LGA™ technology. The Image Xpert 5000 is ideal for tab newspaper masters, newsletter spreads, oversized technical/scientific documents—any application requiring detailed text with photos.

Call today for the complete picture on how the Image Xpert 5000 can give your big jobs a whole new look. 1-800-433-8040



XLI Corp., 800 West Cummings Park Suite 6650, Woburn, MA 01801.

Circle 164 on Inquiry Card (RESELLERS: 165).

Image Xpert, SUPER LGA are trademarks of XLI Corporation. Windows is a trademark of Microsoft Corporation. PostScript is a registered trademark of Adobe Corporation.

THE MANY FLAVORS OF SQL

Everyone agrees that a SQL standard is essential for cross-platform client/server computing, but marketplace reality keeps getting in the way of good intentions

MARK CLARKSON



SQL (Structured Query Language) has been *the* standard data description and access language for relational databases for almost a decade, making it a linchpin technology for client/server computing. The only problem with the SQL standard is that there are too many of them.

No fewer than eight efforts are underway to create a standard based on SQL. ANSI alone is responsible for three standards, either published or in progress. Other efforts involve industry consortia, such as SAG (the SQL Access Group) and X/Open, and companies such as IBM, Microsoft, and Borland. If you also consider that every database speaks its own SQL dialect and has its own set of unique extensions to the language, it's not surprising that client/server installations are the exception rather than the rule.

The lack of one widely accepted standard drives up the cost of databases and related tools and makes maintaining a client/server environment complex and difficult. "What is the difference between too many standards and no standards at all?" asks Anu Shukla, vice president of worldwide marketing for Amsterdam-based Uniface. "Not much."

The Standards Soup

ANSI took the first crack at creating a SQL standard in 1989 (SQL'89) and followed up with a revision in October of last year (SQL'92). But because ANSI standards are vague about the details of their implementation, products that claim to be SQL-compliant often fail to work with one another. The proliferation of different SQL implementations by vendors led to the formation of SAG. A consortium of hundreds of companies in the database field, SAG was formed to generate SQL standards based on a subset of ANSI SQL'89 and to deal with issues of connectivity and programming interfaces for SQL clients and

State of the Art The Many Flavors of SQL

servers. In conjunction with the industry group X/Open, SAG is constructing a standard based on the current state of the art in client/server implementations.

Many major companies are not waiting for the efforts of standards-setting bodies to bear fruit but are launching their own attempts to create de facto standards. Last year, SAG member Microsoft introduced ODBC (Open Database Connectivity), a SQL database API standard based in part on a draft of the SAG standard. Borland, also a member of SAG, is readying its own SQL API standard, called IDAPI (Integrated Database Application Programming Interface), which is based on the SAG version. Both companies are lining up support for their standards.

In addition, ANSI is working on its next-generation SQL standard, called SQL3. Not expected until the latter part of the decade, SQL3 will add structure, branching, flow control, error handling, and object-oriented capabilities to an already groaning SQL standard.

Finally, IBM is developing its own standard for database access, DRDA (Distributed Relational Database Access), which

includes yet another version of SQL. Given the variety of SQL standards, says Judith Hurwitz, president of the Hurwitz Consulting Group (Newton, MA), "It's quite understandable if you're getting confused."

The Importance of Standards

The reasons for the proliferation of SQL standards are many. One is that standards are designed to serve only as guides. This leaves a lot of room for interpretation as a vendor takes a language specification and implements it in software. Like two house builders working from the same blueprint, says Hurwitz, "different people can interpret a specification differently."

This assumes a vendor is trying to conform to a standard. More often than not, vendors are trying to do much more. "The problem is that each vendor has probably made excellent, but different, decisions about how to extend the SQL standard," says Malcolm Colton, director of product marketing at database vendor Sybase.

Writing standards-compliant code means that a developer is using three- to five-year-old technology, says Colton. If you want the benefits of the latest technology,

you can't conform to standards. "For example," says Colton, "we have had flow-control statements, stored procedures, and triggers in Sybase's SQL dialect since 1987. SQL'92 doesn't have those features. That's the type of thing you find in the SQL3 standard." In the absence of an acceptable standard, database vendors have invented their own.

A Question of APIs

Even if the market's competitive pressures forever deter the universal adoption of a single SQL standard, database and tool vendors are looking at other ways of making life easier in the client/server environment. "I do not see the SQL language standards as too important," says Ron Wolf, product marketing director for SQL

database vendor Gupta (Menlo Park, CA). "The next step down—the programming interface—is where significant things are happening. Those standards are quite a bit more useful."

The programming interface—referred to as the API or the CLI (call-level interface)—lets programs communicate with a database using function calls instead of SQL statements. Where SQL standards address data access and manipulation, API standards deal largely with connectivity issues: connecting the client to the database and exchanging SQL messages and data.

A common API for SQL would make it less expensive for developers to support several different databases, making their tools more affordable. However, a common API may prove elusive, given market realities. Microsoft and Borland are pushing their own API standards on SAG, and the consortium has yet to weigh in with its finished standard.

Going Nonstandard

ODBC, IDAPI, and SAG's APIs are based on a common subset of the ANSI standard. That, says Uniface's Shukla, is taking the lowest-common-denominator approach, which "doesn't exploit the features of a database, other than perhaps Microsoft's or Borland's own."

Database tool vendors, who must deal with a host of different databases and exploit the individual capabilities of each to the fullest, resort to intelligent drivers. These drivers sit on top of a data source—usually, but not always, a relational database—and intercept incoming messages from clients.

The driver then translates the messages into a SQL statement or a series of API calls that is tailored to a database. Instead of talking directly to the database, the client tools speak to the drivers. With the proper driver, any application can function as a SQL server and be accessed by the same tools used with relational databases. Such drivers can fine-tune transactions, maximizing performance based on the SQL dialect or API library involved.

For example, says Shukla, Uniface has an intelligent driver that exploits all the features of each of the 27 databases it supports. As SQL standards grow larger and more complex, she says, "the standards bodies are taking longer to ratify them." In fact, the glacial pace of ANSI is largely responsible for the involvement of industry consortia like SAG and X/Open in the SQL standards business.

continued

What SQL Is



Relational databases store data in tables—rows and columns—not unlike spreadsheets. The SQL language includes commands to describe, create, and delete those tables, as well as to update the data within them. For example, to retrieve the names of inexpensive writers from a database, you might use the following statement:

```
SELECT Writer
FROM Writer_database
WHERE Pay_per_word < .05
```

You can also embed SQL statements in other languages, such as C and COBOL.

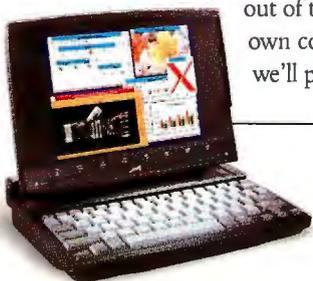
Using SQL, a client computer can access data anywhere on a network. SQL commands don't refer to data's location; data can be moved from platform to platform without affecting the application code.

Theoretically, SQL lets database vendors create products compatible with databases and tools from other vendors. Almost all tools in the client/server arena expect to communicate with the server database using SQL commands. These tools can access other data sources, too, if the sources present a SQL-compatible interface. Practically, however, the many different flavors of SQL make integrating different database tools difficult at best.

Now you can run X from virtually any hole in the wall.

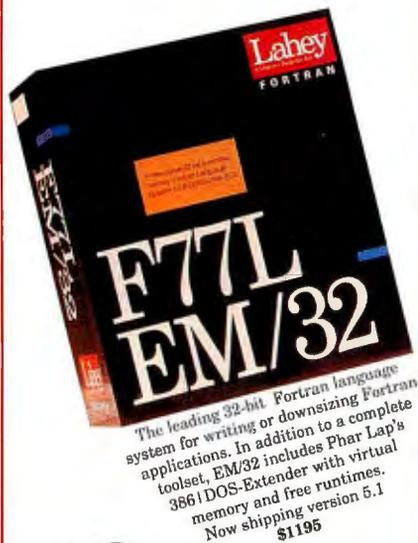


There's really only one way to effectively run X from a phone jack—NCD's PC-Xremote Edition of PC-Xview. It's a special version of our X server software for PCs, one that doesn't require LAN support. Just install it on your laptop or home personal computer and you can run X out in the country, out of the country, or better still, in the comfort of your own home. For your very own copy or more information, call NCD at 1-800-793-7638. For just \$199, we'll place the power of X right on your desktop. Wherever that may be.



Network Computing Devices, Inc. **NCD**

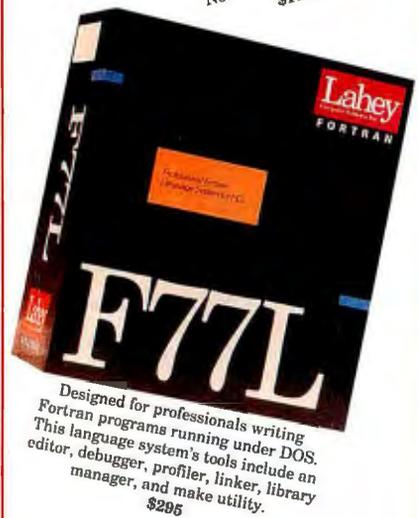
Just Add Code.



Lahey
FORTRAN

F77L EM/32

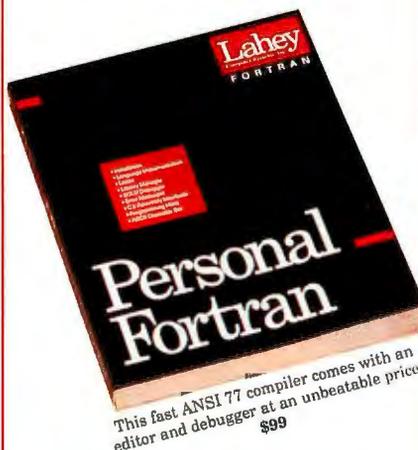
The leading 32-bit Fortran language system for writing or downsizing Fortran applications. In addition to a complete toolset, EM/32 includes Phar Lap's 386 I DOS-Extender with virtual memory and free runtimes. Now shipping version 5.1
\$1195



Lahey
FORTRAN

F77L

Designed for professionals writing Fortran programs running under DOS. This language system's tools include an editor, debugger, profiler, linker, library manager, and make utility.
\$205



Lahey
FORTRAN

Personal Fortran

This fast ANSI 77 compiler comes with an editor and debugger at an unbeatable price.
\$99

(800) 548-4778

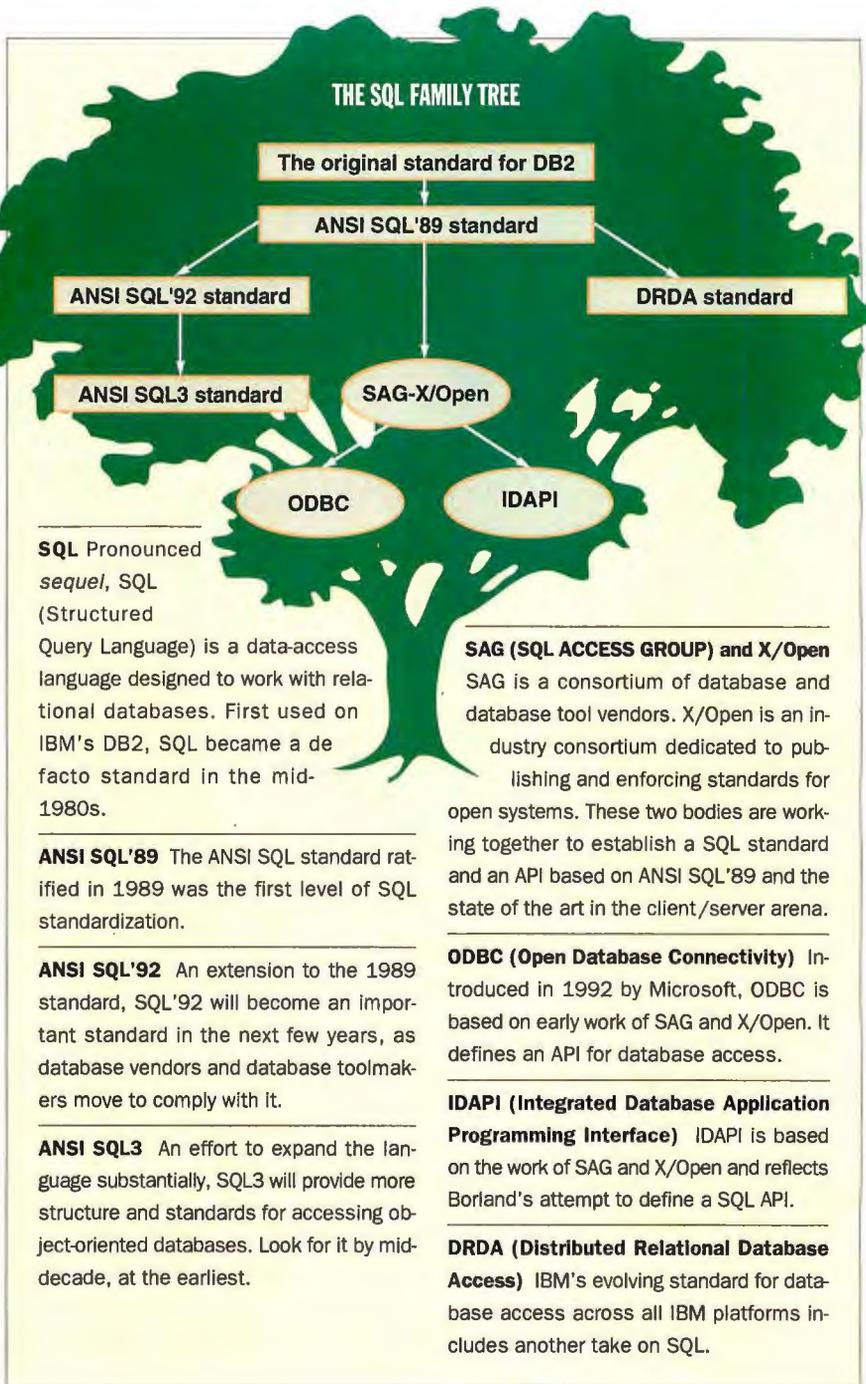
Free, Unlimited Technical Support
30-Day Money-Back Guarantee
Same-Day Shipping



(702) 831-2500
Fax: (702) 831-8123
P.O. Box 6091
Incline Village NV 89450

Fortran is our forte

State of the Art The Many Flavors of SQL



SQL Pronounced *sequel*, SQL (Structured Query Language) is a data-access language designed to work with relational databases. First used on IBM's DB2, SQL became a de facto standard in the mid-1980s.

ANSI SQL '89 The ANSI SQL standard ratified in 1989 was the first level of SQL standardization.

ANSI SQL '92 An extension to the 1989 standard, SQL '92 will become an important standard in the next few years, as database vendors and database toolmakers move to comply with it.

ANSI SQL3 An effort to expand the language substantially, SQL3 will provide more structure and standards for accessing object-oriented databases. Look for it by mid-decade, at the earliest.

SAG (SQL ACCESS GROUP) and X/Open SAG is a consortium of database and database tool vendors. X/Open is an industry consortium dedicated to publishing and enforcing standards for open systems. These two bodies are working together to establish a SQL standard and an API based on ANSI SQL '89 and the state of the art in the client/server arena.

ODBC (Open Database Connectivity) Introduced in 1992 by Microsoft, ODBC is based on early work of SAG and X/Open. It defines an API for database access.

IDAPI (Integrated Database Application Programming Interface) IDAPI is based on the work of SAG and X/Open and reflects Borland's attempt to define a SQL API.

DRDA (Distributed Relational Database Access) IBM's evolving standard for database access across all IBM platforms includes another take on SQL.

Next-Generation Databases

What does the future hold for SQL? Yogesh Gupta, a senior vice president at Computer Associates (Islandia, NY), thinks it might hold echoes of the past. He points out that when relational databases came to prominence, there was debate about what the query language of choice should be. Then IBM came out with DB2 using SQL, and SQL became the de facto standard. "The same thing can happen with ODBC," says Gupta. "Microsoft is in a position to

initiate it, and the time is right." Of course, that can also be said about SAG or Borland.

Although the world of SQL is in turmoil, it's unlikely that SQL will be supplanted anytime soon. "Standards take such a long time," says consultant Hurwitz. "You don't want to just trash all that work and move on to something new." ■

Mark Clarkson is a freelance technology writer living in Wichita, Kansas. You can reach him on BIX c/o "editors."

IBM

“As the next wave of technology rolls in, we’ll help you ride it.”

IBM PCs and IBM people help make it easier to choose a computer for today — and tomorrow.

In fact, tomorrow is just around the corner. It's the brave new world of processing called Pentium™.¹

These newest IBM PS/ValuePoint™ PCs are upgradable to an Intel® OverDrive™ processor that will be based on Pentium¹ technology. So when you're ready to take this big next step, these PCs — along with the personal computing experts at IBM PC Direct™ — will help you take it in stride.

PS/ValuePoint systems are available in more than 20,000 configurations: as stand-alones, servers or medialess clients. Call us and we can customize one for you using many of today's most popular options.

Also new and standard: faster local bus video, larger and faster hard drives, upgradable memory to 64MB and easier processor upgradability.

PS/ValuePoint 425SX/S

\$1,579*

NEW!

IBM Credit Lease \$57/mo.**
4MB RAM, IBM DOS and
Microsoft® Windows™ preinstalled

Fast!

- i486™ SX/25MHz processor
- 8KB internal cache
- High Performance SVGA VESA
Local Bus Video with 1MB DRAM

Easy Upgrades!

- Expanded processor upgradability via Intel OverDrive technology all the way up to Pentium¹
- RAM upgrades available

And More:

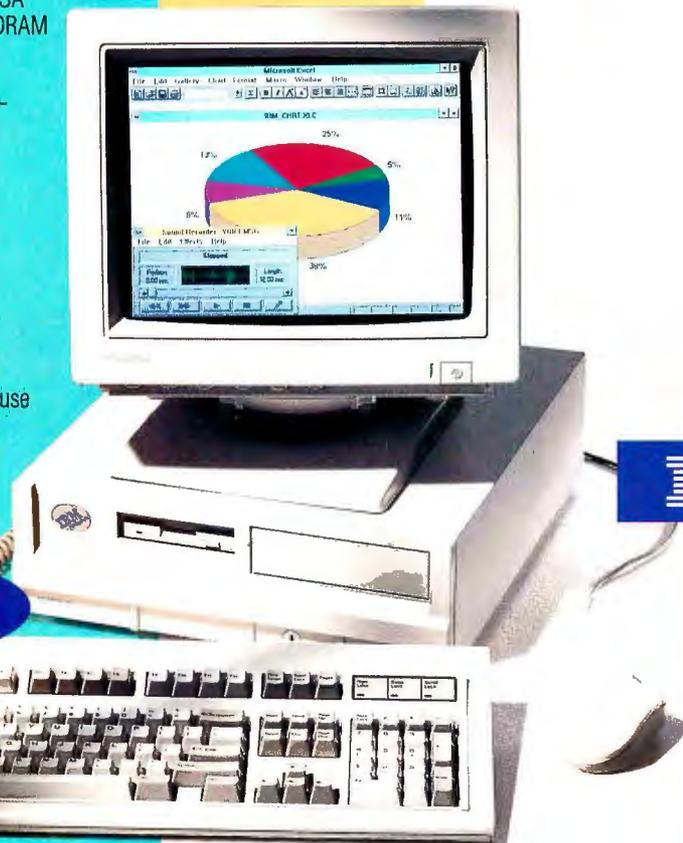
- 120MB (15ms) hard drive
- 3.5" 1.44MB diskette drive
- 3 slots (one 32-bit VESA
Local Bus), 3 bays
- IBM enhanced keyboard/mouse
- 6312 SVGA NI 14" color display
- Networkable
- Industry Standard
Compatibility

Prices may be even lower!
Call us today for the
latest quote.



Angelica P. Horaitis

Angelica Horaitis
Director of Value Brands
IBM Personal Computer Company-NA



IBM PC Direct

*We're putting the personal
in personal computing.*

Call
1 800 IBM-2YOU

1 800 426-2968, refer to: X613BYTE
8am-midnight M-F, EDT; 8am-7pm Sat., EDT.



**Purchase order is available for
qualifying customers.**



PS/ValuePoint 466DX2/T

\$3,609*

NEW!

IBM Credit Lease \$130/mo.**
4MB RAM, IBM DOS and
Microsoft Windows preinstalled

\$3,789*

IBM Credit Lease \$137/mo.**
8MB RAM, IBM OS/2® preinstalled

Fastest!

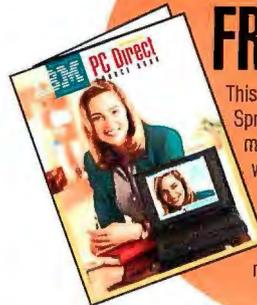
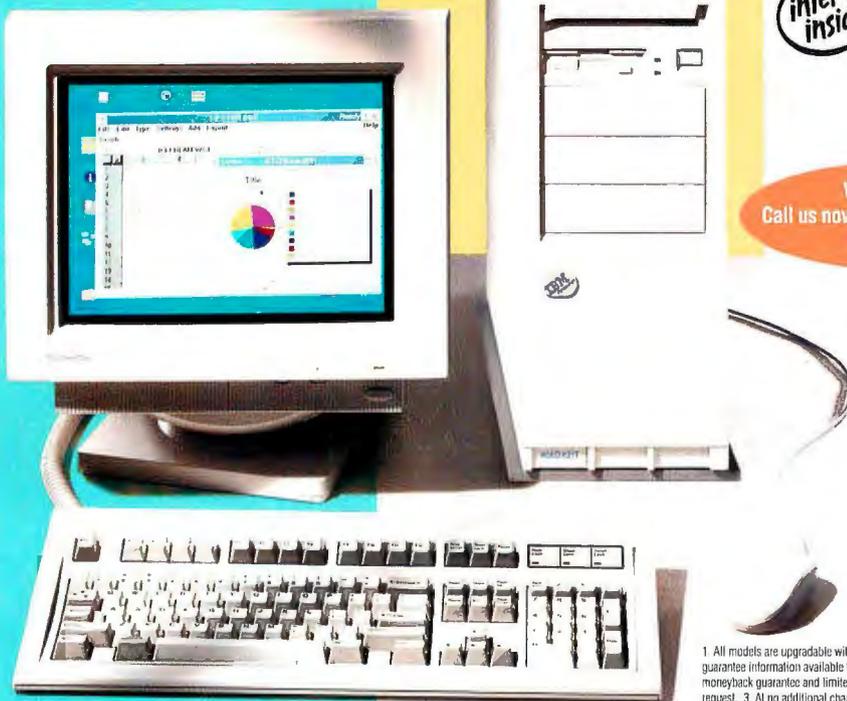
- i486 DX2/66MHz processor
- 8KB internal cache
- High Performance SVGA VESA Local Bus Video with 1MB DRAM
- Internal i487™ math coprocessor
- 128KB L2 cache

Easy Upgrades!

- Pentium[®] upgradable via Intel OverDrive technology
- RAM upgrades available

And More...

- 527MB (9ms) hard drive
- 3.5" 1.44MB diskette drive
- 8 slots (one 32-bit VESA Local Bus), 6 bays
- IBM enhanced keyboard/mouse
- 6319 SVGA NI FS 15" color display
- Networkable
- Industry Standard Compatibility



FREE The IBM PC Direct Source Book

This is it! The 1993 Spring/Summer Source Book for many of the most popular hardware, software and peripheral products for IBM and IBM-compatibles.

Call 1 800 IBM-2YOU now for your free copy.

“One call gets your and your

Choose from quality components to have IBM PCs personalized for you.

If the systems on these pages don't meet your exact specifications, we'll customize an IBM PS/ValuePoint for you with your choice of...

- Processors
- Hard Drive
- Floppy Disk
- Memory
- Display
- L2 Cache Memory
- Video DRAM
- IBM OS/2 or IBM DOS and Microsoft Windows

...And more!

Call us today for a quote.



We customize!
Call us now for a PC with your specs,
at your price.

Prices may be even lower!
Call us today for
the latest quote.

1. All models are upgradable with Intel's future OverDrive processor based on Pentium processor technology. 2. Warranty and 30-day guarantee information available through IBM and IBM Authorized Dealers. Please call 1 800 426-2968 for details regarding IBM's moneyback guarantee and limited warranty. Copies of the terms of IBM's moneyback guarantee and limited warranty are available upon request. 3. At no additional charge during warranty. 4. Available Monday-Friday 8am-5pm 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 PC DIRECT SALES ONLY.

The "PC" in PC Direct stands for personal computers — and a good deal more.

It stands for Personal Commitment. Any time of the day or night, the IBM Personal Systems HelpCenter™ is always available.

It stands for the Personal Care you can count on from professionals: the IBM Service Representatives.

And it stands for the Personal Confidence that comes from knowing you're getting a quibble-free,

30-day moneyback guarantee plus one of the best warranties in the industry.

All of which is brought to you by the people who design, build, sell and service more PCs than anyone else. So while you compare how much PC you can get for the price, don't forget to factor the people behind the PCs into the equation, too.

Call IBM PC Direct today. Get to know the PC people you've always been looking for. And who'll always be there for you.

The HelpWare™ Advantage: Guarantees and personal service every step of the way.

30-day moneyback guarantee. No qualms, quibbles or questions asked. If you're not happy, neither are we.²

Expert help from PC specialists 24 hours a day. Need help deciding, deciphering and demystifying? Call us and we'll help. We're always here. 24 hours a day. You can also contact us by 24-hour

bulletin board or automated fax, if you wish.³

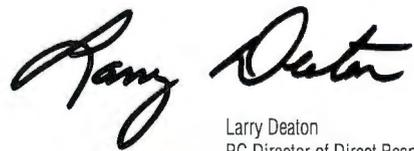
Free 1-year onsite service. You send nothing to us, we come to you — with genuine IBM Service — no charge.³

Fast, genuine IBM Service. If you do need to call us, our own service representatives — not a third-party vendor — will respond. We have over 10,000 service representatives, in more than 1,600 locations nationwide, backed by more than one billion dollars in parts.⁴

IBM Personal Computer Trade-in Program. If you need to replace your current systems give us a call... even if they're not IBM PCs.

IBM Credit Lease. Don't have ready cash to make your purchase? We offer an IBM Credit Lease to qualified commercial customers.

specs, your prices kind of people."



Larry Deaton
PC Director of Direct Response Marketing and Customer Support
IBM Personal Computer Company-NA

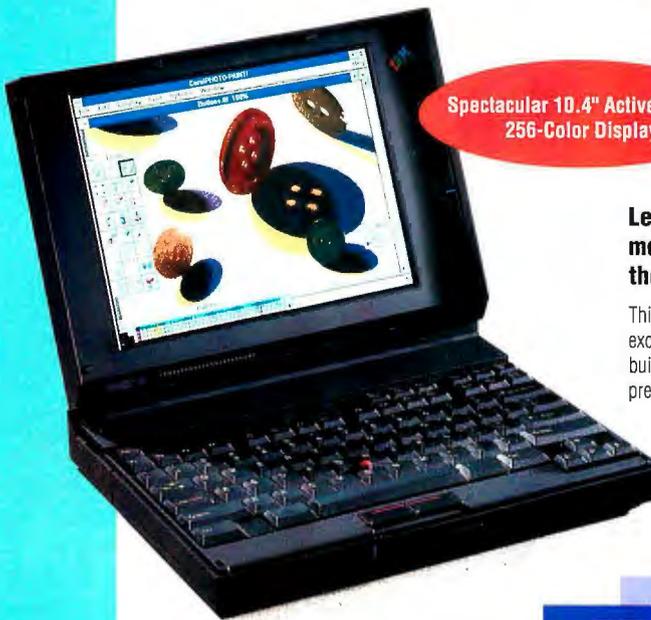
IBM ThinkPad™ 700C

\$4,229*



IBM Credit Lease \$153/mo.**

- 486SLC™/25MHz processor
- 4MB RAM
- 120MB removable hard drive
- 3.5" 1.44MB diskette drive
- 16KB internal cache
- 10.4" active matrix 256-color display
- Full-size keyboard with integrated TrackPoint II™ pointing device
- Advanced Power Management
- IBM DOS, Microsoft Windows and Prodigy®+ preinstalled



Spectacular 10.4" Active Matrix 256-Color Display

Leave your mouse at the house



ThinkPad 700 series models have the exclusive TrackPoint II cursor control built right into the keyboard. It's smooth, precise and easy to use.

IBM ThinkPad 700

\$2,639*

IBM Credit Lease \$96/mo.**

- 486SLC/25MHz processor
- 4MB RAM
- 80MB removable hard drive
- 3.5" 1.44MB diskette drive
- 16KB internal cache
- Full-size keyboard with integrated TrackPoint II pointing device
- 9.5" mono STN LCD display
- IBM DOS and Prodigy® preinstalled

Thinking options? May we suggest...

IBM Port Replicator for 700 and 700C	\$75
IBM Expansion Unit (docking station) for 700 and 700C	\$859
IBM Expansion Cartridge for 700 and 700C	\$425
IBM High Speed Internal Data/Fax Modem (14,400 bps/14,400 bps) for 700 and 700C	\$545

IBM PC Direct

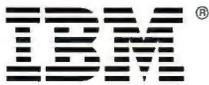
We're putting the personal in personal computing.

Call 1 800 IBM-2YOU

1 800 426-2968, refer to: X613BYTE
8am-midnight M-F, EDT; 8am-7pm Sat., EDT.



Purchase order is available for qualifying customers.



“They listened,
they helped me,

and made it
easier to get
everything
I needed.”

Carla Hendra

Carla Hendra
Customer, IBM PC Direct



Prices may be even lower!
Call us today for the
latest quote.

PS/ValuePoint add-ons

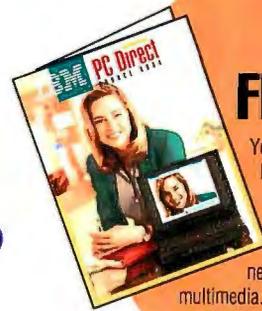
PS/ValuePoint displays:		Price
6312 Color Display	6312001	\$379
6314 Color Display	6314001	\$439
6319 Color Display	6319001	\$349
6317 Color Display NEW	6317M01	\$999
Memory:		
2MB SIMM (70ns)	6450902	\$130
4MB SIMM (70ns)	6450128	\$265
8MB SIMM (70ns)	6450130	\$625
16MB SIMM (70ns)	60G1622	\$1,195
1MB DRAM KIT(PS/ValuePoint graphics)	60G1623	\$72
Storage:		
IBM 245MB AT® Hard Drive (IDE) NEW	32G4194	\$539
IBM 340MB AT Hard Drive (IDE) NEW	32G4195	\$719
IBM 527MB AT Hard Drive (IDE) NEW	32G4196	\$1,079
IBM 1.0GB SCSI Hard Drive NEW	6451052	\$2,279
IBM 3.5" Enhanced Rewritable Optical Drive	6451295	\$1,499
IBM 16-bit ATFast SCSI Adapter (internal) NEW	32G4088	\$205
IBM CD ROM II Drive	6451104	\$489
IBM 3510 SCSI Enclosure	35100V0	\$215
LAN/Communications:		
T/R Adapter 16/4 AT	25F7367	\$535
T/R Adapter 16/4 II	03F0215	\$610
10 base 2 Ethernet® ISA	60G0615	\$140
10 base T Ethernet AT	60G0605	\$125
LAN Streamer MCA 32-bit card	92F8942	\$860
LAN Adapter/A Ethernet	48G7171	\$260
LAN Adapter Ethernet	48G7169	\$156

IBM ThinkPad 300
\$1,699*

IBM Credit Lease \$62/mo.**

- 386SL/25MHz processor
- 4MB RAM
- 80MB hard drive
- 9.5" mono STN LCD display
- 3.5" 1.44MB diskette drive
- 64 KB external cache
- 82 keys with embedded numeric keypad
- Power management features
- IBM DOS preinstalled

*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. **IBM Credit Lease prices quoted are for 36-month terms. Lease rates quoted are good through 6/30/93, after which time rates are subject to change without notice. Lease available to qualified commercial customers only. †PRODIGY will not run without a modem. A modem is not included with the ThinkPad 700C or 700. A customer who acquires a ThinkPad 700 or 700C and a modem may contact PRODIGY to obtain a One-Month Free Trial Membership. ThinkPad 700C, 700 and 300 systems and options are manufactured in Japan. PS/ValuePoint 6312, 6314 and 6319 Color Displays are manufactured in Korea. The PS/ValuePoint 6317 Color Display is manufactured in Taiwan. IBM, OS/2 and AT are registered trademarks of International Business Machines Corporation. PS/ValuePoint, SLC, ThinkPad, TrackPoint II, HelpWare and HelpCenter are trademarks of International Business Machines Corporation. PC Direct is a trademark of Ziff Communications Company and is used by IBM under license. Intel and the "Intel Inside" logo are registered trademarks of Intel Corporation. Pentium, OverDrive, i486 and i487 are trademarks of Intel Corporation. Ethernet is a registered trademark of Xerox Corporation. PRODIGY is a registered servicemark and trademark of Prodigy Services Company. Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation. ©1993 International Business Machines Corporation.



FREE IBM PC Direct Source Book

You'll find it all and more in the latest edition. From the newest IBM PS/ValuePoint and ThinkPad models, to software, peripherals, printers, networking products, multimedia... anything and everything. **Call 1 800 IBM-2YOU** and we'll send one 2YOU today.

We sell personal computing products one person at a time.

What's the one thing you have in common with millions of other computer products buyers?

You're different.

Whether it's hardware, software or peripherals, your needs are almost as unique as your fingerprints. But at IBM PC Direct, the unusual is usual and we pick up the phone ready for anything.

We can sell you just about any add-ons or software you want. In fact, if you don't see an IBM or IBM-compatible product listed in our catalogs—a copy of which is yours for the asking—call us anyway. Chances are we have what you need!

After all, keeping you happy is something we take personally.

IBM PC Direct

We're putting the personal in personal computing.

Call 1 800 IBM-2YOU

1 800 426-2968, refer to: X613BYTE
8am-midnight M-F, EDT; 8am-7pm Sat., EDT.

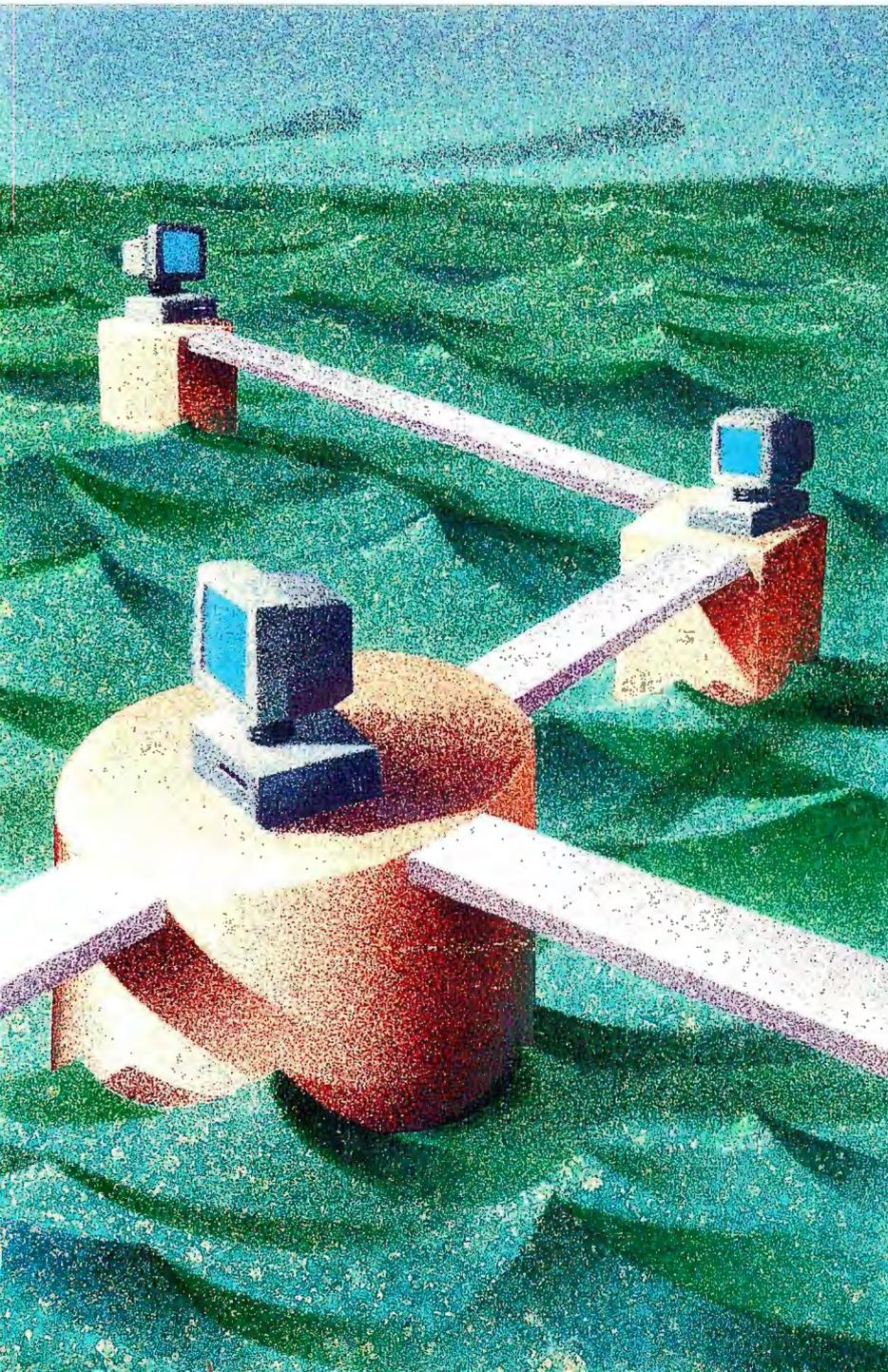


Purchase order is available for qualifying customers.

MAKE WAY FOR DATA

Middleware, such as RPCs and message-passing systems, helps data move smoothly through client/server networks. Soon these capabilities will become a part of your operating system.

PAUL KORZENIOWSKI



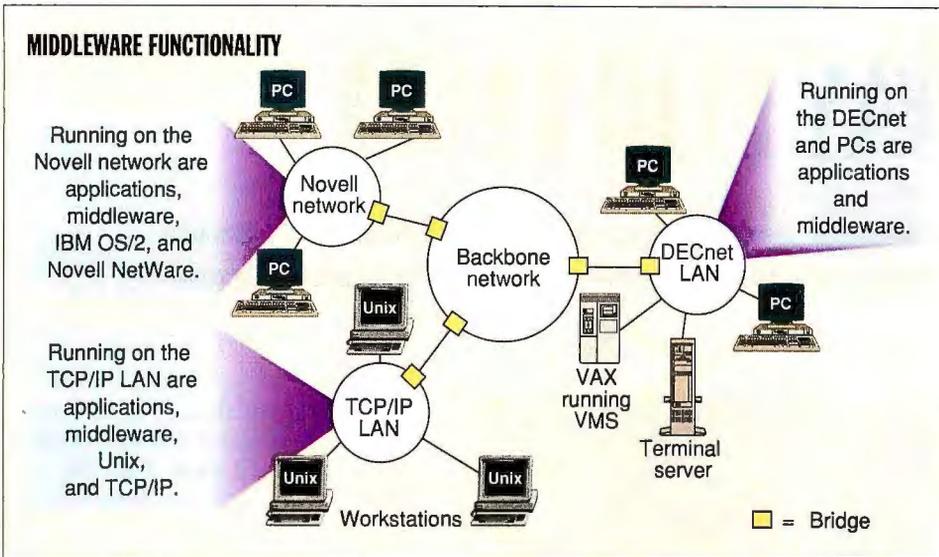
The term *middleware* is becoming quite fashionable, and many suppliers are bandying it about. But what is it, and how does it work? It's difficult to define, because thorny matters relating to building distributed applications (e.g., having an application function consistently while running on different operating systems) don't fit neatly under a single term. And further blurring middleware's identity is its transparent nature. "Users want transparent access to information, so the goal of middleware is to make itself invisible," states Martin Goetz, president of Martin Goetz Associates, a consulting firm based in Teaneck, New Jersey.

Middleware is a breed of client/server software that helps move data between applications running on your computer and your network. The software gives your programming team standard APIs that save development time, because the programmers don't have to modify applications to accommodate network protocols. With middleware, your programming team wastes less time trying to make an application work with your network's protocols or operating system and is free to spend more time fine-tuning your application.

For example, IBM's Logical Unit 6.2 network protocol has 32 verbs (e.g., SEND and RECEIVE). Some of them have more than 100 parameters. Your programmers have to tinker with more than 1400 error conditions to get everything to work. But middleware, such as Message Express from Horizon Strategies (Needham, MA), can reduce the number of verbs to five and the parameters to about a dozen.

OLTP (on-line transaction processing) monitors, which speed the exchange of data in various transactions (e.g., booking airline reservations) between databases and data sources, often provide middleware features. And many database companies, such as Gupta Technologies (Menlo Park, CA),

State of the Art Make Way for Data



Middleware uses RPCs or message-passing techniques to overcome network and operating-system incompatibilities. A backbone network links DECnet, Novell, and TCP/IP networks. Middleware, running on each network component, ensures that all network users have transparent access to applications and resources on any of the three networks.

build middleware components into their product lines so that each product can interact seamlessly with its siblings. But neither OLTP monitors nor databases with rudimentary middleware functionality are designed solely as stand-alone products that move data smoothly across a network.

Today, two primary types of middleware are available: RPCs (remote procedure calls) and message-passing systems. But tomorrow, distinct middleware products could vanish, because their main components are becoming integral parts of operating systems, much as TCP/IP has become a part of many Unix implementations.

RPCs Deployed Widely

RPCs are the best-known and most widely deployed class of middleware, according to Max Dolgicer, a director at Tucker Network Technologies (South Norwalk, CT), a consulting firm. An RPC functions like a programming call, completing a single processing chore in a series of steps undertaken by a software program. For instance, a programming call may gather a set of customer records. That step would be just one of many functions an application

would have to complete to generate a company's monthly invoices.

Traditionally, applications and their programming calls ran on one computer. But with client/server applications, your records may not be located on the computer running the application. Consequently, you need a mechanism to travel through a network, find the data, and bring it back to your application. RPCs perform these chores in a manner that's transparent to end users, making it seem as if the data is stored locally.

RPCs first emerged in the Unix environment for Sun Microsystems and Hewlett-Packard computers, later branching out to desktop and larger computers. For example, five years ago, Novell (Provo,

UT) began reselling RPC Tool from Netwise (Boulder, CO) and announced that it planned to incorporate the package in future versions of NetWare. RPC Tool supports a number of operating systems, including MS-DOS, OS/2, and Windows, as well as such network protocols as AppleTalk, DECnet, NetBIOS, and TCP/IP.

HP's RPC, NCS (Network Computing System), received a big boost three years ago when the vendor consor-

tium OSF (Open Software Foundation, Cambridge, MA) selected it as the basis for its DCE (Distributed Computing Environment) standards. DCE is a set of standards designed to help users and software vendors create client/server applications.

OSF claims that more than 100 vendors are building DCE products, including DEC (Maynard, MA) and HP, although no such products have appeared on the market yet. Much of the activity is focused on Unix-based systems, where the vendors are building DCE products to run on the OSF/1 and Unix System V release 4.0 operating systems.

Gradient Technologies (Hudson, MA) is leading the charge to bring DCE to PC users. Formed three years ago by former Prime Computer employees, Gradient built PC-DCE to run under Windows. It claims that more than a dozen suppliers, including HP and IBM, plan to incorporate PC-DCE software into their product lines. PC-DCE lets you build applications on your PC that will work with versions of the application running on other types of systems.

Passing Messages

Although not as widely deployed as RPCs, message-passing systems are gaining acceptance rapidly. "Both message-passing systems and RPCs will be adopted," notes Tucker Network Technologies' Dolgicer, "but a message-passing system offers more flexibility."

Both types of middleware were built on antithetical foundations, says Dolgicer, and each possesses pluses and minuses. RPCs were designed to connect two computers using synchronous connections. As a result, the software produces inefficient processing. For example, if there is not a clear line between two computers, the computer running the application sits and waits for a line to open. The upside is higher data integrity. Because of the tight connection between the two computers, it's likely that both will work with up-to-date information. High data integrity is important with mission-critical applications, such as electronic funds transfers.

Message-passing systems, on the other hand, are based on a flexible, store-and-forward methodology that is common with E-mail systems (see "Smarter E-Mail Is Coming," March BYTE). A message may

Remote Procedure Calls

Pros

- runs on a variety of computers
- is incorporated into such products as Windows NT
- offers high data integrity

Cons

- is difficult to use with many servers
- uses computer resources inefficiently
- lacks flexibility

It drives

When you oversee the most technologically advanced race in the world, the engine is running long before the race starts. Massive amounts of data need to be collected. Everything from entry fees, qualifying times and



speeds to engine serial numbers and driver and crew information. Then all the data collected dur-

PCs

that

ing the race needs to be compiled so the results can be validated.

At the world's most famous motor speedway, mission critical is a way of life. That's why the United States Auto Club (USAC®) and the Indy 500® have a computer system with the horsepower to get the job done. And OS/2® is the driving force behind it.

With true pre-emptive multitasking and multithreading capabilities, OS/2 helps USAC process Indy 500 data at record speeds. In fact at this year's Indy, USAC is testing an OS/2-based system that tracks cars via radio signal. In 1994, OS/2 will drive the

the



drive

official timing and scoring system, and determine the actual winner of the race.

Whether you measure speed in MPH or MHz, OS/2 brings the same high performance to all your DOS, Windows™ and OS/2 applications. And our soon-to-be-released Version 2.1 will be even more powerful. To find out how OS/2 can help your 386 and 486 machines run on all cylinders, call 1 800 IBM-3-OS/2.*

Operate at a higher level.

Indy 500.

*In Canada call 1-800-465-7999.

IBM and OS/2 are registered trademarks of International Business Machines Corporation. Indy 500 is a registered trademark of IMS Corp. Windows is a trademark of Microsoft Corporation. USAC is a registered trademark of the United States Auto Club. © 1993 IBM Corp.



E-mail That Works...!

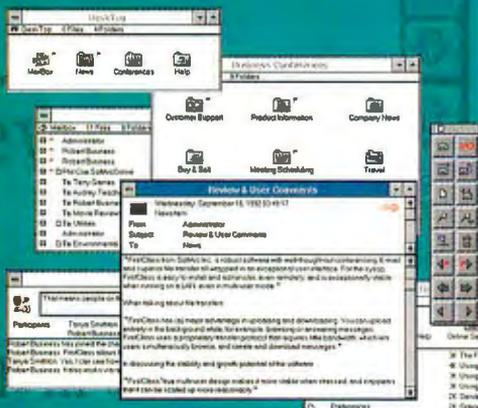
More than just a leading multi-platform **e-mail** system, FirstClass features **electronic conferencing** and **remote access**—all in the same package.

E-mail

Conferencing

Remote Access

Use FirstClass for internal mail, workgroup communication, and even as a public access tech support solution. All simultaneously from **the same non-dedicated server!**



Windows screens show Macintosh services similar. ASCII interface also available.

FirstClass™

- ✦ Built-in support for both Macintosh® and Windows machines on the same network (or via modem) without costly file servers
- ✦ Handles up to 250 users simultaneously per server, 20 of which may be via modem
- ✦ Simple network or modem connectivity to other FirstClass servers or other mail systems
- ✦ Remote or local administration with the same client all others use
- ✦ Messages with multiple fonts, styles, colors & unlimited file attachments
- ✦ Simultaneous multiple file transfers
- ✦ Background searching
- ✦ Gateways to other mail systems or the Internet with full Usenet newsgroup sending & receiving
- ✦ Fax gateway for individual or broadcast faxing and more!

FREE DEMO PACKAGE AVAILABLE UPON REQUEST

SoftArc Inc.
Global-Area Communications

805 Middlefield Road, Unit 102, Scarborough, Ontario, CANADA M1V 2T9 Fax: (416) 754-1856 Internet: sales@saogate.softarc.com FirstClass: (416) 609-2250

PHONE: (416) 299-4723

Circle 176 on Inquiry Card.

State of the Art Make Way for Data

have to pass through computer after computer to reach its destination. Rather than wait for each computer to be free, a message-passing system moves the message forward whenever the next resource needed to get it closer to the destination (e.g., a port or process) becomes available. Using this system, your computers never sit idly waiting to establish network connections. The downside is unreliability. For instance, a message can get struck halfway to its destination, and neither side would know there was a problem.

The XIPC (XInterProcess Communications) message-passing system from Momentum Software (Englewood, NJ) is used by American Airlines to speed up client/server applications development. "We needed software that could pull information from a variety of DBMSes," says Patrick O'Leary, a consultant who works at American Airlines. "We thought about developing our own but determined that the Momentum software had most of the features that we needed."

American Airlines used XIPC to build a cargo-system application for its employees and a second application, which O'Leary declined to identify, for an American Airlines customer. O'Leary says that XIPC cut development time by two-thirds, because it was easy to program. The company is considering using the software for additional applications.

Management Technologies, Inc. (New York, NY), a designer of financial applications, uses XIPC to simplify porting its software. "Our customers operate a wide range of computers, so we needed tools that operated in many environments," explained John Brann, MTI's vice president of research.

MTI selected XIPC over competing RPCs and distributed OLTP monitors because the Momentum message-passing system seemed to offer the most flexibility and was the most mature product, says Brann. MTI built its application in nine months, about half the time it would normally devote to such a project. Further, Brann reports that a beta version of the application has been running smoothly at customer sites.

Disappearing Future

It's likely that middleware will slowly disappear as its functionality becomes a base operating-system component. This incorporation may already be under way. For example, the Windows NT operating system will incorporate RPCs (see "Windows Everywhere?" on page 72). And while the future of RPCs may look bright, that of message-passing systems is less sunny, because the technology is immature and competing against an established RPC base. One indication of the status of message-passing systems is that OSF has no plans to establish a message-passing mechanism at this time.

As middleware is integrated into client/server operating-system functions, you can expect to see new genres of middleware emerge in response to wider industry trends. For example, it's likely that software will evolve to facilitate the use of multimedia applications on different platforms. "Historically, vendors have attempted to differentiate their products with high-level software," notes Michael Matthews, marketing manager for distributed-computing programs at Hewlett-Packard

(Cupertino, CA). "I expect a similar transformation will occur once there is a large base of middleware."

Even though Matthews and other observers expect another three to five years to pass before that transformation happens, evidence of middleware's growing influence can be seen now. For example, OSF's DCE comes with such features as naming-service functions and security safeguards, but it also comes with an RPC. ToolTalk from SunSoft (Mountain View, CA), a set of applications development tools, comes with CASE tools and built-in messaging functions.

Larry Russell, SunSoft's ToolTalk product manager, expects the number of middleware products to expand significantly during the next few years. "Users want universal plug-and-play capabilities with their applications," he says. Middleware helps them get it. ■

Paul Korzeniowski is a freelance writer based in Malden, Massachusetts. You can contact him on BIX clo "editors."

Message-Passing Systems

Pros

- provides flexible programming model
- uses resources efficiently
- works well with networks

Cons

- has small user base
- lacks set standards
- offers no instant-update capabilities

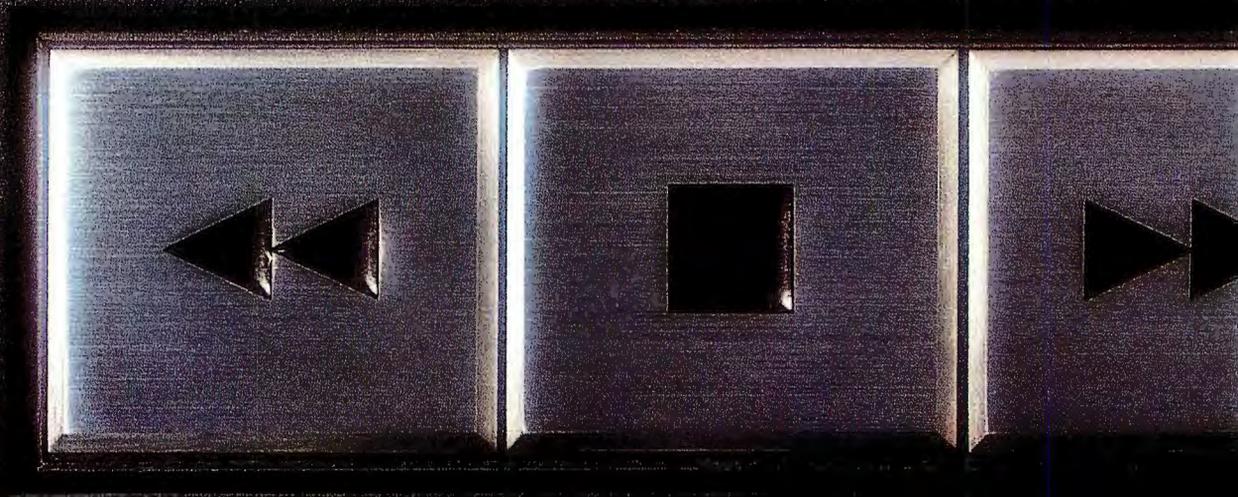
*It could be worse.
We might've stored our
data on something else.*



Verbatim® tapes, optical and floppy disks. Your best defense against data loss.



Circle 152 on Inquiry Card.

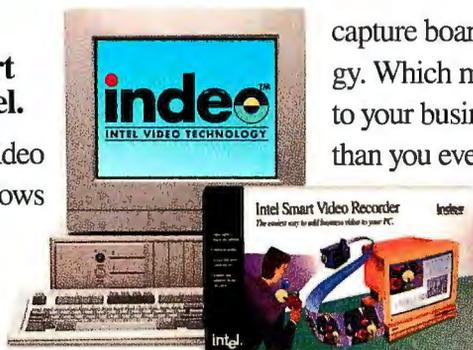


Intel's video brings the same easy

Introducing Indeo™ technology and the Smart Video Recorder from Intel.

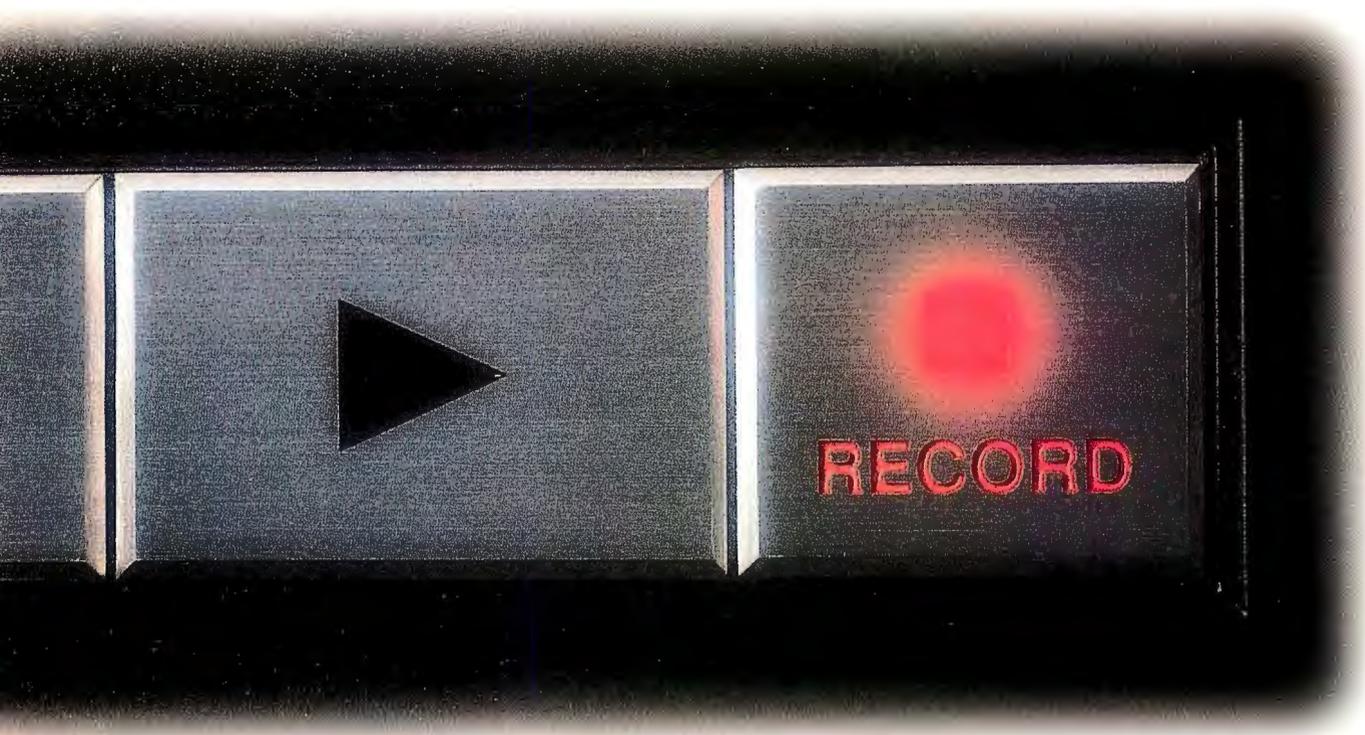
When it comes to putting video technology on your PC, Intel knows exactly which buttons to push.

Intel's Indeo™ technology is the first video compression technology that lets you capture and compress video in one single step. (Now that's easy.) And the Smart Video Recorder is the first video



capture board that takes advantage of Indeo technology. Which means adding the impact of motion video to your business presentations is faster and simpler than you ever imagined.

Recording with the Smart Video Recorder is as simple as pushing a button. And it's fast. It only takes one minute to capture and compress a one-minute video clip. (Other boards take up to 15 minutes.) One-step recording also cuts the Smart Video Recorder's disk space requirements



technology concept to your PC.

dramatically—it takes about 9MB to record a 60-second clip. Other systems may require more than 50MB to record the same clip.

A key component of Indeo technology, scalable performance adjusts playback quality based on your system's processing power. And you don't need special hardware for playback. Scalable performance gives you the best playback possible from the computer you have now, and whatever computer you may use in the future.

You can get started right away, too, because Microsoft Video for Windows* and Asymetrix

Compel* and MediaBlitz* software programs are included in the Intel Smart Video Recorder box.

To learn more about Indeo technology and the Smart Video Recorder, call 1-800-538-3373, ext. 1150. Or to receive information immediately, call Intel's automated FaxBACK® service at 1-800-525-3019 and ask for document 9871. Because with Intel, PC video is all fast forward.

intel®

Circle 96 on Inquiry Card.

The inspiration for our new Club World seat.



© 1993 British Airways

With an adjustable lumbar support, a newly designed footrest and the privacy of side headrests, you'll think you're flying on cloud nine. *It's the way we make you feel* that makes us the world's favourite airline.

BRITISH AIRWAYS

The world's favourite airline®

Circle 68 on Inquiry Card.

EISES MINE YOUR DATA

Executive information systems and client/server computing help you understand your data better

RANDALL D. CRONK



Client/server computing is transforming EIS (executive information system) software. With an EIS, you can pull together, view, analyze, and report on data that's in assorted formats such as spreadsheets or mainframe databases. Client/server computing has changed where people find information and how they understand that data once they acquire it.

The alliance between EISEs and client/server computing means that, in theory, anyone in your organization can become a knowledge worker (i.e., someone who can acquire, analyze, investigate, manipulate, observe, and study data). "In the past," says Tom Wood, an analyst at the consulting firm Business Research Group (Newton, MA), "most EISEs were mainframe-based and hierarchical. The data you received was structured and not easily manipulated—not exactly what knowledge workers needed to do their job correctly. The client/server shift solves this problem perfectly."

Because of a client/server's ability to interconnect, today's EIS generation gathers data not only from mainframes but from sources such as minicomputers, LAN servers, and networked PCs. "In client/server computing, the PC does what it does best—manipulates data—while the data itself can stay on the mainframe," says Howard Dresner, an analyst with the Gartner Group (Stamford, CT).

EISEs give you powerful analytical tools that help you pinpoint meaningful relationships and trends in your data through-out your distributed databases. Graphics features let you depict data in charts and graphs that easily communicate its significance to your colleagues. Using statistical-analysis tools and data definitions in your database, an EIS can even suggest what data you should present and how to portray it.

Still, EISEs have problems. For example, they don't always give you easy access to

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



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

©1992, Back-UPS, PowerChute, Guaranteed ABSOLUTE Protection are trademarks of APC. All other trademarks are property of their respective owners.

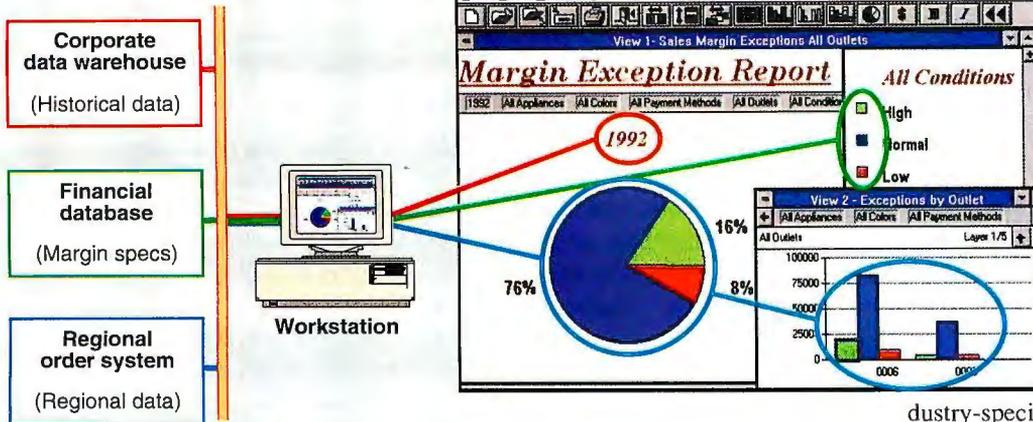
Model	Application	List	New List
Back-UPS 250	LAN nodes, 386SX, 286, internet hardware, POS	\$169	\$139
Back-UPS 400	Desktop 386, 486 systems, 286 servers	\$249	\$229
Back-UPS 450	Tower 386, 486 systems, servers	\$329	\$279
Back-UPS 600	Heavily configured systems, CAD/CAM workstations	\$449	\$399
Back-UPS 900	Multiple systems, longer runtime applications		\$599
Back-UPS 1250	Multiple systems, LAN hubs, small minis, telecom equipment		\$799

**NEW!
NEW!**

Circle 64 on Inquiry Card.

State of the Art EISes Mine Your Data

Viewing Data Through an EIS



Cognos's PowerPlay, running on a client/server system, has been fed data from three databases. This data has been used to develop a pie chart on last year's sales conditions. The bar graph shows how the same data can be manipulated to produce a what-if scenario, enabling you to explore and develop new strategies. (Photo courtesy of Cognos)

data, despite what some vendors claim. But the biggest problem, according to Dresner, is on the data preparation side: Where is the data? How do you clean it up, make sense of it, and relate it to other information? "The person responsible for implementing the EIS product may know that the relationships are there [in the database]," says Dresner, "but may not be able to find them or present them through an application to users in a timely fashion so they can act on it."

Once you find the data, you must deliver it—not an easy step with today's patchwork of network protocols, database managers, operating systems, and windowing environments (see "Client/Server Frees Data" on page 96).

Bridges to Data

Client/server computing is great in theory. Most database servers speak Novell's NetWare, TCP/IP, or both. Several of the popular database managers, such as Sybase and Oracle, allow you to access remote databases as if they were on your PC.

But in practice, real-time access to your production database isn't always as easy as clicking on a few icons. For example, when you first install your EIS, it might not be able to tell you whether the data you want is available. If it can, you might not be able to extract or manipulate the data unless you can apply your own expertise to your database's query language. Even if you can get your EIS to produce the data, the data may not be presented in a form that you or your applications can

read. For example, your EIS may be able to handle Lotus 1-2-3 or dBase, but your data may be formatted for an arcane main-

frame database manager.

When problems arise, they usually are not with your network-to-database connections. Rather, they occur because your EIS either can't read the format of the data itself or cannot cope with the schema used to organize the database. Further, some DBMSes are tied to industry-specific formats, such as the Apollo or Sabre airline reservation systems.

If you work with an industry-specific database, you might have to rely on yourself or a third party for a data provider to serve as a bridge between your EIS and data. EIS vendors cannot make bridges between their product and every database. For example, if you use PowerPlay from Cognos (Burlington, MA), you'd have to rely on Showcase Vista from Rochester Software (Rochester, MN) to access your IBM AS/400-based

What business does sound have in a computer?

	FY1991	FY1992	
12 Revenue			
13 Golf	350,000	335,000	
14 Salari	600,000	748,000	
15 Tennis	270,000	297,000	
16 Misc	64,400	92,800	
17 Total Revenues	1,884,400	2,072,800	
18 Operating Expenses			
19 Marketing	94,500	102,060	110,225
20 R&D	77,000	84,024	90,200
21 Maintenance	69,400	74,952	80,160
22 Purchases & Supplies	17,400	18,792	20,295
23 Rent	188,440	203,515	219,796
24 Depreciation, Building	6,400	7,168	8,008
25 Insurance	12,670	13,684	14,778
26 Utilities	14,100	15,208	16,446
27 Total Operating Expenses	490,710	519,423	559,829
28 Income Before Taxes	1,403,690	1,553,417	1,720,195
29 Income Taxes	477,255	528,162	584,866
30 Net Income	926,435	1,025,255	1,135,329



For starters, you can increase your productivity when you proof spreadsheets with the new Microsoft® Windows™ Sound System. Just highlight a series of numbers or words on the screen and it will read them back to you. It will even read them aloud as you enter them, if you like. To hear more, turn the page.

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

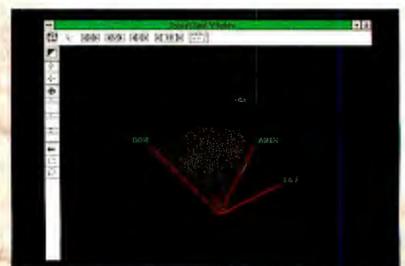
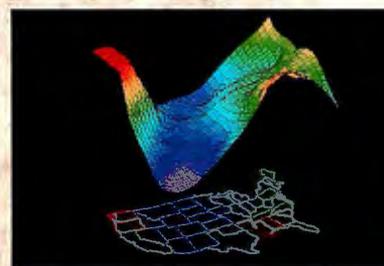
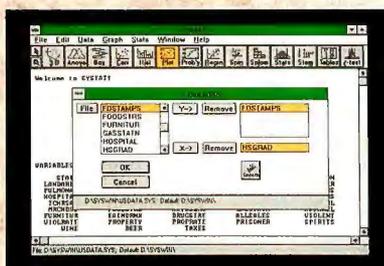
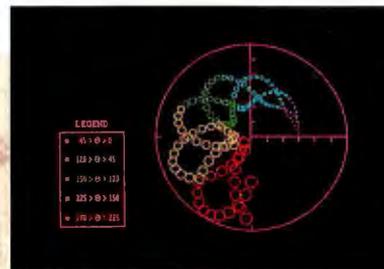
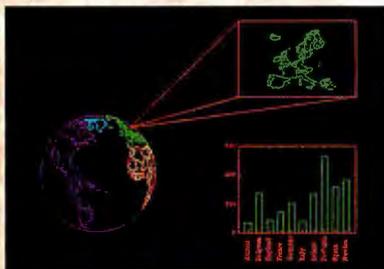
A compatible family of products

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 143,
For IBM/DOS circle 144.



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: 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, New Zealand: Hoare & Assoc. 64.78.562675, Poland: COMPANION 48.12.360791, Spain: AddLink 34.3.4590722, Switzerland: F & P 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.

State of the Art EISes Mine Your Data

database, because Cognos doesn't make a data provider for it.

End-user experiences vary. For example, Gordon Seeler, a technician at Prudential Insurance (Newark, NJ), reports that Forest and Trees, a Windows-based EIS from Channel Computing (Portsmouth, NH), comes with the bridges he needs. Seeler's job is to set up Forest and Trees throughout the company. Prudential's main database is IBM's DB2. Forest and Trees accesses DB2 via Microsoft's SQL Server, which allows a PC to

access DB2 data over a network (see "The Many Flavors of SQL" on page 109). The connection to the SQL Server is a data provider within Forest and Trees itself.

"I love it," says Seeler. "The product is easy to install. I just insert the first [of three] disks, go to Windows Program Manager, drop down the file menu, and select RUN. Forest and Trees prompts me for what data providers I want installed, and that's it."

Staging Strategies

Perhaps more typical are those client/server administrators who cannot—or do not want to—assign direct connections between end users and live databases. Instead, they opt to create an intermediate staging database. Charles Smith, general manager of a beer distributor in Kingston, Massachusetts, chose this option.

At the heart of Smith's problem is that the EIS he uses, Pilot Software's (Boston, MA) LightShip, cannot access the company's industry-specific DBMS, the VIP Beverage System from Vermont Information Processing (Colchester, VT). Smith's solution is to download VIP data from his IBM System/36 server to a standard dBase-type file running on a 486-based PC. His clients then access the data from their 386-based PCs running LightShip. LightShip uses a single data provider, called LightShip Lens, which is compatible with such widely used data formats as Microsoft's DDE.

Smith, whose background is in finance, set up his first EIS application for sales analysis in about two weeks. He doesn't consider this an unreasonable amount of time, especially in view of what the application does for him. For instance, Smith says that his LightShip application helps

maximize profits by letting him determine how many bottles of beer should be stocked at certain sales outlets. "This will let me bury my competition," says Smith.

Security and compatibility factors are among the reasons that Chemical Bank uses a data-staging strategy. Cort Jacobsen is a vice president at Chemical Bank's securities trading department. He uses dBase running on a pair of 486-based PCs as a staging database for two reasons. One is to keep clients from sending queries against the trading database, which could

slow down the database and result in a lag in the posting of stock market activity reports. The other reason is to overcome format incompatibilities between LightShip Lens running on client 486s and the database containing the bank's trading records, running under Microsoft's Fox-

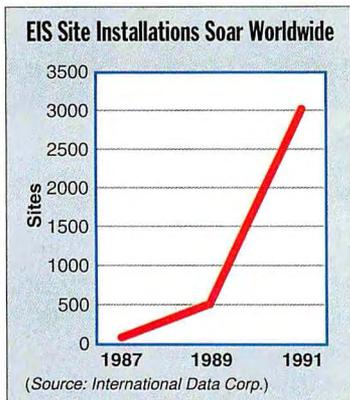
pro on 486-based servers.

Although LightShip can access Foxpro data directly, it can't do so with Foxpro's memo fields. This complication makes historical-trend analysis impossibly long to accomplish, since LightShip cannot use Foxpro's data indexes for searches. Like Smith, Jacobsen doesn't consider these data-connection issues a serious obstacle. One reason for this is that, as with many large companies, Chemical Bank has an information systems infrastructure for which such workarounds are not difficult to implement.

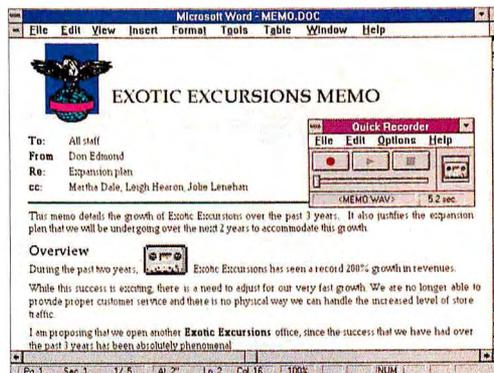
The good news is that the need for these kinds of workarounds is vanishing rapidly as EIS vendors implement data providers for more and more databases. Channel Computing seems to have the longest list of databases for which data providers are available, although all EIS vendors continue to add to their own lists.

EIS Magic

According to Judith Hurwitz, president of Hurwitz Consulting (Newton, MA),



What business does sound have in a computer?



Now you can communicate more effectively by adding your voice, or even music, to documents and presentations. Just record it, drag it and drop it in.

Microsoft Windows Sound System can also recognize and execute spoken commands like *open*, *cut* and *paste*. You can easily create custom commands in any application for the Microsoft Windows™ operating system. Want to hear something else? Turn the page.

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**



SHOWN ACTUAL SIZE

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 Fast Electronic GmbH, Tel: 49-89-539-800-20 Fax: 49-89-539-800-40
In Korea contact Finecom, Tel: 82-2-690-5811 Fax: 82-2-805-5729
In Brazil contact HT-MAGH, Tel: 21-257-9314 Fax: 21-235-8808
In Chile contact Datasoft S.A., Tel: 562-248-7448 Fax: 562-208-0591
In Peru contact VCFEL, Tel: 51-1-440537 Fax: 51-1-4475934
In Uruguay contact Sorotec, Tel: 90-80-10-92-30-03 Fax: 9593-2-32-18-18

See us in Atlanta at Comdex/Windows World '93, Booth #W8755.
For international information circle 89, For Domestic information circle 90 on Inquiry Card.

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

State of the Art EISes Mine Your Data

customers are buying EISes today without the data providers they need, proving the perceived value of the genre. Sales figures buttress this assertion. Clare Gillan, director of information access for International Data Corp. (Framingham, MA), a market-research firm, reports that sales of PC-based EISes jumped from about \$5 million in 1985 to \$125 million last year. By 1996, IDC projects that sales will rock up to \$329 million.

"Executive decision support used to mean back rooms filled with programmers, each one providing a 'view for hire,'" says Hurwitz. "By comparison, today's EISes are not especially difficult to install or use, and [they] provide an enormous amount of leverage."

"The magic," says Hurwitz, "[is that an EIS] lets you see things you can't see just by looking at rows and columns." Indeed, some packages, such as IDIS: The Information Discovery System from IntelligenceWare, go so far as to suggest what trends and relationships you should be asking your database about.

To do this, IDIS scrutinizes your raw data and uses statistical analysis to generate rules about it. For example, while looking at a supermarket's national sales data, IDIS might generate a rule that says that if a supermarket is between 31,000 and 73,000 square feet in size and sells between 2500 and 3000 boxes of cereal weekly in February, then 92 percent of the time, it will sell between 4000 and 5000 cases of milk in July.

Cognos's PowerPlay also uses statistical analysis to automatically suggest how data should be summarized and structured. Its statistical-analysis capabilities let you determine, say, whether a particular sample of time-series data would be more meaningful to you if it were displayed as a monthly, year-to-year, or year-to-date sampling. You can also determine whether there is greater variability in your sales data if the data is displayed by product type, vendor, or geographic region.

Helps You Think

With its combined graphical interface and multidimensional-analysis capabilities, an EIS has the power to help guide you in your thought process. "Dimensionality is

as key to the new EIS paradigm as client/server computing," says Douglas McCartney, Pilot Software's vice president of marketing. "It gives you the ability to see the relationships in your data that are not obvious to you."

One dimension of a sales transaction, for example, is what sale was made when. Other dimensions are year-to-date sales, this year versus last year, first quarter versus second quarter, and so on. However, it is likely that none of these dimensions is called out explicitly in your database. An EIS can bring the relationships

of these dimensions to the surface for your investigation and analysis.

That's precisely how Jerry Reilly, a data administrator at Amitech (Sellerville, PA), a gauge maker, uses PowerPlay. In what he

describes as a "breakthrough application," Reilly analyzes product-delivery performance in many different ways. For example, he can analyze performance for the company as a whole; for any market group, customer, salesperson, or distributor; and for any time period or product type. In addition, Reilly can view the analysis in dollars, quantity, or number of orders. He can place months as rows and view performance as a trend line. He can also analyze performance at either of Amitech's manufacturing plants or for both simultaneously.

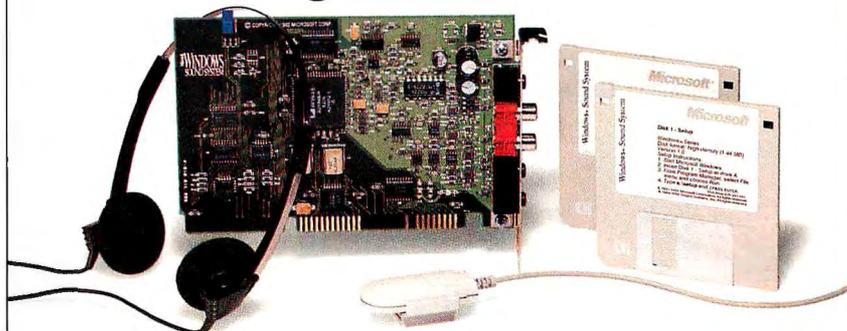
"In the old days," states Reilly, "when I printed a report, the next thing that would happen would be people coming back and wanting it sorted in a million different ways. No longer." Reilly says his next PowerPlay application will "reengineer the business." It will give him gross margins for any customer, region, product, or item sold.

In addition, EISes let you use graphics to manipulate the data, not just present it. Virtually every desktop EIS offers a "drill-

What EISes Do for You

- create graphically rich charts
- find data in multiple distributed sources
- help discover relationships between data
- provide information at or near real time
- suggest pertinent data and how to present it
- give you statistical-analysis tools for summarizing and structuring data

Microsoft Windows Sound System. You'll be hearing a lot about it.



It's the complete audio solution for your business, with all the hardware and software included. Call (800) 426-9400, Dept. JK8, for a free demo disk that'll bring the Microsoft Windows Sound System to life on your PC. It's the first audio system specifically designed for the Microsoft Windows operating system.

Microsoft
Making it easier

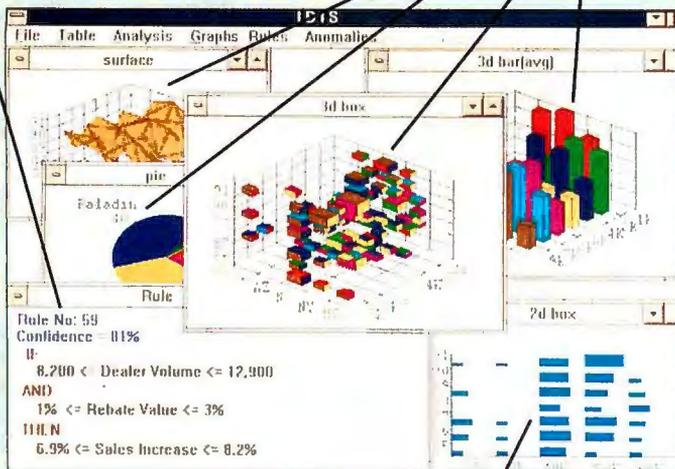
*Requires the Windows operating system 3.1 or later. Demo is on a 3.5-inch high-density disk. Offer good while supplies last. Inside the 50 United States, call (800) 426-9400, Dept. JK8. For information only: In Canada, call (800) 563-9048; outside the United States and Canada, call (206) 936-9661. © 1992 Microsoft Corporation. All rights reserved. Printed in the USA. Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation.

State of the Art EISes Mine Your Data

GRAPHING DATA WITH AN EIS

After you enter the operating parameters for your search, IDIS uses this information and statistical analysis to generate rules about the data.

IntelligenceWare's IDIS EIS lets you use different types of graphs to visualize data (e.g., sales information over time by location).



You can graph what-if scenarios.

(Photo courtesy of IntelligenceWare, Inc.)

down" capability, for example. This means that you can click on a data item, say a pie slice representing New York state sales, and view the underlying statistics, such as a pie chart of all your New York distributors.

More recent capabilities allow you to set up virtual instrument-control panels for monitoring your business in real time.

LightShip, for example, allows you to display a chart of statistics as a bar graph by clicking on that presentation in a style menu. You can then drag the bar graph next to the original chart and view both at the same time. Using a "view selector" window, you can size your graph and populate it with the names of some of the fields in the original chart (e.g., regions,

years, and products). By scrolling through this window and double-clicking on the desired view, alternative presentations of your company's sales performance are displayed, all in real time. You can even make the words in the main title change automatically according to the name of the view being displayed.

Increasingly, EIS makers are using hypertext to make data manipulation more powerful and intuitive. IntelligenceWare's Iconic Query, for example, lets you specify relationships between objects by drawing a line between them. This allows non-experts to express relationships that may not have been previously defined in the database and thus are unavailable to Iconic Query. For example, drawing a line between a shipments icon and a customers icon expresses the notion that shipments are made to customers.

EIS Potential Grows

EIS vendors claim that their products empower you to find relationships and trends in your distributed data so that you can quickly adopt new business strategies; many EIS users agree. According to Charles Smith, "20 seconds is not long to wait for a [business] strategy."

But, obviously, issues such as data staging and interchange need more attention—and they're getting it. This attention is evident in the growing lists of databases and compatible data formats supported, the higher level of built-in statistical-analysis functions, and the hypertext features.

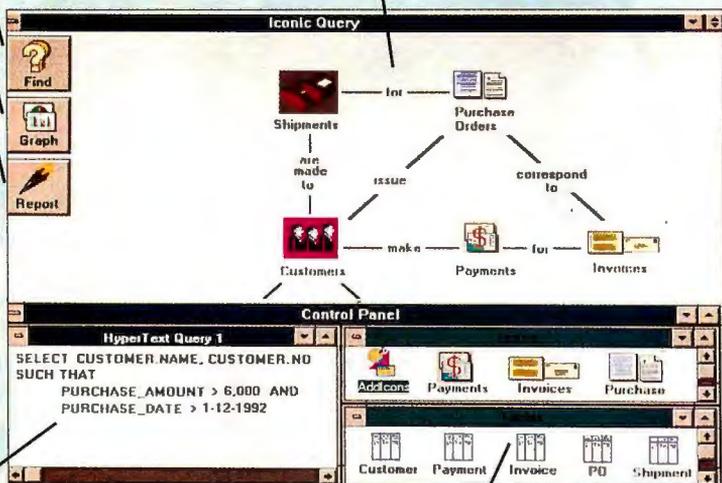
Still, the energy behind the acceleration of desktop EIS is the continuing expansion of client/server computing. According to analyst Wood at the Business Research Group, 51 percent of all personal computers are networked, and 49 percent of all networks are interconnected to another network. Furthermore, a recent Business Research Group survey of 500 companies found that two-thirds of the companies either have begun to implement a client/server computing strategy or have one in place already.

According to Wood, the trend is undeniable. "In the past, the obstacle to EISes on the PC was the lack of a client/server infrastructure," he notes. "Now companies are installing [that] infrastructure." ■

SEARCHING WITH AN EIS

IntelligenceWare's Iconic Query lets you search for a particular item, generate a graph, or create a report.

The lines connecting icons express the relationship among actions that comprise a sales transaction.

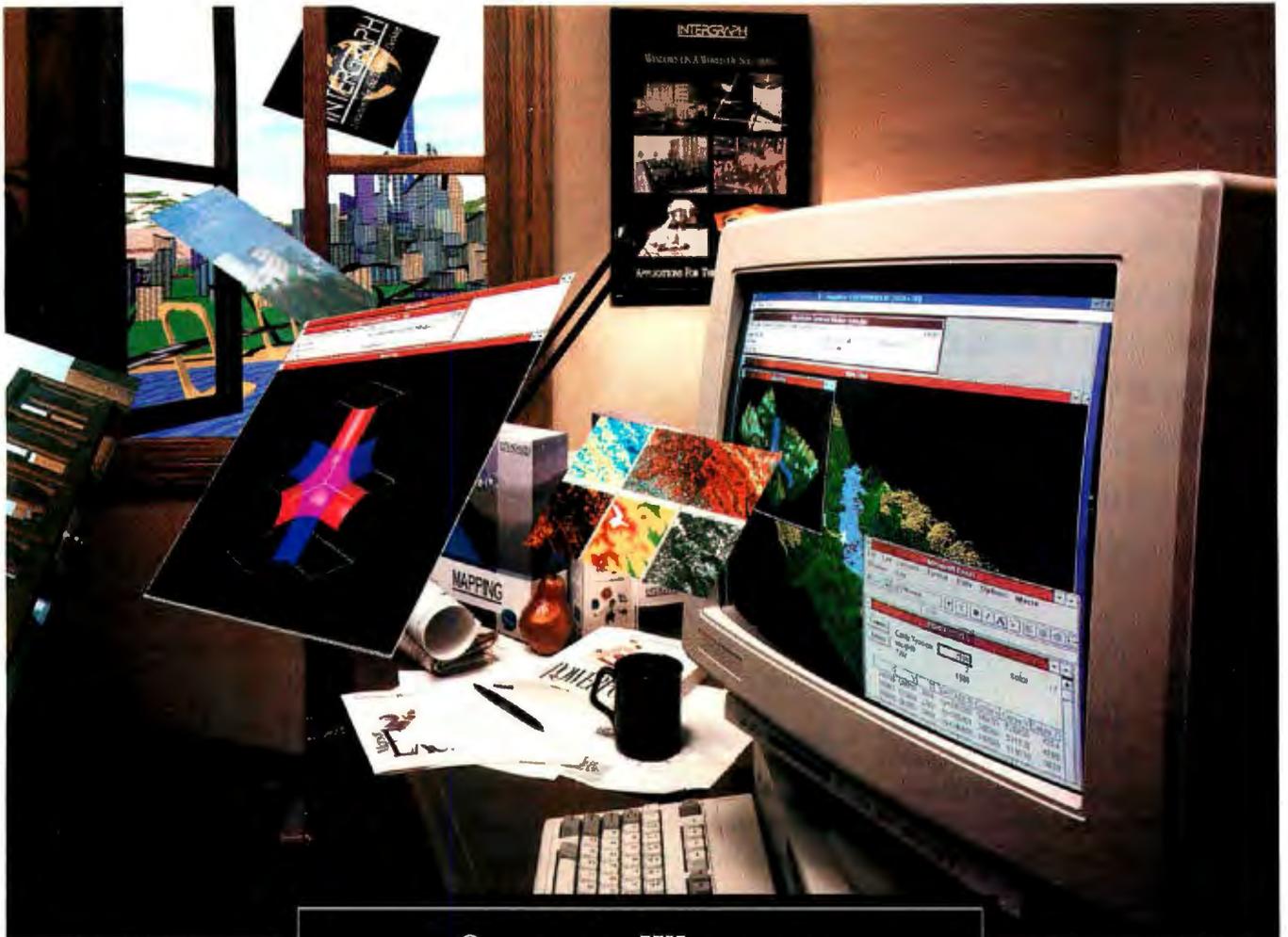


You define each icon before you begin a search. The parameters shown define the customer icon.

Iconic Query lets you select icons that represent your databases.

(Photo courtesy of IntelligenceWare, Inc.)

Randall D. Cronk of Boston, Massachusetts, is a marketing consultant for software companies and a freelance writer on computer-industry topics. He holds an MBA in marketing from Clark University (Worcester, MA). You can reach him on BIX c/o "editors."



OPENING WINDOWS TO A WORLD OF SOLUTIONS

In the world of Windows NT, Intergraph's applications bring a new level of power and sophistication to the technical desktop.

The computer graphics industry has made another leap forward. Under Microsoft's New Technology operating system, popular business programs and Intergraph's

"The Microsoft-Intergraph alliance provides a full range of technical applications, as well as a wealth of personal productivity tools – complete solutions for the technical desktop."

*Paul Maritz, Microsoft
Senior Vice President of Systems*

technical applications can run alongside each other on the same computer. The same friendly Windows environment appears throughout the applications – word processing, spreadsheets, architecture, civil engineering, mapping, and all the rest. CAD users can now spend time designing and drafting, not navigating through the operating system.



MicroStation is general-purpose CAD software that runs on

PCs, Macs, and UNIX workstations. It is a primary tool in Intergraph's solutions for the technical desktop. If you appreciate the economy of PCs but need sophisticated design power, take a look at MicroStation. It means a more productive, more profitable future for you and your company.

CAD

should give you the productivity edge you need to be competitive in today's business environment. You need a tool that streamlines the process of drafting,

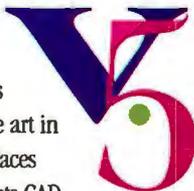
"MicroStation includes a robust set of 3D capabilities and gives you a variety of ways to render models."

Infoworld

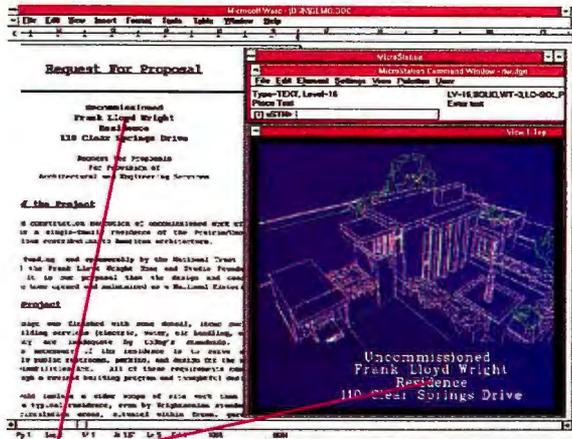
as well as a modeler that helps you create virtually any object — fast. You should be able to store design data in relational databases without programming. Your future depends on the ability to share data

with your design team and other operations. MicroStation software gives its users this level of proficiency. And keeps them in tune with the best in applications solutions.

Intergraph introduces MicroStation Version 5. It refines a product that is considered the state of the art in CAD graphical user interfaces (GUI). In doing so it boosts CAD to a higher level of usability.



MicroStation Version 5 brings renowned integration advantages to designers and



LINK TEXT

engineers who need to run in the Microsoft Windows business environment — Windows, Windows for Workgroups, and Windows NT.

Software that puts you in charge.

Today, *user friendly* means more than easy — it means software that empowers you. You control MicroStation through a graphical command center featuring icon command buttons ... pull-down menus ... tear-away palettes ... multiple, resizable overlapping views. The display is sleek. With no perceptible repaint, Version 5's graphical user interface seems to float over your drafting and design area.

MicroStation runs as an extension of the way you work. Choose from unique *Workspaces* designed for your profession. They configure the graphical CAD desktop for you and manage the computing environment to your needs. Even discipline-specific drafting *styles* are provided. And it's all tailorable: Graphically build your own pull-down menus and palettes. Rearrange fields in dialog boxes. Disengage commands. You've got the power to create the interface that best meets the needs of the task at hand.

CAD software should accommodate the way you think, work, learn — even change your mind. You should be able to select a different dimensioning system right in the middle of a command. Or modify a shape and have

MicroStation integrates with your favorite Windows business applications.



February 23, 1993
MicroStation PC, 4.0.3

"MicroStation PC is an exceptionally usable, powerful package with such rare and exotic features as nonuniform

rational B-splines."

PC Magazine

all of the dimensions automatically change. Simple actions — like grabbing a line or object — should be so fast that they require no conscious effort. MicroStation performs functions like these as a matter of course. Other CAD software simply can't.



Store information in popular relational databases — without programming!

A powerhouse of features gives you the productivity edge!

MicroStation offers more functionality in one package than any other CAD software. New *dimension-driven design* options help you design intelligently using geometric and dimensional constraints. Apply variables to the constraints and save your design for reuse with different parameters when creating similar objects or parts. These and more new capabilities — like user-defined linstyles and associative patterning and hatching — provide the most complete drafting environment available.

Powerful tools help you create freeform, mathematically precise surface models. Model virtually any object, no matter how complex. Perform trim, blend, fillet, and Boolean operations between surfaces. You've got the simplicity of solid modeling without the overhead.

Visualizing your designs is easy and cost-effective with MicroStation's new photorealistic rendering capabilities. Light sources, shadows, transparencies, depth cueing, anti-aliasing, and bump and pattern mapping help you market your designs. You can even create flythrough animations and play them onscreen for your clients. MicroStation is a powerhouse of features in one package.

The best tool for the '90s production environment.

Users value the way MicroStation performs in the production environment. On large projects, it's a clean-running, fast performer. One user said, "MicroStation is an all-encompassing system ... capable of covering all facets of project management, not just design and drafting."

MicroStation users enhance productivity through real-time data sharing. True file referencing allows each member of a workgroup to easily



MicroStation Version 5 reads and writes to AutoCAD .dwg format.

"Compared to DataCAD, AutoCAD, and VersaCAD, MicroStation is much faster ..."

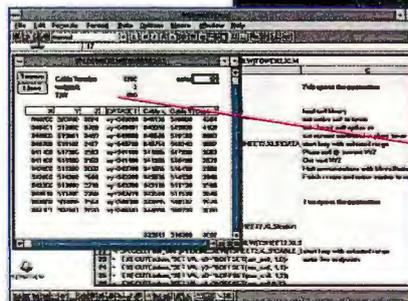
Computer-Aided Engineering

and safely share files concurrently with others. It's peer-to-peer sharing of design information while everyone continues working — across multiple hardware platforms and networks.

Run MicroStation with other Windows applications. Cut and paste graphics in a Word proposal. Link document text with your MicroStation design file. Drive MicroStation graphics with an Excel spreadsheet. Embed sounds and messages in your design file.

MicroStation

All in all, if you combine MicroStation's integration capabilities with Windows' data sharing capabilities, you've got just what you'd expect from a '90s CAD product. And you have a clear growth path to Intergraph's sophisticated application solutions for UNIX and Windows NT.

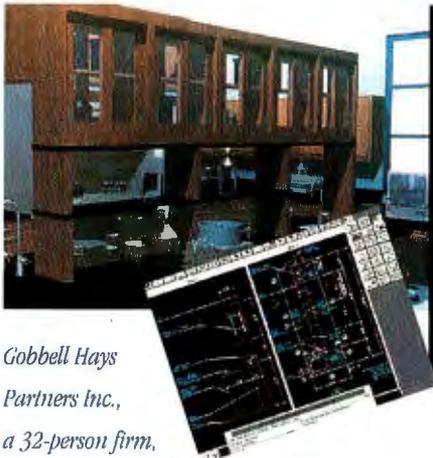


DRIVE GRAPHICS



Beyond the immediate benefits, there are advantages that come

from Intergraph's years of experience. In some industries, 25 years is not much. In computer graphics, 25 years is the lifetime of the industry. For almost a quarter of a century, Intergraph has developed computer graphics systems — hardware, software, and support — for industries that rely heavily on maps, engineering drawings, and models to convey information.



Gobbell Hays Partners Inc., a 32-person firm, uses MicroStation and ModelView from Intergraph to design laboratories for corporations and universities. Says firm president Ronald Gobbell, "Three-dimensional modeling shows the scientist exactly how his lab is going to look." With MicroStation, Gobbell Hays can customize and reuse cells with symbols of equipment, cabinets, and other basic lab features.

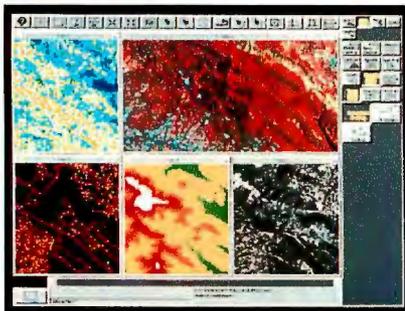
The Intergraph advantage.

The arrival of a powerful new Windows operating environment means that for the first time, hundreds of thousands of microCAD users will have access to the functionality and technical sophistication of Intergraph applications.

Long-term partnerships with customers worldwide.

Intergraph's reputation for top-notch customer service follows the company around the globe as international business steadily increases. Intergraph's extensive customer support network

continues to earn top ratings in customer satisfaction surveys. The most recent Daratech *Industry Update* quotes a wide range of



With Intergraph's MGE geographic information system, California's Division of Mines and Geology will provide digital maps to enable Californians to determine if they live in risky earthquake or landslide zones.

Intergraph users range from small offices or departments to large multinational firms, and their projects run the gamut from single drawings to complex aircraft carriers.

Intergraph users satisfied with their systems. Intergraph's track record of technological stability and continuity is important:

"Intergraph has given me a competitive advantage for a number of years."

"No other vendor could have given us total binary file compatibility for all these years."

"I'm a firm believer that they have the best CAD product on the market."

*Daratech Industry Update
November 1992*

Olé OLE

Integrate CAD processing with other Windows applications such as Word and Excel by taking advantage of complete support for Microsoft's Object Linking and Embedding (OLE) technology.

Linvatec Corporation uses the high-performance solid modeling technology in Intergraph's Engineering Modeling System (EMS) to design products for least invasive surgery. The process of identifying and developing new and innovative products is



fundamental for growth in the health care industry, and Linvatec credits Intergraph systems for providing a strong competitive edge.

NT

Intergraph is the world's largest independent development site for Windows NT applications.

Technical leadership.

The list of disciplines addressed with Intergraph software is one of the longest in the industry — and continues to grow.

- Aeronautical charting • Architecture
- Cartography • Civil engineering • Dispatch management • Document management
- Electronics design • Energy exploration
- Environmental resource management
- Facilities management • Geographic information systems • Image processing
- Industrial design • Manufacturing
- Mechanical engineering • Photogrammetry
- Plant design • Publishing • Ship design
- Surveying • Telecommunications • Urban planning • Utilities — gas, electric, water



In 39 of the 50 departments of transportation in the United States, Intergraph applications for surveying, civil engineering, and GIS enable the DOTs to design and maintain the nation's transportation infrastructure.

New opportunities arise when you go with the CAD standard.

MicroStation can give you a foot in the door on major projects around the world. For example, the U.S. Army Corps of Engineers and their subcontractors use MicroStation-based applications. On the massive Hong Kong airport project, Intergraph has been named CAD supplier in the four contracts announced so far. Through numerous contractors and subcontractors, Intergraph applications will play a major role in designing and building the new airport and township, as well as the railway that connects them to Kowloon and Hong Kong.

Designed for Windows NT — the new Technical Desktop Series workstations.

Intergraph has traditionally supplied complete software and hardware solutions. In keeping with this tradition, Intergraph offers its own systems designed for Windows NT. They're optimized for CAD immediately out of the box, with full networking capabilities built-in. So it's simply plug-and-play. And with an Intergraph workstation, display clarity, high resolution, and graphics performance make viewing your work a pleasure.

These fast, affordable systems are perfect for running the new technical applications from Intergraph, along with thousands of other applications that run under Windows. And workstations in the Technical Desktop Series are fully interoperable with other systems on your network.

Low-cost suite of AEC applications

Feature-packed and available at a low cost, Intergraph's MasterWorks applications for architects and civil engineers bring a new level of power and value to the technical desktop. Intergraph brings to the Windows world functions formerly available only in high-end CAD systems. The MasterWorks series includes these applications:

- RoadWorks — transportation engineering
- DesignWorks — architectural design
- CogoWorks — coordinate geometry
- FrameWorks — structural modeling
- SiteWorks — site design

Whatever your project, MasterWorks will empower you to master your design challenges.

Affordable, expandable geographic information systems (GIS)

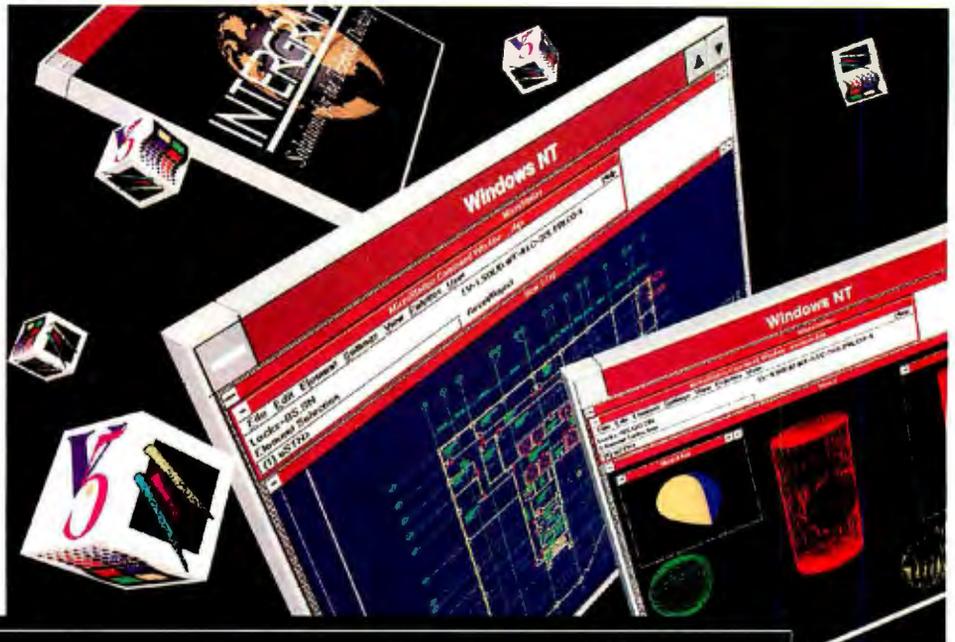
With the Modular GIS Environment (MGE) solutions for the PC, Intergraph gives you the best of both worlds — the power of the world's leading GIS on the world's most popular computing platform. Using MGE PC solutions, you can build an integrated, powerful GIS without investing large amounts of time, money, or resources. Start with a single PC and add workstations and sophisticated software as your needs grow. Or expand your existing MGE network with cost-effective PC seats. MGE PC solutions include:

- MGE PC-1 — database creation and project management
- MGE Grid Analyst PC — spatial modeling and analysis
- MapInfo for Windows — desktop thematic mapping
- MGE Project Viewer — read-only database display and query



Before you spend a dollar, look at the value of your investment. You can be highly productive with MicroStation's powerhouse of features for only \$3,790

CALL 800-345-4856 today for an Intergraph Solution Center reseller or sales representative in your area.



APPLICATIONS FOR WINDOWS NT

Innovative technology — once the domain of high-end systems — is now available on the technical desktop. For a more productive future, this is what you need . . .

Workgroup integration.

Intergraph pioneered reference files, the technology that enables each member of a workgroup to easily share designs with others. And, since .dwg files can also be referenced, you can work with AutoCAD-created data in MicroStation. In the Intergraph distributed computing environment, you share information, printers, plotters, and storage devices — and see dramatic savings in time and money.

Integrated applications.

Intergraph's integrated data management architecture provides access to technical information within applications and across disciplines. This means that Intergraph's applications can address an entire project workflow from end to end. Access to information across disciplines is made even easier by the fact that all applications feature the same easy-to-learn-and-use graphical user interface.

Smooth operation between operating systems.

Many of Intergraph's customers operate on networks that include a mixture of workstations and PCs, so interoperability is essential. Because Intergraph application file formats are common across hardware platforms, there are no problems of data incompatibility or translation, and sharing data is easy. Also, basic Windows NT includes all the tools needed for TCP/IP communication with our UNIX-based systems, so users can mix UNIX-based and Windows NT-based workstations in their networks and enjoy smooth interoperability.

Relational database support.

Intergraph data management tools feature built-in interfaces to Oracle, Informix, and other database management products. This support of leading databases in multiple environments enables you to create links to them without programming.

Growth path.

If you choose to upgrade your hardware or add other high-end technical applications, Intergraph gives you a growth path. You can upgrade your system and continue to share files.

Open systems and industry standards.

Your investment in hardware and software is protected by Intergraph's continuing support of major standards for computing, networking, drafting, and design.

Value-added services.

Intergraph also provides support in the form of project implementation, customization, systems integration, training, and worldwide service and maintenance.

Call 800-345-4856 for an Intergraph sales representative in your area.

INTERGRAPH
Solutions for the Technical Desktop

Intergraph® is a registered trademark and Cogo/Works, Design/Works, EMS, Frame/Works, Master/Works, ModelView, Road/Works, Site/Works, and Solutions for the Technical Desktop are trademarks of Intergraph Corporation. MicroStation® is a registered trademark of Bentley Systems, an Intergraph affiliate. Other brands and product names are trademarks of their respective owners. Copyright 1995 Intergraph Corporation, Huntsville, AL 35894-0001.

Circle 98 on Inquiry Card (RESELLERS: 99).

Apple's Midrange Mac a Heavy Hitter

The Centris 650 packs a wallop for just over \$3000

TOM THOMPSON

Until early this year, the midrange Apple Macintosh was the Mac IIci, a 25-MHz 68030-based computer. Now, with its Centris line of Macs, Apple put this aging warhorse out to pasture. The 68040-based Centris line redefines the norm for midrange Mac performance. It also redefines the price of this performance: A three-slot, 25-MHz Centris 650 with 8 MB of RAM and an 80-MB hard drive costs \$3169, and you can get a 20-MHz Centris 610 configuration for as low as \$1969.

CD-ROM Included

The Centris 650 looks just like a Mac IIvx, and in fact it uses the same chassis. My evaluation unit was packed with goodies: 8 MB of RAM, a 230-MB hard drive, built-in Ethernet, 1 MB of VRAM (video RAM), and a CD-ROM drive. The cost of such a system is \$3939. The 1 MB of VRAM gives the Centris 16-bit color capability on a 640- by 480-pixel screen, making it useful for most image editing and multimedia work.

When setting up the Centris, I couldn't locate the packet with the usual high-density floppy disks containing system software. I was looking in the wrong place, because CD-ROM-equipped Centris systems include system software on a CD platter. The Centris boots from this CD-ROM by default when it can't locate a bootable SCSI drive. You can also force the Centris to boot from the CD-ROM by holding down the Command-Option-Shift-Delete keys simultaneously as the computer starts. Either way, a CD-ROM boot lands you in the At Ease shell, a system shell that puts you a mouse-click away

The Centris 650 redefines midrange-Mac performance by outrunning the Quadra 700 while maintaining a price close to those of high-end PC clones. Equipped with a double-speed CD-ROM and a 25-MHz 68040 processor, the Centris 650 makes a solid multimedia platform. Here, the Centris 650 is quickly running Reactor's Spaceship Warlock interactive movie directly off CD-ROM.

from applications that format the hard drive, test its integrity, and install the operating system. Other utilities allow you to create high-density floppy disks loaded with system software, such as a bootable "crash floppy" that includes disk formatting and repair applications. Storing crucial system software on a sturdy, read-only medium and providing ready access to it is one of Apple's better innovations.

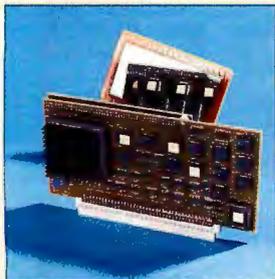
A CD-ROM-equipped Centris can handle a wide variety of media. Its AppleCD 300 CD-ROM supports CD-ROM XA (Extended Architecture), which lets it read multisession Kodak Photo CD format. A QuickTime compressor/decompressor provided with the system software lets graphics applications transparently read the images stored on Photo CDs. The AppleCD 300 is a double-speed drive, which means it delivers over 300 KBps, twice the transfer rate of earlier drives. I inserted Reactor's Spaceship Warlock interactive CD-ROM into the drive and launched the software. This software makes heavy use of graphics and sound and is sensi-



tive to system throughput. On a Quadra 950 using a slower CD-ROM drive, I had to copy the files onto the hard drive to get acceptable performance. On the Centris 650, I ran the interactive movie straight off the CD-ROM with snappy response.

With the Centris's 68040 heart beating at 25 MHz, you would expect to get only Quadra-700-class performance. However, the BYTE application benchmarks show otherwise, with the Centris 650 running about 13 percent faster than the Quadra 700. This is a conservative estimate, since I had to disable the processor caches (which degrades performance) in order to run Word 4.0 in the word processing benchmarks. The combined effects of tightly integrated components (which reduces the clock cycles required to shuffle data about the system) and interleaved memory (which minimizes the clock cycles needed to access adjacent memory locations) result in a tremendous performance boost for the system.

For those who bought a Mac IIvx and



If you're not quite ready to retire that Mac IIci but want Quadra performance, there's DayStar Digital's Turbo 040 (\$1599). The Turbo 040 is a 33-MHz 68040 accelerator board. At boot time, the Turbo's faster 68040 processor outraces the IIci's CPU and takes control of the system. The Turbo 040 has a plug-in socket for a FastCache (\$399), an expansion module with a 128-KB, 12-nanosecond SRAM (static RAM) cache. A IIci equipped with a Turbo 040 and a FastCache performed better than a Quadra 950.

BYTE Macintosh Benchmarks



All machines were tested using System 7.1. All results are indexed. For each test, a Mac Classic II = 1, and higher numbers indicate faster performance. The floating-point benchmarks use the SANE library. Comprehensive test results and detailed configurations are available for all machines on request. The Mac Classic II used a 512- by 342-pixel screen, and the PowerBooks used 640- by 400-pixel screens. All others used 640- by 480-pixel screens. The Mac IIfx was equipped with an Apple Cache board and 8x24 GC display board. For 68040-based Macs, caches were disabled for the Word Processing tests, and PageMaker 4.2 was used for the Desktop Publishing tests.

BYTE's Macintosh application benchmarks pegged Centris 650 performance about 13 percent higher than the performance of a Quadra 700. The PowerBook 165c is about as fast as a PowerBook 180 on most tests, but it falls behind on benchmarks that depend on video speed.

are disappointed with its performance (it's actually slower than the older IIfx), there's still hope. For \$1199, Apple offers a main logic board swap that upgrades the IIfx

to a Centris 650. Be aware that the Centris uses a new 72-pin RAM SIMM that is incompatible with the 30-pin SIMMs found in the IIfx and older Macs.

Thanks to the ground-breaking Quadas, software compatibility for the 68040-based Centris 650 was excellent. Aldus PageMaker 4.2, Symantec's Think C 5.0.4, and Zedcor's FutureBasic 1.01 all ran without a hitch. Scanning color images using Light Source's Ofoto 2.0 and an Apple Color OneScanner also went without problems. Adobe Photoshop 2.5 blitzed through loading and editing huge image files.

The Centris represents a great step forward, providing excellent performance and solid compatibility for a price that puts it in direct competition with high-end PCs. If there's one thing wrong with the Centris 650, it is—ironically—the price. Or at least the pricing structure. Prices between related Mac models usually differ by only a few hundred dollars, but the difference between a similarly equipped Centris 610 and Centris 650 is closer to \$1000. ■

Tom Thompson is a BYTE senior technical editor at large and a certified Apple developer. You can reach him on BIX as "tom_thompson" or on the Internet at tomt@bytepb.byte.com.

PORTABLE COLOR



The PowerBook 165c is more or less a PowerBook 180 under the hood: It contains the same 33-MHz 68030 processor and

68882 FPU as does the PowerBook 180. But there's no mistaking the two because of the 165c's passive-matrix color LCD screen. The smaller 9-inch panel uses a higher dot density to achieve the same 640- by 400-pixel resolution as the 180 while displaying 256 colors. The 165c's display is clear and bright, but you have to adjust the brightness to maximum (thereby taxing the battery) to see it at its peak. Typical of passive LCD technology, the 165c's display also exhibits display artifacts (colored streaks) as cross-talk voltages leak to adjacent pixel lines. Nevertheless, several BYTE editors (not just me) judged it to be the best passive-matrix screen they've seen.

The low-level BYTE benchmarks gauged a PowerBook 165c (with 4 MB of RAM and an 80-MB hard drive) similar in performance to the PowerBook 180, except for video. PowerBook 165c designers used DRAM, rather than dual-port-

ed VRAM (video RAM), for the frame buffer. Because the processor and display circuitry battle over access to this memory, video performance suffers. The slow display hampers throughput, causing some application benchmarks to plummet to apparent Mac IIfx speeds. Since the rest of the computer operates at 33 MHz, the performance penalty appears only when an application makes heavy use of the display. I hope future color PowerBooks avoid this design flaw.

While 256 colors seems limiting, it's adequate if you need to run small group presentations and need to carry a bare minimum of hardware. You might not want to edit anything in Adobe Photoshop on the 165c, but professional artists can use Photoshop to present portfolios of their work or to preview artwork while traveling.

PowerBook Battery Life



About the Products

Centris 650 .....\$3939	Apple Computer, Inc. 20525 Mariani Ave. Cupertino, CA 95014 (800) 776-2333 (408) 996-1010 fax: (408) 974-6412
PowerBook 165c.....\$3399	Circle 1221 on Inquiry Card.
DayStar Digital Turbo 040 .....\$1599	DayStar Digital 5556 Atlanta Hwy. Flower Branch, GA 30542 (800) 962-2077 (404) 967-2077 fax: (404) 967-3018
System Configuration	Circle 1222 on Inquiry Card.
Centris 650: 8 MB of RAM, 1 MB of VRAM, 230-MB hard drive, CD-ROM drive.	
PowerBook 165c: 4 MB of RAM, 80-MB hard drive.	

Great News!
QEMM Solves
DOS 6 Memory Problems!

Safety in Numbers

Safe Memory Management Keeps Your System Running Smoothly.

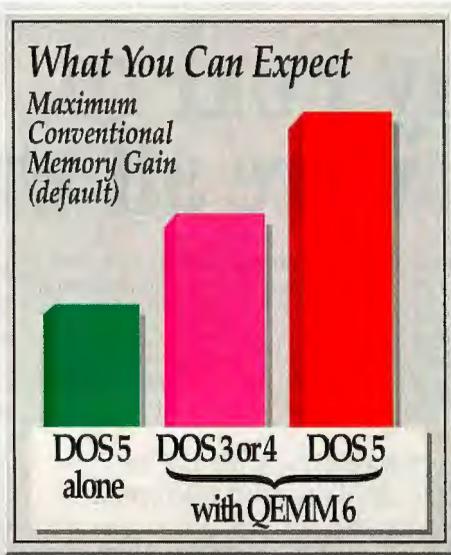
What's more annoying than losing work on your PC? A crash or 'hang' destroys everything you've done since the last time you saved. That work is lost forever.

Two major causes of crashes are memory conflicts and running out of memory. To avoid these problems, many users sacrifice productivity-enhancing TSRs or useful network utilities. And that's unfortunate, because the right memory management lets you have it all—safety and performance.

Have Your Cake and Eat it, Too.

QEMM-386™ version 6 lets you run your favorite programs *and* TSRs without fear of 'out of memory' problems or conflicts. It provides the maximum memory right where your programs need it.

The more memory you have, the more reliability you get. No other memory manager measures up to QEMM's performance.



This is what QEMM-386 does for a typical PC. It reorganizes memory to produce greater speed and safety.

Nobody Knows Memory Like We Know Memory.

That's not bragging, just fact. As recently as two years ago, DOS ignored the importance of maximizing conventional memory. At that time, our QEMM-386 v5 provided up to 128K more usable memory. QEMM became a virtual necessity for 'power users'

Today, our latest QEMM-386 version 6 surpasses even that achievement. Thanks to our new, smart 'stealth' technology, it finds as much as 96K more high memory than other memory managers. And speaking of other memory managers, not one has yet been able to match our performance. Instead, some have slashed prices or started nasty rumors just because they couldn't reliably deliver the same results. These tactics must not work, since we outsell all the others put together.

QEMM. The Memory Manager Millions Rely on Every Day.

Considering its unsurpassed performance and the safety it adds to your system, it's no wonder that millions of PC owners use QEMM. And it should be no surprise that 'gurus' and MIS managers consistently vote QEMM-386 the top memory manager in poll after poll, year after year.



QEMM has won more recognition than all other memory managers combined.

Protect Your Productivity; Keep Your Work Safe.

Any task, from programming to writing the company business plan to composing a personal letter, takes time and thought. Your PC is supposed to make that process easier; your output better. When you can't run your favorite grammar-checking TSR or have to get by without a vital network utility, you're sacrificing productivity.

QEMM comes with Manifest, the award-winning memory analyzer that helps you avoid memory conflicts.

Whether you're running MS-DOS, IBM™ PC-DOS, DR DOS or MS Windows, don't

sacrifice; don't compromise; don't risk losing work. QEMM-386 version 6 is the most powerful, flexible memory manager you can buy. Period.

PC Week Ratings	All Charge 386 3.2	Netroom 2.10	QMAPS 2.0	386Max/BlueMax 6.00	QEMM 6.01 Analyst's Choice	Memory Commander 2.1
Software Compatibility	●	●	●	●	●	●
Hardware Compatibility	●	●	●	●	●	●
Reliability	●	●	●	●	●	●
Ease of Use	●	●	●	●	●	●
Memory Management	●	●	●	●	●	●
Flexibility	●	●	●	●	●	●
Quality of Documentation	●	●	●	●	●	●

● GOOD ● SATISFACTORY ● NEEDS IMPROVEMENT

PC Week carefully compared them all and rated QEMM-386 v6 the best memory manager.



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

Circle 132 on Inquiry Card.

©1993 Quarterdeck Office Systems. Trademarks are property of their respective owners.

CodeBase 5.0

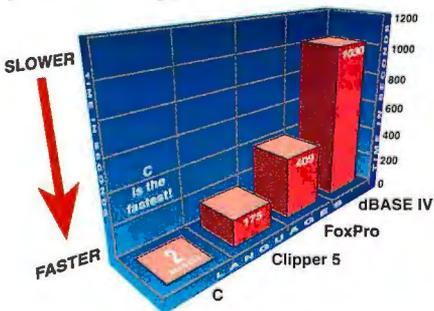
Discover why FoxPro, Clipper, and dBASE were all written in C.

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 Eratosthenes" 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:

Product	Quantity	Value
Database	82	\$24,658.00
Spread Sheet	83	\$18,876.00
Monthly Summary	121	\$47,803.80

Product	Quantity	Value
Database	82	\$24,658.00
Spread Sheet	83	\$18,876.00
Monthly Summary	116	\$46,737.80

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 July 31, 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

SEQUIER SOFTWARE INC. FAX 403-436-2999
Europe 33.20.24.20.14
#209,9644-54 AVE., EDMONTON, AB, CANADA T6E-5V1

Microsoft's Visual C++

It's not quite Visual Basic gone to C, but this enhancement to C++ 7.0 removes some of the drudgery of Windows programming

JIM HURD

Microsoft's Visual C++ brings welcome, sweeping changes to the Microsoft C/C++ 7.0 programming environment. The familiar character-mode Programmer's Workbench IDE and CodeView debugger are replaced in a single stroke by Visual Workbench. The menagerie of resource-creation and editing tools on which most Windows programmers cut their teeth is superseded by an all-in-one resource utility called App Studio. A new version of the Microsoft Foundation Classes (MFC 2.0) greatly enhances the value (and doubles the size) of Microsoft's application framework. Taken together, these changes represent a major shift toward removing some of the common hurdles C and C++ developers face when moving to Windows.

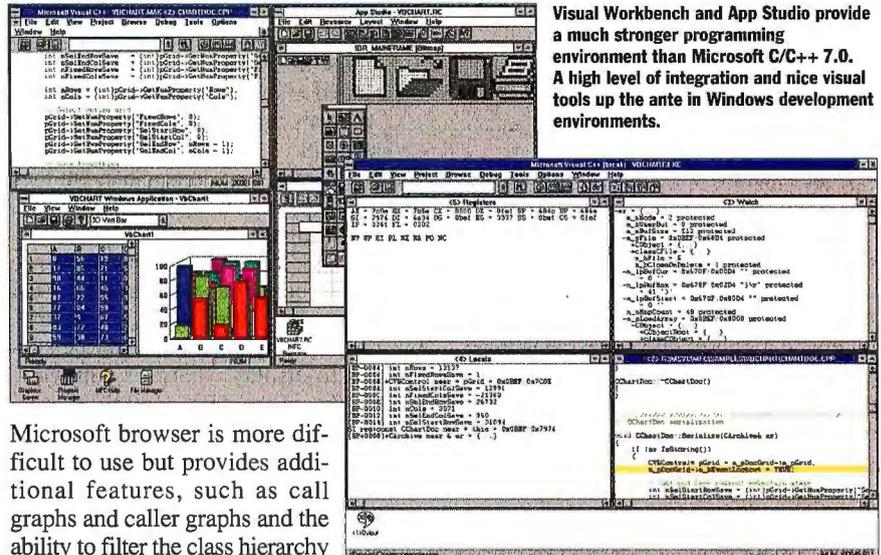
But Visual C++ won't do for C++ what Visual Basic did for BASIC. Visual C++ has little in common with Visual Basic other than its ability to use VBX-style controls. However, the common ground that VBX controls provide is important: It's the path that makes it possible to prototype in Visual Basic and move to a finished application in C++.

Visual Workbench

Visual Workbench is an integrated development environment that replaces C/C++ 7.0's Programmer's Workbench. With a full-blown Windows interface, an integrated debugger, and background compilation, Visual Workbench goes far beyond its predecessor.

Visual Workbench provides a straightforward cut/copy/paste editor similar to the one in Borland C++. Like Borland's IDE editor, the Visual Workbench editor can highlight code syntactically—for example, keywords in red, comments in green, and preprocessor instructions in blue. This may seem trivial, but it helped me catch bugs that are easily missed.

The source browser from Programmer's Workbench gets a Windows face-lift in Visual C++. Compared to Borland's browser, the



Visual Workbench and App Studio provide a much stronger programming environment than Microsoft C/C++ 7.0. A high level of integration and nice visual tools up the ante in Windows development environments.

Microsoft browser is more difficult to use but provides additional features, such as call graphs and caller graphs and the ability to filter the class hierarchy for selected symbols. For basic browsing, neither is superior. Unlike traditional browsers (but like Borland's), the Visual Workbench browser does not let you view or edit code directly. Instead, clicking on a method moves you to the editing window, opening one if necessary.

Microsoft's first Windows-hosted debugger, a component of Visual Workbench, is short on bells and whistles. It doesn't offer the wide feature set of the MultiScope debugger, but fortunately it is more robust. As with the debugger in Borland's DOS IDE, you can set breakpoints at any time and jump directly into the editor when you find a bug. This high level

The debugger integrated into Visual Workbench. It's Windows-hosted (finally), but its features are those common to many other debuggers, and it doesn't support remote debugging. Visual C++ also ships with CodeView.

of integration translates to increased productivity. However, I still had to use Nu-Mega's SoftICE to trap the nasty bugs. And since the Visual Workbench debugger doesn't support remote debugging, you need to use a large monitor to give yourself enough space for both debugger and target application. I missed the ability to debug code on another machine, but not badly enough to use CodeView (also included with Visual C++).

App Studio

Like Borland's Resource Workshop, App Studio integrates a collection of resource editors, including editors for dialog boxes, menus, bit maps, icons, cursors, and string tables. App Studio goes beyond Resource Workshop with its Class Wizard, support for VBX controls, and a superior user interface.

The Class Wizard forms the link between App Studio and Visual Workbench. Programmers can select a control in App Studio and quickly jump to the code in their program that implements that control. If you haven't written the code

MFC 2.0 FEATURES

- Printing, including print preview
- Multiple Document Interface, with toolbar and status bar
- Split windows for VBX controls
- Dialog box controls in windows
- Drag-and-drop file manager support
- OLE
- Context-sensitive help
- Code placed in shared DLL

EXECUTION SPEED

Using Thomas Lane's JPEG file-compression utility, I tested the execution speed of Visual C++ versus Borland C++ running under Windows. Execution times, in seconds, are shown for speed-optimized 386 code in both cases.

	BORLAND C++ 3.1	VISUAL C++
JPEG to PPM	6.6	6.8
JPEG to GIF	16.6	20.0
PPM to JPEG	11.5	8.6

yet, the Class Wizard whips up a simple template.

Unlike the Application Wizard (described below), which is used once to set up a project, the Class Wizard is in constant use. The Class Wizard's main purpose is to map Windows messages to appropriate methods that you define; adding a new menu command is a reason you might invoke the Class Wizard. However, you can also use it as a simple browser.

App Studio supports VBX controls. Importing a VBX control integrates it into

the control palette along with the standard Windows controls (e.g., button and check box) and makes its properties accessible through the property editor. Through the Class Wizard feature, App Studio can generate code for mapping VBX messages to C++ methods. The ease of using off-the-shelf VBX controls is a big plus for Visual C++ programmers. In testing Visual C++, I often added features in the form of VBX controls that I would not otherwise attempt.

VBX controls are convenient, but they don't replace a good class library. Compared to using grids with MacApp, for example, the VBX grid control is easier to implement but not as flexible. The VBX grid can hold text, numbers, or pictures, but the MacApp grid class can be subclassed to display whatever you want. Also, many of the VBX controls are cosmetic adjustments that add little functionality. Still, I often found VBX controls to be the shortest path to a finished product.

The real solution, of course, is to use a

class library where you need a class library and a control where you need a control. Fortunately, Visual C++'s MFC 2.0 class library is no slouch. MFC 2.0 can dramatically reduce the amount of code needed for a basic Windows program by providing an architecture and a set of pre-built components. Unlike its predecessor, MFC 2.0 adds real functionality to programs that use it. MFC eclipses other Windows frameworks, but it still has a number of weaknesses compared to some application frameworks, notably MacApp.

The Application Wizard feature provides a quick way to create all the files needed to start a new project using the Microsoft Foundation Classes. The Application Wizard is like a shell script on steroids: Check items in a dialog box, specifying a few names and planned application features (such as OLE or drag and drop), and the Application Wizard creates a project directory complete with make file and basic application shell. By using the Application Wizard, I quickly created the shell for an OLE test application that instantly had the basic menus, toolbars, and so on.

Key Application Framework Classes

Mac programmers will feel at home with Visual C++'s new Microsoft Foundation Class libraries: Much of the new terminology and architecture have been borrowed from MacApp. Here are a few key classes:

CObject supports run-time class identification, streams, and collections.

CCmdTarget command targets are objects that take part in the dynamic command routing. Menu commands, for example, traverse the command chain until "handled" by a command target.

CDocument objects manage an application's data. CDocument subclasses inherit default file-interface functionality, such as load, save, and save as.

CWinApp does many things for MFC applications automatically, such as maintaining the Windows menu and updating the list of recently used documents. Every MFC application has a class that descends from CWinApp. The single instance of this class is the application object.

CVBControl supports use of Visual Basic controls within Visual C++ programs.

CView objects are responsible for displaying data. These objects manage screen repainting and printing.

CFormView allows windows to be created in App Studio using the same tools used for dialog creation. Unlike dialogs, form views can be resized and scrolled.

CEditView provides basic text editing in a view wrapper. It's limited by functionality of the Windows edit control—one font, no styles, and a limited amount of text.

The Deciding Factors

Visual C++ is not the perfect compiler. Compilation can take two to three times longer than it does with Borland C++ 3.1. If you don't muck around with Microsoft's tedious precompilation procedure, the difference can be a factor of 10. The quality of generated code is roughly equal to that of code from Borland's compiler (see the table "Execution Speed"). Visual C++ is still based on CFront 2.1. Templates, exceptions, and flat-model 386 code generation didn't make it into this release.

Still, Visual C++ clearly sets a new target for the quality of development environments. It's a stunning upgrade that should be immediately embraced by anyone using Microsoft C/C++ 7.0. Users of other compilers will have to weigh the advantages of Microsoft's advanced environment and application framework against the lack of templates and relatively slow compilation. You may find that you have a place for more than one C++ compiler in your software toolbox. ■

About the Product

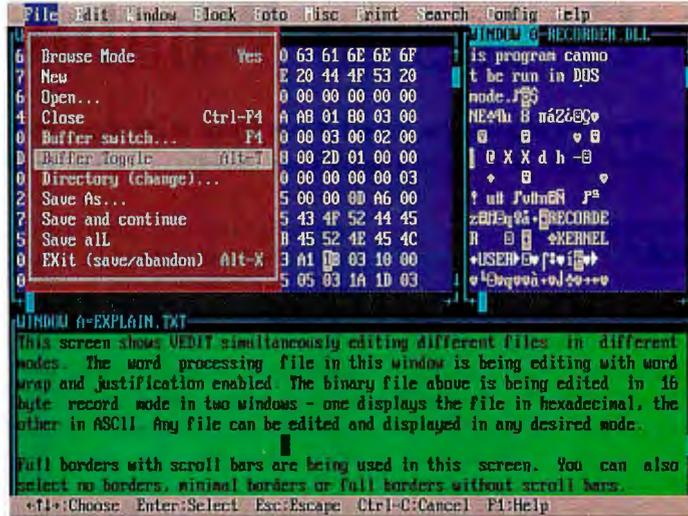
Visual C++\$499
 Microsoft Corp.
 1 Microsoft Way
 Redmond, WA 98052
 (800) 227-4679
 (206) 882-8080
Circle 1229 on Inquiry Card.

Jim Hurd is vice president of R&D at National Software Testing Laboratories (Plymouth Meeting, PA). You can reach him on BIX c/o "editors."

The Worlds First Universal File Editor

Edit Any Text/Data/Binary File Up To 2 Gigabytes

- Unique multi-mode, multi-file editor handles any text, data or binary file.
- Edit DOS, Unix and Mac text files, fixed and variable length data records.
- Edit in ASCII, Hexadecimal or EBCDIC, or combination of modes.
- Edit database, mainframe, Postscript, .EXE and other non-standard files.
- Hyper-browse CD-ROM files.
- Full featured program editor.
- Convenient word processing.
- Also VEDIT for only \$89.



Until now, data files, such as database files, downloaded mainframe files, Postscript and plotter output, .EXE executables and other non-standard files were a real headache if you ever had to view, patch, search, search/replace or extensively edit them.

Traditional text editors can't handle these files because they are non-standard or too big. Traditional disk utilities allow only the most primitive viewing and patching. Just a single corrupted data file could take days to fix, and you sweated and cursed the whole time.

A new way to handle data files

VEDIT lets you edit data files as effortlessly as text files. Its secret is incredible speed, huge file capacity and special editing modes.

File modes support DOS, Unix and Mac style text files plus data files with fixed length or variable length records. Display modes include five ASCII modes, Hexadecimal and EBCDIC, or split the screen for any combination. Search using pattern matching or regular expressions, cut and paste data files, and much more. Long lines can be horizontally scrolled or wrapped onto multiple screen lines.

Handle nasty "text" files too

Text files may sound easy to edit, but other editors choke when they hit embedded control (null) characters, very long lines or the 400 Megabyte file you are trying to put onto a CD-ROM. VEDIT handles all text files effortlessly and automatically detects the correct file type. With VEDIT you can conveniently edit any file you will ever encounter.

Speed, speed, speed

Only VEDIT has the speed to edit multi-megabyte files. Traditional text editors such as Brief(tm) and Sage(tm) are much too slow to edit files much larger than memory; and Multi-Edit(tm) is 7 times slower than VEDIT. And none of them can efficiently edit data files.

	VEDIT	Brief	Multi-Edit	Sage
Edit data/binary files	Yes	No	Some	Some
Support fixed-length records	Yes	No	No	No
Maximum line length	Unlimited	512	2048	65K
Maximum file size	2000 Meg	32 Meg	32 Meg	100 Meg
Hex/EBCDIC editing	Yes/Yes	No/No	No/No	No/No
Multiple display modes	Yes	No	No	No
Fast browse of CD-ROM	Yes	No	No	No
Global search/replace in 10 Meg file	2:49 min	>24hours	20.0 min	2:10 hour

Ultimate programmer's editor

Long a favorite among programmers, VEDIT has every advanced feature you might expect. Simultaneously edit numerous files, split the screen into windows, search/replace with regular expressions. Automatic indent, block indent, parentheses matching and block operations by character, line, file or column speed program development. Word wrap, paragraph formatting, justification, centering and many printing options are ideal for text processing.

Its unique compiler support integrates tools from different vendors and fully supports "make". VEDIT PLUS has the most powerful macro programming language of any editor. It's ideal for translating files from one format to another.

Easy to learn, easy to use

An intuitive user interface with drop down menus, hot keys, mouse support, optional scroll bars, context sensitive help, point and shoot file selection and unlimited keystroke macros make VEDIT PLUS easy to use, easy to learn. Safety features include 1000 level undo, auto-save and optional backup files.

The entire keyboard layout and everything in VEDIT is configurable with easy to use menus. With over 100 configuration parameters you can fine-tune VEDIT to your exact needs and preferences.

Installation is trivial. Only the 85K VEDIT.EXE is required (no overlays) and a full installation is only 500K.

DOS UNIX QNX

FREE Fully Functional Demo!
Call 1-800-45-VEDIT

Confidently order your VEDIT PLUS today; it comes with a 30 day money-back guarantee. VEDIT has been the choice of 100,000 programmers, writers and engineers since 1980.

VEDIT PLUS - DOS single user license: \$185; DOS network 5 user license: \$385; UNIX/XENIX, QNX, FlexOS/IBM 4680: \$285.

A new, fully functional demo of VEDIT PLUS and a shareware VEDIT Jr. are available on our BBS at (313) 996-1304.

Toll Free: 1-800-45-VEDIT (1-800-458-3348)
Telephone: (313) 996-1300, Fax: (313) 996-1308
Mail: P.O. Box 1586, Ann Arbor, MI 48103

VEDIT is a registered trademark of Greenview Data, Inc. All other product names are trademarks or registered trademarks of their respective holders.

Greenview Data

VEDIT PLUS - Universal File Editor

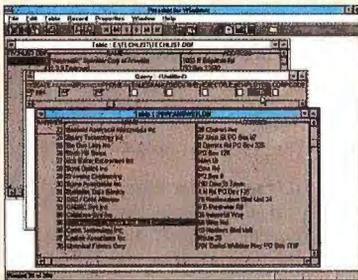
Two Roads to Windows Databases

Paradox for Windows and FoxPro 2.5 for Windows migrate from DOS. One's good for a client-server setup; the other's built for speed.

STAN MIASTKOWSKI AND
MARC SCHNAPP

If there's one thing you can be certain of these days, it's that wherever you find Borland, you'll also find Microsoft. So it's not surprising that both companies have moved well-established DOS database managers to Windows—though each by a different route. Borland has redesigned Paradox to fully exploit OOP (object-oriented programming), while FoxPro 2.5 for Windows remains true to its Xbase heritage and still boasts blazing speed on demanding jobs.

Paradox for Windows



Paradox, Borland's powerful relational database program, has evolved through four DOS versions during the past decade. The latest incarnation, Paradox for Windows, is a complete rewrite and redesign, including aggressive object-oriented access.

Data Access and Connectivity

The heart of Paradox for Windows is the Borland InterBase Engine, a core technology that will be the heart of all the company's database products. The InterBase Engine's biggest advantage is that it offers potential native access to a wide range of data formats.

The first release of Paradox for Windows lets you use Paradox and dBase (.DBF) files. Borland promises SQL access within the next few months, to be followed by modules for Interbase, Oracle, and Microsoft/Sybase, among others. The important thing to underline about the InterBase Engine is the native data access. No exporting or importing is involved. We

were easily able to create a sophisticated linked database that used a mix of both Paradox and dBase files.

Paradox has always offered extensive built-in multiuser support, which has been extended with Paradox for Windows. In a network setup, multiple users can work with data on a central server running Paradox for Windows. File and record locking is automatic, and the database owner can further restrict access to files through read and write locks.

Creating a new database with Paradox for Windows isn't much different from using any Windows database. You do have a few choices, however, such as choosing whether you want to use Paradox for Windows, Paradox 3.5, or dBase format.

Paradox for Windows offers some unique field types, although they're not exportable to other database managers. Besides the standard database fields, Paradox for Windows has *dynamic memo* and *formatted memo* fields that are useful for storing large amounts of text. The formatted memo field lets you give rich text attributes such as font, size, and color to stored text.

Stored data is often more than text, so Paradox for Windows also has two other unique field types: *graphic* and *BLOB*. As the name implies, graphic fields hold standard graphics file formats, including BMP, EPS, GIF, TIF, and PCX. BLOB (Binary Large Object) fields hold virtually any type of binary data. In a database environment, you're likely to use BLOBs for audio and motion-video files, or perhaps a CAD drawing. *OLE* fields are a specialized form of BLOBs. Using Windows' Object Linking and Embedding, they let Paradox for Windows act as an OLE host. Clicking on an object in an OLE field launches the associated application.

More Than a Windows Interface

Paradox for Windows' Database Desktop interface is new and completely different. The interface makes everything that appears on

the screen an object that you can manage and manipulate. Paradox for Windows is the first major Windows application that's completely object-oriented. From a user-interface standpoint, objects are primarily visual entities that encapsulate (i.e., hide) packets of code and data. That's one reason it's so difficult to explain how the interface works in Paradox for Windows. You have to see and use it. The Object Inspector is the key to the object-oriented interface. When you point to anything on the screen and click the right mouse button, you see a menu showing all the properties that are associated with the object.

One familiar feature of Paradox for Windows is QBE (Query by Example). Paradox was the first to incorporate it into database technology, and it works much the same way in Paradox for Windows as it does in the DOS version, although it's more graphical. Creating a query is still a matter of checking the fields you want to search and entering search criteria. It remains one of Paradox's most powerful features.

Form and report design has been vastly extended in Paradox for Windows. The program's aggressive object orientation makes the process more obvious and considerably more capable.

Data Modeling

Paradox for Windows extends Paradox's data models. You can use the usual single and multifield primary indexes, but you can also use secondary indexes. This powerful concept can dramatically speed up operations as well as create complex relationships among tables.

The program has many data-integrity

THE ROADS TAKEN

Paradox

- Object-oriented
- Multiuser support
- Native access to a wide range of data formats via InterBase Engine
- Graphical query by example

FoxPro

- Xbase-oriented
- Multiuser support
- Superb speed via Rushmore query-optimization technology
- RQBE with optimized SQL links

features. Most notable is referential integrity using foreign keys. This lets a database contain rules and conditions about what you can and can't do with its data. Also important is domain integrity, which lets you specify a valid set of values for a field.

Paradox for Windows shines at constructing extremely complex data relationships. The program's graphical object-oriented approach helps cut through the complexity of creating relationships such as one-to-many-to-many-to-many-to-one.

Application Development

Paradox for Windows' Database Desktop has all the tools necessary to create a wide range of databases. But if you want to do more, there's ObjectPAL. The successor to the DOS version's PAL (Paradox Application Language), object-oriented ObjectPAL is itself a paradox because of its range.

A user without programming experience can easily use ObjectPAL to customize an application. For experienced developers, ObjectPAL is a powerful application development environment that lets you use either its custom programming language or a visual drag-and-drop approach. There's a downside: PAL programmers have a great deal new to learn. It's also very difficult to convert existing PAL programs to ObjectPAL.

some menus and menu items have been shuffled to accommodate Windows conventions. For instance, the Windows version eliminates the DOS menu bar and places its utilities in the Help menu. In addition to the common Windows menu bar, FoxPro for Windows features a command window into which you can type Xbase commands. The main screen area becomes the TTY terminal for feedback on interactive commands. You can create MDI (Multiple Document Interface) child windows using Xbase DEFINE WINDOW commands or by invoking data-manipulation surfaces and design tools. FoxPro includes a screen painter with a user-modifiable Xbase template file to generate Xbase code.

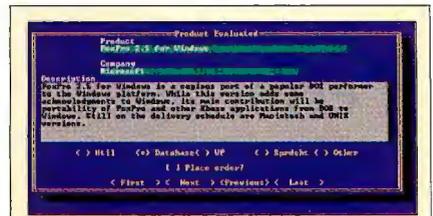
FoxPro for Windows' screen painter, report generator, and label maker let you manipulate screen objects directly, but this is not by any means an OOP environment. FoxPro's programming language is a dialect of procedural Xbase. Applications written using the supplied design tools can be moved back and forth between DOS and Windows using a "transporter" tool. To exploit DDE, FoxPro for Windows adds commands that turn FoxPro into a DDE server or client.

Leaving the Shadow of dBase

The FoxPro series was designed to live in a dBase world. FoxPro for Windows' underlying dBase-clone heritage becomes quickly evident when you examine the Xbase code it generates. FoxPro for Windows comfortably runs dBase III Plus code. However, there are still semantic differences between FoxPro for Windows and dBase IV. Microsoft has created a dBase IV Migration Kit to move dBase IV programs into FoxPro. The kit centers on a FoxPro application that analyzes the syntax of dBase programs.

FoxPro for Windows makes several significant leaps over dBase IV. FoxPro adopted dBase IV's concept of a single file holding multiple index expressions. This means that indexes are continually updated as data is entered into tables. FoxPro amplifies the idea by using its own file structure with bit-mapped indexes and advanced query optimization.

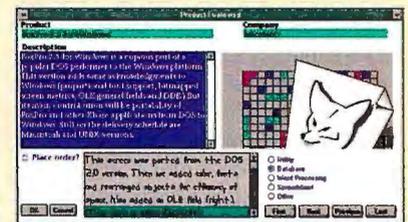
To gain the most from FoxPro, you index just about every field. With queries that include matches against multiple fields, FoxPro can generate fast result sets by finding the union of records with hits in the various indexes. FoxPro uses query-optimization technology, known as Rushmore, which has been responsible for up-



A FoxPro 2.5 for DOS character-based screen created using the screen painter.

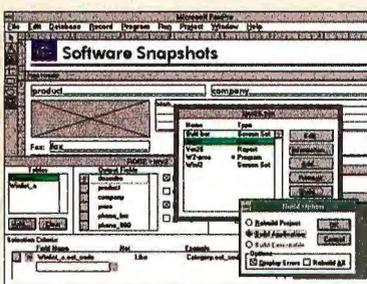


The same code runs under Windows unmodified, but the results aren't very Windows-like.



After treatment with the Windows screen designer, the application is enhanced with TrueType fonts and an OLE picture field.

FoxPro for Windows



Don't think of FoxPro 2.5 for Windows only as a Windows DBMS—although it certainly is a respectable one. As the first Windows incarnation of FoxPro, FoxPro for Windows' key strength is its ability to quickly migrate DOS FoxPro applications to Windows. FoxPro applications will run with minimal adjustments on both the DOS and Windows sides and are also compatible with dBase III Plus and dBase IV.

The New Face

FoxPro 2.5 for Windows' user interface is close to that of FoxPro 2.0, although

ping market standards in PC database performance.

Data Access and Types

Although Microsoft has touted ODBC (Open Database Connectivity) as a solution for universal connectivity to various databases, FoxPro 2.5 has no access to SQL database servers. FoxPro for Windows can access dBase III and dBase IV tables and will generate FoxPro index files automatically on the first access. FoxPro data can be exported to ASCII, dBase III, DIF, SYLK, WK1, WKS, WR1, and Excel formats.

Like previous versions, FoxPro for Windows supports multiuser operation. DOS and Windows versions of FoxPro respect each other's locks. No new commands have been added to the existing set of record- and file-locking and error-handling constructs.

FoxPro for Windows continues to use fields that can hold binary data. There is also a new General field type. FoxPro for Windows is an OLE client. By defining a field as type General in a table, you reserve a space for linked or embedded objects. There are no menu options to invoke

Performance Comparisons

RICK GREHAN

I tested the performance of FoxPro 2.5 for Windows and Paradox for Windows with a subset of the BYTE Lab/NSTL database benchmarks. These benchmarks consist of four transaction tests and three queries. Running the benchmarks required porting them from their DOS origins to the Windows environment. FoxPro for Windows happily recompiled the benchmark source code and was ready to run in just minutes. However, I had to completely rewrite the PAL source code written for Paradox to work with Paradox for Windows' ObjectPAL.

The tests simulate database operations for a book order-entry system using five tables: book, author, link (for associating author names to book titles), orders, and entry (where each entry record represents a line item attached to an order). I ran all the tests on a Gateway 50-MHz 486DX laptop with 7 MB of RAM and a 120-MB hard drive. The results (in seconds) appear in the table.

The Results

On the simple queries, Paradox does well. The first query test involves a single-table search, and Paradox outdoes FoxPro by a hair. The second query requires a three-table join, and again Paradox hits the finish line ahead of FoxPro, although this

BENCHMARK RESULTS		
	FOXPRO	PARADOX
Query tests		
#1	5.14	4.50
#2	67.23	34.01
#3	15.41	36.77
Transaction tests		
#1	12.53	10.86
#2	48.97	28.49
#3	29.75	21.05
#4	4.83	2.84

time the lead is healthy. However, in the third query—a demanding five-table join—FoxPro shines. FoxPro's secondary indexes and Rushmore optimization seem to give it the edge on more complex data sets.

In the transaction tests, Paradox does well across the board. Transaction test 1 requires an exact search, and Paradox does marginally better than FoxPro. Transaction test 4 is a simple update test, requiring an exact search as in test 1, and again Paradox is slightly faster.

Transaction tests 2 and 3 are more complex, requiring a search of a large table (25,000 records in one case) using an inexact key. ObjectPAL's set-filter method, which enables you to create a restricted view of an otherwise huge index, enabled Paradox to outrun FoxPro's seek command.

Overall, it appears that Paradox for Windows has the upper hand. The engine beneath the new Paradox is a complete rewrite of the engine living beneath the DOS version of Paradox. Borland's engineers claim that this new engine contains both ISAM-type (indexed sequential-access method)

operations and table-type operations. From a performance standpoint, the rewrite was obviously a success.

Rick Grehan is technical director of the BYTE Lab. You can contact him on BIX as "rick_g."

The RQBE module generates a unique FoxPro flavor of SQL that runs queries against DBF files. In addition to the standard SQL aggregate functions, FoxPro SELECT statements can include Xbase functions and expressions. Optionally, you can preview SQL code and save it for reuse.

FoxPro's RQBE and Rushmore query-optimization technology are intimately linked. Although Xbase programmers have always been able to link files, FoxPro cannot optimize these links; it can optimize only the performance of SQL joins. The RQBE facility is an easy way to do so.

Which for Windows?

Paradox for Windows pushes the edge of database technology while retaining surprising ease of use. The product has layers of features and abilities. The heavy-duty marketing battle between Borland and Microsoft over dominance in the growing database market unfortunately gives the impression that high-end databases are easy-to-use necessities for nearly every computer user. That's not the case. Paradox for Windows is most comfortable in a client-server environment handling huge amounts of data.

FoxPro for Windows benefits from user-interface refinements and language enhancements, but its real value is in its heritage; it's simply the most formidable Xbase contender now available. It offers a potent combination of high performance, slick tools, and a smooth multiplatform migration path that Xbase developers can exploit today. With Rushmore's superb response time, and good application design tools, FoxPro is a strong tool for downsizing applications with massive data sets that require speedy interactive queries. ■

Stan Miastkowski is a BYTE consulting editor and a Paradox user and developer. You can contact him on BIX as "stanm" or via MCI Mail at 530-9979. Marc Schnapp is acting chairman of X3J19, the ANSI committee for Xbase language standardization. You can reach him on MCI Mail at 172-5429 or on CompuServe at 73767,517.

OLE, but FoxPro for Windows adds a new APPEND GENERAL command to store objects in a table under program control.

RQBE

The nongraphical RQBE (Relational Query by Example) procedure for joining FoxPro tables lets you select picklist items for tables and join conditions. FoxPro sup-

ports outer joins, and the table browser will display one-to-many relationships. RQBE results are directed to the user's choice of a temporary cursor, a browse table, a stored DBF table, a report, a label, or a graph. Selecting a graph output invokes a graph "wizard" that aids the user in selecting from an Excel-like gallery of charts.

Product Information

Paradox for Windows\$795

Borland International, Inc.
1800 Green Hills Rd.
P.O. Box 660001
Scotts Valley, CA
95067

(408) 438-8400
fax: (408) 438-8696
Circle 1227
on Inquiry Card.

FoxPro 2.5 for Windows\$495

Microsoft Corp.
1 Microsoft Way
Redmond, WA 98052
(800) 426-9400
(206) 882-8080
fax: (206) 936-7329

Circle 1228
on Inquiry Card.

INTRODUCING THE ULTIMATE UTILITY FOR COMPRESSED DATA RECOVERY.

So you're working with compressed data, huh? You need the Norton Utilities 7.0.

NEW FEATURES

- Complete DOS 6.0 Support
- Automatic Compressed Data Recovery
- Advanced Recovery Mode for Physically Damaged Disks
- Large Hard Drive Support up to 2 Gigabytes
- Optimization of Compressed Data
- Hardware Diagnostics

This new version of the world's best-selling utility not only supports your regular files, but also offers total protection for DOS 6.0 DoubleSpace, Stacker, SuperStor, and SuperStor Pro files. No other single product gives you such complete compressed data support.

With Norton Utilities 7.0, compressed data users can take full advantage of the features Norton is famous for.

Like Speed Disk, which defragments your files for faster disk access and improved data recovery. And the Norton Disk Doctor, which identifies potential problems inside your system, and then automatically eliminates

them. Only Disk Doctor has automated repair functions—nine of them in all—designed especially for compressed data problems.

Norton Utilities 7.0 also comes with the new Norton Diagnostics. It analyzes and tests all vital system components, including memory, communication ports,



From Peter Norton, the leader in data recovery software.

and system boards. This helps prevent data loss due to sudden system lock-ups. And gray hairs due to data loss.

What's more, our Disk Editor is now armed with something we call Advanced Recovery Mode. For the first time, you can actually recover data from physically damaged disks. (Perfect for times when they mysteriously find their way into your coffee cup.)

To pick up Norton Utilities 7.0, take advantage of the upgrade offer below.

Your compressed data will thank you.

Now current customers can pick up the Norton Utilities 7.0 for up to \$130 off the suggested retail price. Here's all you do:

To Upgrade from Norton Utilities:
Send us the original first page from any version of a Norton Utilities manual* and Norton Utilities 7.0 is yours for only \$49**—you save \$130.

To Upgrade from PC Tools (any version):
Send us the original first page of your manual* and we'll send you Norton Utilities 7.0 for only \$99**—you save \$80.
Disk size 5¼ HD 3½ HD

For faxed information call 1-800-554-4403*. To order directly call 1-800-453-1062 (code AA27) or fax your order to 303-727-4611. Or enclose this card and your payment in an envelope addressed to: Symantec Fulfillment Center; Attn: Norton Utilities Offer AA27; P.O. Box 22335, Denver CO 80222-9509
 Check M.C. Visa Amex

CARD NUMBER	EXP.	
SIGNATURE	PHONE	
NAME	COMPANY	
ADDRESS		
CITY	STATE	ZIP

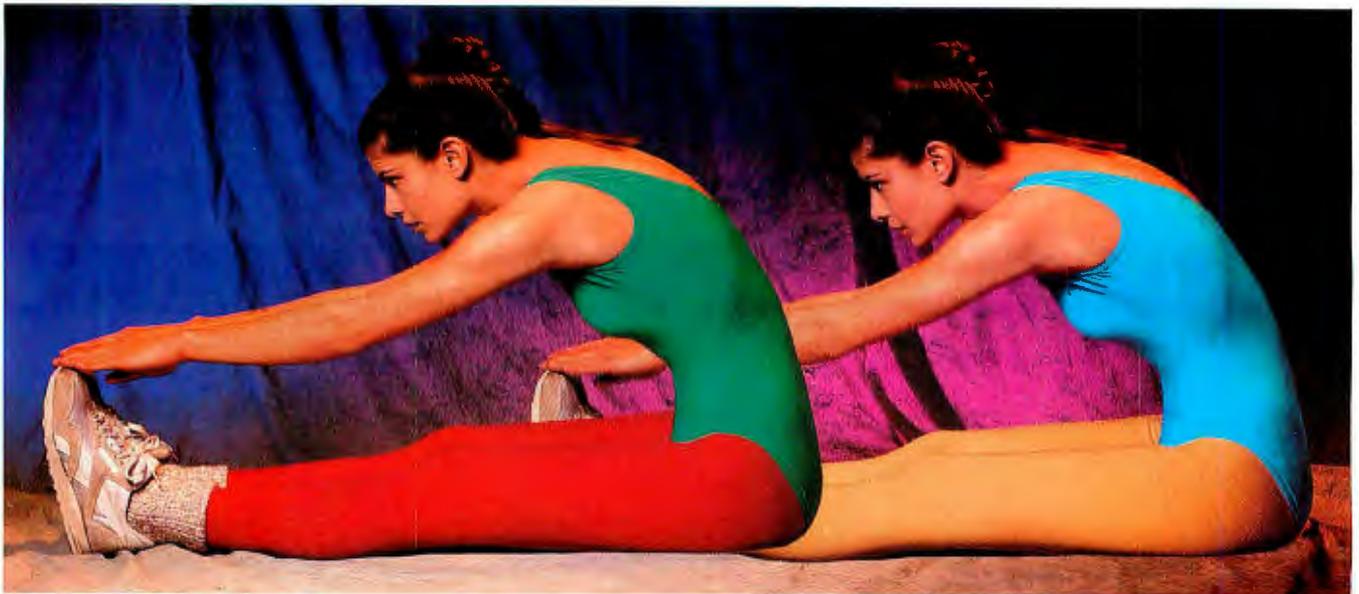
*No photocopies please. Limited to one copy for each proof of ownership.

**Plus \$8.50 shipping and handling and applicable sales tax for AZ, CA, CO, CT, DC, FL, GA, IA, IL, IN, MA, MI, MD, MN, MO, NJ, NY, OH, PA, TX, VA, WA, WI. Include applicable local tax for AZ, CA, CO, GA, NY, MN, OH, TX, VA, WA, WI. Offer good in U.S. only.
Please attach order form with payment. Allow 2 weeks for processing your order. No P.O. Boxes or C.O.D.s accepted.

THE NORTON UTILITIES
SYMANTEC

*Choose option 1, select document 475. Valid in the U.S. and Canada only. For more information in Europe, call 31-71-353111. In Australia, call 612-879-6577. In Canada, call 1-800-465-2266. Everywhere else outside U.S., call 408-238-9570. Other names are trademarks of their respective holders. Actual retail price may vary. ©1988 Symantec Corporation. If you are tax exempt, please include exemption certificate or letter providing number. Resellers are not eligible.

Circle 157 on Inquiry Card.



Exercise Your Video ... Stretch It!

Why settle for an out-of-shape graphics board? Let ATI's new GRAPHICS ULTRA+ and GRAPHICS ULTRA PRO cards pump up your computer with graphics and multimedia video acceleration.



Only the GRAPHICS ULTRA+/PRO cards come ready to accelerate¹ multimedia applications under Windows. Stretch small video images to partial or full screen for better visibility ... and maintain smooth dynamic motion (when others fall behind).

ATI's *mach32* Accelerator Chip adds the muscle to run Windows, NT, OS/2 and CAD fast... even faster

than other local bus solutions. With 2.0MB of video memory, ATI accelerates 1024x768 in 65,000 colors. Run resolutions up to 1280x1024, colors up to 24-bit, and sit-up to flicker-free graphics at 76Hz refresh rate. Plus, the best software support of ANY accelerator product with ATI, accelerated by ***mach32*** VGA, VESA or **ATI TECHNOLOGIES INC.** 8514/A drivers.

Exercise your options under Windows with the FlexDesk Control Panel or use DeskScan to pan and zoom across a virtual desktop. And our exclusive CRYSTAL FONTS smooths TrueType for laser-quality text right on-screen.



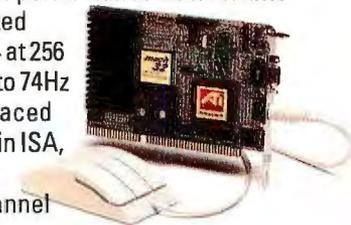
GRAPHICS ULTRA +

- ▶ Accelerated 1024x768 at 65,000 colors
- ▶ True color (16.7M) at 800x600
- ▶ Multimedia Video Acceleration
- ▶ Fast zero wait-state VGA
- ▶ Includes three button inport mouse²
- ▶ Available in 1.0MB or 2.0MB versions
- ▶ 5 year warranty
- ▶ Priced from \$399.00³



GRAPHICS ULTRA PRO adds

- ▶ Even faster performance with VRAMs
- ▶ Accelerated 1280x1024 at 256 colors up to 74Hz non-interlaced
- ▶ Available in ISA, EISA and Micro Channel versions
- ▶ Priced from \$599.00³



Avoid low impact graphics. Shape up with ATI Graphics and Multimedia Video Accelerators.

ACCELERATORS • GRAPHICS • MULTIMEDIA • COMMUNICATIONS



ATI TECHNOLOGIES INC.
3761 Victoria Park Avenue
Scarborough, Ontario
Canada M1W 3S2
Tel: (416) 756-0718
Fax: (416) 756-0720

Copyright © ATI Technologies Inc., 1993. All company and/or product names are trademarks and/or registered trademarks of their respective manufacturers. ¹Accelerates Indeo Video, RLE and Video 1 compressed files under Video for Windows. QuickTime for Windows support is planned. Performance varies depending on system configuration. ²ISA versions only. ³Suggested retail prices, dealers may sell for less. Prices and features are subject to change without notice.

Circle 65 on Inquiry Card.

HP's Simple Laser

A 4-ppm printer that breaks new ground—not your desk or your budget

HOWARD EGLOWSTEIN

The days of having a laser printer on the network and a dot-matrix printer on the desktop may be drawing to a close. As shared resources, laser printers give you crisp-looking, classy documents, but you sacrifice convenient access and document privacy.

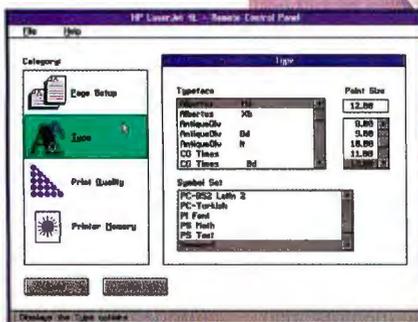
Hewlett-Packard's new low-end LaserJet 4L will break that mold. It brings the output quality of a 300-dot-per-inch laser printer to individual desktops. It includes the attributes that have made dot-matrix technology the choice for most personal printers: low cost, simple operation, and an unassuming footprint. What it lacks is speed and the expandability you might expect from high-end lasers.

The LaserJet 4L comes in two varieties. The 4L is a PCL-only (Printer Control Language) printer for DOS and Windows users, while the 4ML serves Mac clients as well, with both PostScript and PCL support. Both are compact, 4-page-per-minute, 300-dpi lasers with very unlaserlike prices: \$849 list for the 4L and \$1279 list for the 4ML.

Both printers are equipped with HP's Resolution Enhancement Technology (RET) and a new flavor of PCL, PCL5e. Each unit is just over a foot square and weighs less than 16 pounds. I tested the 4L, but the 4ML shares many of the same new features, although the extra \$430 on the 4ML's price tag brings significantly more capability. The 4L comes standard with 1 MB of RAM and an MC68000 processor, while the 4ML is packed with 4 MB of RAM, a more powerful Intel 960 processor, PostScript Level 2, and a LocalTalk port. The 4ML also offers automatic port sensing, automatic emulation sensing, and a full complement of PostScript fonts.



HP's new LaserJet 4L printer is designed for personal use. The front panel is replaced by a set of software utilities. A PostScript version (the 4ML, not shown) adds PostScript and an Apple LocalTalk port to the standard PCL5e and parallel-port configuration.



THE LASERJET 4L skips the usual front-panel controls in favor of a TSR and DOS-utility combination called Explorer. Explorer lets you adjust the print intensity, determine the number of copies, and choose among fonts without having to navigate through the branches of traditional front-panel push-button menus. It can also pop up alerts on jams or out-of-paper conditions.

technology (MEt), and other significant improvements.

Look closely and you will notice (or rather, *not* notice) the front control panel. Instead of the usual LCD and buttons, you'll see just one button and four status lights. With the 4L, you control output by activating HP's Explorer, a TSR control program on your PC. Explorer's remote control uses HP's Bi-Tronic technology. This allows information to travel back and forth between the printer and PC via the parallel port. If you run out of paper or some other error occurs, an optional pop-up mode that monitors the printer's status

For First-Time Owners

The 4L embodies a lot of new technologies, but the technical advances are mostly directed toward increasing ease of use and lowering cost. These include Explorer control software, Memory Enhancement Tech-

breaks into your DOS application with appropriate messages.

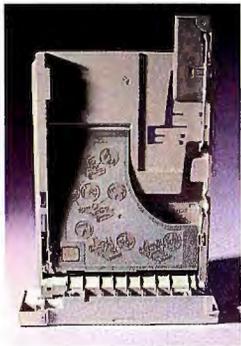
The 4L's single front-panel button takes the printer on- or off-line, resets the printer, and outputs test pages. The 4L doesn't even have a power switch. HP says its research indicated most users leave their printers on at all times, so the 4L was designed with automatic power control. The 4L remains on as long as it's plugged in. About 15 minutes after the last print job, the printer shuts down everything except its processor. Total power draw in standby mode is only 5 W. Sending a print job to the 4L reactivates it, preserving all previously set modes and downloaded fonts.

The 4L's complement of 1 MB of memory sounds skimpy. However, with MEt, 1 MB of printer memory should be enough for printing *anything* you could send to a 300-dpi printer. MEt extends memory use by compressing fonts before saving them during the initial download. MEt also exposes graphical data to a variety of compression algorithms to conserve as much memory as possible. If that doesn't do the

Reviews HP's Simple Laser

trick and there still isn't enough memory to print a given job, an Image Adapt mode kicks in and removes just enough fine detail to fit the page into the buffer. If you don't want to sacrifice the finer graphics, you can turn Image Adapt off and opt for a 1-MB upgrade.

The LaserJet 4L is simpler to maintain than traditional laser printers. It's built around a new Canon print engine that has no corona wire and fewer parts to clean. You can also save toner by printing proofs in Economode. Similar to the draft mode on many dot-matrix printers, Economode prints each page with half the usual amount of toner. This feature saves money and makes your toner last longer.



ADJUSTABLE PAPER TRAYS are common, but the mechanism on the 4L's single tray is unique. An adjustable stop on its single tray slides along a special track and locks in settings for 8 1/2- by 11-inch, executive, and B5 sheets. The tray is sized for standard A4 paper, but it also prints envelopes, labels, and transparencies. To fit legal-size paper, the slide juts off the end of the tray, allowing the paper to stick out the back of the printer.

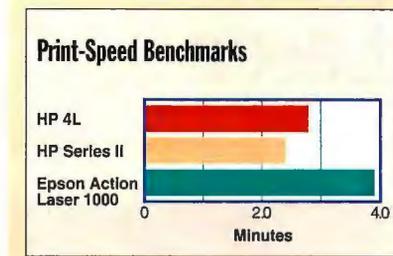
The 4L ships with Windows 3.1 drivers, drivers for many popular DOS applications, and HP's Explorer. Installing the drivers is predictably simple. A Windows application takes care of copying the drivers, checking your Windows configuration, and setting your default printer driver. The DOS application drivers are similarly easy to install. If your application doesn't support PCL5e, you can use LaserJet II, III, or 4 drivers with the 4L.

The 4L's simplicity introduces some

limitations if you'd rather coerce a 4L into an inexpensive shared resource. Swapping the front panel for a clever software solution means you can't use print-sharing devices unless they pass all the signals directly from *your* computer to the printer. You can't use the 4L with electronic sharing switches or most mechanical switch boxes, and you can't control it across a network.

Someday Your Prints Will Come

Making a printer smaller, lighter, and less expensive has its drawbacks. The most obvious of these is speed. The 4L's print engine is rated at 4 ppm, but I was able to achieve this speed only by sending a series of sparse pages, printed entirely in one font. Effective speed with standard busi-



On a series of five mixed text and graphics pages, the 4L was almost 30 percent faster than the more expensive Epson Action Laser 1000 (also 4 ppm). The 4L was slightly slower than the full-size (8 ppm) Series II. The Series II was only a few seconds faster in spite of its faster-rated print engine. The 4L uses data compression to speed up data transfers.

ness documents (mostly text) was closer to 2 or 3 ppm.

To get a quantitative measure of the 4L's print speed, I put together a number of test documents with a variety of fonts and bit-mapped graphics. I compared results for the 4L, an Epson Action Laser 1000, and a near-antique HP LaserJet Series II with 4.5 MB of memory.

The figure "Print-Speed Benchmarks" shows the results of printing a mixed text and graphics test document on each of these printers. For each printer, I installed the appropriate print driver (PCL5e for the 4L and the standard Windows Series II driver for the others) and used a second computer to capture the printer data stream. The results shown in the figure indicate the time required to copy the captured data to the printer. Printing from Windows rarely yields consistent results due to its internal task switching and memory management. Capturing the data stream eliminates these variables.

The two HP printers flew through the test much faster than the Action Laser. For a mixed document, a variety of factors affect performance; the Series II's 8-ppm print engine was a definite advantage on the simpler pages, while the data-compression algorithms built into PCL5e gave the 4L an edge on the graphics-intensive pages.

The 4L's small size is great for fitting on your desk. The trade-off is its lack of expansion options. The 4L has no font-cartridge slots, it doesn't take third-party upgrade cards, and you can't add memory beyond 2 MB. If you want PostScript, you'll have to purchase the 4ML instead of the 4L—there is no 4L-to-4ML upgrade.

In general, the 4L's output quality is excellent. HP's RET works by tracking the outline of solid graphical areas and adjusting dot position (from the standard 300 by 300 grid) to make outlines smoother. It's not the same as using a higher resolution, but it can give that illusion. RET on the HP 4L gave its output an edge over that of similarly priced printers like the Action Laser.

An informal poll (I passed print samples around BYTE) easily placed the 4L's text quality higher than the Action Laser's. It also fared better than the Series II, and its quality was better than that of a preproduction Texas Instruments microWriter (see First Impressions, April BYTE). However, I also took a more critical look at graphics samples from the 4L, examining the effects of the printer's dithering algorithms, tonal range, and coverage. The 4L's graphics displayed noticeable posterization in areas of fine detail. Both the Action Laser and the LED engine in the microWriter produced better detail and tonal range than the HP printers.

The Canon SX engine that usually runs in the Series II (and many other 8-ppm printers) prints washed-out, streaky blacks; the LaserJet 4L's microfine toner cartridge prints better. However, the HP Series II that I used for comparison was running a special third-party graphics toner cartridge (Black Lightning, Hartland, VT) that prints good, solid blacks, better than those produced by the LaserJet 4L.

A Pitch for Selfishness

Why consider a 4L? You may be printing confidential material that you don't want coming out of a shared network printer; your computer could be a long walk from the shared printer; or you may simply be working in a home office. The LaserJet 4L's two weak points, speed and expansion capability, aren't usually issues for personal printers, and you'll probably find 4 ppm more than adequate.

Most important, the 4L and the 4ML give you the same quality as big, expensive

models without taking up your entire desk and a big chunk of your cash. Forget what you learned growing up—if you buy a 4L, don't share it. Keep it all for yourself. ■

For More Information

HP LaserJet 4L, \$849
HP LaserJet 4ML, \$1279

Hewlett-Packard Co.
P.O. Box 58059/
MS 511L-SJ
Santa Clara, CA 95051
(800) 752-0900
fax: (208) 344-4809
Circle 1224 on Inquiry Card.

Howard Eglowstein is a testing editor for the BYTE Lab. You can contact him on BIX as "heglowstein."

BASIC for the Rest of Us

Zedcor's FutureBasic is a powerful (but simple) Mac development tool

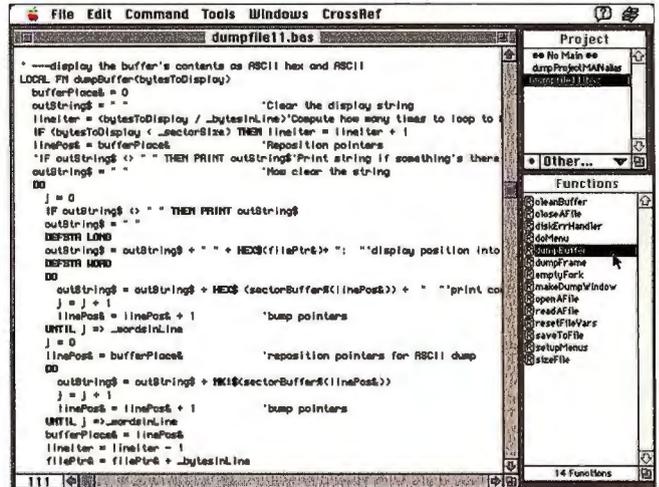
TOM THOMPSON

All you MacFolk bear with me while I speak heresy. Despite the Mac's many strengths, it's sorely lacking in good, easy-to-use development tools. Sure, there's Symantec's Think C and Think Pascal compilers. However, both C and Pascal have steep learning curves, and neither language is suitable for rapidly knocking out a quick fix. Regrettably, the Mac lacks a decent BASIC compiler. The BASIC language is easy to learn, yet powerful enough to tackle many problems. I've watched many troubles put to rest in the BYTE Lab by quick hacks whipped out in BASIC on PCs, and I've wished that the Mac was capable of the same feat.

Zedcor's FutureBasic promises to change all this. The package costs \$299.95, runs on any Mac, and requires only 2 MB of RAM. It has an integrated development environment that's similar to that of the

Think products: You write code in a program editor, interactively compile, link, and launch the application, and land back in the program editor when the application quits. The result is a quality stand-alone application, with its own resources for menus, icons, and windows.

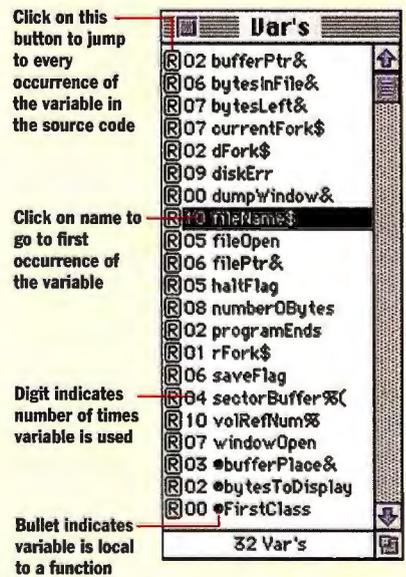
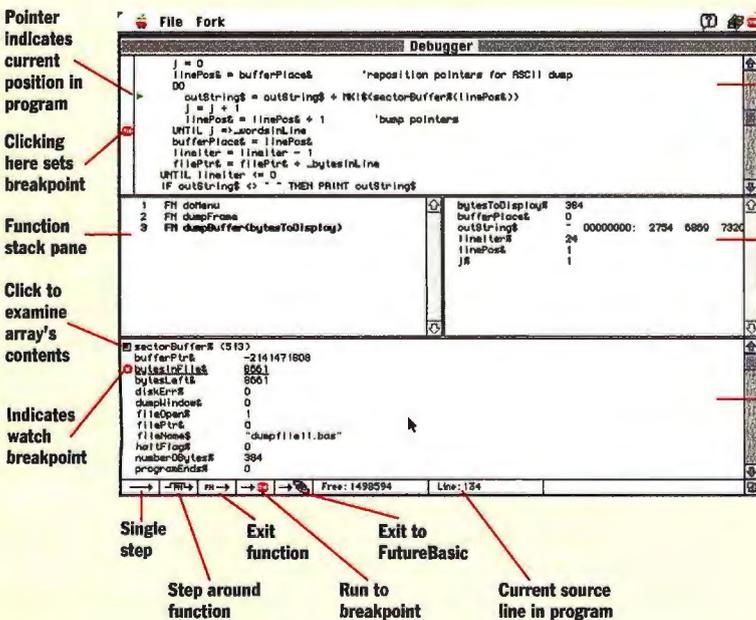
FutureBasic has many of the familiar BASIC keywords, such as DIM, DO, FOR, AND, OPEN, READ#, WRITE#, PRINT USING, LEFT\$, MID\$, and RIGHT\$. Where it makes sense, these differ from BASIC keywords from other environments. For example, the OPEN key-



FutureBasic provides a simple BASIC for knocking out real Mac applications quickly. The development environment is like that of Symantec's Think languages.

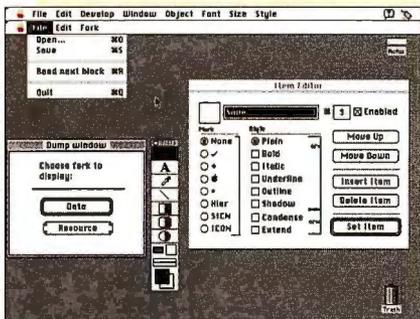
word opens a file's resource fork or data fork. FutureBasic also provides some special Mac-specific keywords, such as HANDLEEVENTS, MENU, DIALOG,

Debugger and Cross Reference Tools



FutureBasic offers a number of plug-in modules called *tools*. You launch them from a Tools menu; each provides FutureBasic with additional capabilities. Keystrokes, mouse-clicks, and other events pass first to active tools, which can act on them or pass them on to the development environment. Of the tools provided with FutureBasic, the Debugger and Cross Reference tools shown here are the most useful.

PG:PRO Application Generator



If you wish the Mac had a good Visual Basic to handle messy interface details, Staz Software has a tool for you. PG:PRO is a program generator that lets you sketch out your interface of menus, windows, and controls on-screen. When you save the completed design, PG:PRO creates both a resource file and FutureBasic files that implement most of the interface operations.

PG:PRO uses a pseudo-object-oriented design to capture events and present them as messages. As an example, there are at least three ways to open a file on the Mac: You can double-click on the file, which launches the application you used to create it; select

Open from an application's File menu and pick a file in the Standard File dialog; or, under System 7, drag and drop a file onto the application's icon. Normally, you have to set up code to field each possibility, but PG:PRO handles all three actions and provides an "open" message with the file's name and volume number.

To test PG:PRO, I reconstructed the file-dump application I'd written with FutureBasic. It was easy to design the interface, since the program's earlier incarnation gave me a good idea of what to do. I then inserted code from the older program into appropriate locations in the FutureBasic files made by PG:PRO. Sure enough, when I dragged a file to the resulting application, it opened the file and dumped its contents to the screen.

(I had to change the application's FREF resource and rebuild the Desktop file for the Finder to allow this operation, but this is an OS detail, not a problem with PG:PRO.) It took only a few hours to rebuild the application using PG:PRO, but remember that I wasn't starting from scratch.

All in all, PG:PRO makes a great partner for FutureBasic and makes it easy to design applications quickly without getting mired in the details of managing the interface.

SOUND, and WINDOW, that help you implement a rudimentary event loop, build menus, play sounds, and create dialog boxes and windows. An ON TIMER keyword lets you specify code that you want to run periodically—handy for creating timing routines or background tasks.

For us rocket scientists, there's direct access to all the Mac Toolbox calls from within the BASIC environment: You use FN (function) when using a Toolbox trap that returns a value (e.g., FN BUTTON), or CALL for a Toolbox trap that doesn't (e.g., CALL TEXTFONT(4)). Finally, FutureBasic supports the use of in-line assembly language code for those who need the ultimate in fine control.

The BASIC language uses a dollar-sign suffix on a variable name to indicate that its contents are a string. FutureBasic uses other suffixes (e.g., filePointer& or numberOBytes%) to set variable sizes and types. It

supports variable types of integer (16-bit), long integer, BCD (binary-coded decimal), and floating-point (single- or double-precision). There's no ready access to byte-size variables, and for a good reason: Such support might let you unwittingly write code that would generate an odd-address exception on 68000-based Macs. However, if you must deal with data at the byte level (perhaps within a buffer), there are the PEEK and POKE keywords. When running on 68000-based Macs, these keywords perform the required odd-address sanity checks.

Try Out

To evaluate FutureBasic, I wrote a program that lets you first select a file and one fork (resource or data) for examination. The application then dumps the fork's contents to a window as both hexadecimal and ASCII data. I was able to code all the menu choices, window display,

and file I/O using FutureBasic and Mac-specific FutureBasic keywords. Although the manuals provide copious sample code for various programs, a Control Panel, a Desk Accessory, an Apple Event handler, and even an Extension, I was never clear on how to properly write a dialog handler for HANDLEEVENT. Instead, I created my own dialog window in ResEdit, used RESOURCES to load the resource file, and used Toolbox traps to manage the dialog.

FutureBasic 1.01 has two faults—one minor, one serious. When you test-launch your application, it doesn't prompt you to save any changes you made to a file, as the Think compilers do. If the application blows up in your face, you stand to lose any changes you made to your code (maybe that's not such a bad idea after all). The big problem is that FutureBasic needs to handle low-memory situations gracefully. If memory runs low when working with large projects (common when working with PG:PRO), FutureBasic quits unexpectedly or crashes without warning. The only workaround is to give FutureBasic as much memory as you can spare.

Once completed, my code ran reliably, and both disk I/O and window drawing were snappy. I wrote most of the display code quickly, but—as usual—it took me several days to get the error handling and the interface to work properly.

While FutureBasic has flaws that need correcting, it's such a big improvement for BASIC programming on the Mac that I have to admit I like it. Zedcor has provided a powerful compiler that lets more people program the Mac. But the price is a tad steep: I would much rather see it at the introductory price of \$149 it had only a month ago. I'd like to ultimately see Zedcor and Staz merge compiler and application generator into a single product. But even as separate tools, FutureBasic and PG:PRO give Mac developers a strong development environment that mirrors Visual Basic. PC developers, take notice. ■

Tom Thompson is a BYTE senior technical editor at large and a certified Apple developer. You can reach him on BIX as "tom_thompson" or on the Internet at tomt@bytepb.byte.com.

About the Product

PG:PRO\$169
Staz Software
11A Leisure Time Dr.
Diamondhead, MS 39525
(601) 255-7085
fax: (601) 255-7086
Circle 1226 on Inquiry Card.

About the Product

FutureBasic.....\$299.95
Zedcor, Inc.
4500 East Speedway,
Suite 22
Tucson, AZ 85712
(800) 482-4567
(602) 881-8101
fax: (602) 881-1841
Circle 1225 on Inquiry Card.



CompuServe does Windows.

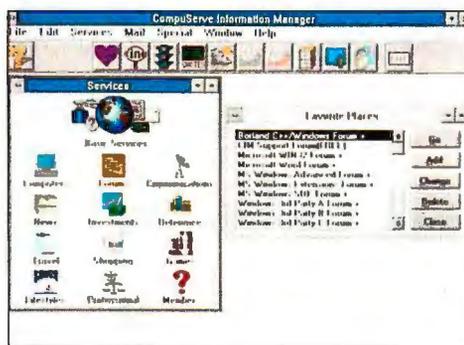
Introducing a whole new way to look at CompuServe: CompuServe Information Manager for Windows (WinCIMSM). It's a fully integrated Windows application, and lets you take advantage of Windows when you're on CompuServe. It'll make your session faster, more efficient, easier, and a lot more fun.

With the help of icons and pull-down menus, you'll find your CompuServe time is almost effortless. Cruise the forums, browse through your messages, download files — it's all about as simple as clicking a mouse button.

And with WinCIM you can do more offline, too. That means everything from writing letters to reading the answers to your hardware and software questions can be done much more economically.

So take a look for yourself. If you're already a CompuServe member, just type GO WINCIM. If you aren't, call us for more information at 1 800 848-8199. Either way, you'll soon see why

the best view is the one from CompuServe Information Manager for Windows.



CompuServe[®]
The information service you won't outgrow.[™]

The Renaissance of Imaging

Kodak releases flagship support products for Photo CD

RAYMOND GA CÔTÉ

Eastman Kodak intends to change the way graphics professionals handle photographic computer images. Instead of developing traditional photographs and scanning them into the computer, you can have the pictures delivered on a Kodak Photo CD and access them directly from your computer's CD-ROM drive.

To capitalize on the Photo CD revolution, Kodak plans an extensive line of supporting software to retrieve, manipulate, and publish Photo CD images. The first two entrants are PhotoEdge, an image editor running on the Windows and Macintosh platforms, and Renaissance, a publishing tool for the Mac.

The Edge

PhotoEdge (\$135) is a basic image editor that works with Photo CD, TIFF, and Macintosh PICT files. Both the product and the documentation are well designed and intuitive. Although you can manipulate several different image formats, PhotoEdge works best with Photo CD files. Photo CD-specific enhancements include the ability to read in a contact sheet that shows the contents of an entire Photo CD (see the screen below) and automatically displays images in any one of five resolutions. The contact sheet can display im-

ages in three different sizes and lets you define the number of columns to be displayed. These options allow you to view the maximum number of images, depending on your display monitor.

Once loaded, images can be adjusted for brightness, contrast, and color balance using a pair of scroll bars in a floating window. Changes can be previewed before you commit to the new values. PhotoEdge supports a fairly standard set of image filters. These include a smoothing filter to average the values of adjacent pixels, a sharpening filter to improve contrast, an edge filter to produce outlines, and an inversion filter to create a negative image.

I was surprised to find the image-cropping tool given such prominence in PhotoEdge. Each image window prominently displays the crop-tool button along with the current cropping dimensions. Usually, the crop operation is kept on a menu or toolbar along with other manipulation functions. However, after just a few hours, I was reminded that in a production environment, I perform cropping much more frequently than any other manipulation. You can achieve a fine level of control by dragging a rough crop outline around an object of interest and then performing minor adjustments using a combination of mouse movements and directly entered sizes.

Various image conversions are also

available. Full-color Photo CD images can be converted to 256 colors or gray scales, 16 different colors or gray scales, and monochrome. The monochrome conversion offers 18 halftone patterns used to simulate shades of gray on a black-and-white display.

Unless you are a professional user of halftones, you will find this wide selection to be rather bewildering. The documentation doesn't provide any guidance as to when particular halftone patterns are most useful. You'll need to experiment to see how particular patterns look on your printer for specific images.

You can store images in several file formats including EPSF (Encapsulated PostScript File), TIFF, and Macintosh PICT. Unfortunately, you cannot read the EPS files back into PhotoEdge. Surprisingly, the popular GIF file format is not supported.

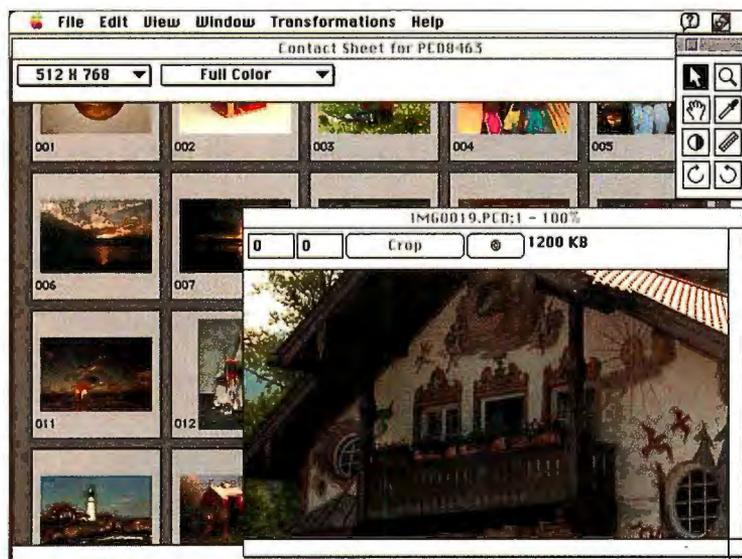
PhotoEdge is a good base-level image-manipulation program. The reasonable price, intuitive interface, and well-written documentation make PhotoEdge an excellent choice for a first imaging package and a real asset to Photo CD acceptance.

The Renaissance

When I first looked at Renaissance (\$695), I was positive that this was what the world surely does not need—another page-layout program. But, in this case, first looks are definitely deceiving. Renaissance allows you to do page design rather than page layout.

In Renaissance, the focus is on images and graphics rather than text. The program is suitable for designing advertisements, brochures, and probably even small newsletters with a heavy graphical content. Like page-layout programs, Renaissance allows you to define page dimensions, two-page spreads, multiple horizontal and vertical columns, and positions for registration marks. You can also define text boxes and link them together to produce automatic text flow from one box to the next. But that's where the similarity to page-layout programs ends.

The screen on page 147 shows a brochure cover I put together in about 5 minutes to highlight several Renaissance features. The graduated background is one of



A PhotoEdge contact sheet displays the contents of an entire Photo CD and automatically shows images in any one of five resolutions.

several stock patterns that can be stretched to any arbitrary size. Objects, such as the drawn circle, all have borders with definable sizes and colors. Images can be pasted into arbitrary shapes (including text) and automatically cropped to the image dimensions.

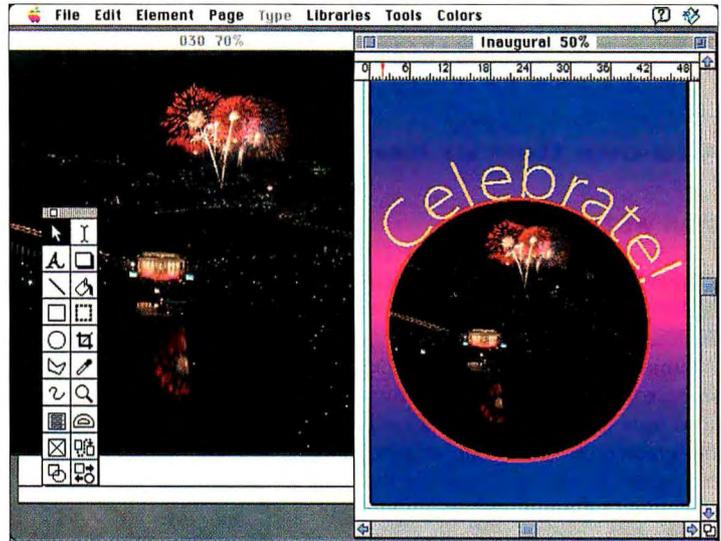
I simply dropped the photo shown here into the circle and then positioned it for best viewing. I then entered the "Celebrate!" text on the page and joined it to the circle. Renaissance automatically joined the text baseline to the graphic outline and positioned the text. I then dragged the text to the proper position at the top of the circle and stretched it out slightly. Instant brochure. You can store frequently used graphical elements in a series of on-line libraries. These libraries include text styles, text, page definitions, graphical elements, color palettes, and printer setups. For example, if a client insists that his or her brochures use a specific color scheme, you can build a color palette displaying only the appropriate colors.

The manner in which images can be moved around the page is something else that sets Renaissance apart from standard page-layout programs. Grouped graphical elements can show six different behaviors when the group is resized. The default behavior stretches all the elements both horizontally and vertically. You can also elect to stretch each element equally and not change the distance between elements. When resizing a group, you may not want to change the element size but rather just the space between elements. The "move proportionally" option changes the space between elements without changing the element sizes.

You can set each of these options for individual elements and designate different settings for behavior when stretched horizontally and vertically. Renaissance is intelligent about stretching graphical objects such as rules and borders. The weight of a stretched rule will change, but not the border around a box. Borders are controlled separately.

When Renaissance is installed, it also installs a copy of the Pantone Professional Color Matching software. This software lets you correctly select industry-standard Pantone colors on your printouts. Renaissance provides sophisticated control over printed output. If you have a color printer, particularly one that is certified to match the Pantone Color Matching software, you can just print your finished work. Most people, however, need to create color separations for a printing process. Renais-

Renaissance objects, such as this circle, have borders with definable sizes and colors. Images can be pasted into arbitrary shapes (including text) and automatically cropped to the image dimensions. (Photo by Richard W. Strauss, from the Smithsonian Institution's Photographic Collection. Used with permission.)



sance provides a fine level of control over color-separation definitions, even allowing you to define which colors will overprint others. Separated output can be sent directly to a laser printer or to EPS files for transmission to a service bureau for processing.

For your final design, text elements are as important as graphical ones. Renaissance provides a rich set of text-display and -manipulation capabilities, some of which will be familiar to those involved in typesetting. Along with standard functionality such as setting font style, tabs, and indents, Renaissance allows you to fully control kerning, letter and word spacing, leading, and drop caps. A set of special icons let you insert left, right, and center commands to override the defaults for the paragraph (typesetters will feel comfortable with the names Quad left, Quad right, and Quad center). You can also insert variously sized spaces—such as em, en, thin, and figure—and define discretionary hyphens.

Automatic hyphenation uses a rule-based algorithm or a dictionary lookup. You can also apply a combination of the two, using the rules as the default and placing the difficult-to-hyphenate exception in a lookup table. The lack of an on-line spelling checker is disconcerting; there is nothing quite as distressing as spending days on a layout only to find a misspelled word in the final copy.

Renaissance is a flexible, high-powered page-design package that I found to be very easy to use. It is ideal

for graphics-intensive page-layout tasks such as advertisements, brochures, and newsletters.

Resource Hungry

Both these products will happily swallow all the processor power and memory you can provide and come back looking for more. PhotoEdge, a relatively small (480-KB) application, can require around 30 MB of memory when manipulating the largest images (2048 by 3072 pixels in full color). Renaissance has similar resource demands, particularly when you are designing pages with multiple photos and text tied to complicated graphical objects. While reviewing these two products on a Mac IIci, I frequently had time to grab a cup of coffee while waiting for an image to load. Small images load quickly, but if you plan to do professional-level work, you'll want a fast system and a big hard drive.

Kodak PhotoEdge and Kodak Renaissance run the range from entry-level to professional-quality tool. They demonstrate that Kodak is seriously attempting to address image-processing needs at all levels. PhotoEdge is an excellent choice for casual image manipulation. I recommend Renaissance for anyone needing to create small multipage graphical documents. ■

For More Information

Kodak PhotoEdge..... \$135

Kodak Renaissance... \$695

Eastman Kodak Co.

343 State St.
Rochester, NY 14650
(800) 242-2424, ext. 53
(716) 724-1021, ext. 53
fax: (716) 781-5986

Circle 1223 on Inquiry Card.

Raymond GA Côté is a software development engineer for Appropriate Solutions. He also edits Robot Explorer newsletter. You can contact him on BIX as "rgacote" or on the Internet at rgacote@world.std.com.

Windows Dressing

Add-ons that enhance, streamline, and simplify Windows

STAN WSZOLA

Everyone has a unique method for organizing applications and files under Windows. Even if you run a common set of programs (e.g., a word processor, spreadsheet, and communications package), you've probably changed the screen colors, program groups, icons, and other elements to modify the Windows desktop environment to suit your own style.

In this review, I look at 12 packages that customize and enhance your Windows desktop. These packages help you launch programs, manage files, organize your work flow, and personalize the appearance of your Windows desktop. No two do the same job in the same way. Some utilities can replace the Windows desktop with a different metaphor for organizing your working environment. Other packages have a smaller list of features and concentrate on improving or enhancing the built-in Windows program and file management tools.

Since each of these packages takes a unique approach to common features, a head-to-head comparison is difficult. Instead, I'll explain some of the features common to all the packages and discuss outstanding software in more detail. Some of the common features in each package are only components of larger Windows utility bundles. Take a close look at the table "Features of Windows Accessories" to see exactly what components each package includes.

Here I'll focus on attributes like program launching and virtual-desktop capabilities, but there are other useful utilities such as file managers, file and text finders, and system-resource displays. In selecting any package, look at the range of features to determine the best mix of utilities for your needs. Remember, though, that an appropriate selection involves more than a simple feature comparison. Because these packages can change the look and feel of Windows, you must make a basic decision. Do you want to overhaul the Windows interface and impose a more structured working environment, or would you rather stick with the basic operation of the Program Manager?

Amish Utilities offers a set of small programs for creating sticky notes, managing files, monitoring memory usage, and launching applications.

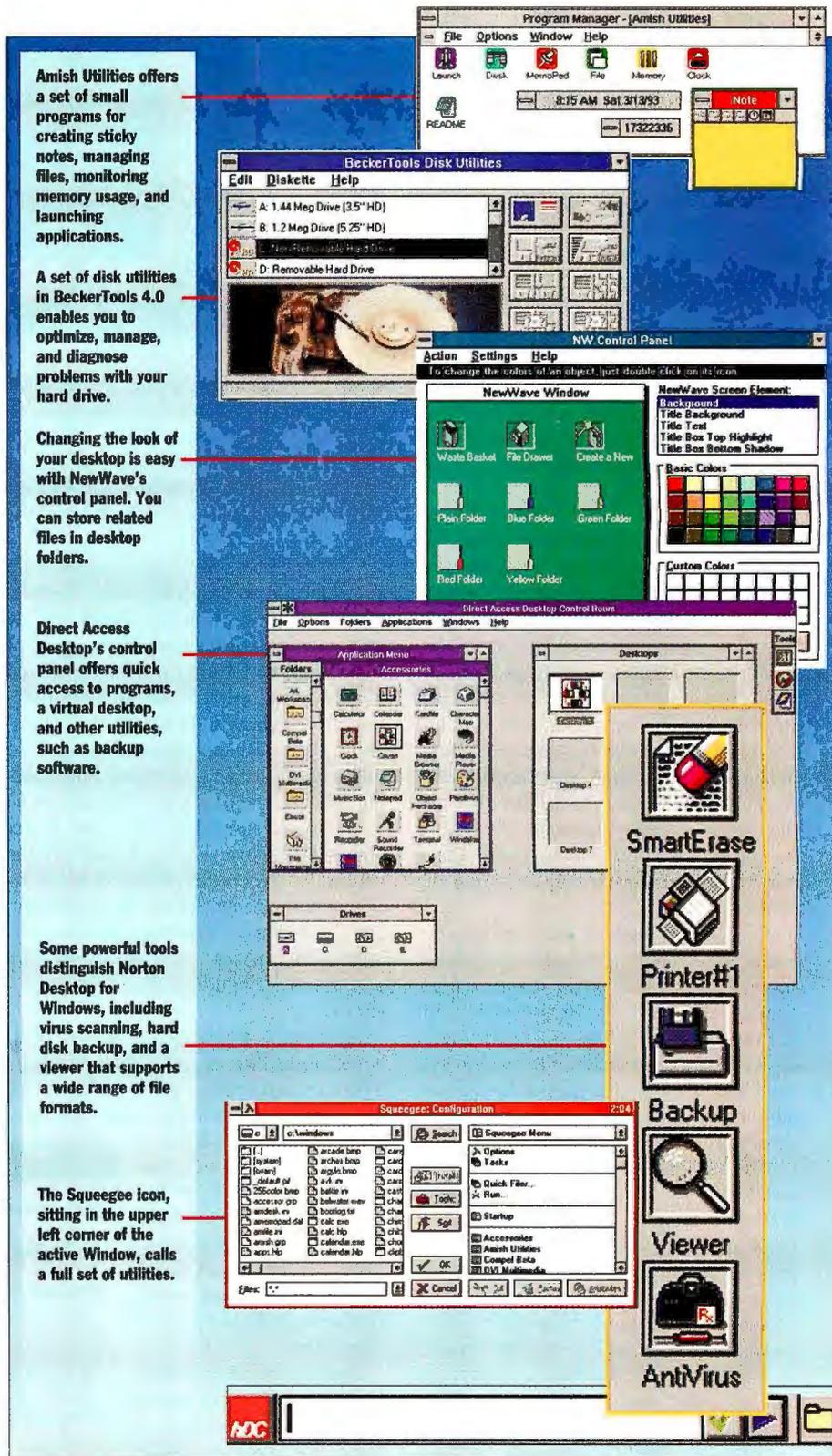
A set of disk utilities in BeckerTools 4.0 enables you to optimize, manage, and diagnose problems with your hard drive.

Changing the look of your desktop is easy with NewWave's control panel. You can store related files in desktop folders.

Direct Access Desktop's control panel offers quick access to programs, a virtual desktop, and other utilities, such as backup software.

Some powerful tools distinguish Norton Desktop for Windows, including virus scanning, hard disk backup, and a viewer that supports a wide range of file formats.

The Squeezeee icon, sitting in the upper left corner of the active window, calls a full set of utilities.



Program Launchers

Complete Communicator

Digital Soup	
ATM	Ctrl+Alt+A
Laplink	
Conversion Artist	Ctrl+Alt+C
Excel	Ctrl+Alt+E
PageMaker	
Terminal	Ctrl+Alt+T
Write	
Paint	
Cardfile	
Calendar	



Program-launching utilities give you an easy method for running applications from a menu or toolbar. All the packages I've reviewed here function as launchers. They all provide convenient commands for finding and launching applications under Windows.

Some of these launchers are quite sophisticated and offer a boggling array of features. You can use a configurable toolbar that will launch any application with a mouse-click, and you can configure toolbars to automatically load with each of your applications.

Each accessory package takes a slightly different approach to launching applications. All the packages reviewed are add-ins that leave the Program Manager as the primary shell. Some launchers, such as Hewlett-Packard's NewWave 4.1 and Symantec's Norton Desktop for Windows 2.0, give you the option of replacing the Program Manager entirely.

Launchers come in two flavors: a pull-down list or a toolbar filled with icons. The most flexible list launchers, such as hDC's Power Launcher 2.0 and Icom Simulations' Squeeze for Windows, position icons on the title bar of the active window. You click on the icons to launch programs or access drop-down menus for further options. With both the launch lists and toolbar packages, you can also define the type of files that are associated with applications (e.g., text files with word processors and graphics files with graphics editors). You can then click on a document icon to run the associated program.

Toolbar or toolbox launchers provide a collection of icons corresponding to those in the Program Manager groups. You can position the toolbar anywhere within the screen area. The toolbars offer the advantage of high visibility with easily recognized icons. The disadvantage is that the toolbar takes up room on your computer's screen. Some toolbars, such as hDC's Power Launcher and Task Manager 2.01

WinTools has a strong drag-and-drop orientation. Drop a file on the trashcan object, and the file's gone.

The Metz Task Manager replaces its Windows counterpart and provides additional functions, including a toolbox launcher and file utilities.

By maintaining sets of files in project folders, Workspace for Windows can restore a complete working environment.

The Power Disk window reveals WinMaster's strongest suit: an impressive set of disk utilities and drive-optimization software.

XTree features a convenient replacement for the File Manager. It can even manage ZIP files.

The features of Power Launcher are available from a convenient ribbon stretching across the top of the screen.



Reviews Windows Dressing

FEATURES OF WINDOWS ACCESSORIES

These tools offer a host of useful functions, from program launching to file recovery to resource tracking. (○ = yes; ● = no.)

NAME	BECKERTOOLS 4.0	AMISH UTILITIES FOR WINDOWS 2.0	WORKSPACE FOR WINDOWS 1.0	DIRECT ACCESS DESKTOP	POWER LAUNCHER 2.0	NEWWAVE 4.1	SQUEEGEE FOR WINDOWS
Manufacturer	Abacus Software	Amish Software	Ark Interface	Fifth Generation Systems	hDC Computer Corp.	Hewlett-Packard Co.	Icom Simulations
Price	\$129.95	\$99	\$149	\$129	\$99.95	\$195	\$79.95
Desktop features							
Load as Program Manager shell	○	○	○	○	●	○	●
Install user applications as icons	○	○	○	○	○	○	●
Display files as icons	●	●	○	○	●	○	●
Drag and drop icons	●	○	●	○	○	○	●
Configurable menus	●	○	●	●	○	●	○
Password security	●	●	●	●	●	○	●
Link files and applications	○	○	○	○	○	○	○
Link sounds and applications	●	●	●	●	●	●	●
Launch applications	○	○	○	○	○	○	○
Task switching	●	●	●	○	●	●	○
Virtual desktop	●	○	●	○	○	●	●
File management features							
Drag and drop files onto desktop	○	○	○	○	○	○	●
Drag and drop files onto applications	●	●	●	○	●	○	●
Manage program groups	○	●	●	○	●	●	○
Filename limit (characters)	8	8	●	8	8	32	8
File viewer	○	○	○	●	●	●	●
File formats supported	9	9	Icons	ASCII	ASCII	ASCII	ASCII
File finder	○	○	●	○	●	○	○
Text finder	○	●	●	○	●	○	○
File archive/compression	○	●	●	●	●	●	●
Rename files/directories	○	○	○	○	●	○	○
Text editor	Text and Hex	Notes editor	●	○	●	○	●
Directory cut and graft	○	○	●	●	●	●	○
Drive management							
Optimize drive	○	●	●	●	●	●	●
Tree and file list	○	○	●	○	●	●	File list
Expand/collapse tree	○	○	●	○	●	●	○
File filter	○	○	●	○	●	●	○
Format disk	○	●	●	●	●	●	●
Copy disk	○	●	●	●	●	●	●
Back up to tape	●	●	●	●	●	●	●
Back up to floppy disks	○	●	●	○	●	●	●
Data recovery							
Disk diagnosis	○	●	●	●	●	●	●
File undelete	○	●	●	●	●	●	●
Trashcan	●	○	●	○	○	○	●
File shredder	●	●	●	●	●	●	●
Virus scanning	●	●	●	○	●	●	●
Accessories							
Calculators	●	●	●	●	●	●	●
Screen saver	○	●	●	●	○	●	●
Icon editor/library	○	●	●	●	●	●	●
Customize tool icons	○	●	○	●	○	●	●
System information	○	●	●	●	○	●	●
Resource information	○	○	●	●	●	●	○
Batch commands	●	●	●	●	○	●	●
Macro commands	●	●	●	●	○	○	●
Scheduled macro commands	●	●	●	●	○	○	●
Network compatibility							
Use across network	●	○	●	●	●	○	●
Share files across a network	●	○	○	●	●	○	●

What to do when Windows® won't work.

PC Certify™ from Landmark resolves hardware and software conflicts FAST!

CPU & System Board Tests -

Clock speed, instruction set, DMA controller 1 & 2, interrupt controller 1 & 2, CMOS RAM, 8253/8254 timer, math coprocessor (instruction set).

COM & LPT Port Tests -

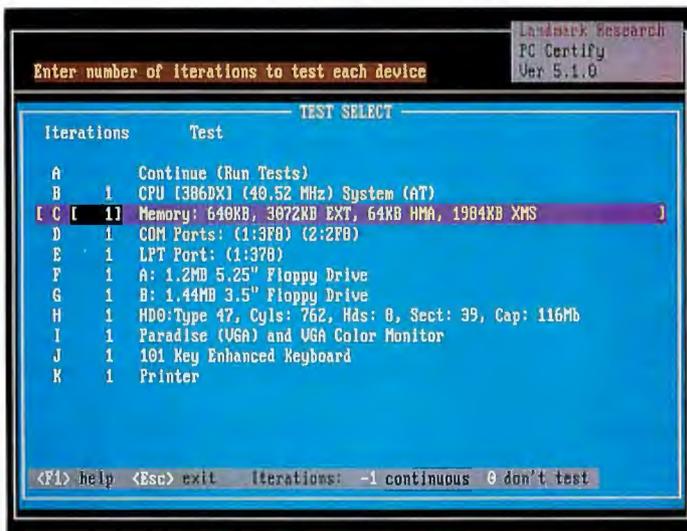
COM (1, 2, 3, 4), LPT (1, 2, 3, 4), internal loopback, identifies addresses.

Hard Drive Tests -

Non-destructive testing of drive and controller for MFM, RLL, IDE, ESDI, and SCSI. Includes identification of IDE specs (hds, cyl, spt) for quick and easy setup.

CMOS Save & Restore -

CMOS recovery program for restoring lost CMOS settings.



Memory Tests -

Tests conventional, UMB, HMA, XMS, extended and expanded, identifies address, bit, and parity failures, displays bad RAM address.

Floppy Drive Tests -

Non-destructive tests for 3.5" and 5.25", with high and/or low density controllers.

Video Tests -

Text attributes, ASCII character display, scrolling character set, high and low resolution graphics, EGA/VGA color tests. Supports Hercules, MONO, CGA, EGA, and VGA (up to 1MB).

Printer & Keyboard-

Printer character and barber pole tests, 84 and 101 key model keyboards.

WHAT IS PC CERTIFY?

PC Certify is an easy-to-use, non-destructive PC diagnostic program designed to quickly identify hardware faults and system configuration errors. Windows setup problems can be frustrating. You don't know whether it's the software, configuration, or a hardware fault. With PC Certify you'll quickly be able to pinpoint what the source of the problem is.

WHAT DOES PC CERTIFY DO?

PC Certify software allows you to easily:

- Diagnose hardware vs. software failures.
- Identify system setup problems.
- Keep track of system upgrades and configuration changes.
- Run a complete preventative maintenance check on your system.
- Print a testing and certification report for quality control and inventory records.



WHY YOU NEED PC CERTIFY

Few things are more aggravating than computer downtime and lockups. You waste time waiting for help and usually pay a dear price to get it when you finally do. Your time is valuable, so let PC Certify handle the problem for you.

Anyone can use PC Certify. Simply run the program in AUTOMATIC or QUICK MODE, sit back, and relax while PC Certify scrutinizes and tests your computer system for hardware failures.

Once the battery of tests is complete (usually within minutes), a Test Results Summary will be on your computer screen. You can route the summary to a disk file or your printer. Either way, you'll know what's wrong with your PC hardware.

SLASH TECHNICAL SUPPORT TIME

When you find yourself needing technical support for your software and hardware or when you experience a computer malfunction, PC Certify is the quick, inexpensive answer.

With PC Certify on your system, you can quickly identify the source of the problem; hardware, software, or configuration. Telephone support becomes fast and easy. Repair bills drop like a rock (50% and more of your repair bills are for diagnosing the problem. PC Certify does it for you at NO COST!).

EASY PC INVENTORY CHECKS

With PC Certify you can check your system configuration and use the hidden database to compare the current configuration with the original. This will eliminate unauthorized system configuration changes or loss of computer system components. You'll identify hardware problems and know exactly what parts you'll need to repair your system.

PRODUCT FEATURES

- Run tests in single or multiple passes.
- Run tests with or without operator interaction.
- Prints system certification document.
- Utility included to park the hard drive.
- Detects and stores presence of major system components.
- Keeps an up-to-date internal database with complete system information.
- Internal database can be output to delimited ASCII file to any database for tracking of system assets and configuration changes.
- CMOS Save & Restore CMOS recovery program.
- Includes easy to understand on-line help & manual.



SYSTEM INFORMATION

- Displays DOS environment.
- Displays AUTOEXEC.BAT.
- Displays CONFIG.SYS.
- Displays software interrupts.
- Displays BIOS RAM data area.
- Displays ROM copyrights and text strings.



COMPATIBILITY

PC Certify requires 256K of RAM, DOS 3.0 or greater, and is compatible with all IBM PC/XT, AT, 386, 486, or true compatible computers. PC Certify is not a Windows program. It can be run in Windows configured in Standard mode. However, it is imperative that you run any PC diagnostic from DOS or a boot disk and not from within Windows, otherwise you will not be able to fully test your memory and hard disk functions.

- 90 Day Money-Back Guarantee
- Toll-Free Lifetime Tech Support
- Discount Two-Day Shipping

ORDER DIRECT:
Call (800) 683-6696

FAX (813) 443-6603 • Int'l (813) 443-1331

LANDMARK
RESEARCH INTERNATIONAL CORPORATION

703 Grand Central Street • Clearwater, FL 34616

Copyright © 1992. All Rights Reserved. PC Certify is a trademark of Landmark Research International Corporation. Windows is a registered trademark of Microsoft Corporation. Other names are trademarks of their associated owners.

Circle 141 on Inquiry Card (RESELLERS: 142).

Regularly \$99
Now Only \$39!
Save 60%!

the operating system and the user interface to a greater degree. And, while all Mac applications share a common user interface, NewWave has to contend with a wide variety of Windows applications, each with its own unique interface.

File Management



File management is a critical component of Windows accessories. You need to know what files you have, where your files are, how to get them, and how to keep them intact. One of the major complaints about Windows has always been the File Manager. Although the File Manager has improved with each Windows update, it is still somewhat clumsy and inadequate. The utilities covered here include all the basic functions of the File Manager while adding important features—such as file viewing—that the File Manager lacks.

I appreciate Norton Desktop for Windows because I know that no matter what happens, I can always find, copy, back up, or recover my files. The Norton Desktop is not extraordinary in appearance. The Desktop displays the drive icons on the right, with a toolbar on the left. Clicking on any drive icon brings up the Norton File Man-

ager window. Similar to the Windows File Manager, the Norton File Manager includes a set of buttons to let you move, copy, delete, sort, and filter elements in the file display. You can drag and drop files from one drive window to another or onto the printer icon on the toolbar.

Norton Desktop presents you with a user interface that is better than Windows' but not as unusual as that of NewWave or Workspace for Windows. Norton's Quick Access module looks and works like the Windows Program Manager; however, it provides password protection to selected files within groups. You can also position groups and icons directly on the desktop, and you have the option to display groups in normal mode, in a list, or in a toolbox. Another popular feature allows you to browse through word processing, spreadsheet, database, and graphics files in 45 formats.

Norton Desktop is configured for use across a network, and the latest version includes support for Microsoft's Windows for Workgroups, allowing you to send mail or files to other WFW users. You can purchase a Network Menuing Administration Pack to simplify setup and maintenance. The administration module lets you standardize the look of the Norton Desktop across a network and control access to applications and files.

With so many features and accessories, there is no doubt that Norton Desktop for Windows is the best of the file and hard disk management accessory packages. The sheer volume of its features takes it be-

yond a collection of accessories and turns it into an excellent working environment. Of the packages reviewed, the only other one that comes close is BeckerTools 4.0. It has a similar set of utilities, but it lacks the network support. I took the file management component from BeckerTools and used it to replace the Windows File Manager. I then had a more functional file manager without having to overhaul my Windows environment. BeckerTools has a convenient toolbar in its file management shell for one-click deleting, searching, viewing, printing, editing, or executing files.

Choosing a Set of Utilities

After working with all these packages, I naturally developed a few favorites. Unfortunately, few of these Windows utility compilations offer the best of every feature. The Power Launcher has the best program launcher; NewWave offers the most comfortable desktop metaphor. I was intrigued with the Workspace for Windows environment, but it's a little too cute to work with on a daily basis.

It's too bad you can't buy just the desktop metaphor from NewWave, or the virtual desktop from Amish Utilities. As a complete package, I like Norton Desktop for Windows best. It's not the best in every category, but the desktop organization is very strong and the package includes all the Windows tools you'll ever need. ■

Stan Wszola is a testing editor for the BYTE Lab. You can reach him on BIX as "stan."

Company Information

Abacus Software, Inc.

(BeckerTools 4.0)
5370 52nd St. SE
Grand Rapids, MI 49512
(800) 451-4319
(616) 698-0330
fax: (616) 698-0325
Circle 1230 on Inquiry Card.

Amish Software, Inc.

(Amish Utilities for Windows 2.0)
541 Cowper St., Suite A
Palo Alto, CA 94301
(415) 323-4627
fax: (415) 323-0138
Circle 1231 on Inquiry Card.

Ark Interface, Inc.

(Workspace for Windows 1.0)
1201 Third Ave., Suite 2380
Seattle, WA 98101
(800) 275-3698
(206) 654-4127
fax: (206) 654-4188
Circle 1232 on Inquiry Card.

Fifth Generation Systems, Inc.

(Direct Access Desktop)
10049 North Reiger Rd.
Baton Rouge, LA 70809
(504) 291-7221
Circle 1233 on Inquiry Card.

hDC Computer Corp.

(Power Launcher 2.0)
6742 185th Ave. NE
Redmond, WA 98052
(206) 885-5550
Circle 1234 on Inquiry Card.

Hewlett-Packard Co.

(NewWave 4.1)
974 East Arques Ave.
Sunnyvale, CA 94086
(800) 554-1305
(408) 720-3441
fax: (408) 720-3560
Circle 1235 on Inquiry Card.

Icom Simulations, Inc.

(Squeegee for Windows)
648 South Wheeling Rd.
Wheeling, IL 60090
(708) 520-4440
Circle 1236 on Inquiry Card.

Metz Software, Inc.

(Task Manager 2.01)
P.O. Box 6699
Bellevue, WA 98008
(206) 641-4525
fax: (206) 644-6026
Circle 1237 on Inquiry Card.

PC-Kwik Corp.

(WinMaster 1.5)
15100 Southwest Koll Pkwy.
Beaverton, OR 97006
(503) 644-5644
fax: (503) 646-8267
Circle 1238 on Inquiry Card.

Symantec Corp.

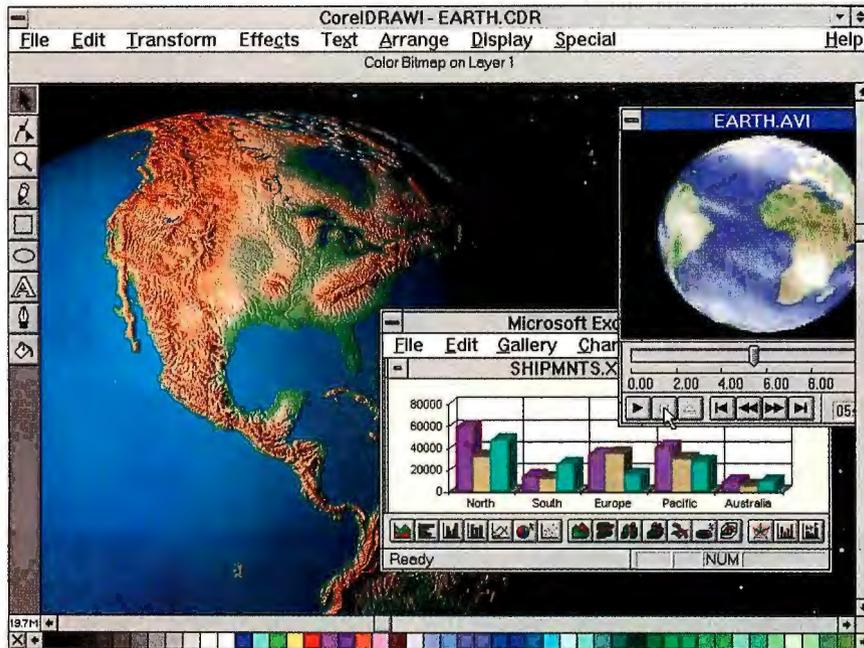
(Norton Desktop for Windows 2.0)
10201 Torre Ave.
Cupertino, CA 95014
(408) 253-9600
fax: (408) 253-4092
Circle 1239 on Inquiry Card.

Tool Technology Publishing

(WinTools 1.0a)
1125 A St., Suite 107
San Rafael, CA 94901
(415) 459-3700
Circle 1240 on Inquiry Card.

XTree Co.

(XTree for Windows)
4115 Broad St., Building 1
San Luis Obispo, CA 93401
(800) 876-6368
(805) 541-0604
fax: (805) 541-8053
Circle 1241 on Inquiry Card.



Now Windows users are opening
a new world of possibilities.

The new Bernoulli® 150. The standard in removable storage.



The Bernoulli 150 is a MultiDisk drive. So it not only reads/writes 150MB disks, but 35, 65, 90 and 105MB disks, too. It even reads our 44MB disks.

Ah, the things you can do with software these days. Amazing, isn't it? That's why we created the new Bernoulli 150 removable drive. So you can get more out of your storage than ever before—more freedom. More excitement. And frankly, more storage. With the new Bernoulli, you can explore new ideas without running out of space. You just add inexpensive disks in the sizes and prices you need—150, 105, 90, 65 & 35MB. That's what we call MultiDisk™.

And since no one has time to sit on their hands, we offer a very quick 18-msec effective access time. As you might have guessed, only award-winning Bernoulli Drives give you this much potential.

What's more, you can take your data where you need it, when you need it. Free from worry.

CorelDRAW bundle offer. Call 1-800-283-7608.

Sound good? Give us a call today for more information. Or visit your local dealer. And from now on, expect the world out of your storage.



©1993 Iomega Corp. The Iomega logo and Bernoulli are registered trademarks, and MultiDisk is a trademark of Iomega Corp. All other products are trademarks of their respective holders. For customer service in U.S.A. and Canada, call 1-800-456-5522. In Europe, call 49-761-45040. For worldwide customer service, call 1-801-778-3000. For accessory items, call IOMART at 1-800-723-3770.

Circle 100 on Inquiry Card.

HANDS-ON TESTING

DESKTOP DYNAMITE:

We test 50- and 66-MHz 486DX2 and 486DX systems to find the best machines for DOS, Windows, and Unix

RICHARD FOX, ALAN JOCH, LEONARD PRESBERG, AND LESLIE REISZ

If you need the most powerful PC you can buy, consider one of the 116 systems tested here. These 50- and 66-MHz 486DX2s and 50-MHz 486DXs allow you to run today's business and scientific applications efficiently. What's more, these systems are a hedge against obsolescence: Even in light of Intel's recent Pentium announcement, high-end 486s should remain the processors of choice for most single-user workstations well into next year. And if Windows NT, OS/2, or Unix is in your future plans, these 486s can adequately handle those 32-bit environments.

We chose winners and runners-up that are particularly suited to important applications under DOS, Windows, and Unix. The list at the far right shows our choices for the best systems. In subsequent pages, we recommend the best 486s that are highly expandable and those that are inexpensive. We also evaluate the various graphics chip sets, disk caches, and local-bus schemes these systems use and show how these design choices relate to system performance.

We found that the local bus has taken high-end systems by storm. We ranked a total of 29 systems as winners or runners-up, and only five—from Computer Sales, Hertz, Swan, Micro Express, and Unisys—didn't use a local bus to speed the graphics subsystem. All the ranked local-bus systems used the VESA implementation, the VL-Bus, except for those from Dell and NEC, which used proprietary schemes.

The graphics-accelerator choices by systems vendors also proved to be significant. Of the top 15 performers in our graphics tests, 13 used the Weitek Power 9000 (the remainder used the S3-805 accelerator).

Best of all, the marketwide drop in hardware prices over the last 18 months has also touched the high end. Although the most expensive systems we tested sell for \$10,000, we can recommend 10 systems for under \$2700 that performed close to the fastest systems and were built to last.

But not all the trends we found were positive. Quality control is a pervasive problem: 40 out of the 116 systems we received either wouldn't boot on the first try or had some other serious hardware problem.

How to use this guide

To find the best high-end system, follow the main headings until you come to the application category that most closely matches yours. Then look to the Best Overall, Most Expandable, or Low Cost summaries. In all cases, higher index numbers indicate faster performance. Our decision was

based 50 percent on performance, 30 percent on features, and 20 percent on ease of use. Although you can use high-end 486s as network servers, this report focuses on their suitability as single-user workstations. The prices we quote are list prices for our as-tested configurations.

Summary boxes detail the best systems for each application category. For each application, we name best overall, most expandable, and best low-cost systems.

Besides the top pick, each summary box gives the vital statistics for other outstanding systems.

BEST OVERALL Xinetron X/LAN 486DX2

This 5-foot-tall mini-tower ran our word processing tests faster than any of the runners-up did and scored a virtual tie with the Best 486EV as the fastest system for the spreadsheet test suite. Its storage subsystem, which is built around a 340-MB Meador SCSI drive with 1 MB of cache, was the fastest in this group, as was the system's VL-Bus graphics system. We found this system easy to live with: We could quickly add expansion cards, thanks to its easy-to-remove case and accessible add-on slots and SIMM slots. The system comes standard with a 36-month warranty and an informative manual.



The top system in each group. We point out the qualities that made us choose this system as best for this application.

The deciding factors for this category. Speed-index numbers change from application to application, because we calculate these indexes based on tests most appropriate for the category. For example, the speed index in the database category is most dependent on our database application test.

	PROCESSOR	CASE PRICE	SPEED INDEX	EASE OF USE	BUS	DISPLAY (MAX. RES.)	HARD DRIVE	RAM CACHE (KB) STANDARD MAX.
BEST	Xinetron X/LAN 486DX2	486DX2/56	□ \$2699	7.6	Excellent	VL, ISA	1024 × 768 340-MB SCSI	128 256
RUNNER-UP	AST Pragma 486S	486DX2/56	■ \$5050	6.7	Good	VL, EISA	1280 × 1024 340-MB IDE	256 512
RUNNER-UP	NEC Image 486	486DX2/56	■ \$3409	6.9	Excellent	ISA	1024 × 768 340-MB IDE	256 256
RUNNER-UP	Boss 486EV	486DX2/56	■ \$4495	7.4	Fair	VL, EISA	1024 × 768 340-MB SCSI	256 256
RUNNER-UP	Hertz 486/56E	486DX2/56	■ \$3670	6.2	Excellent	EISA	1024 × 768 1.2-GB SCSI	128 256

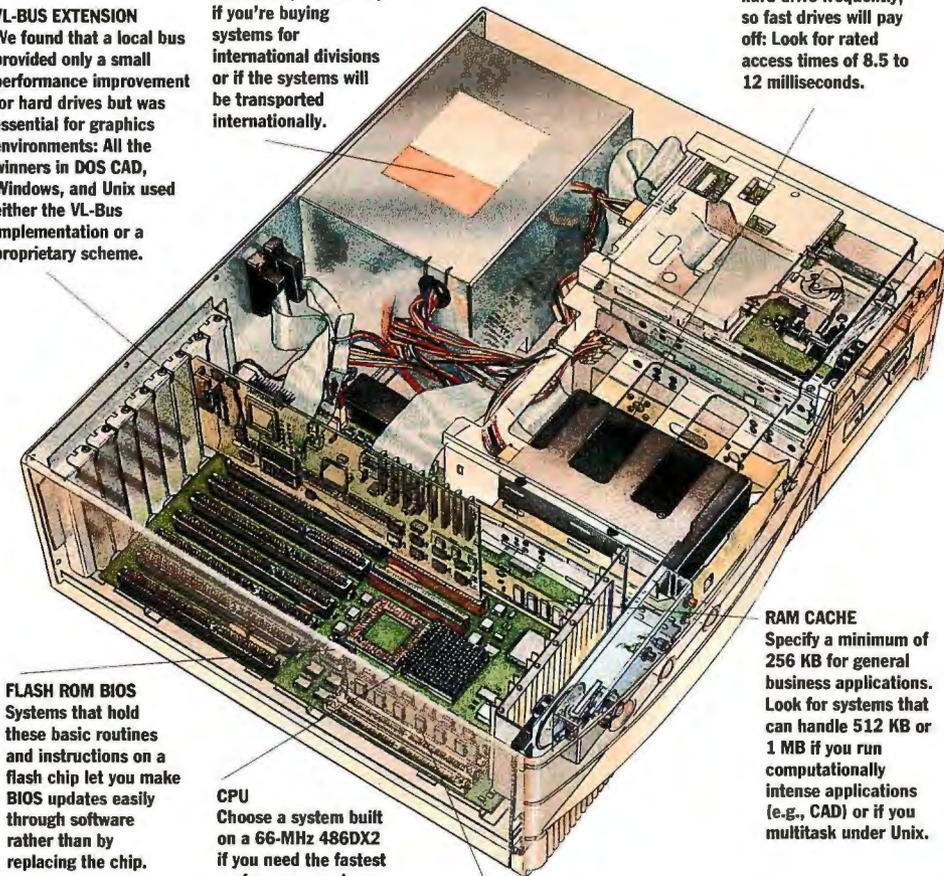
116 FAST 486S

What to Look For in a High-End System

VL-BUS EXTENSION
 We found that a local bus provided only a small performance improvement for hard drives but was essential for graphics environments: All the winners in DOS CAD, Windows, and Unix used either the VL-Bus implementation or a proprietary scheme.

POWER SUPPLY
 The typical output for high-end systems is 200 W, but specify 300 W or more if you plan to run multiple hard drives. Look for power supplies that switch between 110 and 220 V, a necessity if you're buying systems for international divisions or if the systems will be transported internationally.

HARD DRIVE
 Choose capacities of at least 100 MB for DOS business applications, 200 MB for DOS CAD and Windows, and 300 MB for Unix. Database and development applications access the hard drive frequently, so fast drives will pay off: Look for rated access times of 8.5 to 12 milliseconds.



FLASH ROM BIOS
 Systems that hold these basic routines and instructions on a flash chip let you make BIOS updates easily through software rather than by replacing the chip.

CPU
 Choose a system built on a 66-MHz 486DX2 if you need the fastest performance and can afford to spend an average of \$4000. The 50-MHz 486DX2s were the slowest of the high-end processors we tested and had little or no price advantage over better-performing 50-MHz 486DXs.

SIMMS
 For DOS applications, purchase a minimum of 4 MB; for DOS CAD and Windows, at least 8 MB; and for Unix, at least 12 MB.

RAM CACHE
 Specify a minimum of 256 KB for general business applications. Look for systems that can handle 512 KB or 1 MB if you run computationally intense applications (e.g., CAD) or if you multitask under Unix.

DOS WORD PROCESSING, DESKTOP PUBLISHING, AND SPREADSHEETS

Xinetron X/LAN 486DX2

This workstation is fast: it turned in outstanding results on our word processing and spreadsheet application tests and also had the fastest storage and graphics subsystem. **PAGE 159**

DOS DATABASE AND DEVELOPMENT

Lightning Thunderbox II

A tower system that captured both Best Overall and Most Expandable honors. The Thunderbox II includes a full megabyte of processor cache, which helped it outperform all other systems in this category. **PAGE 163**

DOS CAD AND GRAPHICS

NEC Image 466

NEC's Image 466 uses a proprietary local-bus implementation to boost graphics performance. The system's combination of graphics speed, low cost, and clear, sharp monitor makes it best for CAD and graphic arts. **PAGE 165**

WINDOWS

CompuAdd 466 DX2 Desktop Power

VL-Bus graphics, a non-interlaced 1280-by-1024-pixel display, and easily accessible memory and adapter slots qualify the CompuAdd 466 DX2 as the best system for Windows. Besides performance features, the 466 DX2 also comes with excellent documentation and strong technical support. **PAGE 171**

UNIX

Hertz 486/66Ei

BYTE Unix tests and SPEC benchmark results both ranked the Hertz 486/66Ei fastest among Unix systems. **PAGE 179**

SYSTEMS FOR

DOS WORD PROCESSING, DESKTOP PUBLISHING, AND SPREADSHEETS

Even though at first blush a 50- or 66-MHz CPU with an integrated FPU may sound like overkill, we found fast 486s to be excellent choices for DOS word processing, desktop publishing, and spreadsheet applications. This power comes in handy for today's versions of WordPerfect and Lotus 1-2-3, which let you perform demanding tasks like linking data from many spreadsheets, running spreadsheets in 3-D, or working out WYSIWYG previews. The right 486 can ensure that page scrolling, text search and replace, graphing, and computation take place without slowing the pace of your work.

Performance was the key attribute we considered when choosing winners and runners-up in our word processing and spreadsheet application tests. Many word processing and spreadsheet operations are computationally intense—the computer must frequently access the hard drive, and graphics-intensive page scrolling is common—so we looked at an even mix of CPU, memory, hard drive, and graphics subsystem performance. We used BYTE's hardware-component tests to rate the speed of subsystems. Our suite of application tests, which included WordPerfect 5.1 and Lotus 1-2-3 release 2.4, gave us insights into how each system ran actual business programs. Our performance rankings weighted these subsystem and application tests most heavily (additional subsystem and application tests rounded out our evaluations).

We identified some clear technology trends that explained why the winners and runners-up stood out from the rest of our test sample. All the systems that were rated Best Overall or Low Cost used 66-MHz 486 processors. Of the 12 systems we ranked in the entire business applications group, only the Swan 486/50ES, a Most Expandable runner-up, used a 50-MHz processor. In most cases, the 66-MHz systems performed faster than 50-MHz counterparts and didn't necessarily command a premium price. The Swan system was a notable exception: It recorded the same performance score as the Swan 486/66ES, which was identical except for its 66-MHz processor. The 50-MHz model costs \$100 less, but apparently identical supporting hardware for the 50- and 66-MHz versions make the extra clocks moot. We saw no reason to buy Swan's 66-MHz system over its less expensive cousin.

UNSAFE AT ANY SPEED?

In the relentless quest for more computing power, vendors are always striving for ways to produce the fastest systems. One vendor, Personal Computer Graphics, submitted the Turbo Max 80, a system based on a 66-MHz 486DX2 that PCG says can run internally at 80 MHz.

Our test results showed that the Turbo Max 80 clearly operated at speeds beyond those of most of the other systems in this roundup. It outperformed all the other systems in our three DOS application categories and placed within the top five for the Windows and Unix performance tests.

According to an Intel spokesperson, Intel does not test or guarantee and, consequently, does not condone operating any of its CPUs outside of the rated specifications. Moreover, unless the entire system is designed to withstand the excess heat being generated by the 486DX2 chip, unexpected heat dissipation could lead to system failure. PCG addresses this issue by equipping the Turbo Max 80 with three fans, including one mounted on the CPU. In the end, we decided not to include this system in our rankings, because of our unanswered questions about its long-term reliability.



PCG Turbo Max 80

In the Best Overall category, the AST Premmia 4/66d Model 343W, the Boss 466EV, and the NEC Image 466 came with 256 KB of secondary cache RAM, which sped up these systems in handling large applications, such as those in our application tests. Secondary cache RAM among slower systems was 128 KB. The Xinetron X/LAN Workstation and the Boss 466EV included 1 MB of hard disk cache; in contrast, many unranked systems came with no disk cache or only a 64-KB track buffer. Finally, among the Best Overall systems, only the Hertz 486/66Ei didn't take advantage of a local-bus graphics accelerator to speed screen redraws. Accordingly, its graphics test results were the slowest of these five systems.

Bus type showed little differentiation in our performance tests: ISA and EISA systems performed comparably, primarily because we tested them as workstations rather than as network servers.

Although performance accounted for half of our selection criteria, we also rated each system by the presence or absence of standard features that would aid DOS users running word processors and spreadsheets. This represented 30 percent of our evaluation.

Running classic DOS applications?

BEST OVERALL Xinetron X/LAN 486DX2



This 1-foot-tall mini-tower ran our word processing tests faster than any of the runners-up did and scored a virtual tie with the Boss 466EV as the fastest system for the spreadsheet test suite. Its storage subsystem, which is built around a 340-MB Maxtor SCSI drive with 1 MB of cache, was the fastest in this group, as was the system's VL-Bus graphics system. We found this system easy to live with: We could quickly add expansion cards, thanks to its easy-to-remove case and accessible adapter slots and SIMM slots. The system comes standard with a 36-month warranty and an informative manual.



For example, monitor quality is important for these applications. The best monitors were High Definition's Amax Impression Plus and the unit bundled with the AST Premmia, both of which support noninterlaced resolutions of up to 1280 by 1024 pixels. NEC's Image 466 is available with an NEC 3FGX monitor, another standout for crisp displays.

Keyboard feel is obviously important for word processing applications, but we had two reasons for leaving it out of our numerical rating. First, the suitability of a keyboard is a subjective rating, and our preference for clicky versus mushy or the position of the Escape key in the upper left corner may not match yours. Second, high-end machines such as these are more amenable to page-layout and design tasks and are a bit too expensive for heavy data-entry tasks, where keyboard quality is critical.

Finally, we rated systems for ease of use by considering such factors as the quality of technical manuals and the accessibility of expansion slots and drive bays. Here, specifications were sometimes deceiving. For example, the Acma 486/DX2-66 VESA System, a low-cost runner-up, offered five available ISA slots, but two of them were obstructed by wiring and would accommodate only half-length cards.

As with a number of other systems we tested (see the text box "Poor Quality Control" on page 169), the first X/LAN we received would not boot. Xinetron eventually sent a replacement unit that ran without problems. Even though its performance, ease of use, and features were all high enough to make it a winner in our Best Overall category, we remain disappointed by the lack of quality control made evident by the problem system. In the end, we let the Best Overall designation stand, only because the replacement unit ran without a hitch.

		PROCESSOR	CASE	PRICE	SPEED INDEX	EASE OF USE	BUS	DISPLAY (MAX. RES.)	HARD DRIVE	RAM CACHE (KB)	STANDARO	MAX.
BEST	Xinetron X/LAN 486DX2	486DX2/66	□	\$2699	7.6	Excellent	VL, ISA	1024 × 768	340-MB SCSI	128	256	
RUNNER-UP	AST Premmia 4/66d	486DX2/66	■	\$5090	6.7	Good	VL, EISA	1280 × 1024	340-MB IDE	256	512	
RUNNER-UP	NEC Image 466	486DX2/66	■	\$3499	6.9	Excellent	ISA ¹	1024 × 768	340-MB IDE	256	256	
RUNNER-UP	Boss 466EV	486DX2/66	■	\$4495	7.4	Fair	VL, EISA	1024 × 768	340-MB SCSI	256	256	
RUNNER-UP	Hertz 486/66Ei	486DX2/66	■	\$5870	6.2	Excellent	EISA	1024 × 768	1.2-GB SCSI	128	256	

Need expansion?

MOST EXPANDABLE Boss 466EV



The \$4495 Boss 466EV ran almost a dead heat with the Best Overall X/LAN in the word processing and spreadsheet application tests. Among the Most Expandable finalists, the Boss ran the application tests about 20 percent faster than the competition did. In addition to performance, the Boss will meet most expansion needs with one VL-Bus and four EISA slots, a SCSI port, and six 5 1/4-inch drive bays. One caution: The second of two fans located inside the chassis troubled us. Its tacked-on mounting suggested an additional fan was added to the original system design because of overheating problems; however, we didn't experience any heating problems during our testing.

		PROCESSOR	CASE	PRICE	SPEED INDEX	EASE OF USE	BUS	DISPLAY (MAX. RES.)	HARD DRIVE	DRIVE BAYS	3 1/2"	5 1/4"
BEST	Boss 466EV	486DX2/66	■	\$4495	7.4	Fair	VL, EISA	1024 × 768	340-MB SCSI	0	4	
RUNNER-UP	Hertz 486/66Ei	486DX2/66	■	\$5870	6.2	Excellent	EISA	1024 × 768	1.2-GB SCSI	7	2	
RUNNER-UP	Swan 486/50ES	486DX/50	■	\$5969	6.0	Excellent	EISA	1024 × 768	325-MB SCSI	7	2	
RUNNER-UP	Lightning Thunderbox II	486DX2/66	■	\$3895	7.8	Fair	VL, EISA	1280 × 1024	520-MB SCSI	0	3	
RUNNER-UP	Microtech MT/VLB	486DX2/66	■	\$3099	7.7	Fair	VL, ISA	1280 × 1024	340-MB IDE	1	5	

Watching the bottom line?

LOW COST Eastern Tech ET 486VLB66



If performance were our only consideration, the 486VLB66 would have been a Best Overall finalist. We're comfortable in putting it at the top of our low-cost list because the system's speed and \$2595 price compensate for the superficial documentation and the lack of a flash ROM BIOS and a toll-free technical-support line. But it shines in speed: The system ran our word processing and spreadsheet tests faster than any other machine we ranked. The low-level test results showed it was especially fast in the drive tests, which is attributable to the local-bus Tekram hard drive controller with 1 MB of cache (maximum of 16 MB) and the 14-ms, 340-MB Western Digital hard drive. Graphics performance was also outstanding, thanks to a VL-Bus implementation of an S3-805 graphics accelerator.

		PROCESSOR	CASE	PRICE	SPEED INDEX	EASE OF USE	BUS	DISPLAY (MAX. RES.)	HARD DRIVE	TECH. SUPPORT
BEST	Eastern Tech ET 486VLB66	486DX2/66	■	\$2595	7.9	Fair	VL, ISA	1024 × 768	340-MB IDE	Lifetime
RUNNER-UP	High Definition HDVLB66	486DX2/66	■	\$2400	6.5	Fair	VL, ISA	1280 × 1024	340-MB SCSI	Lifetime
RUNNER-UP	Acma 486/DX2-66 VESA	486DX2/66	■	\$2595	7.2	Fair	VL, ISA	1024 × 768	360-MB IDE	12 months
RUNNER-UP	Computer Expo 486VLB/66	486DX2/66	■	\$2567	6.9	Fair	VL, ISA	1024 × 768	340-MB IDE	36 months

¹ Video is on proprietary local bus.

KEY

- Desktop
- Mini-tower
- Tower
- VL = VL-Bus

"ZEOS couples smart design with excellent software options...easily upgradable, excellent video performance."

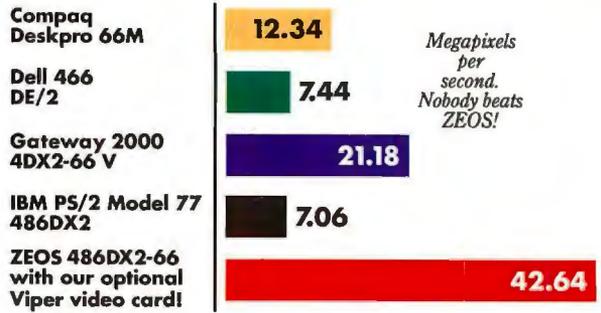
—PC Computing, March 1993, BEST VALUE

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* tested

PC MAGAZINE LABS BENCHMARK TESTS: GRAPHICS WINMARK



ZEOS "blew all competitors away—in some cases performing more than ten times as fast as competitors."

—PC Magazine, 1/26/93

ZEOS[®]. Your Best Value Is Now Even Better!

NOW: LARGER, FASTER LOCAL BUS HARD DRIVES!

a ZEOS system with our optional Viper video card. Their findings? The ZEOS "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 has it and so can you.

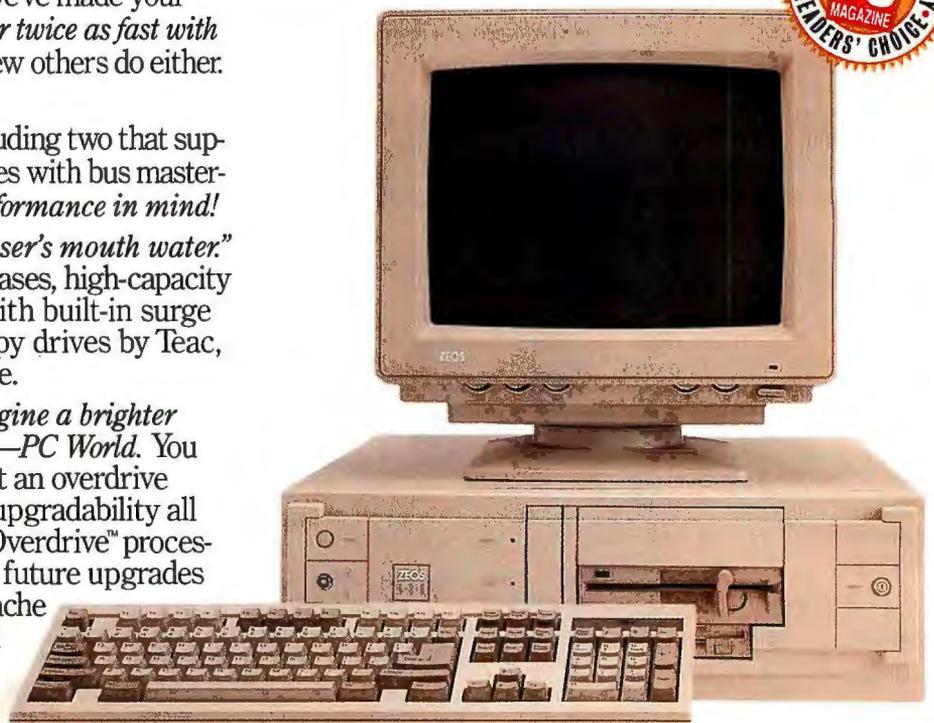
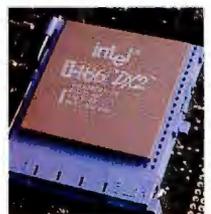
■ You get eight expansion slots, including two that support VESA-standard local bus devices with bus mastering. *Expandability with local bus performance in mind!*

■ "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.

■ "It's hard to imagine a brighter upgrade picture." —*PC World*. You get more than just an overdrive socket—you get upgradability all

the way to Intel's Pentium™-based Overdrive™ processor. Not to mention Flash BIOS for future upgrades by disk or modem, six-bay cases, cache all the way to 256K...plus optional on-board SCSI for only \$49!

■ *PC Magazine Readers' Choice for Service and Reliability—February 9, 1993!* ZEOS was the *only* PC vendor to receive the "Excellent" rating for both desktop *and* laptop systems. Our customers vouch for our excellent



standards. 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!

■ 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 to us for a complete, no-questions-asked refund.* Plus, you're covered by our One Year Limited Warranty, our Express Parts Replacement Policy and our Complete Customer Satisfaction Package.

■ You get your choice of a popular Windows application from Lotus 1-2-3, Ami Pro, Freelance Graphics, or new Lotus Improv, called the most "revolutionary and accessible" spreadsheet ever. That's in addition to DOS 6.0 (plus enhanced tools), Windows, and the fabulous Lotus Organizer. With all the free software you get with your new ZEOS system, you save hundreds of dollars!

NOW: Larger drives, all with high-speed built-in cache. Up to 452MB!



"The ZEOS 486DX-33 is the fastest 33-MHz 486 DX-33 system we tested, and its performance even topped that of two 50-MHz 486DX2s."

—PC World, February 1993, BEST BUY

IT ALL COMES DOWN TO VALUE.

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-CardSM 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). UPRGR:BYT-9306



CHOOSE FROM FOUR MONEY-SAVING PACKAGES.

Or we can custom-build a system to your exact specifications. Just call us!

#1	#2	#3	#4	
\$1295	\$1795	\$2195	\$2495	486SX-25
1395	1895	2295	2595	486SX-33
1595	2095	2495	2795	486DX-33
1695	2195	2595	2895	486DX2-50
1795	2295	2695	2995	486DX2-66
■	■	■	■	Intel 486 CPU
■	■	■	■	ZIF upgrade socket
2	4	8	16	MB of RAM expandable to 64MB on motherboard
107	214	340	452	High-speed IDE hard drive (MB)
32K	128K	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 color monitor
.28	.28	.28	.28	Monitor dot pitch (mm)
■	■	■	■	1MB high-speed VESA local bus card with Windows accelerator
■	■	■	■	Eight expansion slots including two VESA local bus
■	■	■	■	Two serial ports, one parallel port
■	■	■	■	Shadow RAM/EMS support
■	■	■	■	Socket for optional on-board SCSI
■	■	■	■	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 6.0 (plus enhanced tools)
■	■	■	■	Microsoft Windows
■	■	■	■	Microsoft Mouse
■	■	■	■	Choice of Lotus Improv, 1-2-3, Ami Pro or Freelance
■	■	■	■	Lotus Organizer
■	■	■	■	24-Hour-A-Day Toll-Free Technical Support
■	■	■	■	30-Day Money-Back Guarantee
■	■	■	■	One Year Limited Warranty

COMPARE THE NEW HONEYWELL MOUSE TO ALL THE OTHERS.

Microsoft Ball Mouse.



Logitech Ball Mouse.



Cheap Ball Mouse.



Honeywell
Mouse
(No Ball!)

**It's Different. It's Better.
It's The Last Mouse You'll Ever Need To Buy.**

It's Almost Unfair To Compare. Our new technology is so advanced it virtually makes other mice obsolete.

Compare the accuracy. A ball mouse picks up dust and dirt that can roll up and contaminate the internal mechanism, which makes your cursor jump around the screen.

Our unique design keeps the mouse free of debris, so your cursor goes precisely where you want it—when you want it—forever.

Compare the ease of use. The Honeywell mouse doesn't need a special pad; it works perfectly on any surface—at any angle—even upside down!

Compare the quality, reliability and price. Proven Honeywell quality and fewer parts make our mouse extremely reliable. So reliable, we back it with a limited lifetime warranty.* And, our simple design allows it to be competitively priced with mice using out-of-date ball technology.

So, compare all of the other mice. But do yourself a favor and try a new Honeywell mouse—you'll see why it's the last mouse you'll ever need to buy. We guarantee it.

The Honeywell mouse is Microsoft[®], Windows[™], and DOS compatible, and works with IBM, compatibles and PS/2 systems.

For information on where to get the new Honeywell mouse call us at 1-800-445-6939. In Canada, call (416) 293-8111.



Honeywell

Helping You Control Your World

Circle 273 on Inquiry Card.

Available At

COMPUSA

Honeywell Inc. Keyboard Division, 4171 N. Mesa, Bldg. D, El Paso, Texas 79902 1-800-445-6939.

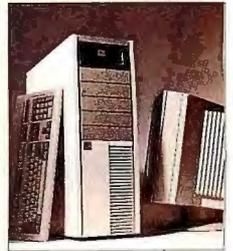
*See warranty for complete details. ©1993 Honeywell Inc. All product names are trademarks of their respective companies.

Want the fastest database machine?

BEST OVERALL Lightning Thunderbox II



This tower received the highest score among the database and development leaders in our subsystem and application tests. In addition, it sped through the FoxPro 2.0 application test two times faster than its nearest competitor (the FutureTech System 462eV). It includes 1 MB of secondary cache (128 or 256 KB is the norm), a Tekram SCSI hard drive controller with 1 MB of cache, a 520-MB Maxtor hard drive with a fast (8.5-nanosecond) access time. Rounding out its fine performance, the system comes with a two-year warranty covering parts, labor, and shipping, as well as lifetime technical support with a toll-free support line.



Fast performance for database applications hinges on the effective integration of CPU, memory, and hard drive subsystems. The efficiency of the components translates into being able to work rather than wait while your system is executing queries, generating reports, or compiling code.

Performance was our most important selection criterion, and we devised our speed-index number by combining results of application and subsystem tests and giving emphasis to the CPU, memory, hard drive, and FoxPro portions of the two test suites.

The Lightning Thunderbox II, the best system overall, distinguished itself with high scores in our CPU and drive tests. All the Best Overall systems used 66-MHz processors. The AST Premia, the CompuAdd 466 DX2 Desktop Power, and the Hertz 486/66Ei each posted high marks in the memory subsystem tests. The Thunderbox II and the FutureTech System 462eV showed fast performance on our drive tests, along with solid scores for CPU and memory.

Database users need flexibility for adding memory to boost performance or drives to provide redundant storage. Our Most Expandable rankings show the five standout systems. The Swan 486/50ES deserves mention. Its tower case is one of the most flexible designs we have seen: It has eight free 3 1/2-inch drive bays and six free EISA slots.

The systems in the low-cost category provided 486 power for under \$2600, with the 50-MHz Micro Flex selling for less than \$2000 (we recommend it as only a runner-up because it was the slowest in the group).

		PROCESSOR	CASE	PRICE	SPEED INDEX	EASE OF USE	BUS	DISPLAY (MAX. RES.)	HARD DRIVE	RAM CACHE (KB) STANDARD	MAX.
BEST	Lightning Thunderbox II	486DX2/66	■	\$3895	7.8	Fair	VL, EISA	1280 × 1024	520-MB SCSI	1024	1024
RUNNER-UP	Xinetron X/LAN 486DX2	486DX2/66	□	\$2699	7.2	Excellent	VL, ISA	1024 × 768	340-MB SCSI	128	256
RUNNER-UP	Hertz 486/66Ei	486DX2/66	■	\$5870	6.2	Excellent	EISA	1024 × 768	1.2-GB SCSI	128	256
RUNNER-UP	CompuAdd Desktop Power	486DX2/66	■	\$4039	6.3	Excellent	VL, ISA	1280 × 1024	500 MB IDE	256	256
RUNNER-UP	AST Premia 4/66d	486DX2/66	■	\$5090	6.3	Good	VL, EISA	1280 × 1024	340-MB IDE	256	512
RUNNER-UP	FutureTech System 462eV	486DX2/66	■	\$3129	7.1	Good	VL, EISA	1280 × 1024	340-MB SCSI	256	512
RUNNER-UP	NEC Image 466	486DX2/66	■	\$3499	6.5	Excellent	ISA ¹	1024 × 768	340-MB IDE	256	256

Planning for expansion?

MOST EXPANDABLE Lightning Thunderbox II



In addition to its pacesetter performance in our FoxPro and subsystem tests (see item above), the Thunderbox II can easily be expanded in the three areas vital to database and development performance: CPU, memory, and storage. The system contains a socket for upgrading to Pentium processors, disk cache that's expandable to 16 MB, and five available EISA slots.

		PROCESSOR	CASE	PRICE	SPEED INDEX	EASE OF USE	BUS	DISPLAY (MAX. RES.)	HARD DRIVE	DRIVE BAYS 3 1/2"	5 1/4"
BEST	Lightning Thunderbox II	486DX2/66	■	\$3895	7.8	Fair	VL, EISA	1280 × 1024	520-MB SCSI	0	3
RUNNER-UP	Hertz 486/66Ei	486DX2/66	■	\$5870	6.2	Excellent	EISA	1024 × 768	1.2-GB SCSI	7	2
RUNNER-UP	Swan 486/50ES	486DX/50	■	\$5969	6.1	Excellent	EISA	1024 × 768	325-MB SCSI	8	2
RUNNER-UP	Boss 466EV	486DX2/66	■	\$4495	7.4	Fair	VL, EISA	1024 × 768	340-MB SCSI	0	4
RUNNER-UP	Microtech MT/VLB	486DX2/66	■	\$3099	7.7	Fair	VL, ISA	1280 × 1024	340-MB IDE	1	5

Need top performance for under \$2600?

LOW COST Eastern Tech ET 486VLB66



The 486VLB66 came in second to the Thunderbox II as the fastest performer of our database systems and costs \$6000 less than the most expensive system in this applications group—the Swan 486 150ES, which ran the tests considerably slower. The 486VLB66 derives much of its speed advantage from the VL-Bus IDE interface with 1 MB of cache and 256 KB of secondary cache. The 486VLB66 comes with a 24-month warranty covering the system and a 12-month warranty covering the 14-inch 1024- by 768-pixel ViewSonic 6E monitor and the 340-MB Western Digital hard drive.

		PROCESSOR	CASE	PRICE	SPEED INDEX	EASE OF USE	BUS	DISPLAY (MAX. RES.)	HARD DRIVE	TECH. SUPPORT
BEST	Eastern Tech ET 486VLB66	486DX2/66	■	\$2595	7.4	Fair	VL, ISA	1024 × 768	340-MB IDE	Lifetime
RUNNER-UP	Acma 486/DX2-66 VESA	486DX2/66	■	\$2595	6.8	Fair	VL, ISA	1024 × 768	360-MB IDE	12 months
RUNNER-UP	High Definition HDVLB66	486DX2/66	■	\$2400	5.9	Fair	VL, ISA	1280 × 1024	340-MB SCSI	Lifetime
RUNNER-UP	Micro Express Micro Flex	486DX/50	□	\$1999	5.5	Good	ISA	1024 × 768	325-MB IDE	Lifetime
RUNNER-UP	Acma ISA Workstation	486DX2/50	■	\$2295	6.3	Good	ISA	1024 × 768	360-MB IDE	12 months
RUNNER-UP	Computer Expo 486VLB/66	486DX2/66	■	\$2567	6.5	Fair	VL, ISA	1024 × 768	340-MB IDE	36 months

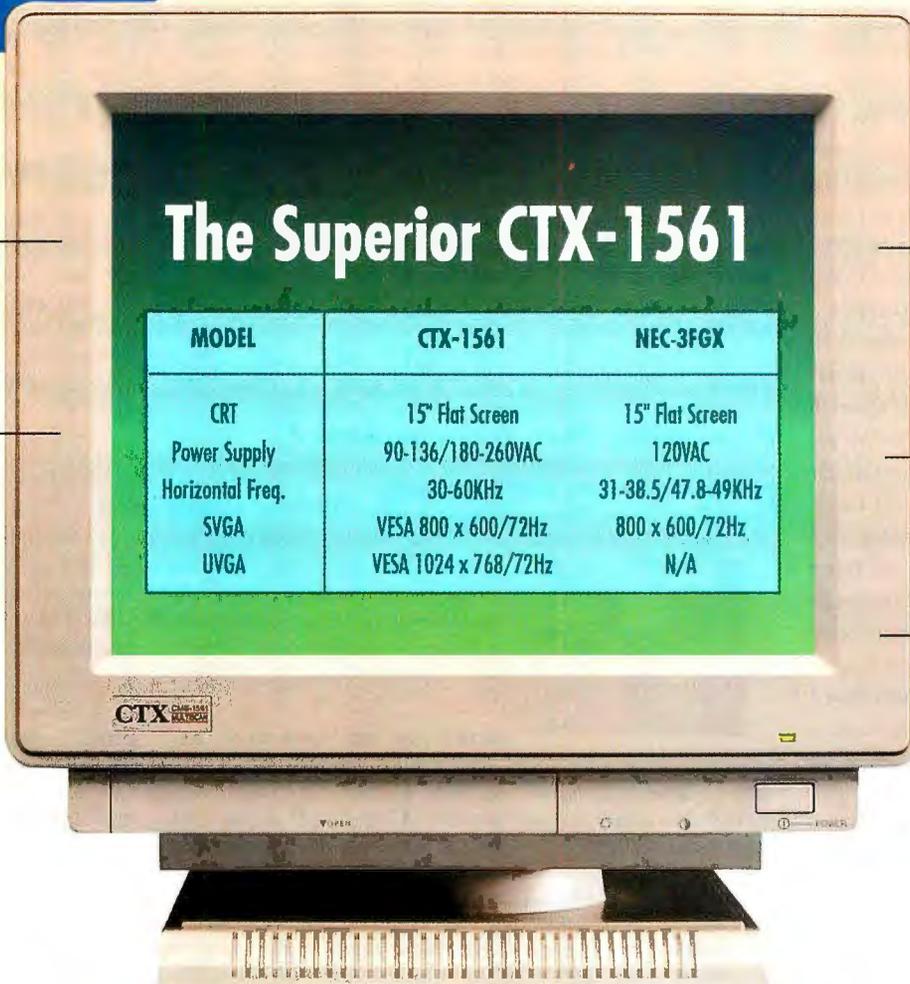
¹ Video is on proprietary local bus.

KEY

- Desktop
- Mini-tower
- Tower
- VL = VL-Bus

**CTX-1561
VS
NEC-3FGX**

Higher Performance for Less.



VESA
1024 x 768/72Hz

15-inch
Flat Screen

Overscan
Capability

High
Refresh

ISO 9002
Certificated

MODEL	CTX-1561	NEC-3FGX
CRT	15" Flat Screen	15" Flat Screen
Power Supply	90-136/180-260VAC	120VAC
Horizontal Freq.	30-60KHz	31-38.5/47.8-49KHz
SVGA	VESA 800 x 600/72Hz	800 x 600/72Hz
UVGA	VESA 1024 x 768/72Hz	N/A



Even in the most demanding environments, **CTX-1561** is a proven price/performance winner of 15-inch monitors in today's market. For your budget concerns, CTX also provides **CTX-1461** as an economical alternative to CTX-1561 without sacrificing resolution or other advanced features.

See us at

COMDEX/Spring '93

Booth 1614, Hall B



Committed To Xellence



*LR: Low Radiation MPR-II Model available for all CTX Professional Series Monitors

CTX INTERNATIONAL

20530 Earlgate Street
Walnut, CA 91789
909/595-6146
Fax 909/595-6293

CTX SOUTH

6090-F Northbelt Pkwy
Norcross, GA 30071
404/729-8909
Fax 404/729-8805

CTX EAST

146 Division Place
Hackensack, NJ 07601
201/646-0707
Fax 201/646-1998

CTX MIDWEST

500 Park Blvd., Ste. 425
Itasca, IL 60143
708/285-0202
Fax 708/285-0212

CTX OEM

1225 E. Crosby Rd., A21
Carrollton, TX 75006
214/416-9610
Fax 214/245-7447

©Copyright 1993. CTX International, Inc. All Rights Reserved. All brand or product names are trademarks or registered trademarks of their respective owners.

Circle 84 on Inquiry Card (RESELLERS: 85).

Fast 486s are the systems of choice for CAD and graphics professionals. The high clock speeds and integrated floating-point processors play well against the complex computations of these applications. And with high-resolution displays the norm for CAD and graphics, local-bus video accelerators mean faster screen redraws and more efficient work.

We gave the most emphasis to the results of the Lotus 1-2-3 release 2.4 and Autodesk Animator Pro 1.0 tests, which together challenged each system's computational, floating-point, and graphics capabilities. We gave equal weight to BYTE's subsystem and Windows tests when evaluating performance. We also looked for important CAD and graphics features, such as support for 1280- by 1024-pixel (noninterlaced) displays.

Because of the high computational needs of CAD and graphics, 66-MHz processors dominated our three categories. The only exception was the Keydata Key VL-Bus Windowstation, a 50-MHz 486DX that made runner-up in our low-cost category on the strength of its VL-Bus graphics system.

All the winners and runners-up in this applications group came with some implementation of a local bus. The Best Overall winner, NEC's Image 466, and a runner-up, Dell's 466/ME, used proprietary local-bus implementations; the remaining systems were VL-Bus-based. In the BYTE Windows index, the NEC Image 466 and the Dell 466/ME scored about 10 percent faster than many of their VL-Bus competitors.

Looking for the best graphics performer?

BEST OVERALL NEC Image 466



The NEC Image 466 finished a close second to the Boss and X/LAN systems in our performance tests weighted for CAD and graphics, but it achieved top honors on the strength of its entire package. The Image 466's Tseng ET-4000 W32 video accelerator (with 1 MB of DRAM) is integrated on the

motherboard using a proprietary local-bus scheme. Its advantages: Integrated video doesn't occupy a slot, while local-bus video offers fast screen redraws. We found the desktop chassis easy to access for upgrading drives, memory, and boards. The \$3499 price, which was second lowest among the seven Best Overall systems, includes an NEC 3FGX 15-inch monitor—a monitor with outstanding clarity. The price also includes a three-year basic warranty covering parts and labor, lifetime technical support, and a year of free on-site service.



		PROCESSOR	CASE	PRICE	SPEED INDEX	EASE OF USE	BUS	DISPLAY (MAX. RES.)	HARD DRIVE	RAM CACHE (KB) STANDARD	MAX.
BEST	NEC Image 466	486DX2/66	■	\$3499	7.8	Excellent	ISA ¹	1024 × 768	340-MB IDE	256	256
RUNNER-UP	AST Premia 4/66d	486DX2/66	■	\$5090	7.4	Good	VL, EISA	1280 × 1024	340-MB IDE	256	512
RUNNER-UP	Xinetron X/LAN 486DX2	486DX2/66	□	\$2699	8.0	Excellent	VL, ISA	1024 × 768	340-MB SCSI	128	256
RUNNER-UP	CompuAdd MC 466EDX2	486DX2/66	■	\$6884	7.3	Excellent	VL, EISA	1280 × 1024	525-MB SCSI	256	256
RUNNER-UP	Boss 466EV	486DX2/66	■	\$4495	8.0	Fair	VL, EISA	1024 × 768	338-MB SCSI	256	256
RUNNER-UP	Dell 466/ME	486DX2/66	■	\$3669	7.4	Good	EISA ¹	1024 × 768	320-MB IDE	128	128
RUNNER-UP	Tri-Star 486 VL Station	486DX2/66	■	\$3279	7.6	Good	VL, ISA	1280 × 1024	340-MB IDE	256	256

Need a CAD system with room for growth?

MOST EXPANDABLE Boss 466EV



The 466EV ran our CAD and graphics tests faster than any other system ranked Most Expandable. The system's 60-ns memory speed and 256-KB 15-ns secondary cache contributed to the strong showing. The 466EV uses a VL-Bus Genoa WindowsVGA 24 video adapter based on a Cirrus Logic chip set; this implementation achieved the highest score in this group for the graphics-intensive BYTE Windows tests. If you need to expand the system to improve performance, the motherboard holds up to 256 MB of memory. The caching drive controller came with 1 MB of cache RAM; the controller can hold a maximum of 16 MB of RAM.

		PROCESSOR	CASE	PRICE	SPEED INDEX	EASE OF USE	BUS	DISPLAY (MAX. RES.)	HARD DRIVE	DRIVE BAYS 3 1/2" 5 1/4"
BEST	Boss 466EV	486DX2/66	■	\$4495	8.0	Fair	VL, EISA	1024 × 768	340-MB SCSI	0 4
RUNNER-UP	Hertz 486/66Ei	486DX2/66	■	\$5870	6.8	Excellent	EISA	1024 × 768	1.2-GB SCSI	7 2
RUNNER-UP	Microtech MT/VLB	486DX2/66	■	\$3099	7.7	Fair	VL, ISA	1280 × 1024	340-MB IDE	1 5

Cost-conscious?

LOW COST High Definition HDVLB66



This 66-MHz system finished first in this group thanks to its \$2400 list price, solid performance in our CAD tests, and flexible expansion options. The system offers a local-bus Genoa WindowsVGA 24 video card featuring the Cirrus Logic GD5426 chip set. The HDVLB66 includes 256 KB of secondary cache, 8 MB of RAM, a socket for a P24T processor, and a local-bus UltraStor hard drive controller connected to a 340-MB Fujitsu drive.

		PROCESSOR	CASE	PRICE	SPEED INDEX	EASE OF USE	BUS	DISPLAY (MAX. RES.)	HARD DRIVE	TECH. SUPPORT
BEST	High Definition HDVLB66	486DX2/66	■	\$2400	7.6	Fair	VL, ISA	1280 × 1024	340-MB SCSI	Lifetime
RUNNER-UP	Eastern Tech ET 486VLB66	486DX2/66	■	\$2595	8.4	Fair	VL, ISA	1024 × 768	340-MB IDE	Lifetime
RUNNER-UP	Acma 486/DX2-66 VESA	486DX2/66	■	\$2595	7.7	Fair	VL, ISA	1024 × 768	360-MB IDE	12 months
RUNNER-UP	Key VL-Bus Windowstation	486DX/50	■	\$2395	7.0	Fair	VL, ISA	1024 × 768	210-MB IDE	Lifetime
RUNNER-UP	CompuEx 486VLB/66	486DX2/66	■	\$2567	7.6	Fair	VL, ISA	1024 × 768	340-MB IDE	36 months

¹ Video is on proprietary local bus.

KEY

- Desktop
- Mini-tower
- Tower
- VL = VL-Bus

"It's NeXTSTEP system software is years ahead of its potential rivals such as Microsoft Corp's. Cairo and Apple and IBM's Taligent systems."

BUSINESS WEEK, JANUARY 25, 1993

"We have not seen a development environment anywhere that matches the power of NeXTSTEP. We have already proven this power by delivering applications to our business in a matter of weeks that would have taken months in other environments."

INGVAR PETURSSON, CIO, MCCAW CELLULAR

"...NeXTSTEP is probably the most respected piece of software on the planet. The underlying reason for NeXT's success is objects..."

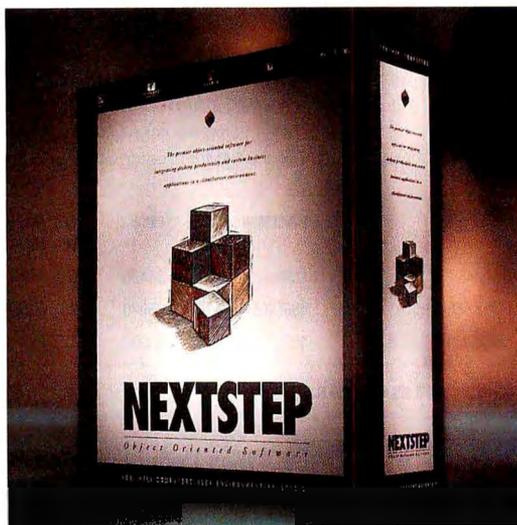
BYTE, OCTOBER 1992

"...NeXT has the potential to be the Microsoft of objects..."

LISA THORELL, DATAQUEST

"NeXTSTEP is the best platform for developing object-oriented, client/server applications."

LARRY ELLISON, CHAIRMAN & CEO, ORACLE CORP.



"NeXTSTEP is the ideal environment for cross-platform development."

TOM MALLORY, VP DEVELOPMENT, WORDPERFECT CORP.

**IT WON'T BE OUT OF THE BOX
UNTIL MAY 25TH.
BUT THE REVIEWS ARE ALREADY IN.**

NeXTSTEP™ for Intel® processors. The world's only object-oriented user and development environment. Coming soon to industry-standard computers all over the world. For information, call 1-800-TRY-NEXT.



THE OBJECT IS THE ADVANTAGE.™

©1993 NeXT Computer, Inc. NeXT and NeXTSTEP are registered trademarks of NeXT Computer, Inc. The Object is the Advantage is a trademark of NeXT Computer, Inc. Intel is a registered trademark of Intel Corporation.

Circle 120 on Inquiry Card.

How We Tested

PERFORMANCE

We tested each system under Windows 3.1, DOS 5.0, and SCO Unix 3.2.4. Our DOS and Windows performance testing consisted of DOS and Windows low-level tests designed by the BYTE Lab and application tests developed by the National Software Testing Laboratories.

The low-level DOS tests determine the quality of computer subsystems by isolating hard drive, memory, and CPU performance. The collection of Windows low-level tests exercises the Windows GDI (Graphical Device Interface), as well as memory management and file I/O routines. The graphics components of these tests determine how fast a system can execute basic graphics calls within Windows, including calls that display pixels, lines, rectangles, polygons, and ellipses. The graphics tests also exercise text display and BitBlt operations. BYTE's Windows tests were run in resolutions of 1024 by 768 pixels at 256 colors, and the DOS tests were run in VGA resolution.

The application tests give us accurate "real-world" representations of system performance; the only way to really know how well a system runs Microsoft Excel, for example, is to test with Excel. For DOS tests, we used WordPerfect 5.1, Lotus 1-2-3 release 2.4, FoxPro 2.0, and Autodesk Animator Pro 1.0. We ran Excel 4.0a, Microsoft Word 2.0b, and Lotus 1-2-3 for Windows 1.1 for our Windows evaluations.

In addition, we ran a set of tests on each system under SCO Unix. This suite consisted of the BYTE Lab's low-level Unix tests and SPEC89. The Unix tests cover a spectrum of typical scientific and engineering tasks, such as electronic-circuit analysis, architectural analysis, and compilation, as well as general Unix system operations. Therefore, the platforms were tested as scientific and engineering workstations, not as file servers or database processors.

USABILITY

We worked with each system to gauge its usability. For example, we rated systems according to how easy it was to perform simple upgrades; high marks

went to systems where the cover came off easily, add-in cards fit without problem, and the cover fit back on without undue fiddling. We evaluated memory expansion by determining how easy it was to access the open SIMM slots; similarly, we judged whether open drive bays were obstructed or difficult to reach. In addition, we evaluated the manuals provided by each vendor. Did one integrated manual come with the system, or was there a collection of manuals for each of the system parts? Were the manuals well organized? As we found the answers to these and other questions, we kept extensive lab notes to refer to during our selection process.

FEATURES

We chose several features that we considered vital for high-end 486 systems:

- 32 MB or more of system-memory capacity
- local-bus graphics
- support for 1280- by 1024-pixel displays
- one or more drive bays available for expansion
- bundled applications software
- free one-year parts-and-labor warranty

CONFIGURATION

We tested 50- or 66-MHz 486DX2 and 50-MHz 486DX systems in either desktop, mini-tower, or tower configurations. We accepted systems with ISA, EISA, and Micro Channel architecture buses. We specified up to 1 MB of hard disk cache. We didn't use any software cache that may have been supplied by vendors.

We requested 8 MB of system RAM, the system's maximum amount of secondary processor cache RAM, and a 300- to 400-MB hard drive. Finally, we asked for each system's best graphics hardware configuration or a minimum of 1024- by 768-pixel resolution at 256 colors and 1 MB of VRAM. Test-configuration prices include a 14- or 15-inch 1024- by 768-pixel or better monitor, whichever was standard.



Leslie Reisz (left), Alan Joch, and a few of the 116 systems we tested.

SELECTION

After we evaluated performance, features, and usability scores, we weighted our findings to help us select our winners. If you're buying a high-end system, you want speed and power, so we selected performance to be worth 50 percent of our final score. To determine our performance scores, we gave the most weight to tests based on applications related to each individual category (e.g., WordPerfect 5.1 and Lotus 1-2-3 release 2.4 for word processing and spreadsheet selection). Similarly, features represented 30 percent of our final determination; usability was 20 percent.

Contributors

Michael P. Connors, Contributing Editor of PC Digest (an NSTL publication), writes and researches comparative reviews of PCs.

Richard Fox, Senior Test Engineer/NSTL, has spent the last two years testing compatibility and performance of high-end PCs, software, and operating systems for NSTL.

Alan Joch, Senior Editor/BYTE, coordinates combined testing between the BYTE Lab and NSTL.

Leonard Presberg, Manager of Performance Testing/NSTL, directed the development of NSTL's applications benchmarks for PCs. He holds a B.A. in computer science from Oberlin College.

Leslie Reisz, Senior Test Engineer/NSTL, wrote Unix interface programs for Unisys before joining NSTL in 1991. Since then, he has coordinated the testing of Unix systems and networks.

The Lab Report is an ongoing collaborative project between BYTE Magazine and National Software Testing Laboratories (NSTL). BYTE Magazine and NSTL are both operating units of McGraw-Hill, Inc.

The best sound is not in the cards.

PORT-ABLE *sound* PLUS™



Perk up your presentations. Make training more effective. And, put some guts into your gaming pastimes. Anytime. Anywhere. In fact, if you

are not a card carrying member of the computer set, you have to hear PORT-ABLE Sound Plus from Digispeech. You know, those real smart people who make simple sound solutions.

PORT-ABLE Sound Plus is the first portable external sound peripheral to deliver 16 Bit CD quality music with stereo audio capabilities. And, since you just plug into your IBM PC or compatible, desktop or laptop parallel port, you do not need an engineering degree or even a screwdriver.

When you compare PORT-ABLE Sound Plus to any other external sound peripherals, you will see why anything else is just noise. PORT-ABLE Sound Plus is based on advanced Digital Signal Processing technology, so you will enjoy the greatest



compression capability with the highest quality sounds. Here is something else that will be music to your ears. PORT-ABLE Sound Plus comes complete with everything you need including a high fidelity speaker and built-in microphone. There is an "Audio-in" for a CD or tape player and a "Line-out" for external powered stereo speakers. Even a built-in smart parallel port pass through so you can keep printing.

Whether you take your work across the hall or across the country, with PORT-ABLE Sound Plus, you have all the cards you need to play right in your hip pocket. The hinged design lets you flip up the unit if you are short on desk space or lap space. And, the power will always be with you whether you use rechargeable or non-rechargeable AA batteries. PORT-ABLE Sound Plus also comes equipped with an AC/DC power converter.

As a bonus, you will get all the software you need to communicate. Like Lotus Sound™ an OLE server for Windows 3.1. WinReader for Windows 3.1, a handy text-to-speech utility. Digispeech's DOSTalk and DOSReader text-to-speech applications. Show & Tell For Kids™ for

Windows – an easy to use MultiMedia Authoring program. It is also Sound Blaster and AdLib compatible.

Why compromise on quality, portability, compatibility or affordability? When all the cards are on the table, PORT-ABLE Sound Plus from Digispeech, Inc. is your ace in the hole. Suggested retail is only \$198.95.



To order or obtain more information about PORT-ABLE Sound Plus, write or call Digispeech, or, contact your local dealer.

Sales Office: 550 Main Street, Suite J, Placerville, California 95667. Telephone: (916) 621-1787. Fax (916) 621-2093.

Circle 173 on Inquiry Card.



Digispeech™ inc.
THE SOUND SOLUTION



PORT-ABLE Sound Plus is a trademark of Digispeech, Inc. All other product names are trademarks or registered trademarks of their respective owners.



Poor Quality Control

Of the 116 systems we tested, 40 experienced hardware problems that were significant enough to delay their testing. We solved some of the problems simply by opening the systems and ensuring that the power and data connections, as well as the adapter boards on the motherboard, were secure.

IDENTIFYING PROBLEMS

However, we called the vendors to identify at least half of the problems. For instance, when we powered up the Ares Microdevelopment 486-66DX2-VL, the system produced only a series of beeps. Hearing those beeps over the phone, the Ares technical staff instantly isolated the problem to a bad secondary processor cache.

Three systems, the Xinetron X/LAN, the Sho-Tronics 486 MAX DX2/66, and the Micro Express Micro Flex, experienced problems so severe that the vendors had to supply a new unit. In these cases, the problem systems would not boot at all, so no POST (power-on self test), video output, hard drive activity, or beeps occurred.

We contacted Wyse Technology after realizing that the Decision 486SE was clearly not operating at the expected speed of a 66-MHz DX2. During a conference call with several technicians, we checked each CMOS setting and DIP switch. We finally discovered that one of the DIP switches on the motherboard was between two settings. Once it was pushed into the proper setting, the system operated at the correct speed.

SCO UNIX

We experienced a number of problems installing SCO Unix, due in some degree to problems with third-party peripherals and their drivers. The two Gateway ISA IDE-drive desktops we tested worked fine. However, we had problems with the company's EISA towers, which shipped with UltraStor 24F SCSI controllers and Seagate hard drives. Unix would not install on the Gateway 4DX2-50V. It would install on the 4DX2-66V model, but the system would periodically lock up. Gateway sent us replacement Adaptec SCSI controllers. The 50-

MHz machine worked fine with the new controllers, but the 66-MHz version would no longer install SCO Unix. After more calls to Gateway, a technician suggested we turn the turbo switch off. This fixed the problem: Unix installed and ran—but very slowly.

Duracom's systems had similar problems. We tested two ISA IDE-drive machines and two EISA SCSI-drive machines with Duracom's Adaptec clone controllers. The ISA machines ran fine, as did the EISA 50-MHz DX2. But the 66-MHz DX2 EISA would not install Unix. After a number of CMOS setting changes and system part swaps—SCSI controllers, hard drives, and CPUs—Duracom sent us a replacement Adaptec controller. Even with the new controller, we couldn't get our tests to work correctly. We could not resolve this problem before press time.

The Ariel 486DX2-66VLS ISA and the Ares 486-66DX2-VL both had problems running the BYTE benchmark file-system test. The Ares hit a kernel panic (i.e., an error from which the operating system cannot recover), and the Ariel system locked up during the test. Both had UltraStor SCSI controllers; the Ares ran a Quantum hard drive, and the Ariel ran a Toshiba hard drive. After several attempts, these systems successfully completed our tests.

The Lightning Thunderbox II also locked up during SCO Unix testing. After a number of tries, the tests finally ran, but the results were not consistent with the other test systems. Eventually, the Tekram SCSI controller failed completely. Lightning then sent a new Tekram controller, and from then on we had no problems running the tests.

VIDEO AND UNIX

There were a few machines whose original video cards would not work with SCO Unix. The CAF Technology Gold 6D2 and Gold 5T each came with a Poka video adapter, and both exhibited this problem. CAF sent two Western Digi-

tal VGA boards, which worked fine with Unix and were \$125 cheaper. The High Definition System HDEISA 50 came with an Orchid Prodesigner that was replaced with an Oak Technology Super VGA card, which was fine.

The Dell 466/L ran slow. After we attempted to solve the problem by swapping memory, Dell Computer's technical-support staff told us to put the 66DX2 CPU into the 450/L, an identical machine. The new "466/L" ran as we expected.

The Malone machine repeatedly locked up during testing. Technical support determined that the problem was due to the CMOS settings, and after a few adjustments, the problem was resolved.

Quill sent us a machine that would not install Unix. The installation procedure

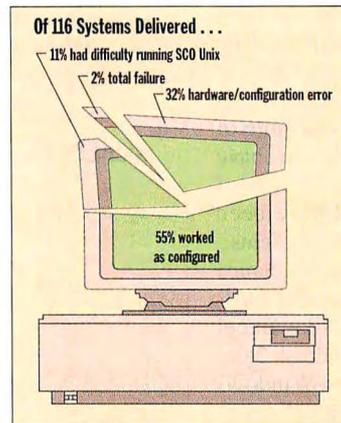
could not make the file systems on the hard drive. After a controller jumper-switch change didn't work, Quill sent a different hard drive controller, which solved the problem.

TECHNICAL SUPPORT

Sometimes we found the responsiveness of technical support disappointing. We made repeated calls to Gateway 2000 for SCO Unix drivers. After getting no response, we resorted to downloading the drivers from UltraStor.

Most troubling about these problems was the sheer number. There were 40 systems that gave us some degree of hardware difficulty, which required time, patience, and technical expertise to correct. These figures paint a grim picture of the current state of the market.

In the end, we didn't see any correlation between the size of the vendor and the quality of the system. So-called upper-tier vendors (e.g., Dell and Gateway) were just as likely to send problem systems as were their smaller competitors. Our advice: Before buying a system from any vendor, make sure you are comfortable with the support and warranty options available.



SYSTEMS FOR

WINDOWS

Our test specification of a high-end 486 with 8 MB of RAM and a 300-MB hard drive was a potent combination for Windows workstations. The processor and memory size kept the systems from balking as we ran through our suite of Windows applications that have grown to take up 10 MB of storage space and have been known to stall lesser systems.

Our Windows performance tests included important business applications like Excel 4.0a, Word for Windows 2.0b, and Lotus 1-2-3 for Windows 1.1. These benchmarks compared how well each system performed charting, file I/O, statistical-computation, search-and-replace, and spelling-checker functions, among dozens of others. Complementing these tests were the BYTE Windows benchmarks, which run custom tests that exercise eight specific graphics functions and help us see how effectively the graphics subsystems perform.

After we ranked systems for performance, we made our final selections by considering features, such as whether graphics subsystems supported resolutions of up to 1280 by 1024 pixels, the accessibility of internal components, the construction quality, and service and support options.

The 66-MHz 486s swept the Windows competition with every winner and runner-up, including those in the low-cost category. All 19 of the ranked systems used a local bus to speed graphics performance, with two—the Dell 466/ME and the NEC Image 466—running a proprietary local-bus implementation. The remaining systems were all VL-Bus-based.

Best Overall, CompuAdd's 466 DX2 Desktop Power, sells for \$4039 and ranked near the top with an index score of 8.2 in the Windows tests. You'll get your money's worth from the

DIFFERENT BUS CHOICES

The bus is the common pathway that connects a computer's processor, memory, and peripheral control units. It's a term both for the common wiring paths that make up these connections and for the physical connectors (e.g., ISA sockets) into which expansion devices fit. Here are the current choices:

LOCAL BUS

A local-bus device connects directly to the processor bus and runs at processor clock speed (25 MHz for a DX2/50; 33 MHz for a DX2/66). Many vendors—including Dell and NEC—use proprietary local-bus designs. These are direct connections and are not designed for third-party peripheral expansion. The Video Electronics Standards Association has developed a local-bus standard known as VL-Bus. VL-Bus defines a connector for up to three local-bus devices. VL-Bus is a simple extension of the standard ISA bus, so local-bus systems and adapters can be designed with a minimal price premium. VL-Bus systems are available with both ISA and EISA systems. Intel has released a more sophisticated local-bus specification known as PCI (Peripheral Connect Interface). PCI allows the addition of up to 10 local-bus devices and supports concurrent CPU and bus-master operation. PCI also supports the new 64-bit Pentium processors; the VL-Bus does not. No systems or devices utilizing PCI are available as we go to press; however, they should be available later this year.

ISA BUS

This standard AT bus has several technical limitations. These include the inability to address more than 16 MB of RAM, an 8-MHz operating speed, and a theoretical 16-Mbps data transfer rate. Nevertheless, it remains the most popular choice for an expansion bus due to the large number of ISA boards available and its low cost.

MICRO CHANNEL ARCHITECTURE BUS

This 32-bit design put forth by IBM allows for bus-mastering devices and 40-Mbps data transfer rates. It uses software-configurable boards (no messing with DIP switches or jumpers) and is software compatible with the ISA bus. The bus uses an entirely different connector than the ISA bus. Two disadvantages: Only a few vendors support it, and systems using it tend to be much more expensive than ISA systems.

EISA BUS

Another 32-bit bus that supports bus mastering and data transfer rates of up to 32 MBps. It's also compatible with existing ISA cards; this feature is EISA's best and worst aspect. EISA systems will accept ISA cards, but this acceptance can cause conflicts with the EISA configuration software. EISA configuration software cannot configure ISA cards or recognize ISA cards' settings. This means you still must configure ISA IRQs (interrupt requests) and other settings by hand. EISA systems used to command a large price premium over ISA systems, but that premium has dropped considerably in the last year.

Need a high-powered Windows workstation?

BEST OVERALL CompuAdd 466 DX2 Desktop Power



The CompuAdd 466 DX2 Desktop Power posted the second fastest Windows performance score (behind the Comtrade VESA Local Bus Professional). Its fast graphics performance derives from the new Diamond Computer Viper video card with the Weitek Power 9000 chip set and 2 MB of VRAM. The video is connected through a VL-Bus slot. The \$4039 price includes a CompuAdd 14-inch monitor with a video adapter that can display resolutions of up to 1280 by 1024 pixels (noninterlaced).



\$2993 Zeos 486DX2-66. A Weitek graphics accelerator on the VL-Bus makes the Zeos system a fast Windows machine. It comes with 128 KB of 12-nanosecond secondary processor cache, support for up to 64 MB of system RAM, one free VL-Bus slot, a choice of several Lotus Windows applications, and excellent documentation. The performance score of the Dell 466/ME lagged behind the previous two systems, but slower performance was counterbalanced by useful features like a 16550 UART (universal asynchronous receiver/transmitter) for improved serial communications, and a 224-watt power supply.

The best system for expansion, the Lightning Thunderbox II, also ranked within the top 6 percent for performance. The P C Pros/Touché 486/66 DX2 EISA VLB 5550T finished as a runner-up in this category, with good performance and features scores. However, its usability score was substandard: Cables obstructed all three EISA slots, and the CPU socket made only half-length cards viable. Moreover, the system was shipped with its DX2 processor in the P24T upgrade socket.

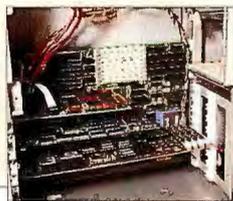
We also found the Microtech MT/VLB 486DX2/66 hard to use. Its two nine-pin serial ports were unmarked, and five of the seven ISA slots were limited to half-length cards due to poor placement of the RAM SIMM slots, a fan-mounted CPU, and secondary cache SIMM.

We named the \$2400 486/66 VESA tower system from High Definition System the best low-cost system, even though it ran our Windows tests slower than three runners-up. One runner-up that the High Definition machine bested was the 486DX2 system from Bi-Link, which frustrated us with its cramped mini-tower case that made adapter installation and memory expansion difficult.

		PROCESSOR	CASE	PRICE	SPEED INDEX	EASE OF USE	BUS	DISPLAY (MAX. RES.)	HARD DRIVE	RAM CACHE (KB) STANDARD	MAX.
BEST	CompuAdd 466 DX2	486DX2/66	■	\$4039	8.2	Excellent	VL, ISA	1280 × 1024	500-MB IDE	256	256
RUNNER-UP	Zeos 486DX2-66	486DX2/66	■	\$2993	7.7	Excellent	VL, ISA	1280 × 1024	340-MB IDE	128	256
RUNNER-UP	Lightning Thunderbox II	486DX2/66	■	\$3895	8.1	Fair	VL, EISA	1280 × 1024	520-MB SCSI	1024	1024
RUNNER-UP	Dell 466/ME	486DX2/66	■	\$3669	7.3	Good	EISA ¹	1024 × 768	320-MB IDE	128	128
RUNNER-UP	Tri-Star 486 VL Station	486DX2/66	■	\$3279	7.5	Good	VL, ISA	1280 × 1024	340-MB IDE	256	256
RUNNER-UP	Comtrade VESA Local Bus	486DX2/66	■	\$2695	8.7	Fair	VL, ISA	1280 × 1024	340-MB IDE	256	256
RUNNER-UP	NEC Image 486	486DX2/66	■	\$3499	7.2	Excellent	ISA ¹	1024 × 768	340-MB IDE	256	256
RUNNER-UP	Gateway 4DX2-66V	486DX2/66	■	\$2995	7.5	Excellent	VL, ISA	1024 × 768	340-MB IDE	256	256

Searching for capacity as well as speed?

MOST EXPANDABLE Lightning Thunderbox II



The graphics subsystem on the 66-MHz Thunderbox II is a Diamond Viper VL-Bus video card with 2 MB of VRAM and a Weitek Power 9000 chip set. The Diamond Viper supports modes of up to 1280- by 1024-pixel resolution. The Thunderbox has five available EISA slots and three available 5 1/4-inch drive bays. The system's EISA-based SCSI controller supports up to 16 MB of cache and 1024 KB of secondary cache to boost performance (most other systems contained 256 KB or smaller cache).

		PROCESSOR	CASE	PRICE	SPEED INDEX	EASE OF USE	BUS	DISPLAY (MAX. RES.)	HARD DRIVE	DRIVE BAYS 3 1/2" 5 1/4"
BEST	Lightning Thunderbox II	486DX2/66	■	\$3895	8.1	Fair	VL, EISA	1280 × 1024	520-MB SCSI	0 3
RUNNER-UP	Microtech MT/VLB 486DX2/66	486DX2/66	■	\$3099	7.5	Fair	VL, ISA	1280 × 1024	340-MB IDE	1 5
RUNNER-UP	P C Pros EISA VLB 5550T	486DX2/66	■	\$4721	7.9	Fair	VL, EISA	1280 × 1024	640-MB SCSI	3 3
RUNNER-UP	Ariel 486/DX2-66EVS	486DX2/66	■	\$4995	8.1	Fair	VL, EISA	1280 × 1024	877-MB SCSI	0 4
RUNNER-UP	Boss 466EV	486DX2/66	■	\$4495	7.3	Fair	VL, EISA	1024 × 768	340-MB SCSI	0 4
RUNNER-UP	Ares 486-66DX2-VL	486DX2/66	■	\$3519	7.6	Fair	VL, ISA	1024 × 768	525-MB SCSI	0 3

Want a low-cost, Windows-capable system?

LOW COST High Definition HDVLB66



The \$2400 High Definition HDVLB66 includes a 14-inch Amax Impression Plus monitor with a video adapter that supports noninterlaced resolutions of up to 1280 by 1024 pixels. The graphics subsystem is a VL-Bus Genoa WindowsVGA 24 video card with a Cirrus Logic GD5426 chip set. The system also has a VL-Bus UltraStor hard drive controller connected to a 340-MB Fujitsu drive.

		PROCESSOR	CASE	PRICE	SPEED INDEX	EASE OF USE	BUS	DISPLAY (MAX. RES.)	HARD DRIVE	TECH. SUPPORT
BEST	High Definition HDVLB66	486DX2/66	■	\$2400	7.0	Fair	VL, ISA	1280 × 1024	340-MB SCSI	Lifetime
RUNNER-UP	Acma 486/DX2-66 VESA	486DX2/66	■	\$2595	7.3	Fair	VL, ISA	1024 × 768	360-MB IDE	12 months
RUNNER-UP	Bi-Link 486 VESA Local Bus	486DX2/66	□	\$2599	7.3	Fair	VL, ISA	1280 × 1024	360-MB IDE	Lifetime
RUNNER-UP	Image 486DX2-66VL	486DX2/66	■	\$2339	6.7	Fair	VL, ISA	1024 × 768	340-MB IDE	Lifetime
RUNNER-UP	Eastern Tech ET 486VLB66	486DX2/66	■	\$2595	7.3	Fair	VL, ISA	1024 × 768	340-MB IDE	Lifetime
RUNNER-UP	HiQ Super Power	486DX2/66	■	\$2699	6.3	Fair	VL, ISA	1280 × 1024	340-MB IDE	Lifetime

¹ Video is on proprietary local bus.

KEY
 ■ Desktop ■ Tower
 □ Mini-tower VL = VL-Bus



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 McGraw-Hill

Link to Products

Your network buy for today's business technology market.

McGraw-Hill TechNet



McGraw-Hill Magazines. Your Best Business Partners.

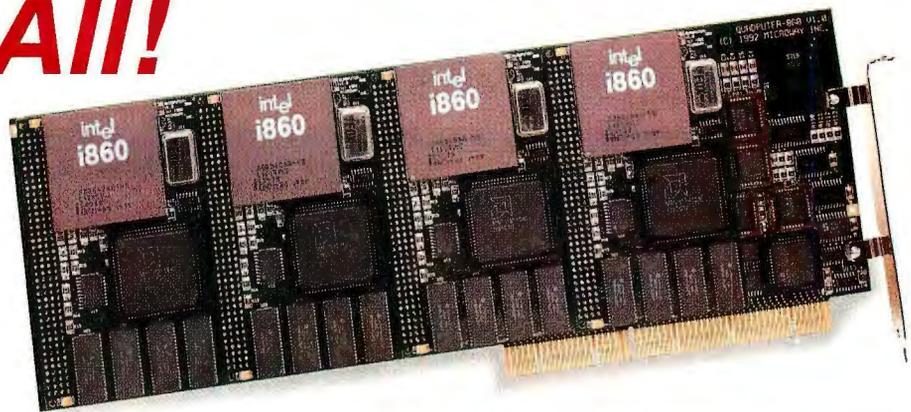
- 4- Architectural Record ■ 7- A/C Flyer, Aviation Week & Space Technology, AW & ST China Quarterly, AW & ST USSR, Business & Commercial Aviation, World Aviation Directory and Buyer's Guide ■ 20- Business Week, Business Week China, Business Week Hungary, Business Week International, Business Week USSR
- 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



From parallel 860s, to coprocessors and workstations-

NDP™ Fortran Drives Them All!

Microway's industry-leading 32-bit Fortran produces the highest quality numeric code and supports all x86 operating systems, processors and numeric devices. NDP Fortran was used to port industry standards like SRAC's COSMOS/M to the 486 and is required to use Aspentech's ASPEN PLUS, IBM's OSL, and Fluid Dynamics' FIDAP. The compiler uses advanced numeric optimizations and instruction scheduling which favor fast numerics and RISC devices.



QuadPuter®-860 . . . 200 Megaflops

The 200 megaflops of Microway's QuadPuter-860 are optimally harnessed using NDP Fortran-860, libraries from IMSL, NAG and KUCK, and the PSR Vectorizer.

NDP Fortran, C/C++, Pascal

and our new **Fortran 90**

for the 386, 486, Pentium, and 860 run under either Extended DOS, OS/2, NT, UNIX V.3/4, SOLARIS, or COHERENT.



The extended DOS compilers feature GREX, Microway's proprietary device-independent graphics library. To run large applications on DOS, our VCPI-based, demand paged virtual memory is superior to all alternatives. We also offer DPMI support for the OS/2 and the Windows DOS Prompt Box. The OS/2 compilers include support for OS/2's 32-bit graphics engine.

Microway's NDP Fortran 90 is a full implementation of the ANSI Fortran 90, which includes the entire array syntax notation, dynamic memory allocation, module definitions, and a complete library of intrinsics. Call for your free demo disk and white paper.

If you plan to use a 386, 486, 860 or Pentium and require portability across operating systems, numeric speed, precision and superior technical support, then NDP Fortran, C/C++ or Pascal is the only solution.

GIGABOX™

Microway can build you a customized one gigaflop NFS computational server using five QuadPuters® running in one of our industrial grade Towers for under \$50K. We also configure less expensive 486 workstations. All feature industrial grade American power supplies based on Todd cores and flow-through filtered cooling.



To learn why more government research labs, universities and engineers worldwide specify "Microway" call our Technical Support Department at 508-746-7341 or any of the international representatives below.

Microway®

Technology You Can Count On

Corporate Headquarters, Research Park, Box 79, Kingston, MA 02364 USA • TEL 508-746-7341 • FAX 508-746-4678
U.K. 081-541-5466 • Germany 069-752023 • Greece 01-291-5672 • India 11 681 0645 • Israel 3-751-2929
Italy 2-749-0749 • Japan 079 822 5855 • Poland 22-414115 • Portugal/Spain 1-60 4049 • Russia 095 155 030

Chips for Fast Graphics

With the battle of video-accelerator chips becoming more intense, we decided to see which chip sets performed the best in our BYTE Windows graphics tests. Our results showed that the Weitek Power 9000 graphics-coprocessor chip was the hands-down winner. Seven of the top 10 graphics performance systems contained a Weitek Power 9000 chip on the local bus. Of the next six top performers, three contained the S3-805 chip and three contained the ATI Mach 32. All 15 systems were of the same class: 66-MHz 486DX2 systems with all but two (the DECpc and the Unisys PW²) having the video adapter located on the local bus.

The Weitek Power 9000 chip was included primarily in Diamond Computer's Viper and in boards from Orchid. The Diamond Stealth 24 used an S3-805 chip, and the ATI Mach 32 was used only in the ATI Graphics Ultra Pro video board.

The following charts provide specifics on the graphics subsystems of all the BYTE Best and runner-up systems.

SYSTEM	VIDEO BOARD	CHIP	BYTE WINDOWS SPEED INDEX
Ariel 486DX2-66EVS	SixGraph	Weitek Power 9000	7.3
Bi-Link 486 VESA Local Bus	Star 2000	Weitek Power 9000	6.9
Comtrade VESA Local Bus Professional	Diamond Viper	Weitek Power 9000	8.7
FutureTech System 462eV	Diamond Viper	Weitek Power 9000	8.4
HiQ Super Power 4DX2-66VLB	Diamond Viper	Weitek Power 9000	7.7
Lightning Thunderbox II	Diamond Viper	Weitek Power 9000	8.5
P C Pros/Touché 486/66 DX2 EISA VLB 5550T	Karros	Weitek Power 9000	7.3
Zeos 486DX2-66	Diamond Viper	Weitek Power 9000	8.2
CompuAdd 466 DX2 Desktop Power	ATI Graphics Ultra Pro	ATI Mach 32	8.3
CompuAdd MC 466EDX2	ATI Graphics Ultra Pro	ATI Mach 32	3.6
Gateway 4DX2/66V	ATI Graphics Ultra Pro	ATI Mach 32	5.1
Micro Express Micro Flex	ATI Graphics Ultra	ATI 38800	4.1
Microtech MT/VLB 486DX2/66	ATI Graphics Ultra Pro	ATI Mach 32	5.1
Tri-Star 486 VL Station	ATI Graphics Ultra Pro	ATI Mach 32	5.1
Unisys PW ² Advantage Plus 4666	ATI Graphics Ultra Pro	ATI Mach 32	4.7
Acma 486/DX2-50 ISA Workstation	Diamond Stealth 24	S3-805	4.4
Acma 486/DX2-66 VESA System	Diamond Stealth 24	S3-805	5.5
Ares 486-66DX2-VL	Diamond Stealth 24	S3-805	5.6
DECpc 466ST	Appian	S3-925	4.5
Dell 466/ME	Integrated	S3-805	5.4
Image 486DX2-66VL	Diamond Stealth 24	S3-805	5.3
AST Premmia 4/66d Model 343W	Integrated	Cirrus Logic GL5422	2.7
Boss 466EV	Genoa WindowsVGA 24	Cirrus Logic GL5426	4.1
Computer Expo CompuEx 486VLB/66	CompuEx LB	Cirrus Logic GL5426	3.6
Eastern Tech ET 486VLB66	Genoa WindowsVGA 24	Cirrus Logic GL5426	4.2
High Definition HDVLB66	Genoa WindowsVGA 24	Cirrus Logic GL5426	4.1
Key 486DX-50 VL-Bus Windowstation	Genoa WindowsVGA 24	Cirrus Logic GL5426	3.5
NEC Image 466	Integrated	Tseng ET4000W32	4.0
Xinetron X/LAN 486DX2 Workstation	Color Designer	Tseng ET4000AX	2.1
Computer Sales Professional Pro-486DX2/66	Paradise Accelerator Card for Windows	WD 90c31	2.6
Hertz 486/66Ei	Integrated	WD 90c30	1.7
Swan 486/50ES	Integrated	WD 90c30	1.3
Swan 486/66ES	Integrated	WD 90c30	1.6

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*

UNIXWORLD
McGraw-Hill's Magazine of Open Systems Computing

More Driver Dilemmas

Every month we have a driver problem. Last month, Windows printer drivers gave us headaches. This month, Windows video drivers, SCO Unix disk drivers, and EISA configuration files all took their toll.

MISSING DRIVERS

It does you no good to spend extra money on an accelerated graphics card if the video driver doesn't support the accelerator. Make sure the system you purchase ships with the proper driver, and be sure the driver you receive is the latest. We had no less than three different versions of the video drivers for ATI's Mach 32 chip.

PLAN FOR UNIX

Be sure you have an SCO Unix driver that supports your drive controller card, or you won't even be able to install

Unix. SCO supports most IDE drivers and Adaptec SCSI adapters, but we had problems with other SCSI adapters.

EISA .CFG FILES

We were astounded by the problems we had with missing EISA configuration files. While not driver files, EISA .CFG files allow each system's EISA configuration utility to properly configure the system and the adapter. If you are purchasing EISA, make sure you get the appropriate configuration disk for all adapters shipped with the system.

BACKUPS

Be diligent about keeping a backup of all drivers and configuration files, as well as any EISA configuration or setup utilities. Also make sure that the vendor doesn't just install the drivers on your

system; insist on driver disks, too. That will help you avoid problems when reconfiguring. Dell's preinstalled Windows video driver was lost when we installed Unix. We had to retrieve the file from Dell's BBS to go back to running Windows in high resolution.



Software Bundles

With the price of systems dropping significantly in the past year, it's now easy to have more money tied up in software than in hardware. Software bundles offered by systems vendors can be a significant savings that is often overlooked when purchasing systems. DOS and Windows were standard with most of the systems we reviewed. The vendors listed here offered much more. Also, you should make sure that you get original floppy disks for any preinstalled software, along with manuals and registration materials.

SYSTEMS VENDOR	SOFTWARE
Altec	Choice of Turbo Pascal, Ami Pro, Lotus 1-2-3, Freelance Graphics, Turbo C++, or Paradox
Ariel	Choice of Borland C++, Quattro Pro, or Paradox
CompuAdd	NetWare Lite
Computer Sales Professional	PFS:WindowWorks and Quicken
Computers by Malone	SuperStor PE, Search and Destroy, and Online Bible
Gateway 2000	Choice of eight applications or bundles
Image	PFS:WindowWorks
Keydata	Choice of Quattro Pro for Windows, Norton Desktop, Object Vision, or Sidekick
NEC	Micrografx PhotoMagic
Q Tech	Quattro Pro for either DOS or Windows
Tandy	America Online
Zenith	Windows for Workgroups
Zeos	Lotus Organizer and choice of 1-2-3 for Windows, Ami Pro, or Freelance Graphics

MADE TO ORDER

Buying a system is like ordering a meal at a fast-food restaurant—you can have it your way, if you know what to ask for. Before you order, ask yourself:

WHICH PROCESSOR DO I WANT?

The systems in this review all contain 486DX2/66, 486DX2/50, or 486DX/50 processors. For best performance, choose a 486DX2/66, which surprisingly doesn't command a huge price premium over a 50-MHz system.

HOW MUCH MEMORY DO I NEED?

For DOS, get at least 4 MB; for Windows, 8 MB; and for Unix, 12 MB. More memory is always better, especially for working in multitasking environments.

WHAT HARD DRIVE IS BEST?

For Windows users, 200 MB is probably the minimum; for DOS, at least 100 MB; and for Unix, where a full installation can take up about 170 MB, we recommend at least a 300-MB drive. IDE drives are often cheaper, but SCSI drives offer you daisy-chaining expandability.

DO I NEED A GRAPHICS ACCELERATOR?

The answer is yes, if it comes with drivers for the applications you run. In environments like Windows, speeding up your video will make more difference in performance than anything short of upgrading your processor.

WHAT KIND OF CASE SHOULD I CHOOSE?

Tower cases offer more expandability but can command a premium price. Slim-line desktop cases aren't as expandable, but they are good if desktop space is limited. New mini-tower designs are a good mix between desktops and towers.

UNIX

To gauge Unix performance, we analyzed the BYTE Unix benchmarks and SPEC89. The file copy and the pipe elements of the BYTE suite gave us insights into hard drive speed. The SPEC tests run Unix applications to test system performance. The SPEC tests consist of computationally intense scientific and mathematical tasks such as simulation of electronic circuits and manipulation of complex math operations.

High scores in our Unix performance tests indicate systems with superior CPU speed and fast memory access times. All but two of our Unix-ranked systems relied on 66-MHz processors. The exceptions were the Swan 486/50ES, which posted the lowest speed scores in the two categories it appeared in as a runner-up: Best Overall and Most Expandable. Although this machine trailed in performance, its speeds were within 10 percent of the average, and the tower's design was one of the most flexible we saw, with eight free 3½-inch drive bays and six free EISA slots. The other 50-MHz machine, Micro Express's Micro Flex, ranked in the low-cost category on the strength of its acceptable performance, ease of use, and low \$1999 price tag.

In addition to speed, each system's features score accounted for 30 percent of our final choice. High physical-memory capacity is an important criterion for multitasking environments like Unix. Accordingly, when we rated systems for features, we gave the most points to models with motherboards that could hold the most memory. All nine systems in the Best Overall category could handle 32 MB; the standouts, including systems from AST, CompuAdd, Hertz, Swan, and Unisys could accommodate 128 MB of RAM on the main memory board. All the systems in the Best Overall category contained 256 KB of secondary cache, except for the Unisys PW² Advantage Plus, which comes with 128 to 256 KB of expandable RAM cache. The AST Premmia can handle a cache as large as 512 KB. A second processor cache is more beneficial for Unix operation than for DOS or Windows due to the large programs, multitasking, and heavy computational tasks involved in Unix.

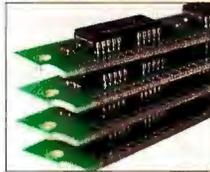
Graphical environments such as the X Window System stress the video subsystem and make a system's video speed a performance bottleneck. Although our tests were not graph-

DISK CACHES: WHERE TO PUT YOUR MEMORY

Almost everyone in the computer industry can agree on this: Disk caches speed performance. A disk cache can be maintained by software in a section of system memory or held in dedicated memory on the hard drive controller. Here's what we learned about this speed-enhancing technique.

A HARDWARE CACHE ISN'T NECESSARILY BETTER THAN A SOFTWARE CACHE. Vendors tout caches on the hard drive controller (or on the drive itself). We ran tests on the Micron Computer 486VL WinStation 466 with a Tekram local-bus IDE controller using both a 4- and a 1-MB cache on the drive controller. Next, we ran the same system using a 4-MB software cache under Windows 3.1's SmartDrive. The result: SmartDrive slightly outperformed the similar-size hardware cache.

There are several reasons why this may be the case. Even though the controller we used was in a VL-Bus slot, accessing the data cached in main system memory may have been faster than accessing the memory on the drive controller. Presumably, this difference may be even greater on traditional ISA or EISA systems. Also, SmartDrive may provide a better caching algorithm than Tekram hardware.



A SOFTWARE CACHE IS MORE FLEXIBLE THAN A HARDWARE CACHE.

You can easily reconfigure a software cache. Changing the settings on a hardware cache often means rebooting and accessing the system setup utility or even using your EISA configuration software. Also, the memory dedicated to a software disk cache may be used as regular system memory when the cache is turned off, while the memory on a drive controller card is completely committed.

Hardware caches may have an advantage in data integrity. If your system happens to lock up as a software cache writes, you will likely lose data. With a hardware cache, that data is likely to be written out and not lost. Neither write-caching implementation will save you from losing data on a power loss, however.

In most cases, you're better off spending the money you'd have spent on a hardware cache on system memory instead. That way, you have the option to portion the additional RAM as cache or as main memory, whichever improves performance most.

ical in nature, users of concurrent windowing applications would benefit from the graphics accelerators used in all the ranked systems. Note: Make sure the version of X that you are running supports your video adapter or that the manufacturer supplies drivers; otherwise, you might be forced to operate in non-Super VGA video modes.

All the systems in our test sample supported displays of at least 1024 by 768 pixels; we gave extra points to AST's Premia 4/66d and the CompuAdd 466 DX2 Desktop Power, both of which came with 2 MB of VRAM and supported display resolutions of 1280 by 1024 pixels (noninterlaced).

Although the floating-point operation of these high-end 486 systems lags behind that of RISC-based workstations, often the choice for Unix users, many of the 486s contained a socket for the addition of a Weitek math coprocessor that will help boost performance of floating-point tasks.

The large applications and data files common in the Unix world make storage expandability an important consideration. Our features ratings gave extra emphasis to the systems with the most drive bays. Similarly, we considered open drive bays important for CD-ROM—increasingly the delivery media of choice for Unix software vendors—or tape backup. Not surprisingly, 12 of our 17 ranked Unix systems were tower cabinets, while all five of the remaining ranked systems were mini-tower designs.

The remainder of our evaluation was based on ease of use. Here we rated each system for how quickly we could add hard drives and expansion cards, whether expansion areas were free of wiring and other obstructions, and how clear and comprehensive the accompanying users manuals were.

KEY

- Desktop
- Tower
- Mini-tower
- VL = VL-Bus

BYTE BEST

UNIX

Plan to run Unix on a desktop 486?

BEST OVERALL Hertz 486/66Ei



The combined BYTE Unix benchmark and SPEC benchmark results for this tower were better than those of any system we tested. The Hertz system also offers a maximum of 128 MB of 32-bit memory on the main memory board (compared to 32 and 64 MB for the runner-up DECpc and the NEC Image 466, respectively). This, along with a maximum of 256 KB of secondary cache helps the Hertz system handle multiple sessions and large Unix applications. The system's Adaptec hard drive controller and Micropolis 1.2-GB SCSI hard drive recorded the fastest score overall on the BYTE Unix File Copy test—20 percent better than the Unisys PW² Advantage Plus 4666, the second fastest Unix system overall.



		PROCESSOR	CASE	PRICE	SPEED INDEX	EASE OF USE	BUS	DISPLAY (MAX. RES.)	HARD DRIVE	RAM CACHE (KB) STANDARD	MAX.
BEST	Hertz 486/66Ei	486DX2/66	■	\$5870	9.0	Excellent	EISA	1024 × 768	1.2-GB SCSI	8	128
RUNNER-UP	Swan 486/50ES	486DX/50	■	\$5969	8.2	Excellent	EISA	1024 × 768	325-MB SCSI	16	128
RUNNER-UP	CompuAdd 466 DX2	486DX2/66	□	\$4039	8.4	Excellent	VL, ISA	1280 × 1024	500-MB IDE	8	256
RUNNER-UP	AST Premia 4/66d	486DX2/66	□	\$5090	8.4	Good	VL, EISA	1280 × 1024	340-MB IDE	8	128
RUNNER-UP	DECpc 466ST	486DX2/66	■	\$5449	8.8	Good	EISA	1024 × 768	1-GB SCSI	8	32
RUNNER-UP	Unisys PW ² Advantage Plus	486DX2/66	□	\$6552	8.7	Excellent	EISA	1024 × 768	1-GB SCSI	8	128
RUNNER-UP	NEC Image 466	486DX2/66	□	\$3499	8.5	Excellent	ISA ¹	1024 × 768	340-MB IDE	8	64

Need a Unix system with room for options?

MOST EXPANDABLE Hertz 486/66Ei



In addition to excelling in Unix performance (see item above), the Hertz 486/66Ei stood out as an expandable system. The system can address a maximum of 384 MB of 32-bit memory. The tower case has eight available 3 1/2-inch hard drive bays and eight adapter slots. The drive bays are easily accessible and free from obstructions, such as wiring or adapters.

		PROCESSOR	CASE	PRICE	SPEED INDEX	EASE OF USE	BUS	DISPLAY (MAX. RES.)	HARD DRIVE	RAM CACHE (KB) STANDARD	MAX.
BEST	Hertz 486/66Ei	486DX2/66	■	\$5870	9.0	Excellent	EISA	1024 × 768	1.2-GB SCSI	8	128
RUNNER-UP	Swan 486/50ES	486DX/50	■	\$5969	8.2	Excellent	EISA	1024 × 768	325-MB SCSI	16	128
RUNNER-UP	Boss 466EV	486DX2/66	■	\$4495	8.3	Fair	VL, EISA	1024 × 768	340-MB SCSI	8	256
RUNNER-UP	Microtech MT/VLB	486DX2/66	■	\$3099	8.2	Fair	VL, ISA	1280 × 1024	340-MB IDE	8	64
RUNNER-UP	Lightning Thunderbox II	486DX2/66	■	\$3895	8.2	Fair	VL, EISA	1280 × 1024	520-MB SCSI	8	256
RUNNER-UP	Ares 486-66DX2-VL	486DX2/66	■	\$3519	8.6	Fair	VL, ISA	1024 × 768	525-MB SCSI	8	64

Seeking power for Unix at a bargain price?

LOW COST High Definition HDVLB66



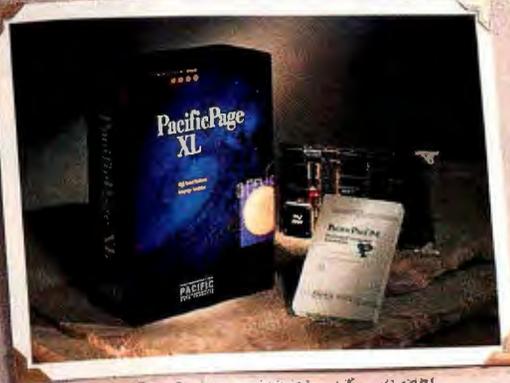
This \$2400 tower system ran our Unix tests faster than any other low-cost system. To optimize graphics and hard drive performance, the system used the VL-Bus for its Genoa WindowsVGA 24 video card and the UltraStor SCSI drive controller. The HDVLB66 can hold a maximum of 1 MB of secondary cache RAM (most of the Unix-ranked systems topped out at 256 KB). The system can hold 256 MB of 32-bit RAM on the main memory board. The system also offers one free drive bay.

		PROCESSOR	CASE	PRICE	SPEED INDEX	EASE OF USE	BUS	DISPLAY (MAX. RES.)	HARD DRIVE	RAM CACHE (KB) STANDARD	MAX.
BEST	High Definition HDVLB66	486DX2/66	■	\$2400	8.1	Fair	VL, ISA	1280 × 1024	340-MB SCSI	8	32
RUNNER-UP	Computer Sales Professional	Pro-486DX2/66	■	\$2199	7.2	Good	ISA	1024 × 768	212-MB IDE	8	32
RUNNER-UP	Eastern Tech ET 486VLB66	486DX2/66	■	\$2595	7.9	Fair	VL, ISA	1024 × 768	340-MB IDE	8	32
RUNNER-UP	Acma 486/DX2-66 VESA	486DX2/66	■	\$2595	7.5	Fair	VL, ISA	1024 × 768	360-MB IDE	8	32
RUNNER-UP	Micro Express Micro Flex	486DX/50	□	\$1999	6.3	Good	ISA	1024 × 768	325-MB IDE	8	32
RUNNER-UP	Key VL-Bus Windowstation	486DX/50	■	\$2395	6.7	Fair	VL, ISA	1024 × 768	210-MB IDE	8	32

¹ Video is on proprietary local bus.



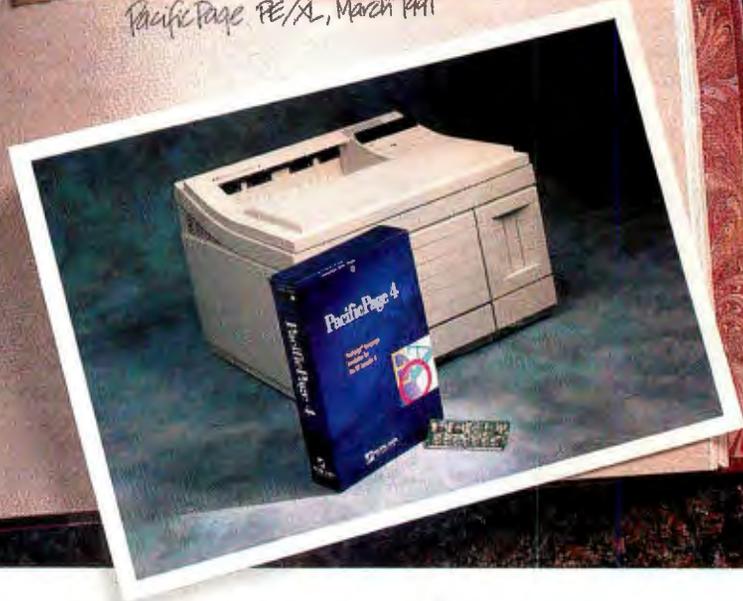
PacificPage PE, September 1989



PacificPage PE/XL, March 1991



PacificPage PE, March 1990



Introducing PacificPage 4. The latest addition to a very prominent family.

The latest member of the award winning PacificPage® family has arrived. Called PacificPage 4, it's designed just for the new LaserJet® 4 printer.

Like all of its earlier family members, PacificPage 4 provides full PostScript® language emulation. The same 35 Apple® LaserWriter® scalable typestyles. And all of PostScript's powerful graphics capabilities. It also accepts downloaded Type 1 and 3 font formats.

Just install the SIMM module into any of your printer's memory slots. With 4 MB of additional printer memory, PacificPage 4 can print your PostScript output at an impressive 600 dpi resolution. You'll get sharp, crisp output that you'd expect only from an expensive, high-end PostScript device.

And your PostScript files will be printed quickly because PacificPage 4 utilizes the i960™ processor built into each LaserJet 4.

If your printer is on a network, you never have to worry about confusing the printer with PCL and PostScript files.

That's because PacificPage 4 fully supports the automatic language sensing and switching feature of the LaserJet 4.

Like all of the PacificPage products before it, PacificPage 4 is covered by a full lifetime warranty and is backed by a 60-day money back guarantee of satisfaction.

With all of these impressive features and capabilities, you'll be surprised to learn that PacificPage 4 is priced at a low \$299. Although, if you're familiar with PacificPage 4's predecessors, you know that high quality and low price run in the family.

For the dealer nearest you or to order PacificPage 4, call (619) 625-3628, Fax (619) 552-0889.

**PostScript
language
emulation for
the LaserJet 4**

Be sure to ask about Pacific 4 SIMM Memory™ — 1, 2, 4, and 8 MB memory upgrades for the LaserJet 4.

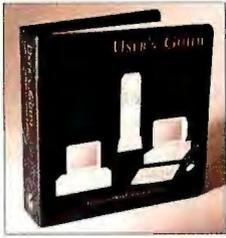


Pacific Data Products, Inc., 9125 Rehco Rd., San Diego, CA 92121. In Europe, call (353) 61 4756099. PacificPage is a trademark of Pacific Data Products, Inc. PhoenixPage is a registered trademark of Phoenix Technologies Ltd. All other brands and product names are trademarks or registered trademarks of their respective manufacturer. © 1993 Pacific Data Products, Inc.



**PACIFIC DATA
PRODUCTS**

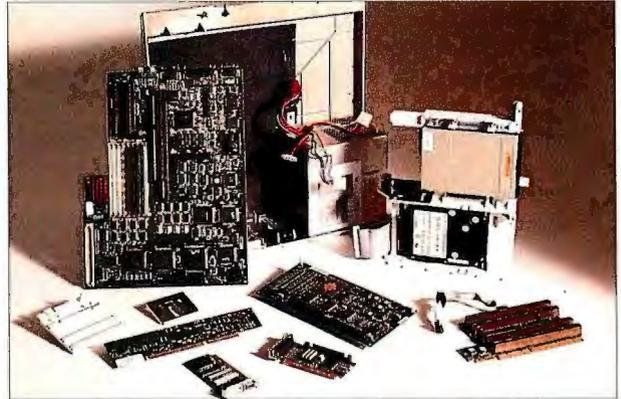
HONORABLE MENTIONS



The Gateway 2000 manuals were comprehensive, organized in a straightforward way, and easy to use. Most systems in the roundup supplied a different manual for each subsystem—one for the hard drive controller, one for the video card, two for the motherboard, and so

on—but Gateway 2000 chose a better approach. Gateway's systems include a single, integrated manual with one index and one glossary. This one-stop documentation made it much easier to configure and work with Gateway's machines. And the glossary not only covers system components, but it also includes definitions of general computing terms (i.e., everything from *open architecture* and *multitasking* to *hacker* and *nerd*).

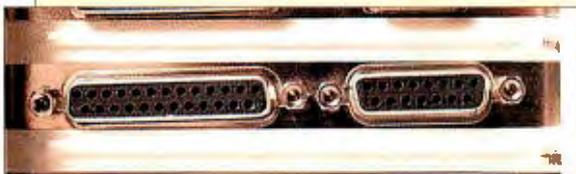
IBM Adapter-Card Connectors It's easy to put adapter cards into the IBM PS/2 Model 77 DX2. Adapter cards are held down by a single thumbscrew at the bottom of the card instead of one at the top of the card. With other systems, you not only need a screwdriver, but the case and motherboard must be aligned precisely to make sure cards are seated.



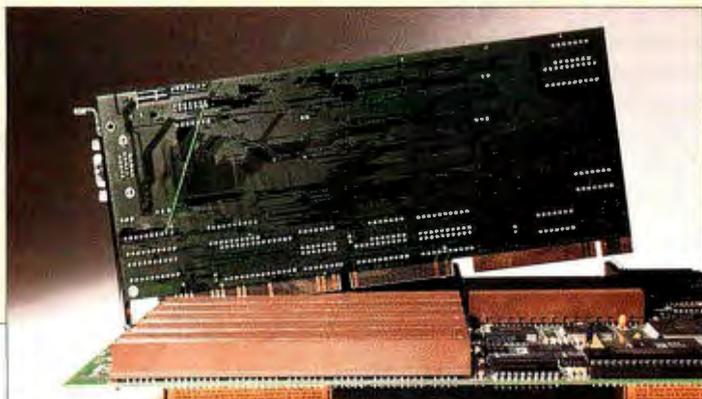
Zenith Modularity The Zenith Z-Station system's modular design lets you quickly replace or upgrade every system component. The CPU, video adapter, Ethernet port, and SCSI port each are located on an easily removable card. The same motherboard can accept a proprietary EISA bus or ISA bus card that provides four horizontal slots. The hard drive and floppy drive come in a single chassis that require only one power connection and no data cables. Memory SIMMs are easily accessible, and there are six open banks for RAM expansion.

Dubious Achievements

CAF Parallel Port The CAF Technology Platinum 5B came to us with its parallel-port connectors inserted upside down into the port's metal faceplate. Consequently, the larger end of the connector (with 13 pins) was aligned with the smaller end of the faceplate and vice versa. This must have been difficult to accomplish since both the case and port are designed to fit together one way only. As such, this parallel port is completely useless; no parallel-printer cable or any other device meant for this port can attach to it since the pin holes are facing in the opposite direction from the faceplate.



VL-Bus Connectors The VL-Bus specification defines a new card-edge connector. The connector adds a short extension to standard ISA or EISA slots, making VL-Bus sockets more versatile. However, the extended connector also means you must fit almost 9 inches of card edge into a socket when installing VL-Bus cards. That makes it very difficult to seat an adapter properly. One side of the adapter will snugly snap into place, but the other end will pop out, making installing most VL-Bus cards like riding a seesaw.



ROLL CALL OF SYSTEMS TESTED

VENDOR	MODEL	PERFORMANCE	EASE OF USE	PRICE	PHONE	TOLL-FREE NO.	INQUIRY NO.
CAF Technology, Inc.	Gold 5T	5.5	Fair	\$3049	(818) 369-3690	N/A	976
CAF Technology, Inc.	Platinum 5B	5.7	Fair	\$3149	(818) 369-3690	N/A	977
Deico Electronics	Predator-I	5.9	Excellent	\$2995	(510) 651-7800	(800) 321-8990	978
Image Microsystems	Image 486DX-50	6.2	Fair	\$2189	(310) 815-1000	(800) 729-3400	979
Keydata International, Inc.	Key 486DX-50 VL-Bus Windowstation	6.2	Fair	\$2395	(908) 755-0350	(800) 482-7010	980
Micro Express	Micro Flex (ME 486-50)	5.7	Good	\$1999	(714) 852-1400	(800) 989-9900	981
PC Craft	PCC 2804-50IS	5.7	Fair	\$2099	(714) 256-5000	(800) 938-4888	982
Swan Technologies, Inc.	486/50ES	5.4	Excellent	\$5969	(814) 234-2236	(800) 468-9044	983
Acma Computers, Inc.	486/DX2-50 ISA Workstation	6.1	Good	\$2295	(510) 623-1212	(800) 786-6888	984
American Mitac Corp.	LanMaster 6000E	5.4	Fair	\$4795	(510) 623-5300	(800) 765-6972	985
Compaq Computer Corp.	DeskPro 50M	5.6	Excellent	\$3734	(713) 370-0670	(800) 345-1518	986
CompuDyne Products, Inc.	486/DX2-50 VLB	6.1	Fair	\$2439	(214) 702-5600	(800) 932-2667	987
Dell Computer Corp.	450/L	6.0	Fair	\$2919	(512) 338-4400	(800) 289-3355	988
Dell Computer Corp.	450/ME	6.0	Good	\$3569	(512) 338-4400	(800) 289-3355	989
Digital Equipment Corp.	DECpc 450d2 MT	5.3	Good	\$2899	(508) 493-5111	(800) 722-9332	990
Digital Equipment Corp.	DECpc 450ST	5.8	Good	\$4849	(508) 493-5111	(800) 722-9332	991
Duracom Computer Systems	DeskSaver 486/50DX2	5.3	Fair	\$2449	(214) 518-1200	(800) 551-9000	992
Duracom Computer Systems	DeskSaver 486/50DX2 E	5.3	Fair	\$3149	(214) 518-1200	(800) 551-9000	993
Gateway 2000	4DX2-50E	5.0	Excellent	\$3495	(605) 232-2000	(800) 523-2000	994
Gateway 2000	4DX2-50V	5.8	Good	\$2495	(605) 232-2000	(800) 523-2000	995
Grid Systems Corp.	MFP 450 Plus	4.8	Fair	\$4138	(817) 491-5200	(800) 934-4743	996
High Definition System, Inc.	HDEISA 50	6.0	Fair	\$2850	(408) 720-0493	(800) 347-0493	997
Lucky Computer Co.	LSI-486/50/VLB	6.2	Fair	\$2395	(214) 690-6110	(800) 966-5825	998
Micron Computer	486VL WinStation 450	6.5	Poor	\$3349	(208) 465-3424	(800) 438-3343	999
Microtech Computer Corp.	MT486DX-50	6.1	Fair	\$2699	(404) 345-6508	(800) 342-6508	1334
Sho-Tronics, Inc.	486 Tech DX2/50	4.7	Fair	\$1978	(602) 780-5920	(800) 289-8881	1335
Tandy Corp.	450 DX2	4.9	Good	\$2749	(817) 390-3011	N/A	1336
Zenith Data Systems	Z-Station 450XEH	5.4	Good	\$3549	(708) 808-5000	(800) 553-0331	1337
Zenith Data Systems	Z-Station 450Xh	5.1	Fair	\$3249	(708) 808-5000	(800) 553-0331	1338
Acma Computers, Inc.	486/DX2-66 VESA System	7.4	Fair	\$2595	(510) 623-1212	(800) 786-6888	1339
Advanced Logic Research, Inc.	ALR Evolution IV 4/66d Model 240DW	6.7	Fair	\$3211	(714) 581-6770	(800) 444-4257	1340
Aims Information Systems	EISA-VLB486	7.6	Good	\$3698	(408) 456-0111	(800) 697-2467	1341
Alpha Computer Concepts, Inc.	VL 486DX2 66	7.0	Poor	\$2999	(404) 662-8776	(800) 682-5742	1342
Altec Technology Corp.	486DX2/66	6.0	Fair	\$2699	(818) 969-2988	(800) 255-9971	1343
American Mitac Corp.	Ballistic 486/66	7.3	Poor	\$2995	(510) 623-5300	(800) 765-6972	1344
Ares Microdevelopment	486-66DX2-VL	7.2	Fair	\$3519	(313) 473-0808	(800) 322-3200	1345
Ariel Design, Inc.	486DX2-66EVS	7.3	Fair	\$4995	(617) 982-8800	(800) 882-7435	1346
Ariel Design, Inc.	486DX2-66VLS	6.9	Fair	\$3895	(617) 982-8800	(800) 882-7435	1347
AST Research, Inc.	Bravo 4/66d Model 213W	6.0	Excellent	\$2880	(714) 727-4141	(800) 876-4278	1348
AST Research, Inc.	Premmia 4/66d Model 343W	6.6	Good	\$5090	(714) 727-4141	(800) 876-4278	1349
Bi-Link Computer, Inc.	486 VESA Local Bus	6.7	Fair	\$2599	(310) 692-5345	(800) 888-5369	1350
Boss Technology	466EV	7.5	Fair	\$4495	(404) 636-2126	(800) 628-1787	1351
Boss Technology	466IV	7.0	Fair	\$3995	(404) 636-2126	(800) 628-1787	1352
CAF Technology, Inc.	Gold 6D2	6.2	Fair	\$3129	(818) 369-3690	N/A	1353
CAF Technology, Inc.	Platinum 6T2	6.2	Fair	\$3379	(818) 369-3690	N/A	1354
Caliber Computer Corp.	SYS14	6.8	Fair	\$2599	(408) 942-1220	(800) 995-4594	1355
CIC Computers Ltd.	CIC-Sigma 466 DS	6.4	Good	£2699	+44 81 813 8217	N/A	1356
Compaq Computer Corp.	DeskPro 66i	6.2	Fair	\$3019	(713) 370-0670	(800) 345-1518	1357
Compaq Computer Corp.	ProLinea 4/66i	6.3	Fair	\$2698	(713) 370-0670	(800) 345-1518	1358
Compaq Computer Corp.	ProSignia 486DX2/66-550	6.8	Fair	\$5459	(713) 370-0670	(800) 345-1518	1359
 CompuAdd Computer Corp.	466 DX2 Desktop Power	7.4	Excellent	\$4039	(512) 250-1489	(800) 627-1967	1360
CompuAdd Computer Corp.	MC 466EDX2	6.0	Excellent	\$6884	(512) 250-1489	(800) 627-1967	1361
CompuDyne Products, Inc.	486/DX2-66 VLB	7.3	Fair	\$2639	(214) 702-5600	(800) 932-2667	1362
Computer Expo	CompuEx 486VLB/66	7.0	Fair	\$2567	(713) 531-0990	(800) 229-3976	1363
Computer Sales Professional	Pro-486DX2/66	5.8	Good	\$2199	(908) 560-1143	(800) 950-6660	1364
Computers by Malone	CBM 466	6.0	Fair	\$2589	(402) 333-6783	(800) 842-0906	1365
CompuTrend Systems, Inc.	Premio VESA DX2-66	5.8	Poor	\$2150	(818) 333-5121	(800) 677-6477	1366

 = BYTE Best. N/A = Not available.

VENDOR	MODEL	PERFORMANCE	EASE OF USE	PRICE	PHONE	TOLL-FREE NO.	INQUIRY NO.
Comtrade	VESA Local Bus Professional	7.5	Fair	\$2695	(818) 961-6688	(800) 969-2123	1367
CoreMicro Systems	Core VLB-66	7.5	Poor	\$3295	(408) 452-2752	(800) 369-2783	1368
Data Storage Marketing, Inc.	DataStor 486-66 DX2 EISA	6.6	Excellent	\$3545	(303) 442-4747	(800) 543-6098	1369
Data Storage Marketing, Inc.	DataStor 486-66 DX2 ISA/VL	6.6	Excellent	\$3195	(303) 442-4747	(800) 543-6098	1370
Deico Electronics	Predator-II 486DX2	6.6	Good	\$2895	(510) 651-7800	(800) 321-8990	1371
Dell Computer Corp.	466/L	7.2	Fair	\$3219	(512) 338-4400	(800) 289-3355	1372
Dell Computer Corp.	466/ME	7.1	Good	\$3669	(512) 338-4400	(800) 289-3355	1373
Digital Equipment Corp.	DECpc 466ST	6.4	Good	\$5449	(508) 493-5111	(800) 722-9332	1374
DTK Computer, Inc	Feat-6630V	7.0	Fair	\$3599	(818) 810-8880	(800) 289-2385	1375
Duracom Computer Systems	DeskSaver 486/66DX2 E	6.2	Poor	\$3299	(214) 518-1200	(800) 551-9000	1376
Duracom Computer Systems	FilePro 486/66DX2	5.9	Fair	\$2699	(214) 518-1200	(800) 551-9000	1377
Eastern Tech Corp.	ET 486VLB66	7.7	Fair	\$2595	(718) 459-1407	(800) 289-8128	1378
Epson America, Inc.	Progression 486DX2/66	6.0	Excellent	\$3986	(310) 782-0770	(800) 922-8911	1379
First Computer Systems, Inc.	FCS 486-66 P	7.2	Fair	\$3099	(404) 441-1911	(800) 325-1911	1380
First Computer Systems, Inc.	FCS 486-66 VLB	6.3	Fair	\$2699	(404) 441-1911	(800) 325-1911	1381
FutureTech Systems Inc.	System 462e	6.0	Fair	\$3429	(201) 488-4414	(800) 275-4414	1382
FutureTech Systems Inc.	System 462eV	6.9	Good	\$3129	(201) 488-4414	(800) 275-4414	1383
Gateway 2000	4DX2-66E	6.1	Excellent	\$3495	(605) 232-2000	(800) 523-2000	1384
Gateway 2000	4DX2-66V	7.1	Excellent	\$2995	(605) 232-2000	(800) 523-2000	1385
Grid Systems Corp.	MFP 466 Plus	5.7	Fair	\$4167	(817) 491-5200	(800) 934-4743	1386
 Hertz Computer Corp.	486/66Ei	5.9	Excellent	\$5870	(212) 684-4141	(800) 232-8737	1387
High Definition System, Inc.	HDISA66	4.8	Fair	\$1950	(408) 720-0493	(800) 347-0493	1388
High Definition System, Inc.	HDVLB66	6.9	Fair	\$2400	(408) 720-0493	(800) 347-0493	1389
HiQ Systems, Inc.	HiQ Super Power 486DX2-66VLB	6.0	Fair	\$2699	(408) 245-5836	(800) 827-5836	1390
IBM Personal Computer Co.	IBM PS/2 Model 77 486DX2	5.5	Good	\$4670	(914) 766-1900	(800) 772-2227	1391
Image Microsystems	486DX2-66VL	6.7	Fair	\$2339	(310) 815-1000	(800) 729-3400	1392
Lapine Computer	466I	6.0	Poor	\$2799	(818) 884-3685	(800) 927-3772	1393
Lapine Computer	466VL	6.6	Poor	\$2299	(818) 884-3685	(800) 927-3772	1394
Legacy Technology	VESA 486DX2-66	— ¹	— ¹	\$2750	(818) 854-8288	(800) 832-8883	1395
Lightning Computers, Inc.	Omniflex 66	6.8	Poor	\$2495	(415) 543-3111	(800) 347-4486	1396
 Lightning Computers, Inc.	Thunderbox II	7.7	Fair	\$3895	(415) 543-3111	(800) 347-4486	1397
Lucky Computer Co.	LSI-486/66/ELB	6.2	Fair	\$2995	(214) 690-6110	(800) 966-5825	1398
Micro Express	ME 486-VL/DX2/66	6.8	Good	\$3480	(714) 852-1400	(800) 989-9900	1399
Micro Professionals	Pro Series 486DX2/66LB	6.8	Fair	\$2169	(708) 339-8398	(800) 800-8300	1400
Micron Computer	486VL WinStation 466	8.0	Fair	\$3549	(208) 465-3434	(800) 438-3343	1401
Microtech Computer Corp.	MT/VLB 486DX2/66	7.3	Fair	\$3099	(404) 345-6508	(800) 342-6508	1402
 NEC Technologies, Inc.	Image 466	7.2	Excellent	\$3499	(508) 264-8000	(800) 388-8888	1403
P C Pros/Touché	Touché 486/66 DX2 EISA VLB 5550T	6.9	Fair	\$4721	(708) 810-1010	N/A	1404
Personal Computer Graphics	Turbo Max 80	8.6	Fair	\$2895	(310) 214-0550	(800) 255-9893	1405
Polywell Computers, Inc.	Poly 486-66EV	7.3	Fair	\$4300	(415) 583-7222	(800) 999-1278	1406
Polywell Computers, Inc.	Poly 486-66VZ	7.4	Fair	\$2800	(415) 583-7222	(800) 999-1278	1407
Quill Corp.	QTech 4D266-VL	6.2	Poor	\$2299	(708) 634-6650	N/A	1408
Santron Computer	Senior Partner 486	7.6	Fair	\$2895	(415) 571-1619	(800) 938-7555	1409
Sho-Tronics, Inc.	486 MAX DX2/66	6.3	Fair	\$2355	(602) 780-5920	(800) 289-8881	1410
Sirex USA, Inc.	486DX2-66 EISA	4.5	Fair	\$3299	(718) 746-7500	N/A	1411
Sirex USA, Inc.	486DX2-66 ISA Local Bus	6.1	Fair	\$3099	(718) 746-7500	N/A	1412
Swan Technologies, Inc.	486 DX2-66DB	6.3	Excellent	\$3149	(814) 234-2236	(800) 468-9044	1413
Swan Technologies, Inc.	486/66ES	5.6	Excellent	\$6069	(814) 234-2236	(800) 468-9044	1414
Tandy Corp.	466 DX2	5.6	Fair	\$3264	(817) 390-3011	N/A	1415
Transource Computers	Verxion 486-66 VL-Bus	6.5	Fair	\$2383	(602) 997-8101	N/A	1416
Tri-Star Computer Corp.	486 VL Station	7.2	Good	\$3279	(602) 961-3401	(800) 800-7668	1417
Unisys Corp.	PW [®] Advantage Plus 4666	6.7	Excellent	\$6552	(215) 986-4011	(800) 448-1424	1418
Vektron International, Inc.	486DX2/66	7.4	Fair	\$2199	(214) 606-0280	(800) 725-0020	1419
Wyse Technology	Decision 486SE-66DX2	5.9	Excellent	\$4381	(408) 473-1200	(800) 438-9973	1420
 Xinetron, Inc.	X/LAN 486DX2-Workstation	6.6	Excellent	\$2699	(408) 727-5509	(800) 345-4415	1000
Zenith Data Systems	Z-Station 466XEh	6.3	Good	\$3749	(708) 808-5000	(800) 553-0331	1001
Zenith Data Systems	Z-Station 466Xh	5.5	Good	\$3449	(708) 808-5000	(800) 553-0331	1002
Zeos International Ltd.	486DX2-66	6.9	Excellent	\$2993	(612) 633-4591	(800) 554-5226	1003
Zeos International Ltd.	486DX2-66 EISA	6.3	Fair	\$4390	(612) 633-4591	(800) 554-5226	1004

¹ Unable to run the test suite; problem unresolved at press time.



MGA and DynaView making AutoCAD designs come to life.

**SEE US AT
WINDOWS WORLD
BOOTH W7214**

Introducing Matrox

MGA...

**Harness the Power of
64-Bit Graphics**

Introducing Matrox MGA, the new series of 64-bit graphics accelerators for the PC Power User.

MGA's 64-bit graphics engine surpasses regular 32-bit technology to deliver workstation graphics performance for CAD and Windows professionals. MGA gives you up to 12 times more hardware performance and up to 60 million WinMarks.

In real-life applications, MGA delivers speed with the highest display resolutions, true color, real-time 3D and the best productivity enhancing features.

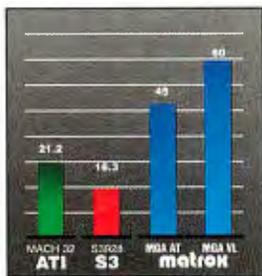
For Windows users, MGA's Control Panel, lets you easily access features like hardware pan and zoom, virtual desktop, and on-the-fly resolution

switching without having to leave your application or restart Windows. MGA displays 1024 x 768 in full 24-bit color and up to 1600 x 1200 in near true color

with QCDP, Matrox's exclusive color quality dithering process.



Just a few of the 16.7 million colors to choose from.



Attention CAD users. MGA comes bundled with DynaView, the most powerful interface to AutoCAD and Microstation. In a viewport, you can interactively render 3D models with high-quality Gouraud shading. DynaView gives you the smoothest real-time pan and zoom in the industry.

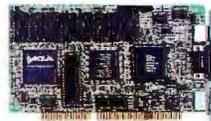
MGA is the one-card graphics solution for Windows, CAD and

Multimedia. MGA's Upgrade Options let you capture broadcast quality video, output graphics to standard video devices or increase your printing speed up to 600%.

For the PC Power User on a budget, MGA starts as low as \$599. Call us for more information 1-800-361-1408.

Experience the performance of MGA, graphics designed for the Power User.

**M A T R O X
MGA™
POWER GRAPHICS**



matrox

©1993 All rights reserved. Matrox is a registered trademark of Matrox Electronic Systems, Ltd.; MGA and ClearType are trademarks of Matrox Electronic Systems, Ltd.; Windows is a trademark of Microsoft Corporation; Ziff-Davis WinMark 3.1, 486 DX 2/66, 4Mb memory, 1024 x 768 in 256 colors, 72Hz.

Circle 110 on Inquiry Card.

Photo courtesy of Yamaha Motor Corporation, U.S.A.

The Multiprocessor Solution

New architectures overcome I/O performance bottlenecks



DICK POUNTAIN

Multiprocessor file servers are big business. Every major player in the PC market either has one of its own or is working furiously to develop one. But it was

not always this way.

Four years ago, pundits dubbed the then-upcoming Intel 486 a "mainframe on a chip." Had this label been accurate, a single-processor 486 system could have served an entire corporate department. But it was only a half-truth. A single 486 might outpace an old mainframe in floating-point calculations, but the strength of superminicomputers and mainframes rests on a balance between great computing power and equally great I/O bandwidth. While PC computing power has grown 80-fold in 10 years—from 0.5 MIPS for the original IBM PC to 40 MIPS for a 486DX2-66 system—I/O performance has failed to keep pace. Even the Micro Channel and EISA buses offer a barely five-fold improvement.

Multiprocessor systems fill this performance gap. They use multiple CPUs to spread the I/O burden as well as to increase computational power, and their manufacturers are adopting architectures that are strongly influenced by superminicomputers, mainframes, and even supercomputers.

The Multiprocessor Defined

Systems designers have come up with many approaches to building a multiprocessor computer (see "All Systems Go," August 1992 BYTE). But here I'll focus only on shared-memory multiprocessor architectures, which connect several CPUs to a single shared-memory space.

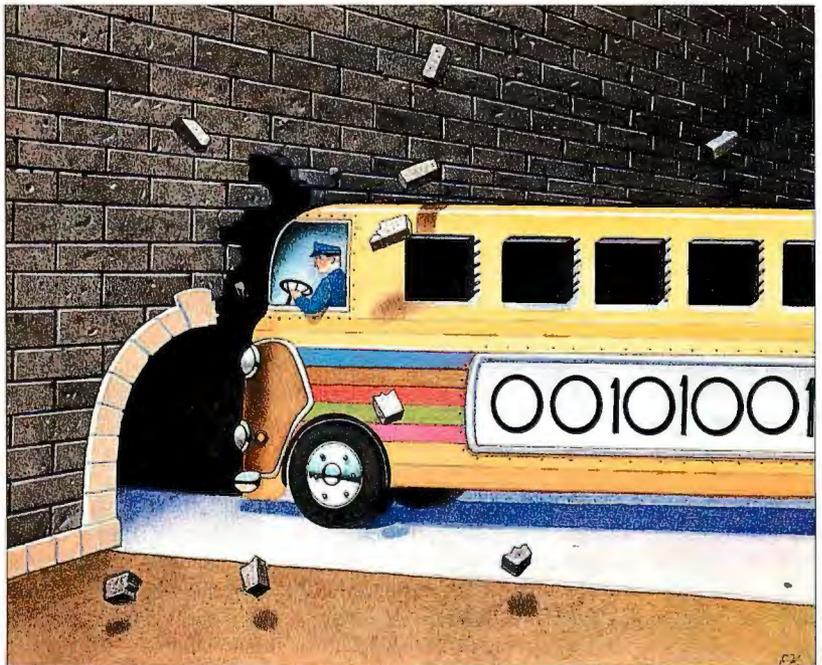
The major alternative to the shared-memory multiprocessor approach is the message-passing multicomputer, in which each CPU has its own private memory space. Here, interprocessor communication takes place by way of messages sent over a separate communications network. The high bandwidth available from a dedicated communications network lets designers combine hundreds—or even thousands—of CPUs in a single machine. That's why most massively parallel supercomputers are message-passing machines.

In contrast, shared-memory multiprocessor architectures are limited to at most tens of processors, and many commercial machines offer no more than four. It's difficult to design a bus that allows more processors to access

shared memory without creating a severe bottleneck. However, shared-memory machines have an enormous advantage: They can run, unmodified, software written for single-processor PCs. In contrast, message-passing machines impose completely new programming techniques and usually require custom software.

Shared-memory multiprocessors that are based on industry-standard CPUs such as the Intel 486 or the Sun SPARC make excellent fast file servers or database servers, running industry-standard operating systems like Unix and NetWare (and, soon, Windows NT) with multiprocessing extensions. They exhibit a coarse-grained form of parallelism in which a whole program or Unix process is the smallest unit allocatable to a different CPU, and the operating system performs this allocation automatically.

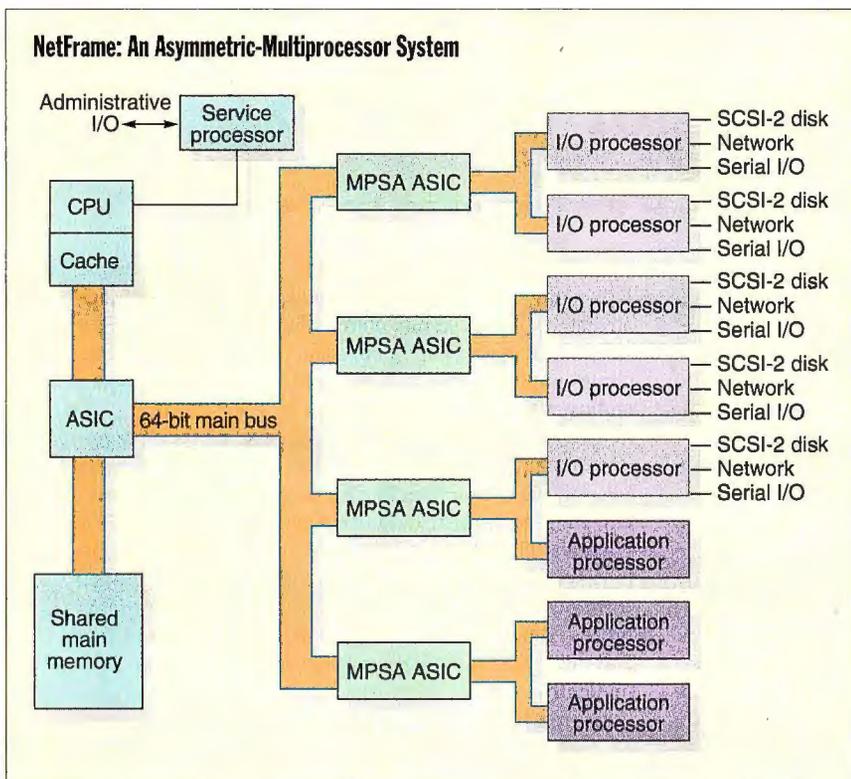
Currently, Intel-based shared-memory multiprocessors are not as effective as compute servers; they won't



EARL KELENY © 1993

accelerate recalculation of your Excel spreadsheets, for instance, because the code that calculates the cells is not multithreaded (i.e., divisible into units that can be allocated to more than one processor). This situation should change once Windows NT becomes established, since NT supports distribution of multithreaded applications over multiple processors. And NT will be similar enough to Windows to make multithreaded rewrites of key Windows applications, such as Excel, feasible.

continued



NetFrame Systems' asymmetric architecture uses one CPU to run the network operating system while dedicated processors handle I/O tasks. The main CPU bus connects via custom ASIC bus controllers to MPSA buses, each of which can support two dedicated processor boards.

Scalability

The challenge for a shared-memory multiprocessor systems designer is to make the machine work faster as more processors are added—in other words, to achieve *scalability*. While multi-computers may approach the ideal of linear scalability, where twice as many CPUs give twice the throughput, shared-memory machines fall far short of this ideal: Adding a second processor increases throughput often by as little as 50 percent, and this number drops steeply as more processors are added, until adding an extra processor slows the system down. How soon the design reaches this point depends on the effective bandwidth of the bus connecting the processors to shared memory.

To avoid a bottleneck, a multiprocessor's memory bus must have a sustainable bandwidth that equals or exceeds the sum of the bandwidths of all the components connected to it. Sustainable bandwidth is the product of bus availability and peak bus bandwidth (i.e., how often you can get the bus, multiplied by how fast it is once you've got it).

The ISA bus, which is capable of 1.5-MBps throughput, is far too slow to serve as the memory bus even for today's uniprocessor desktop PCs, let alone for multiprocessor systems. Likewise, its 33-MBps successor, the EISA bus, has been rendered inadequate by rapid CPU evolution; a multiprocessor system using several Intel Pentium processors would need a memory-bus bandwidth measured in the hundreds of MBps.

Designers often use the EISA bus (or IBM's Micro Channel) as a supplementary I/O bus, although both are far too slow to serve as the memory bus in multiprocessor systems. Multiprocessor memory buses always support multiple mastering so that

intelligent EISA I/O devices can transfer data to and from memory without involving the CPUs. These bus-master devices contend with the CPUs for a share of the memory-bus bandwidth, which makes scalability of the I/O system another top priority for the systems designer.

Higher Bandwidth

The simplest route to obtaining a high peak bus bandwidth is to adopt a wide data path. Clocked at the 33 MHz that's typical of 486DX2-66 systems, a nonmultiplexed 64-bit bus—one with separate data and address lines—can carry a peak load of 267 MBps (33 million \times 8 bytes). Electrical constraints place a performance ceiling on PCB-based (printed circuit board) buses, and to go much faster you have to move up to transmission-line technologies such as Apple's 350-MBps QuickRing (see "Fast Transit," October 1992 BYTE). However, further improvements to this theoretical peak bandwidth can come from splitting the bus into multiple parallel data paths.

The biggest boost to bus availability comes from large and efficient CPU caches, which can shield the bus from up to 90 percent of CPU traffic. While one CPU or I/O bus master has control of the bus for a lengthy transaction, the other

CPUs can continue running at full speed from their caches.

A designer can also make the bus more available by increasing its internal concurrency and by distributing its workload more evenly. For example, separating the lines that carry bus-arbitration signals from the data lines enables arbitration to take place concurrently with data transfer—in effect costing nothing in terms of performance. *Bus parking*, another optimization, lets a bus owner keep the bus without arbitration if no one else has requested it. This speeds up burst transfers. A multiprocessor interrupt scheme should allow all the CPUs to interrupt each other for efficient arbitration, and I/O interrupts should be routable to any CPU to avoid swamping one CPU.

The new Intel 82489DX APIC (Advanced Programmable Interrupt Controller) multiprocessor fulfills both of these requirements by automatically routing interrupts to the least-busy or lowest-priority processor. The APIC will soon replace the old 8259A (used in all PC compatibles since the original PC), which is slow and has no internal multiprocessor support.

The Write-Back Cache

Today's high-performance microprocessors all contain an on-chip cache, but multiprocessor systems designers always supplement this with an external or secondary SRAM (static RAM) cache, which runs at the full bus speed of up to 40 MHz. The cache gets filled from memory in large (often 32-byte) chunks, or *lines*, using the CPU's burst-transfer mode. To simplify both PCB design and user upgrading, vendors segregate these fast circuits onto small, separate CPU-cache modules, which you can plug into a passive bus backplane.

continued

“I couldn't find a powerful CASE tool that was affordable. So I designed one.”

JAN POPKIN, CHIEF SCIENTIST
POPKIN SOFTWARE & SYSTEMS, INC.

“I'm an engineer. And I know what it's like to need a high-performance and easy-to-use CASE tool. One that I could afford to place on every project team member's desk, not just a select few. That's why I developed System Architect.”

As Chief Scientist at Popkin Software, my role is to bring the experiences of our developers to bear on the design of the best CASE tool possible. System Architect is the result.”

Low Price. High Performance.

Since its introduction in 1988, System Architect (SA) has proven that many of the features

 offered by more expensive CASE tools are available for a fraction of the cost. There are now more than 12,000 SA copies in use at 3,000 installations worldwide.

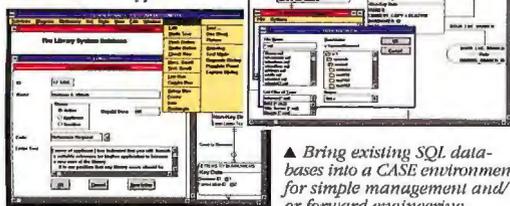
Quick And Easy.

System Architect works on IBM® and IBM-compatible PCs running *MS Windows®* or *OS/2 PM®*. It comes with an integrated data dictionary that users can customize to meet their needs. Project personnel can easily share information both on and off a network. It's so user-friendly that even from the first day you can sit down, get to work, and produce results.

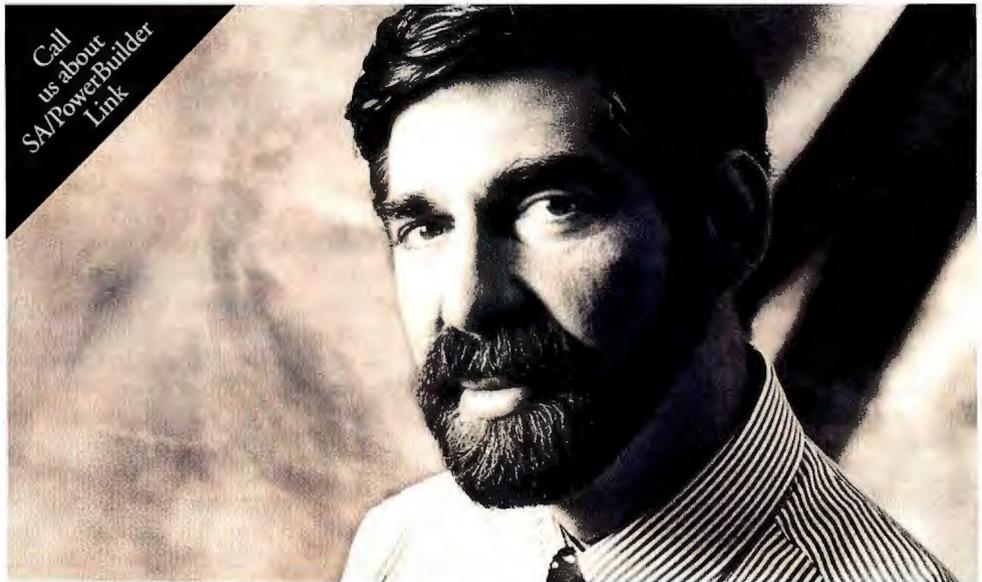
Multiple Choice.

SA works with multiple methodologies: Yourdon/DeMarco, Gane & Sarson, Ward & Mellor (real-time), Shlaer/Mellor (OO), Information Engineering, SSADM, and ER diagrams.

▼ Develop screens for GUI or character-based applications.



▲ Bring existing SQL databases into a CASE environment for simple management and/or forward engineering.



The Power To Grow.

To respond to advances in technology such as Client/Server Architecture, SA continues to grow in functionality and productivity. A few optional modules now offered are:

SA Reverse Data Engineer: Provides reverse engineering of Windows dialogs/menus and SQL databases, including DB2, Informix, Oracle, and SQL Server; provides generation of graphic screens and menus from .DLG and .MNU files; ensures new SQL database applications are built with the proper design integrity.

SA Screen Painter: Allows you to create GUI or character screens as well as to edit screens generated automatically from your SA Data Dictionary or captured from existing Windows applications; generates MS Windows dialogs, COBOL screen sections and associated data structures.

SA Schema Generator: Translates entity models from the encyclopedia into schema for DB2, Oracle, Ingres, SQL Server, Rdb, PROGRESS, Paradox, SQL Base, AS400 (SQL & DDS), Interbase, OS/2 DBMS, dBASE III, XDB,

SYBASE, and Informix. Generates Windows DLGs, and C type data definitions or COBOL data structures.

SA Object Oriented Analysis & Design (OOA/OOD): Supports Booch '91 and Coad/Yourdon.

SA Network Version: Diagram and data dictionary record locking allows multiple project members to work concurrently on the same project.

All The Tools You Need.

SA also has other features: automated documentation; extensible dictionary; normalization, rules and balancing; requirements traceability; import/export; custom reporting; and CRUD Matrices.

Call Us Toll-Free Today At 800-REAL-CASE, x109.

To find out how to qualify for your free 30-day evaluation copy, simply call us today or fax us at 212-571-3436.



SYSTEM ARCHITECT

Popkin Software & Systems, Inc.,
11 Park Place, New York, NY 10007
England 44-926-881186; Benelux 31-3406-65530;
Germany 49-6151-82077; Italy 39-49-8700366;
Switzerland 41-61-6922666; Denmark 45-45-823200;
Australia 61-02-346499; Sweden 46-8-626-8100.

Caching a multiprocessor system raises tricky cache-coherency issues. For example, since several CPUs may hold a copy of the same variable in cache memory and since all of them may have modified its value, which is the correct value? The easiest way to maintain coherency is through a write-through cache design: Whenever a CPU writes to a cache line, the system immediately updates the value in main memory, too—the data is *written through the cache*.

Your desktop PC's cache is almost certainly a write-through design. Though easy to implement, such a design is inefficient in a multiprocessor system because it involves a main-memory access every time that a value changes. That soon saturates the bus and makes scalability beyond two processors impractical.

Instead, multiprocessor systems adopt the more difficult write-back technique, which writes modified data to main memory only when it's absolutely necessary. Unfortunately, this technique requires a complex scheme to maintain coherency.

The *write-invalidate* coherency protocol is fast becoming the standard for multiprocessor caches. It marks the state of every cache line (using 2 extra bits in the cache tag) as modified, exclusive, shared, or invalid. For this reason, the write-invalidate protocol is also called MESI. Each processor's cache controller monitors all bus activity, a task known as *bus snooping*, looking for attempts by other devices to read memory locations currently held in its cache.

A processor can write to any line that is exclusive (i.e., not held in any other cache). The controller then marks the line as modified, but it does *not* write it back to main memory. If the bus-snooping controller discovers another processor requesting the now-out-of-date value from main memory, the controller traps the read attempt, places its own modified data on the bus to satisfy the request, and marks the line as shared—again without accessing main memory. A processor is not allowed to write to a shared line. Instead it must broadcast to all other caches holding that line, telling them to mark their copies as invalid (i.e., they must be reread from memory). The line then becomes exclusive again.

Under the MESI protocol, most processor reads and writes go to each CPU's local cache or between CPU caches, and the system updates stale values in main memory only when a cache is flushed. A write-back cache design is particularly effective when the interprocessor and memory buses are separated, as in Compaq's Triflex architecture (described below). This allows I/O bus masters to access main memory concurrently with the inter-CPU activity.

Symmetric vs. Asymmetric

Shared-memory multiprocessor systems fall into symmetric and asymmetric varieties. Symmetric systems treat all CPUs equally: Any processor is available to perform any task. Asymmetric designs dedicate each CPU to a specific task.

Each processor in a symmetric-multiprocessor system has equal access to I/O devices and main memory. All the CPUs cooperate in running a single stream of code; all run the operating system and application code concurrently. Any processor can perform any operating-system service,

such as file access or memory allocation, so operating systems for symmetric-multiprocessor machines must be multithreaded right down to the kernel and the device-driver level. They must also provide secure locking mechanisms so that a CPU can lock onto the thread it is currently executing to prevent other CPUs from interfering with it (see "A Fearful Symmetry," May 1990 BYTE). This is necessary for critical sections of operating-system code that perform indivisible operations.

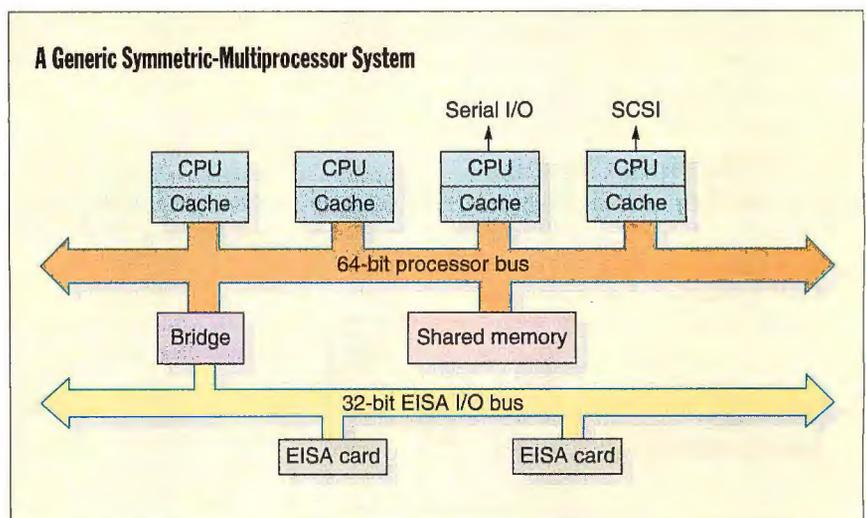
Such operating systems allocate new tasks to whatever processors are free by using a priority queuing system. Operating systems with these symmetric-multiprocessing features include SCO Unix System V release 3.2 with MPX (multiprocessor extensions), Unix System Laboratories' Unix System V release 4.0 MP V2, SunSoft's Solaris 2.0, the Mach-based NextStep, Banyan Vines SMP, and Windows NT. Many vendors also offer proprietary multiprocessing modifications to NetWare, and Novell will offer its own solution soon.

Symmetric systems vary in their degree of symmetry. Machines like the Tricord PowerFrame mix symmetric processors with dedicated I/O processors, while some older designs such as Compaq's Flex/MP are computationally symmetric but allow only the processor that booted the system to service I/O interrupts.

An asymmetric-multiprocessor system devotes each processor to a particular task. Normally, one processor runs the operating-system kernel while the rest service disk drives or networks or run a particular application. These dedicated I/O processors behave like the intelligent I/O channels in mainframe computers, which feed the CPU and main-memory data without bus contention.

Asymmetry confers several economic advantages. An asymmetric machine can run a conventional network operating system like NetWare 3.11 or LAN Manager. Since vendors don't have to wait for a multiprocessor port of the operating system or modify their application code, they can get usable applications to market faster. A systems designer can also tailor the cost and power of each CPU to its own task. But an asymmetric machine is good only for the job for which it's designed, usually as a file or database server. In contrast, a symmetric machine has the potential to fulfill any role (assuming application support is available).

continued

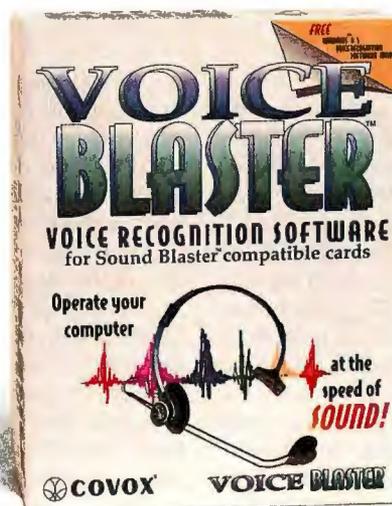


A symmetric-multiprocessor system distributes workload evenly between processors, each of which has equal access to I/O devices and main memory. Here, a 64-bit processor-to-memory bus connects processor/cache modules to the EISA I/O bus via a bridge.

If you *LISTEN* to your computer with one of these...



now you can *TALK* to your computer with **THIS!**



From the developers of the U.S. Air Force's "Bionic Ear" comes VOICE BLASTER, the world's first voice recognition software for popular sound cards.

The DOS and Windows 3.1 voice recognition programs included allow you to add voice commands to popular education, business and entertainment programs such as WordPerfect, F117A, Lotus 123, Secret Weapons of the Luftwaffe, DAC Easy, and hundreds more.

Easy to install and use, you will be up and running *at the speed of sound* in no time!

Also included are DOS and Windows 3.1 recording, editing and playback programs which represent leading edge PC sound technology.

Voice annotation software included brings your Windows 3.1 word processor to life by adding your own recorded messages to your documents.

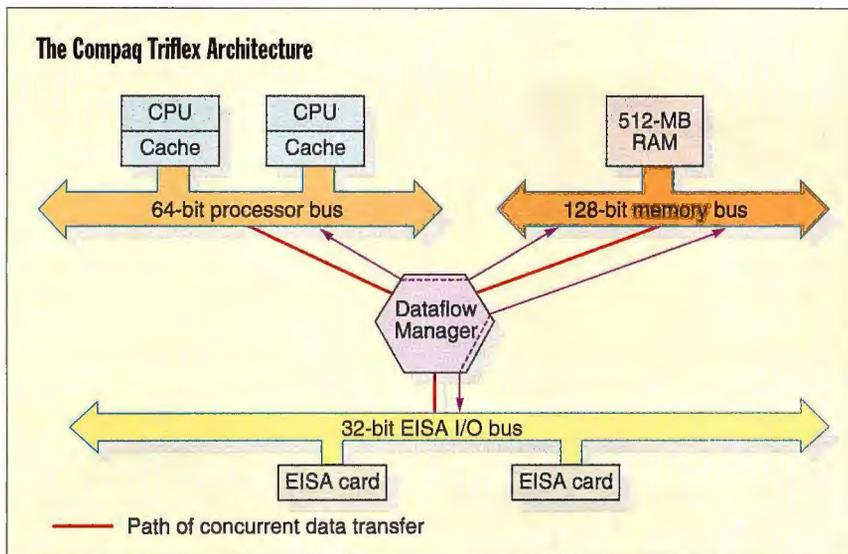
The COVOX E/Q module and headset provided with VOICE BLASTER will improve your sound card's recording capability while giving you the best voice recognition possible. VOICE BLASTER *will change the way you use your computer!*

VOICE BLASTER is available at CompUSA, Electronics Boutique, Software Etc. and other fine computer retail outlets

Call COVOX, INC. (800)733-0420 Dealer inquiries call (818) 446-9932

Copyright 1993 COVOX, INC. All products and corporate names are trademarks and registered trademarks of their respective owners. All rights reserved. COVOX, INC. 675 Conger St. Eugene, OR 97402 (503) 342-1271

Circle 82 on Inquiry Card (RESELLERS: 83).



Compaq's symmetric Triflex architecture uses both an interprocessor bus and a memory bus and connects both to the EISA I/O bus by way of Compaq's custom Dataflow Manager chip. This chip allows processors to access main memory concurrently with EISA bus-master devices more than 70 percent of the time.

Asymmetry in Action

An impressive example of a wholly asymmetric architecture is the NetFrame Systems design. It uses a single CPU—a 386, 486, or (as is planned) Pentium—that runs NetWare or LAN Manager from a main memory consisting of up to 256 MB. The main CPU bus connects via custom ASIC (application-specific IC) bus controllers to two or four I/O channels called MPSA (Multiprocessor System Architecture) buses, each of which can support two dedicated peripheral processor boards. These boards contain either Intel 376 (used in conjunction with the 386SX family) I/O processors or 50-MHz 486 application processors fitted with 4 to 128 MB of local memory.

All these peripheral processors can access the main shared memory, and the MPSA buses handle this traffic concurrently, with essentially zero contention. Each peripheral processor can handle 12.5 MBps, yielding a total I/O bandwidth of 100 MBps from four fully configured MPSA buses. That precisely matches the bandwidth of the 64-bit memory bus.

Multiple I/O buses provide a high degree of fault tolerance, and the NetFrame architecture also includes an Intel 80188 service processor that monitors system integrity (e.g., bus parity checking, ECC [error-correction code] memory correction, power supplies, and disk mirroring), permitting mainframe-style remote diagnosis and maintenance via a modem and telephone line.

Symmetric-System Architecture

The dual-bus architecture in the figure "A Generic Symmetric Multiprocessor System" could describe many of today's symmetric-multiprocessor systems. A 64-bit processor-to-memory bus accepts plug-in processor/cache modules and is bridged to an industry-standard (usually EISA) I/O bus that accepts off-the-shelf network and disk controllers or other I/O cards. The bridging circuitry might be based on Intel's 82350 EISA chip set or a special ASIC designed by the system vendor. The system design usually implements basic PC motherboard functions such as keyboard and floppy disk support and VGA video.

This basic architecture was pioneered by Corollary, whose C-

Bus and XM multiprocessor board sets have been licensed by many OEMs. Corollary also helped develop the multiprocessing code for SCO MPX. Its latest-generation C-Bus II is a multiplexed 64-bit bus with a 267-MBps peak transfer rate, a 32-GB address space, and support for up to 14 CPUs. C-Bus processor boards may contain private I/O subsystems (e.g., SCSI-2); this lets the designer build mixed symmetric/asymmetric systems. Corollary is also developing an implementation of C-Bus II, called SIMPL, for Intel's Pentium.

Tricord's PowerFrame architecture is similar. Its proprietary 32-bit PowerBus reads its interleaved memory 128 bits at a time, giving a sustained bandwidth of 132 MBps or a burst rate of 267 MBps. The seven-slot PowerBus backplane accepts up to four symmetric 486DX2-66 CPU boards or up to six asymmetric I/O boards, called Intelligent SCSI Subsystems (ISSes). These bus-master boards each contain a 33-MHz 386SX I/O processor,

an I/O cache, disk-handling firmware in ROM, and four SCSI controllers that can support up to 28 SCSI devices. The ISSes provide I/O transfer rates that are two to three times faster than those you'd get with the EISA bus. Like the NetFrame, the PowerFrame offers mainframe-style system management, diagnostics, and fault-tolerance features.

Several other symmetric-multiprocessor architectures would also fit the model shown in the figure "A Generic Symmetric-Multiprocessor System" if you eliminated the asymmetric I/O. These architectures include AST Research's Manhattan SMP and its 64-bit nonmultiplexed Cupid-MP_x bus (which can support up to six symmetric 486 CPUs), Olivetti's 64-bit OLIBus 4 (supports up to four CPUs), Acer/Altos's 64-bit FrameBus (supports four CPUs), Compaq's 32-bit Flex/MP (supports two CPUs), and Wyse's 64-bit Wyde Bus (supports three CPUs).

Split Bus

Compaq's new generation of Systempro/XL servers introduces the radical Triflex architecture, which increases concurrency by splitting the processor bus (see the figure "The Compaq Triflex Architecture"). Unlike Compaq's older Flex/MP, Triflex is now fully symmetrical, with I/O interrupts equally distributed among the processors. Triflex features a 64-bit interprocessor bus and a 128-bit memory bus, both connected to the EISA I/O bus by way of Compaq's custom Dataflow Manager chip. This chip contains multistage 256-bit buffers that can cache up to 16 EISA transfers or up to four processor transfers. This allows the processors to access main memory concurrently with EISA bus-master devices more than 70 percent of the time. Compaq claims Triflex has the same peak bandwidth (267 MBps) as other vendors' designs, but the extra concurrency should give it an edge in I/O-bound applications.

Compaq's new 64-bit ServerCache-2 snooping cache controller is designed specifically to exploit the Intel Pentium and its successors. Although the recently launched Systempro/XLs still offer only two 50-MHz 486 processors, it's no secret that future Triflex models will support up to four Pentiums.

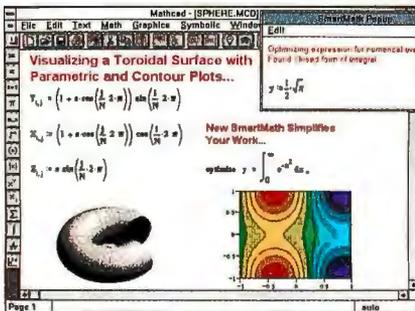
continued

New Mathcad 4.0 is ergonomically designed to relieve pressure on the most important part of your body.

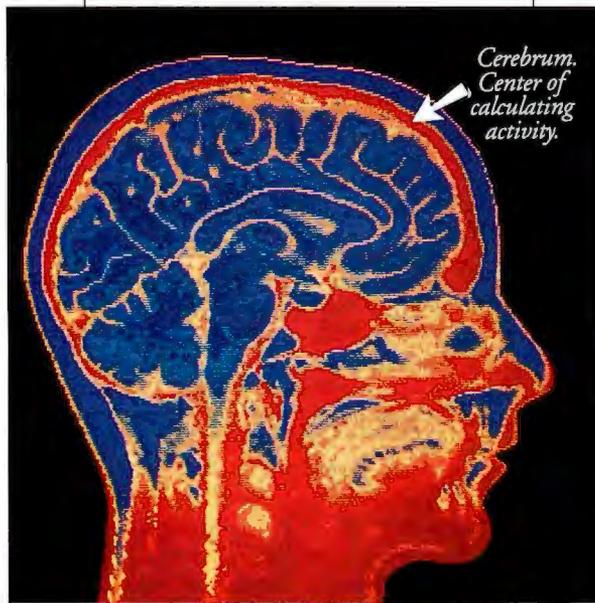
For everyone with better things to do with their brains than punch calculators, scribble on scratch pads, build spreadsheets and transcribe equations, we present Mathcad® 4.0. It's the best way ever to do engineering and scientific calculations, because it's smarter than ever about the way you work.

As always, Mathcad lets you enter equations anywhere on the worksheet. Graph results in 2-D and 3-D. Change variables and instantly update answers. And print presentation quality documents with text, graphics and equations in real math notation. But now there's even more.

Like new Windows features that make Mathcad easier to use. Including the tool bar with mouse-click execution of file, edit, math and text controls. And full Windows DDE and OLE support that integrates Mathcad with your Windows spreadsheet.



New Mathcad 4.0 has more features, more functions, and better usability than ever.



All new SmartMath knows when an equation is best solved numerically or symbolically, and hands off the work to the appropriate calculating engine. New live symbolic calculations automatically update just like numerical ones. And new symbolic optimization automatically

simplifies equations for faster, more concise results.

In addition to more than 200 built-in numeric and symbolic functions, you'll find enhancements like trailing zeros, extra unit and Nth derivative operators. As well as extended graphing capabilities with Polar and Contour plots.

Best of all, new Mathcad 4.0 runs twice as fast as before.

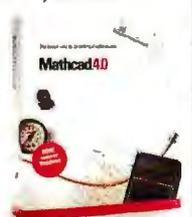
So why suffer through another day of calculators, scratch pads and spreadsheets? Get a load off your mind with Mathcad 4.0.

Call now for a free working model, to upgrade, or for

information on optional Mathcad Applications Packs and Electronic Handbooks*.

Call: 617-577-1017
Fax: 617-577-8829

1-800-MATHCAD



FREE Mathcad 4.0 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.

Name _____ Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Country _____ Phone _____

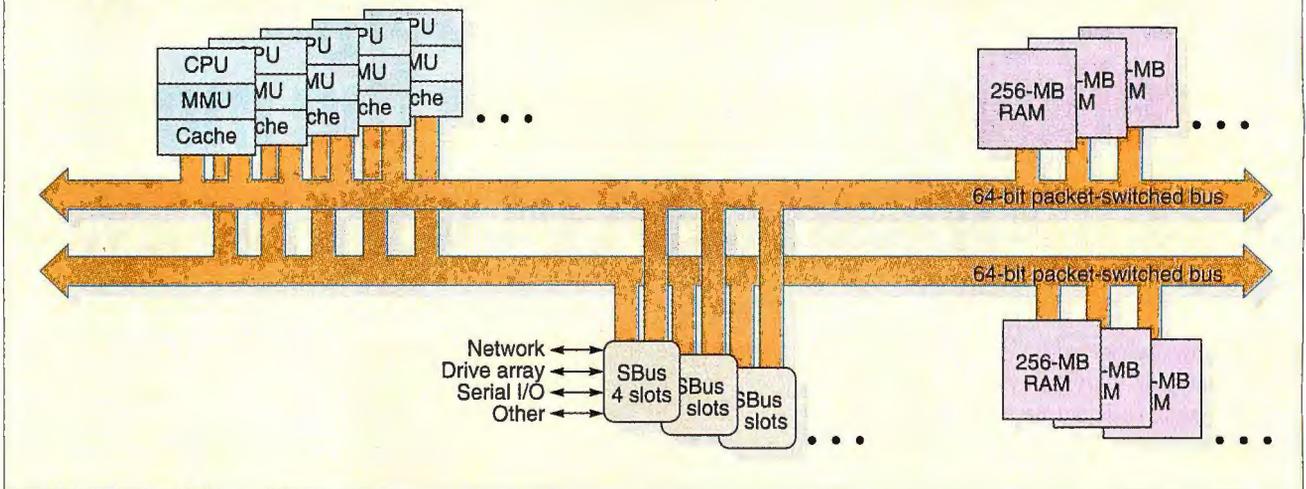
SPECIFY:

- PC Windows* PC DOS
 UNIX* Macintosh*
 3 1/2" 5 1/4" Diskette

B 96

MathSoft, Inc. 201 Broadway, Cambridge, MA 02139 USA • Phone: 1-800-628-4223 • 617-577-1017 • Fax: 617-577-8829
MathSoft Europe, P.O. Box 58, Livingston, UK EH54 7AE • Phone: +44.506.460373 • Fax: +44.506.460374
© 1993 MathSoft, Inc. TM and © signify manufacturer's trademark or registered trademark respectively. *Electronic Handbooks require Mathcad 3.1 or higher.

The Sun SparcCenter 2000 Architecture



Sun Microsystems' SparcCenter 2000 uses two parallel packet-switched memory buses to double I/O bandwidth. The packet-switched architecture allows Sun to split the request/reply cycle into two transactions. While one processor waits for a reply, other processors can access the bus.

Split Transactions

One alternative multiprocessor bus design provides two parallel memory buses to double the bus bandwidth. NCR's System 3000, for example, uses twin 64-bit buses that each carry two or four 486 CPUs and use a dual-ported shared memory. Using this design, the System 3000 achieves a peak bandwidth of 400 MBps (225 MBps sustained).

Sun Microsystems' flagship multiprocessor, the SparcCenter 2000, follows the same route but uses *packet-switched* memory buses. All the multiprocessor systems I've described so far—and indeed, most computers—use *circuit-switched* buses, on which transactions are atomic, or indivisible, operations. Here, a requesting device arbitrates for the bus, gets control, places a target address on the bus, and then keeps control while it transfers the data to or from that address. For the duration of this transaction, other processors are denied bus access. Unfortunately, much of this time is wasted in nonbus activities like waiting for a RAM chip to deliver its data.

When a packet-switched bus is present, a device arbitrates for the bus, gets control, sends a request packet containing the target address, and then releases the bus. Later, the requester receives a reply packet on the bus. Under this asynchronous bus protocol, requests may be separated from replies by any number of other packets—hence the term *split transactions*.

Although it is more complex to implement, packet switching offers great benefits. It maximizes bus throughput by keeping the bus full of packets. It accommodates slow devices connected to the bus without compromising overall performance. And small, fixed-size packets guarantee short transactions, so you can adopt a simple nonpreemptive arbitration scheme. For example, the SparcCenter implements interrupts as packets, which are carried on the main bus.

The SparcCenter uses a parallel pair of 64-bit XDBuses (originally developed by Xerox), with memory addresses interleaved between the pair on 256-byte boundaries to give the effect of a single 128-bit bus. Its fault-tolerant design allows the system to remain operational should one bus fail, but with only half the bandwidth, shared memory space, and cache. Each XDBus has a peak

bandwidth of 320 MBps, and the sustained bandwidth is proportionally high at 250 MBps, which allows for 500 MBps of total sustainable bandwidth.

The SparcCenter can handle up to 20 SuperSparc processor modules, each holding a 40-MHz CPU, 1 MB of secondary cache, an MMU (memory management unit), and a SuperCache snooping cache controller chip. The latter offers three alternative write-back coherency protocols, which are selectable in software and optimized for different types of workloads: write-invalidate; write-broadcast, which is more efficient when many lines are shared; and competitive caching, a heuristic compromise between the first two.

You can expand the shared memory to 5 GB, and a programmatic address space enables dynamic reconfiguration to fill "holes" in the memory map. I/O is provided by up to 10 of Sun's proprietary SBuses, each of which has four 50-MBps slots for SparcStation-compatible I/O cards.

Mainframe Challenge

It's difficult to verify vendors' scalability claims for their multiprocessor system designs, but vendors' figures suggest that CPU scalability was rather poor for first-generation symmetric machines (50 percent or less for a second processor). Right now, asymmetric and mixed symmetric/asymmetric architectures like the NetFrame and Tricord PowerFrame are probably the most cost-effective solutions for general file-serving applications. However, the more advanced architectures described here, together with improved operating-system support, promise realizable performance increases from up to four CPUs—more for the SparcCenter.

For most of the past decade, PC enthusiasts have been prematurely promising the death of the mainframe. But these new microprocessor-based architectures, when combined with new mass-storage devices like erasable optical disks, just might make good on that promise. ■

Dick Pountain is a BYTE consulting editor based in London. You can contact him on BIX as "dickp."

YOUR DIRECT LINK CARD

For free product information, mail your completed card today. For quicker response, fax to 1-413-637-4343!

Yes, I want FREE information on the following products!

1. Circle the Numbers on Your Direct Link Card

Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

2. Print Your Name and Address

Answer questions "A" through "E" and mail or fax card to 1-413-637-4343.

3. Product information will be rushed to you from the selected companies!

Fill out this coupon carefully. Please Print.

Name _____
 Title _____
 Company _____
 Address _____
 City _____ State _____ Zip _____
 Phone _____ Fax _____

A. What is your primary job function/principal area of responsibility? (Check one)

- 1 MIS/DIP
 2 Programmer/Systems Analyst
 3 Administration/Management
 4 Sales/Marketing
 5 Engineer/Scientist
 6 Other

B. What is your level of management responsibility?

- 7 Senior-level 9 Professional
 8 Middle-level

C. Are you a reseller (VAR, VAD, Dealer, Consultant)?

- 10 Yes 11 No

D. What operating systems are you currently using? (Check all that apply)

- 12 PC/MS-DOS 15 Unix
 13 DOS + Windows 16 MacOS
 14 OS/2 17 VAX/VMS

E. For how many people do you influence the purchase of hardware or software?

- 18 1-25 20 51-99
 19 26-50 21 100 or more

June 1993

86 96 98

Product Category Information	Disks & Optical Drives	7	Multimedia	19	Educational	30	Shareware	42
Circle the numbers below for information on the entire category of products you're interested in.	Diskettes/Duplicators	8	Printers/Plotters	20	Engineering/Scientific	31	Software Duplication	43
	Fax Boards/Machines	9	Programmable Hardware	21	Entertainment	32	Spreadsheets	44
	Graphics Tablets/Mice/ Pen Input	10	Scanners/OCR/Digitizers	22	Graphics	33	Unix	45
	Keyboards	11	Tape Drives	23	Macintosh	34	Utilities	46
	LAN Hardware	12	UPS	24	Mail Order	35	Windows	47
	Laptops & Notebooks	13	Software		Mathematical/Statistical	36	Word Processing	48
	Mail Order	14	Business	25	Miscellaneous Software	37	General	
	Memory/Chips/Upgrades	15	CAD/CAM	26	On-Line Services	38	Books/Publications	49
	Miscellaneous Hardware	16	Communications/Networking	27	Operating Systems	39	Recruitment	50
	Modems/Multiplexors	17	Data Acquisition	28	Programming Languages/Tools	40	Miscellaneous	51
	Monitors & Terminals	18	Database	29	Security	41		

Inquiry Numbers 52-233

52	78	104	130	156	182	208
53	79	105	131	157	183	209
54	80	106	132	158	184	210
55	81	107	133	159	185	211
56	82	108	134	160	186	212
57	83	109	135	161	187	213
58	84	110	136	162	188	214
59	85	111	137	163	189	215
60	86	112	138	164	190	216
61	87	113	139	165	191	217
62	88	114	140	166	192	218
63	89	115	141	167	193	219
64	90	116	142	168	194	220
65	91	117	143	169	195	221
66	92	118	144	170	196	222
67	93	119	145	171	197	223
68	94	120	146	172	198	224
69	95	121	147	173	199	225
70	96	122	148	174	200	226
71	97	123	149	175	201	227
72	98	124	150	176	202	228
73	99	125	151	177	203	229
74	100	126	152	178	204	230
75	101	127	153	179	205	231
76	102	128	154	180	206	232
77	103	129	155	181	207	233

Inquiry Numbers 409-590

409	435	461	487	513	539	565
410	436	462	488	514	540	566
411	437	463	489	515	541	567
412	438	464	490	516	542	568
413	439	465	491	517	543	569
414	440	466	492	518	544	570
415	441	467	493	519	545	571
416	442	468	494	520	546	572
417	443	469	495	521	547	573
418	444	470	496	522	548	574
419	445	471	497	523	549	575
420	446	472	498	524	550	576
421	447	473	499	525	551	577
422	448	474	500	526	552	578
423	449	475	501	527	553	579
424	450	476	502	528	554	580
425	451	477	503	529	555	581
426	452	478	504	530	556	582
427	453	479	505	531	557	583
428	454	480	506	532	558	584
429	455	481	507	533	559	585
430	456	482	508	534	560	586
431	457	483	509	535	561	587
432	458	484	510	536	562	588
433	459	485	511	537	563	589
434	460	486	512	538	564	590

Inquiry Numbers 766-947

766	792	818	844	870	896	922
767	793	819	845	871	897	923
768	794	820	846	872	898	924
769	795	821	847	873	899	925
770	796	822	848	874	900	926
771	797	823	849	875	901	927
772	798	824	850	876	902	928
773	799	825	851	877	903	929
774	800	826	852	878	904	930
775	801	827	853	879	905	931
776	802	828	854	880	906	932
777	803	829	855	881	907	933
778	804	830	856	882	908	934
779	805	831	857	883	909	935
780	806	832	858	884	910	936
781	807	833	859	885	911	937
782	808	834	860	886	912	938
783	809	835	861	887	913	939
784	810	836	862	888	914	940
785	811	837	863	889	915	941
786	812	838	864	890	916	942
787	813	839	865	891	917	943
788	814	840	866	892	918	944
789	815	841	867	893	919	945
790	816	842	868	894	920	946
791	817	843	869	895	921	947

Inquiry Numbers 1123-1304

1123	1149	1175	1201	1227	1253	1279
1124	1150	1176	1202	1228	1254	1280
1125	1151	1177	1203	1229	1255	1281
1126	1152	1178	1204	1230	1256	1282
1127	1153	1179	1205	1231	1257	1283
1128	1154	1180	1206	1232	1258	1284
1129	1155	1181	1207	1233	1259	1285
1130	1156	1182	1208	1234	1260	1286
1131	1157	1183	1209	1235	1261	1287
1132	1158	1184	1210	1236	1262	1288
1133	1159	1185	1211	1237	1263	1289
1134	1160	1186	1212	1238	1264	1290
1135	1161	1187	1213	1239	1265	1291
1136	1162	1188	1214	1240	1266	1292
1137	1163	1189	1215	1241	1267	1293
1138	1164	1190	1216	1242	1268	1294
1139	1165	1191	1217	1243	1269	1295
1140	1166	1192	1218	1244	1270	1296
1141	1167	1193	1219	1245	1271	1297
1142	1168	1194	1220	1246	1272	1298
1143	1169	1195	1221	1247	1273	1299
1144	1170	1196	1222	1248	1274	1300
1145	1171	1197	1223	1249	1275	1301
1146	1172	1198	1224	1250	1276	1302
1147	1173	1199	1225	1251	1277	1303
1148	1174	1200	1226	1252	1278	1304

Inquiry Numbers 234-408

234	259	284	309	334	359	384
235	280	285	310	335	360	385
236	281	286	311	336	361	386
237	282	287	312	337	362	387
238	283	288	313	338	363	388
239	284	289	314	339	364	389
240	285	290	315	340	365	390
241	286	291	316	341	366	391
242	287	292	317	342	367	392
243	288	293	318	343	368	393
244	289	294	319	344	369	394
245	270	295	320	345	370	395
246	271	296	321	346	371	396
247	272	297	322	347	372	397
248	273	298	323	348	373	398
249	274	299	324	349	374	399
250	275	300	325	350	375	400
251	276	301	326	351	376	401
252	277	302	327	352	377	402
253	278	303	328	353	378	403
254	279	304	329	354	379	404
255	280	305	330	355	380	405
256	281	306	331	356	381	406
257	282	307	332	357	382	407
258	283	308	333	358	383	408

Inquiry Numbers 591-765

591	616	641	666	691	716	741
592	617	642	667	692	717	742
593	618	643	668	693	718	743
594	619	644	669	694	719	744
595	620	645	670	695	720	745
596	621	646	671	696	721	746
597	622	647	672	697	722	747
598	623	648	673	698	723	748
599	624	649	674	699	724	749
600	625	650	675	700	725	750
601	626	651	676	701	726	751
602	627	652	677	702	727	752
603	628	653	678	703	728	753
604	629	654	679	704	729	754
605	630	655	680	705	730	755
606	631	656	681	706	731	756
607	632	657	682	707	732	757
608	633	658	683	708	733	758
609	634	659	684	709	734	759
610	635	660	685	710	735	760
611	636	661	686	711	736	761
612	637	662	687	712	737	762
613	638	663	688	713	738	763
614	639	664	689	714	739	764
615	640	665	690	715	740	765

Inquiry Numbers 948-1122

948	973	998	1023
-----	-----	-----	------

YOUR DIRECT LINK CARD

For free product information, mail your completed card today. **For quicker response, fax to 1-413-637-4343!**

See reverse side for card.

1. Circle the Numbers on Your Direct Link Card

Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

2. Print Your Name and Address

Answer questions "A" through "E" and mail or fax card to 1-413-637-4343.

3. Product information will be rushed to you from the selected companies!

READER SERVICE
P.O. BOX 5110
Pittsfield, MA 01203-9926
USA

BYTE

POSTAGE WILL BE PAID BY ADDRESSEE

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 176 PITTSFIELD, MA



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



BYTE magazine



IBM Unleashes a New OS/2

Like PC-DOS 2.1, OS/2 2.1 could become a rock-solid winner



BARRY NANCE

Remember PC-DOS 2.1? Its features and reliability were exactly what most users needed—so much so that many people stuck with it when newer versions came to market. IBM and many OS/2 users would like history to repeat itself with OS/2 2.1. While it's not perfect, OS/2 2.1's overall quality and new features may well earn it the same reputation as its DOS counterpart.

The IBM OS/2-support forums are CompuServe's busiest areas. People talk about the unwieldy number of installation disks, the sluggishness of Windows under OS/2 2.0, the need to run Windows software in enhanced mode, the lack of video drivers, the wish for more and faster printer drivers, the desire to run OS/2 on laptops and notebooks, and the dream of running CPU-interrupt-intensive multimedia software on OS/2. Version 2.1 resolves all these issues.

You can install OS/2 2.1 from CDs or floppy disks, and you can install portions of it on different logical drives. Version 2.1 supports Hitachi, IBM, NEC, Panasonic, Sony, Texel, and Toshiba CD-ROM drives connected through Adaptec, Distributed Processing Technology, Future Domain, and IBM SCSI controllers. It includes MSCDEX support in each DOS session via the VCDROM virtual device driver, and VCDROM lets MSCDEX-aware DOS and Windows multimedia applications process both audio and digital data concurrently.

Multimedia Supported Here

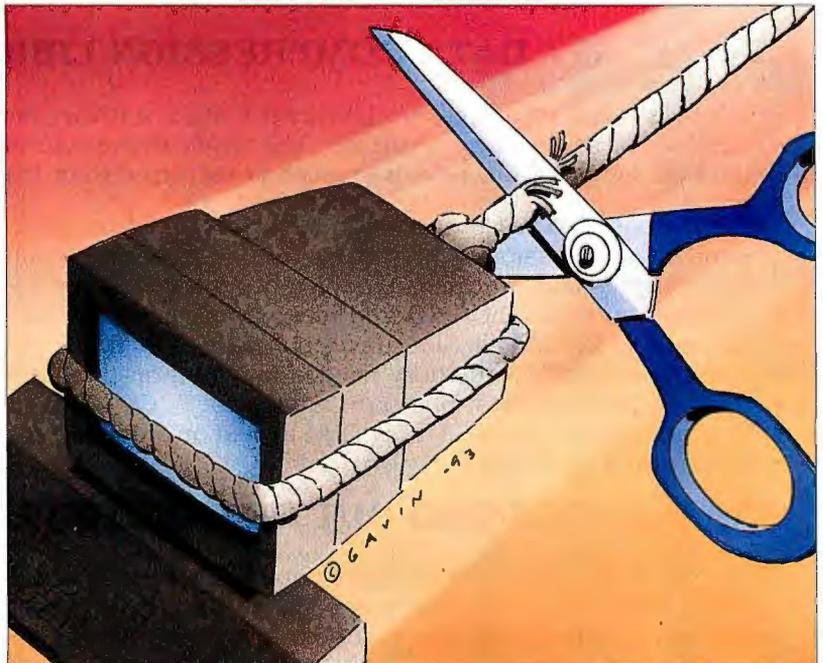
OS/2 now includes built-in multimedia support, in the form of MMPM/2 1.01. To allow DOS multimedia programs to run well in a DOS session, IBM has added *dual-thread DOS-session support*. As a multimedia-based program reads from or writes to a disk file, the program needs to service sound-card interrupts on a timely basis. In effect, dual-thread support lets DOS applications run concurrently along two threads in a single DOS session. The second processing thread within the session lets the program handle sound-card interrupts while file read or write operations occur. Support is automatic; the DOS program doesn't have to do anything. The OS/2 settings notebook entry for a DOS session, `INT_DURING_IO`, enables the dual-thread feature.

Multimedia isn't the only software that must service interrupts during file read and write operations. You can use

`INT_DURING_IO` to accelerate the uploads and downloads you do with a DOS communications program. IBM also rewrote the `VCOM.SYS` serial-port handler, making it smarter and faster, to help DOS communications programs perform better.

Some of the biggest changes are in OS/2's WINOS2 (Windows within OS/2) area, which runs Windows 2.x, 3.0, and 3.1 applications, full-screen or on the OS/2 desktop. OS/2 runs Windows programs faster than DOS does. A Windows 3.1 session can run in enhanced or standard mode, and you can have several sessions. (You can't yet run Win32s or extended Windows applications, but support for Win32s applications may appear later this year.)

You can configure DDE and the Clipboard to operate in public mode, where PM (Presentation Manager) software can share data with Windows software through a global Clipboard, or in private mode. Windows 3.1 under OS/2 uses TrueType fonts, includes new printer dri-



KERRY GAVIN © 1993

vers, offers OLE support, and uses the same display resolution as the OS/2 desktop.

OS/2 Acceleration

IBM's programmers used a variety of techniques to speed up Windows sessions and OS/2. IBM calls one technique *page tuning*. Each time IBM programmers installed new code in the operating system, performance experts used software- and hardware-monitoring tools to profile code

execution frequency and memory utilization. Because 16- and 24-bit ICEs (in-circuit emulators) weren't up to the task, IBM developed a 32-bit ICE called RTS (Real-Time Tracing System) to monitor OS/2's behavior. The programmers used this information to optimize and tune OS/2.

The process of page tuning is highly iterative. Each build of the operating system was followed by a detailed analysis of how the system behaves in a variety of situations, with each situation involving a given mixture of applications software activity and Workplace Shell activity on different hardware platforms.

I was amazed to discover that IBM used the Watcom C compiler, not the Microsoft C compiler, to compile the Windows components of OS/2. John Sierra, manager of OS/2 Systems Performance at IBM, says that the speed improvements in WINOS2 and in OS/2 were the result of a combination of factors: choosing the appropriate compiler, analyzing the page-tuning statistics, and simply using common sense and creative programming techniques to optimize the code. Using the Watcom C compiler was a low-risk way to speed up WINOS2.

IBM used its own 32-bit C Set/2 compiler for the base operating system, the 32-bit graphics engine, and many other parts of OS/2. Performance experts claim that the C Set/2 compiler lends itself nicely to the page-tuning process, letting programmers easily control and manage code tuning. The judicious use of assembly language in some modules accounts for further performance gains. IBM uses an internal version of MASM (Microsoft Macro

Assembler) 5.1 to produce object code for these modules.

IBM is in the process of producing the manual *OS/2 2.1 Performance Tuning for End Users*, which should be available soon after you read this. I found my alpha copy of it quite useful.

Windows Reworked

You can now start DOS and even OS/2 sessions from within a Windows session running within OS/2. IBM also rewrote the Windows Clipboard and the DDE and OLE modules to make them faster and more reliable. (PMCLIP.DLL, PMDDE.DLL, and VWIN.SYS replace CLIPOS2.EXE, DEEAGENT.EXE, and VDMSERVER.EXE, respectively.) The Clipboard now uses a form of shared memory, rather than named pipes, to transfer data. And since both DDE and OLE pass through the Clipboard, this speeds things up considerably.

IBM uses a technique called *virtual clipboard rendering* to postpone the rendering of Clipboard data until paste time. VWIN doesn't have to convert Clipboard data into every possible format. Instead, VWIN.SYS looks at paste time for the requested format and renders in just that format.

You get the usual accessories that are found in Windows 3.1, including the following: Sound Recorder, Character Map, Media Player, Calculator, Calendar, Cardfile, Notepad, Object Packager, Paintbrush, and Windows Write. The Windows 3.1 File Manager and Print Manager are there, if you prefer to manage your computer through Windows. IBM also includes the system

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

BY693

See us at COMDEX Booth #441 Atlanta '93

The World's Best Selling UNIX Clone Just Got Better.

Now with full 32-bit implementation!

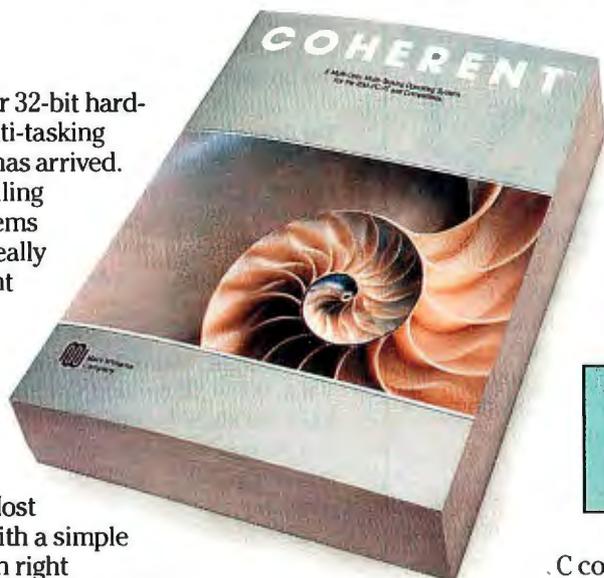
If you want to ignite your 32-bit hardware with the multi-user, multi-tasking power of UNIX, Coherent 4.0 has arrived. And if you're operating or selling small business network systems with dozens of users, that's really good news. Because Coherent 4.0 is what you want in UNIX at a price that's hard to believe.

Run UNIX applications today!

Coherent is now binary compatible with UNIX. Most UNIX PC applications port with a simple recompile and many now run right out of the box. The list is growing everyday, so call for details.

Yes, It's For Real!

How can it be? First of all, Coherent was independently developed by the Mark Williams Company, so you don't pay for UNIX licensing fees. You don't pay any mark-up or reseller costs either. Coherent is only sold directly to you.



six disk installation is a breeze compared to their 25. You'll also learn it faster and increase overall performance. All because Coherent is smaller, faster... and better.

Small, But So Complete.

Make no mistake, Coherent is a wholly professional development system. You get a complete

"Coherent comes so fully qualified as a UNIX clone, you find yourself thinking, 'I can't believe it's not UNIX.'"—Sean Fulton, UNIX Today!

Coherent.TM Still \$99.95.

C compiler, assembler and over 200 UNIX commands including full sets of functions for development, administration, maintenance and text processing.

Coherent also comes with UUCP capabilities that connect you to a world-wide network of free software, news and millions of UNIX users. And it's all clearly documented in Coherent's highly praised 1200 page manual.

Experienced, Supported, Guaranteed.

Mark Williams Company has been developing professional programming tools since 1976. Our commitment to our products and users is unsurpassed. Users applaud our popular BBS and the widely acclaimed telephone support they get free from Coherent developers.

Still, we're not asking you to take a chance on Coherent. We've made it fool-proof to see for yourself—with a 60-day money-back, no hassles guarantee. So pick up that phone and order Coherent now. And the best way to UNIX will be on its way to you!

800-MARK WMS

(800-627-5967 or 708-291-6700, FAX: 708-291-6750)

60-DAY MONEY BACK GUARANTEE!

	MWC COHERENT Version 4.0	SCO UNIX/386 Version 3.2V2
No. of Manuals	1	14
No. of Disks	6	25
Kernel Size	100 K	375 K
Install Time	40 min.	3-4 hours
Suggested Disk Space	10 meg	60 meg
Min. Memory Required	1 meg	2-4 meg
Performance*	85.7	31.3
Price	\$99.95	\$2590

*Byte C Compiler Benchmark: Compiles per minute on 25 MHz 486.

"... (Coherent) may be the best thing that has happened to UNIX yet."
—William Zachmann, PC Week

In fact, over 40,000 copies of Coherent have already been sold. And, like the ones we quote here, virtually every critic who's reviewed Coherent has raved about it.

So Much Less, Yet So Much More.

As a virtual clone of UNIX, Coherent embraces the original UNIX philosophy: Small is beautiful. Small price, yes. But there's more, much more, to Coherent than its amazing price.

Requiring only 10 megabytes of disk space, Coherent can reside with DOS. So you can keep all your DOS applications and move up to Coherent. And it runs with as little as 1 MB of memory versus 4 MB for other UNIX versions.

The World's Only Plug And Play UNIX Clone.

You'll have Coherent up and running with a fraction of the time and effort it takes for other UNIX versions. Our



Mark Williams Company

60 Revere Drive, Northbrook, IL 60062

Coherent is a trademark of Mark Williams Company. UNIX is a trademark of ILS.

Distributors: Australia + 07-266-2270, Brazil + 011-883-2299, Czech. + 06-32-62877, France + 1-4741-4519, 1-4672-8074, Germany + 0511-53-7295, Greece + (01) 222-3511, Holland + 023-386-599, Hungary + 153-0988, Malaysia + 03-756-4477, Venezuela/Caribbean + 1-809-723-5000, Sweden + 06-60-19290, UK + (0) 81-541-5466

FIRMLOC
Hardware and Software
Computer Security System
Version 2.0

FIRMLOC™ uses a combination of hardware and software to provide total system security to owners/users of IBM PCs or compatible computers for only \$249.95. Get the same security now in use by major corporations and U. S. government agencies.



Features include:

- Installs easily
- No password/hotkey req'd
- Hardware auto-verify
- No I/O slot needed
- Hardware card disables floppy boot-up
- File/Directory selective
- Electronic key
- Network compatible—up to 100 users/system
- Electronic bookmark
- User audit trail
- Windows™ compatible
- Total security

AFFORDABLE, EFFECTIVE, EASY-TO-USE!

Dealer inquiries welcomed. Direct all inquiries to:

INTELLIGENT SECURITY SYSTEMS, INC.

P. O. Box 1133 • Addison, Texas 75001-1133

Phone: (214) 315-1254 or FAX: (214) 315-1597

Toll Free: 1-800-237-4774

CALL NOW! Limited Offer! 10% off Version 2.0!

Now Shipping....

NDP OS/2 2.1 Developer's Pack

\$595 Includes:

- 32-bit Globally Optimized Code
- 32-bit Graphics and API Access
- IBM Toolkit and Workframe
- Integrated Development Environment
- 1500 pages of documentation
- Your Choice of Compiler:

**NDP C/C++, NDP Fortran-77
or NDP Pascal**

Call for our White Papers on OS/2, i860 Parallel Processing on PCs, Fortran 90 and our port of LAPACK to the 486 and i860.

Microway®

Research Park, Kingston, MA 02364 USA (508) 746-7341
U.K., 081-541-5466 USA FAX (508) 746-4678

Hands On Beyond DOS

diagnostic tools MSD.EXE and DRWATSON.EXE.

OS/2's memory management environment within DOS sessions includes DPMI (DOS Protected Mode Interface) 1.0. OS/2 previously supported DPMI 0.9. The DPMI support lets OS/2 run programs like AutoCAD.

The Driver Issue

The biggest complaint about OS/2 2.0 was the dearth of high-resolution video drivers. OS/2 now supports seven Super VGA chip sets in 800- by 600-pixel or 1024- by 768-pixel modes with 256 colors. The seven chip sets are ATI Technologies' VGA Wonder XL; Headland Technology's Video Seven HT209; Trident Microsystems' 8900; Tseng Laboratories' ET4000; Western Digital's Paradise WD90C00, C11, C30, and C31; Cirrus Logic's CL-GD542X; and IBM's 256c Super VGA chip. The drivers for VGA, XGA (Extended Graphics Array), 8514/A, and Super VGA are all 32-bit code.

You may even see seamless 8514/A and S3 Windows support in OS/2 2.1. IBM has written and was testing the code at press time.

IBM has optimized OS/2's 32-bit graphics engine. Its programmers replaced much of the graphics engine with faster code and used the 32-bit C Set/2 compiler to produce the DLLs and device drivers that make up the graphics engine. During the page-tuning effort, the programmers gave special emphasis to the Workplace Shell and graphics-intensive applications software.

OS/2 2.1 contains new and enhanced printer drivers. IBM programmers tuned and reworked both the printer drivers and the parallel-port device drivers to speed printing. OS/2 supports laptops and notebooks through APM (Advanced Power Management) and PCMCIA drivers. If your notebook is APM-aware, OS/2 will coordinate with its power-conservation features to make your battery last longer. You can double-click on the APM icon in the System Setup folder to see how much battery power remains or to turn power management functions on and off.

The Next Step

OS/2 2.1 isn't perfect. You still must boot up two installation disks to run CHKDSK against your OS/2 boot-up partition. A CONFIG.SYS editor doesn't yet exist. And 4 MB isn't really enough RAM to run OS/2. But IBM says it's working on these and other issues.

In the future, look for IBM to reduce the memory and disk space requirements for OS/2. IBM programmers will continue to work on the 32-bit graphics engine and WINOS2, page tuning as they go. IBM will develop more device drivers for more kinds of video, disk, and other adapters. You'll see many of the device drivers and enhancements appear as downloadable files in IBM's support area on CompuServe. Look for IBM to provide OS/2 migration paths to the PowerPC, IBM RS/6000, and other computers later this year or early next year. You'll also see the Workplace Shell user interface on more computers.

In the meantime, I'm using a native OS/2 word processor under OS/2 2.1, with 1024- by 768-pixel resolution, to write this. I'm downloading a file with my modem. And I'm compiling a program in yet another session. ■

Barry Nance is a contributing editor for BYTE. He is the author of Using OS/2 2.1 Special Edition (Que, 1993), and Networking Windows for Workgroups (Wiley, 1993). He is the editor for the IBM Exchange on BIX, where you can reach him as "barryn."

Animation for Windows Applications

Use this C++ class to add movement to your Windows programs



MICHAEL J. YOUNG

The ability to move a small image or sprite within a window, independently of the background graphics, can be useful in numerous types of programs, including computer games, tutorials, demos, and simulations. Even if you're not writing one of these special types of programs, you will find this ability to be useful for adding drag-and-drop capability to your Windows applications.

A C++ class is an ideal medium for encapsulating the data and functions needed to create animation. The C++ class CSprite lets you move a figure of any size or shape across a window containing any pattern of text or graphics. The class is designed to generate smooth, flicker-free animation.

Using the Class

To use the CSprite class, you would include the class header file SPRITE.H (see page 200) in your C++ source code and then link your program with the compiled version of the class implementation file, SPRITE.CPP. If you are using Microsoft C/C++ or Borland C++, you simply include SPRITE.CPP in the project file for your Windows program.

To create an object for animating an image, you can declare an instance of CSprite or use the new operator:

```
CSprite *PCSprite;
PCSprite = new CSprite;
```

You can increase the efficiency of the animation by specifying the CS_BYTEALIGNCLIENT class style when you register your window class. This style allows the CSprite class to transfer blocks of graphics that begin on even byte boundaries, generating faster transfers.

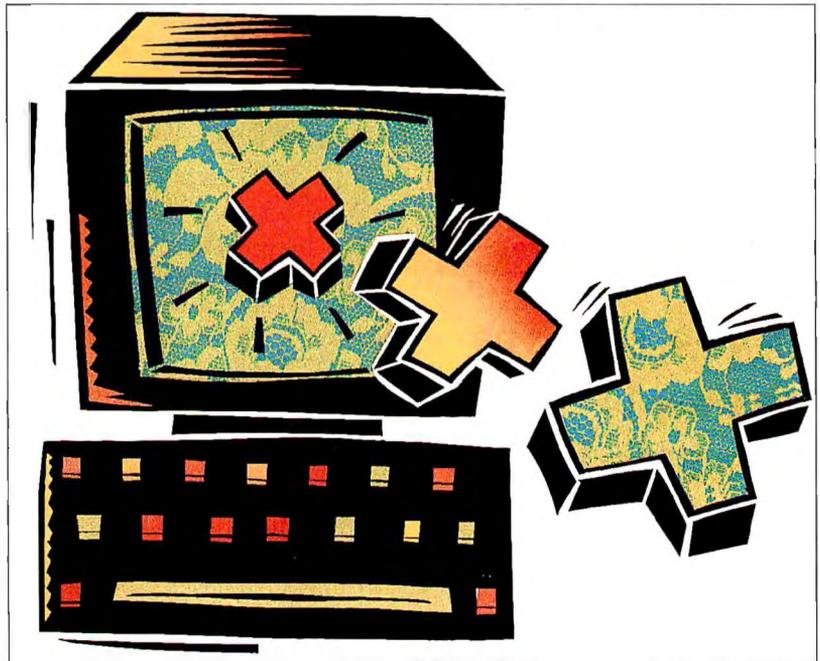
Once you've produced an instance of CSprite, you can use the public member functions of this class to generate an animation sequence. I declared these functions in the CSprite class definition within the SPRITE.H header file. Note that all the member functions except GetCoord return TRUE if successful or FALSE if an error occurs.

Before you use any other member function, you will need to call Initialize, which has the following format:

```
BOOL Initialize (HBITMAP HMask, HBITMAP
HImage);
```

You pass the handles for the mask and image bit maps, which define the figure that you want to animate. In the mask bit map, the figure appears as black on a white background; the image bit map contains the normal color figure on a black background. When displayed, the figure appears in color, but the background is invisible. Only the X appears, surrounded by the existing screen graphics.

The easiest way to create the bit maps is to design them using a bit-map editor or drawing program such as Windows Paintbrush, save them in separate files, and incorporate them as program resources by means of BITMAP statements within the program's resource-definition file. You can then load the bit maps and assign



JOHN NELSON © 1993

them to the CSprite object using statements such as these in the program source code:

```
HBITMAP HImage;
HBITMAP HMask;
HMask = LoadBitmap (HInstCurrent,
"Mask");
HImage = LoadBitmap (HInstCurrent,
"Image");
Sprite.Initialize (HMask, HImage);
```

Hands On Some Assembly Required

Before your program exits, call `DeleteObject` to delete the two bit maps—neither Windows nor the `CSprite` class deletes them for you. If you later want to use the same `CSprite` object to animate another figure, you can call `Initialize` again, passing it the handles for different bit maps.

To display the object at its initial position and start an animation sequence, call the member function `BOOL Start (HDC HDC, int X, int Y);`, where `HDC` is the handle of the device context in which you want to display the image, and `X` and `Y` are the horizontal and vertical coordinates of the upper left corner of the area where you want the image displayed. `Start` saves the current graphics underlying the position where the image will appear and then draws the image at the specified coordinates. The following code displays an image at the upper left corner of the window:

```
HDC HWinDC;  
HWinDC = GetDC (HWnd);  
// HWnd contains the window handle  
Sprite.Start (HWinDC, 0, 0);  
ReleaseDC (HWnd, HWinDC);
```

Note that the device context you specify when calling `Start` (or any other `CSprite` member function that receives a device context handle) must be in the `MM_TEXT` mapping mode, which is the default.

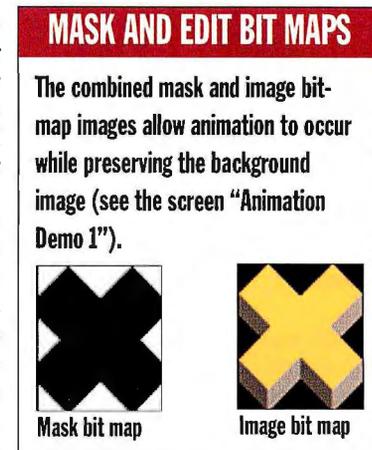
To move the object to each subsequent position in the animation sequence, call `MoveTo`, which has the following form:

```
BOOL MoveTo (HDC HDC, int X, int Y);
```

A C++ class is an ideal way to encapsulate the data and functions that you'll need to create smooth, flicker-free animation.

`MoveTo` in response to each `WM_MOUSEMOVE` message to transfer the image to the current mouse-cursor position.

If you want to redraw the image at its current position (i.e., at the position specified in the most recent call to `Start` or `MoveTo`), you can invoke the call `BOOL Redraw (HDC HDC);`. The `Redraw` function, which draws the image without saving or restoring screen graphics, is useful for restoring the image at its



The parameters are the same as those passed to `Start`. `MoveTo` restores the saved screen graphics at the prior image position, saves the current graphics underlying the new display position, and then draws the image at the new position. If, for example, a user is dragging the object with a mouse, the program calls

current position when redrawing the screen in response to a `WM_PAINT` message.

To erase the image, call `BOOL Hide (HDC HDC);`. The `Hide` function restores the saved screen graphics, erasing the image. The `CSprite` class saves the current position; you can call `Redraw` to view the object again.

Finally, you can obtain the current coordinates of the image by passing the address of a `RECT` structure to `GetCoord`, which takes the form:

```
void GetCoord (RECT *Rect);
```

`GetCoord` assigns the coordinates for the upper left corner of the image to the structure's left and top fields, and it assigns the co-

ordinates of the lower right corner of the image to the right and bottom fields. If you call `GetCoord` after calling `Initialize` but before calling `Start`, the top and left field values will be 0 and the right and bottom fields will contain the image width and height (i.e., the dimensions of the bit map used to create the image).

Sample Programs

I wrote two sample programs, `DEMO1` and `DEMO2`, that use the `CSprite` class to animate an X-shaped image, 52 pixels wide by 61 pixels high. In `DEMO1`, you move the image by pressing an arrow key or by dragging it with the mouse. In `DEMO2`, the image moves automatically in a continuous circular path. Both programs display a checkered background to demonstrate that you can move the image over the background without disturbing the existing window graphics.

I used several techniques in `DEMO1`. I declared the `CSprite` instance `Sprite` as a global object. After creating the main program window, the initialization routine loads the bit maps and calls `CSprite::Initialize` to initialize the object. On the first `WM_PAINT` message, the message-handling routine calls `Start` to position the image in the middle of the screen; on subsequent messages, the routine calls `Redraw` to restore the image at its current position. These functions are called after the message-handling function draws the window background.

When the user presses an arrow key, the `WM_KEYDOWN` message handler calls `GetCoord` to obtain the current image position and calls `MoveTo` to move the image 4 pixels in the appropriate direction. When the user drags the image, the `WM_MOUSEMOVE` message handler calls `MoveTo` to move the image to each new mouse-cursor position.

`DEMO2` works the same way, but to move the image automatically, it calls the Windows API function `SetTimer` to start a Windows timer. This function causes Windows to send a series of `WM_TIMER` messages, with a specified time duration between each message. On the first `WM_TIMER` message, `DEMO2` calls `Start` to position the image at the starting point along its circular path. On each subsequent message, it calls `MoveTo` to move the image to the next position along the circle (it uses the C++ library functions `sin` and `cos` to calculate the coordinates for each point on the circle).

To make the automatic movement of an image as smooth as possible, set the duration of the timer to the lowest possible value. Note that as you assign smaller values to the `uTimeout` parameter

Hands On Some Assembly Required

passed to `SetTimer`, the time between `WM_TIMER` messages decreases; eventually, you reach a point where, because of the time overhead required to send and process the messages, passing smaller values does not decrease the actual time between these messages. The constant `PERIOD` contains the duration assigned to the `uTimeout` parameter.

You should then adjust the amount of movement on each `WM_TIMER` message to achieve the desired object speed. In `DEMO2`, I use the constant `DELTA` to determine the amount of movement. The constant is the value added, on each timer message, to the subtended angle that determines the position of the image on the circle.

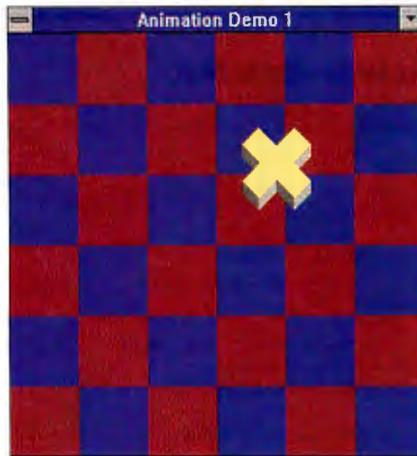
You could increase the frequency of object movements by repeatedly calling `MoveTo` during the processing of a single message, rather than moving it each time the program receives a timer message. However, this practice blocks Windows message processing, which means that the user cannot enter commands or do task-switching.

How CSprite Works

The `CSprite` class has several member functions. `Initialize` uses the Windows API function `GetObject` to obtain the sizes of the mask and image bit maps that it receives (it returns an error code if the bit maps are not the same size). It then calls the API function `CreateCompatibleBitmap` to create a new bit map that is the same size as the mask and image bit maps. It uses this bit map to save the underlying screen graphics when it displays the sprite. Its handle is saved in the private data member `mHSave`. `Initialize` also saves mask and image bit-map handles.

`Start` calls the Windows API function `BitBlt` to save the underlying screen graphics in the `mHSave` bit map, passing it the raster-operation code `SRCCOPY` to perform a simple copy operation. It then uses `BitBlt` to draw the screen image (see the `CSprite::Start` listing). `Bit` transfers are much faster than calling individual drawing functions, and you can easily create a complex drawing using a bit-map editor and simply load and copy the bit map to the window.

Unfortunately, `BitBlt` always transfers a rectangular block of graphics, so it overwrites the existing background when handling nonrectangular images. That's why I used two bit maps. When `Start` calls `BitBlt` to transfer the mask bit map, it assigns the value `SRCAND` to the raster code parameter. `BitBlt` then combines the bits in the bit map with the existing bits on the screen using the AND operator. Because the background within the mask bit map is white (all 1s), the existing screen graphics in the background area are unaltered. And because the figure within the mask bit map is black (all 0s), the resulting figure on the screen is also black.



In `Animation Demo 1`, the image bit map creates the X; a mask bit map preserves the checkerboard background as the image moves across the screen.

When `Start` then calls `BitBlt` to transfer the image bit map, it specifies the `SRCINVERT` raster-operation code, which tells `BitBlt` to combine the bits in the bit map with the existing bits on the screen using XOR. Because the background within the image bit map is completely black, the existing screen graphics are again unaltered. However, because the existing figure on the screen is all black (due to the previous `BitBlt` call), the colors within the figure portion of the bit map are copied to the screen without alteration.

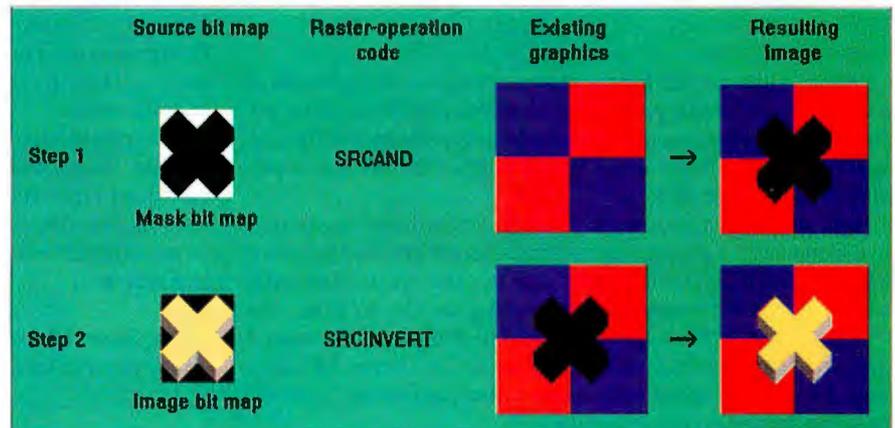
The final result is that the nonrectangular figure within the image bit map is transferred to the screen without disturbing the existing screen graphics surrounding the figure. (This is essentially the same method that Windows uses to draw icons.) After the image has successfully been drawn at its initial location,

`Start` saves the image coordinates in the private data members `mX` and `mY`.

`MoveTo` begins by restoring the saved screen graphics at the previous image position. It does this by calling `BitBlt` to transfer the graphics saved in the `mHSave` bit map to the window coordinates stored in `mX` and `mY`, specifying the `SRCCOPY` raster-operation code. It then saves the screen graphics at the new position and transfers the image to this position.

If, however, `MoveTo` were to restore the previous graphics and then draw the new graphics directly on the screen, an annoying flicker would result as the image first disappeared completely and then reappeared. To prevent flicker, `MoveTo` first copies the entire affected portion of the window to a temporary bit map and then performs all the bit operations within the temporary bit map. When the bit manipulations are complete, it copies the temporary bit map to the screen. Only a single bit transfer is visible, which greatly minimizes flicker.

The temporary bit map has to be large enough to hold the entire affected screen area. The affected area is the smallest rectangle that bounds both the prior image coordinates and the new image coordinates. The coordinates of this rectangle are obtained



The final result: `BitBlt` transfers only rectangular blocks and so tends to overwrite the background around nonrectangular objects. By assigning the raster-operation code value `SRCAND` to the mask bit map and `SRCINVERT` to the image bit map, the program cancels out the background colors, and the original background appears unaltered.

The CSprite header file SPRITE.H.

```
class CSprite
{
    int mHeight;
    HBITMAP mHImage;
    HBITMAP mHMask;
    HBITMAP mHSave;
    int mWidth;
    int mX;
    int mY;

public:
    CSprite ();
    CSprite ();

    void GetCoord (RECT *Rect);
    BOOL Hide (HDC Hdc);
    BOOL Initialize (HBITMAP
        HMask, HBITMAP HImage);
    BOOL MoveTo (HDC Hdc,
        int X, int Y);
    BOOL Redraw (HDC Hdc);
    BOOL Start (HDC Hdc,
        int X, int Y);
};
```

using the Windows API function UnionRect:

```
URECT RectNew;
RECT RectOld;
RECT RectUnion;
```

```
RectOld.left = mX;
RectOld.top = mY;
RectOld.right = mX + mWidth;
RectOld.bottom =
    mY + mHeight;
```

```
RectNew.left = X;
RectNew.top = Y;
RectNew.right = X + mWidth;
RectNew.bottom = Y + mHeight;
```

```
UnionRect (&RectUnion, &RectOld, &RectNew);
```

MoveTo then adjusts the resulting rectangle so that it begins on an even byte boundary, to allow more efficient bit-transfer operations. (Windows can perform a block transfer more efficiently if the screen coordinate of the left edge of the block—in pixels—is a multiple of 8.)

This adjustment ensures that the client coordinate begins on a byte boundary; to ensure that the screen coordinate also begins on a byte boundary, you must make sure that the client area itself is aligned on a byte boundary by assigning the CS_BYTEALIGNCLIENT style to the window class. The temporary bit map is then created using the CreateCompatibleBitmap API function. To increase speed and ensure smooth animation, MoveTo performs minimal error checking.

Finally, Hide uses BitBlt to copy the saved graphics in the mHSave bit map back to the current image position, thereby erasing the image. Redraw simply displays the image using the same method as Start and MoveTo, without any transfers to or from

The function CSprite::Start.

```
BOOL CSprite::Start (HDC Hdc, int
X, int Y)
{
    HDC HMemDC;
    int Result;

    if (mHSave == 0)
        return (FALSE);

    HMemDC =
        CreateCompatibleDC (Hdc);
    if (HMemDC == NULL)
        return (FALSE);

    // Save current window
    // graphics:
    SelectObject (HMemDC,
        mHSave);
    Result = BitBlt
        (HMemDC,
        0,
        0,
        mWidth,
        mHeight,
        Hdc,
        X,
        Y,
        SRCCOPY);
    if (Result == 0)
    {
        DeleteDC (HMemDC);
        return (FALSE);
    }

    // Display mask bit map:
    SelectObject (HMemDC,
        mHMask);
    Result = BitBlt
        (Hdc,
        X,
        Y,
        mWidth,
        mHeight,
        HMemDC,
        0,
        0,
        SRCINVERT);

    DeleteDC (HMemDC);

    if (Result == 0)
        return (FALSE);

    mX = X;
    mY = Y;

    return (TRUE);
}
```

the mHSave bit map.

Calling Hide and then Start would have the same overall effect as calling MoveTo, but it would result in flicker and would be less efficient than a single call to MoveTo.

Room for Improvement

You will probably think of many ways to use CSprite in your C++ programs. You can create instances of CSprite, or you can use it as a base for deriving new classes to perform specific types of animation.

You might also want to fine-tune the implementation of CSprite. For example, you might try to increase the efficiency of the MoveTo member function, which is the most performance-critical function. The faster it is, the more frequently the object can be moved and, therefore, the smoother the resulting animation can be made. ■

Editor's note: The complete listings for programs mentioned in this article are available electronically. See page 5 for details.

Michael J. Young is an author of programming books and a freelance Windows programmer in Mill Valley, California. His latest titles are Visual Basic—Game Programming for Windows (Microsoft Press, 1992) and Windows Programming with Microsoft C++ (Sybex, 1992). He can be reached on BIX clo "editors" or on CompuServe at 75156,2572.

JERRY POURNELLE

Statistics Programs Help Businesses Work

This has been one heck of a month at Chaos Manor, what with work on a new novel and about a hundred book signings for *The Gripping Hand*. Alas, Larry Niven has back problems, so much of the publicity work fell on me, and all the travel gave me a cold.

Then there were conferences. Columnists have to go to lots of meetings and conferences. Most of them are worthwhile, and getting to major conferences is the only way I can keep up with what's new, but there are far too many. Some I like. My favorite is the annual meeting of the AAAS (American Association for the Advancement of Science), and that was this month, too.

At AAAS I get to learn about what's new in science and technology, both discoveries and policies. It's one of the few places where I can talk to both scientists and policymakers.

One main concern is getting more women into the sciences. That used to be a problem of removing the glass ceilings. Now it's more one of getting girls to take science and math in the sixth grade; no easy task, but if they don't do that, they're not likely to be in science later. A science career is the ultimate deferred reward.

I'm also putting together papers on another problem of science policy, reviving the X programs. Between WWII and the end of the 1960s, the U.S. built a series of experimental aircraft. The best known was the X-1, in which Chuck Yeager broke the sound barrier (and yes, that was first done by an American at Edwards Air Force Base, and no, he didn't have to reverse the controls to do it). There was also the X-15, which flew into space and returned. Less famous X-airplanes were no less successful, and the technologies developed with X-airplanes enabled American aerospace firms to dominate world markets for decades.

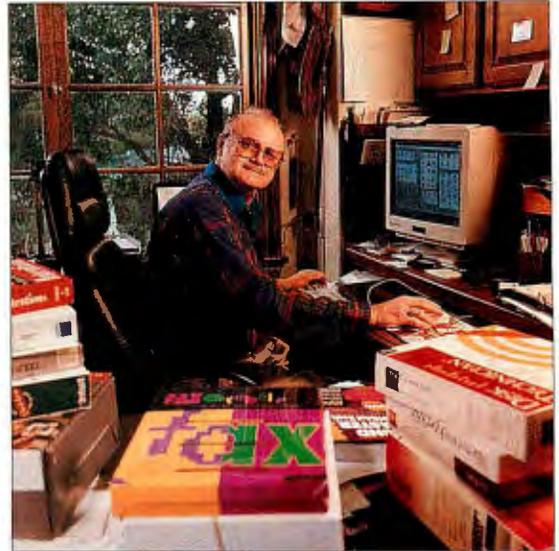
The X programs were canceled in the name of arms control, but now there's some interest in re-

viving them. I'd very much like to see that happen, and I don't see any reason why the X concept can't be employed to develop technologies in fields other than aerospace. X programs are a way for government to assume some technological risks and yet leave actual product development to private enterprise.

All in all, it was a busy month. Meanwhile, the stuff pours into Chaos Manor.

Systems analysis was the buzzword when I was in the aerospace business, but what I actually did was what I had learned as *operations research*, or OR. There was a close-knit fraternity of OR people, and I always thought that OR was an accurate description of what we did, even if it didn't sound as impressive as *systems analysis*.

OR grew out of WWII, when some British mathematicians and scientists applied scientific method to military and industrial activities. One of the better-known results of that was victory in the Battle of the North Atlantic, when OR people developed new tactics for the RAF and the



PHOTOGRAPHY: AMY ETRA © 1993

Most people put statistics right up there with root-canal therapy for enjoyment. With new forecasting software, it doesn't have to be that way.

Royal Navy, dramatically increasing the amount of cargo that got through to Britain. It incidentally showed the RAF how to sink more German U-boats.

That last sentence was deliberate: while sinking U-boats *sounds* more dramatic than getting cargo ships through, it wasn't the primary goal. One of the most fundamental lessons in OR is that you must choose the right criterion. If the RAF had sunk every one of the German U-boats, but the subs had sunk all the cargo ships first, Britain would have lost the war. The

goal wasn't to sink U-boats but to get the cargo through, and the latter was best accomplished by making it difficult for the U-boats to attack.

OR was successfully applied to some other parts of the war effort and became a pretty glamorous field for a while. In fact, you could get graduate degrees in it, even though no one had a real good definition beyond "operations research is what OR people do." When you come down to it, that wasn't a bad operational definition, except that it wasn't always easy to de-

scribe precisely just what we did.

In general terms, we'd go look at some ongoing activity to determine the goal of the activity in precise and quantifiable terms. This was known as *criterion selection*, and it was often the hardest part of the task. Asking the right question generally is. Then we'd study just what people did—not what they said they did, or what the organization charts said they should do, but what they did when they went to work. We'd then make up a mathematical model of the activities and play with that model to see if we could improve production or cut costs by having people do things differently. We'd test the new techniques and go back and work on the models some more.

For example, the original OR teams looked at aircraft search-and-attack patterns to determine which ones got the most cargo through; as you probably suspect from what I said before, this didn't turn out to be the same as the tactics that sank the most subs. Another OR discovery was *queuing theory*, which resulted in the development of "just-in-time" inventory-control methods. Other techniques included linear programming methods for finding solutions to allocation and assignment problems. We also did multiple regression analysis to derive methods for predicting such complexities as college GPA from data on students who are entering college.

It didn't work every time. However, application of OR techniques got some surprising and spectacular results, and there was a period when operations analysts—by then called by the more impressive term *systems analysts*—were the heroes of industry, and no consultant firm could do without a good OR team.

In my day there was one major problem: while you might be able to devise a quantifiable criterion and build an accurate model of the activity, there was no guarantee that you could *solve* the model. For example, we could use matrix-algebra techniques to relate data on entering students to their eventual GPA, but solving that to yield useful equations required inverting a 75 by 75 matrix; and that task would take lifetimes if done by teams of graduate students punching Monroe calculators.

Enter the computer. When IBM gave the University of Washington a RAMAC 650 computer, the first task of the Grade Prediction Project was to teach it to invert matrices. The 650 had one 10-byte word of main memory and 5000 10-byte words of drum-storage memory. Everything had to



- NEW**
- FEATURES**
- ▶ Full VT340/420 Terminal emulation
 - ▶ ReGIS, Tektronix & sixel graphics
 - ▶ Multi-sessions
 - ▶ Multilingual menus
 - ▶ Copy & paste
 - ▶ DDE
 - ▶ File transfer
 - ▶ Network interfaces
 - ▶ Script language
 - ▶ On-screen buttons

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.

See KEAterm for Windows and Windows NT at Windows World in Atlanta, May 24-27. Booth 6454.



KEA Systems Ltd.
Call 1-800-663-8702
Phone: (604) 431-0727
Fax: (604) 431-0818

KEA Systems Ltd. 3728 North Fraser Way, Unit 101, Burnaby, BC, Canada V5H 5G1
 KEA, KEAterm, ZSTBA, 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. 1992. All rights reserved.

Discover the basic principle of connectivity...



Defy the gravity of your connectivity problems.

It's a basic principle worthy of Newton:

When the complexities of multiple platforms weigh you down, discover superior PC-to-host connectivity solutions from SmarTerm.[®]

Take emulation to new highs.

SmarTerm provides PC users with advanced DEC and Dasher terminal emulation (including VT420, VT340, and D470) and connectivity to VAX/VMS, UNIX, and Data General hosts.

Whether you need precise emulation for text or graphics (including full ReGIS, Tektronix, and sixel capabilities), or for Windows, DOS, and soon Windows NT, SmarTerm connects on the highest levels.

Break free under your own power.

Escape from high support costs with SmarTerm's pioneering tools and utilities, including simplified keyboard remapping, pop-up keyboard, on-screen toolbox, user-definable button palettes, and customizable help system. You'll reduce calls to the help desk and standardize your site's connectivity.

See us at Windows World, #6883, and DECUS, #936.

Persoft U.S.A. 465 Science Dr. • Box 44953 Madison WI 53744-4953 • Phone (608) 273-6000 • FAX (608) 273-8227

Persoft Europe World Trade Center • Beursplein 37 • Box 30237 • 3001 DE Rotterdam, The Netherlands • Phone +31 10 405.3560 • FAX +31 10 405.5073

Discover SmarTerm.

It's the only emulation software that includes a multiprotocol kit FREE in every package. Get implementations of LAT, TCP/IP, Token Ring drivers, and support for a variety of third-party TCP/IP, all designed and supported by Persoft, and all at no extra cost! Discover the basic principle of connectivity today.

Call 1-800-EMULATE.



persoft[®]

CONNECTIVITY SOLUTIONS
DOS • Windows • Ethernet • Token Ring

be fed into it on punched cards, and there weren't any programming languages, so writing a matrix-inversion program was difficult and tedious. I left graduate school before that project was completed, but eventually it was done, and the project worked very well indeed, a spectacular testimony to the usefulness of matrix techniques.

Old OR people would have sold their souls for techniques that modern PCs give anyone access to. Not only is it simple enough to write routines for doing matrix algebra, but many languages, including BASIC, have most matrix operations built into them; which naturally leads to the question, why isn't good OR more common now? It should be. The tools are available to almost anyone.

I suspect the reason has something to do with changing the name from *OR* to *systems analysis*, which sounds a great deal more complicated. OR was always done by interdisciplinary teams, and thus we had powerful incentives to keep the language simple so that we could talk to each other. Systems analysis seems to have developed a complex jargon that's in-

comprehensible without a lot of specialized study.

I suppose that people who want fancy job titles like "systems specialist" have no choice but to learn the new jargon. Those more interested in getting the flavor of modern OR should get hold of Ian Bradley and Ronald L. Meek's *Matrices and Society* (Princeton University Press, 1987) and read that carefully. The information density is pretty heavy, but the book has almost no jargon and goes lightly over everything from multiple regression to Markov chains. It's not precisely light reading, but it's not beyond anyone who reads BYTE, either.

The next step may not be as easy. In my day, the beginning OR bible was Churchman, Ackoff, and Arnoff's *Introduction to Operations Research* (Wiley, 1957); doubtless there's something better out now, but I don't know what it is. The point is that this book is easier reading now than it was in my day, because many of the equations in the book can be set up and run in

something like Mathcad or Macsyma (see last month's column), or for that matter programmed in BASIC. It used to take years to learn how to do things like that.

Now you just have the computer do it.

OR teams often made forecasts that involved some pretty heavy-duty mathematics: as, for instance, the fire-control problem, aiming a gun to put a shell where the target will be when the shell arrives. Targets can be in any direction, moving along any azimuth, and need not be traveling in a straight line or at constant speed. This is known as a *time series*, and solving such problems was one of the first military uses of computers.

Stock-market analysts are frequently called on to make forecasts, often from no more real data than the stock's past performance; but that performance data may stretch back a long way in time, far enough to show cyclical behavior. Weather and climate also show cyclical activity, and climate is one determiner of crop—and thus



GREAT THINGS COME IN SMALL PACKAGES

This powerful print server can tackle your biggest network printing problems

- Connects any parallel printer directly to your Ethernet LAN
- Fully Novell Network 286 and 386 compatible
- Can attach to 8 file servers simultaneously
- Fast and easy to install
- Combines high-speed printing and exceptional printer control
- Supports encrypted passwords, forms, notify, cancel, and others
- Full one-year warranty and unlimited free technical support
- Made in the U.S.A.



Ethernet port available in thin or twisted-pair

Status LED

Power jack

Serial port can be input or output

Parallel port plugs directly into any printer

Press switch to print status

Make the Rose Connection



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

1-800-333-9343

Windows,
DOS, Macintosh

STATISTICA/W

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.

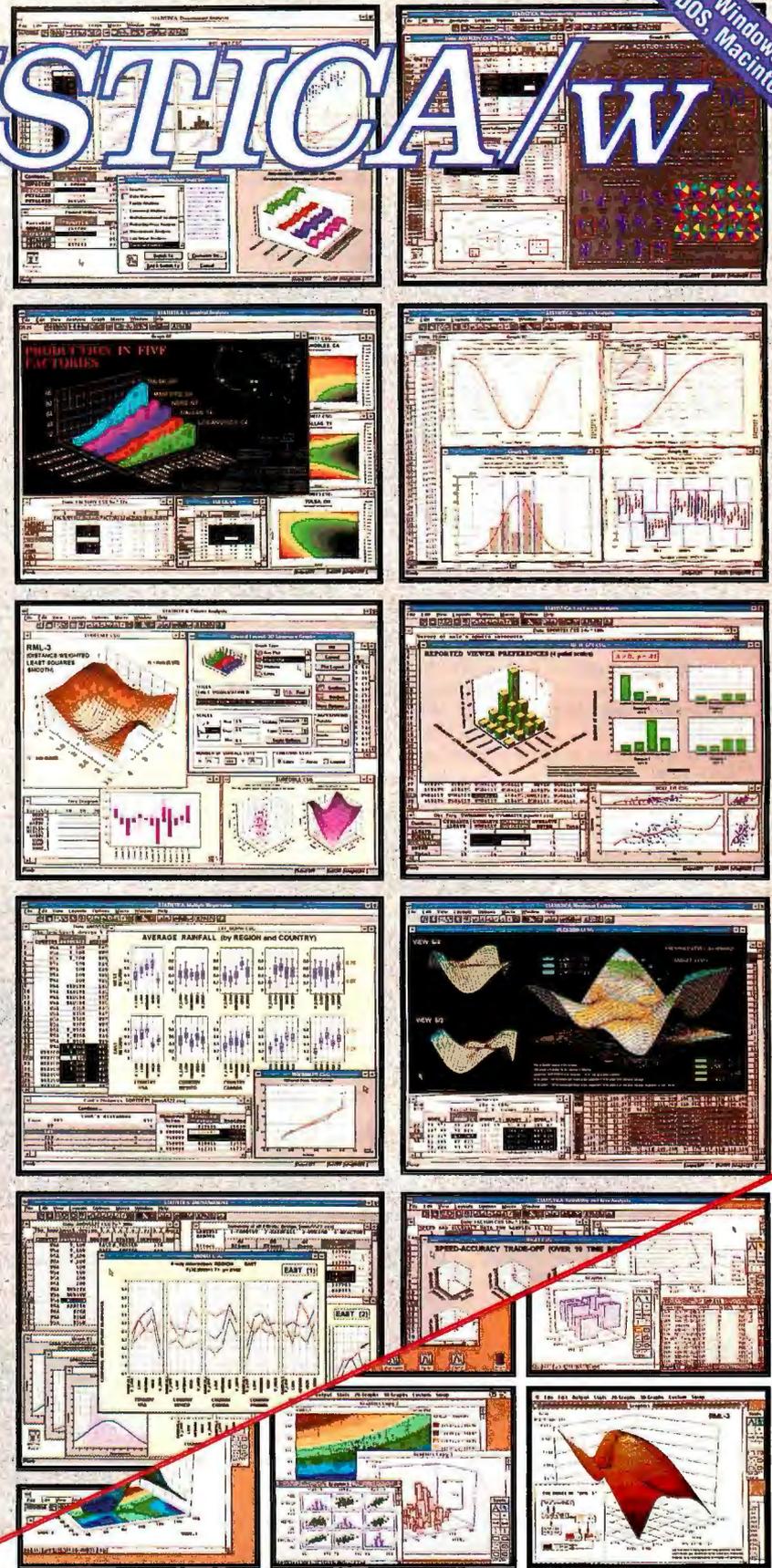
Quick STATISTICA/DOS™ (for DOS) A subset of STATISTICA/DOS statistics and graphics ■ Price \$295.

Domestic sh/h \$10 per product; 14-day money back guarantee.
Circle 140 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 Jalsing, 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.



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. EDA, 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.



StatSoft, STATISTICA/W, Quick STATISTICA/W, STATISTICA/Mac, Quick STATISTICA/Mac, STATISTICA/DOS, Quick STATISTICA/DOS, and Scrollsheet are trademarks of StatSoft, Inc.

commodity—prices. You might also want to predict export demand, consumption of some manufactured item such as O-rings or safety pins, credit demand, or whatever.

One method of forecasting is to look at things, think about the problem, and produce a forecast like Athena springing from the brow of Zeus. There are people for whom this works; however, this is a technique useful only to acknowledged experts with a track record. Anyone else will have to show how they got their answer.

The other method of forecasting is to

assemble the past history of everything you think relevant and look for patterns. You use those patterns to predict future behavior. With a great deal of luck, you'll recognize causative factors and be able to build a real predictive model. Usually, though, you won't know *why* certain patterns repeat, or why some things seem to predict others. You may have a good idea, but you can't really say you understand what's going on; it just happens that way. In those cases, you may also have some nagging doubts about whether you noticed

all the patterns in your data.

All of which brings us to Forecast Pro from Business Forecast Systems. This program, available for DOS or Windows, does stochastic models for you. Feed it the data, and it will not only make a forecast, but also tell you what it based the forecast on. It will let you play about with the data and muck about with the models. You can unleash an expert system to recommend models, or you can tell the program how to go about its business. Either way, you get to see exactly what it did and get some explanation of why.

There's a tutorial to show you how to use Forecast Pro and a statistical reference section that explains what's going on. The tutorial uses supplied sample data sets that are pretty good for showing you what the program can and can't do and what kind of accuracy to expect from the results. It starts with the assumption that you don't know anything about what you're doing and walks you through. It won't make you a systems analyst or an expert on forecasting, but when you finish the tutorial, you'll know more about forecasting—including its limits—than most of your colleagues.

There are lies, damned lies, and statistics, as the old saying goes, but you can make the case that everything we know, including physical law, is probabilistic (i.e., based on statistical inference). I won't try to prove that, but clearly a lot of what we know does depend on probabilities, and those armed with a good understanding of probability and statistics are much better equipped to deal with the real world than those who are not.

For instance, suppose you have two mail-order ads. One is quite expensive to produce and mail, but it seems to be more effective than the other. You are also offered two mailing lists, one small but known to contain people very interested in your product, the other much larger and said to be "pretty good."

You want an optimum strategy. Clearly you need to do some tests, mailing each presentation to a sample of each list. Fine. How many of what do you mail to whom? What confidence will you have in the result?

Rather than make wild guesses, most people at this point will hire an expert, only how do you know the expert is any good? What you really need is some understanding of what statistics is all about.

A great deal of classical OR dealt with probabilities and statistics, and doing statistical analysis without computers was right up there with root-canal therapy for enjoyment. Because the mechanical work

PUT AN END TO SOFTWARE PIRACY!

Meet the growing family of security keys from Software Security.

Each one a specialist at enforcing your license agreement in virtually any user environment you can think of. Whether it's DOS, UNIX, Macintosh or OS/2. Whether it's a single user installation or a LAN.

Simply connect the appropriate key to a single user computer, or a non-dedicated file server in a network, and you control all access to your protected application.

Users, however, won't even know it's there. The keys are transparent and won't impact software functionality or the ability to make back-up copies. Normal node and LAN operations are unaffected.

The Ultimate Protection For Software Publishers

Simple. Unassuming. Ever vigilant. Easy to incorporate into your application package. And quite possibly the most profitable hardware investment a software developer can make.

To find out more, call:

1-800-841-1316

IN CONNECTICUT CALL: 203-329-8870

FAX 203-329-7428

EUROPE AND UK: + 44 784 43 00 60



SOFTWARE SECURITY

1011 High Ridge Road
Stamford, CT 06905

Proudly Made in the USA

**NOW AVAILABLE!
NETWORK
PROTECTION
WITH REMOTE
UPDATING!**



North American Readers circle 138; Other Readers Worldwide circle 139.

All product names are trademarks or registered trademarks of their respective holders. Made in U.S.A.

Have You Ever Wanted To Leap Out The Nearest Window?

Take The Plunge With Proxy. It's Network Remote Control For Windows, From Windows.

Some things you expect in remote control software. Like lightning-fast speed. And control over both DOS and Windows on the host PC. But new Proxy gives you something you probably don't expect. Because it not only works with Windows, it works from Windows. And that makes all the difference.

You see, other remote control products run from DOS, even



If it runs on the host, it runs in a Proxy window. Even graphical DOS programs.



Proxy supports host computers running Windows.

No need to abandon your own work when someone calls. Just click on a Proxy icon and instantly connect to the caller's machine. You now have full control of their hardware and software, complete with mouse and keyboard support, whether they're running Windows or DOS.

Reconfiguring Lots of Workstations? Leap Out The Nearest Window.

Now you can perform administrative chores like software installation, updates, and system configuration without going from room to room. Just capture a PC and perform any operation as if you were sitting in front of it. You can even reboot it remotely!



Proxy gives you complete control of any computer on the network.

Need More Processing Power? Leap Out The Nearest Window.

Imagine off-loading your most CPU-intensive tasks to separate machines you control as if they were part of your own desktop. Imagine two, three, or more applications, each running at full speed because each has its own dedicated processor. That's the power of multi-processing with Proxy.

You can make Proxy available across the network and give power-hungry users access to spare or idle PCs. You can even dedicate PCs to specific tasks, like a high-powered 486 for CAD or a modem-equipped 286 for communications.

Take The Next Logical Leap in Remote Control. Get the most advanced network remote control available, with applications ranging from user support to multi-processing. Get Proxy. It's from Funk Software. The same people who brought you Sideways®, Allways, and other top-selling PC utilities.

Call today to order or for more information.
1-800-828-4146 Ext. 806 (U.S. and Canada)

PROXY™



You can connect to multiple PCs over a network, with each appearing in its own window.

those that support a host running Windows. So they allow just one connection at a time, and demand total attention from your computer. But Proxy is a Windows application that lets you make multiple connections simultaneously. You can display and control a different host PC in each window you open, while you continue to run local applications.

Users Calling For Help? Leap Out The Nearest Window.

If your job is to help users on the network, Proxy will make it easier.



Run time-consuming jobs on dedicated processors, and control them all from Proxy.

**FUNK
SOFTWARE**

System Requirements: Proxy "Master" runs in Windows and can control multiple "Hasts" running DOS or Windows over an IPX network (e.g. NetWare).

© 1992 Funk Software, Inc. Proxy is a trademark of Funk Software, Inc.

Funk Software, 222 Third Street, Cambridge, MA 02142 Tel (617) 497-6339 Fax (617) 547-1031

Circle 169 on Inquiry Card.

in statistics was boring and tedious, the whole subject got a lousy reputation; but it doesn't have to be that way. Now true, the American school system seems dedicated to the notion that self-esteem is more important than accomplishments, so studying math is discouraged lest the student find it too difficult and get a bruised ego; but the actual elements of probability and statistics aren't hard to understand. Manipulating the numbers can be tedious, but you don't have to do that. Use Systat.

I once pointed this out to a friend in the police department, and for some reason he believed me. He got Systat running on his home computer and began to analyze the crime data that floated around his precinct headquarters. The results were important enough to earn him two promotions in five years, and now he's teaching the subject to other detectives.

I can't promise that good a result to everyone, but I can say that I sure wish I'd had Systat in my early OR days. What with a matrix-manipulation language, a forecasting program, and Systat, I'd have been the greatest OR man alive; and indeed, if I ever get tired of what I'm doing, I know what I'll do.

Polysoft's PS-Plot 1.2 is no Systat, but it's a lot cheaper. Check it out if you already know about statistics and all you want is something that will accept your data, plot it, and crank out analyses. For many it will do the job, such as if you need to prepare a paper using correlations, T-tests, F-tests, and the other usual stuff.

The manual is best described as terse. There's a set of lessons, and the package as a whole is superior to the introductory statistics course I took at the University of Iowa. You can learn how to do statistical cookbook operations with this. You aren't going to learn *why* you do those things, but we didn't learn that in Introduction to Statistics; few do, especially in education and the social sciences.

Overall, PS-Plot is a satisfactory package with some spectacular graphical capabilities. It's more than satisfactory for people who pretty much know what they want to do and don't need all the capabilities of Systat.

Before the solar eclipse of 1991, we drove down Baja California to a beach in Todos Santos to watch it on July 11. It's hard to believe that was almost two years ago. Anyway, watching the eclipse was certainly spectacular enough to make that rather grueling and very hot trip worthwhile. You can read all about it—including how we used the Magellan GPS NAV 1000 Pro system to access the global positioning satellites to tell us exactly where we were—in my November 1991 column.

However, if you have a Mac II and want to experience the eclipse, get Warner New Media's View from Earth CD-ROM. It's not like being there—nothing could be, not without shadow bands—but it's certainly an experience. With audio narration, tons of text, diagrams, simulations, and color photographs and illustrations, this will tell you as much about eclipses as you're likely to want to know. If you're into eclipses, or want to be, get View from Earth. Recommended.

continued



The Perfect Back-up For An Imperfect World.

Accidents don't happen in perfect worlds. In *this* world, the best solution is VALITEK.

VALITEK builds every tape back-up drive as though your business depends on it. There's no safer, simpler, smarter tape back-up drive anywhere. No installation. No controller cards. No pre-formatting tapes. Back-up from 60 MB to 1.2 GB with speed and reliability no bargain basement tape drive can begin to match.

Complete portability. Rock-solid construction. Uncompromising quality.

When you can't afford to lose a single bit of data, can you afford anything less than VALITEK?

VALITEK

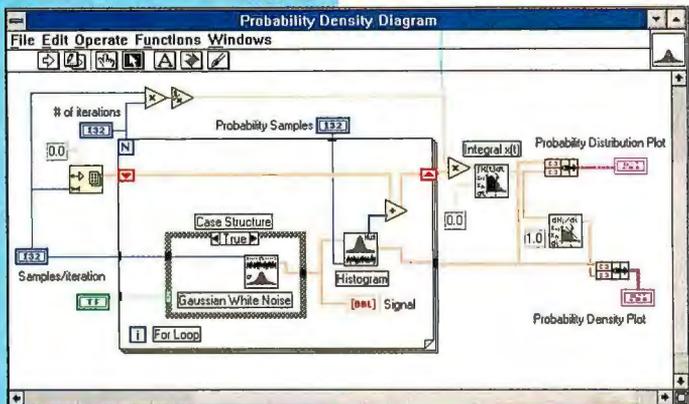
100 University Drive, Amherst, MA 01002
CALL: 1-800-VALITEK or 413-549-2700
FAX: 413-549-2900 BBS: 413-549-7560



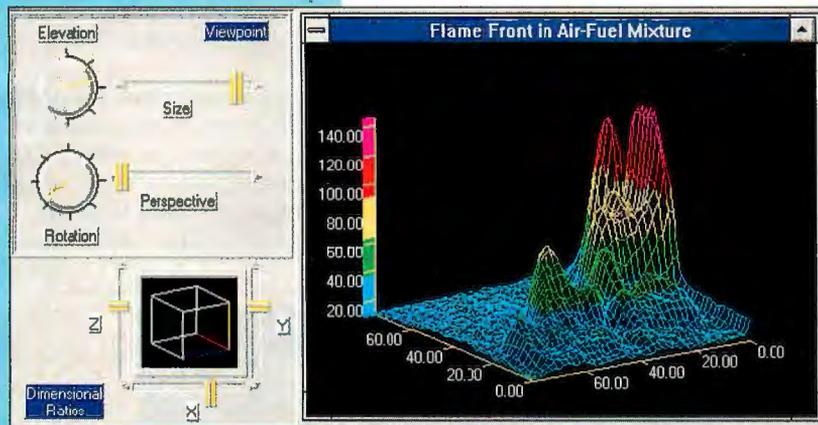
The worldwide leader in parallel/serial technology



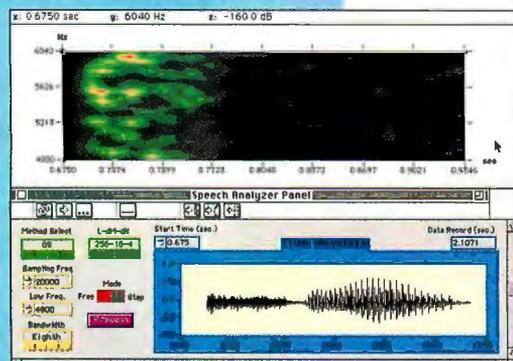
Draw Your Complete Analysis Solution with LabVIEW® Graphical Programming



LabVIEW is a complete graphical programming language.



Surface plot of a flame front using LabVIEW and the SurfaceView toolkit.



Data courtesy of NIH.



The Gabor Spectrogram displays a portion of the sentence "I take two people out for breakfast," computed and displayed with LabVIEW.

Productive and Creative Methodology

Quickly develop programs for analysis, simulation, and algorithm development with the complete graphical programming language found in LabVIEW. It is more than a math calculator. LabVIEW has graphical constructs for While Loops, For Loops, and Case structures.

Advanced Visualization and Plotting

Rapidly create spectrograms, 2D plots, 3D plots, waterfall plots, strip charts, contours, and XY graphs with annotation, printing, and importing.

Powerful Mathematics

The award-winning LabVIEW Gabor Spectrogram algorithm for joint time-frequency analysis (JTFA) is an example of industry-leading innovation. In addition,

LabVIEW has hundreds of analysis function blocks for signal processing, digital filters, statistics, and linear algebra. Add-on analysis toolkits include:

- image processing
- surface rendering
- PID control
- 3D plotting
- speech processing
- JTFA

Beyond Analysis

Acquire data from GPIB, VXI, and RS-232 instruments and plug-in data acquisition boards. Connect to other applications with DDE, Apple Events, QuickTime, or TCP/IP. With the open design of LabVIEW, you can easily call programs from C and other languages. In addition, LabVIEW executes at speeds comparable to compiled C code.

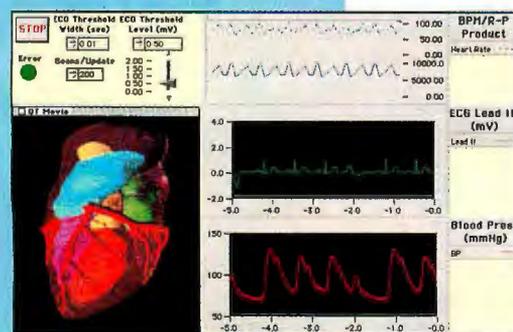
Graphical User Interface (GUI) Tools

Easily create virtual instruments and interactively control real-world processes using the GUI controls and indicators built into LabVIEW.

Call for your FREE LabVIEW demo and the application note, "Making Real-World Measurements with Fast Fourier Transforms and LabVIEW."

(800) 433-3488 (U.S. and Canada)

LabVIEW is now available on Windows, Sun, and Macintosh.



EKG signal and QuickTime heart video using LabVIEW.



6504 Bridge Point Parkway
Austin, TX 78730-5039
Tel: (512) 794-0100
95 (800) 010 0793 (Mexico)
Fax: (512) 794-8411

Branch Offices
Australia 03 879 9422 • Belgium 02 757 00 20 • Canada 519 622 9310
Denmark 45 76 26 00 • Finland 90 527 2321 • France 1 48 65 33 70
Germany 089 7 14 50 93 • Italy 02 48301892 • Japan 03 3788 1921
Netherlands 01720 45761 • Norway 03 846866 • Spain 91 896 0675
Sweden 08 984970 • Switzerland 056 27 00 20 • U.K. 0635 523545

If you don't know about Battle Chess, you should: it's pure fun. In theory, you can play Interplay's Battle Chess against your computer, or two humans can play against each other. In practice, you'll find yourself letting the computer play itself just so you can watch. The pawns attack or cringe away. Rooks turn into monsters; a rook taking a queen is a thing to see. The bishops use magic. Queens slink across the board. King takes queen is fascinating. There are sound effects, too. We have Battle Chess running on a CD-ROM with Sound Blaster Pro, and everyone loves to watch it.

They have a "futuristic" version of Battle Chess as well. Some like that better than the "classical" version. Both are extremely well done, with graphics and sound working together to produce real humor. (Now, for a matchup of the futuristic team against the classical one....)

Interplay also puts out a typing tutor, Mario Teaches Typing. Roberta reports: "The graphics are Interplay's usual high

quality. Mario is nothing if not colorful! Strictly speaking, this may not teach typing; it's really a game. If you can already type, it will drive you bananas to try to type just one letter at a time. Of course, Mario has to teach you about the home row, and his pudgy fingers are color-coded so that you will use the correct one to press the indicated key."

After you reach 10 words per minute, you can graduate to Water World. Roberta says it has a "Niven/Pournelle feeling of entering a castle or museum that has been magically waiting for you," and she really likes the images. All told, Mario teaches typing about as well as most programs do, and this one's pretty.



If you like the zoo, get The Animals, a multimedia CD-ROM about the San Diego Zoo, designed by Arnowitz, Inc., and published by The Software Toolworks. It's got what you'd expect and a lot more. There's a map and interesting ways to get around. There's a children's level and an adult lev-

el. People will read to you.

Roberta's reaction: "This thing is fun. The zoo staff tell stories and don't just present a page of facts. They tell you about the workers and veterinarians in the zoo. It makes you interested in their jobs and leads kids to want to know more about those science careers. And that's hot stuff. Catch those girls when they're five or six."

There's also full video with sound. The Windows version runs in a tiny window within the small window the whole program uses, which makes it small indeed, but it's visible. There's a short clip about a condor puppet mother (a hand puppet used to feed a baby California condor), clips about lions, elephants socializing—that sort of thing.

Roberta says, "This is like Wing Commander, only they're learning something real." I have to agree. Try this one; you'll love it. Highly recommended.

The African American Experience: A History is a middle-school-level history textbook put onto a CD-ROM. (I suppose in some areas this would be considered high-school level, but it would have been middle school when I

WORLD'S FIRST VOICE MAIL BOX & FAX MAIL BOX



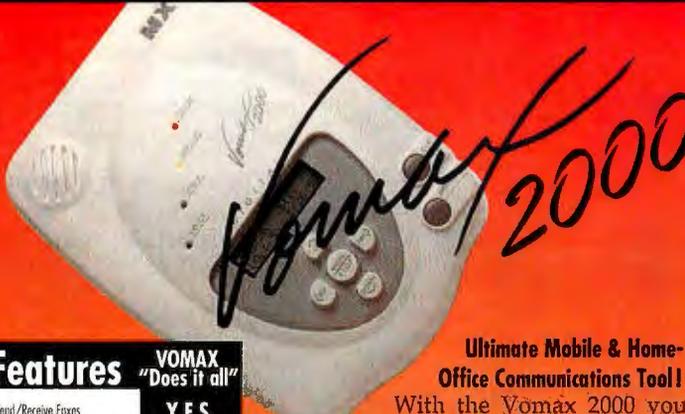
Print & Send Faxes from your PC or Mac



Send & Retrieve from any Fax in the World



Keep in touch with Voice Mail



Features VOMAX "Does it all!"

Send/Receive Faxes	YES
Remote Fax Retrieval/Forward	YES
40 Page Fax Mail Box	YES
Group III Fax Capability	YES
1 Line Voice/Data Switch	YES
Expandable Memory	YES
Send/Receive Modem	YES
Voice Mail	YES
3 Out-Going Messages	YES
Automatic Message Forwarding	YES
Incoming Message Pager Alert	YES

Ultimate Mobile & Home-Office Communications Tool!

With the Vomax 2000 you stay in-touch, well informed, and ahead of the competition with the world's first voice & fax mail box. Compatible with the PC, Macintosh or as a stand-alone assistant. Call today for a reseller near you, 1-800-858-5311.



MACRONIX, INC.



Retrieve & Send Fax Mail Remotely



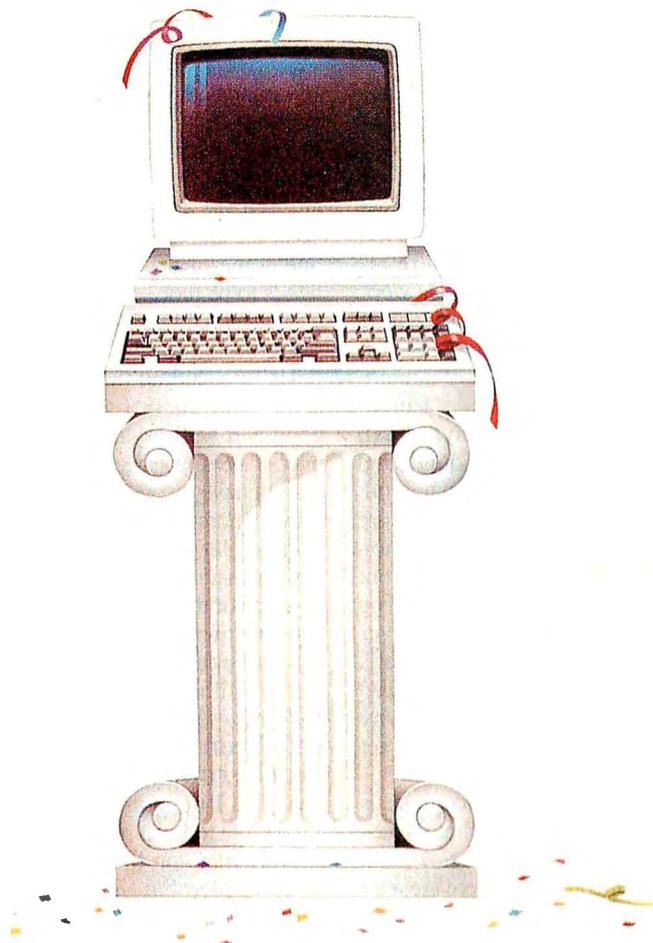
Message Waiting Notification



Check your Voice Mail from the Field

1348 Ridder Park Drive, San Jose, CA 95131 Tel: (408) 453-8088, FAX: (408) 453-8488. Vomax 2000, the Vomax 2000 logo, & the MX logo are trademarks of Macronix, Inc. All other names are trademarks of their respective holders. Specifications subject to change without notice. © 1993 Macronix, Inc.

Circle 274 on Inquiry Card (RESELLERS: 275).



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.

NSTL

Plymouth Corporate Center
Box 1000, Plymouth Meeting, PA 19462
215-941-9600

Micro Channel™ and OS/2™ are trademarks of the IBM Corporation.

Circle 121 on Inquiry Card.

was a lad in rural Tennessee.)

It's a very good book. It's straight history, emphasizing the achievements of Africans while embedding them into the history of America and Western civilization. It begins in the Bronze Age, and the authors understand the difference between Egyptian and sub-Saharan African peoples, telling of the interactions and accomplishments of both. It presents the Nubians and Kushites in a fair manner. Moving to American colonial times, it tells of an African-American soldier aboard the boat that carried Washington across the Delaware (and gives a black-and-white rendering of that famous picture; I saw the original when we did our White House briefing on the SSX program). In other words, this is good American history with emphasis on African-Americans.

The CD-ROM reader is a good one. It runs under DOS and gives an excellent VGA screen image in crisp letters of a

good font. The navigation tools work quite well. There's a decent search engine. Some words are highlighted, but there's no hypertext capability; however, there is a reference icon that will pop up quotes from people like Ralph Ellison, and there are some cross-references that work.

It's a good textbook with good reading tools. Alas, it is not a good example of a multimedia CD-ROM. As I mentioned, there's no hypertext. There's very little sound, and what there is isn't very helpful. For example, there's a picture of slaves working in a cotton field. There's a sound button; press that, and a voice tells you that this is a picture of slaves working in a cotton field. That's pointless: there's no need to read you the caption of a photo. Why should the voice messages act as if you can't read?

And worse, there's no source data: is this a photo or a drawing? If a photo, when was it taken, by whom and where? And, alas, that's not uncommon. There are a lot

of unattributed illustrations.

What this needs is more multimedia. Go to Cal Arts, where they have a wonderful collection of African-American music, and get some clips of that. Add more color illustrations. There is an "art gallery," and some of it is pretty good, but there needs to be more, and it could be presented better. Add maps, and make it easy to get to the appropriate one.

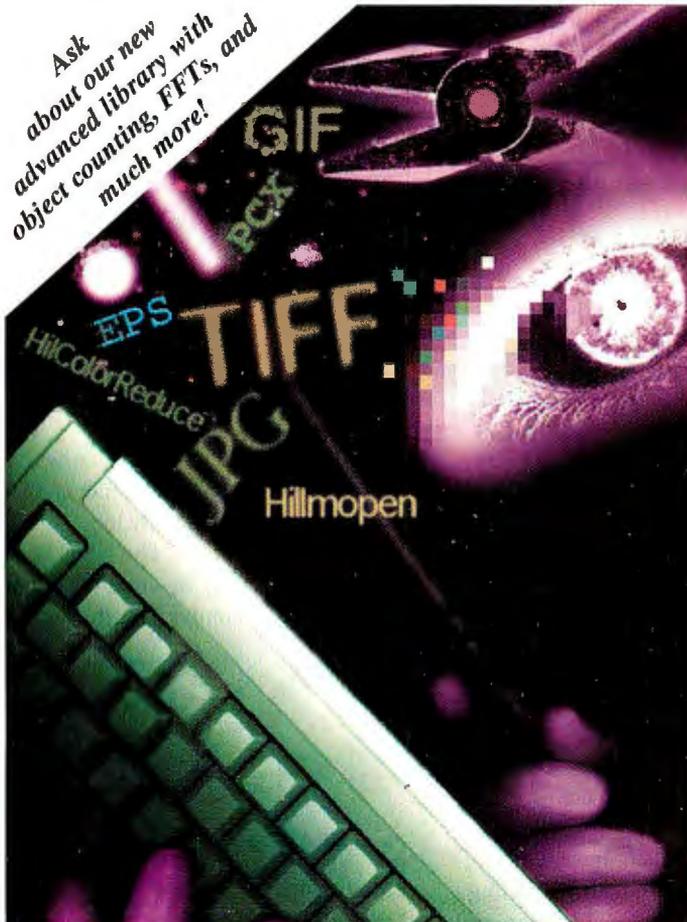
Having said all this, let me emphasize again that this is a good textbook, with good and well-organized content. Moreover, it's easily as well done a CD-ROM as many I have recommended in the past. It's only by comparison with the new generation of CD-ROMs—such as The Animals—that this one is disappointing. Given some of the awful junk that's put out as history nowadays, this is wonderful.

Good content, well-written text, with plenty of illustrations. Recommended.

I've been running Windows for Workgroups for a couple of months now, and I'm pretty happy with it. I like being able to keep resources, like Corel's clip-art files, on the network, available when needed but out of the way. I like

I've been running Windows for Workgroups for a couple of months now, and I'm pretty happy with it. I like being able to keep resources, like Corel's clip-art files, on the network, available when I need to use them but out of the way.

Ask about our new advanced library with object counting, FFTs, and much more!



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

See us at Comdex, Booth #W8831

HOT

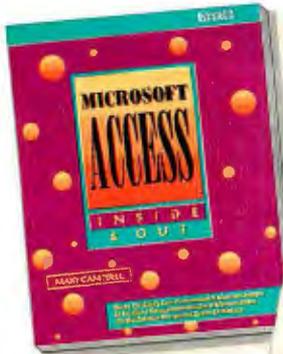
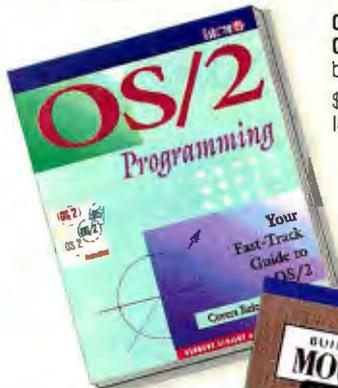
...Books to Get Your Computing Down Cold

For Matchless Coverage, Get Red Hot Computer Books from Osborne

**Sound Blaster:
The Official Book**
by Richard Heimlich,
David M. Golden, Ivan Luk
& Peter M. Ridge
\$29.95 Book/Disk
ISBN: 0-07-881907-5



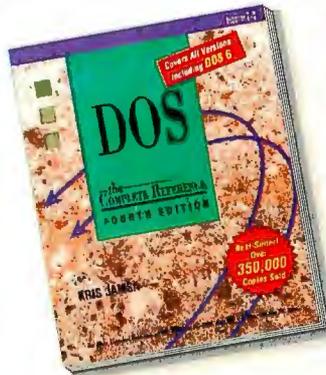
**OS/2 Programming
Covers Versions 2.0 & 2.1**
by Herbert Schildt
\$29.95
ISBN: 0-07-881910-5



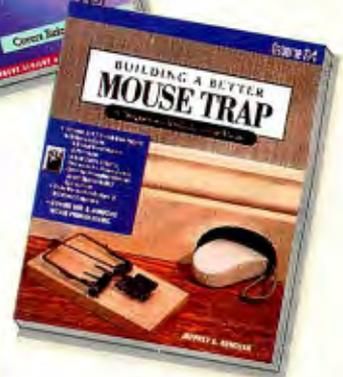
**Microsoft Access
Inside & Out**
by Mary Campbell
\$27.95
ISBN: 0-07-881818-4



**File & Disk Management:
From Chaos to Control**
by Alfred Glossbrenner
\$39.95 Book/Disk
ISBN: 0-07-881834-6



**DOS: The Complete
Reference, Fourth Edition
(Covers All Versions, Including DOS 6)**
by Kris Jamsa
\$29.95
ISBN: 0-07-881904-0



**Building a Better Mouse Trap:
How to Program the Mouse**
by Jeffrey Donovan
\$39.95 Book/Disk
ISBN: 0-07-881930-X



**Multimedia:
Making It Work**
by Tay Vaughan
\$27.95 Book/Disk
ISBN: 0-07-881869-9

AVAILABLE NOW AT THESE FINE STORES

If you paid full price, you didn't buy it at
CROWN BOOKS
SUPER CROWN
Three times more books. Same great Crown prices.

Barnes & Noble
Booksellers Since 1873

BOOKSTAR
The Complete Discount Bookstore

BOOKSTOP
The Complete Discount Bookstore

Osborne 

Copyright © 1993 McGraw-Hill, Inc.

THE FOCUSED, FULL-TEXT DATABASE WITH MCGRAW-HILL CREDIBILITY...

McGraw-Hill Publications Online

Business Week
Aerospace Daily
Airports
Aviation Daily
Aviation Week & Space Technology
Biotechnology Newswatch
Byte
Chemical Engineering
Clean-Coal/Sunfuels Letter
Coal Week
Data Communications
Electric Utility Week
Electrical World
Engineering News-Record
Federal Technology Report
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
Modern Plastics
Nucleonics Week
Platt's International Petrochemical Report
Platt's Oilgram News
Platt's Oilgram Price Report
The Physician & Sportsmedicine
Postgraduate Medicine
S&P's Emerging & Special Situations
S&P's Review of Banking & Financial Services
S&P's Review of Securities & Commodities
Regulation
Securities Week
Utility Environment Report
The Weekly of Business Aviation
Unixworld

And More...

It's all there, word for word, an unedited electronic library containing the full-text of articles (except graphics) exactly as they are published in McGraw-Hill magazines and newsletters. And because it's from McGraw-Hill, the world's leading provider of information services, you also get unparalleled excellence and reliability of content.

Plus, you can search the entire McGraw-Hill database (over 45 leading publications) faster with more user-friendly ease than any other text. There are no cumbersome indexes, no summary words to look up and learn...so you can get right into your hunt for the information you need about companies, people, and products on any topic.

Make the connection to McGraw-Hill Publications Online today. For more information and our latest, complete 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® • NewsNet®
• Dow Jones News/ Retrieval® • Lexis/Nexis®
• F.T. Profile (U.K.)

McGraw-Hill Publications Online

Princeton-Hightstown Road
Hightstown, NJ 08520 U.S.A.



Please send me the complete list of your publications online.

BY

Name _____

Title _____

Company _____

Company Address _____

City _____ State _____

Zip/Postal Code _____ Country _____

Tel. _____

A MESSAGE TO OUR SUBSCRIBERS

FROM TIME TO TIME WE make the BYTE subscriber list available to other companies who wish to send our subscribers material about their products. We take great care to screen these companies, choosing only those who are reputable, and whose products, services or information we feel would be of interest to you. Direct mail is an efficient medium for presenting the latest personal computer goods and services to our subscribers.

Many BYTE subscribers appreciate this controlled use of our mailing list, and look forward to finding information of interest to them in the mail. Used are our subscribers' names and addresses only (no other information we may have is ever given).

While we believe the distribution of this information is of benefit to our subscribers, we firmly respect the wishes of any subscriber who does not want to receive such promotional literature. Should you wish to restrict the use of your name, simply send your request to the following address.

BYTE Magazine
Attn: Subscriber Service
P.O. Box 555
Highstown, NJ 08520



Pournelle

having my Pioneer CD-ROM drive available in addition to the local Sound Blaster Pro multimedia CD-ROM drive. I like being able to send stuff off to the Pioneer read/write optical drive and knowing I can get it back when I want it; all this and, thanks to Quarterdeck's QEMM-386 6.0 memory management system, I still have DOS windows of 620 KB. I like having Niven's machine linked into mine, so I can move our current work files back and forth and at the same time send a copy off to a glass disk for archiving just in case.

Windows for Workgroups isn't the perfect network, but for a small operation like mine, it's sure neat. It was easy to set up, it's easy to add to, and it takes no work to maintain it.

If you use Windows and you've got a couple of computers, think seriously of networking them. You'll be surprised at the increase in productivity—and Windows for Workgroups is about as painless a way to set up a network as I know.

Some weirdnesses remain, not fatal, but annoying.

One is the very odd behavior of my Sound Blaster Pro. When I launch a program that uses it, I get an error message: "Unable to play sound—the Sound Blaster is in use by another application." It then iconizes whatever I launched and tucks that icon down at the bottom of the screen with the other background icons. If I double-click on that icon, the application launches. It may or may not have sound; usually it does. This happens only on my Cheetah 486/33.

Incidentally, when I talk about the Cheetah 486/33 and Cheetah 486/25, I really should say 486/66 and 486/50. We put Intel's OverDrive chips in both those machines. They work fine, caused no problems whatever, and speeded things up something wonderful. I wish Intel's prices on those chips would come down, but I sure have saved time.

There's an oddness to the video quality, but I understand that one. I've got ATI Technologies' Graphics Ultra Pro boards with the latest 8514/A drivers (downloaded from BIX; the ATI BBS is almost always busy) in the two Cheetah systems. Both machines show CGA graphics; but CGA text is mush on the 486/33, while it's fine on the 486/25.

Windows for Workgroups isn't the perfect network, but for my operation it's sure neat.

There's a simple explanation. We use QEMM—I still think it's the best memory manager available—and in the 486/25 we exclude A000–A7FF, while we don't do that with the 486/33. CGA text uses that area. I can't afford to exclude A000–A7FF in my main machine.

I suppose that requires explanation. I use the network to access the Pioneer CD-ROM drive, and for that matter any CD-ROM drive on any machine on the net-

work, but I still need a local drive for quick CD-ROM changes. Until Microsoft builds CD-ROM access tools into either DOS or Windows for Workgroups, I have to run MSCDEX on my local machine. That takes a 15-KB chunk of high memory; and if I exclude A000–

A7FF, I won't have big enough DOS windows. Since some of my programs (and almost all my games) require big DOS windows, I have to live with the result.

One of these days, I'm going to bite the bullet: I'll back everything up on the Palindrome DAT (digital audiotape) drive (which continues to work *wonderfully* well; I *love* the Palindrome system, hardware and software), erase Windows entirely, and reinstall from scratch. Since this will take hours, and my problems are nothing I can't live with, I'm in no tearing hurry to do it. But I suspect that's what it's going to take. Oh, well.

If you need a loan-amortization program and you use Windows, Winmortization Pro 2.1 is a good choice. Put in your loan data, whether this is a U.S. or Canadian loan or mortgage (the defaults are different for the different cases), and you get your answers. There's a little spreadsheet and a file-saving capability. You can build up a spreadsheet to let you compare different options of payment periods, payments, compounding periods, and suchlike.

All told, it's a neat little program that makes good use of Windows. It's simple to use and easy to install. If you don't have a loan-amortization calculator, I can recommend this one.

Alas, when I installed it, I got an odd error message: "Invalid object use." I've never seen that particular message before, and so far I haven't found anyone who can explain it. The really weird part is that

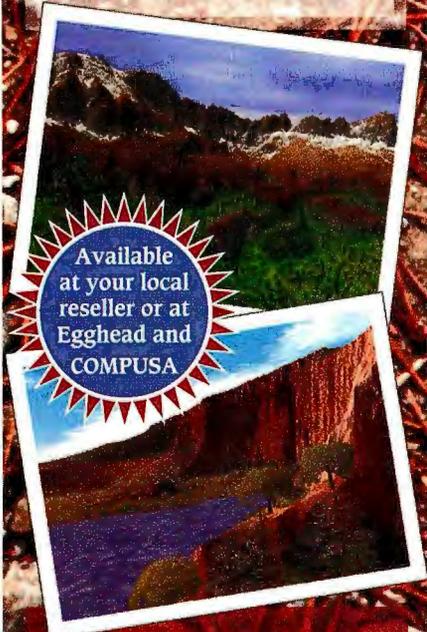
Announcing Vistapro 3.0!



VISTAPRO 3.0

This spectacular 3-D landscape exploration program is loaded with new features including: 24-Bit color, 3-D trees, fractal texturing, clouds, the ability to generate left and right images for 3-D viewing, and more! IBM version supports 24-bit BMP, Targa 24, PCX and FLC. Amiga Version supports AmigaDOS 3.0, AGA 256, HAM8 and SuperHiRes modes. Comes with 19 landscape sets, and many more are available separately. IBM version Retail: \$129.95 Amiga version Retail: \$99.95

ARTHUR C. CLARKE, The grand master of science fiction, warns Stanley Kubrick: "If you get Vistapro into your computer, you'll never do any more work! It produces images of almost photographic quality... So I can explore all the interesting places on Mars!"



Available at your local reseller or at Egghead and COMPUSA

Virtual Reality Labs
1-800-829-VRLI

2541 Ganador Court • San Luis Obispo CA 93401

Pournelle

everything worked fine on the Gateway 2000 4DX2-66V and the Cheetah 486/25; it was only the Cheetah 486/33 that gave me that message.

It doesn't matter. When I installed the current version (2.1) of Winmortization Pro, the problem went away; now the program runs on every machine in the house.

Windows is a big and complex program, and I'm not sure anyone really understands it. Why else would I get weirdnesses that no one can explain?

One of the Windows mysteries is "resources," which isn't exactly the same thing as memory. You can seemingly have plenty of memory and still run out of resources. Worse, resources use a different kind of math from what you're used to. I am told that my system, which tends to operate with about 63 percent resources free, is running on the low side, and when you get down to 25 percent resources free, it's time to panic.

One way to free up resources is to remove needless fonts. If you ever installed CorelDraw on your system, I guarantee you will have some. Many other programs add fonts as well, and every font eats some resources (as well as adding to the time it takes for Windows to load up and initialize). Worse, there is an absolute limit to the number you should load, and Windows doesn't keep you informed.

I recently received a review copy of *Windows Programmer's Guide to Resources* by Alex Leavens (Sams, 1992), and I thought I'd try to learn more. Alas, while the book is thorough and complete, it's for programmers and makes few concessions to the rest of us. Windows programmers need this book. The rest of us will have to wait for something simpler to appear.

Want to see Princess Leia turn into Chewbacca the Wookiee? ASDG's Morph Plus for the Amiga will do it, and it's something to see. There's also Gryphon's Morph, a similar program for the Mac; you can use it to create QuickTime movies, add animations, or just plain have fun.

Kay Yarborough Nelson's *The Little System Seven Book* (Peachpit Press, 1992) is the book to give an end user who's familiar with System 6 and wanting to use System 7. The real computer book of the

month is by Rich Heimlich, et al., and titled *Sound Blaster, The Official Book* (Osborne/McGraw-Hill, 1993). This will give users and programmers alike what they need to know about the most popular sound board, and it's selling like hotcakes.

The book of the month is Charles Pellegriano's *Unearthing Atlantis: An Archaeological Odyssey* (Random House, 1991), with an introduction by Arthur C. Clarke. This is the story of Spiridon Marinatos's excavations on Thera. I spent a fascinating few days with Dr. Marinatos on Thera in the 1970s, and I've always intended to write a book much like this one; maybe now I won't have to. If you get through that and need some light reading, try Terry Pratchett's *Witches Abroad* (Signet, 1993), one of his Discworld madnasses.

One of the Windows mysteries is "resources," which isn't exactly the same thing as memory. You can seemingly have plenty of memory and still run out of resources. Worse, resources use a different kind of math from what you're probably used to. One way to free up resources is to remove needless fonts.

The game of the month is Empire Deluxe from New World Computing. This is an upgraded edition of the classic game Empire. It has much better graphics—switch between 640 by 480 pixels and 800 by 600 pixels on the fly! Nifty. It has several new units and a scenario editor. If you liked Empire, you'll love this. Lord knows the original ate enough of my time. I'm also playing Accolade's Star Control II, a galactic role-playing game with quite an elaborately worked-out story line. I guarantee you will not finish this one in a few hours.

Meanwhile, there's a lot going on at Chaos Manor. I have Mobidem, a Radiomail system that lets me receive and answer my E-mail on a notebook-size system that includes an HP 95LX. People who travel a lot will find this extremely useful: it even works when you're sitting on the taxiway at the airport.

We've got a new Forminco computer desk and chair. The chair looks odd, but it's sure comfortable; a full report after I've had a chance to use them. We've also got a new IBM PS/2 with OS/2 and a CD-ROM drive. I'm sure you'll hear a lot more about that one.

There's a One Stop Music Shop sound board for the Amiga from Blue Ribbon Soundworks that has 32 true stereo voices and software to let you create music.

Next month, all the above, a lot more on networking—I intend to install Novell's NetWare—and Video Spigot from

TRUTH IN HARDWARE

Vendors make performance claims. Compatibility claims. Support promises.

As a buyer of PCs and peripherals, you need the TRUTH. Based on objective, head-to-head tests of major competitors in each product category. So you can choose the right products the first time.

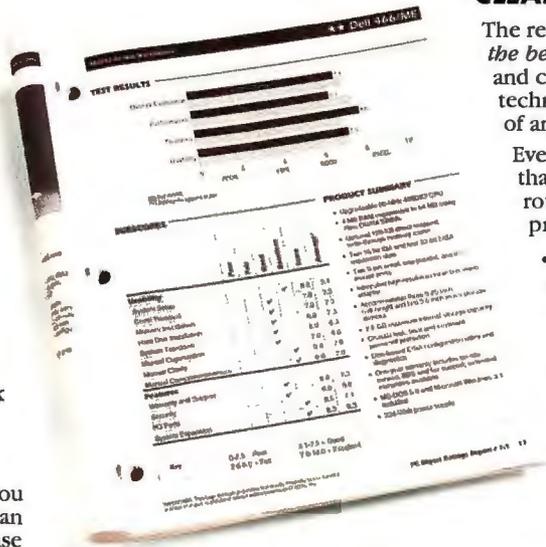
Since the dawn of the microcomputer era, buyers making high-stakes purchases have been using National Software Testing Laboratories (NSTL) for authoritative evaluations of standalone and networked systems and peripherals.

NSTL originated the concept of testing PC products. Today our state-of-the-art benchmarks and methodologies set the mark that others imitate.

ACCESS TO NSTL TEST RESULTS

PC Digest, published by NSTL/BYTE, gives you direct access to NSTL's test results. So you can make smarter, easier, more confident purchase and upgrade decisions.

No other testing system uncovers core performance, versatility and usability differences. We force products to show their strengths and weaknesses in head-to-head, feature-to-feature competition. In real-world, applications-based environments like the one you work in every day.



PC Digest is published 20 times a year by NSTL, the industry's first and most authoritative independent testing laboratory.

CLEAR-CUT WINNERS

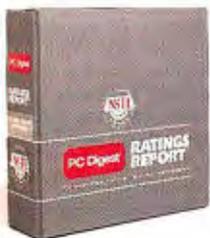
The result: clear-cut winners that give you the best value for your money. Concisely and clearly described by expert test technicians — without ads or distractions of any kind.

Every issue focuses on a new technology that you need to know — or features a roundup of established technologies in price-competitive categories.

- 486 66MHz systems
- EISA Ethernet cards
- Pen systems
- Mobile computers
- Multimedia upgrades
- Unix servers
- High res monitors
- Color notebooks
- SCSI disk drives
- PostScript printers
- CD-ROMs
- 9600 V.42 bis modems

PC Digest's features charts are so complete that vendors consult them before designing upgrades. Shouldn't you consult us before buying your next piece of equipment?

FREE BINDER



To help you build your resource library, you get a FREE durable, 3-ring binder with tabbed subject dividers upon payment.

2 FREE ISSUES

Include payment with your order now (check or credit card) and receive two additional issues with our compliments.



ORDER NOW!

YES, please enter my subscription to PC Digest for one year (20 issues) at \$445, and send my free binder with my first issue. If I elect to include payment now, add two additional issues to my subscription at no cost. I must be completely satisfied with PC Digest or I will receive a full refund of my entire investment.

MAIL TO: PC Digest, P.O. Box 551, Hightstown, NJ 08520-0551

NAME _____

COMPANY NAME _____

COMPANY ADDRESS _____

CITY/STATE/ZIP _____

PHONE _____

PAYMENT INFORMATION:

Payment enclosed

Please bill me P.O. # required _____

Charge my: Visa MasterCard AMEX

ACCOUNT NUMBER _____

EXPIRATION DATE _____

SIGNATURE _____

Orders outside North America: Please add US \$20. for airmail delivery.
ADBY630

PC DIGEST IS NOW PART OF THE BYTE FAMILY OF PUBLICATIONS!

PHONE

1-800-232-2983

FAX

609-426-7087

MONEY-BACK GUARANTEE

If at any time you are not COMPLETELY satisfied with your subscription, you will receive a full refund of your entire investment.

No Doubt

YOU're
the
Expert!

BYTE READERS are considered **experts** in today's complex computer environment. When you need to make decisions, BYTE editorial is there to give information on current products and emerging technologies.

And when you order products, **BYTE advertisers** are ready to answer your every need. Use the convenient toll-free numbers in this issue, and remember to say:

You Saw it in
BYTE

Pournelle

Creative Labs, which they licensed from SuperMac Technology. Then there's LapLink V from Traveling Software. Get it. I'll tell you why next month. ■

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."

For More Information

The African American Experience: A History is a very good electronic textbook on CD-ROM that tells African-American history, but it lacks multimedia embellishments. The \$129 disc, for DOS systems only, is available from **Computerized Educational Resources, Ltd., 1313 Fifth St. SE, Suite 227, Minneapolis, MN 55414, (612) 379-3928. Circle 1146 on Inquiry Card.**

The Animals CD-ROM takes you on a tour through the world-famous San Diego Zoo. You'll love it. DOS, Windows, and Mac versions sell for \$119.95 from **The Software Toolworks, 60 Leveroni Court, Novato, CA 94949, (800) 234-3088 or (415) 883-3000. Circle 1147.**

Battle Chess is a \$79.95 Windows chess program on CD-ROM with spectacular animations. It's available from **Interplay Productions, 17922 Fitch Ave., Irvine, CA 92714, (800) 969-4263 or (714) 553-6678. Circle 1148.**

Empire Deluxe is an upgraded edition of the classic Empire game for DOS systems. Much better graphics. \$59.95 from **New World Computing, 20301 Ventura Blvd., Suite 200, Woodland Hills, CA 91364, (818) 999-0606. Circle 1149.**

Forecast Pro (for DOS or Windows) is a business forecasting package for nontechnical users. It uses AI technology and built-in statistical-analysis software to analyze data. It sells for \$595 from **Business Forecast Systems, Inc., 68 Leonard St., Belmont, MA 02178, (617) 484-5050. Circle 1150.**

The Graphics Ultra Pro is one fast video accelerator board, and the 8514/A driver software gives you a roomy display space. Prices start at \$599 from **ATI Technologies, Inc., 3761 Victoria Park Ave., Scarborough, Ontario, Canada M1W 3S2, (416) 756-0718. Circle 1151.**

Mario Teaches Typing is a \$39.95 interactive touch-typing tutor for DOS systems. It's available from **Interplay Productions, 17922 Fitch Ave., Irvine, CA 92714, (800) 969-4263 or (714) 553-6678. Circle 1152.**

A big hit at last year's MacWorld Expo, **Morph** image manipulations only get better with time. It costs \$149 from **Gryphon Software Corp., 3298 Governor Dr., P.O. Box 221075, San Diego, CA 92122, (619) 536-8815. Circle 1153.**

Morph Plus is a sophisticated morphing program that's available only for Amiga users. The package costs \$295 from **ASDG, 925 Stewart St., Madison, WI 53713, (608) 273-6585. Circle 1154.**

The Creative Labs **Multimedia Upgrade Kit** adds sound and CD-ROM capabilities to your PC with the Sound Blaster Pro audio card, a CD-ROM drive, and software. Kits start at \$649.95 from **Creative Labs, Inc., 1901 McCarthy Blvd., Milpitas, CA 95035, (800) 998-5227 or (408) 428-6600. Circle 1155.**

If your system has an OverDrive socket, Intel's **OverDrive** processors will double the clock speed of the internal CPU core while maintaining the existing clock speed of the external system. Prices start at \$449 from **Intel Corp., 2200 Mission College Blvd., Santa Clara, CA 95054, (800) 538-3373. Circle 1156.**

PS-Plot 112 is no Systat, but it gets the job done for just \$299 and has spectacular graphics. It's available from **Polysoft, P.O. Box 526368, Salt Lake City, UT 84152, (801) 485-0466. Circle 1157.**

QEMM-386 6.0 is still the best memory manager available for the PC. It sells for \$99.95 from **Quarterdeck Office Systems, Inc., 150 Pico Blvd., Santa Monica, CA 90405, (800) 354-3222 or (310) 392-9851. Circle 1158.**

Star Control II is a \$59.95 galactic role-playing game for DOS machines. It's available from **Accolade, 5300 Stevens Creek Blvd., Suite 500, San Jose, CA 95129, (800) 245-7744 or (408) 985-1700. Circle 1159.**

Systat is a professional statistical-analysis program that's available for DOS, Windows, and the Mac. All versions are \$895 from **Systat, Inc., 1800 Sherman Ave., Evanston, IL 60201, (708) 864-5670. Circle 1160.**

The **View from Earth** CD-ROM for the PC and Mac tells you and shows you everything you ever wanted to know about eclipses. It sells for \$79.99 from **Warner New Media, 3500 West Olive Ave., Suite 1050, Burbank, CA 91505, (800) 593-6334 or (818) 955-9999. Circle 1161.**

Windows for Workgroups provides workgroup applications and file services for creating a peer LAN. It even runs concurrently with NetWare. I'm pretty happy with it. Prices start at \$249.95 from **Microsoft Corp., 1 Microsoft Way, Redmond, WA 98052, (800) 426-9400 or (206) 882-8080. Circle 1162.**

The **Winnortization Pro 2.1** amortization calculator for Windows is a neat little program that lets you quickly compare different payment periods, payments, and compounding periods. It sells for \$99.95 from **Etter Industries, Inc., 82 Shoreview Dr., Bedford, Nova Scotia, Canada B4A 1V5, (800) 565-2662 or (902) 835-6060. Circle 1163.**

Decisions, decisions, decisions.

Decider, decider, decider.

Down-sizing, upgrading, multi-platform environments. Today's computer hardware issues are more numerous, more difficult, more critical than ever. So how do companies make decisions?

According to a new IntelliQuest study, they turn to the only person qualified to decide. Someone like Bob Barrett. A person with 18 years in computers. Who oversees a technical staff of 75. And whose buying decisions and approvals affect nearly 3,000 users worldwide.

In other words, they turn to the BYTE reader. A full 92% of whom control the products and brands their companies buy.

If you want to reach an audience as influential as this, then yours is an easy decision—advertise in BYTE.

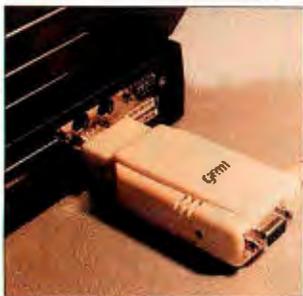
BYTE reader Robert N. Barrett, Vice President Management Information Systems, M/A-COM, Inc.

It doesn't get bought without

© 1992 BYTE, a McGraw-Hill publication. For a presentation of the March 1992 IntelliQuest study, call (603) 521-2635.



What's New Hardware



PORTABLE PRESENTATIONS

The Demo Key Geni (\$289) portable unit lets you display your computer-generated slide show presentations on a color TV. The device, from Arthur Krolman Enterprises (Toronto, Ontario, Canada), has a VGA output port and an external adjuster to sharpen NTSC output frequency. The unit is particularly geared toward programs such as

Harvard Graphics, Microsoft PowerPoint 3.0, CorelDraw Show, and Lotus Freelance Graphics.

Phone: (800) 388-3639 or (416) 931-7039.

Circle 1135 on Inquiry Card.

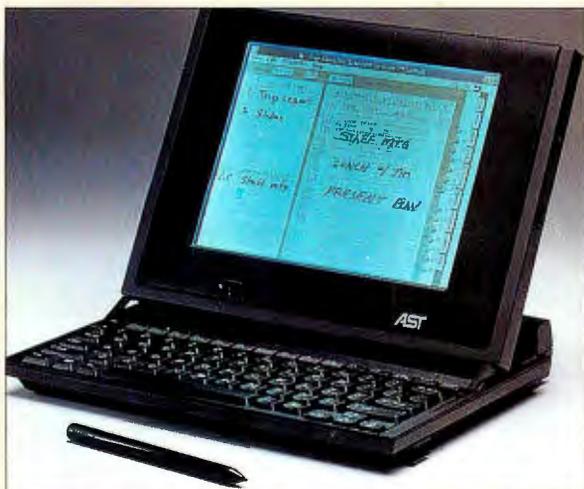
NONNUMERIC COPROCESSOR

From Microway (Strommen, Norway) comes the MS160 Search Engine (\$1665; 238.76 kroner), a PC-based nonnumeric coprocessor board for text processing and fuzzy information retrieval. The MS160 can search through unstructured text and identify words and sentences at a rate equivalent to 64,000 A4 pages per second, Microway says. The 10.5-MB board is expandable to 320-MB of DRAM.

Phone: +47 6 89 2020.

Circle 1138 on Inquiry Card.

HYBRID NOTEBOOK/PEN COMPUTER



The PenExec (\$3000) combines a traditional notebook with a keyboard and a pen computer in a 5.5-pound magnesium box. Based on the Grid Convertible, PenExec comes with DOS 6.0, Windows 3.1, and Windows for Pen Computing installed, as well as demo versions of PenWare's PenCell spreadsheet and Slate's AST Pen Essentials.

PenExec's hinged, backlit monochrome VGA screen hides a high-resolution, 400-dpi digitizer that is activated by the unit's cordless pen. The unit includes a 120- or 200-MB hard drive, a Type II PCMCIA slot, 2 or 4 MB of upgradable RAM, and AST's flash ROM BIOS.

Contact: AST Research, Inc., Irvine, CA, (800) 876-4278 or (714) 727-4141.

Circle 1131 on Inquiry Card.

MAC MAGNETO-OPTICAL

Two MO systems from Ricoh (San Jose, CA) are the 128-MB-per-cartridge Transporter Mac (internal, \$1795; external, \$1995) and the external 600-MB-per-cartridge HyperSpace Mac (\$3995). With Insignia's Rapid-Trak driver software, the units are System 6- and System 7-compatible. Caching provides access times and read data transfer rates of 12.4 ms and 1572 Kbps for the Transporter and 13.8 ms and 1966 Kbps for the HyperSpace.

Phone: (800) 955-3453 or (408) 432-8800.

Circle 1145 on Inquiry Card.

MINI POWERBOOK ETHERNET LINK

The cassette-size, 12-ounce Mini EN/SC SCSI adapter (\$459) links PowerBooks to 10Base-T and Thin Ethernet networks. Auto-sensing ports on this device from Asanté (San Jose, CA) allow you to change from one type of network to the other without setting any jumpers or switches. The unit also provides Ethernet docking for closed desktop Macs such as the Classic.

Phone: (800) 662-9686 or (408) 435-8388.

Circle 1144 on Inquiry Card.

HIGH-PERFORMANCE UPSes

The modular Matrix series of UPSes from American Power Conversion (West Kingston, RI) includes the 3000-VA Matrix 3000 (\$3499) and the 5000-VA Matrix 5000 (\$5199). The units' hot-swappable components, such as the SmartCell microprocessor-controlled battery packs, virtually eliminate downtime. Via peripherals, the UPSes provide support for SNMP and multiple server shutdown.

Phone: (800) 800-4272 or (401) 789-5735.

Circle 1136 on Inquiry Card.

PORTABLE POSTSCRIPT

Portable and PostScript-compatible, the 6-ppm Mobile-

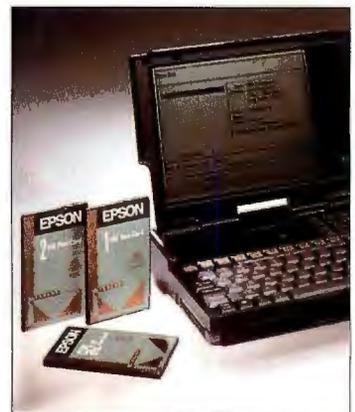
WriterPS (\$999) from Mannesmann Tally (Kent, WA) has 35 fonts as well as Centronics parallel and AppleTalk connectivity. A built-in nickel-cadmium battery supports 150 pages of printing per charge. An integrated fold-out sheet feeder holds 80 pages of letter, legal, or A4 paper.

Phone: (800) 843-1347 or (206) 251-5500.

Circle 1284 on Inquiry Card.

PCMCIA MEMORY

Epson's (Torrance, CA) credit-card-size SRAM cards (from



\$169.99) are available in 512-KB, 1-MB, and 2-MB capacities. JEIDA-/PCMCIA-compatible, the 200-ns cards incorporate a lithium main battery and a non-replaceable, rechargeable lithium subbattery.

Phone: (800) 922-8911 or (310) 782-0770.

Circle 1143 on Inquiry Card.

DOCK YOUR HP 95LX

A docking station for the HP 95LX palmtop, the SmartDock ComStation (\$399.95) provides a built-in fax modem, a serial-parallel converter, DataExchange software for PCs or Macs, and rechargeable batteries. Sparcom (Corvallis, OR) also has available a SmartDock PrintStation (\$169.95).

Phone: (503) 757-8416.

Circle 1275 on Inquiry Card.

Hardware

CMOS BACKUP

The Clovis Point (Rochester, VT) CMOS backup battery C-Life (\$25) connects to the spare power source on your computer's power supply. The C-Life contains a nickel-cadmium power pack and a charging circuit with current derived from a drive power-output cable. The device has a nominal output voltage of 4.5 V.

Phone: (802) 767-9292.

Circle 1283 on Inquiry Card.

LAN PRINT SERVER

The LANpress 1+1 (\$695) from Castelle (Santa Clara, CA) is a self-contained print server for NetWare 10Base-T and 10Base-2 Ethernet networks. Small enough to fit in your hand, the server has a parallel and a serial port and works anywhere on the LAN. You can optimize the speed of the server so that it is compatible with older, slower printers without compromising the performance of newer, higher-speed printers on the LAN.

Phone: (408) 496-0474.

Circle 1271 on Inquiry Card.

A BUDDY FOR YOUR LASERJET

Autotime's (Portland, OR) LaserBuddy (\$249) is a label- and envelope-printing device that attaches to any Hewlett-Packard LaserJet or compatible printer. The LaserBuddy automatically scans any document sent to the printer and captures an address from within the document. You can then print the address on labels or envelopes with the push of a button.

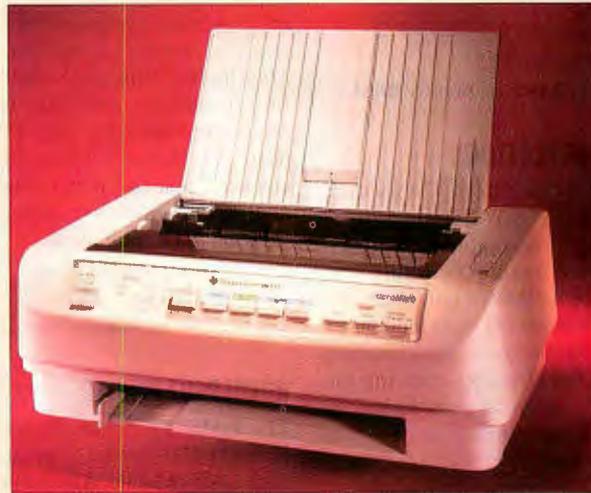
Phone: (503) 452-8577.

Circle 1272 on Inquiry Card.

A MONITOR FOR PCS AND MACS

The ViewSonic 17 (\$1599), a flat-square, noninterlaced color monitor from ViewSonic (Walnut, CA), features a DQ-DAF (double quadrupole dynamic astigmatism focus) gun. The monitor also has an AIM Shad-

CLEAN-AS-A-WHISTLE INK JET



With a drop-on-demand, 128-nozzle thermal ink-jet print engine, the microMarc printer's (\$419) extended-life ink-jet cartridge (\$40) lasts for up to 1100 pages, TI says. The 300-dpi unit prints 300 cps in letter-quality mode. An automatic sheet feeder handles up to 100 sheets of letter, legal, and A4 paper in portrait and landscape format; a manual feeder handles envelopes. The microMarc includes PCL level 3 emulation, three built-in font families, and DOS and Windows compatibility. The acoustic noise level of the printer is rated at less than 46 dB; the unit weighs 12.1 pounds, is 15.7 by 13 by 5.6 inches, and includes a parallel port.

Contact: Texas Instruments, Inc., Austin, TX, (800) 527-3500 or (817) 771-5856.

Circle 1132 on Inquiry Card.

ow mask, ViewMatch color control that matches printer color output, and a 1600- by 1280-pixel resolution. The drop-down control panel includes color tuning, moiré on/off and tuning, video input voltage, and horizontal and vertical size and positioning.

Phone: (800) 888-8583 or (909) 869-7976.

Circle 1273 on Inquiry Card.

OPEN CLOSED CAPTIONS

The Closed Caption Decoder (\$89) plug-in board and software reveals normally hidden TV closed captions and text. The International Computers (Wauwatosa, WI) package acquires the captions from a TV signal plugged into the FCC-approved

board via the supplied cable and displays the captions on your computer screen. You can save the captions to a file or print them.

Phone: (414) 764-9000.

Circle 1274 on Inquiry Card.

ADDRESSING SYSTEM HAS NETWORK CONNECTIONS

Designed for stand-alone or network use, the Address Express (from \$795) for PCs and Macs is an on-line addressing system from CoStar (Greenwich, CT). The 12-pound printer with its addressing software prints envelopes, postcards, and cut-sheet labels. The software manages its own mailing lists and prints lists from other programs. The sys-

tem also prints U.S. Postal Service-approved Postnet bar codes for speedier mail delivery.

Phone: (800) 426-7827 or (203) 661-9700.

Circle 1276 on Inquiry Card.

AUDIO/VIDEO COMPRESSION

An audio/video compression board that supports Microsoft Video for Windows, Video Wizard (\$1950) from Advanced Digital Systems (Cerritos, CA) provides 30-frame-per-second real-time audio/video recording. You can display the captured video sequence full-screen or as a scalable, movable picture. An on-screen control pad, which simulates a TV/VCR remote controller, provides the user interface.

Phone: (800) 888-5244 or (310) 865-1432.

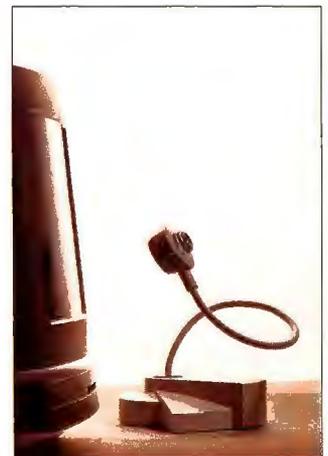
Circle 1277 on Inquiry Card.

A FLEXIBLE VIDEO CAMERA

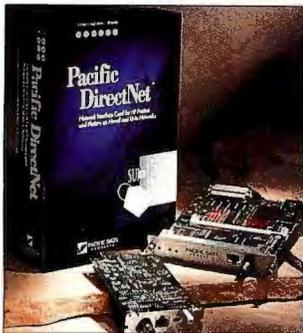
FlexCam (\$595), an integrated camera and microphone for desktop video and audio communications, produces color NTSC video and industry-standard, line-level audio output. From VideoLabs (Minneapolis, MN), the 1/8-inch camera with two directional stereo microphones is compatible with most video-digitizing boards for Macs and with Microsoft Video for Windows.

Phone: (612) 897-1995.

Circle 1141 on Inquiry Card.



What's New Hardware



A TWO-NETWORK PRINTER

Completely transparent to the user, the Pacific DirectNet print server card (\$699) allows NetWare and TCP/IP network users to access the same printer simultaneously. The Pacific Data Products (San Diego, CA) card can locate a LaserJet printer anywhere on either network, eliminating the need to attach the printer directly to the server. The card is upgradable via programmable flash memory.

Phone: (619) 552-0880.

Circle 1139 on Inquiry Card.

ADD A DRIVE TO YOUR PS/2

The QED (Quick Easy Disk) Drive System (from \$650) from Sigma Data (New London, NH) is an add-in drive for PS/2 Model 70 computers. The internally mounted drive and controller operate as a second hard drive. The QED disk controller card replaces the existing disk controller card, and the IDE drive mounts in the B drive bay.

Phone: (800) 446-4525.

Circle 1140 on Inquiry Card.

SIMPLIFIED NETWORKING

Available in configurations for 10Base-T or 10Base-2, the software-configurable TC5143 Ethernet adapter (\$159) from Thomas-Conrad (Austin, TX) is an 8-/16-bit switchless adapter with four ICs and surface-mount technology. Based on National Semiconductor's AT/LANtic chip, the TC5143 is configured for plug-and-play ease of use. The company's Ether Tools menu-driv-

en setup and diagnostic utility and Quickset command-line utility are included with the board.

Phone: (800) 332-8683 or (512) 836-1935.

Circle 1282 on Inquiry Card.

COLOR PLOTTING

Encad (San Diego, CA) is shipping the Novajet II (\$7995) wide-format plotter. A proprietary dithering algorithm produces a 300-dpi unidirectional color mode that runs four passes per line and minimizes bleeding and buckling by reducing the ink volume per pass. Enhanced black-and-white plotting is also provided.

Phone: (800) 356-2808 or (619) 578-4070.

Circle 1280 on Inquiry Card.

SMART CONNECTION FOR PORTABLES

A portable adapter for connecting notebook computers to token-ring networks, the Smart 16/4 Pocket Ringnode (\$895) runs at either 4 or 16 MBps. The Madge Networks (San Jose, CA) adapter, which connects to your computer's parallel port, is available in two models to support UTP and STP cabling.

Phone: (800) 876-2343 or (408) 955-0700.

Circle 1281 on Inquiry Card.

WORKGROUP PRINTER

The QMS 420 Print System (\$1995) 600-dpi laser printer from QMS (Mobile, AL) is rated at 4 ppm. The printer's parallel, serial, and LocalTalk interfaces

are simultaneously active; each interface has a user-configurable input buffer. The system has a standard 6 MB of RAM, expandable to 10 MB via SIMM modules. QMS ESP technology provides printer-resident emulation-switching capabilities.

Phone: (205) 633-4300.

Circle 1285 on Inquiry Card.

DOLBY SOUND FROM YOUR PC

A playback-only, digital audio card for Dolby AC-2 and other compressed audio formats, the



Antex SX-7 (\$995) from Antex Electronics (Gardena, CA) provides real-time direct-from-disk decoding of files recorded using Dolby AC-2 bit-rate reduction technique. The Windows 3.1-compatible board has playback sample rates up to 50 kHz.

Phone: (310) 532-3092.

Circle 1137 on Inquiry Card.

ACCELERATE IN WINDOWS

Diamond Computer Systems' (Sunnyvale, CA) latest accelerator cards, the ISA bus SpeedStar Pro (\$169) and the VESA local-bus SpeedStar Pro VLB (\$179), provide driver support for Windows 3.1, OS/2, AutoCAD, Lotus 1-2-3, Microsoft Word, and WordPerfect. The boards include 1 MB of DRAM video memory and a menu-driven installation program. The SpeedStar Pro VLB comes with Halo Desktop Imager, Panacea's TurboDLD Deluxe, and Diamond's TurboWindows.

Phone: (408) 736-2000.

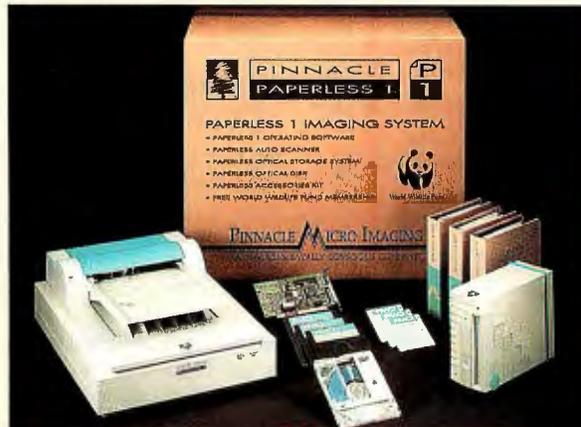
Circle 1279 on Inquiry Card.

IMAGING SYSTEM CUTS PAPER CONSUMPTION

Paperless 1 (\$6995), a complete document-imaging system that connects directly to your PC or Mac, lets you file your paper documents or images electronically. Novell- and AppleShare-compatible, the P1 lets you share your data with others on your network so they, too, can scan, file, view, or send documents. The system includes a gray-scale 400-dpi P1 scanner, a 650-MB P1 optical drive, a 5¼-inch P1 optical drive, and P1 software. The four main functions of the software are scanning, retrieval, template design, and administering. A password-protection window and a paperless print option are also included. Pinnacle Micro claims that the P1 system will reduce paper consumption in the office by 50 percent.

Contact: Pinnacle Micro Imaging, Irvine, CA, (800) 553-7070 or (714) 727-3300.

Circle 1133 on Inquiry Card.



Now, creating a multimedia CD-ROM is as easy as point and click.

Introducing the Multimedia Formatter from Sony Electronic Publishing.

If you demand a simple, comprehensive solution to creating multimedia CD-ROMs, here's everything you need. The Multimedia Formatter software series from Sony Electronic Publishing combined with the Sony CDW-900E CD-ROM write-once recording unit gives you the premier multimedia CD-ROM mastering system. Available for both PC and Macintosh, Multimedia Formatter software enables you to output a real or virtual ISO 9660 premaster image, CD-XA, CD audio, electronic book (8cm) or CD-I. Plus, it supports the new Sony MMCD. Engineered to support Red Book audio and Mode 1 and Mode 2 files, Multimedia Formatter doesn't require a huge hard disc and accommodates 2X speed recording. Plus you can master multiple discs simultaneously. So if you're in the market for a multimedia CD-ROM solution, choose Multimedia Formatter for PC or Mac. It makes mastering your next CD-ROM as easy as point and click.

The Multimedia Formatter software and the Sony CDW-900E are available through the PDSC division of Sony Electronic Publishing, which specializes in software development products, training and engineering.

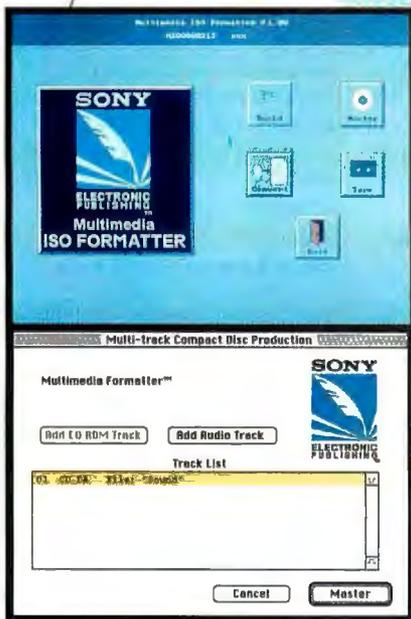
For further information:
TEL: (800) 654-8802
FAX: (408) 372-9267

The Multimedia Formatter with the Sony CDW-900E CD-ROM recording unit, delivers a total CD-ROM mastering system.

Multimedia Formatter

On the PC, simple point and click CD-ROM mastering with Sony's Multimedia ISO Formatter.

Multi-track disc mastering, by simple point and click mouse control on the Macintosh.



Multimedia Formatter available for:



What's New Hardware



VIDEO PROJECTION

An active-matrix LCD color projection panel, the PanelBook (\$5995) is compatible with domestic and international video formats and power sources. The notebook-size panel from In Focus Systems (Tualatin, OR) projects full-motion video computer graphics.

Phone: (800) 327-7231 or
(503) 692-4968.

Circle 1142 on Inquiry Card.

PCMCIA LAN ADAPTER

The EthernetCard (\$299) is a PCMCIA card from Linksys (Irvine, CA) that provides access to a standard Ethernet network. The credit card-size LAN adapter, with 16 KB of RAM, 128 KB of flash RAM, and automatic configuration, supports 10Base-2 or 10Base-T networks.

Phone: (800) 326-7114 or
(714) 261-1288.

Circle 1278 on Inquiry Card.

POCKET MODEM WITH FAX

General DataComm's (Middlebury, CT) GDC 914 Pocket (\$725) is a full-featured V.32bis modem with integrated V.17 fax support and speeds as high as 14,400 bps. The unit measures 5 by 2.2 by 1.2 inches.

Phone: (203) 574-1118.

Circle 1286 on Inquiry Card.

TRUE-COLOR SCANNING

The Sagitta Color (US\$299; NT\$7714), a true-color hand scanner from Qtronix (Taipei, Taiwan), gives you access to unlimited dither patterns and independently controlled *x* and *y* axes. The 800-dpi scanner is Windows 3.x-compatible and

includes a TWAIN scanner driver, the ProImage imaging utility, and the Perceive Personal OCR.

Phone: +886 2 716 3178

Circle 1325 on Inquiry Card.

ADD SPECIAL EFFECTS TO VIDEOS

The Screen Machine II video overlay board (\$1203; £795) integrates live video in true color at a 1024- by 768-pixel resolution. The Magnifeye (London, U.K.) board supports Microsoft Video for Windows; its digital filtering while recording Microsoft Video Movies lets you play back the movies on any Windows PC without additional hardware.

Phone: +44 71 221 8024.

Circle 1326 on Inquiry Card.

SBUS SPEEDSTER

A single-width SBus accelerator for Sun SparcStations and compatibles, the RM03 (\$3837.50; £2500) from Riverside Machines (Cambridge, U.K.) is based on

the 860XR RISC processor. Available in speeds of 25, 33, and 40 MHz, the accelerator card has 2 or 8 MB of memory. The card's 64-bit floating-point coprocessor operates in parallel.

Phone: +44 223 321083.

Circle 1327 on Inquiry Card.

COLOR ANIMATION

Commodore Business Machines (West Chester, PA) has added the Amiga 4000-030 (\$2399) to its line of desktop computers. The unit comes with AmigaDOS release 3; 2 MB of chip (i.e., video) RAM; 2 MB of fast, standard 32-bit RAM; and a 120-MB hard drive. The AGA custom coprocessor chip set lets you display and animate graphics in multiple resolutions at up to 256,000 colors.

Phone: (215) 431-9100.

Circle 1328 on Inquiry Card.

EXPANDABLE HUB

A miniature nine-port Ethernet hub that you can link with five

other identical hubs, the Patton Model 2108 (\$425) from Patton Electronics (Gaithersburg, MD) lets you create a single repeater set of eight AUI connections and 48 10Base-T connections. The 1.6- by 5.5- by 7.5-inch hub supports AUI distances to 165 feet and twisted-pair distances to 330 feet. Each 10Base-T port has an LED status indicator.

Phone: (301) 975-1000.

Circle 1329 on Inquiry Card.

PCMCIA DRIVES

The MCDisk-1 (\$675) PCMCIA memory-card drive from Gespac (Mesa, AZ) is designed to interface with any desktop PC or workstation through a SCSI connection. The external drive has a built-in power supply, SCSI address select, and two SCSI connectors.

Phone: (602) 962-5559.

Circle 1330 on Inquiry Card.

Intégral Peripherals' (Boulder, CO) PocketFile PCMCIA drives (from \$495) are PCMCIA Type III-compatible. The drives, available in 42- and 85-MB capacities, have an average seek time of 18 ms and a 32-KB buffer.

Phone: (303) 449-8009.

Circle 1331 on Inquiry Card.

PUT TV ON YOUR COMPUTER

TelevEyes/Pro (\$799.95) from Digital Vision (Dedham, MA) features multiflicker filtering and genlock. The computer-to-TV video scan converter works with PC VGA and Mac output.

Phone: (617) 329-5400.

Circle 1332 on Inquiry Card.

REMOVABLE MAC DRIVE

The hammerDisk105 removable cartridge drive (\$1299) from FWB (San Francisco, CA) has a 105-MB capacity, an average seek time of 14.5 ms, and a rotational speed of 3600 rpm. It ships with Hard Disk ToolKit SCSI utility software.

Phone: (415) 474-8055.

Circle 1333 on Inquiry Card.

MODULAR FAULT-TOLERANT SUBSYSTEM FOR OS/2

Raidion LT (from \$8960), a modular fault-tolerant disk array for OS/2 and LAN server-based systems, can be configured as a two-module 500-MB mirrored system or as a 28-GB system, with various configurations in between. Each module has its own 3½-inch drive, power supply, and cooling fan. The Raidion LT is hot-swappable in all configurations. Thus, you can replace a failed module at any time without interrupting array or host system operations. You control the system through a GUI directly from your workstation or console as you do any standard OS/2 application.

Contact: Micropolis Corp., Chatsworth, CA, (818) 709-3300.

Circle 1134 on Inquiry Card.



THE SIMPLE CONNECTION BEHIND COMPUTERS AND BACKPACK TAPE DRIVES.



It's fast. It's small. It's reliable. It's incredibly compatible.

Backpack is the best selling parallel port tape drive on the market. We'd like to tell you why.

With Backpack, tape backup is quick and simple. Just plug it into your printer port and it's ready to use. No hardware conflicts, no slots required. One model fits all IBM PCs, compatibles and portables, regardless of CPU speed.

Backpack can store up to 250MB on a tape using data compression, is completely QIC80 compatible, and reads QIC40 tapes. With its compact size

and 1Mbps transfer rate, Backpack is the smallest and fastest parallel port tape drive you can buy.

Micro Solutions is dedicated to the perfection of backup technology.

CD-ROM, hard drive, and diskette Backpack drives are also available. Call today for ordering information and a dealer nearest you.

Telephone 815.756.3411 FAX 815.756.2928

MicroSolutions 132 West Lincoln Highway DeKalb, IL 60115

See us at Comdex, Booth #2348
Circle 114 on Inquiry Card (RESELLERS: 115).

What's New Software

TECHNICAL REFERENCES ON DISK

Three Electronic Handbooks from MathSoft (Cambridge, MA) provide interactive, easily accessible technical data when used with Mathcad 3.1. The three titles—Theory and Problems of Electric Circuits from Schaums' Outline Series (\$69, McGraw-Hill), Topics in Mathcad: Advanced Math (\$99, MathSoft), and Electrical Engineering (\$99, MathSoft)—give you access to formulas, constants, and diagrams. You can change parameters and plots and watch Mathcad calculate answers in the handbook or save the answers for later reference.

Phone: (800) 628-4223 or (617) 577-1017.

Circle 1305 on Inquiry Card.

MERGE FRAMEMAKER WITH YOUR RELATIONAL DATABASE

IXOS-FrameMerger (\$2995) links Frame Technologies' FrameMaker desktop publishing software with most relational databases. The software, from IXOS Software (Munich, Ger-

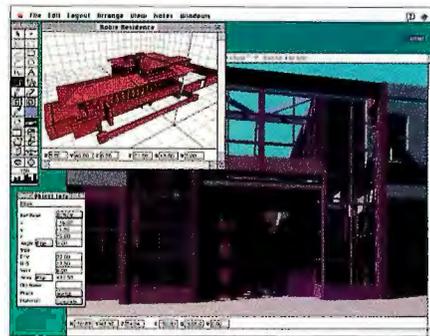
many), is based on the company's IXView/SQL graphical query generator for Unix relational databases. Without any knowledge of programming or SQL, you can create mail-merged documents and make ad hoc queries of Oracle and Informix relational databases. Editing tools let you create customized communications and automate document production. You can view the results of IXOS-FrameMerger on the screen or save them to a file.

Phone: +49 89 460050.

Circle 1292 on Inquiry Card.

ONGOING INFORMATION SHARING

OnGo Office (\$70 per 100 users) and OnGo Write/Paint/Draw (\$298 per 100 users) are the first components of the modular and scalable OnGo information-sharing software from Uniplex Integration Systems (Dallas, TX). OnGo Office is a native X.400 mail system that can transport documents over TCP/IP, OSI networks, and LAN networks such as NetWare and LAN Manager. The module includes E-



3-D MODELING

DesignWorkshop 1.0 (\$895) from Artifice (Eugene, OR) is 3-D CAD software for the Mac. You can create, move, resize, and reshape models graphically with a 3-D crosshair in a live perspective-modeling space. The software uses a Mac-

Draw-style interface.

Phone: (503) 345-7421.

Circle 1295 on Inquiry Card.

PC TELECONFERENCING

An audio-visual PC teleconferencing package from Modus Software (Los Altos, CA), Synconference (\$395) lets you present and discuss electronic documents on two remotely linked computers. Synconference is compatible with Windows 3.1 and works with a standard modem running at 1200 bps or higher. During a remote presentation, Synconference acts as two synchronized slide projectors; a special feature can exchange the roles of presenter and listener at any time. You can create and rearrange the slide stacks from various bitmap files and save images in bit formats such as BMP, GIF, TIF, and PCX.

Phone: (415) 964-1936.

Circle 1302 on Inquiry Card.

mail, filtering, calendaring, routing, and directory and resource management. OnGo Write/Paint/Draw is a document publisher for creating complex documents that include text, tables, graphics, and images.

Phone: (214) 717-0068.

Circle 1294 on Inquiry Card.

CREATE A HABITAT ON YOUR COMPUTER

A desktop manager for Windows, Habitat (\$99.95) is also a network manager for LAN administrators (from \$349). From Computer Knacks (Shrewsbury, NJ), Habitat supports data objects, group and ad hoc toll launches, and full drag-and-drop under Windows 3.1. You can configure Habitat to replace the Program Manager or to supplement it.

Phone: (800) 551-1433 or (908) 530-0262.

Circle 1296 on Inquiry Card.

VIEW YOUR DATA IN REAL TIME

The Windows-based application Realtime Vision (\$395) collects and graphically displays constantly changing business and manufacturing data in real time. The Laboratory Technologies (Wilmington, MA) product lets you monitor your business activities by connecting the graphical display to business databases. The software also converts data into trend charts, digital readouts, analog meters, and dials to let you watch the data as it changes.

Phone: (508) 657-5400.

Circle 1300 on Inquiry Card.

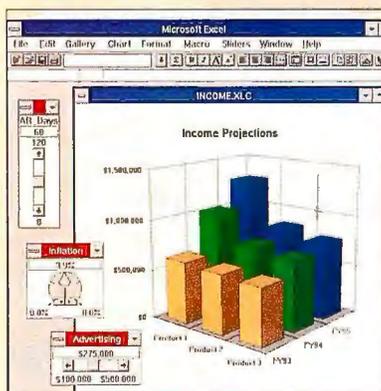
DATA ANALYSIS AND VISUALIZATION

Research Systems' (Boulder, CO) IDL for Windows (\$1500) is a software environment for application development, analysis, and visualization of any type of data. The software incorporates the features and capabilities of Unix-based versions, including a built-in GUI toolkit, 2-D and 3-D plotting, and state-of-the-art volume visualization.

Phone: (303) 786-9900.

Circle 1298 on Inquiry Card.

SLIDE THROUGH YOUR SPREADSHEET UPDATES



Sliders & Dials (\$79.95), a spreadsheet application for Excel for Windows, provides interactive tools for data analysis, forecasting, planning, and what-if analysis. The software lets you graphically manipulate data at predefined

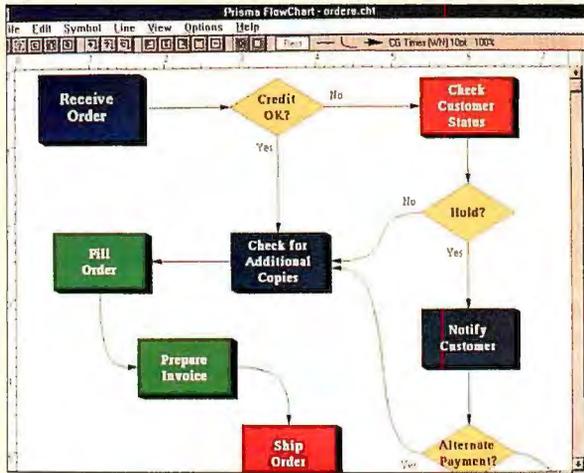
increments while watching your worksheet or chart change to reflect the impact of your manipulation. You can assign as many as 14 virtual dials or sliders to worksheet cells and manipulate each cell's value by moving the position of the pointer.

Contact: Golden Technologies, Inc., Lake Oswego, OR, (800) 653-2201 or (503) 620-2201.

Circle 1287 on Inquiry Card.

Software

PRESENT PROJECTS GRAPHICALLY



FlowChart (\$59), a Windows business graphics program, lets you create and edit presentation-quality diagrams and flowcharts. You can customize charts, use automatic line routing between symbols, and incorporate special effects such as 3-D symbols and overlays. The program imports BMP and WMF files. Horizontal and vertical formats you can choose from include geometric shapes, straight and curved lines, and directional symbols.

Contact: Prisma Software Corp., Cedar Falls, IA, (800) 437-2685 or (319) 266-7141.

Circle 1288 on Inquiry Card.

ADD QC CHARTS TO YOUR SOFTWARE

The QCTalk (\$145) charting program from Omega Engineering (Stamford, CT) adds quality-control charts to existing software, produces X and R charts, calculates quality-control statistics, and captures data directly from other programs. The memory portion of the DOS- and Windows-compatible program reads numbers directly from the screen to other programs.

Phone: (203) 359-1660.

Circle 1299 on Inquiry Card.

FONTS FOR WINDOWS, MAC

A library of 303 fully scalable PostScript and TrueType fonts on a CD-ROM, Key Fonts Pro (\$39.95) includes a single CD-ROM for Windows 3.1 and Mac use. Each font package from

SoftKey Software Products (Boca Raton, FL) contains 216 classic typefaces and 87 specialty display fonts usable in portrait or landscape mode.

Phone: (407) 367-0005.

Circle 1307 on Inquiry Card.

POP-UP DRAWING VIEWER FOR AUTOCAD RELEASE 12

RxEasyView (\$195), from Norway's Rasterex, is available from Expert Graphics (Atlanta, GA). Viewing features of this utility for AutoCAD Release 12 allow you to search for any drawing on any specification, open a drawing or insert it into an existing drawing, view 16 drawings simultaneously,



and view small, quick-view, or full-screen displays. The utility works with any VGA and high-resolution graphics board and supports DOS, Windows, and Sun operating systems. A version that uses AutoCAD Release 12's Proteus interface (\$295) lets you run outside AutoCAD as well as inside.

Phone: (800) 648-7249 or (404) 320-0800.

Circle 1291 on Inquiry Card.

CREATE APPLICATIONS FASTER

Sheridan Software Systems' (Melville, NY) 3-D Widgets (\$109) lets you create applications for Windows that give Visual C++-based applications a state-of-the-art look and feel. With 3-D Widgets, you can apply prebuilt objects to dialogs in the Visual C++ AppStudio toolbox without needing extra coding.

Phone: (516) 753-0985.

Circle 1301 on Inquiry Card.

SAFE MAC BACKUP

SafeDeposit (\$99 through July, then \$189) gives you automated backup for your Macintosh files. The application, from Dayna Communications (Salt Lake City, UT), creates a backup plan that determines which files to back up, as well as where, when, and how to back them up. Backup can occur continuously, on command, at system shutdown, when you insert a disk, or at a specified time.

Phone: (801) 269-7394.

Circle 1303 on Inquiry Card.

Software Update

The **Mathcad 4.0** (\$495) technical calculation program from MathSoft (Cambridge, MA) now offers the



SmartMath intelligent interface.

SmartMath's symbolic/numeric optimization feature uses Mathcad's symbolic processor to simplify expressions before they are computed. Version 4 also supports 32-bit processing using Microsoft's Win32s libraries.

Phone: (800) 628-4223 or (617) 577-1017.

Circle 1315 on Inquiry Card.

Modular Terminal Server 3.0

(8-port terminal server, \$1695) from Specialix (Campbell, CA) adds Reverse Telnet, SNMP, and multiple printer support for up to nine printers.

Phone: (800) 423-5364 or (408) 378-7919.

Circle 1319 on Inquiry Card.

PackRat 5.0 (\$395) from Polaris Software (San Diego, CA) adds customizable folders, forms and lists, and objects; the Instant Options menu; OLE objects; the PackRatBASIC macro language; scripts; and SmartStart. Improved functions



are action-bar customization, data transfer, E-mail, and integration.

Phone: (800) 722-5728 or (619) 674-6500.

Circle 1320 on Inquiry Card.

Tivoli Systems' (Austin, TX) Tivoli Management Environment Release 1.6

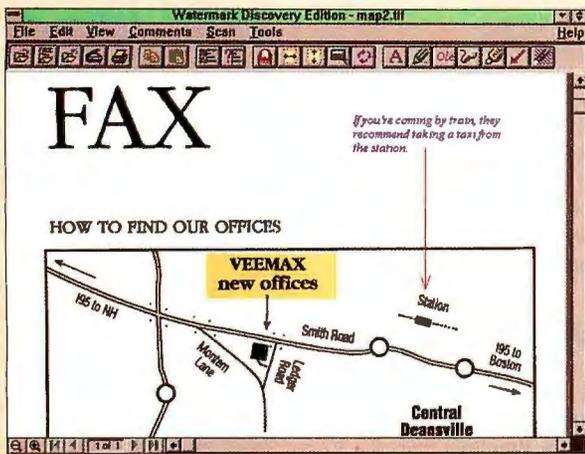
now has configuration and change services that simplify and automate setting up, maintaining, and changing enterprise-wide networks of client/server computers.

Phone: (512) 794-9070.

Circle 1318 on Inquiry Card.

What's New Software

DOCUMENT IMAGING



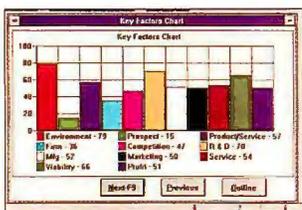
Watermark (\$149), a Windows document-imaging software package, uses OLE technology to enable Windows applications that previously were not image capable to manipulate, copy, store, and distribute images of incoming faxed and scanned documents. The software lets you integrate paper or fax-based documents as Image Objects into existing Windows applications such as E-mail and databases.

Contact: Watermark Software, Inc., Burlington, MA, (617) 229-2600.

Circle 1289 on Inquiry Card.

GAIN BUSINESS STRATEGY INSIGHT

Focusing on nonfinancial factors that affect a business strategy, Business Insight for Windows (\$495) provides graphical analyses relating to your business and marketing strategies. In addition to pointing out strengths, weaknesses, and inconsistencies, Business Resource Software's (Austin, TX) Business Insight provides hyperlinked text and graphics, a way to compare alternative strategies, and a tracing facility that lets you follow the program's logic in arriving at conclusions.



Phone: (800) 423-1228 or (512) 251-7541.

Circle 1297 on Inquiry Card.

UNIX DISK MIRRORING

A disk-mirroring product for SCO Unix and Open Desktop, VxMirror (\$595) features full disk-mirroring functionality for standalone, networked, and replicated system configurations. The Veritas Software (Santa Clara, CA) product provides streamlined procedures for setting up mirrored configurations. Informational messages appear during installation, and messages that require reconfirmation appear if you try any action that might damage data.

Phone: (408) 727-1222.

Circle 1306 on Inquiry Card.

STATISTICS AND GRAPHICS IN WINDOWS

Statistica/W (about \$535; £790), is a Windows 3.1-compatible statistical data analysis and scientific graphics system from StatSoft (Old Hatfield, Herts, U.K.). The software maintains data files in spreadsheet format and lets you customize graphics images via drawing and scaling options. File import and export facilities are included.

Phone: +44 462 482822.

Circle 1308 on Inquiry Card.

OPEN THE TRANSM TO WINDOWS

Transom (\$129), from Metro Software (Tucson AZ), creates a compatible pathway for DOS programs to gain the benefits of Windows-scalable TrueType fonts, print manager, and printer drivers. The DOS applications are automatically integrated into the Transom Launch Pad, from which you can open any DOS application into Windows. All Windows functions are managed in the Launch Pad, which remains in the background until needed.

Phone: (800) 697-6971 or (602) 292-0313.

Circle 1309 on Inquiry Card.

EASY WINDOWS PROGRAMMING

The OptiScript developer's toolkit (\$399.95) provides real-time PostScript display on your PC and output of PostScript code to any raster device, such as monitors, printers, and film recorders. From Postcraft International (St. Catharines, Ontario, Canada), OptiScript includes full bit-map manipulation and interfaces between the software application and the Windows graphics GDI, letting you program Windows graphics directly, without having to program the GDI.

Phone: (416) 641-0768.

Circle 1304 on Inquiry Card.

Software Update

XRrunner Release 2.0 (from \$10,000 per floating license) from Mercury Interactive (Santa Clara, CA) now has an automated software-testing system that creates tests that adapt to changes in GUI-based applications without having to re-create tests each time a GUI element changes location in a new release.

Phone: (408) 987-0100.

Circle 1321 on Inquiry Card.

Act for Windows version 1.1 (\$395) from Contact Software International (Carrollton, TX) adds data integration and portability, a point-and-shoot import filter for dBase IV and ASCII files, and filters to import data from other contact managers and PIMs.

Phone: (214) 919-9500.

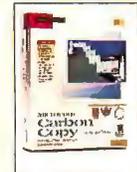
Circle 1316 on Inquiry Card.

Biosoft's (Ferguson, MO) **SolvEq 2.4** (\$299; £149) includes improved editing functions, two-tiered success criteria for the solver, circular operation for constraining unknowns with MIN and MAX, scatter plot symbols added to graphics line styles, and increased maximum array size.

Phone: (314) 524-8029.

Circle 1317 on Inquiry Card.

Carbon Copy for Windows 2.0 (\$199) from Microcom (Nor-



wood, MA) adds LAN communication, Asynchronous Communication Server

support, high-resolution video support, enhanced DOS support, enhanced data-compression algorithm, drag-and-drop file transfer, remote clipboard, and compatibility with Carbon Copy for DOS.

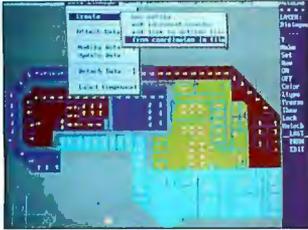
Phone: (800) 822-8224 or (617) 551-1000.

Circle 1324 on Inquiry Card.

Software

OBJECT-ORIENTED INFORMATION MANAGEMENT

Object Graphics' (Mountain View, CA) TIMS Toolkit (\$1000; with TIMS R12, \$3500) lets you pro-



gram and customize AutoCAD Release 12. An AutoLisp interface to a library of over 200 routines written in C provides flexibility, reducing the effort required to design and implement GIS and facilities management systems. Features include two-way linkage to outside databases; spatial relationship functions; organizational hierarchical chart buildup; and polygon overlays. You can also attach data to an existing AutoCAD entity or create a new one with attached data.

Phone: (415) 968-1500.

Circle 1293 on Inquiry Card.

TALK TO YOUR COMPUTER

Telaccount Speech Recognizer (TSR) (\$69) works in the background until it recognizes words or phrases from its vocabulary. When it recognizes a word, it types a series of keys associated with it as if you had typed them on the keyboard. The voice macro system from Telaccount (Narberth, PA) is compatible with Sound Blaster and features an API that lets Windows or DOS programs directly control the voice recognition system. You can train TSR to understand several people's voices at once.

Phone: (215) 664-2410.

Circle 1312 on Inquiry Card.

Voice Blaster (\$119.95) from Covox (Eugene, OR) adds voice recognition to Sound Blaster and compatible sound cards and keyboard-intensive applications. Running under DOS or Windows, the software's voice-command interface can be tied to

keyboard and mouse macros. The toolbox lets you record, edit, and play back sound; voice annotation software adds your spoken messages to documents. A high-fidelity headset is included with the program, which runs in the background.

Phone: (503) 342-1271.

Circle 1313 on Inquiry Card.

Voice Command for Windows (\$179) is a hardware-independent voice-input system from Command Corp. (Duluth, GA) that lets you bring a Windows application to the foreground by saying its name. You can also vocally call commands instead of using the mouse to navigate through hierarchical menus.

Phone: (404) 925-7950.

Circle 1314 on Inquiry Card.

POINT, CLICK, AND ZIP

Zip Manager (from \$19.95), a front-end interface to PKZip and PKUnzip for Windows and OS/2

users, lets you point and click and drag and drop to compress and uncompress PKZip and PKUnzip files. The interface, from Software Builders (Smyrna, GA), uses the Windows MDI feature so that you can open and view more than one Zip file at a time. It can also convert Zip files to Self-Extract Zip files and run PKZipfix.

Phone: (800) 432-0025 or (404) 319-9621.

Circle 1311 on Inquiry Card.

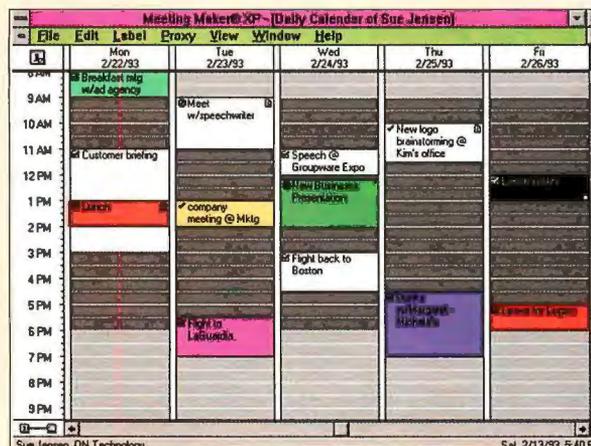
MULTIPLATFORM PRINTING

PowerPrint/NW (\$499) allows Macs to share and print to over 1000 dot-matrix, ink-jet, and laser printers via Novell networks. The GDT Softworks (Burnaby, BC, Canada) software has built-in spooling and the capability to print labels and forms.

Phone: (800) 663-6222 or (604) 291-9121.

Circle 1310 on Inquiry Card.

GROUP SCHEDULER FOR WINDOWS AND MACS



A Windows and Mac group scheduler, Meeting Maker XP (from \$695) provides seamless interoperability between Windows and Mac clients connected to a single Windows or Mac server. The scheduler lets you plan, schedule, and confirm meetings on either a Windows PC or a Mac. XP's portable client has full support for laptops and PowerBooks as well as the ability to automatically reconcile schedule changes.

Contact: On Technology, Inc., Cambridge, MA, (800) 548-8871 or (617) 876-0900.

Circle 1290 on Inquiry Card.

Software Update

AutoMate/Pro for Windows 2.0 (\$295) from Vermont Microsystems (Winooski, VT) displaces AutoCAD Release 12 for Windows' display



list software with its own for a one-third memory saving and a three to five times speed increase.

Phone: (802) 655-2860.

Circle 1322 on Inquiry Card.

Wildcat 3.6 BBS software (from \$129) from Mustang Software (Bakersfield, CA) has added WcDraw for creating multicolored screens; an upgraded message-reading capability scrolls message text while the message header remains stationary. Now supports Fido Netmail messages.

Phone: (805) 395-0223.

Circle 1323 on Inquiry Card.

ICAP/4M PreSpice Module 3.2M (\$275), Intusoft (San Pedro, CA), now offers Monte Carlo statistical yield analysis, parameter sweeping, and circuit optimization.

Phone: (310) 833-0710.

Circle 1164 on Inquiry Card.

Mixer View, click-and-drag support, Undo editing options, wider range of time signatures, and Humanize control in Quantize are among the new features of Studio for Windows 3.10 (\$249.95), Midisoft (Bellevue, WA).

Phone: (206) 881-7176.

Circle 1165 on Inquiry Card.

Webcorp (Sausalito, CA) has added Windows and faster performance to WEB Parallel PairWare 4.0 (\$129).

Phone: (415) 331-1449.

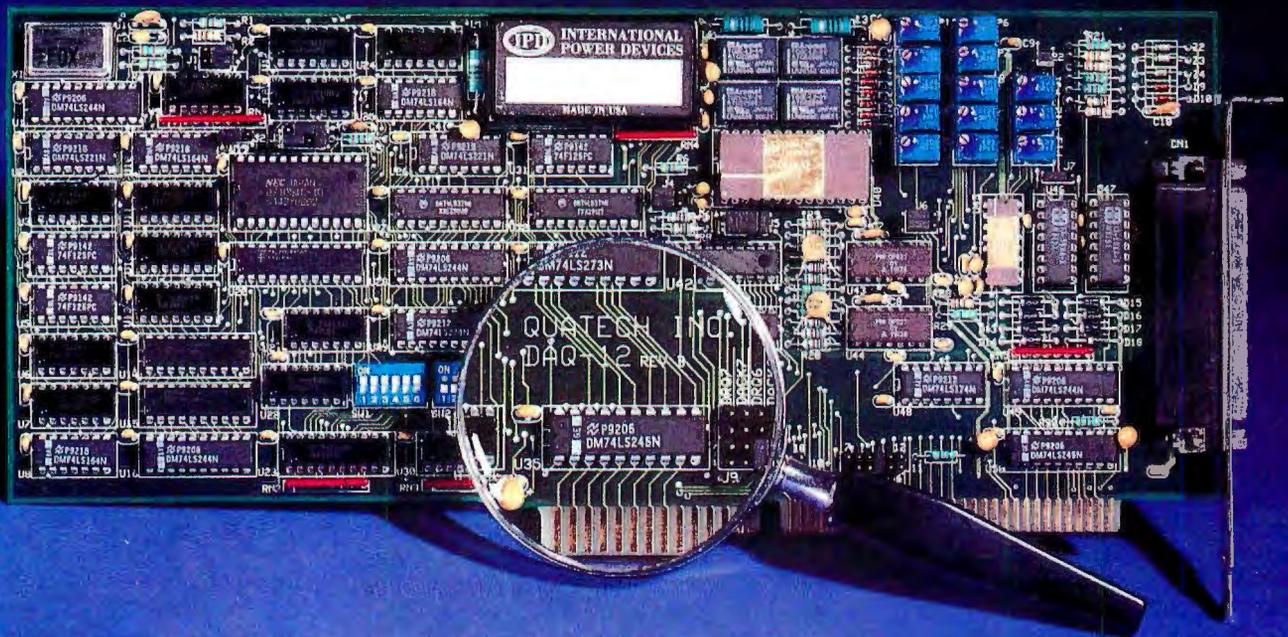
Circle 1166 on Inquiry Card.

Roomer 3 2 (\$395), Hufnagel Software (Clarion, PA), now provides faster 3-D rendering and data handling.

Phone: (814) 226-5600.

Circle 1167 on Inquiry Card.

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.

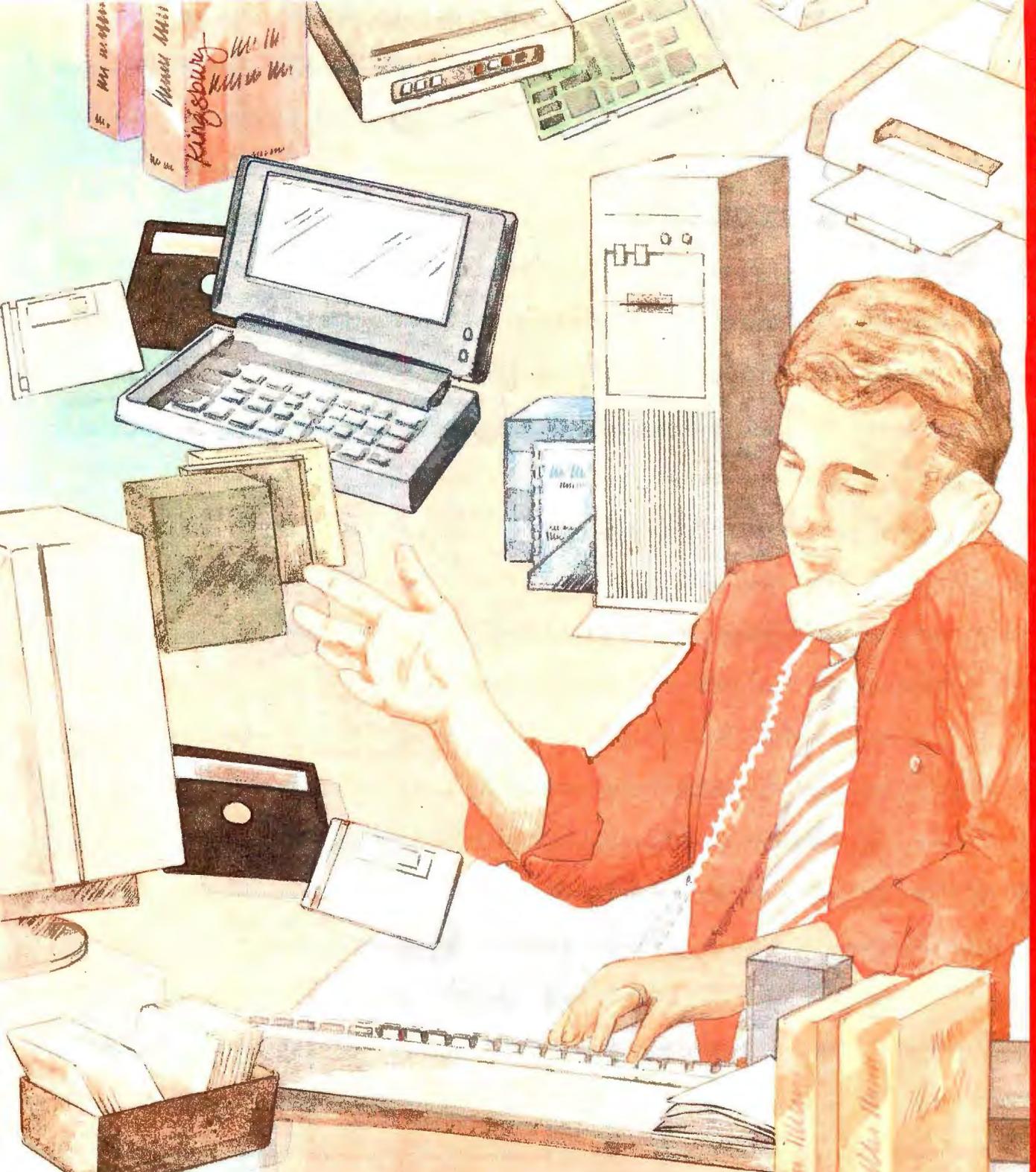


For a free catalog call: **800-553-1170**

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.

 **QUATECH**

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.

232

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.

252

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.

262

HARD DRIVE SALE

NEW REDUCED PRICES

Seagate

MODEL	SIZE	SPEED	TYPE	PRICE
ST225	20MB	65MS	MFM 5.25"	\$169
ST4096	80MB	28MB	MFM Full HT	\$389
ST511	42MB	28MB	MFM 5.25"	\$249
ST511A (1" high)	42MB	28MB	IDE 3.5"	\$144
ST130A (1" high)	105MB	18MB	IDE 3.5"	\$209
ST130A (1" high)	130MB	16MB	IDE 3.5"	\$229
ST3283A (1" high)	240MB	12MB	IDE 3.5"	\$399
ST5168N	660MB	15MS	SCSI/FH	\$599
ST41200N	1037MB	15MS	SCSI/FH	\$1499

CONNER

MODEL	SIZE	SPEED	TYPE	PRICE
CP3000E	40MB	17MS	IDE	\$149
CP3000E	80MB	17MS	IDE	\$238
CP3010A (1" high)	120MB	19MS	IDE	\$259
CP3017A (1" high)	170MB	17MS	IDE	\$299
CP3025A	250MB	15MS	IDE	\$379
CP3444A	525MB	15MS	IDE	\$899
CP3540	540MB	12MS	SCSI	\$999

Maxtor

MODEL	SIZE	SPEED	TYPE	PRICE
2585 (2 1/2" Drive)	80MB	17MS	IDE	\$248
2120 (1" high)	130MB	15MS	IDE	\$229
7213A (1" high)	213MB	18MS	IDE	\$399
7213S (1" high)	213MB	15MS	SCSI	\$341
7245A	245MB	15MS	IDE	\$348
7345A	345MB	15MS	IDE	\$559
LTX3405/A	340MB	16MS	IDE/SCSI	\$598
DT535A	535MB	15MS	IDE	\$999
PANTHER (FH)	1000MB	13MS	SCSI	\$1389
PANTHER (FH)	1500MB	13MS	SCSI	\$1648

FUJITSU 3 YEAR WARRANTY

MODEL	SIZE	SPEED	TYPE	COST
2622A/S (3.5")	330MB	12MS	SCSI/IDE	\$799
2623A/S (3.5")	420MB	12MS	SCSI/IDE	\$839
2624A/S (3.5")	520MB	12MS	SCSI/IDE	\$879
2626S (FH)	1080MB	14MS	SCSI	\$1449
2626S (FH)	1750MB	11MS	SCSI	\$2499
26545H	2000MB	11MS	SCSI	\$2489

MICROPOLIS

MODEL	SIZE	SPEED	TYPE	COST
1624 (FH)	660MB	15MS	SCSI	\$1199
2112 (3.5")	1030MB	13MS	SCSI/IDE	\$1688
1398 (FH)	1050MB	14MS	SCSI	\$1499
1548 (FH)	1748MB	14MS	SCSI	\$2049
1528-15 (FH)	1350MB	14MS	SCSI	\$1749
1924 (FH)	2100MB	11MS	SCSI	\$2895

PS/2 HARDDRIVES

FOR PS/2, 50, 50Z, 555X, 60, 70, P70, 80

Internal compatible with DOS, OS/2, Novell, Comes with SCSI or IDE Controller, Cables and Mounting Kit.

MODEL	SIZE	SPEED	TYPE	COST
85MB	17MS	IDE	\$429	
125MB	15MS	IDE/SCSI	\$489	
200MB	15MS	IDE/SCSI	\$649	
340MB	12MS	IDE/SCSI	\$899	
500MB	12MS	IDE/SCSI	\$1289	
1.2GB	12MS	SCSI	\$1789	

Floppy Drives

MODEL	SIZE	SPEED	TYPE	COST
360K 5.25"	1/2 HF	\$29	1.44/1.2 DRIVE	\$149
720K 3.5"	1/2 HF	\$34		
1.2MB 5.25"	1/2 HF	\$58		
1.44MB 3.5"	1/2 HF	\$58		
5.25"	MOUNT	\$5		

Drive Controllers

MODEL	PRICE
8Bit 4 Floppy	\$49
8 Bit 4 Floppy High Density	\$49
8 Bit 2 Hard Drive MFM	\$59
8 Bit 2 Hard Drive RLL	\$59
16 Bit Hard Drive Only	\$24
16 Bit Hard Drive Floppy 1.1 Interface	\$34
SCSI DTC-3280 (Supports 7 drives)	\$139
32Bit Adapter 17.5MB	\$489
SCSI Adaptic 1.542B Bus Mastering	\$219
ESDI DTC2822-24	\$149
IDE Hard and Floppy	\$39
IDE Hard Drive w/IO	\$29
Cables Hard Drive	\$59
Cables Hard and Floppy	\$14

SOFTWARE LIQUIDATION

WORDSTAR Wordstar 2000 Ref. 3.5

This is not a misprint! These are the exact same ones selling for over \$300.00 from our competitors. We have thousands in stock to sell below dealer cost. Retail boxed and factory sealed.

REDUCED PRICE \$59 (100 For \$55) EACH

WE BUY EXCESS INVENTORY

For U.S. and Canadian

Orders Call Toll Free: **800-982-2925**

HOURS: M-F 7AM-6PM / SAT 10AM-3PM PST

TECHNICAL & CUSTOMER SERVICE CALL: (702) 294-0204 FAX ORDERS, INQUIRIES, PO's & INTERNATIONAL ORDERS TO: FAX (702) 294-1168

NEVADA COMPUTER

TOSHIBA CD ROM'S

In Touch with Tomorrow

3401 INTERNAL 200MS \$498
3401E EXTERNAL 200MS .. \$584

Photo CD Software & One Caddy

FAX MODEM LIQUIDATION

9600 BPS Group III Facsimile, 2400 BPS Hayes Compatible Modem, True Background Send and Receive, Menu Driven Command Line, Normal and Fine Modes, Half Card, One Year Warranty

IBM **\$49**
 Pocket PC or MAC **\$99**
 Laptop Toshiba or Compaq **\$148**
 9600 Baud Fax only cards **\$29**

Largest selection of Memory! Call if you don't see it!

IBM PS/2 MEMORY

MODEL #	MEMORY	PART#	PRICE
PS/1 and 386/SX (2121)	2MB	92F9935	\$78
	4MB	92F9494	\$141
PS/2 30/286; Adpt Brd 1497259	512K	30F5348	\$35
PS/2 30/286/25786; Adpt Brd 1497259	2MB	30F5360	\$84
PS/2 355X, LS, 405X, 555X; LS, 655X; Adpt Brd 6450600; 34F3011; 34F3077	1MB	6450603	\$49
XStation 120 & 130	2MB	6450604	\$79
	2-8MB	1497259	\$259
	2-16MB	6450609	\$388
PS/2 50, 50Z, 55X, 60, 655X	4MB \$159, 8MB \$289		

BOCRAM 3 PLUS

For PS/2 16 Bit Memory for all IBM MCA Systems, DOS and OS/2 UM

MODEL	PRICE
5MS 4.0 Support, 2 8MB (Uses 1MB Sims)	2MB-\$179 4MB-\$245 8MB-\$372

IBM Laptops

Thinkpad 700, 700C, 300

MODEL	PRICE
PS/Note N455L	2MB 07G1419 \$168 4MB 07G1420 \$239 8MB 07G1421 \$389
PS/2 Model N51, N82, Notebook SIC, SX	2MB 92F8857 \$98 4MB 92F8857 \$168 2MB 07G1826 \$88 4MB 07G1827 \$158 8MB 07G1828 \$308

TOSHIBA Laptop & Notebook Memory

MODEL	MEMORY	PART#	PRICE
T2000SX	2MB CARD	PA8311U	\$84
T1000 SE/LE/XE	2MB CARD	PA8312U	\$84
T2000SX/T1000 LE	4MB CARD	PA8311U	\$168
	8MB CARD	PA8315U	\$308
T1200 XE	2MB BOARD	PA8306U	\$92
T1600	2MB BOARD	PA8302U	\$85
T2000 SX/T2000SX/T1800	2MB CARD	PA2000U	\$89
	4MB CARD	PA2001U	\$168
	8MB CARD	PA2002U	\$328
T3100	2MB MCD	PA7135E	\$139
T3100 E	2MB MCD	PA8341U	\$88
T3100 SX	2MB BOARD	PA8308U	\$88
	4MB BOARD	PA8310U	\$158
T3200 SX	2MB MCD	PA8307U	\$88
	4MB MCD	PA8309U	\$158
T3200 SX	2MB MCD	PA8318U	\$88
	4MB MCD	PA8319U	\$158
T3300	4MB MCD	PA8317U	\$158
T3300SL	2MB CARD	PA2004U	\$128
	4MB CARD	PA2007U	\$188
	8MB CARD	PA2008U	\$378
	16MB CARD	PA2009U	\$789
T4400 SX, SXC, T6400 SX, DXC	2MB CARD	PA2004U	\$128
	4MB CARD	PA2005U	\$188
	8MB CARD	PA2005U	\$348
	16MB CARD	PA2010U	\$799
T5100	2MB BOARD	PA8301U	\$89
T5200/T5200C/T5800	2MB MCD	PA8310U	\$99
	4MB MCD	PA8313U	\$298

PCMCIA SRAM MEMORY

AST POWEREX, DEC PALMOT, DELL 3205U, GRID GRIDPAD, HP 955X, IBM PC RADIO, MOMENTA PENTOP, NCR 3125 NOTEPAD, POGET, SHARP PC3000/3100, SHARP PC-6700/6741/6781/6785, SHARP PC-6800/6841/6881/6891, ZEOS POCKET PC

\$12K \$89.00 1MB \$159.00 2MB \$279.00

TERMS: SHIPPING: UPS (Min. \$8.25) Shipping charges are non refundable. NET 10 on approval. Purchase orders from Universities, Fortune 500 & Government Agencies, COD add \$5.00 (Cashiers check)

We ship by UPS, DHL, FEDERAL EXPRESS AND PARCEL POST

Nevada's Largest Computer Wholesaler!

• We will try to beat all prices! Corp. & Govt. P.O.'s Welcome!

Kirium 386 & 486 Processor Upgrades

Now you can use Windows in enhanced mode, get bus multistaking & background operation for Windows 3.11, OS/2, and other 386 specific software. Processor upgrades offer dramatically increased system performance & easy installation & improves your systems performance by up to 350%. Available for most machines.

SX Now! Supports IBM AT and others into a 386

MODEL	PRICE
20MHz	\$209
33MHz	\$249
SCX Now! Supports 286 PS/2 into a 486	20MHz \$139
25MHz	\$168
50MHz	\$428

intel CPU's

386DX

MODEL	PRICE
80386 DX/25	\$39
80386 DX/33	\$59

COMPAG Memory

MODEL	MEMORY	PART#	PRICE
Desktop 386/16	1-2MB	108049-001	\$248
	2MB	108049P71	\$348
	4MB	108070-001	\$398
	1MB	113131-001	\$598
	4MB	113132-001	\$178
Desktop 386/5	4MB Board	113634-001	\$229
	4MB Board	112534-001	\$179
Desktop 386-20E, 23E	4MB	113645-001	\$239
Desktop 386/33; 386/33; 486/25; 331,50L; Systempro	2MB	115144-001	\$309
	4MB	115561-001	\$369
	8MB	115568-001	\$479
Compaq TM	2-64MB	129160-001	\$298
Desktop 386/33; 386/33; 386/33; 20N; Portable 486c; Desktop M; Systempro LT	1MB	118688-001	\$49
	2MB	118690-001	\$58
	4MB	118690-001	\$158
	8MB	128877-001	\$318
	8MB	141738-001	\$399
Prelimo 3/25 & 25Z	2MB	141742-001	\$299
	4MB	141683-001	\$398
Prelimo 4/25w; 4/33; 4/50	2MB Module	141684-001	\$168
	4MB Module	141685-001	\$318
Compaq Pro Signia	16MB	149230-001	\$1295
	32MB	149147-001	\$2395
Systempro; Desktop	6 SKT EXP BRD W/2MB	116569-001	\$299

Compaq Laptop & Notebook Memory

MODEL	MEMORY	PART#	PRICE
Centura 320, 325	2MB	139497-001	\$88
	4MB	139498-001	\$168
	8MB	139499-001	\$318
SLT/286	1MEG MOD	110235-001	\$218
	2MEG MOD	110237-001	\$218
SLT/386	1MEG MOD	118303-001	\$179
	2MEG MOD	118304-001	\$198
	4MEG MOD	118305-001	\$179
Ute 286	1MEG BRD	117081-001	\$175
	2MEG BRD	117082-001	\$218
	4MEG BRD	117081-001	\$218
	8MEG BRD	121125-001	\$298
Ute/20, 25, 25C	2MEG BRD	12125-001	\$139
	4MEG BRD	129769-001	\$238
	8MEG BRD	129769-001	\$399
	16MEG BRD	129769-001	\$1198
LTE Lite/20 & Ute/25, 25C	16MB Card	N/A	\$1045
Compaq Ute 486/25C	8MB Card	142337-001	\$378
	16MB Card	142337-001	\$1198

Simm Modules

Prices change up and down call. Sipp modules, add \$3.00 each

DESCRIPTION	100MS	80NS	70NS	60NS	53NS
256K1	\$1	\$1	\$1	\$1	\$1
1MEGx3	\$9	\$32	\$33	\$38	
1MEG X 9	\$31	\$37	\$39	\$44	\$64
4MEG X 9	\$139	\$149	\$179		
16MEG X 9			\$699		
256K16 1MEG (72 Pin)			\$50		
512K16 2MEG (72 Pin)			\$85	\$95	
1X36 4MEG (72 Pin)			\$149	\$159	\$189
2X36 8MEG (72 Pin)			\$299	\$318	\$379
4X36 16MEG (72 Pin)			\$599	\$649	\$749

D-Ram Chips

DESCRIPTION	150NS	120NS	100NS	80NS	70NS	60NS
64 X 4	\$1.95	\$2.25	\$2.45	\$2.95		
256X16 STATIC				\$1.95	\$2.25	
256 X 1	\$1.05	\$1.45	\$1.90	\$2.00	\$2.05	\$2.20
512 X 1	\$4.45	\$4.95	\$5.45	\$5.95		
1MEG X 1			\$3.95	\$4.75	\$5.45	\$5.75
1MEG X 1			\$4.95	\$5.25		
1MEG X1 STATIC			\$17.00	\$20.00	\$24.00	

CACHE MEMORY

MODEL	PRICE
8Kx8	4.95
32Kx15.95	8.95
64x1	9.95
64x4	9.95
16x4	8.95

THE SAME BUFFER USED BY NASA. AND IT'S UNDER A MILLION DOLLARS.



\$695.00

When NASA went shopping for a printer buffer, they were looking for a flexible, high-powered buffer that was reliable. And don't think they weren't checking price tags, too.

Our top-of-the-line, Buffalo SL was their performance choice. It also just happens to be the best value on the market.



And although the SL is loaded with state-of-the-art features, including full Windows compatibility, you don't have to be a rocket scientist to use or install it.

Now, does that mean it's better because it's easier? Or it's easier because it's better?



Fax: 503-585-4505
Response Code: 63SL3

Buffalo is a registered trademark of MELCO, Inc. Other brands and product names are trademarks or registered trademarks of their respective owners.

Circle 184 on Inquiry Card.

WINDOWS 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



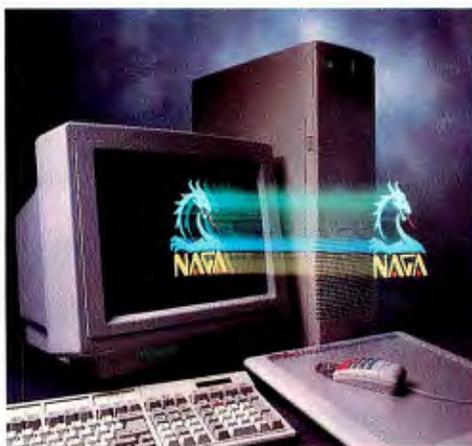
FASTER:
EISA offers 32MB/second transfer rates on a 16 bit wide databus



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 BOTTLENECHS 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.



You'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 WINDOWS SOFTWARE BUNDLE WITH ANY WINDOWS VL SYSTEM!

NAGA gives you more value, more capability to start fast. Our WINDOWS VL-Bus systems include:

- Norton Desktop for Windows*
- Lotus SmartSuite (includes Lotus 123 with smartpak, AMI Pro 3.0 word processor package, Freelance Graphics presentation graphics package, Lotus Organizer and cc:Mail Remote)

WINDOWS SOLUTION 486-VL

- Intel 80486 Processor
 - 4MB RAM (exp. to 32MB)
 - 128K 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 1MB
 - 15" Flat N/I SVGA (1280x1024)
 - 101 Enhanced Keyboard
 - Vertical Case with 250W Power & 2nd Fan
 - MS DOS 5.0, Windows, Mouse
 - WINDOWS SOFTWARE BUNDLE
- 486DX-33 MHz **\$2,295**
486DX-2-50 MHz **\$2,395**
486DX-2-66 MHz **\$2,595**

EXECUTIVE SOLUTION 486-VL

- Intel 80486 Processor
 - 4MB RAM (exp. to 32MB)
 - 128K RAM Cache (exp. to 256K)
 - 130MB <15 ms IDE Hard Disk
 - Teac 1.2 & 1.44 Floppy Drive
 - 32 Bit VL/IDE I/O Controller
 - 32 Bit VL-Bus 2MB
 - 14" Flat N/I SVGA (1280x1024)
 - 101 Enhanced Keyboard
 - Desktop Case with 200W Power Supply
 - MS DOS 5.0, Windows, Mouse
 - WINDOWS SOFTWARE BUNDLE
- 486DX-25 MHz **\$1,795**
486DX-33 MHz **\$1,995**
486DX-2-50 MHz **\$2,095**

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.



MasterCard, VISA, Discover, American Express and Cirrus



1520 West Mineral Road
Tempe, AZ 85283



1 - 8 0 0 - 5 6 8 - 6 2 4 2

Circle 202 on Inquiry Card (RESELLERS: 203).

*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 vendors subject to change without notice. Prices do not include shipping or applicable sales tax. AutoCAD is a registered trademark of Autodesk.



Notebook	
Thinkpad 300 4/120.....	1730
Thinkpad 700 4/120	2699
Thinkpad 700 Color 4/120	3995
IBM ValuePoint (VESA LOCAL BUS)	
486SX/25 4/120 MDL F30	1199
486SX/33 4/120 MDL K30	1399
486DX/33 4/120 MDL M30.....	1699
486DX/33 4/340 MDL 84M70.....	2109
486DX/2/66 4/245 MDL W50	2359
486DX/2/66 4/340 MDL W70	2545
486DX/2/66 4/527 MDL W90	2995
Monitor Extra	

Modems

ZOOM 14.4 EXT.S/R Fax	299
ZOOM 14.4 INT.S/R Fax.....	249
INTEL Satisfaxtion 400.....	439
INTEL Satisfaxtion 400E.....	479

TOSHIBA NOTEBOOKS

Toshiba 4400c, 120 meg	3625
Toshiba 6400MM, 200 meg	CALL
Toshiba 4500, 120 meg	CALL

Call for pricing on other brand name models

CD ROM/Multi Media

Toshiba TXM3301 w/controller	520
NEC CD ROM 74 w/o controller	605
Sound Blaster 16 ASP	245

BRAND NAMES

LOW PRICES LEADER SINCE 1983

We export to Europe, Asia

Apple

Mac PowerBook

160, 40/80/120 MB	\$2,230/2,540/2,860
Duo 210, 4/80 MB	\$2150
180, 4/120 MB.....	\$4,160

Mac Centris 650, 6/230 MB	\$3080
Quadra 950, 8/0 MB	\$4390

14" Mac Color Monitor.....	\$499
Extended Keyboard	\$159
LaserWriter III, 4 MB	1,795

AST

Power Exec 386SL/25, 120 meg.....	2395
Power Exec 386SL/25C, 120 meg	3575
Power Exec 486SL25, 25C, 200 MB	4250

Call for all AST, Bravo and Premium products



All ProLinea systems are Local Bus

Prolinea 4/25s, 4/120 MB Win+	1225
ProLinea 4/25S, 4/240 MB Wind+	1425
Prolinea 4/33, 4/120 MB Win+.....	1625
ProLinea 4/25CDS, 4/120 MB Win+.....	1665
Prolinea 4/50, 4/240 MB Win+.....	2055
Prolinea 4/66, 4/240 MB Win+.....	2255
DESKPRO 4/33M, 4/340 MB Win	3125
DESKPRO 4/50M, 8/240 MB Win	3075
DESKPRO 4/66M, 8/240 MB Win	3305
Contura Notebook 3/25, 4/120 Win+	1675
Contura Notebook 4/25 4/120 Win	1995
Contura Notebook 4/25 color, 4/120 Win	2695
Contura Notebook 4/25CX 4/120 Win.....	3325
LTE Lite 3/25C, 4/120 MB Win.....	3725
LTE Lite 4/25C, 4/209 MB Win.....	4299
Portable 486DX2/66C, 4/210 MB Win.....	6745
Portable 486DX2/66, 4/525 MB Win.....	7755
Win+ MS-DOS 6, MS-Windows 3.1, Compaq Mouse Win+, Win plus PFS; Works/Windows, 5.25" FDD, Modem	
Please call for updated prices	

NOVELL SPECIALS

Authorized Dealer

Netware 386 V.3.11

5 users	625	10 users.....	1395
20 users	1895	100 users.....	3795

NEW Netware 4.0

5 users	925	10 users.....	2125
25 users	3075	50 users.....	CALL

Software From:

Adobe
Aldus
Borland

Central Point
Corel
IBM

Intuit
Lotus
Mathematica

MicroProse
Microsoft
Quarterdeck

Spinnakor
Symantec
WorkPerfect

Fonts From:

Adobe
IQ Engineering
MicroLogic



Computers

Made In USA

486DX2/66, 4MB RAM, 200 meg HD	2195
486/50, 4MB, 200 meg HD	VESA 1960
486/33, 4MB RAM, 120 meg HD	Local 1620
386/40, 4MB RAM, 120 meg HD	Bus 1390

All Systems Include:

- 2 S/1P/1 Game Ports, 101 AT Enhanced Keyboard, Mouse
- 1.2 (5.25") & 1.44 (3.5") meg TEAC Floppy Drives
- SVGA card w/1 meg & SVGA 0.28mm Monitor
- MS-DOS 5.0 & MSWindows 3.1 (complete w/manuals)
- One year parts and labour limited warranty

Tape Back-Up Drives

Colorado	
Jumbo 120 Int	145
Jumbo 250 Int	195
Trakker 120 Ext	355
Trakker 250 Ext	410
Syquest	
88 meg kit Int	425
88 meg Ext.....	625

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

Video Boards

ATI Graphics	
Ultra +, 1MB	295
Ultra Pro, 1MB.....	435
Ultra Pro, 2MB.....	515
Ultra Pro, 2MB EISA	575
Diamond	
Stealth 24, 1MB	175
Orchid Fahrenheit	
VESA Local Bus	\$235

Hard Disks

Conner	
CP30104H, 120 meg	269
CP3204, 212 meg	349
Quantum (ELS/LPS)	
ProDrive 170 meg	275
ProDrive 240 meg	395
ProDrive 525 meg	995
Maxtor	
LXT 340 meg	619
LXT 535 meg	919
Micropolis (SCSI)	
1624 670 meg.....	1195
1598 1GB SCSI2.....	1475
Fugica, Micronet, Seagate	
CALL FOR ALL MODELS	

SVGA Monitors

NEC 3FGX, 14"	645
NEC 5FG, 17"	1375
Viewsonic 4E, 14"	325
Viewsonic 8, 20".....	1785
Aamazing, 14"	335

LASER PRINTERS

HP LaserJet 4SI	3225	
HP LaserJet IV	1395	
HP LaserJet IIIP	CALL	
HP LaserJet 4P	1188	
HP Laser 4D	CALL	
OKI OL 400, 800.....		CALL
OKI OL 840 P.S.....		1720
Panasonic 4450		1295
NEC Model 95		1385
NEC Model 97.....		CALL
Compaq Pagemarq 20		4295

WE STOCK:
ADAPTEC
BOCA

CALCOMP
CITIZEN
INTEL

CREATIVE LABS
HOUSTON INSTRUMENTS
TEXAS INSTRUMENTS

EPSON
HAYES
MAYNARD

MOUNTAIN
KINGSTON
LOGITECH

TALLGRASS
US ROBOTICS
MEGAHERTZ

Computerlane inc.

Corporate Accounts
Volume Discounts
And
Consultant Orders
Welcome

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 DISCOUNT

Visa, MasterCard and American Express also accepted

Prices subject to change without notice.

The Feather Weight Champion

ONLY
2.2 lbs



The New 386SL Sub-Notebook

BICOM SL

- Weight 2.2 lbs (Bicom & battery)
- Dimension 9.00" x 6.36" x 1.22"
- Intel 386SL/25MHz processor
- Support 387SX co-processor
- 2Mb Ram
- 80 Mb Hard Disk
- 5AA size NiMH Batteries
(3 hours operation with PM enabled)

- High Resolution (640X400) LCD screen
- 1 parallel (bi-direction), 1 serial port
- External 1.44 Mb FDD (optional)
- Multi-function port for external keyboard and extra serial port
- DR DOS 6.0. File Transfer software & serial Download cable
- Universal AC/DC adaptor



Option: External Floppy Drive, Mini-Track ball Multi function port cable, extra batteries.

30 day money back guarantee. Life-time technical support.

BICOM SL \$ 995
Ask also B280i \$ 795

ABC COMPUTERS® **1-800-336-2280**

U.S. Office: ABC Computer (U.S.A.) Corp.
2531, 237th Street, Suite 122,
Torrance, California 90505, U.S.A.
Tel: 310-3254005 Fax: 310-3256369

Headquarters: ABC Computer Co. Ltd.
28/F Wyler Centre Phase II, 200 Tai Lin Pai Road,
Kwai Chung, N.T., Hong Kong. Tel: 852-4816118
Fax: 852-4815836 Telex: 52178 ABCCTC HX



The Intel Inside Logo is a trademark of Intel Corporation
All brand names are registered trademark of their respective owners.

Circle 178 on Inquiry Card (RESELLERS: 179).

FIRST SOURCE INTERNATIONAL PRESENTS MEMORY AND MUCH MORE...

Personal Computer Memory

IBM	
PS/1 286, 386SX	
2MB 92F9935	\$89 4MB 92F9694 \$149
PS/1 Consultant, Essential & Expert models x43, x44 & PS/Valuepoint all models except Cx series	
4MB PH NA	\$159 16MB PH NA \$379
PS/2 286, 30/286, & memory adaptor 1497259	
2MB Kit	30F5360 \$79
PS/2 355X; LS, 405X, 502, 555X; LS, 655X; LS, 70, & XStation	
1MB 6450603	\$49 2MB 6450604 \$79
PS/2 70-A21; A61; B21; B61; PS/1 Consultant, Essential & Expert models x11, x13 & x14, PS/Valuepoint Cx series	
2MB	6450608 \$79
PS/2 355X; LS, 405X, 555X; LS, 655X; LS, XStation, PS/Valuepoint Cx series & adaptor board 34F3011 or 34F3077	
4MB	34F2933 or 87F9977 \$149
PS/2 355X; LS, 405X, PS/Valuepoint Cx series	
8MB	6450429 \$299
PS/2 90 XP, 95 XP, P75 (pairs), 56, 37 (all), PS/1 Pro M2123	
2MB	6450902 \$89
PS/2 90 XP, 95 XP, P75, 56, 37 (all), PS/1 Consultant, Essential & Expert models x11, x13 & x14, PS/1 Pro M2123 RS/6000 POWERstation/POWERserver 220 series	
4MB 6450928	\$149 8MB 6450930 \$299
Expansion boards for 50, 502, 555X, 60, 655X	
2-8MB w/2MB	1497259 \$289
Expansion boards for all models 70 & 80	
2-14MB w/2MB	34F3077 \$329
Compaq	
ProLinea 3/25; 3/25z	
2MB	147738-001 \$89 8MB 147742-001 \$289
ProLinea 4/25; 4/33, 4/50	
1MB	147682-001 \$55 2MB 147683-001 \$89
4MB	147684-001 \$159 8MB 147685-001 \$309
DeskPro 386-20, 20e & 25	
4MB Module	11F132-001 \$179
DeskPro 386/16	
4MB Module	112534-001 \$179
DeskPro 1 series, 286H; 386H; 386SX/20; 20H	
SystemPro LT Series, ProSignia PC Server 486/33; DX2/66	
Portable 486 & M Series expansion boards	
4MB 11693-001	\$155 8MB 112877-001 \$315
ProSignia PC Server 486/33; DX2/66	
16MB	149320-001 \$999 32MB 149147-001 \$2499
SystemPro XL (486-50)	
16MB	136916-001 \$799 32MB 136917-001 \$1599
DeskPro 386-33, 486-33, & SystemPro	
2MB	115144-001 \$99 8MB 116561-001 \$289
DELL	
Power Desktop 3250, 325P, 3330, 333P, 433P, 486P & 486D	
1MB	310-2505 \$59 4MB 310-2507 \$149
PowerLine Workstation 420; 25; 33; 50; 450DE/2 & 466DE	
2MB	310-2465 \$99 4MB 310-2467 \$179
8MB	310-2468 \$319 16MB 310-2469 \$629

Laptop & Notebook Memory

AST	
PowerExec 3/25SL, 3/25SL-C and EL	
4MB	\$179
8MB	\$649
16MB	\$1249
Premium Exec 286, 386SX/20; 25; 25C	
4MB	\$729
Compaq	
Contura 3/20, 3/25, 3/25c	
4MB	\$169
8MB	\$309
LTE 386S/20	
4MB	\$189
LTE Lite 20; 25; 25c, 25e	
4MB	\$159
8MB	\$359
16MB	\$1299
LTE Lite 4/25c	
4MB	\$219
8MB	\$359
4MB	\$259
8MB	\$179
IBM	
ThinkPad 300	
2MB	\$159
8MB	\$429
PS/2 CL57SX, ThinkPad 700 and 700C	
4MB	\$219
8MB	\$369
NS1 Notebook (All)	
2MB	\$179
4MB	\$249
LA05X, H335X and PS/Note 182	
4MB	\$135
LA05X and PS/Note 182	
8MB	\$285
PS/Note N455L	
2MB	\$136
NEC	
UltraLite & Cellular Workstation 286F	
4MB	\$369
UltraLite & Cellular Workstation SX/20	
2MB	\$179
8MB	\$589
UltraLite III, SL/25C	
2MB	\$149
4MB	\$189
UltraLite SL/20, SL/20P	
2MB	\$119
8MB	\$289
Texas Instruments	
TravelMate 3000 (all models)	
2MB	\$79
TravelMate 4000 (all models)	
4MB	\$199
TravelMate WinSLC/25	
2MB	\$79
Toshiba	
T1000SE/1E/1E; 2000, 2000SX, 55e,	
T2200SX and T1800 Satellite Series	
2MB	\$79
4MB	\$159
8MB	\$289
T1200XE, 160D, and 3100E	
2MB	\$89
T3100SX, 5200SX, and SXC	
2MB	\$89
4MB	\$149
8MB	\$189
T3200	
4MB	\$169
T3300SL	
8MB	\$469
16MB	\$915
T4400 and T6400 (all models)	
4MB	\$169
8MB	\$309
16MB	\$915
T5100	
2MB	\$89
T5400, T5200; T5200C and T8500	
2MB	\$89
8MB	\$279
Zenith	
Z-Note 320L, 320Lh, 325L, 325Lh	
2MB	\$169
8MB	\$369
Z-Sport 420S, 425S	
4MB	\$189
Z-Sport 325S	
2-6MB	\$139
4MB	\$249
8MB	\$399
MastersPort 386SL, SL, SLc	
2MB	\$109
MastersPort 386SX	
2MB	\$139
SupersPort SX; 286e; SilmsPort	
4MB	\$279

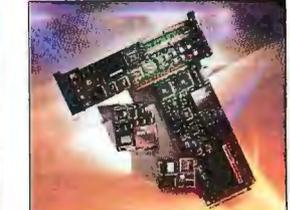
We also carry a large inventory of memory upgrades for other name brand laptop and notebook systems. Please contact our sales staff for information on your specific model.

Laser Memory

Hewlett-Packard LaserJet IIij, 4, 4M & XL300	
4MB	\$109
8MB	\$209
Hewlett-Packard LaserJet III, IIIi, IIIiL	
2MB	\$347.79
4MB	\$419
Hewlett-Packard LaserJet II & IID	
2MB	\$304.48
4MB	\$345.58
8MB	\$180
IBM Laser 4029 All Models	
4MB	\$183.355
8MB	\$129
Canon LBP-4, 4Lite, 4PUS	
1MB	\$65-2250
2MB	N/A
4MB	\$169
Canon LBP-III & IIIi Plus	
2MB	\$65-2350
3MB	\$65-2360
4MB	\$299

CPU Upgrades

Upgrade your system to 386 or 486 power!



Kingston processor upgrades improve the performance of DOS 5.0, Windows, OS/2 and other business, graphic and CAD/CAM programs without purchasing a new system, look to Kingston Technology!

SL/Now!	
25MHz (SX)	\$199 33MHz (SX) \$219
SLC/Now!	
20MHz (SLC)	\$129 33MHz (SLC) \$219
50MHz (SLC)	\$249
486/Now!	
25MHz (SX)	\$429 33MHz (DX) \$659
MicroMASTER	
25MHz (SX)	\$629 33MHz (DX) \$1299
With 4MB add	\$149 With 8MB add \$289
ATMASTER	
25MHz (SX)	\$999 33MHz (DX) \$1439
With 4MB add	\$149 With 8MB add \$289

Fax Modems

COMPUTER PERIPHERALS, INC.



PC Magazine says, "The ViVa's data-transfer performance was excellent!"
PC Magazine December 8, 1992

ViVa Internal Modems	
14,400bps V.32/V.42 modem, send & receive FAX	\$219
24/9600bps with send/receive FAX	\$89
ViVa External Modems	
14,400bps V.32/V.42 modem, send & receive FAX	\$279
24/9600bps with send/receive FAX	\$95

Megahertz CORPORATION
For AST, Compaq, IBM, Sharp, TI, Toshiba, Zenith and many other Laptop and Notebook Systems.

PCMCIA 2.0 Internal FAX/Modems	
14,400bps FAX/Modem, Autosync	\$495
24/9600bps FAX/Modem	\$295
Internal FAX/Modems w/MNP-5 & V.42/V.42bis	
14,400bps FAX/Modem, Autosync	\$499
24/9600bps FAX/Modem	\$219
External Pocket Modems for any RS-232 Serial Port	
14,400bps FAX/Modem, Autosync	\$379
24/9600bps FAX/Modem	\$189

Video Cards

Diamond Computer	
Stealth Pro 1MB	\$249
Stealth Pro 2MB	\$359
Stealth 24 1MB	\$169
SpeedStar 24X 1MB	\$159
Viper VLB 1MB	\$319
Viper VLB 2MB	\$409
Stealth VLB 1MB	\$249
Stealth VLB 2MB	\$369

SIMM Modules

Industry Standard 30-pin SIMMs	
1MB x 9-70 or 80ns, Fast Page Mode	\$335
4MB x 9-70 or 80ns, Fast Page Mode	\$129
36-Bit, 72-Pin SIMMs	
512K x 36-70 or 80ns (2MB)	\$79
1MB x 36-70 or 80ns (4MB)	\$149
2MB x 36-70 or 80ns (8MB)	\$289

30 day
Money Back Guarantee
Buy with confidence!

- 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, APO/FPD's welcome
- Government and Educational pricing
- International orders welcome
- Special volume pricing
- 24-hour fax line
- Same day shipping
- Overnight delivery available
- No surcharge on credit cards

CALL FOR ANY MEMORY UPGRADE NOT LISTED!
We stock upgrades for over 1700 computers and printers

TOLL FREE FROM THE UNITED STATES AND CANADA

800/648-9866

INTERNATIONAL
714/588-9866

FACSIMILE
714/588-9872

Business hours:
Monday - Friday, 8am-5pm, P.S.T.
Saturday, 9am-3pm, ORDERS ONLY



Mail or fax orders to:
First Source International, Inc.
7 Journey
Aliso Viejo, CA 92656

Terms and Conditions: Memory products are third party, manufacturer's numbers are for your convenience. Freight charges are non-refundable. A RMA number is required for all returns. All non-defective returns, unopened, unused, or cancelled orders, will be subject to a 20% restocking fee. Prices and 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 typography or photography. We will meet any advertised price valid only on identical brands, offer not good for SIMMs or OEM. Trademarks and registered trademarks are of their respective companies.

We'll meet or beat any advertised price!
CALL THE UPGRADE EXPERTS TOLL FREE 800/648-9866

We Carry

ALPS 
BASF brother.
Canon
CENTRONICS
 **CITIZEN** 
CREATIVE LABS INC.
CURTIS Dataproducts
 **Dysan**
EPSON EXABYTE
FACIT  **FUJITSU**
 **GRAMAM MAGNETICS**
GENICOM 
 **HEWLETT PACKARD** **IBM**
 **MEGA**  **KYOCERA**
3M M. TALLY
maxell MICROSOFT
Nashua NEC
OCLI OKIDATA
olivetti OLYMPIA
OTC PACIFIC DATA
Panasonic
 **Polaroid** **QMS**
QuickShot
Qume RICOH
 **Seagate**
SEIKOSHA SMITH CORONA
SONY 
SYQUEST 
TEAC 
 **TEXAS INSTRUMENTS** **TOSHIBA**
TRIPPLITE
Verbatim 

and many more
OEM supplies!

ALL LOGOS ARE THE PROP-
 ERTY OF THEIR RESPEC-
 TIVE COMPANIES

P.O.S./ATM SUPPLIES
 RIBBONS, ROLLERS AND
 OTHER CHECK PROCESS-
 ING SUPPLIES FOR
 DIEBOLD, IBM, ICL, TEC,
 EPSON, OMRON, SWEDA
 AND NCR, (TO QUOTE
 PRICES, WE NEED PART
 NUMBERS)

ATTENTION!!!
WHOLESALE DEALERS
& VOLUME BUYERS
SAVE \$\$\$

DISKETTES (10 per box)

DESCRIPTION	TDK	BASF	MAXELL	3M
5 1/4" DS/DD	\$ 2.75	3.15	3.45	3.75
5 1/4" DS/HD	5.25	5.15	5.45	5.75
3 1/2" DS/DD	4.35	5.15	5.35	5.35
3 1/2" DS/HD	6.95	7.85	8.15	8.95

BULK DISKS (Inc. Sleeves & Tabs)

DESCRIPTION	FORMAT	UNFORMAT	OEM GRADE
5 1/4" DS/DD	\$ 0.20	0.19	0.32
5 1/4" DS/HD	0.29	0.27	0.30
3 1/2" DS/DD	0.34	0.31	0.36
3 1/2" DS/HD	0.51	0.47	0.54

DATA CARTRIDGES

DESCRIPTION	3M	MAXELL	DYSAN
DC-2120	\$ 13.95	12.95	11.95
DC-6150	15.25	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-600 XD	12.25	150 MB	CT-600N .. 16.75
CS-600 SX	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 1/2" 512/128 MB	\$ 36.00	35.00	39.00
5 1/4" 512/600 MB	76.00	75.00	86.00
5 1/4" 1024/650 MB	76.00	75.00	86.00

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		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.

PANASONIC

KX-P115	RIBBON	.. \$ 6.59
KX-P140	RIBBON	.. 8.59
KX-P4450	TONER KIT	.. 25.99
KX-P4450	DRUM KIT	.. 105.99

(CALL FOR OTHER PANASONIC ITEMS)

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	.. \$ 32.75
LN03X-AD OPC KIT	.. 104.75
TK-50 TAPE CARTRIDGE	.. 16.75
TK-70 TAPE CARTRIDGE	.. 26.75
TK-85 TAPE CARTRIDGE	.. 27.75
RA60-P DISK PACK	.. 595.00
Dec Ribbons & other supplies	
Please call for the lowest prices.	

IOMEGA (Bernoulli Cart)

5 1/4" GOLD 20MB	.. \$ 53.00
5 1/4" GOLD 44MB	.. 83.00
5 1/4" GOLD 90MB	.. 124.00
5 1/4" CLEANING KIT	.. 30.00

SyQUEST (Removable Disk Cart.)

88MB DISK 1-YR WARRANTY	\$ 89.00
88MB DISK 5-YR WARRANTY	94.00
44MB DISK 1-YR WARRANTY	62.00
44MB DISK 5-YR WARRANTY	64.00

CANON

BC-01 INK CARTRIDGE	.. \$ 15.95
BC-02 INK CARTRIDGE	.. 18.95
BJI-481 INK CARTRIDGE	.. 10.95
BJI-642 INK CARTRIDGE	.. 14.95
BJI-801 INK CARTRIDGE	.. 8.95
EPS/SX TONER HP 92295A	.. 67.95
EPL/IIP TONER HP 92275A	.. 54.95

KODAK

MICRO GRAPHICS FILM	
DA CO-DL FILM	
105 X 125M	.. \$ 215.00
DACOMATIC FILM	
16MM X 170M	.. 57.00
THERMAL PRINT FILM	
16MM X 200'	.. 16.00
IMAGE LINK FS	
16MM X 1025'	.. 32.00

EPSON

RIBBONS		LASER	
7753	.. \$ 3.45	SO50002	.. \$ 71.95
7754	.. 3.85	SO51005	.. 106.95
7762	.. 5.85	SO51009	.. 139.95
8750	.. 3.05	SO51011	.. 112.95
8755	.. 3.45		
8762	.. 5.85		
8763	.. 4.25	INK JETS	
8764	.. 9.05	7750	.. 46.95
8766	.. 17.75	7760	.. 16.95
		SO20002	.. 18.95
		SO20025	.. 12.95

COPIER TONERS

CANON

F41-2302-100	.. \$ 75.00
F41-4102-710	.. 100.00
F41-4214-700	.. 89.00

CANON COLOR

F41-6811-000	.. \$ 83.00
F41-6821-000	.. 83.00
F41-6801-000	.. 83.00

KONICA

946-181	.. \$ 9.25
946-241	.. 12.25
947-376	.. 31.25

MINOLTA

8915-743	.. \$ 12.90
8915-348	.. 27.90
8931-202	.. 76.90

MITA

37037011	.. \$ 12.25
37041011	.. 5.25
37042011	.. 27.25

RICOH

887051	.. \$ 5.75
887132	.. 6.75
887143	.. 17.75

SHARP

SF-730MTI	.. \$ 16.50
SF-830MTI	.. 14.50
SF-980MTI	.. 33.50

TOSHIBA

T-220P	.. \$ 17.80
T-61P	.. 7.80
T-68P	.. 8.80

XEROX

6R-229	.. \$ 27.90
6R-244	.. 51.90
6R-257	.. 41.90

IBM

RIBBONS		LASER	
1040150	.. \$ 8.20	1348330	.. \$ 520.00
1040282	.. 45.30	1348331	.. 295.00
1040440	.. 11.40	1348347	.. 170.00
1040930	.. 7.50	1348349	.. 37.00
1299095	.. 1.70	1380200	.. 143.00
1299790	.. 9.90	1380520	.. 160.00
1299845	.. 3.90	1669113	.. 15.00
1299933	.. 13.80	1669115	.. 60.00
1319308	.. 11.30	1669151	.. 60.00
1337765	.. 2.70	70X7001	.. 71.00
1361195	.. 1.50	70X7002	.. 175.00
1380999	.. 3.40	70X7003	.. 17.00
6295158	.. 28.40	70X7280	.. 33.00
6328829	.. 5.30	70X7281	.. 121.00
6845100	.. 28.90	70X7243	.. 363.00
7034437	.. 27.50	70X7244	.. 276.00
7034640	.. 5.40	70X7285	.. 83.00
7819690	.. 12.50	70X7286	.. 379.00

Genius

CLIXes ERGONOMIC STREAMLINE	
MOUSE 350-4200 DPI	.. \$ 12.75
MouseOne SERIAL - STARTER	
MOUSE, 350-1050 DPI	.. 9.95
HITrak-SPACE SAVER MOUSE,	
350-1050 DPI	.. 38.85
GS-4500A FOR WINDOWS-	
BLACK & WHITE HAND HELD	
SCANNER, 100-400 DPI	.. 84.25
GS-B105A FOR WINDOWS	
256 GRAYSCALE HAND HELD	
SCANNER, 100-400 DPI	.. 139.00
GS-C105 FOR WINDOWS COLOR	
HAND SCANNER, 100-400 DPI	.. 270.00



STARTECH *International*
COMPUTER SUPPLIES

5575 Magnatron Blvd., Suite G
 San Diego, CA 92111 USA

TEL: 619-278-2600
 FAX: 619-278-2780
 TLX: 415779
 ANS: STARTECH

WE BEAT ANY PRICE!!

TERMS: C.O.D., BANK DRAFT,
 WIRE TRANSFER OR L/C AT
 SIGHT. P.O.'S ACCEPTED FROM
 RECOGNIZED INSTITUTIONS ON
 NET 30 DAYS. MINIMUM ORDER
 \$3000.00 PRICES ARE SUBJECT
 TO CHANGE WITHOUT NOTICE.
 WE CANNOT BE RESPONSIBLE
 FOR TYPOGRAPHICAL ERRORS.

Rack Mount Computers - Motherboard or Passive Backplane

Use external monitor
Up to 6 drives



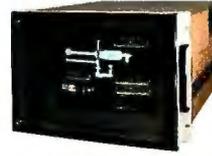
8.75" high

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

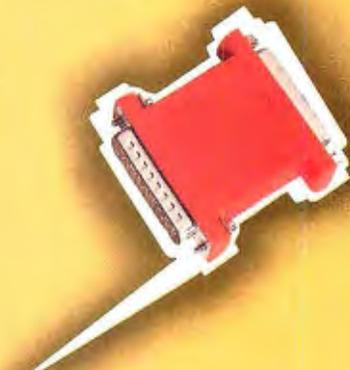
KeyPro ... A Legend in Software Protection

Just as the legendary Chinese warrior god **Zhong-Kui** had the reputation of a fearsome warrior who easily fended off evil spirits, KeyPro has established its reputation as a dependable means of guarding programs against unauthorized copies. **Zhong-Kui** enslaved and ate ghosts, but KeyPro employs a much more useful and appealing method to protect your software.

While designing the KeyPro software protection device, our engineers considered not only the need of software developers but also the convenience of users. Software developers enjoy KeyPro's protection capability, while users can forget the key after installing it.

The KeyPro Family

- **KeyPro II** : for PC environments
- **Net-KeyPro**: for Netware environments



Outstanding Features

- ❖ **Unbreakable Electronics**
An ASIC-based hardware and a proprietary encryption algorithm are used to prevent code tracing by the most persistent software pirates.
- ❖ **Compatibility**
KeyPro is transparent to the computer and other peripherals that are attached to it. It works on every computer it has been tried on without interfering with computer's normal operations.
- ❖ **Cascadability**
KeyPro can cascade on the printer port with any other KeyPros or the keys manufactured by other companies. Because KeyPro's both sides are transparent, it can sit in any position in the cascade chain.
- ❖ **Runtime Reprogrammability**
A buffer with read/write runtime memory inside the hardware allows developers to protect and write into multiple software programs using only one key.
- ❖ **Virus Detection**
KeyPro provides the protected program a virus detection option to check whether it is infected.
- ❖ **User Limit**
KeyPro allows programmers to designate up to 100 workstations using one software in Netware environment.
- ❖ **Driver/External Protections**
Two protection methods provide the security for a software with or without its source code.

Regional Distributors Welcome!

* KeyPro is a registered trademark of Transcend Information Inc.
* All other trademarks are registered by their respective owners.

Transcend

*Your Supplier, Your Partner,
Your Friend.*

Transcend Information Inc.

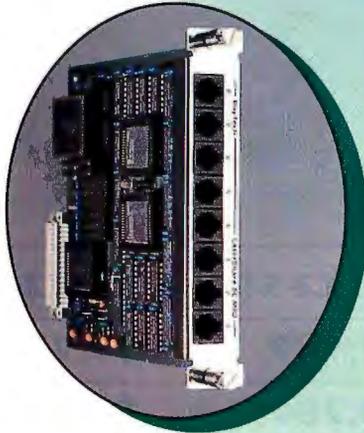
U.S.A.	Taiwan
104 Exchange Place, Pomona, CA 91768	3Fl., No. 465, Chung Hsiao E. Rd., Sec. 6, Taipei, Taiwan
TEL: (909) 598-5500	TEL: (886) 2-7881000
FAX: (909) 598-5050	FAX: (886) 2-7881919
(909) 598-6050	(886) 2-7889191

Germany
Transcend Information Trading GmbH
Lademannbogen 45a, 2000 Hamburg 63
TEL: (49) 40/538 81 37
FAX: (49) 40/538 17 81

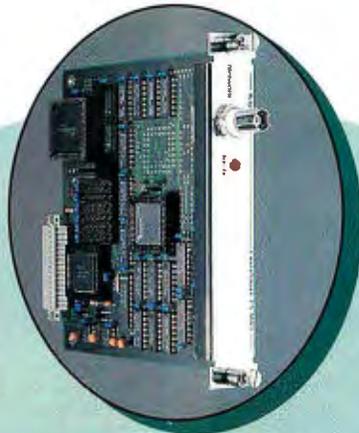
Circle 200 on Inquiry Card.

HP Connectivity

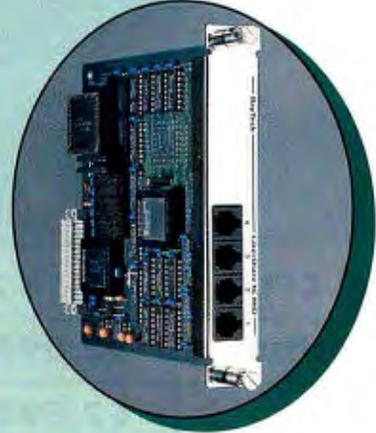
More Affordable, Faster Performance



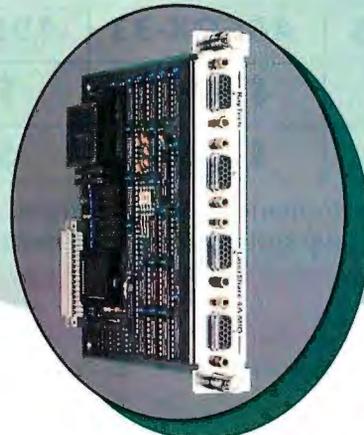
Printer Sharing 8 Serial Ports
\$695.00



**Ethernet Network®
Print Server \$395.00**



Printer Sharing 4 Serial Ports
\$549.00



Printer Sharing 4 Parallel Ports
\$549.00

Network Print Servers For HP LaserJet MIO

BayTech has combined performance and affordability in the new Ethernet print server card. The LaserShare® PS-MIO easily installs into the MIO slot of your HP LaserJet Series 4, IIISi and 4Si laser printers.

The three key advantages LaserShare PS-MIO has over standard network printing are: speed, printer location, and congestion reduction. The fast throughput speeds allow downloading of large text and graphic files at the speed of your network. It increases file server efficiency by assuming the printing functions of the file server. You can locate your laser printer anywhere on the Novell Netware® 3.x compatible network by using either 10BASE2 or 10BASE-T connections.

For only \$395.00 it is the best low cost, high performance print server available.

8 Can Share Your LaserJet

BayTech is pleased to offer a more diverse LaserShare product line with the inclusion of MIO expansion cards.

LaserShare allows up to 8 users to connect simultaneously to the MIO expansion slot of your HP LaserJet laser printer. LaserShare models are available with 4 parallel ports, and 4 or 8 serial ports. LaserShare's standard 1MB buffer is user expandable to 4MB. The LaserShare 4A-MIO is the only 4 parallel port card available for HP LaserJet MIO products.

Parallel input speeds of 70Kcps are the fastest in the industry. Use BayTech's Tran-x® for parallel printing, with serial port models, for distances more than 1,000 feet and speeds to 46Kcps.

Experience & Reliability

For 17 years, BayTech has been a leader in the design and manufacture of

Circle 182 on Inquiry Card (RESELLERS: 183).

data communication products including: Network Print Servers, Printer Sharing Solutions, Statistical Multiplexers and Data Acquisition Controllers. Call toll-free today to learn more about BayTech connectivity products.

All product or company names are trademarks of their respective holders.

Because Resources Should Be Shared



Data Communications Products Division
200 N. 2nd St., PO Box 387, Bay St. Louis, MS 39520
Fax: 601-467-4551 Phone: 601-467-8231
or toll-free

800-523-2702

Micro-International Inc.

since 1984, world-wide distribution of quality computer systems and components



Intel CPU	486SX-25	486DX-33	486DX2-50	486DX2-66
Monochrome	\$2,090	\$2,240	\$2,480	\$2,720
Color	\$2,890	\$3,040	\$3,280	\$3,520

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 | ▪ Upgrade hard drive to 210 MB | \$200 |
| ▪ Auto cigarette adapter | \$ 40 | ▪ Upgrade hard drive to 450 MB | \$600 |
| ▪ Memory upgrade to 16 MB | \$500 | ▪ Additional battery | \$ 90 |
| ▪ Memory upgrade to 8 MB | \$160 | ▪ Battery charger | \$ 30 |
| ▪ Upgrade hard drive to 320 MB | \$400 | ▪ Additional AC adapter/charger | \$ 50 |

Micro-International, Inc.



10850 Seaboard Loop
Houston, Texas 77099

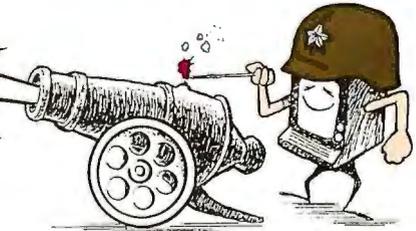


National Sales 800/967-5667 Houston 713/495-9096

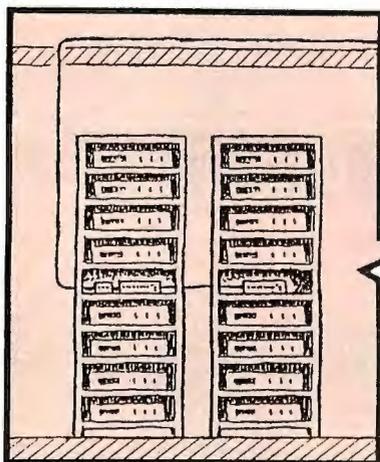
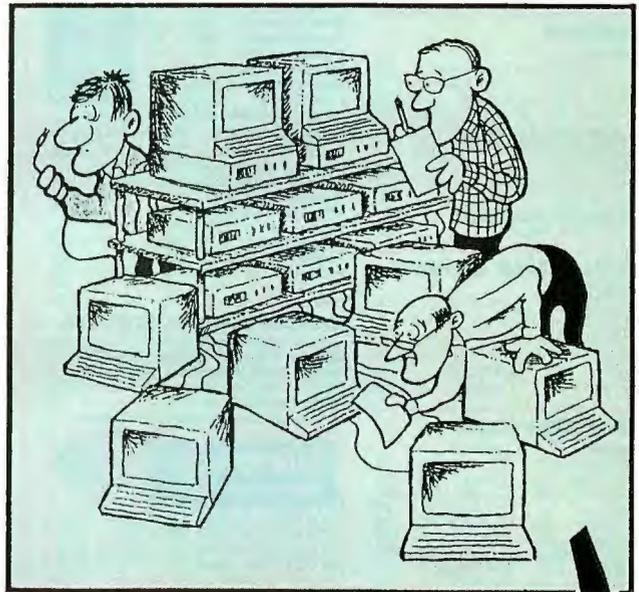
Hours: 9:00 a.m. to 5:00 p.m. Monday-Friday (Central Time)

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.

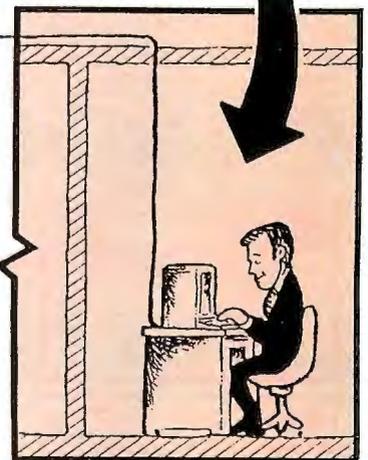
CONTROL UP TO 96 PC FILE SERVERS WITH 1 KEYBOARD AND MONITOR USING... **COMMANDER™**



- 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
- Able to Broadcast to all attached computers



- PS/2 and Serial 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



2800-H Bob Wallace Ave.
Huntsville, Alabama 35805
(205) 534-0011
Fax (205) 534-0010

See us at COMDEX Booth #N5353

Dealer Program Available

PC, PC/XT, PC/AT and PS/2 are trademarks of International Business Machines Corp.

Ask for your copy of the ACP Computer Hotline

Upgrade to MultiMedia at ACP SuperStore!

Hard Drives

Western Digital
High performance
"Caviar" series with 1" height, Coche Flow 9.5 and 32k buffer.
AC2120 120Mb 1" 3.5" 13ms IDE Call
AC1190 170Mb 1" 3.5" 13ms IDE Call
AC2200 212Mb 1" 3.5" 13ms IDE Call
AC2250 250Mb 1" 3.5" 13ms IDE Call
AC2340 340Mb 1" 3.5" 13ms IDE Call

Maxtor
7080A 80Mb 1" 3.5" 15ms IDE Call
LX12A 120Mb 1" 3.5" 15ms IDE Call
LX213A 213Mb 1" 3.5" 15ms IDE Call
MX1240 1.2Gb 1" 3.5" 15ms IDE Call
Panther 1.2Gb S-Call Panther 1.7Gb Call

Conner Peripherals
CP3004 84Mb 3.5" 28ms IDE Call
CP3008 84Mb 3.5" 19ms IDE Call
CP30134 120Mb IDE 3.5" 19ms IDE Call
CP30204 212Mb 3.5" 12ms IDE Call
CP30254 250Mb 3.5" 12ms IDE Call
CP30124E 170Mb 3.5" 12ms IDE Call

Hard Drive Specials
Seagate ST3252 249Mb IDE 499.95
Samsung 120Mb IDE 249.95
Call for Quantum, Microplots, Seagate, Controllers from Ultrastar, Always, WD etc.

Backups

Colorado
DJ10 120Mb Tape Drive Internal .. 149
DJ20 250Mb Tape Drive Internal .. 229
Tracker 120/250 Tape Backup 349/419
PowerTape 2Gb/4Gb 999/1599

Syquest (with cartridge)
44Mb kit SQ555, SQ400, SQ01(16 bit) .. 419
44Mb external 499
88Mb kit SQ5110, SQ800, SQ01(16 bit) 529
88Mb external 629

GrassRoots Floptical
Floptical 21 Mb Int/ext Call

Floppy Disk Drives

Toshiba
ND04DG 360K 5.25" HH PC/XT 59
ND08DE 1.2Mb 5.25" HH PC/AT 72
ND3516GR 1.44Mb 3.5" HH w/AT Kit .. 72

ACP
1.2 Mb 5.25" .. 66 2.88Mb 3.5" 1491
1.44Mb 3.5" 67 All In One 3.5/5.25 149

Input Devices

Advanced 3-button Mouse 15	Logitech Mouseman 75
101 Keyboard 58	Mouse (OEM) 35
Mouse+Windows 88	Cardless Mouse 88
Microsoft Serial Mouse 78	Trackman 78
Ballpoint 69	Trackman Port. 94
Ballpoint 98	Scanman 32 ... 128
Ballpoint+Windows 148	Scanman 255 ... 258
Microspeed PC Trac 78	FlightStick 49
PC Trac bus vers 88	Joystick MachIII call

IBM Compatible Cards

Advanced Monochrome 38	VGA 512K, 800x600 53
Color Card 48	512K, 1024x768 .. 88
EGA Card 48	1Mb, 1024x768 .. 88
Windows Modems 2400bps internal. 39	2400bps external. 69
Interface Parallel Card 29	Memory AT 0.5Mb(sim) 99
Serial Card 35	XT 0.8Mb(C's) ... 99
Multi I/O 59	Call for your special needs...
IDE 16-bit 19	
IDE Multi I/O 69	

Canon
Authorized Reseller **NEW LOW PRICES**
BJ10ex/BJ20ex Portables Call
BJ200 Inkjet Call
LBP-45X/LBP-85X Laser Printers Call
BJ333 Printer (B/W) Call
BJC 800/BJC 820/Color Call
BJJ 300 BubbleJet(B/W) Call

SHARP
Color **NEW!**
386SL/20 Notebook
• Only 4.9 LBS!
• 2Mb RAM • 80Mb
PC688 IC Color Notebook Call
PC6785 LCD Notebook Call

ACP SPECIAL!
Modem Bundle \$39.95
2400 Baud, FREE Prodigy Software

Chips and SIMM's

dRAM Qty 1 25	SIMMS Qty 1 12
256x1-100 ... 1.49 .. 1.35	1Mbx9-80 ... 35 34
256x1-100 ... 1.59 .. 1.45	1Mbx9-70 ... 36 35
256x4-80 ... 4.79 .. 4.59	1Mbx8-80 ... 32 31
1Mbx1-100 ... 4.05 .. 3.95	4Mbx8-70 129 .. 126
1Mbx1-80 ... 4.49 .. 4.39	4Mbx9-70 139 .. 135

Call for VIDEO RAMS & CACHE RAMS
Over 200,000 IC's in-stock including
We Specialize in Memory Modules

Math Coprocessors

Intel	Cyrix
387SL Mobile 78	387SX(16-25) 73
80387DX (all) 85	387DX(20-33) 88
80387SX (all) 78	387DX(40) 108
RapidCAD 248	80287(alt) 78
8087 29	Intel Overdrive
80287-10 89	486DX-33 649
80287-20 89	486SX-25 489

Memory Upgrades

Notebooks/Laptops

AST PowerExec 4Mb .. 178	Toshiba T4400/16Mb .. 799
AST PowerExec 16Mb .. 1325	Apple Powerbook 140/170-6Mb .. \$249
Compaq Contura 4Mb .. 169	IBM ThinkPad 2Mb .. \$158
Compaq Contura 8Mb .. 369	8Mb .. \$449
Compaq Lite4/25C 4Mb .. 239	
Compaq Lite4/25C 8Mb .. 399	
HP95LX Palmtop 2Mb .. call	
TI TravelMate3000 2Mb 87	
TI TravelMate4000 4Mb 218	
Toshiba T4400/6400 4Mb 187	
Toshiba T4400/6400 8Mb 388	
Zenith Z-Note 2Mb 168	

Call for all Notebook Memory Upgrades!

Laser Printers

Canon LBP-4, 4M, XL300 4Mb. 148 8Mb 298
Canon LBP-8III, 8III Plus 2Mb. 169 3Mb 199
Compaq Pagemark 15/20 B/16Mb. 299/599
Epson ActionLaser II 2Mb 138
HP LJ III, 4M, XL300 4Mb. 148 8Mb 298
HP LaserJet IIP, III, IIP, IID 2Mb. 98 4Mb 158
HP LaserJet II, IID 2Mb. 98 4Mb 158
Panasonic 4410/4430 2Mb. 118 4Mb 188
Panasonic 4420/4450 2Mb. 118 4Mb 188
Okilaser 400 1Mb .. 78 2Mb .. 98
TI MicroLaser Turbo, XL 1Mb .. 69 4Mb 269

Computer Memory Upgrades

AST Bravo 4/33, 486/25 2/8Mb 88/299
Compaq Prolinea 3/25s, 25s 2/8Mb 88/288
Prolinea 4/25s, 4/33, 4/50 2/8Mb 88/308
IBM ValuePoint except Cxx 4/16Mb 158/578
IBM PS/2 Model 90, 95 2Mb 88
Call for all Computer Memory Upgrades!

Micronics
Motherboards

486DX/33 ISA ... Call	486DX2/50 VL ... Call
486DX2/50 ISA ... Call	4000LB Video ... Call
486DX2/66 ISA ... Call	486DX/33 EISA ... Call
486DX2/66 VL ... Call	486DX2/50 EISA ... Call

Advanced
Motherboards

80286/12MHz .. Call	486DX/33MHz .. Call
386SX/25MHz .. Call	486DX/50MHz .. Call
386DX/40MHz .. Call	486DX2/50MHz .. Call
486SX/25MHz .. Call	486DX2/66MHz .. Call

PC Special \$269
286/12MHz

Call ACP for Notebook Deals!
COMPAQ

ProLinea 3s/25 w/84Mb Call
Prolinea 4/25 w/120Mb Call
Contura 3/20 w/84Mb Call
Contura 3/25 w/84Mb Call
Contura 3/25 w/120Mb Call
Contura 3/25c w/84Mb Call
Contura 3/25c w/120Mb Call
Compaq LTE Lite/25c w/84Mb Call
Compaq LTE Lite/25c w/120Mb Call

TOSHIBA

T1800 Satellite 60Mb Call
T1850 Satellite 80/120Mb Call
T1850C Satellite w/120Mb Color Call
T3300SL 80/120Mb Call
T4400SX LCD/Plasma 120Mb Call
T4400C Color 120Mb Call
T4500 80/120Mb Call
T4500C Color 120Mb Call
T6400DXC Color 200Mb Call

Advanced Computers

486 High Performance CPU's • Plus MultiMedia Upgrades

486 SuperVGA System

Includes:

- 486DX/33 w/256k Cache
- 4Mb RAM
- 1Mb SVGA Card
- 120Mb HardDrive
- 1.2Mb 5.25" Floppy
- 1.44Mb 3.5" Floppy
- IDE Controller
- 101 Keyboard
- 14" SuperVGA .28 Color Monitor and more!

ACP's Sale Price **\$1399**

Call for MiniTower and Tower configurations... plus EISA, SCSI, Local Bus (add \$75.), and 486DX2/50, 486DX2/66 and 486DX/50

Multi-Media Upgrades

SOUND BLASTER™ Discovery CD-16 Upgrade Kit

Creative Labs-New for '93! Latest 16-bit technology Includes: SoundBlaster 16, Stereo Speakers, Hi-Performance CR-ROM Drive (Int.) MPC and Photo CD compatible, 390 ms, Plus Software Toolworks, MultiMedia Encyclopedia, San Diego Zoo Animals and Lemmings

ACP's Sale **\$498**

MEDIA VISION Fusion CD-16 Upgrade Kits

FUSION CD 16-E
ACP's Sale **\$599**

- NEC DRV 25J(ext) 650ms/150KD
- Audio Spectrum 16-SCSI
- LAB TECH Speakers
- Software-Free CD Titles Included

photo may vary ...where in the World is Carmen San Diego, Civilization and Mantis by Microprose, Compton's Family Encyc., BattleChess by Interplay

FUSION CD 16-I Sony 31A(Int) 490ms/150KD, ProSpectrum 16-bit SLCD-IDE, LAB TECH Speakers, Great Software (same as above), see line listings for more MediaVision products... **\$529**

TEXEL "Double-Speed" CD-ROM Kit

For Maximum Performance! ...experience the difference with a Double Speed Drive. Includes: DM3024 drive (Int), 265ms, Double Data Transfer for 300KB/sec, MediaVision Spectrum 16, Interface Kit, Microphone, Compton's MPC Encyclopedia, Carmen San Diego, National Parks, PC Library, Nautilus Mag, GamePak, Music CD, MPC Wizard, Mediaclips, King's Quest V, etc.

ACP's Sale **\$995**

Our Best Seller! CD ROM Drives • CD Bundles

MITSUMI CD-ROM Drive
265ms, MPC Interface Crd, MS Ext, SW, BONUS OFFER w/Drive Purchase
• Compton's Family Encyc., World Atlas, Webster's Dic, \$39.95
• Family Choice's 15 Ed. \$29.95
• Lucas Games "Loom" \$19.95

CD Bundle #1, Ret. Val. \$804. \$99
Software Toolworks Mavis Beacon Teaches Typing, World Atlas Multimedia Ed., US Atlas w/Automap, Reference Lib, Microsoft Works for Windows-Multimedia Edition

CD Bundle #2, Ret. Val. \$1013. \$299
Reference Library, Family Doctor, US History, Animals, Software Du Jour, Grallier's Illustrated Encyclopedia

CD Bundle #3, Ret. Val. \$519. \$179
Loom, CD Game Pack II, Secret of Monkey Island, Sherlock Holmes Cons. Detective, Secret Weapons of the Luftwaffe, Wing Commander w/ Ultima VI

More MultiMedia...

Creative Labs New for '93 Upgrade Kits

Edutainment Kit (upgrade kit) Call
Discovery Kit (upgrade kit) Call
Sound Blaster Deluxe/Pro 88/149
Video Blaster 338
Sound Blaster 16 ASP Call
Video Splgat/Windows 399

MediaVision

Pro 16 MultiMedia System 899
Fusion CD 16 Int/ext 499/549
CD/PC XL Subsystem 1169
Pro Movie Spectrum 289

NEC -New Multispin!
CD-R 84-1 (Int) 74-1 (ext) 535/595
MultiMedia Gallery w/Multispin 869
CD-R 38 Portable CD 459

Turtle Beach
Multi-Sound Upgrade Kit 1289

Texcel
MultiMedia Bundle 16-bit with 10 Software Titles Int/ext 995/1095
Home Bundle Double Speed 665/765
DM3024 DoubleSpeed CD Int/ext 399/499
8-bit Kit w/Transfer I/O Int/ext 485/575

Video Graphics Cards

ATI

Graphics Ultra Pro 2Mb 495
Graphics Plus 2Mb 315
Graphics Vantage 1Mb 285

Diamond-New for '93

SpeedSTAR 24X 1Mb 154
Stealth 1Mb 210
Stealth 24 ISA/VESA 165/169
Stealth Pro 1Mb/2Mb 239/349
Stealth Pro VESA 2Mb 335
Viper VESA Local Bus 2Mb 389

Sigma Designs

Windstorm MM Display Card 335
Orchid Fahrenheit 1280 w/1Mb ... 189

CALL 1-800-FONE-ACP TOLL-FREE ORDERS



The difference between their prices and ours is simply too great to ignore. No wonder we've been around **SINCE 1984**

(AND WHAT AUDACITY THE COMPETITION HAS TO CLAIM THAT THEY WON'T BE UNDERSOLD)

CONTROL memory upgrades "experts in portable intelligence"

TOSHIBA MEMORY

T2200SX, T2000SXE, T2000SX, T2000, T5100, T3200SX, T3100SX, T3100e, T1600, T1200XE, T1000XE/SE/LE, and T1800, T1850, and T1850C

2MB..\$ 78
4MB..\$158
8MB..\$286

*ALL CARDS ARE FAST 70ns

LASER PRINTER MEMORY

WE OFFER MEMORY FOR ALMOST ALL BRANDS AND MODELS OF LASER PRINTERS AT ROCK-BOTTOM PRICES. JUST CALL OR FAX YOUR REQUIREMENTS, AND WE WILL RESPOND IMMEDIATELY WITH OUR BEST PRICES. (HP LASERJET 4/4M 2MB MODULE ONLY \$72.)

PCMCIA V2.0 96/24 FAX/MODEMS

\$259

MORE LAPTOP/NOTEBOOK MEMORY

AST PENEXEC 2MB/4MB/6MB	\$118/\$207/\$284	
AST POWEREXEC/386 4MB/8MB	\$170/\$654	
AST PREMIUM EXEC/ADVANTAGE 4MB	\$120	
COMMODORE CLT/286/386 2MB	\$ 93	
EVEREX TEMPO/LX 2MB/4MB	\$ 93	
*** GRID CONVERTIBLE 2MB/6MB ***	\$158/\$413	
GRID 1720/1750 2MB	\$ 88	
GRID 1660/1755 2MB/4MB/6MB	\$158/\$283/\$358	
NEC ULTRALITE II/SL25C 2MB/4MB/8MB	\$105/\$173/\$303	
NEC ULTRALITE SL20/20P 2MB/6MB	\$105/\$244	
NEC ULTRALITE VERSA 4MB/8MB		\$CALL
PANASONIC CF-170/270/370 1MB/2MB	\$58/\$98	
PANASONIC CF-470/480 2MB/6MB	\$158/\$385	
SANYO M8C-17NB/18NB 2MB	\$93	
SHARP PC-6200/6220/6240/TI TM2000 1MB BOARD	\$86	
SHARP PC-6600/6640/6661/TI TM3000 2MB UPGRADE	\$72	
SHARP PC-7700/7750 4MB MEMORY BOARD	\$389	
SHARP PC-8041/8081 1MB MODULE	\$53	
SHARP PC-8501 COLORSTAR 2MB	\$119	
TANDY 1500HD/2810HD/3810HD 1MB/2MB	\$58/\$98	
TANDY 2820/3820/3830 2MB/6MB	\$158/\$385	
TI TRAVELMATE 4000 4MB	\$180	
ZEOS 286/386SX NOTEBOOK 2MB	\$93	
ZENITH MASTERSPORT SX/SL/SLC 2MB	\$98	
ZENITH Z-20/386 2MB/8MB	\$113/\$311	
ZENITH Z-LITE 2MB/4MB	\$163/\$306	

DESKTOP/WORKSTATION MEMORY

APPLE MAC IIx 4MB	\$151	CPQ PROLINEA 4/33 4MB	\$146
APPLE MAC +SE/511C/CX 4MB	\$150	CPQ PROLINEA 3/25 8MB	\$281
AST BRAVO LC 3/33x 2MB/8MB	\$78/\$117	CPQ SYSTEMPRO 2MB/8MB	\$98/\$377
AST BRAVO 486/25 & 4/33 2MB/8MB	\$102/\$330	CPQ SYSTEMPRO/LT 4/8MB	\$153/\$325
AST BRAVO LC486 4/6/16MB	\$153/\$307/\$585	DECpc 433 & 433 PORTABLE 8MB	\$281
AST CUPIID-32 2/4/8MB	\$102/\$165/\$330	DELL 316SX 2MB	\$78
AST PREMIUM 386/486 4MB/8MB	\$165/\$330	EPSON 386/33 4MB/8MB	\$146/\$291
AST PREMIUM 386C 4MB	\$158	EPSON EISA SERIES 2/8MB	\$87/\$325
AST PREMIUM II 4MB/8MB	\$156	EPSON EQUITY486Plus 4MB	\$156
AST PREMIUM SE 4/50 32MB	\$1352	HP 700/RX TERMINAL 4MB/8MB	\$153/\$325
AT&T 6386 2MB/4MB	\$70/\$141	HP XSTATION 700/RX 8MB	\$325
IBM 34F2933 4MB	\$153	HP VECTRA TA/ SERIES 4/8MB	\$153/\$325
IBM 6450128 4MB	\$153	NCR 386SX/1S & 486/MC 8MB	\$281
IBM 6450128 8MB	\$325	NEC POWERMATE 386/25e 8MB	\$312
IBM 6450130 8MB	\$325	SUN X104C/PC/11+ 4MB	\$156
IBM 6450803 1MB	\$48	SUN ELC 4MB/18MB	\$153/\$585
IBM 6450804 2MB	\$78	SUN SLC 4/20 4MB	\$153
CPQ DESKPRO 4MB/8MB	\$135/\$260	SUN SPARCSTATION 18MB	\$585
CPQ DESKPRO 386e 4MB	\$153	ZENITH 386 1MB/2MB	\$48/\$79
CPQ PROLINEA 4/33 8MB	\$294	ZENITH Z-STATION4MB/16MB	\$153/\$585

PCMCIA SRAM MEMORY

AST PowerExec, AST PenExec, AT&T NCR Safari, CANON NoteJet, DAUPHIN 5500 Color Pentop, DECpc 325SL, DELL 320SL, EO 440, FUJITSU 325 Point, FUJITSU Poquet PC, FUJITSU PoquetPad, GRID GridpadHD, GRID Convertible, GRID Palmpad, HP 95LX, HYUNDAI Courier, IBM Thinkpad 710T, IBM PC RADIO, MEMOREX Commuter, MOMENTA Pentop, NCR 3130, NCR 3170, NEC UltraLite Autograph, NEC UltraLite Versa, OLIVETTI Quademo, OMRON Toucan, PI Info, SAMSUNG PenMaster, SHARP PC-3000/3100/6700/6741/6781/6785/6900/6941/6981/6981, TOSHIBA Dynapad T100X, ZENITH Z-Lite 320L, ZEOS Pocket PC

512K \$87 1MB \$135 2MB \$244

COMPAQ LAPTOP MEMORY

CONTURA 2MB/4MB/8MB	\$98/\$145/\$288
LTE386e/20 1MB/4MB	\$ 88/\$158
LITE 486 4MB/8MB/16MB	\$189/\$332/\$5948
LITE/20 & LITE/25 1MB/4MB/8MB	\$ 88/\$158/\$299
PORTABLE 486 & 486C 2MB/4MB/8MB	\$79/\$153/\$325
LTE/286 1MB/2MB/4MB	\$45/\$91/\$150
SLT386e/20 4MB	\$163

FULLY-CONFIGURED NOTEBOOKS

AST PREMIUM EXEC 386SX/20 200MB LCD W/ 8MB	\$1923
AST POWEREXEC EL 386/25SL 60MB LCD W/ 10MB	\$1603
AST POWEREXEC EL 386/25SL 60MB LCD W/ 10MB	\$1779
AST POWEREXEC EL 386/25SL 120MB LCD W/ 12MB	\$2131
AST POWEREXEC 3/25SL 60MB LCD W/ 12MB	\$2131
AST POWEREXEC 3/25SL 80MB LCD W/ 12MB	\$2395
AST POWEREXEC 3/25SL 120MB LCD W/ 12MB	\$2571
AST POWEREXEC 3/25SL 80MB ACTIVE COLOR W/ 12MB	\$3275
AST POWEREXEC 486/25SL 200MB ACTIVE COLOR W/ 12MB	\$3715
AST POWEREXEC 486/25SL 80MB LCD W/ 12MB	\$2562
AST POWEREXEC 486/25SL 120MB LCD W/ 12MB	\$2738
AST POWEREXEC 486/25SL 200MB W/ 12MB	\$3002
AST POWEREXEC 486/25SL 80MB ACTIVE COLOR W/ 12MB	\$4058
AST POWEREXEC 486/25SL 120MB ACTIVE COLOR W/ 12MB	\$4234
AST POWEREXEC 486/25SL 200MB ACTIVE COLOR W/ 12MB	\$4489
***** GRID CONVERTIBLE 125MB W/ 8MB *****	\$3505
IBM THINKPAD/300 386SL/25 80MB LCD W/ 12MB	\$2094
IBM THINKPAD/300 386SL/25 120MB LCD W/ 12MB	\$2282
IBM THINKPAD/700 486SLC/25 80MB LCD W/ 16MB	\$2987
IBM THINKPAD/700 486SLC/25 120MB LCD W/ 16MB	\$3154
IBM THINKPAD/700C 486SLC/25 120MB ACTIVE COLOR W/ 18MB	\$4481
NEC ULTRALITE VERSA 486SL/20C/120MB ACTIVE COLOR W/ 12MB	\$4325
NEC ULTRALITE VERSA 486SL/25 120MB LCD W/ 12MB	\$3374
NEC ULTRALITE VERSA 486SL/25 180MB LCD W/ 12MB	\$3623
NEC ULTRALITE VERSA 486SL/25C 120MB ACTIVE COLOR W/ 12MB	\$4492
NEC ULTRALITE VERSA 486SL/25C 180MB ACTIVE COLOR W/ 12MB	\$4741
PANASONIC CF-370 386SX 60MB LCD W/ 5MB	\$CALL
SHARP PC-6340 386SX 386/20 40MB LCD W/ 2MB (CLOSEOUT)	\$1000
TEXAS INSTRUMENTS TM3000/120MB LCD W/ 6MB (CLOSEOUT)	\$CALL
TOSHIBA T1800 386SX/20 80MB LCD W/ 10MB	\$1433
TOSHIBA T1850 386SX/25 80MB LCD W/ 12MB	\$1693
TOSHIBA T1850 386SX/25 120MB LCD W/ 12MB	\$1921
TOSHIBA T1850C 386SX/25 80MB PASSIVE COLOR W/ 12MB	\$2388
TOSHIBA T1850C 386SX/25 120MB PASSIVE COLOR W/ 12MB	\$2539
TOSHIBA T3300SL 386SL/25 120MB LCD W/ 18MB	\$2740
TOSHIBA T4400SX 486SX/25 120MB LCD W/ 18MB	\$3007
TOSHIBA T4400SX 486SX/25 120MB LCD W/ 18MB	\$3388
TOSHIBA T4400SX 486SX/25 200MB LCD W/ 18MB	\$3485
TOSHIBA T4400SX 486SX/25 200MB LCD W/ 18MB	\$3847
TOSHIBA T4400C 486SX/25 120MB ACTIVE COLOR W/ 20MB	\$4049
TOSHIBA T4400C 486SX/25 200MB ACTIVE COLOR W/ 20MB	\$4527
TOSHIBA T4400C 486SX/25 200MB ACTIVE COLOR W/ 20MB	\$4411
TOSHIBA T4400C 486DX/25 200MB ACTIVE COLOR W/ 20MB	\$4745
TOSHIBA T4500 486SX/20 80MB LCD W/ 12MB	\$2828
TOSHIBA T4500 486SX/20 120MB LCD W/ 12MB	\$3002
TOSHIBA T4500C 486SX/20 120MB ACTIVE COLOR W/ 12MB	\$4223
TOSHIBA T5100 386/DX-18 100MB GAS PLASMA W/ 4MB	\$1988
TOSHIBA T6400 486/DX-20 200MB GAS PLASMA W/ 38MB	\$5171
TOSHIBA T6400C 486/DX-20 200MB ACTIVE COLOR W/ 36MB	\$7149
ZENITH NOTEBOOKS (ALL MODELS)	\$CALL

NOTE: Please call for models not listed.

TOSHIBA T4400/T1800
INTERNAL 14400B FAX with
14400B MODEM \$493.00

MATH COPROCESSORS
80287-10/12 \$ 64
80387SX-25 \$ 80
80387DX-33 \$ 81

SHARP PC-6700, 6741, 6781,
6785, 6800, 6881, 6891 RAM
UPGRADES 2MB/4MB \$LOW

We are listed in the TOSHIBA
TECHNICAL INFORMATION GUIDE
as "the most expensive memory
manufacturer approved for Toshiba
laptops and notebooks."

TOSHIBA T1200XE/T3100SX
2MB \$79 4MB \$168
TOSHIBA T4400/T6400
2/4/8/16MB \$95/\$156/\$288/\$638
TOSHIBA T5200/T5200C/T8500
2MB/8MB \$98/\$315
TOSHIBA T3300SL
2/4/8/16MB \$89/\$156/\$221/\$638

TOSHIBA T4400
213MB INTERNAL HARD DRIVE
UPGRADE KIT IN STOCK !!!
EXTERNAL HARD DRIVE KITS
(19 OZS. BATTERY-POWERED)
20, 40, 60, 80, 130, AND 213MB
SIZE-PERFECT FOR LAPTOPS

TOSHIBA T5200
486 CPU UPGRADE
NOW IN STOCK.

APPLE POWERBOOK MEMORY

	2MB	4MB	6MB	8MB	10MB
100	\$94	\$169	\$247	X	X
140	\$94	\$143	\$228	X	X
145	\$94	\$143	\$228	X	X
170	\$94	\$143	\$228	X	X
160	X	\$182	\$280	\$338	\$416
180	X	\$182	\$280	\$338	\$416
210	X	\$182	\$273	\$338	\$442
230	X	\$182	\$273	\$338	\$442

ALL MEMORY UPGRADES
COME WITH A LIFETIME
WARRANTY & A 48 HOUR
EXCHANGE GUARANTEE!

IBM LAPTOP MEMORY

CL575X 2MB/4MB/8MB	\$150/\$190/\$344
LA05X/N335X 2MB/4MB/8MB	\$275/\$163/\$278
N615X/N615C 4MB/8MB	\$163/\$278
THINKPAD 300 2MB/8MB	\$113/\$311
THINKPAD 700/700C/8MB/6MB	\$198/\$344
THINKPAD 700/710T 4MB/8MB	\$163/\$278
PC RADIO PCMCIA SRAM 512K TD 2MB	

SE HABLE ESPANOL
pregunte por Hector

tote-a-lap

550 Pilgrim Drive, Ste.F, Foster City, CA 94404

PHONE : (415)578-1901 FAX: (415)578-1914

ORDERS ONLY : 1-800-9-LAPTOP

(PRIOR APPOINTMENTS ARE NEEDED FOR WILL-CALLS, PLEASE)

TERMS AND CONDITIONS: All sales final. We charge a 25% re-stocking fee on all resold shipments and pre-approved returns. Prices are subject to change without notice, and reflect all cash discounts. Warranty on all merchandise, except memory upgrades, is thru the original manufacturer only, unless previously agreed upon and stated on our invoice. All software, plus all merchandise that include a rom bios, are not returnable for credit, and are subject to an even exchange only. We accept purchase orders from credit-worthy institutions, although prices may be slightly higher on some items. We will not ship to any account with an overdue balance. Purchase prices at the time of sale are final. Memory upgrades guaranteed 100% compatible or your money back. You have NO RISK buying our CONTROL memory upgrades. **ALWAYS INSIST ON CONTROL.**

MEMORY !! MEMORY !! MEMORY !!

ACER 486sx - 16MB SIMM (4M X 36)	\$ 599.00
32MB SIMM (8M X 36)	\$ 1,399.00
AMI EZ-FLEX - 64MB KIT (4 SIMMS)	\$ 2,699.00
AMIGA 2000 - 16MB SIMM	\$ 539.00
AST BRAVO 486LC - 16MB SIMM	\$ 539.00
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	\$ 479.00
MAC IIfc,IIfcx,IIfsi,QUADRA 900 - 16MB SIMM	\$ 479.00
MAC QUADRA 700 & SE/30 - 16MB SIMM	\$ 529.00
NeXT TURBO - 16MB SIMM	\$ 529.00
SUN IPX,ELC - 16MB SIMM	\$ 549.00
SUN SPARC SERVER - 256MB KIT	CALL

OTHER MEMORIES AVAILABLE...

IBM	COMPAQ	HP	LAPTOPS
PS/1 - 2MB \$ 68	DP 386/20,20E,25 - 1MB \$ 66	Vectra QS-16 - 2MB KIT \$ 129	AST EXEC. NB - 4MB \$ 119
4MB \$ 149	4MB \$ 159	4MB KIT \$ 229	COMPAQ LTE386 - 4MB \$ 209
M30 - 2MB \$ 79	DP 386S/16 - 1MB \$ 66	Vectra 486 - 2MB \$ 79	SLT386 - 4MB \$ 168
M50Z,55sx,65sx,70 - 1MB \$ 45	4MB \$ 159	4MB \$ 135	DELL 316,320 LT - 2MB \$ 99
2MB \$ 79	DP 286N,386N,S/20 - 4MB \$ 135	8MB \$ 269	EVEREX TEMPO - 2MB \$ 78
M55sx,65sx,70 - 4MB \$ 135	M-SYSTEMS - 2MB \$ 79	X-Station 700 Ser. - 2MB \$ 89	IBM L40sx - 4MB \$ 135
M70-A21,A61,121 - 2MB \$ 79	4MB \$ 135	4MB \$ 149	MAC POWERBOOK - 2MB \$ 104
M40sx,35sx - 8MB \$ 269	8MB \$ 299	8MB \$ 299	NEC P.S. 286,386sx - 4MB \$ 200
M57sx,90,95 - 4MB \$ 135	DP 386/33,486/25 - 2MB \$ 96	9000/400t,425t - 8MB KIT \$ 495	P.S. 386 - 8MB \$ 429
8MB \$ 269	SystemPro - 8MB \$ 269	16MB KIT \$ 999	P.S. SX/20 - 4MB \$ 200
M80-041 - 1MB \$ 65	OK Exp Brd \$ 335	32MB KIT \$ 1869	PANASONIC CF170 - 1MB \$ 55
M80-111,121,311 - 2MB \$ 99	DP 386S/16 1MB Exp Brd \$ 105	9000/425e - 8MB KIT \$ 428	T.I. TRVL-MT 3000 - 2MB \$ 80
M80-A21,A31 - 4MB \$ 180	DP 386/20,20E,25,25E 1MB Exp. Board \$ 105	16MB KIT \$ 828	TOSHIBA 1000 - 2MB \$ 108
16-BIT OK Exp Board \$ 128			2000SXE - 8MB \$ 388
32-BIT OK Exp Board \$ 128			3200SXC - 4MB \$ 160
			5200 - 8MB \$ 315
AST	DELL	APPLE	PRINTERS
PREM. 386/20C - 1MB KIT \$ 65	325D,P;333D,P - 1MB \$ 41	Ii,SE,SE/30 - 1MB \$ 32	EPSON 6000 - 4MB \$ 229
PREM. 386/25 - 1MB \$ 45	4MB \$ 135	Classic - 1MB Exp. Board \$ 54	HP IIP,III,III,P - 2MB \$ 108
PREM. 486/25 - 1MB \$ 45	420,425,433 - 2MB KIT \$ 82	SE/30,IIfc,IIfcx,IIfsi,LC & Quad. 700,900 - 4MB \$ 115	IIfsi - 4MB \$ 135
PREM. II 486 - 1MB \$ 41	4MB KIT \$ 158	Quad. 700,900 - 32MB KIT \$ 1120	IBM 4019,4029e - 3.5MB \$ 129
4MB \$ 139	8MB KIT \$ 270	IIfx - 16MB KIT \$ 499	4029 - 4MB \$ 135
8MB \$ 277	450DE,450SE - 2MB KIT \$ 82	IIfx - 32MB KIT \$ 1156	OKIDATA 400 - 2MB \$ 129
8MB KIT \$ 278	4MB KIT \$ 158	Quadra 256K V-RAM \$ 27	
PREM. II 1MB Exp Board \$ 469	8MB KIT \$ 270	LC 512K V-RAM \$ 44	

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



EMBARCSM, 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.

In over 200 cities in the U.S. and Canada, you're 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

HeadsUpTM targeted industry news briefs from

INDIVIDUAL, Inc. You can even have your important databases routinely updated—automatically!

All you need 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. Pay as little as \$395, install it in minutes and you're ready to go—without wires, faxes or phones.

Equip your whole team to receive 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.

EMBARCSM

Circle 204 on Inquiry Card (RESELLERS: 205).



Motorola and NewsStream are trademarks of Motorola, Inc. EMBARC is a servicemark of Motorola, Inc. © Motorola, Inc. 1992



DEDICATED OUTSTANDING LEADERS

HEWLETT-PACKARD
& MANCHESTER

INTRODUCING THE
NEWEST
INNOVATIVE PRINTER

THE
**HEWLETT-PACKARD
LASERJET 4Si
PRINTER**

**FAST, EXPANDABLE
LASER PRINTER
IDEAL FOR
MULTIPLE USERS**



- Fast Printing at 17 Pages Per Minute
- High Quality 600dpi output
- High Volume 75,000 Page Per Month Duty Cycle
- 2 MB RAM Standard, Upgradeable to 34MB
- Expandable and Flexible - Excellent for Networks
- High Volume Dual-Bin Paper Handling
- Optional Adobe PostScript Level 2, Automatic Language Switching, and Resource Saving
- Optional Duplex Printing, 1,500 Sheet Paper Feeder, 2,000 Sheet Output Stacker and Power Envelope Feeder

SYSTEMS INTEGRATION
NETWORKING CONNECTIVITY
CAD/CAM RISC/UNIX



**HEWLETT
PACKARD**

Authorized Dealer

MANCHESTER EQUIPMENT COMPANY, INC.

"The Computer Supply and Equipment Experts"

50 MARCUS BLVD. ■ HAUPPAUGE, NY 11788 ■ (516) 435-1199 ■ (212) 629-6677
New York City: (212) 629-6969 ■ Boca Raton: (407) 241-7900 ■ Tampa: (813) 888-8809 ■ Boston: (617) 455-8300

Circle 537 on Inquiry Card.

**IF YOU READ THIS AD,
THEN YOU'RE ONE OF
BYTE'S 500,000 READERS
WHO IS:**

- **INFLUENTIAL**
- **AUTHORITATIVE**
- **TECHNICALLY-ADVANCED**
- **KNOWLEDGEABLE**
- **INNOVATIVE**



AND MOST OF ALL . . . BUSY!

When you want to buy, turn to the **BYTE Buyer's Guide** in the back for fast access to buying direct from reputable suppliers. From computers to CAD, notebooks to networks, memory to mathematics, you'll find it in the **BYTE Buyer's Guide**.

Tell 'em you saw it in BYTE!

PC-UNIX Connectivity from UniPress Software

XVision • Tens of Thousands Sold!

Inexpensively Add X Windows to your MS Windows PC

Best selling Microsoft Windows X server! Less expensive and better than an X terminal - run X and DOS applications simultaneously. Even run X applications over serial lines with XRemote. Support for MS Windows 3.1, X11R5, DECnet, up to 16 million colors, and 2-way copy-and-paste of graphics and text between X and DOS. Can be combined with PC-Connect for full desktop integration. Supports a wide variety of networks: PC/TCP, Chameleon, PC-NFS, Novell, DECnet and others. Price \$449, 5-pack \$1,800. FREE PHONE SUPPORT!

DOS X Server - **XoftWare** - Turns your DOS PC into an X Windows terminal. \$395.

Mac or NeXT X Servers - **eXodus** - Add X Windows to your Mac or NeXT. \$295.

Mail-it • NEW!

MS Windows Access to UNIX e-mail WITHOUT Gateways

Mail-it is a Microsoft Windows application that allows users on PCs to link straight into the UNIX e-mail network. Mail-it is superior to other e-mail products because it doesn't require expensive and inefficient gateways, and uses standard UNIX mail messaging protocols. Mail-it allows users to connect transparently from their familiar Windows environment to the more than 30 million Internet mailboxes worldwide. Mail-it Remote serial line version is also available for remote dial-up access. Priced from \$140 per user.

PC-Connect

Integrate UNIX with MS Windows

Run local PC and remote UNIX or VMS applications simultaneously by clicking on MS Windows icons. Extensive terminal emulation, copy-and-paste, remote printing, file transfer, and Dynamic Data Exchange (DDE). Full support for VMS hosts, Dynacomm and CrossTalk, dynamic keyboard mapping, streamlined installation and enhanced 3-D look-and-feel. Can be combined with XVision. Uses either serial connection or Ethernet. Priced from \$445 for one user, \$205/user for a ten-pack.

SQL-Retriever Option - MS Windows access to Oracle, Informix, Ingres, Interbase, etc. Price \$2.295 for unlimited users.

Chameleon

Smallest, Fastest TCP/IP Networking for MS Windows

The only TCP/IP networking package implemented as 100% DLL, making it the smallest and fastest TCP/IP networking package for MS Windows. Fully integrated TCP/IP applications for Windows are provided, including telnet, ftp and tftp file transfer. NFS option allows DOS disks to be attached to UNIX systems and UNIX disks to be attached to DOS systems. You can even back up your whole DOS network on high-capacity UNIX tape drives. Super easy Windows installation takes just minutes. Ideal for use with XVision and PC-Connect. Priced from \$400.

SoftNet • NEW!

Novell UNIX Server

Enables Sun, HP and SGI computers to act as Novell NetWare 2.2 or 3.1 servers, providing file and print sharing, and more. UNIX disk partitioning is not required; NetWare clients map UNIX directories directly. SoftNet gives you everything you need - no additional purchases are required. Priced from \$1,295 for 16 concurrent NetWare connections.

Novell UNIX Client

Allows your Sun, HP and SGI computers to access and mount NetWare servers as NetWare-compatible clients. Single-user \$395; 5-pack \$1,495.

Stand-alone SoftNet Print and SoftNet Term also available.

PC2X

MS Windows Display on your UNIX Workstation

Run your MS Windows/DOS computer from your UNIX workstation. Ideal for network management, central helpdesks, remote access to your PC applications and as a migration path. Protects PC hardware investment. The DOS computer displays in an X window. PC applications run without slowing your workstation. Run several PC2X windows to work on multiple PCs simultaneously. Copy-and-paste between DOS and UNIX applications. Supports TCP/IP or serial. Starter pack \$695.

PC/TCP

Comprehensive TCP/IP Ethernet Software for PCs

Provides DOS-DOS or DOS-UNIX networking. Runs under DOS or Windows. Includes over 30 TCP/IP applications - ftp, telnet, rlogin and many more. Remote printing: print DOS files on your UNIX printer and UNIX files on your DOS printer. Includes Interdrive support so DOS files can reside on large UNIX disks. Ideal for XVision, PC-Connect, XoftWare, PC2X, Mail-it. Price \$400.

UniPress. A tradition of UNIX software, support and service since 1983.

800-222-0550 • 908-287-2100

2025 Lincoln Highway, Edison, New Jersey 08817

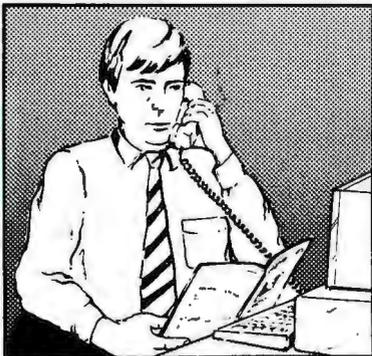
Fax: 908-287-4929 • e-mail: info@unipress.com

All product names are trademarks and registered trademarks of their respective companies.

U N I P R E S S S O F T W A R E

Buy with

Confidence



In an effort to make your telephone purchasing a more successful and pleasurable activity, The Microcomputer Marketing Council of the Direct Marketing Association, Inc. offers this advice, "A knowledgeable buyer will be a successful buyer." These are specific facts you should know about the prospective seller before placing an order:

Ask These Important Questions

- How long has the company been in business?
- Does the company offer technical assistance?
- Is there a service facility?
- Are manufacturer's warranties handled through the company?
- Does the seller have formal return and refund policies?
- Is there an additional charge for use of credit cards?
- Are credit card charges held until time of shipment?
- What are shipping costs for items ordered?

Reputable computer dealers will answer all these questions to your satisfaction. Don't settle for less when buying your computer hardware, software, peripherals and supplies.

Purchasing Guidelines

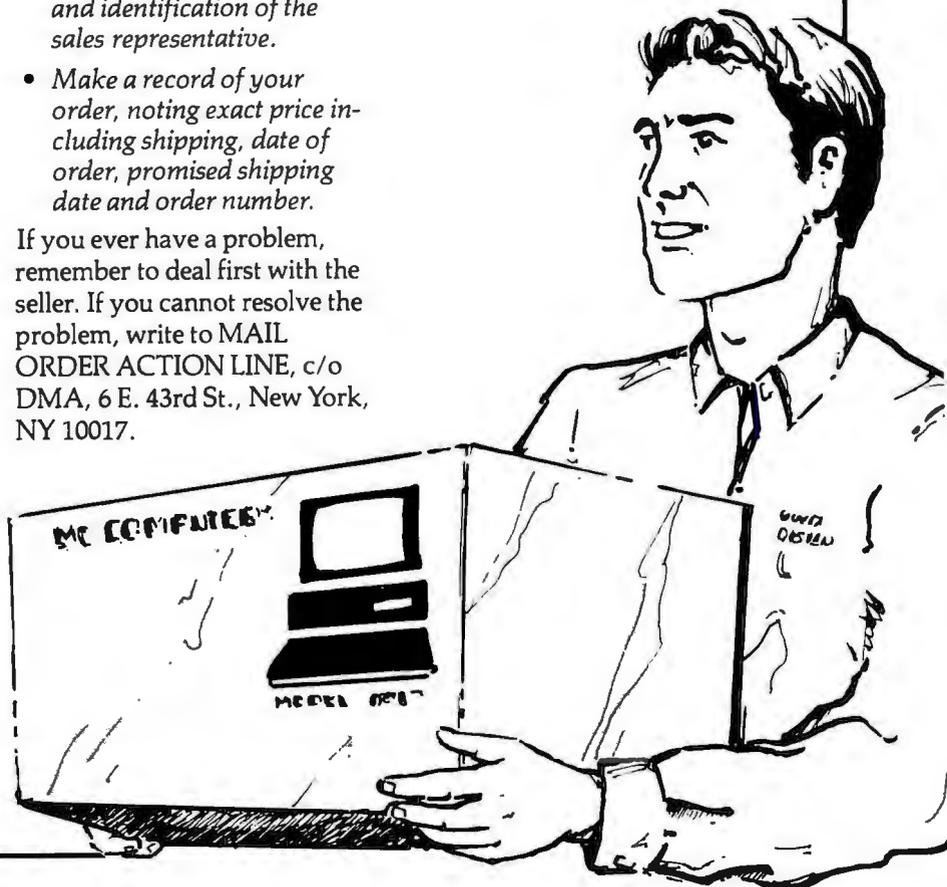
- State as completely and accurately as you can what merchandise you want including brand name, model number, catalog number.
- Establish that the item is in stock and confirm shipping date.
- Confirm that the price is as advertised.
- Obtain an order number and identification of the sales representative.
- Make a record of your order, noting exact price including shipping, date of order, promised shipping date and order number.

If you ever have a problem, remember to deal first with the seller. If you cannot resolve the problem, write to MAIL ORDER ACTION LINE, c/o DMA, 6 E. 43rd St., New York, NY 10017.

This message is brought to you by:

the MICROCOMPUTER
MARKETING COUNCIL
of the Direct Marketing
Association, Inc.
6 E. 43rd St.,
New York, NY 10017

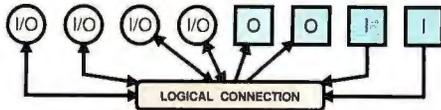
MMC
MICROCOMPUTER
MARKETING COUNCIL
of the Direct Marketing Association, Inc.



PRINTER SHARING & MEMORY

800-238-9415

I/O = input /output
 ○ = serial
 □ = parallel



- LCX-1000 (1Mb)** \$495
8 ports; 4 serial I/O; 57,600 bps
2 parallel in, 2 parallel out
- LC-256 (256Kb)** \$375
- LC-512 (512Kb)** \$425
8 ports; 4 serial I/O; 19,200 bps
2 parallel in, 2 parallel out
- LXFR-ETC** \$49
Windows & OS/2 File Transfer
4 user license, for LC or LCX
- PB-42PP-256Kb** \$199
- PB-42PP-1Mb** \$249
6 parallel ports; 4 in / 2 out
Upgradable to 4Mb; 25,000 cps
- LC-41PAS** \$69
5 parallel ports; 4 in / 1 out
Smart-switch; 25,000 cps
- LC Jr.-256 (256Kb)** \$199
- LC Jr.-512 (512Kb)** \$249
5 ports; 4 serial in, 1 parallel out
Up to 115,200 bps
- SPPS** \$49
9600 bps to 115,200 bps
Serial / Parallel Converter
- PB-11PP-1Mb** \$199
2 parallel ports; 1 in / 1 out
Upgradable to 16Mb; 75,000 cps



- PCMCIA 2.0 SRAM Cards:**
 512Kb - \$120, 1Mb - \$175, 2Mb - \$295
- Toshiba:**
 1000XE/SE/LE, 1800, 1850,
 2000,2000SX/SXE, 2200SX
 2Mb - \$90, 4Mb - \$150, 8Mb - \$275
 3300SL
 4Mb - \$150, 6Mb - \$225
 4400SX
 4Mb - \$150, 8Mb - \$275
- Powerbook & MAC:**
 100/140/145/170/160/165/180
 6Mb - \$250, 8Mb - \$310, 10Mb - \$390
 DUO 210/230:
 6Mb - \$260, 8Mb - \$320, 10Mb - \$410
 Cent.610/650, Quad.800, LCIII
 4Mb - \$145, 8Mb - \$260
- MAC SIMMs (70ns.):**
 1x8 - \$32, 4x8 - \$124, 16Mb - \$495

LOGICAL CONNECTION® 4660 Portland Road NE #108 Salem, OR 97305-1658 Tech.: (503) 390-9375 FAX: (503) 390-9372

BYTE BACK ISSUES FOR SALE

	1990	1991	1992	1993
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				
Special Issues	IBM	Outlook '92	Windows Portability	Windows '93

Windows '93 U.S. Delivery \$4.00 Foreign \$5.00
 Windows-Portability '92 U.S. Delivery \$3.00 Foreign \$4.00
 1990-91-92-93 U.S. Delivery \$6.00 Foreign \$8.00 Canada & Mexico \$6.50

The above prices include postage in the US. European customers please refer to Back Issue order form in the International Advertising section of the 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

Issues Available



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

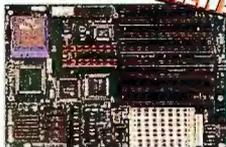


MOTHERBOARDS

VESA LOCAL BUS 486DX

\$599

NEW VALUE



- 33MHz 80486DX
- 128Kb cache expandable to 256Kb
- Uses 256K, 1M or 4M x 9 80ns SIMMs (20K installed)
- Two VL Bus/16-bit slots and six 16-bit slots
- Advanced AMI BIOS with shadow RAM

MCT-486VL-33	33MHz VESA Local Bus	\$599.00
MCT-486VL-66	66MHz VESA Local Bus	\$899.00
MCT-M486-50E	50MHz EISA w/cache	\$999.00
MCT-M486-50	50MHz cache 486	\$799.00
MCT-M486-33	33MHz cache 486	\$549.00
MCT-M486SX-25	25MHz cache 486SX	\$399.95
MCT-C386-40	40MHz cache 386	\$299.95
MCT-C386-33	33MHz cache 386	\$249.95
MCT-M386SX-33	33MHz 386SX	\$169.95

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

2400 BAUD MODEM

- Internal data modem
- Hayes AT command-set compatible
- Configure as COM1-COM2



MCT-241 \$49.95

14,400 BPS INTERNAL FAX/MODEM

- 14,400/9600/4800/2400/300
- Hayes AT command set, V.42bis/V.42/V.32, Group III fax compatible



MCT-1441F \$199.95
 MCT-1441F+ Above with 16550 UART \$229.95
 VIVA-144EF 14,400 baud external version \$299.95

CALL FOR YOUR FREE
 JDR CATALOG TODAY!
 CALL 800-538-5000

DYNAMIC RAM

PART #	SIZE	SPEED	TYPE	PRICE
41256-80	256K x 1	80ns	DIP	1.95
414256-80	256K x 4	80ns	DIP	5.49
1MB-80	1M x 1	80ns	DIP	4.99
1MB-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



PART #	SPEED	PRICE	PART #	SPEED	PRICE
8087-2	8MHz	129.95	80387-SXP	≤25MHz	74.95
8087	5MHz	89.95	80387-DXP	≤33MHz	79.95
80287-XL	12MHz	74.95	80487-SX	≤25MHz	369.95

OVERDRIVE CO-PROCESSORS



ODP486-SX20	.....	\$329.95
For 20MHz 486SX OverDrive socket		
ODP486-SX25	.....	\$459.95
For 25MHz 486SX OverDrive socket		
ODP486-DX25	.....	\$459.95
Replace 25MHz 486DX with 50MHz DX2		
ODP486-DX33	.....	\$589.00
Replace 33MHz 486DX with 66MHz DX2		
ODP486-DX33	.....	\$589.00
66MHz 486DX for OverDrive socket		

NEW LOWER PRICES!

486 COOLING FAN

Make your CPU run cooler!
 Easy snap-in installation.



486-FAN \$29.95
 486-FAN-R Above fan w/electronic refrigeration .. \$49.95

POST CODE DISPLAY CARD

- 8-bit 286/386/486 PC compatible card
- Displays power on self-test code
- Works when software won't even boot
- Supports AMI, Award, Phoenix and IBM AT BIOS



PCODE \$49.95

LOGICLAB EXPLORER

- Transforms your PC into a complete environment for testing & simulating digital logic circuits
- Library includes most common 74LS and CMOS ICs
- Logic analyzer includes 16 logic probes



LOGICLAB \$49.95

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 +I/O decode .. \$79.95
 PDS-611 16-bit breadboard-on-a-card +I/O decode \$89.95

EPROM PROGRAMMER

- 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



MOD-MEP-1A \$199.95
 MOD-MEP-4A As above with 4 ZIF sockets \$269.95

UNIVERSAL PROGRAMMING SYSTEM

- Programs EPROMS and CMOS
- Tests TTL & CMOS devices, Static & Dynamic RAM

MOD-EMUP \$699.00

EPROM ERASER \$39.95

- Quickly and simultaneously erases up to 4 standard EPROMs



DATARASE II \$39.95

LOW-COST WINDOWS ACCELERATOR

- 286/386/486 PC compatible
- 1280 x 1024 in 16 colors
- 1024 x 768 in 256 colors
- 1Mb DRAM installed
- Automatic video mode switching
- 16-bit bus



MCT-VGA-5000 Windows Accelerator \$149.95
 MCT-VGA-1000 800x600, 256Kb DRAM \$49.95
 MCT-VGA-3000 1024x768, 512Kb DRAM \$89.95
 MCT-VGA-4000 1024x768, 1Mb DRAM \$129.95

3-BUTTON MOUSE

NEW VALUE \$14.95

- Accuracy 290-1450 DPI
- Opto-mechanical design
- Windows 3.1 compatible



JDR-MOUSE-3 \$14.95
 MOUSE-PAD \$4.95
 MCT-GAME Dual part game part \$29.95
 JSTK-300 Joystick \$9.95
 JSTK-500 Pilot-style joystick \$19.95

250MB TAPE DRIVE

\$199.95

- 250Mb with DC2120 tape (using data compression)
- Transfers up to 6.7Mb/minute
- 8088 and 286/386/486 compatible
- 5-1/4" internal half-height



DJ-20 \$199.95
 DJ-10 120Mb capacity tape drive \$179.95
 DC2120 Extra tape cartridge \$19.95

SOUNDMACHINE

- 8088 and 286/386/486 compatible card
- 2 shielded speakers & joystick
- 3.5mm microphone
- Built-in 4W amplifier



SOUNDMACHINE \$119.95

INTERNAL CD-ROM DRIVE \$249.95

- 350ms access time
- MPC and PhotoCD compatible
- 150Kb-175Kb/second transfer
- With 286/386/486 compatible card



CDROM-I \$249.95
 CDROM-E External version \$349.95

OVER 70 CD TITLES IN STOCK FROM \$19.95!

MULTI I/O CARD WITH IDE FLOPPY/HARD CONTROL

\$99.95

- 16-bit 286/386/486 compatible
- Supports 2 IDE hard drives & 2 floppy drives (360Kb-1.44Mb)
- 448bps max baud rate



MCT-IDEIO+ With 16550-com. serial I/O ports \$99.95
 MCT-IDEIO With 16450-com. serial I/O parts \$69.95
 MCT-CIDEFH Cache IDE and I/O controller \$199.95
 MCT-IDEFH IDE Floppy/Hard Controller \$29.95
 MCT-AIO Serial/parallel/game port card \$49.95
 MCT-AIO+ Two NS16550 serial/par/game port \$89.95
 SOUNDBLAST-PD SoundBlaster Pro Deluxe \$139.95
 MCT-SOUND 8-bit sound card \$49.95

TEAC COMBO DRIVE

- 5-1/4" and 3-1/2" half-height, supports 360Kb-1.44Mb diskettes.



FD-505 Beige \$149.95
 FDD-1.44A 1.44Mb, 3.5", Beige \$79.95
 FDD-1.44X 1.44Mb, 3.5", Block \$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

120MB DISK KIT



- CP-30104 120Mb, 19ms IDE hard drive, 16-bit floppy/hard disk controller, cables and instructions



HDKIT-120 \$279.00

IDE HARD DRIVES

PART #	BRAND	CAP.	SPEED	TYPE	PRICE
CP-30084	Conner	84Mb	19ms	3-1/2" IDE	\$229
ST-3096A	Seagate	88Mb	16ms	3-1/2" IDE	\$259
CP-30104	Conner	120Mb	19ms	3-1/2" IDE	\$259
ST-3144A	Seagate	131Mb	16ms	3-1/2" IDE	\$289
CP-30204	Conner	212Mb	12ms	3-1/2" IDE	\$399



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.



Add-In Boards

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

\$150.00
(16-Bit HBA/Cntl)

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

\$175.00

(16-Bit HBA/Cntl w/Option Pkg.)

CONTROL CONCEPTS INC.
(703) 876-6444 • (703) 876-6416 Fax



See us at COMDEX, Booth #4239, Exhibit Hall D



Government, Educational and Corporate Discounts Available
Dealer Inquiries Welcome



Circle 253 on Inquiry Card.

MIRRORING - CACHING - SCSI

HOST BUS ADAPTER/CONTROLLER

FEATURES:

- ◆ Transparent disk mirroring for all operating systems.
- ◆ No special drivers required for ANY operating system.
- ◆ Supports 2 to 16 Megabytes of user installed cache memory.
- ◆ SCSI interface supports up to 7 devices including tape, CD-ROM, WORM and R/W OPTICAL devices.
- ◆ PC/AT compatible floppy disk interface.

The LDP CACHE IV provides unequalled performance in systems requiring data redundancy. The LDP CACHE IV provides data redundancy through disk mirroring (RAID 1) support built into the controller. For systems only requiring high performance, the LDP CACHE IV provides outstanding performance with its disk caching. LOMAS DATA PRODUCTS has 13 years experience designing high performance disk controllers for micro computer applications. Buy the best, buy the LDP CACHE IV.



LOMAS DATA PRODUCTS, INC.
420 Maple Street, #2
Marlboro, MA 01772

508-460-0333 508-460-0616 FAX

Circle 221 on Inquiry Card (RESELLERS: 222).

Add-In Boards

.....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.
- **Dual Mode Emulation Models** (PCF, PCM/2, PCE/2)
- **Autoboot Capabilities**, all models
- **MS DOS/DR DOS/E-Venix OS Support**
- **High Capacity Models** (PCF/PCM)
- **NEW! PCMCIA models** (PCM, PCM/2) and accessories
- **Low Cost Models** (FERO/E/2-SR/Special OEM)

.....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

Circle 208 on Inquiry Card.

*Call us for
Unsurpassed
Choices...*



MULTI-PORT SERIAL I/O CONTROLLERS



Multiple Benefits:

- 2 to 128 serial ports on a single PC
- Standard or high performance communications
- Support for a broad spectrum of interfaces and operating systems
- Ideal for office automation, factory automation or P.O.S. applications
- Benefit from Star Gate's *total value*: a synergy of *Product-Price-Service-Support*
- *Compatibility: ISA, EISA, MCA; RJ-12, DB-25, DB-9; RS-232, RS-422, RS-485; speeds up to 115.2 Kbaud; Unix, Xenix, DOS, OS/2 and Windows.*

Call now: 1-800-782-7428



*People and products
you can depend on.*

Star Gate Technologies, Inc.
29300 Aurora Rd., Solon,
OH, 44139 • (216) 349-1860
FAX: 216-349-2056

Circle 243 on Inquiry Card.

Direct Stepper Drive from PC

- No external DC supply or translators required
 - Free 2D/3D interpolation software
 - Free HPGL converter
- SA703 \$249
Drives two 1/2 amp motors
- SA704 \$995
Drives two motors up to 6 amps
- Call (613) 359-1029
FAX (613) 359-1147



P.O. Box 188, ELCIN, Ontario,
CANADA K0G 1E0



Portable Bar Code Readers



TimeWand 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

See us at **COMDEX Spring, booth #M5540**
 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 236 on Inquiry Card.

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.



Fast
ORDER TOLL-FREE 800-282-4835

GTEK INC.

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 213 on Inquiry Card.

REAL TIME INFORMATION
 24 Trucks LOADED
 QUALITY
 FOR MORE INFORMATION CALL (800) 728-9402

Circle 257 on Inquiry Card.

New for Windows 3.1!

It's Voice Mail.
 It's Fax-on-demand.
 It's an Applications Generator.
 It's \$495 for board and software.
 It's **PhoneOffice**.

PhoneOffice application window running in Windows 3.1. Configure for Auto-Attend, Message Centre, Fax-on-demand, Message Forwarding, Paging Scheduling, Fax-scanner, Voice Fax Auto-detection, and much more.



Call our demo line 309-862-1804 to get more information by fax-on-demand.
 Tel: (309)862-1704 Fax: (309)862-1804
 309 W. Beaufort, Suite 8, Normal, IL 61761



Dealers, call us about our specially discounted promotional units.

Circle 251 on Inquiry Card (RESELLERS: 252).

FREE CATALOG

Contains 284 pages of quality tools and tool kits, service diagnostics and test equipment for maintenance of computers and communication systems. Also LAN products: cables, taps, connectors, transceivers, repeaters, assemblies, and more. Free shipping, free technical support, 100% guarantee.



Jensen Tools Inc.
 7815 S. 46th St., Phoenix, AZ 85044
 (602) 968-6231 • Fax (800) 366-9662

Circle 217 on Inquiry Card.

Let your "true colors shine through" when you advertise your computer products in **BYTE's** **HARDWARE/SOFTWARE SHOWCASE** our newest, affordable, 4-color advertising section!

Call for more details:
(603) 924-2695 or (603) 924-2598

Voice Response/Caller ID for Windows

Would you like to develop multi-tasking multi-line non-blocking **Interactive Voice Response** applications for Windows? PIKA offers the developer the high quality, feature rich AVA-B Series 1, 2 & 4 line voice cards with hardware voice compression. Also, the new PIKA IdFi 1, 2 & 4 line **Caller Id** cards are the answer to many new and exciting Windows server applications. All PIKA cards are available (at affordable prices) with Windows DLL & DDE developer toolkits. Inquire about developer toolkits for NT, DOS, UNIX & QNX.

155 Terence Matthews Cres. Kanata, Ontario K2M 2A8, Canada
 Tel: 1-613-591-1555 Fax: 1-613-591-1488

Circle 258 on Inquiry Card.

Communications/Networking • Computer Systems

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 Kits \$650
2 voice lines kit starts at
24 hours free info: 818-368-4566 or 818-368-8848

SigmaTech Software

Tel: (818) 368-6132 Fax: (818) 368-7859
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 245 on Inquiry Card (RESELLERS: 246).

Computer Systems • Data Acquisition

ines

Metzschhof
Datenverarbeitung
ines GmbH
Neuenhofer Allee 45
D-5000 Köln 41 - Germany
Phone: +221/491621-4922 99
Fax: +221/4995605

IEEE-488

- Interfaces + Software
- Analyzer + Converter
- Extender + Cables
- DOS, Windows, OS/2, UNIX, SunOS

Circle 215 on Inquiry Card.



Multi-Line Voice Mail Plus... FAX ON DEMAND!

FAX ON DEMAND • VOICE MAIL CALL PROCESSING • TELEMARKETING

V/S 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.

V/S PLUS Only \$699
MULTI-LINE HARDWARE from \$299

For Sales and Information Call:
1-800-685-4884
510-522-3800 • FAX: 510-522-5556

(Developer/OEM package specials) (VISA-MC-AMEX-COD) **TALKING TECHNOLOGY, INC.**
1125 Atlantic Ave., Alameda, CA 94501

Circle 231 on Inquiry Card.

AT Systems in ROM

- Single Board Computers
- Run DOS code from ROM
- PC Code compatible
- Large Memory space
- Backplane systems



- Develop code on a PC. Run on our CPU cards with DOS and code in ROM. Use off-the-shelf expansion cards.
- KS6: NEC V53 CPU (286eq), 5 serial, 2 Par, Clock, AT bus, Max 4M Ram, 2M Rom, 512K NV Sram. \$299 (q1-oem ver).
- KS3: V40 CPU, 3 Serial, 2 Par, Clock, Flop, Kbd. \$224 (q1).

303-444-7737 Fax 303-786-9983
655 Hawthorn Ave., Boulder CO 80304 U.S.A.

KILA

Circle 218 on Inquiry Card.

486 Computers

486-33 64K Cache\$1599
Intel 486DX 33 MHz Processor
4Mb SIMM Memory
1.2Mb, and 1.44Mb Floppies
120Mb Hard Disk Drive @ 15ms
2 Serial, 1 Parallel, 1 Game Port
Tower Case with 230Watt PS
SVGA Card - Trident 8900 w/1Mb
1024 x 768 .28dp SVGA Monitor
Keytronics 101 Keyboard, Mouse
486-66DX2 256K Cache\$1749
486-50DX 256K Cache\$1699
486SX-33 8K Cache\$1379
350 VA Upsonic UPS only \$90 w/486 Purchase!

386 Computers

386DX 40 128K Cache.....\$1199
Intel 386DX 40Mhz Processor
4Mb SIMM Memory
1.2Mb, and 1.44Mb Floppies
120Mb Hard Disk Drive @ 14ms
2 Serial, 1 Parallel, 1 Game Port
Tower Case with 230Watt PS
SVGA Card - Trident 9000 w/512Kb
1024 x 768 .28dp SVGA Monitor
Keytronics 101 Keyboard

386DX-33 128K Cache\$1189
386SX-33\$999
Free 3 Button Mouse w/386 Purchase

NoteBook Computers

386SX/25\$1229
60Mb Hdd, 2Mb RAM, 64 Gray VGA
1 ser, 1 par, 1 PS/2 Mouse port
86 Key, 12 Function Kbd, 6 Lbs

486SLC/25\$1579
80Mb Hdd, 4Mb RAM, 64 Gray VGA
1 ser, 1 par, 1 PS/2 Mouse port
86 key, 12 function Kbd, Case,
Universal Power Supp., 6 Lbs.

Components

1 Mb SIMMS @ 70ns\$33
250 VA Upsonic UPS.....\$99
213 Mb Hdd.....\$329
Internal FAX modem 96/24\$72
250 Mb Colorado Tape Back-up.....\$239
Internal CD ROM.....\$229
Creative Labs Multi-Media Kit.....\$529
3 Button Mouse\$21
Monterrey Spill-Proof 101 Kbd\$26

Call or Fax for More Great Prices

 COD & Company POs accepted



**911 N. Edgefield
Dallas TX 75208**

**Ph. (214) 948-3155
FAX (214) 942-8360**

Member: Dallas Chamber of Commerce, Dallas Better Business Bureau

Circle 256 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, 10MB 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

VALLEY TECHNOLOGY INC.
2468 Armstrong Street, Livermore CA 94550
(510) 447-2030 FAX: (510) 447-4559



Circle 240 on Inquiry Card.

The Intelligent Solution For Data Acquisition



DAP 2400e™ Data Acquisition Processor™

ANALOG I/O	FFT and FIR-filtering at 16 MIPS
DIGITAL I/O	20 MHz CPU with DRAM to 1024K
• Inputs to 312K samples per second	32 MHz DSP with SRAM to 96K
• Outputs to 312K samples per second	DAPL™ Operating System
• Simultaneous fast input/output	• 100+ standard commands
CPU: i186 or i486	• 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 223 on Inquiry Card.

HARD DISK DRIVE DX-3120A/3060A



Higher reliability for lower price

Finally discover the difference total dedication to reliability and cost can make. Unlike most hard disk manufacturers, we manufacture higher reliability but lower cost drive to sell.

DX-3120A and 3060A are new version of hard disk drive that was developed, tested and proven by a team of engineers with sophisticated experience in the hard disk drive industries.

If you are ready to take these new products for your system, please call us.

Key Features

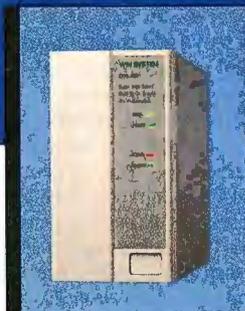
- 3.5" Winchester disk drive
- 120MB/60MB Capacity
- 1 inch Height
- AT/IDE Interface
- 64KB/32KB Buffer
- 1,7 RLL Code
- 19 msec Avg. access time
- 100,000 hours MTBF



Korea H.O. 352, Dangeong-dong, Gumpo-si, Kyungki-do 435-030, Korea Tel: (02) 864-1661 Fax: (02) 864-4479
 Sales Div. 185-4, Saebong-dong, Yongsan-Ku, Seoul 140-240, Korea Tel: (02) 790-6873 Fax: (02) 790-6878
 In the U.S.A. and Canada, address your inquiries to Mark Westec Corp.
 780 Montague Expressway #104, San Jose, CA 95131, U.S.A. Tel: (408) 456-2660 Fax: (408) 456-0828

Circle 260 on Inquiry Card.

DISTRIBUTORS WANTED
 OEM WELCOME



"SPEEDY"
 "RELIABLE"
 "DURABLE"

SILICON DISK EXW-MODELS

- Access Time: 0.3ms
- Interface: SCSI II (Fast SCSI)
- 6 models (40MB-500MB) available

"KEEP YOUR PRICELESS DATA SAFE"

MIRRORING HARD DISK SYSTEM EXM-MODELS

- High performance at simultaneous writing
- Interface: SCSI II (Fast SCSI)
- 4 models (300MB-1GB) available



Contact:

KAKIUCHI Co., Ltd. FAX: 81-3-3273-8474

System Equipment & Materials Group TEL: 81-3-3273-8431

No. 5-4, Honcho 1-chome, Nihonbashi, Chuo-Ku, Tokyo 103, Japan

Developed by: WIN-SYSTEM CORPORATION

Circle 265 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, 15ms, Internal Seagate IDE Drive Kit	\$439
125mb, 15ms, Internal Maxtor IDE / SCSI Drive Kit	\$494/\$504
200mb, 15ms, Internal Seagate IDE/Maxtor SCSI Drive Kit	\$623/\$649
340mb, 13ms, Internal WD IDE/Maxtor SCSI Drive Kit	\$837/\$933
512mb, 12ms, Internal Fujitsu IDE / SCSI Drive Kit	\$1,289/\$1299
1.2gb, 12ms, Internal Toshiba SCSI Drive Kit	\$1,794

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, 85mb/125mb Hard Drive Kit \$243
 85mb/125mb Hard Drive Kit \$313/\$368

General Technics 1 Year Warranty - 10 Day Money Back Guarantee

1-800-GT-SALE-8
 1-800-487-2538

Tel: (516) 981-9473 Fax: (516) 981-5038

38 Rynner Ave. Ronkonkoma NY 11779

Open: Mon to Sat EST, Mon-Fri

Circle 250 on Inquiry Card.

The Parallel Solution



PSS Portable Tape Backup System Combined Backup/Verify At True 11MB/Min Rate

250MB-2GB capacities in native mode. QIC industry standard format. Features unique BUSS (Back Up Supervisor Software) program. Compatible with MS DOS, Windows, OS/2, Novell, SCO UNIX, and SCO Xenix.

PARALLEL STORAGE SOLUTIONS is the pacesetter in parallel to SCSI technology. Full line of tape backup, optical, removable media and CD-ROM devices. PSS offers you reliable, cost effective and professional data storage solutions.

Call for information: 1-800-998-7839



116 South Central Avenue • Elmsford, NY 10523 1-800-998-7839

Circle 262 on Inquiry Card (RESELLERS: 263).

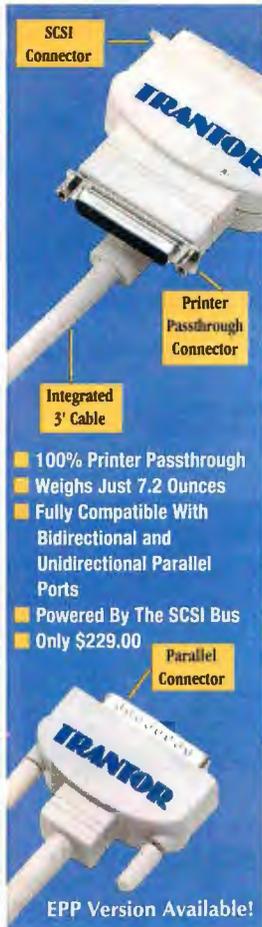
BYTE

Breaks the 4-Color Price Barrier
 with the Hardware/Software Showcase

See how affordable it is to advertise to BYTE's
 500,000 computer professionals in this section!

Call for more advertising information:
 (603) 924-2695 or (603) 924-2598

Disk & Optical Drives • Graphics Tablets/Mice/Pen Input • Keyboards



MiniSCSI^{plus}
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 backup, SyQuest, Bernoulli or other SCSI device from almost any parallel port. For most notebook users, it's the only way to use SCSI devices. Plus, an integrated cable makes it a snap to share SCSI devices with desktops and other notebooks.

Call Today For Details!
800-372-6867 • 800-TRANTOR



Trantor Systems, Ltd.
5415 Randall Place • Fremont, CA 94538-3151
TEL: (510) 770-1400 • FAX: (510) 770-9910
© 1993 Trantor Systems Ltd. MiniSCSI and MiniSCSI Plus are trademarks and Trantor is a registered trademark of Trantor Systems Ltd. All other product names are trademarks of their respective companies.

"This product... is darned near perfect."
-Jerry Pournelle, Byte Magazine March 1993

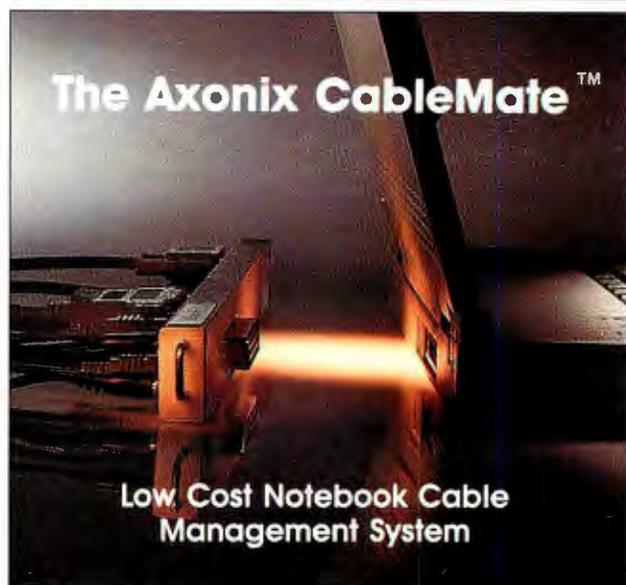
"This year, the company outdid itself... The MiniSCSI Plus is even more elegant than its predecessor and almost twice as fast."
-Jim Seymour, PC Magazine December 1992

- 100% Printer Passthrough
- Weighs Just 7.2 Ounces
- Fully Compatible With Bidirectional and Unidirectional Parallel Ports
- Powered By The SCSI Bus
- Only \$229.00

EPP Version Available!

Circle 239 on Inquiry Card.

Laptops & Notebooks



The Axonix CableMate™

Low Cost Notebook Cable Management System

Now you can connect your desktop peripherals in one easy step while reducing wear and tear on your interface ports. The CableMate Plus option provides bus expansion for low cost ISA compatible Lapstation expansion systems and both versions are available for Compaq LTE, Toshiba T2200-T6400 and other popular Notebook models. CableMate and Lapstation are available from Axonix direct, and from Authorized Axonix dealers worldwide.



1214 Wilmington Avenue
Salt Lake City, Utah 84106
Tel: 801-466-9797 / Fax: 801-485-6204

Call Toll Free for Nearest Dealer 1-800-866-9797

Circle 206 on Inquiry Card.

\$289 /kit plus S & H

EasyMount TOUCHSCREEN kit includes:

- A transparent flat touch plate, sensitive to pressure.
- A controller card, 4"x4" in size, fits into PC bus slot.
- Diskettes provide educational programs, demos, C-callable routines, keyboard and mouse emulators, calibration and coding examples.
- Mounting hardware allows touch screen to be used with most monitors.
- Manual contains instructions for hardware installation, touch screen mounting, library function calls.

Hi-Tech Instruments, Inc., P.O.Box 1509, Stafford, TX 77497-1509 Ph: 713 - 980 - 9040 Fax: 713 - 980 - 4251

Circle 214 on Inquiry Card.

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 tactically 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
- VISA, MC, AmX -

155 Aviation Dr. • Winchester, VA 22602
Tel 1-703-662-1500 • FAX 1-703-662-1682
Auto-FAXed Specs FAX 1-703-662-1675

Circle 210 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

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.

TO PRINTER

(800) 822-4333
17741 Mitchell, North Irvine, CA 92714 USA
TEL (714) 833-3355
FAX (714) 833-0322

GENOVATION

Circle 212 on Inquiry Card.

Portable Hard Disk

Fast and rugged from 20MB to 300MB

Easy to use, plug into the parallel port, includes extra port and internal batteries only 1.5lb! Recommended by Toshiba, NEC, Sharp, Poqet, Atari, and many others. Use with any PC using DOS 3.0 or above.

Complete systems from \$299. Mention this ad for a \$10 discount. Satisfaction Guaranteed! Awarded May 1992

Awarded Again May 1993

The BSE Company 602-527-8843 FAX 602-527-1540



Circle 241 on Inquiry Card.

STAND-ALONE LCD MONITOR

New Touch Screen Option Available



\$795 | 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.

NEW | Touch Screen Version. 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

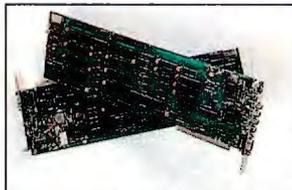
DATALUX

Tel: 1-703-662-1500
FAX: 1-703-662-1682
AutoFAXed Specs:
1-703-662-1675

155 Aviation Drive • Winchester, VA 22602

Circle 209 on Inquiry Card.

IMAGING CARDS



Video Framegrabbers for the XT/AT/386

- Real time grab/display
- Complete with software
- 60 & 50 Hz. Video
- Quality since 1987!
- Money back guarantee

MODEL 1-800-292-1160

- 512/24 512x480x24 - **New**
Full 24 bit color board, mult. in,
24 bit RGB out **\$795**
- 512 512x480x8 - **Advanced**
grayscale board. Multi res/multi
image, 4 inputs, in/out LUTS,
dual ping-pong buffers, RGB
out **\$795**
- 02 256x240x8 Workhorse 8
bit grayscale. 2 inputs, 24 bit
RGB out, cursor **\$495**
- 03 256x240x6 Economy 6 bit
version of -02 above **\$395**
MC/VISA/COD

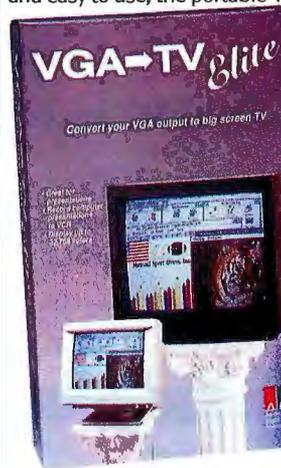
Control Vision

Box 596 Pittsburg, KS 66762
316-231-6647 Fax: 231-5816

Circle 207 on Inquiry Card.

With VGA→TV Elite, any color TV can be your computer monitor!

Supporting 640 x 480 resolution in 32,768 colors, the VGA→TV Elite provides Flicker free high quality video conversion. Rock solid and easy to use, the portable VGA→TV Elite is a true savior to the



Presentation professional. Convert your computer presentation or Animation to show on TV or record to your VCR. Even play computer games on big screen TV! Supports RCA and S-Video Inputs to TV's and VCRs.

\$399.

MicroWAREHOUSE TigerSoftware



Call **800-888-5244**

(8 am - 6 pm, Mon-Fri, Pacific Time)

(310) 865-1432 • (310) 809-6144 Fax

Advanced Digital Systems • 20204 State Road, Cerritos, CA 90701

Circle 261 on Inquiry Card.

VGA makes it to the

BIG SCREEN

Holophonics™
Bring the true feeling to your Multi-Media presentation and experience the future of sound, second to none in the world.
Guaranteed. World famous pop stars like Michael Jackson and Pink Floyd have used Holophonics in their best selling albums. In the motion picture industry, Holophonics was featured in Alien III and Blind Fury.
A total audiovisual experience beyond imagination!
100% credit toward a purchase of Holophonics™ on Floppy Disk-Wave Format
\$23.99 Volume I (Audio Demo)



VGA Mate®



Experience the freedom of viewing your presentation on a giant TV in brilliant colors

\$169

With a little imagination the applications are endless

NTSC & PAL switchable

Product upgrade guaranteed for one year

Calpac Computer Corporation

53 Moody Court
Thousand Oaks, CA 91360

1 800 800-7222

805-379-1312 Tel. 805-379-2653 Fax

German distributor: 06233-340071 Tel. 06233-469-39 Fax



Circle 259 on Inquiry Card.

Printers/Plotters

SMART

PRINTER BUFFER

for 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
- Full Windows® Support

Nobody waits!



STANDARD 1 MB memory • memory sizes thru 8 MB
 • Fast - data rates to 75 KB/S • multiple copies • multiple outputs

NEW	1 MB 6-Port Parallel	Single User Parallel
	\$199.95	\$99.95
	9-Port Parallel \$259.95	512 KBytes - unit is expandable to 4 MB
	15-Port Parallel \$379.95	Serial or Converting buffers available
	4-Serial + 5-Parallel \$269.95	
	16-Serial + 3-Parallel \$399.95	

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 232 on Inquiry Card (RESELLERS: 233).

Don't Move

without telling

BYTE

Clip out form below and mail to:

BYTE Magazine
 Subscriber Service
 P.O. Box 555
 Hightstown, NJ 08520

At least 8 weeks before you move, please give us your new address and/or name change. (Please Print)

New address, name

Name _____

Address _____ Apt. _____

City _____

State _____ Zip _____

Print current name and address

(or affix the mailing label from your current issue of BYTE here)

Current address, name

Name _____

Address _____ Apt. _____

City _____

State _____ Zip _____

Programmable Hardware

µPLC

"High speed scan rate at a fraction of the cost!"

HARDWARE:

DIGITAL CONTROLLER • 8 optically isolated digital inputs at 12 to 24 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 RS485 or RS232 • 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 transfer outputs • RS485 on board • PID loops • BK RAM • OPERATOR INTERFACE • 24 character by 2 line display • 4 by 4 keypad • BK 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

- DWC µPLC Digital controller \$139.00
- DWC µPLC RS485 interface \$59.00
- DWC Analog controller \$259.00
- DWC µPLC RS232 interface \$59.00
- DWC Operator interface \$259.00
- DWC Network Node \$199.00
- DWC Ladder Logic Compiler software \$99.00
- DWC EEPROM programmers development adapter \$16.00

Special offer for first time buyers software \$49.00 with any purchase of above.

1-800-668-2707 tel: (519) 850-0637 fax: (519) 660-1602

DAVISON • WORTH CORPORATION

Circle 248 on Inquiry Card (RESELLERS: 249).

The Easiest Logic I/O For Your PC!!

LOW COST COMPACT PLC PICOLOG

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, • 110x170 mm.

PROGRAMMABLE with any compatible PC thru RS232 in 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 247 on Inquiry Card.

IEEE 488.2 for Notebook PCs

- Attaches to the PC's parallel printer port
- Controls up to 14 IEEE instruments
- Transfers data at up to 170 Kbytes/sec
- Includes DOS or Windows software drivers
- Graphics & analysis software available
- Allows parallel & IEEE devices to be connected simultaneously

Call or fax for more information:

Tel (216)-439-4091

Fax (216)-439-4093



the smart approach to instrumentation

IOtech, Inc. • 25971 Cannon Road • Cleveland, Ohio 44146

Circle 216 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, BPROM, Special PROM, MPU (87XX, 68XX, Z8, PSD301, PIC16XX, TMS320EXX, UPD75PXXX, HD667XXX...).
- 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!



FLXA-700 \$995.00 UNIVERSAL PROGRAMMER SYSTEM NOW AVAILABLE. CONNECTS TO ANY PC XT/AT/386/486/LAPTOP THRU THE PARALLEL PRINTER PORT



Tribal Microsystems Inc.
 44388 S. GRIMMER BLVD., FREMONT, CA 94538

Tel (510) 623-8859
FAX (510) 623-9925

Circle 234 on Inquiry Card (RESELLERS: 235).

SUPERPRO® \$549
SUPERPRO/EM \$399



Universal Programmers

- Programs E(E)PROMs, Flash EPROMs to 8 Mbit & Bipolar Proms.
- Microcontrollers from INTEL, MOT, NSC, PIC, SIG, MICROCHIP, etc.
- PLD, GAL, MACH, MAX,.... (not included in SUPERPRO/EM)
- Tests TTL/CMOS and Memory.
- New parts added upon customer request and free updates on BBS. (24 hrs)
- Online technical support and hardware warranty for 1 year.

ROM MASTER \$129
 • Universal E(E)PROM programmer to 4-Mbit

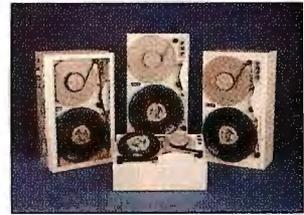
ROM MASTER/4 \$199
 • Universal E(E)PROM programmer 4 Gang Version

XELTEK (408) 524-1929
 (408) 245-7084 FAX • (408) 245-7082 BBS
 757 N. Pastoria Avenue, Sunnyvale, CA 94086

Circle 237 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 1-800-938-TAPE



Laguna Data Systems

7340 Smoke Ranch Road, Suite C, Las Vegas, NV 89128
 Tel: (702) 254-2648 • Fax: (702) 254-0910

Circle 220 on Inquiry Card.

C-PLC™ \$289!

- New C Programmable Miniature Controller
- Seven 10-bit analog inputs
- Seven digital inputs
- 10-bit DAC: voltage or current output
- Twelve digital/relay driver outputs
- RS-232/RS-485 serial ports
- Enclosure with LCD/Keypad available
- Expansion bus for additional, low cost I/O
- Easy to use **Dynamic C™** development software only \$195!



Z-World Engineering (916) 757-3737

1724 Picasso Ave., Davis, CA 95616 • Fax: (916) 753-5141
 24 hr. Information Service: (916) 753-0618. Call from your fax and request data sheet #24.

Circle 238 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!

Tel: 619-571-5555 • FAX: 619-571-0982
 Europe: Tel: (+49) 6172-35027 • FAX: (+49) 6172-35028

Ask about 3480 tape drives too

Circle 225 on Inquiry Card.

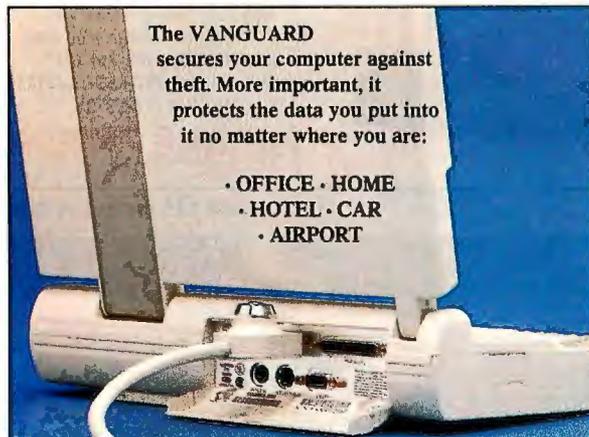
Now you can take it with you.

The Kāblit
VANGUARD

PORTABLE COMPUTER SECURITY

Physical Security for

NOTEBOOKS • LAPTOPS • PORTABLES



The VANGUARD secures your computer against theft. More important, it protects the data you put into it no matter where you are:

- OFFICE • HOME
- HOTEL • CAR
- AIRPORT

Pat Pend

- Installs in seconds...as easy as installing a computer cable.
- Attaches to any unused 9 or 25 pin port screws.
- Fits all computers except Macintosh.

List Price - \$49.95

Call for complete details.



18 Maple Court
 East Longmeadow, MA 01028

800-451-7592

413-525-7039

Circle 229 on Inquiry Card (RESELLERS: 230).

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 227 on Inquiry Card.

SAVE ON 9 TRACK MAGNETIC TAPE SYSTEM

FOR IBM PC/X T 286/386/486

- Mainframe to PC Data Xfer to 24MB/min
- Complete Software Packages
- Ready to Operate Systems
- Service and Support, Easy Installation
- No. 1 in Customer Satisfaction
- SCSI Bus Interface, UNIX Compatible
- 3480, Cartridge, Tape Duplication Systems
- Data Conversion /Duplication Services
- New/Unused, Reconditioned, Used MTUs

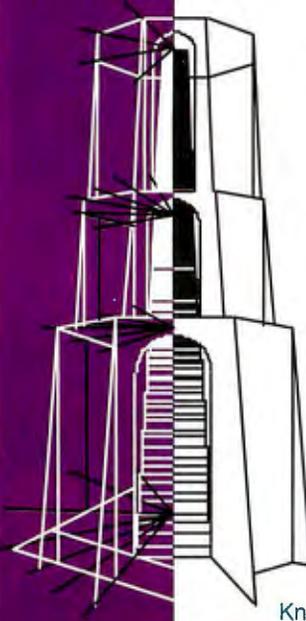
call **(919) 763-8400** or write to:
 4304 Market St., Wilmington, NC 28403



WILTEC

Circle 254 on Inquiry Card.

Architecture for your Enterprise!



Knowledge Based Systems, Inc. leads the way in integration technology. We offer a variety of products that support successful re-engineering and application design. KBSI customers report measurable improvements not just in productivity, but in end-user satisfaction as well.

KBSI is the IDEF authority

- activity based costing
- process analysis
- database design
- consulting
- training

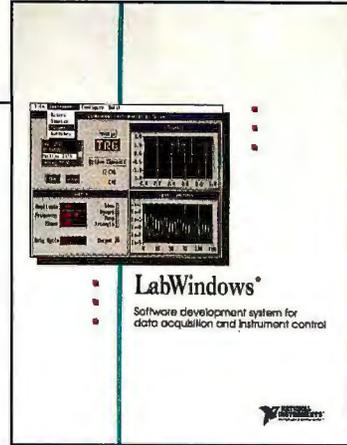
Call KBSI today to receive information or a free demonstration of our programs.



Knowledge Based Systems, Inc.

One KBSI Place tel 409.260.5274
 1408 University Drive East fax 409.260.1965
 College Station, TX 77840-2935 bbs 409.260.4606

Circle 219 on Inquiry Card.



LabWindows®
 Software development system for data acquisition and instrument control



DOS Software for Instrumentation Systems

The free eight-page LabWindows® 2.0 brochure describes the dramatically enhanced instrumentation software used by QuickBASIC and C programmers for test and measurement, data acquisition, and instrument control applications. With the new LabWindows 2.0 User Interface Library, programmers can easily create and control graphical user interfaces (GUIs) for their application programs. LabWindows 2.0 features an Instrument Library of drivers for over 150 GPIB, VXI and RS-232 instruments. A free demo disk is available.

National Instruments

6504 Bridge Point Parkway, Austin, TX 78730
 (512) 794-0100
 (800) 433-3488 (U.S. and Canada)
 Fax (512) 794-8411

Circle 224 on Inquiry Card.

PCB Design The Easy Way



EAGLE 2.6™

Schematic Capture, Layout Editor, 100% Autorouter, DRC, ERC: All In One Program

There are many powerful programs out there, but what good is it if they are too complicated to use. They are wasting your time, your money, and your nerves.

With EAGLE you will be productive from day one, and you will save time again and again, because EAGLE is easy to learn and easy to use.

EAGLE is a very powerful tool. You will discover features which even many high-priced programs could only dream of.

However, the best thing is still to come: Our prices are simply unbelievable. Even with the Layout Editor alone, you get all of the drivers and libraries; no extra charges for anything. What you see below, is all you can spend.

"Thumbs up. Overall, I was impressed... EAGLE 2.6 is easy to learn and easy to use... EAGLE 2.6 has the capabilities and performance that most designers would expect in a higher priced package."

Off the Shelf Review, PRINTED CIRCUIT DESIGN magazine, March, 1993.

AS SEEN ON...

BUSINESS TODAY

EAGLE has been introduced on the CNBC Television series "State of the Art of Technology Design". The producers have selected EAGLE as one of the best and most interesting PC Board Design Packages on the US market.

Call 1-800-858-8355

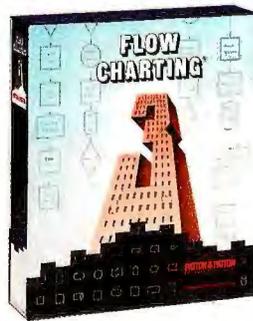
EAGLE Layout Editor	\$ 399
Schematic Module	\$ 399
Ripup Autorouter Module	\$ 399
DEMO with Original Manual	\$ 12



CadSoft Computer, Inc.
 801 South Federal Highway
 Delray Beach, FL 33483
 Hotline: (407) 274-8355
 Fax: (407) 274-8218

Circle 242 on Inquiry Card.

FLOW CHARTING 3



Powerful new features – for greater speed, flexibility, and ease-of-use!

- Single-page, multi-page or canvas charts – portrait or landscape
- Custom fonts support high resolution laser and 24-pin dot matrix printers
- 35 standard shapes, 10 text fonts
- Suggested retail price: only \$250

See your dealer today! or, for a "live" interactive demo disk, call: 800-525-0082, ext 1218
 International: 408-778-6557, ext 1218
 fax: 408-778-9972

PATTON & PATTON
 Software Corporation

Circle 226 on Inquiry Card.

Let your "true colors shine through" when you advertise your computer products in

BYTE's

HARDWARE/SOFTWARE SHOWCASE

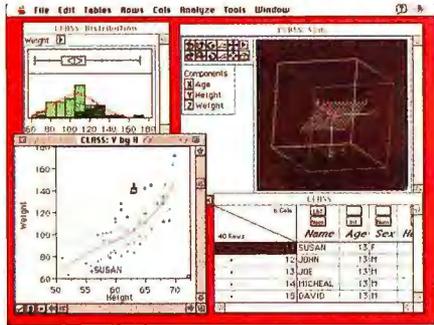
our newest, affordable, 4-color advertising section!

Call for more details:
 (603) 924-2695 or (603) 924-2598

JMP[®] Statistical Discovery Software

"JMP, from the SAS Institute, is the most surprising Mac product in years...with the most helpful

Mac interface of all the statistics programs and one of the best interfaces ever produced for scientific software. It's nothing less than dazzling."



MACWORLD



Call today for a free demo disk and Points of Interest from the leading name in data analysis software...SAS Institute Inc. 919-677-8000. Fax 919-677-8166.

JMP is a registered trademark of SAS Institute Inc. Copyright © 1992

Circle 228 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 244 on Inquiry Card.

FingerCheck Fingerprint verifier

(Good Industrial Design IF-Industries Forum Design Hannover)

FingerCheck fingerprint verifier includes:

- Fingerprint Reader
- I/O Interface
 - PC AT-Bus
 - RS-232
- S/W Application Interface
 - Image Capture
 - enrollment
 - matching

Application Area:

- Computer access or transaction control.
- Computer database security control.
- Physical access control by connecting FingerCheck fingerprint verifier with control circuitry to activate door locks (stand-alone system). The Stand-alone system can be connected to a computer network to perform other functions such as event recording and communications for management (network type system).
- For law enforcement applications the FingerCheck fingerprint verifier can work with card systems, such as smart cards and optical cards to perform identity verification. It provides social welfare security by using cards such as ID card, drivers license, passport, credit card and so on.



Distributors, OEM & ODM are welcome!

STARTEK

STARTEK ENG. INC.

3F, 54 Park Ave II Science-Based Industrial Park Hsinchu, Taiwan 300 R.O.C.
Tel: 886-35-785388 Fax: 886-35-787089

Circle 255 on Inquiry Card.

Subscription Problems?



We want to help!

If you have a problem with your BYTE subscription, write us with the details. We'll do our best to set it right. But we must have the name, address, and zip of the subscription (new and old address, if it's a change of address). If the problem involves a payment, be sure to include copies of the credit card statement, or front and back of cancelled checks. Include a "business hours" phone number if possible.

BYTE Magazine

Attn. Subscriber Service, P.O. Box 555
Hightstown, NJ 08520

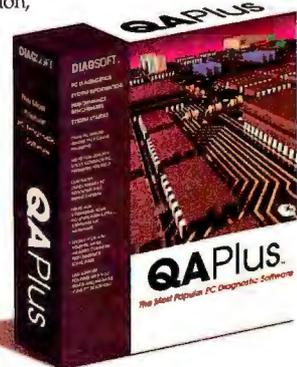
PC Diagnostics and System Information

QAPLUS[™] Over 3 Million users

- New Version 4.7 now includes Reachout[™] Host remote control 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 211 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 1/4" 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
2"x1 1/2"				
1 ad	\$663	\$636	\$557	\$530
2 ads/issue	-	-	530	504
3 ads/issue	-	-	504	477
2"x2 1/4"				
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 VISA/MC/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 651.

PROGRAMMABLE FUNCTION KEYPAD

The Function Keypad 35 features a 7 by 5 matrix of relegendable keys, programmable under both DOS and Windows 3.1. Define up to 11 macros per single or double key. Pass-through connection to parallel port allows concurrent use of standard keyboard. \$160

GENOVATION, Inc.

17741 Mitchell North, Irvine, CA 92714
(800) 822-4333 (714) 833-3355 FAX (714) 833-0322

Inquiry 652.

ARCHIVAL UTILITIES

RawCopy PC™

The Best Archival Utility,
Removes all the things
you HATE
to look up & plug in

CALL US TODAY

\$79.95

FREE SHIPPING

Micro Systems

International™

1-800-944-3410

Inquiry 653.

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
Rütlistrasse 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

Thermal Printer Package

Allegro Thermal Transfer Printer—2" per sec speed. Up to 4" label width—Only 20 lbs. weight—Prints UPC/EAN, 2of5, UCC-128, Code 39, 128—Prints scalable text and PCX graphics with bar codes—Packaged with LabelRIGHT Software, serial cable, ribbon and labels—Complete—\$1895

Worthington Data Solutions

(408) 458-9938 (800) 345-4220

Portable Bar Code Reader

- Use as a PORTABLE, WEDGE, or SERIAL
- 9V Battery Operation with Lithium Backup
- 2x16 Supertwist LCD Display
- 54 Key Keyboard with Separate Numeric Keys
- Real-time Clock Supports Date & Time Stamps
- Reads all Popular Bar Codes (16 types)
- Wand, CCD, Laser, or Serial Input Devices
- Built-In Program Generator
- Create Your Own Custom Programs
- 6 Built-In Inventory Programs
- Up to 250 Programs Can Reside in Memory
- Create up to 250 Data Files per Program
- Up to 250 Look-Up Files in Memory
- Built-In Calculator
- Supports HAYES Compatible Modems
- 64K Memory with Data Compression
- 30-day \$\$ Back Guarantee - 1 Year Warranty
- Complete Unit with WAND Scanner - \$795

AMERICAN MICROSYSTEMS

2190 Regal Parkway, Euless, TX 76040
(800) 648-4452 (817) 571-9015 FAX (817) 685-6232

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
Rütlistrasse 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

For PC, XT, AT, PS/2, & Serial Terminals

- Emulates Keyboard: Works With Any Software
- Data Appears as Keyboard Input
- Uses Enhanced Decoding Algorithms
- Accepts Wand, Slot/Badge, CCD, Laser, Magnetic Stripe Reader, & RS232 Serial Input
- Reads All Popular Bar Codes (16 types)
- Reads HIGH, MEDIUM, & LOW density codes
- Auto-Discriminates Between Bar Code Types
- Easily Programmed with a Bar Code Menu
- Over 140 User Configurable Options
- Daisy Chain Up to 96 Readers
- Supports NOVELL Networks
- Supports US & INTERNATIONAL Keyboards
- Direct From Manufacturer
- 30-day \$\$ Back Guarantee, 1 Year Warranty
- Complete Unit with LASER Scanner - \$1095
- Complete Unit with WAND Scanner - \$395

AMERICAN MICROSYSTEMS

2190 Regal Parkway, Euless, TX 76040
(800) 648-4452 (817) 571-9015 FAX (817) 685-6232

BAR CODE

Bar Code Printing Software LabelWorks for Windows

- ▶ Prints all Popular Bar Code Types (19 Types)
- ▶ Desktop Publishing Features: WYSIWYG, Scalable Fonts, Rulers, Guides, Lines, Shapes, Page Zooms (25%-400%), Templates
- ▶ Rotates Text, Bar Codes, and Graphics
- ▶ Supports Windows Compatible Fonts
- ▶ Choose From Over One Hundred Popular Label Formats or Design Your Own
- ▶ Rich Text Support: Mix Styles, Types, & Sizes
- ▶ Automatically Prints Serial Numbers
- ▶ Imports & Exports Graphic Files: TIFF, GIFF, BMP, PCX, WPG, WMF, TARGA
- ▶ Supports Virtually all Windows Compatible Printers (PostScript, Laser, & Dot Matrix)
- ▶ 30-day Money-Back Guarantee, \$295

*** CALL FOR FREE DEMO SOFTWARE ***

AMERICAN MICROSYSTEMS

2190 Regal Parkway, Euless, TX 76040
(800) 648-4452 (817) 571-9015 FAX (817) 685-6232

CREATE BAR CODE SYSTEMS

Data Harvester Developer's Version can put handheld portable bar code data collection in your application. Generate system to scan, validate entries (lengths, types, etc.) and communicate data to PC. Format data for your software. Easy to use. No programming. Supports many portable terminals. DOS & UNIX.

AccuScan, Inc.

PO Box 80037, Conyers, GA 30208
(404) 922-1220

Inquiry 654.

BEST BAR CODE VALUES

- PC/MAC/RS232 Wedges w/wand & print. utility \$249+
- Portables w/wand (64K+) \$750+
- Mag Stripe Encoder/Reader (1, 2 or 3 tracks) \$1200+
- Mag Stripe Readers (TTL, wedge, RS232) \$89+
- Bar Code Printing/Reading Software w/HP \$149+
- Lasers/CD/DVD/Barcode Slot/POS Products' 1-5 YR WARRANTY
- Dist/Dealer Discounts * SPANISH Dept. avail.

BARCODE INTERNATIONAL SYSTEMS (BIS)

9190 Palm Canyon Drive, Corona, CA 91719
(800) 653-4252 • (909) 277-1917 • FAX (909) 277-1005

Inquiry 655.

NEED A ONE STOP SOURCE FOR YOUR BAR CODE SOLUTIONS?

NO PROBLEM! WE OFFER Quality • Performance • Value
A full line of READERS • PRINTERS • PORTABLES • BAR CODE READERS FOR NOTEBOOKS • HEWLETT-PACKARD SCANNERS • MAGNETIC STRIPE READERS. Our readers plug and play with your existing system without additional software. 30 DAY GUARANTEE • LIFETIME TECHNICAL SUPPORT • NEXT DAY DELIVERY • VARIETY OF PAYMENT OPTIONS • OEM/VAAR DISCOUNTS. CALL US.

INTERNATIONAL TECHNOLOGIES & SYSTEMS

Eastern USA (800) 826-1688 Western USA (800) 228-9487

Inquiry 656.

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 206-451-8966

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 657.

VARIANT MICROSYSTEMS BAR CODE READERS DELIVER

WAND/LASER/MAGNETIC CARD CONNECTIVITY
• Keyboard wedges (Internal/External) for IBM PC/XT/AT, PS/2, and portables
• RS232 wedges for WYSE, Link, Kimtron terminals
• Bar code and label printing software
• Full two-year warranty
• 30-Day Money-Back Guarantee
• Extensive VAR/Dealer Discounts
46560 Fremont Blvd., Suite 206/Fremont, CA 94538/(510) 440-2870
800-666-4BAR FAX: (510) 440-2873

Inquiry 658.

CAD

TERMINATOR ***Super high density router***

(Compatible with schematic & PCB Editor)
This totally integrated CAD software offers superior functionality at competitive prices. DC/CAD packages include:
• Rip up and retry router w/via minimization • No copy protection available
• ASCII file w/automatic procedure recording • Autoplacer • WINDOWS Dos task • Gerber and DXF • Optional Automatic Copper plane w/cross hatching
• Optional simulation & enhanced mode for 386 users

Price from **\$195** • Call for current offer
• EXPEDITED PCB LAYOUT SERVICE AT LOW COST
Design Computation, Inc. 1771 Highway 34, Farmingdale, NJ 07727
Phone: (908) 681-7700 Fax: (908) 681-8733

DC/CAD-The performance value leader for the demanding entrepreneur

Inquiry 659.

ELECTRONICS CAD

Schematic Capture & PCB CAD

Analogue Simulation, Digital Simulation, etc.

Prices from \$195. Credit cards welcome.

For brochure use Inquiry # or contact us at:

NUMBER ONE SYSTEMS

Harding Way, ST. IVES, Cambs, UK, PE17 4WR

Tel: 011-44-480-461778 Fax: 011-44-480-494042

Inquiry 660.

CAD/CAM

CONTOURING MOTION CONTROL

FROM A PRINTER PORT!

NEW Indexer LPT™ software \$249 VISA/MC

- 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 661.

Parametric MultiSurf Surface Modeler

Object oriented, PC-based. Complex models with accurate surface-surface joins. 16 surface types, including lofted, developable, blended, foil, NURBS. 2-D and 3-D DXF output. \$1,975.

AeroHydro, Inc.

PO Box 684, Southwest Harbor, ME 04679 USA
207-244-7347 FAX: 207-244-7249

Inquiry 662.

CD-ROM

CD-Link™-DOS/Windows CD-ROM Driver

Completely replaces MSCDEX and uses space on your hard disk as a very large cache to dramatically improve CD-ROM performance, while reducing RAM requirements. \$79.95 introductory special! Includes reporting of usage statistics. Download a free demo version from our BBS! OEM & dealer pricing available.

Intellectual Products Corporation
Voice: (404) 992-5327 BBS: (404) 640-5017

Inquiry 663.

OPTI-CDcache™

Improve CD-ROM workstation performance!
Only \$89!

OPTI-CDcache™ takes advantage of Extended Memory (XMS) to cache CD-ROM data. Retrieve data from a high speed cache instead of directly from the CD-ROM drive and significantly improve your CD-ROM workstation performance!

Ask for our free catalog of exciting CD-ROM products including the market-leading OPTI-NET™ CD-ROM networking software!

ONLINE COMPUTER SYSTEMS, INC.

A member of the Reed Elsevier group.
800-922-9204 or 301-428-3700
FAX us at 301-428-3700.

Inquiry 664.

CICA MS Windows Shareware, 640 Meg, thousands of new programs, BBS ready, made April 93.....\$24.95

Simtel MSDOS Shareware CDROM, 640 Meg, BBS ready, huge selection of software, made April 93.....\$24.95

Hobbes OS/2 Shareware CDROM, 550 Meg, Nov. 92.....\$24.95

Source Code CDROM. Full source, mostly C, over 15,000 programs. Over 600 Meg....\$39.95

X11/GNU CDROM. Full source to X11 and all the GNU programs. ANSI C/C++ compiler, ghostscript, etc.....\$39.95

C Users Group Library CD-ROM. Up through vol. 364.....\$49.95

CDROM Caddies.....\$4.95
Full Money-Back Guarantee

WALNUT CREEK CDROM

4041 Pike Lane, Suite E, Concord, CA 94520
(800) 786 9907

(510) 674 0783 Fax: (510) 674 0821

Inquiry 665.

COMMUNICATIONS

HOMOLOGATION IN ITALY

All TELCOM devices
◆ POS Terminals
◆ Modems

WE PROVIDE

- PTT Ministry Request submittal
- TRANSLATION Documents and Manuals from English and French to Italian
- VERIFICATION of PTT Ministry rules
- PTT test assistance
- American references available

I.LUBE MILANO - ITALY

TEL/FAX: 39-2-95358815

Inquiry 666.

THE BUYER'S MART

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.

- ◆ Up to 180kpbs under any PC operating system
- ◆ Extensive utilities plus third party support under DOS, Unix, OS/2, Windows
- ◆ CDDT 1988 X.25, many variations of SDLC and HDLC and V.25 bis, dial supported
- ◆ Full function SNA emulation packages also available

Sangoma Technologies Inc.

Tel. (416) 474-1990 1-800-388-2475
FAX (416) 474-9223

Inquiry 667.

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 512-321-9652
Cedar Creek, TX 78612 Fax 512-321-4525
800-880-6818

Inquiry 668.

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
Now available in Ontario, Canada

Inquiry 669.

YOUR SALES MESSAGE

about the special computer product or service that you provide belongs in print

THE BUYER'S MART

can help you reach computer professionals and produce valuable inquiries for your company!

Call **Margot Gnade** for more information

603-924-2656

or

Fax: 603-924-2683

Inquiry 670.

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

SURAH inc. 44912 Osgood Road, Fremont CA 94539 USA
Phone: (510) 651-5101 Fax: (510) 651-5241

1-800-543-1001 Nationwide Orders

Inquiry 671.

CROSS ASSEMBLERS

PC BASED DEVELOPMENT TOOLS

We offer low-cost efficient CROSS ASSEMBLERS and a superb line of SIMULATOR-DEBUGGERS with full built-in DISASSEMBLERS for Intel's MCS-48, 51, 85 and 96, and for the Z80 families of embedded controllers. Our new emulators for the 80C196KB and 80C196KC are unique in the market, and have been received with rave reviews. The price of our software includes unlimited free upgrade privileges!

Lear Com Company

2440 Kipling St., Ste. 206, Lakewood, CO 80215
(303) 232-2226 FAX (303) 232-8721

Inquiry 672.

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
BBS (804) 873-4838

Inquiry 673.

ECAL UNIVERSAL ASSEMBLER

170+ processors supported.

User control of syntax and instructions.

Integrated linker/loader.

Trace and I/O windows.

Monitor and RS-232 windows.

Single micro versions available.

Demo version available.

VAIL SILICON TOOLS (305) 570-5580

Inquiry 674.

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) 977-6237

Inquiry 675.

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:

MN: 1-800-872-2599 • CA: 1-800-752-7557
UK: 44-81-974-5522 • GERMANY: 0130-815-198

Corp. Headquarters: 6321 Bury Drive, Eden Prairie MN 55346

Inquiry 676.

Dr. Solomons Data Recovery Service

NO FIX-NO FEE

Unique Technical Expertise

High Success Rate

Free Diagnosis

Fast Turnaround

S & S International

Tel +44 (0)442 877877 Fax +44 (0)442 877882

Inquiry 677.

DATA/DISK CONVERSION

DATA CONVERSIONS

DISK/TAPE/CARTRIDGE DUPLICATION

CD-ROM DUPLICATION & MASTERING

2500 Word Processor & Computer formats, 3 1/2", 5 1/4", 8" DISKS, MAG TAPES, 3480 TAPES, Syquest, Bernoulli, Colorado, Mountain, Emerald, Sytos, Maynard, 4mm DAT, 8MM, DC2120, TK50 tapes, 1/2" CARTRIDGES, Mag Cards.

OCR SCANNING SERVICES TOO!

Quickest turnaround Quality Media Guaranteed Satisfaction

COMPANY COMPENDIA, INC., 55 E. Washington St., #237

Chicago, IL 60602 TEL: 1-800-374-01SK FAX: 312-419-1390

Inquiry 678.

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 679.

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

Which Windows database is the best? The best?

We recommend **SUPERBASE 2**
We build vertical applications with it,
train end-users and developers on it,
and make it available to others
who want the best

Windows relational database

Superbase 2 for \$189 (list \$795)
Superbase 2 Developers Edition \$650.
Superbase 2 Developer class,
4 days for \$995.

Consulting and on-site training available.

THE NERD SHOP
800-448-NERD

Inquiry 680.

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 681.

EDUCATION

B.S. & M.S. in COMPUTER SCIENCE

The American Institute for Computer Sciences offers an in-depth home study program to earn your Bachelor of Science and Master of Science degrees in Computer Science at home. B.S. subjects covered are: MS/DOS, BASIC, PASCAL, C, File Processing, Data Structures & Operating systems. M.S. program includes subjects in Software Engineering and Artificial Intelligence.

AMERICAN INST. FOR COMPUTER SCIENCES

2101-BY Magnolia Ave. South, Ste. 200, Birmingham, AL 35205

800-767-2427

205-323-6191

DIAGNOSTIC

FREE NEWSLETTER OFFER THE PC TROUBLESHOOTER

Learn all the latest PC troubleshooting tips and tricks from the pros. Covers PCs, networks, Windows and more. CALL NOW for a FREE sample issue.

USA: (800) 683-6696

Int'l: (813) 443-1331, FAX: (813) 443-6603

Landmark Research Int'l Corp.

703 Grand Central Street
Clearwater, FL 34616

Inquiry 682.

FLOW CHARTS

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

NEW Selections & Functions, Inc.'s FRAMEWORK UPGRADE

Hundreds of new menus
hypertext-documentation
Includes OS COMMAND.COM
with process swapping
dBase file indexing. Auto
querying, filtering, reports.
Framework FRED EMail support
Incl. The Framework Magazine

\$140.00

(617) 826-1553

25 Washington Street, Hanover, MA 02339

G.I.S.

Digital Quad Maps

Local Street Maps, State Maps, and World Maps in DXF, PCX, PICT, PIC or TIF Formats. Gigabytes of Map data available.

Micro Map & CAD™

(303) 988-4940

Inquiry 683.

GRAPHICS DATA CONVERTER

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 684.

HARDWARE

Let US Meet Your Hardware Needs

- Complete Systems-Starting @ \$895 w/SVGA monitor
- For 486 DX50 from \$895-\$1795
- Motherboards, Memory
- Software

Call for information or catalog. MC & VISA accepted
Kings Computer Technologies

311 North Gray
Killeen, TX 76541

817-554-5464

Inquiry 685.

Pre-Owned Electronics, Inc™

THE Independent Provider, serving the Dealer, Professional, Corporate, Government, and Educational Buyer since 1985

**APPLE II® & MACINTOSH®
SYSTEMS • PARTS • EXCHANGE REPAIRS**

Call for a Catalog... **800-274-5343**
INT'L: 617-275-4600 • FAX: 617-275-4848
205 BURLINGTON ROAD • BEDFORD, MA 01730

Inquiry 686.

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
(800) 638-4633

Inquiry 687.

HARDWARE/COMPUTERS

**NEW! 20MHz 16-bit FORTH Single Board
Controller with 8ch 10-bit A/D, 3ch 8-bit D/A**
TDS2020 FORTH CONTROLLER AND DATA LOGGER-4"x3" board uses Hitachi 16-bit H8/632 CMOS µP. Streams along at 3MIPS, but runs on only 30ma. On-board high-level easy FORTH language and assembler-no need for in-circuit emulation! Up to 512K NVRAM, 45K PROM. Attach keyboard, lcd, 12C peripherals. Interrupts, multi-tasking, watchdog timer, editor. 33 I/O, 2xRS-232, 6-16v 300µA data-logging! Free ready-made software solutions. Program with PC. Use for machine control, data-logging, inspection, robotics, remote monitoring, etc. \$299 (25s), STARTER PACK \$499.

CALL NOW FOR DETAILS!
Saelig Company
European Technology

Sale-or-return
tel: (716) 425-3753
fax: (716) 425-3835

Inquiry 688.

SC/FOX™ EMBEDDED COMPUTERS

PC Parallel Coprocessor Plug-In Boards: 15 MIPS avg 50 MIPS burst, using the SC32 32-bit CPU or the 16-bit Harris RTX 2000™.
VME Master/Slave System Controller SBC: 18 MIPS avg 70 MIPS burst, uses RTX 2000 cpu, SCSI, 2 ser., 1 prt. ports, to 640K bytes.
Stand-Alone Single Board Computers: 18 MIPS avg 60 MIPS burst, 3U or 100x100mm Euro-card-size using either SC32 or RTX 2000.
Ideal for embedded real-time control, data acquisition, robotics, and signal processing. OEM software development system included.

SILICON COMPOSERS INC (415) 961-8778
655 West Evelyn Ave. #7, Mt. View, CA 94041

Inquiry 689.

LANS

The \$25 Network Try the 1st truly low-cost LAN

- Connect 2 or 3 XTs, ATs, 386s, 486s
- 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 76202
Tech 817-387-3339 Orders 800-628-7992
Hours 1-5 Mon/Wed, 9-5 Tue/Thu/Fri CST

Inquiry 690.

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 691.

LAPTOP PERIPHERALS

Toshiba Serial Cards

- D and E modem slots, DB9 or RJ11/12 connector, RS232- \$199; RS422 - \$249. Options: C550 UART, MiniDIN
 - A slot, DB9 with 2400 bps modem, RS232 - \$199; RS422 - \$249
 - A slot, Dual RS232 - \$249
 - A slot, SCSI host adapter - \$249
 - Designed and made in USA!!
- Custom design capability. Also Auto adapters for various laptops, notebooks, and printers.

Empire Engineering

California USA

tel 805/543-2816 fax 805/543-2820

Inquiry 692.

MEDICAL SOFTWARE

INTELLIGENT MEDICAL SYSTEM

Distributors required for English, French, German & Spanish Market

Horizon Integrated Intelligent Medical System for International use in multilingual environment (HIMS) is a "state of the art" system for Doctors & Hospitals. Developed in conjunction with World Health Organization (WHO) standards.

HORIZON SOFTWARE LTD.

27 East Street, Leicester, LE1 6NB, U.K
TEL: (44) 533-56550 FAX: (44) 533-470942

Inquiry 693.

PC PRODUCTS WANTED

PC Products Wanted

Leading PC Network software vendor is looking for "cutting edge" products to be distributed through its world wide distribution channels. If you have a product or product idea, and need sales or distribution we can help you pave the way to quicker profits. A.C.P. provides national distribution through Tech Data, Merisel, Ingram, and our U.K. and Australian subsidiaries. A.C.P. also offers a well established engineering and marketing force. For more information call A.C.P. at 800-959-2556 or (508) 496-4367, or send inquiries to: A.C.P., P.O. Box 1490, Littleton, MA 01460.

Inquiry 694.

THE BUYER'S MART

PROGRAMMERS TOOLS

SHARE YOUR MODEMS FOR \$149
using Connection Manager Lite Full featured modem server for IPX or NetBIOS networks.

- Non-dedicated server shares two modems at data rates to 155,200 bps using standard serial ports or multiport boards.
- Up to eight clients. Supports NASL or Interrupt 14 interface.
- Outbound and inbound calling.
- Compatible with Windows 3.1.
- Includes reduced price upgrade to standard version.
- 30-day money-back guarantee.

SOFTWAREHOUSE CORPORATION
326 State Street, Los Altos, CA 94022
(415) 949-0203 FAX: (415) 949-0208

Inquiry 695.

Structograms

Software Documentation made quick and easy with PANORAMA

- Structograms (Nassi-Shneiderman) 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**
Schutzenstrasse 11; CH-8245 Feuerthalen, Switzerland
Int'l (+41 53) 29 31 32 FAX: (+41 53) 29 31 43
Call or Fax for information and free demo.

Inquiry 696.

PROJECT BILLING

CLIENT PROJECT

A Time and Billing System that accounts for charges to over 100,000 projects (or matters). Regular price \$299, limited time discount available; send \$10 for demo.

MICRO BILLING SYSTEMS, INC.
117 W. Harrison, Ste# 624M, Chicago IL 60605
Tel: (312) 939-1869 Fax: (312) 939-1351

Inquiry 697.

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 FREE Demo (800) 227-0644
201 East Franklin, Richmond, MO 64085 (816) 776-2700
FAX (816) 776-8398

Inquiry 698.

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 Heritage Lane, Silver Spring, MD 20906
800/TRY-ABBI • 800/678-2224 • 301/671-1094 • FAX:301/460-7545

Inquiry 699.

SECURITY

STOP UNWANTED USERS!

with Easi-Lock™ Software Security
Add Software Security Without Programming • No Hardware Add-Ons or Changes • Block Intrusions and Snooping • Locks Any .EXE or .COM file under DOS • Works with Windows • Locked Files Work Only With "Run" Utility • Tests for Virus Before Executing Any File • Renders Pirated Software Useless • Activity Logging in "Plus" and "Super" versions • Optional (free) Audible Intrusion Alarm
Prices \$69 - \$169 + s/h. Visa, Mastercard Accepted
Easi-Logic Software
div. of CDS GROUP Inc. P.O. Box 449 Paoli IN 47454
800-243-4964 • 812-723-4595

Inquiry 700.

Cop's CopyLock II

The professional software protection with TRUE Machine Install. Option Board safe. OS/2, Networks, Windows, and Trace 3020.

LINK Computer

Int'l: + 45 31232350 Fax: + 45 31238448
US/CAN: 408-729-8162 FAX: 408-923-7061

Inquiry 701.

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, Countera/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 701.

SOFTWARE WANTED

Publish Your Program!

Young, enthusiastic and successful software publisher looking for PC Windows productivity add-on and utility software to acquire or publish. For a confidential review of your software product, send information to **Software Publisher, 2210 Wilshire Blvd., #836, Santa Monica, CA 90403** or circle our number on the Direct Link Card in the back of this issue. We will contact you promptly.

Inquiry 702.

SOFTWARE/ACCOUNTING

dBASE BUSINESS TOOLS

- GENERAL LEDGER
- PURCH ORD/INVENTORY
- ORDER ENTRY
- ACCOUNTS REC/VABLE
- JOB COSTING
- JOB ESTIMATING
- BILL OF MATLS
- SALES ANALYSIS
- PAYROLL
- 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 703.

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

Inquiry 704.

SOFTWARE/ENGINEERING

Circuit Simulation

Electrical Engineers!
Now you can run Analog/Mixed Signal Simulations on your PC or Mac with the **Affordable and Powerful ICAP/4 Simulation System**

Includes:

- IsSPICE3; Mixed Mode SPICE Simulator
- Integrated Schematic Entry
- Extensive SPICE Model Libraries
- Waveform Graphics and Analysis

Full SPICE programs starting at \$95. Complete systems with schematic, IsSpice3 simulation, models, and waveform graphics only \$1575.

Call or Fax for your Free Demo and information kit.

P.O. Box 710 San Pedro, Ca 90733-0710

Tel (310) 833-0710

FAX (310) 833-9658 **intusoft**

Inquiry 704.

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 705.

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 706.

"The Ultimate CAD/CAM/CAE Programming Engine"

Slash your development time, with your CAD programming companion. **3D-Professional v4.0**, 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 (Int/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/386 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 707.

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 708.

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 709.

SOFTWARE/SCIENTIFIC

Weather Monitor & Weatherlink!

The ultimate in weather monitoring systems! A state-of-the-art weather station and a PC link allow you to view, record, summarize, and graph weather information. The perfect marriage of computer and weather technology.

DAVIS INSTRUMENTS

3465 Diablo Avenue, Hayward, CA 94545
1-800-678-3669 FAX 1-510-670-0589 BY30

Inquiry 710.

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 FAX (617) 729-2750

Inquiry 711.

TEX 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 712.

SOFTWARE/VOICE/FAX

MULTI-VOICE® TOOLS

Multi-Voice Tools is a complete development Toolkit for Pascal or "C" to access all the features for most speech processing boards available today. It helps you write MULTI-LINE VOICE APPLICATION systems in minutes. A number of programming examples are provided. All programs and libraries are delivered with source code.

Dialogic, Rhetorex, Pika, VBX: \$599. Watson (Single Line): \$99. ALSO AVAILABLE: Fax Programmer's Toolkit (\$199). Based on CAS specifications. Visa/MC accepted.

ITI Logiciel

4263 Christophe-Colomb, Montreal, Quebec, Can. H2J 3G2
TEL (514) 597-1692 FAX (514) 526-2362

Write your own Voice Mail software

Create advanced, multi-line voice/fax mail systems with VOS™, the Editors' Choice. Complete language for computer/telephone integration. Call for free booklet "Get Into Interactive Voice".

Parity Software

25 Stillman St. #106, San Francisco, CA 94107
415 931-8221 (fax 415 546-7329)

Inquiry 713.

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 714.

NEW! STATIC SAFE

3 1/2" and 5 1/4" rigid disk envelopes with graphite coating for extra protection

☆☆☆☆ FREE SAMPLES ☆☆☆☆

MAIL SAFE

Division of Chicago Packaging
4340 W. 47th St.
Chicago, IL 60632

CALL 1-800-848-6552

Inquiry 715.

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 716.

STATISTICS

NCSS 5.x Series - \$125

Easy-to-use menus & spread sheet. Multiple regression. T-tests. ANOVA (up to 10 factors, rep. measures, covariance). Forecasting. Factor, cluster, & discriminant analysis. Nonparametrics. Cross Tabulation. Graphics: histograms, box, scatter, etc. Reads ASCII/Lotus. Many new add-on modules.

NCSS

329 North 1000 East, Kaysville, UT 84037

Phone: 801-546-0445 Fax: 801-546-3907

Inquiry 717.

UTILITIES

FastTrax THE BEST DISK OPTIMIZER

- Defragments any size DOS disk incl. >2 Gb
- No limits on directories, files or clusters
- Unique in-cylinder method reduces seeks
- **MakeTrax** (incl.) for custom file placement
- Batch operation, power failure protection
- \$70, or \$40 for competitive upgrade, + S&H

FastTrax International

880 Ensenada Avenue, Berkeley CA 94707
24-hr Sales and Tech support (510) 525-3510

Inquiry 718.

PEN PLOTTER EMULATOR

FPLLOT 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. VISAMC/Chk/MO.

FPLLOT Corporation

24-16 Steinway St., Suite 605, Astoria, NY 11103
718-545-3505

Inquiry 719.

UTILITIES

ICSMENU

The menu for users without Windows
Runs any program or series of up to four DOS commands with a single key stroke. Chain as many menus as desired. Never fumble again trying to remember a directory name. Low system overhead. \$50.

Integrated Custom Software, Inc.

701 Hebron Ave., Glastonbury, CT 06033
(203) 657-3339 FAX (203) 657-8150 MC/VISA

Inquiry 720.

WINDOWS

HyperPhoto A HyperImage & Document Management System for Windows

Attach text and data to images. Author HyperLinked applications and navigate from image to image. Graphically design your own custom image database. Search 500k scanned documents in seconds. Navigate HyperLinks through successive levels of detail. Display 64k stamp images on image spreadsheet. Create stamp albums. Associate text or images to any image pixel. PCX, BMP, TIF, GIF, EPS zoom and color matching. Network & JPEG available. **Imaging power for \$225!**

Friendly Information Systems

552 Massachusetts Avenue, Cambridge, MA 02139
CALL 80055HYPER FAX (617) 492-8525

Inquiry 721.

GENETIC ALGORITHMS

NEURAL NETS + GENETIC ALGORITHMS =

LOGIVOLVE™

THE FIRST NEUROGENETIC TOOLKIT

THROUGH GENETIC ALGORITHMS,
LOGIVOLVE™

SOLVES COMPLEX PROBLEMS THAT NO OTHER TECHNOLOGY CAN. EVOLVE COMPLEX SYSTEMS CONTAINING NEURAL NET AS WELL AS PARAMETER-BASED COMPONENTS THAT PROVIDE THE NEEDED SOLUTIONS. POWERFUL, FAST, EASY-TO-USE. AVAILABLE FOR "C", VISUAL BASIC (WINDOWS DLL), AND OTHER LANGUAGES. RUNS ON 386/486S, HYPER SPEED PARALLEL 860S, AND MICROWAY 860 SUPERCOMPUTERS. **ALSO AVAILABLE: N-TRAIN™ NEURAL NET DEVELOPMENT SHELL, AS WELL AS PRE-TRAINED AND PRE-EVOLVED SYSTEMS FOR THE FINANCIAL MARKETS.**

SCIENTIFIC CONSULTANT SERVICES

(516) 696-3333

Inquiry 722.

SPECIAL WINDOWS DECK

Coming This FALL!!

BYTE

INTRODUCES THE

WINDOWS CARD DECK

Mailing: September '93

Circulation: 100,000 targeted Windows Users

For advertising info, call

603-924-2596

or

603-924-2533

Inquiry 723.

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.
A								
61-62	50	800-451-4319	204-205	247	800-EMBARCA ext. 350	108	191	800-628-4223
178-179	236	310-325-6369	539	248S0-3	800-933-4CTC	110	184	514-685-2630
180	244	714-558-8813	507	48IS-3	+39-35-692-229*	111	212	800-992-HALO
261	257	800-888-5244	F			548	220IS-2	516-589-6858*
63	83	800-223-4277	87	33	800-998-7760 4	112	81	800-322-4744
64	122	800-800-4APC DPT.A2	508	128IS-3	+49-89-539800-20	512	48IS-1	407-677-8333
181	249	408-942-9695	521	112IS-3	+886-2-717-4500*	114-115	225	815-756-3411
543-544	248S0-1	408-732-6091	188-189	237	714-588-9866	197-198	242	800-967-5667
65	140	416-756-0718	88	35	800-U4FRAME	113	105	800-395-3748
206	256	801-466-9797	169	207	617-497-6339	*	16-17	206-936-9661
B								
182-183	241	800-523-2702	509-510	112IS-2	713-496-9400	*	30-31	800-468-8899 ext. JC2
450	273	800-695-4775	G			*	67	800-228-7007 ext. RX3
66-67	11	800-336-6464 ext. 5818	*	CII-I	800-846-2058	*	69	800-228-7007 ext. RX3
68	120		*	64A-L	800-846-2058	*	123	800-426-9400 ext. JKB
184	233	800-345-2356	250	255	800-487-2538	*	125	800-426-9400 ext. JKB
*	215		212	256	800-822-4333	*	127	800-428-9400 ext. JKB
C								
*	128IDRC1-2	913-841-1631	89-90	126	800-562-2543	223	254	206-453-2345
242	260	800-858-8355	76-77	135	800-458-3348	*	174	508-746-7341
259	257	800-800-7222	511	128IS-1	+44-0364-53071*	*	196	508-746-7341
70	44-45	800-967-9251	256	254	214-948-3155	520	112IS-2	+972-2-637576*
501	214-215	+49-964-3180	213	253	800-282-4835	513	200IS-1	+49-511-77000
528	111	+886-3-323-5743**	H			123	75	800-238-7272
166	152	514-735-3219	91	12-13	800-LASERJET ext. 7299	540	112IS-1	519-884-2251
196	246	818-855-5688	*	26-27	800-SCANJET ext. 7365	529	200IS-4	+886-2-703-1380*
71-72	39	800-451-4523	257	253	800-723-9402	*	128IS-2	212-580-0541
74	20-21	800-638-8258 ext. 45	214	256	713-980-9040	N		
502-503	15	714-630-7302	273	162	800-445-6939	202-203	234	800-568-6242
*	144A-B	800-848-8199	I			116-117	15	310-325-5202
75	145	800-848-8199	94	112A-D		118	209	800-433-3488
78	47	899-CALL-CAI	93	40-41	407-982-6408	224	260	800-433-3488
80	86-87	899-CALL-CAI ext. 176	215	115	800-IBM-3052	*	128IDRC1-2	512-794-0100
79	99	899-CALL-CAI	95	254	+49-221-491621	119	36-37	800-NEC-INFO
504	48IS-3	415-861-8330	97	62	209-651-1203	*	111	800-800-9599
185	235	800-526-3482	97	48A-D	800-538-3373	190	232	800-654-7762
253	252	703-876-6444	96	118-119	800-538-3373	120	166	800-TRY-NEXT
207	257	316-231-6647	174-175	196	800-237-4774	121	211	215-941-9600
81	43	800-836-DRAW	98-99	128A-F	800-345-4856	O		
82-83	189	800-733-04200	216	258	216-439-4091	122	79	800-OKI-TEAM ext. 261
268	29	800-998-LABS	100	155	800-777-4045	523	128IS-2	+49-40-437472
84-85	164	714-585-6146	524	200IS-3	+39-323-925208*	*	213	
208	252	612-631-9512	159-160	54	800-4FRACTL	225	259	800-729-8725
186-187	243	205-534-0010**	244	261	416-925-6096	515	33	+44-865-56646*
545-546	248S0-2	205-534-0010**	J			P		
505-506	CIV	205-534-0010**	101	93	800-831-4242	*	180	619-625-3628
D								
260	255	+82-02-790-6878**	*	251	800-538-5000	167-168	94	516-759-3011*
170	52	800-258-5061	522	48IS-2	+39-73-3224035*	262-263	255	800-998-7839
210	256	800-DATALUX	217	253	602-968-6231	226	260	800-525-0082 ext. 112
210	256	800-DATALUX	*	128IDRC1-2	212-274-0640	*	216A-B	800-232-29283
209	257	800-DATALUX	K			69	217	800-232-29283
209	257	800-DATALUX	265	255		124-125	89	800-722-6555
248-249	258	800-668-2707	102	202	800-663-8702	126	203	800-368-5283
534	112IS-4		218	254	303-444-7737	127	91	617-661-1510
*	CIII	800-626-8260	103-104	19	714-435-2600	516	76-77	+31-40-73-39-83*
*	CIV	800-626-8260	219	260	409-260-5274	258	253	613-591-1555
211	261	800-DIAGSOFT	L			128-129	8-9	714-727-3300
173	168	916-621-1787	220	259	800-938-TAPE	130	194	414-354-8699
E								
251-252	253	309-862-1704	272	112	800-548-4778	131	187	212-571-3434
86	54	+972-4-528613**	141-142	153	800-683-6696	107	55-57	800-445-7899
*	20-21	+44-81-452-6422**	201	250	800-238-9415	*	200A-D	800-421-8006
247	258	+39 142 451988**	221-222	252	508-460-0333	161-162	53	619-457-5500
M								
N								
O								
P								

YOUR DIRECT LINK CARD

For free product information, mail your completed card today. For quicker response, fax to 1-413-637-4343!

Yes, I want **FREE** information on the following products!

1. Circle the Numbers on Your Direct Link Card

Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

2. Print Your Name and Address

Answer questions "A" through "E" and mail or fax card to 1-413-637-4343.

3. Product information will be rushed to you from the selected companies!

Fill out this coupon carefully. Please Print.

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Phone _____ Fax _____

A. What is your primary job function/principal area of responsibility? (Check one)

- MIS/DIP
 Programmer/Systems Analyst
 Administration/Management
 Sales/Marketing
 Engineer/Scientist
 Other

B. What is your level of management responsibility?

- Senior-level Professional
 Middle-level

C. Are you a reseller (VAR, VAD, Dealer, Consultant)?

- Yes No

D. What operating systems are you currently using? (Check all that apply)

- PC-MS-DOS Unix
 DOS + Windows MacOS
 OS/2 VAX/VMS

E. For how many people do you influence the purchase of hardware or software?

- 1-25 51-99
 19-26-50 100 or more

June 1993

86 96 99

Product Category Information	Disks & Optical Drives	7	Multimedia	19	Educational	30	Shareware	42
Circle the numbers below for information on the entire category of products you're interested in.	Diskettes/Duplicators	8	Printers/Plotters	20	Engineering/Scientific	31	Software Duplication	43
	Fax Boards/Machines	9	Programmable Hardware	21	Entertainment	32	Spreadsheets	44
	Graphics Tablets/Mice/ Pen Input	10	Scanners/OCR/Digitizers	22	Graphics	33	Unix	45
	Keyboards	11	Tape Drives	23	Macintosh	34	Utilities	46
	LAN Hardware	12	UPS	24	Mail Order	35	Windows	47
	Laptops & Notebooks	13	Software		Mathematical/Statistical	36	Word Processing	
	Mail Order	14	Business	25	Miscellaneous Software	37	General	
	Memory/Chips/Upgrades	15	CAD/CAM	26	On-Line Services	38	Books/Publications	49
	Miscellaneous Hardware	16	Communications/Networking	27	Operating Systems	39	Recruitment	50
	Modems/Multiplexors	17	Data Acquisition	28	Programming Languages/Tools	40	Miscellaneous	51
	Monitors & Terminals	18	Database	29	Security	41		

Inquiry Numbers 52-233

52	78	104	130	156	182	208
53	79	105	131	157	183	209
54	80	106	132	158	184	210
55	81	107	133	159	185	211
56	82	108	134	160	186	212
57	83	109	135	161	187	213
58	84	110	136	162	188	214
59	85	111	137	163	189	215
60	86	112	138	164	190	216
61	87	113	139	165	191	217
62	88	114	140	166	192	218
63	89	115	141	167	193	219
64	90	116	142	168	194	220
65	91	117	143	169	195	221
66	92	118	144	170	196	222
67	93	119	145	171	197	223
68	94	120	146	172	198	224
69	95	121	147	173	199	225
70	96	122	148	174	200	226
71	97	123	149	175	201	227
72	98	124	150	176	202	228
73	99	125	151	177	203	229
74	100	126	152	178	204	230
75	101	127	153	179	205	231
76	102	128	154	180	206	232
77	103	129	155	181	207	233

Inquiry Numbers 409-590

409	435	461	487	513	539	565
410	436	462	488	514	540	566
411	437	463	489	515	541	567
412	438	464	490	516	542	568
413	439	465	491	517	543	569
414	440	466	492	518	544	570
415	441	467	493	519	545	571
416	442	468	494	520	546	572
417	443	469	495	521	547	573
418	444	470	496	522	548	574
419	445	471	497	523	549	575
420	446	472	498	524	550	576
421	447	473	499	525	551	577
422	448	474	500	526	552	578
423	449	475	501	527	553	579
424	450	476	502	528	554	580
425	451	477	503	529	555	581
426	452	478	504	530	556	582
427	453	479	505	531	557	583
428	454	480	506	532	558	584
429	455	481	507	533	559	585
430	456	482	508	534	560	586
431	457	483	509	535	561	587
432	458	484	510	536	562	588
433	459	485	511	537	563	589
434	460	486	512	538	564	590

Inquiry Numbers 766-947

766	792	818	844	870	896	922
767	793	819	845	871	897	923
768	794	820	846	872	898	924
769	795	821	847	873	899	925
770	796	822	848	874	900	926
771	797	823	849	875	901	927
772	798	824	850	876	902	928
773	799	825	851	877	903	929
774	800	826	852	878	904	930
775	801	827	853	879	905	931
776	802	828	854	880	906	932
777	803	829	855	881	907	933
778	804	830	856	882	908	934
779	805	831	857	883	909	935
780	806	832	858	884	910	936
781	807	833	859	885	911	937
782	808	834	860	886	912	938
783	809	835	861	887	913	939
784	810	836	862	888	914	940
785	811	837	863	889	915	941
786	812	838	864	890	916	942
787	813	839	865	891	917	943
788	814	840	866	892	918	944
789	815	841	867	893	919	945
790	816	842	868	894	920	946
791	817	843	869	895	921	947

Inquiry Numbers 1123-1304

1123	1149	1175	1201	1227	1253	1279
1124	1150	1176	1202	1228	1254	1280
1125	1151	1177	1203	1229	1255	1281
1126	1152	1178	1204	1230	1256	1282
1127	1153	1179	1205	1231	1257	1283
1128	1154	1180	1206	1232	1258	1284
1129	1155	1181	1207	1233	1259	1285
1130	1156	1182	1208	1234	1260	1286
1131	1157	1183	1209	1235	1261	1287
1132	1158	1184	1210	1236	1262	1288
1133	1159	1185	1211	1237	1263	1289
1134	1160	1186	1212	1238	1264	1290
1135	1161	1187	1213	1239	1265	1291
1136	1162	1188	1214	1240	1266	1292
1137	1163	1189	1215	1241	1267	1293
1138	1164	1190	1216	1242	1268	1294
1139	1165	1191	1217	1243	1269	1295
1140	1166	1192	1218	1244	1270	1296
1141	1167	1193	1219	1245	1271	1297
1142	1168	1194	1220	1246	1272	1298
1143	1169	1195	1221	1247	1273	1299
1144	1170	1196	1222	1248	1274	1300
1145	1171	1197	1223	1249	1275	1301
1146	1172	1198	1224	1250	1276	1302
1147	1173	1199	1225	1251	1277	1303
1148	1174	1200	1226	1252	1278	1304

Inquiry Numbers 234-408

234	259	284	309	334	359	384
235	260	285	310	335	360	385
236	261	286	311	336	361	386
237	262	287	312	337	362	387
238	263	288	313	338	363	388
239	264	289	314	339	364	389
240	265	290	315	340	365	390
241	266	291	316	341	366	391
242	267	292	317	342	367	392
243	268	293	318	343	368	393
244	269	294	319	344	369	394
245	270	295	320	345	370	395
246	271	296	321	346	371	396
247	272	297	322	347	372	397
248	273	298	323	348	373	398
249	274	299	324	349	374	399
250	275	300	325	350	375	400
251	276	301	326	351	376	401
252	277	302	327	352	377	402
253	278	303	328	353	378	403
254	279	304	329	354	379	404
255	280	305	330	355	380	405
256	281	306	331	356	381	406
257	282	307	332	357	382	407
258	283	308	333	358	383	408

Inquiry Numbers 591-765

591	616	641	666	691	716	741
592	617	642	667	692	717	742
593	618	643	668	693	718	743
594	619	644	669	694	719	744
595	620	645	670	695	720	745
596	621	646	671	696	721	746
597	622	647	672	697	722	747
598	623	648	673	698	723	748
599	624	649	674	699	724	749
600	625	650	675	700	725	750
601	626	651	676	701	726	751
602	627	652	677	702	727	752
603	628	653	678	703	728	753
604	629	654	679	704	729	754
605	630	655	680	705	730	755
606	631	656	681	706	731	756
607	632	657	682	707	732	757
608	633	658	683	708	733	758
609	634	659	684	709	734	759
610	635	660	685	710	735	760
611	636	661	686	711	736	761
612	637	662	687	712	737	762
613	638	663	688	713	738	763
614	639	664	689	714	739	764

YOUR DIRECT LINK CARD

For free product information, mail your completed card today. **For quicker response, fax to 1-413-637-4343!**

See reverse side for card.

1. Circle the Numbers on Your Direct Link Card

Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

2. Print Your Name and Address

Answer questions "A" through "E" and mail or fax card to 1-413-637-4343.

3. Product information will be rushed to you from the selected companies!

BUSINESS REPLY MAIL

FIRST CLASS MAIL

PERMIT NO. 176

PITTSFIELD, MA

POSTAGE WILL BE PAID BY ADDRESSEE

BYTE

READER SERVICE

P.O. BOX 5110

Pittsfield, MA 01203-9926

USA



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



BYTE 



YOUR DIRECT LINK

PRODUCT CATEGORY INDEX

For FREE product information from individual advertisers, circle the corresponding inquiry numbers on Your Direct Link Card!

Category No. Inquiry No.	Page No.	Category No. Inquiry No.	Page No.	Category No. Inquiry No.	Page No.
HARDWARE					
1 ACCESSORIES/SUPPLIES					
527	ZECKS	128IS-2			
2 ADD-IN BOARDS					
65	ATI TECHNOLOGIES INC	140			
502-503	COMPEX INC (INT'L)	15			
253	CONTROL CONCEPTS	252			
208	CURTIS INC	252			
534	DEC	112IS-4			
251-252	EDEN'S TECHNOLOGY CORP	253			
96	INTEL CORP	118-119			
101	JAMECO ELECTRONICS	93			
522	JEN ELECTRONICA	48IS-2			
221-222	LOMAS DATA	252			
110	MATROX VIDEO PRODUCTS GRP	184			
133	QUA TECH INC	230			
532-533	SPEA SOFTWARE AG	35			
243	STARGATE TECHNOLOGIES	252			
*	STRADA AUTOTECH, INC	252			
231	TALKING TECHNOLOGY INC	254			
3 BAR CODING					
236	VIDEX, INC	253			
4 COMMUNICATIONS/NETWORKING					
182-183	BAY TECHNICAL ASSOC	241			
534	DEC	112IS-4			
251-252	EDEN'S TECHNOLOGY CORP	253			
*	ELONEX	20-21			
204-205	EMBARC / MOTOROLA	247			
213	GTEK INC	253			
257	HI-TECH ELECTRONICS	253			
217	JENSEN TOOLS	253			
548	MEGADATA	220IS-2			
520	MINICOM LTD	112IS-2			
258	PIKA TECHNOLOGIES	253			
136	ROSE ELECTRONICS	204			
245-246	SIGMA TECH SOFTWARE	254			
243	STARGATE TECHNOLOGIES	252			
231	TALKING TECHNOLOGY INC	254			
232-233	TECHNOLOGIC SYSTEMS	258			
5 COMPUTER SYSTEMS					
543-544	APPRO INTERNATIONAL INC	248SO-1			
74	COMPAQ COMPUTER CORP (N.A.)	20-21			
*	DELL COMPUTER CORP (N.A.)	CIII			
*	DELL COMPUTER CORP (N.A.)	CIV			
*	ELONEX (INT'L)	20-21			
539	ESP / CTC	248SO-3			
*	GATEWAY 2000	CII,1			
*	GATEWAY 2000	64A-L			
256	GSQUARED COMPUTERS	254			
215	INES GMBH	254			
97	INTEL CORP	48A-D			
218	KILA	254			
*	MANCHESTER EQUIPMENT CO	248A-B			
537	MANCHESTER EQUIPMENT CO	248NE-1			
197-198	MICRO-INTERNATIONAL, INC	242			
202-203	NAGA SYSTEMS CORP	234			
119	NEC - SYSTEMS	36-37			
121	NSTL	211			
124-125	PC POWER & COOLING	89			
193-194	RECORTEC INC	239			
519	TECHPOWER COMPANY LTD	112IS-2			
240	TRI VALLEY TECHNOLOGY INC	254			
156	ZEOS INTERNATIONAL	160-161			
6 DATA ACQUISITION					
223	MICROSTAR LABORATORIES	254			
*	NATIONAL INSTRUMENTS	128IDRC1-2			
133	QUA TECH INC	230			
7 DISK & OPTICAL DRIVES					
260	DAEYOUNG ELECTRONICS	255			
250	GENERAL TECHNICS	255			
100	IOMEGA	155			
265	KAKIUCHI	255			
112	MEGADRIVE SYSTEMS	81			
512	MICRO DESIGN INT'L	48IS-1			
114-115	MICRO SOLUTIONS COMP PROD	225			
113	MICROPOLIS CORP	105			
262-263	PARALLEL STORAGE SOLUTIONS	255			
128-129	PINNACLE MICRO	8-9			
525-526	QUANTUM CORP (INT'L)	218			
541-542	QUANTUM CORP (INT'L)	219			
191	STARTECH INTERNATIONAL	238			
239	TRANTROR SYSTEMS LTD	256			
8 DISKETTES/DUPLICATORS					
271	SONY (N.A.)	76-77			
152	VERBATIM CORP	117			
9 GRAPHICS TABLETS/MICE/PEN INPUT					
214	HI-TECH INSTRUMENTS	256			
273	HONEYWELL KEYBOARD DIV	162			
*	MICROSOFT CORP	16-17			
11 KEYBOARDS					
501	CHERRY				
	MIKROSCHALTER GMBH (INT'L)	214-215			
210	DATALUX CORP (INT'L)	256			
210	DATALUX CORP (N.A.)	256			
12 LAN HARDWARE					
182-183	BAY TECHNICAL ASSOC	241			
505-506	CYBEX CORP	CIV			
186-187	CYBEX CORP	243			
545-546	CYBEX CORP	248SO-2			
534	DEC	112IS-4			
201	LOGICAL CONNECTION	250			
520	MINICOM LTD	112IS-2			
124-125	PC POWER & COOLING	89			
13 LAPTOPS & NOTEBOOKS					
178-179	ABC COMPUTER	236			
206	AXONIX CORP	256			
528	CHICONY (INT'L)	111			
521	FIRST INTERNATIONAL COMP	112IS-3			
212	GENOVATION, INC	256			
*	JDR MICRODEVICES	251			
197-198	MICRO-INTERNATIONAL, INC	242			
529	MULTIVENTURE	200IS-4			
535	SUNRACE	128IS-4			
146	TEXAS INSTRUMENTS	7			
148	TOSHIBA AMERICA INC	70-71			
192	TOTE-A-LAP	245			
156	ZEOS INTERNATIONAL	160-161			
14 MAIL ORDER					
196	CITITRONICS	246			
185	COMPUTERLANE UNLTD	235			
*	IBM DIRECT (N.A.)	112A-D			
101	JAMECO ELECTRONICS	93			
190	NEVADA COMPUTER	232			
*	PC DIGEST	216A-B			
69	PC DIGEST	217			
191	STARTECH INTERNATIONAL	238			
15 MEMORY/CHIPS/UPGRADES					
180	ADVANCED COMPUTER PROD	244			
196	CITITRONICS	246			
188-189	FIRST SOURCE INT'L	237			
97	INTEL CORP	48A-D			
101	JAMECO ELECTRONICS	93			
103-104	KINGSTON TECHNOLOGY	19			
241	THE BSE COMPANY	257			
200	TRANSCEND INFORMATION INC	240			
195	WORLDWIDE TECHNOLOGIES	248			
16 MISCELLANEOUS HARDWARE					
180	ADVANCED COMPUTER PROD	244			
181	AMT INTERNATIONAL	249			
95	INTEGRAND RESEARCH	62			
161-162	PROXIMA CORP	53			
517	SEKISUI CHEMICAL CO LTD	112IS-4			
191	STARTECH INTERNATIONAL	238			
17 MODEMS/MULTIPLEXORS					
*	JDR MICRODEVICES	251			
274-275	MACRONIX INC	210			
269-270	ZYXEL USA	101			
18 MONITORS & TERMINALS					
84-85	CTX INTERNATIONAL INC	164			
209	DATALUX CORP (INT'L)	257			
209	DATALUX CORP (N.A.)	257			
*	ELONEX (INT'L)	20-21			
116-117	NANAO USA CORP (N.A.)	15			
516	PHILIPS MONITORS (INT'L)	76-77			
530-531	SAMTRON	48IS-4			
171-172	SCEPTRE TECHNOLOGIES	107			
153-154	VIEWSONIC	85			
19 MULTIMEDIA					
261	ADVANCED DIGITAL SYSTEMS	257			
259	CALPAC COMPUTER CORP	257			
207	CONTROL VISION	257			
82-83	COVOX INC	189			
268	CREATIVE LABS INC	29			
84-85	CTX INTERNATIONAL INC	164			
173	DIGISPEECH INC	168			
96	INTEL CORP	118-119			
272	LAHEY COMPUTER SYSTEMS	112			
167-168	PACIFIC GOLD COAST	94			
161-162	PROXIMA CORP	53			
177	SONY - ELECTRONIC PUBLISHING	223			
145	TEKTRONIX	63			
20 PRINTERS/PLOTTERS					
182-183	BAY TECHNICAL ASSOC	241			
184	BUFFALO PRODUCTS	233			
91	HEWLETT PACKARD	12-13			
201	LOGICAL CONNECTION	250			
537	MANCHESTER EQUIPMENT CO	248NE-1			
513	MINOLTA GMBH (PAN EUROPE)	200IS-1			
122	OKIDATA	79			
*	PACIFIC DATA PRODUCTS	180			
199	RALIN WHOLESALERS	249			
232-233	TECHNOLOGIC SYSTEMS	258			
145	TEKTRONIX	63			
147	TEXAS INSTRUMENTS	95			
164-165	XLI CORP	108			
21 PROGRAMMABLE HARDWARE					
248-249	DAVISON-WORTH CORP	258			
86	ELIASHIM MICROCOMPUTERS	54			

YOUR DIRECT LINK

PRODUCT CATEGORY INDEX

For FREE product information from individual advertisers, circle the corresponding inquiry numbers on your Direct Link Card!

Category No. Inquiry No.		Page No.	Category No. Inquiry No.		Page No.	Category No. Inquiry No.		Page No.
247	ELSIST	258	31	ENGINEERING/SCIENTIFIC		501	CHERRY	
508	FAST ELECTRONIC GMBH	128IS-3	98-99	INTERGRAPH	128A-F	170	MIKROSCHALTER GMBH (INT'L)	214-215
216	IO TECH	258	159-160	ITERATED SYSTEMS	54	86	DALLAS SEMICONDUCTOR	52
*	JDR MICRODEVICES	251	141-142	LANDMARK RESEARCH INT'L CORP	153	507	ELIASHIM MICROCOMPUTERS	54
234-235	TRIBAL MICROSYSTEMS	258	108	MATHSOFT INC	191	508	EUTRON	48IS-3
237	XELTEK	259	523	ON TIME MKT / KARSTEN PETERSEN	128IS-2	89-90	FAST ELECTRONIC GMBH	128IS-3
238	Z-WORLD ENGINEERING	259				174-175	GLENCO ENGINEERING	126
22	SCANNERS/OCR/DIGITIZERS		33	GRAPHICS		134-135	INTELLIGENT SECURITY SYS	196
86	ELIASHIM MICROCOMPUTERS	54	81	COREL SOFTWARE	43	138-139	RAINBOW TECHNOLOGIES	61
*	HEWLETT PACKARD	26-27	84-85	CTX INTERNATIONAL INC	164	255	SOFTWARE SECURITY INC	206
161-162	PROXIMA CORP	53	111	MEDIA CYBERNETICS	212		STARTEK	261
52	SECURITY		116-117	NANAO USA CORP (N.A.)	15	45	UNIX	
229-230	SECURE IT INC	259	167-168	PACIFIC GOLD COAST	94	88	FRAME TECHNOLOGY (N.A.)	35
23	TAPE DRIVES		226	PATTON & PATTON	260	76-77	GREENVIEW DATA	135
71-72	COLORADO MEMORY SYSTEMS	39	532-533	SPEA SOFTWARE AG (INT'L)	35	*	MARK WILLIAMS CO	195
220	LAGUNA DATA SYSTEMS	259	145	TEKTRONIX	63	540	MKS / MORTICE KERN SYSTEMS	112IS-1
114-115	MICRO SOLUTIONS COMP PROD	225	35	MAIL ORDER		*	NETWORK COMPUTING DEVICES	111
225	OVERLAND DATA INC	259	504	COMPUTER QUICK	48IS-3	163	SUNSOFT	2-3
227	QUALSTAR CORP	259	107	PROGRAMMER'S PARADISE	56-57	*	UNIPRESS	248NE-3
151	VALITEK INC	208	*	PROGRAMMER'S SHOP	200A-D	46	UTILITIES	
254	WILTEC, INC	259	518	SOFTLINE CORP (INT'L)	CIII	63	ALADDIN KNOWLEDGE SYSTEMS	83
24	UPS		36	MATHEMATICAL/STATISTICAL		166	CIMMETRY SYSTEMS	152
64	AMERICAN POWER CONVERSION	122	228	SAS INSTITUTE INC	261	211	DIAGSOFT INC	261
123	MINUTEMAN	75	140	STATSOFT	205	87	FARALLON (N.A.)	33
124-125	PC POWER & COOLING	89	143-144	SYSTAT INC	124	141-142	LANDMARK RESEARCH INT'L CORP	153
149-150	TRIPP LITE	64	37	MISCELLANEOUS SOFTWARE		130	PKWARE INC	194
25	BUSINESS		523	ON TIME MKT / KARSTEN PETERSEN	128IS-2	157	SYMANTEC	139
169	FUNK SOFTWARE	207	276	VIRTUAL REALITY LABS	216	47	WINDOWS	
219	KNOWLEDGE BASED SYSTEMS	260	38	ON-LINE SERVICES		61-62	ABACUS SOFTWARE	50
111	MEDIA CYBERNETICS	212	450	BIX		70	CENTRAL POINT SOFTWARE	44-45
*	UNIPRESS	248NE-3	*	COMPUSERVE	144A-B	511	GREY MATTER LTD	128IS-1
26	CAD/CAM		75	COMPUSERVE	145	98-99	INTERGRAPH (N.A.)	128A-F
242	CADSOFT COMPUTER, INC.	260	39	OPERATING SYSTEMS		102	KEA SYSTEMS LTD	202
98-99	INTERGRAPH (N.A.)	128A-F	94	IBM PERSONAL S/W PRODUCTS	40-41	141-142	LANDMARK RESEARCH INT'L CORP	153
27	COMMUNICATIONS/ NETWORKING		93	IBM PERSONAL S/W PRODUCTS	115	116-117	NANAO USA CORP (N.A.)	15
204-205	EMBARC/MOTOROLA	247	*	MARK WILLIAMS CO	195	515	OXFORD ELECTRONIC PUBLISHING	33
87	FARALLON (N.A.)	33	*	MICROSOFT CORP	67	126	PERSOFT INC	203
169	FUNK SOFTWARE	207	*	MICROSOFT CORP	69	532-533	SPEA SOFTWARE AG	35
509-510	FUTURESOFT ENGINEERING	112IS-2	*	NETWORK COMPUTING DEVICES	111	48	WORD PROCESSING/DTP	
520	MINICOM LTD.	112IS-2	120	NEXT COMPUTER	166	88	FRAME TECHNOLOGY (N.A.)	35
126	PERSOFT INC	203	132	QUARTERDECK OFFICE SYSTEMS	131	*	MICROSOFT CORP	30-31
176	SOFTARC	116	40	PROGRAMMING LANGUAGES/ TOOLS		*	MICROSOFT CORP	123
28	DATA ACQUISITION		66-67	BORLAND INTERNATIONAL	11	*	MICROSOFT CORP	125
215	INES GMBH	254	78	COMPUTER ASSOCIATES	47	*	MICROSOFT CORP	127
118	NATIONAL INSTRUMENTS	209	79	COMPUTER ASSOCIATES	99	*	MULTIVERSE	
224	NATIONAL INSTRUMENTS	260	76-77	GREENVIEW DATA	135	515	COMMUNICATIONS USA	128IS-2
29	DATABASE		511	GREY MATTER LTD	128IS-1		OXFORD ELECTRONIC PUBLISHING (INT'L)	33
80	COMPUTER ASSOCIATES	86-87	244	IVERSON SOFTWARE, INC	261	49	BOOKS/PUBLICATIONS	
524	ITALIAN SOFTWARE AGENCY	200IS-3	*	MICROWAY	174	61-62	ABACUS SOFTWARE	50
*	RAIMA CORP	58	*	MICROWAY	196		C USERS JOURNAL	128IDRC1-2
137	SEQUITER SOFTWARE INC	132	540	MKS / MORTICE KERN SYSTEMS	112IS-1		JNL OF OBJ ORIENT PROGRAMMING	128IDRC1-2
30	EDUCATIONAL		120	NEXT COMPUTER	166	*	OSBORNE MCGRAW-HILL	213
61-62	ABACUS SOFTWARE	50	523	ON TIME MKT / KARSTEN PETERSEN	128IS-2	*	UNIXWORLD	176A-B
167-168	PACIFIC GOLD COAST	94	127	PHAR LAP SOFTWARE INC	91	*	UNIXWORLD	176
			131	POPKIN S/W & SYSTEMS INC	187	51	MISCELLANEOUS	
			*	PROGRAMMER'S SHOP	200A-D	68	BRITISH AIRWAYS	120
			155	WATCOM	25	*	BYTE SUB MESSAGE	215
			41	SECURITY				
			63	ALADDIN KNOWLEDGE SYS	83			

No hairstyling tips.



No garbage.

No noise.

No irrelevant clutter.

BIX has the best "signal-to-noise" ratio and the highest quality content in the industry. For serious computer programmers and developers, BIX is the most exclusive online club in town.

BIX now offers Internet

mail (10 million bytes per month, at no charge). Windows users order BIXnav, a graphic front-end for BIX.

Give BIX a try with our new

5 for \$5 Offer! Join BIX today and get 5 hours of evening and weekend access for just \$5! Use the rest of the calendar month to explore BIX, with the option of continuing for only \$13 per month. Further details and complete rate information are provided during registration. Using any communications program, dial 1-800-695-4882. At the "logon" prompt enter bix. Then at the "name?" prompt enter bix.byte36. Questions? Call us at 1-800-695-4775 (voice). Or fax to 617-491-6642. Send Internet mail to bix@genvid.com.



BIX

If you can hack it

Under the 5 for \$5 plan, daytime surcharges (\$9/hr.) apply for access during prime time hours. The 5 for \$5 offer is valid for first-time members only. Unused hours do not accrue to subsequent months. The \$5 charge is a non-refundable flat fee and is charged regardless of use.

Circle 450 on Inquiry Card.

The Cuckoo's Egg Revisited

Five years ago, a hacker broke into a computer at Lawrence Berkeley Laboratory and changed the computing world forever

I'm an astronomer. Five years ago, I found a 75-cent accounting error in my computer. It's curious how trivial errors are often ripe grounds for research. I traced it back to a programmer in Germany who broke into computers, stole data, and sold it to the KGB. Zooks—I'd stumbled onto a spy.

What's happened since then? The cold war has ended, the KGB dissolved, and Germany reunited. That computer spy, since convicted of espionage, has returned to programming. I told my story in *The Cuckoo's Egg*—perhaps the first book to combine espionage, computing, and chocolate chip cookies.

Meanwhile, the Internet has thrived. Five years ago, I counted 60,000 nodes; today, it's more like a million. Happily, worries of spies, viruses, and worms haven't hindered its growth: It doubles every year. It now transfers data and E-mail for academics, commercial groups, and, well, ordinary people. It taps a vast resource of software archives and passes thousands of messages an hour.

Our Internet has grown far beyond the cables that carry data. It's a worldwide community, a neighborhood built on ether. Can it ever go back to the tight-woven neighborhood it once was? No more than a city can return to its rural roots.

Events have conspired to create national policies that are confused, pulling at once toward privacy, openness, and secrecy. The holes in system security that intruders exploited in 1987 have long since been corked. In their place, new problems have arisen. Brute-force password decryption once took a week on a VAX; today's optimized cracking programs might take an afternoon. PC LANs create insecure environments that go undetected until they're tied to nationwide networks.

Meanwhile, the National Security Agency, trying to control cryptography, discourages companies from creating better locks for data. The Secret Service, under the computer security laws, has raided small-time computer hackers. A steady stream of break-in reports keeps the Computer Emergency Response Team hopping, one of the important results of the Internet Worm of 1988.

And the hacker underground has grown. Cyberpunks, often taking aim at phone systems and computer networks, have tweaked noses but haven't become the menace predicted five years ago. Break-ins are now routinely tracked across national borders. Curiously, the virus fad is fading. Hard to say why: It might be due to better antivirals, smarter users, or fewer scare stories.



The Cuckoo's Egg has been misused to justify busts of innocuous BBSes, restrictive legislation, investigations into networked activity, and who knows what monitoring by Big Brother. It's also been misused as a cookbook and as a justification by bad guys to break into computers. I disagree with all of these. I strongly disagree.

I've repeatedly testified before Congress and state legislatures. I don't want to lose the friendly sandbox that our networks have become. Our civil rights—including free speech and privacy—must be preserved on the electronic frontier.

Our computers show the tension between privacy and openness. Each of us wants governmental data to be public and open—there's no reason why we shouldn't be able to search governmental databases electronically. Yet we want data about ourselves—medical, financial, and personal records—to be kept secret and unavailable.

At the same time, we must respect each others' rights to privacy and free speech. This means not writing viruses, breaking into another's computer, or posting messages certain to cause flame wars. Just as important, it means treating each other with civility, respect, and tolerance. Our networks are communities, neighborhoods built on mutual trust.

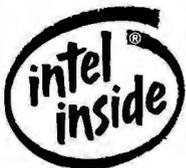
Me? Oh, I'm now returning to astronomy and writing a book about telescopes—back to my roots. I subscribe to BYTE and pay all my shareware fees. You'll find me on CompuServe, AOL, GENie, BIX, Usenet, and the Internet...often reading, occasionally posting.

And if someone breaks into my computer again? Oh, I doubt I'll bother. The first time it's research. The second time is just engineering. ■

Clifford Stoll graduated from Buffalo Public School #61 with a blue star for good attendance. Later, he repaired pinball machines, printed T-shirts, and received a Ph.D. in planetary science. In his spare time, he bicycles, makes plum jam, and squeezes lumps of bituminous coal into diamonds. You can contact him on BIX as "cliffstoll" or on the Internet at stoll@ocf.berkeley.edu.

WE'RE MAKING THEY'RE CHECK

	DELL 425s/L	COMPAQ ProLinea 4/25s
UPGRADEABLE TO PENTIUM TECHNOLOGY	✓	
FLASH ROM BIOS	✓	
FLASH ROM EMBEDDED DIAGNOSTICS	✓	
128KB EXTERNAL CACHE OPTION	✓	
MODULAR CHASSIS DESIGNED FOR EASY SERVICEABILITY	✓	
64MB MAXIMUM RAM ON SYSTEM BOARD	✓	
LOW PROFILE CHASSIS WITH 3 DRIVE BAYS AND 3 ISA EXPANSION SLOTS	✓	✓
GUARANTEED* NEXT-BUSINESS-DAY ON-SITE SERVICE	✓	
UP TO 1MB VIDEO RAM	✓	✓



*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. †Source: Dataquest, Inc., 1992. *Prices valid in U.S. only. Some products and promotions not available in Canada or Mexico. ‡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. The Intel Inside logo is a registered trademark and i386, i486 and Pentium are trademarks of Intel Corporation. MS-DOS and Microsoft are registered trademarks of Microsoft Corporation. Dell disclaims proprietary interest in the marks and names of others. ©1993 Dell Computer Corporation. All rights reserved.

GET A LIST AND BUYING IT TWICE.

Buy any Dell system and we'll install your software right at our factory. It's called Dell ReadyWareSM. With 20 diskettes and 2 hours to load and configure just one system, imagine the time you'll save and the hassles you'll avoid. In fact, we have over 50 competitively priced popular software applications to choose from.

Just order MS-DOS 6.0, Microsoft  Windows 3.1 (for Windows applications), and your ReadyWare choices when you order your Dell Performance Series system.

We'll install as many applications as you need for just \$15. So make a note of it.



THE DELL 333s/L
i386™ SX 33MHz SYSTEM
\$999*

BUSINESS LEASE: \$37/MO.
2MB RAM
80MB (17ms) HARD DRIVE
3 ISA EXPANSION SLOTS
256KB VIDEO RAM
VGA COLOR PLUS
(14", 640 x 480, .31mm)
ONE DISKETTE DRIVE
(3.5" or 5.25")
MS-DOS 6.0
MICROSOFT WINDOWS 3.1
MOUSE

*WHILE SUPPLIES LAST.



THE DELL 450/L
i486 DX2 50MHz SYSTEM
\$2,299

BUSINESS LEASE: \$85/MO.
4MB RAM
230MB (17ms) HARD DRIVE
FLASH ROM EMBEDDED DIAGNOSTICS
3 ISA EXPANSION SLOTS
UPGRADEABLE TO
PENTIUM TECHNOLOGY
ACCELERATED LOCAL BUS
VIDEO WITH 1MB VIDEO RAM
ULTRASCAN 14C MONITOR
(14", 1024 x 768, .28mm, NI)
ONE DISKETTE DRIVE
(3.5" or 5.25")
MS-DOS 6.0



THE DELL 450/M
i486 DX2 50MHz SYSTEM
\$2,499

BUSINESS LEASE: \$92/MO.
4MB RAM
170MB (17ms) HARD DRIVE
128KB EXTERNAL CACHE
FLASH ROM EMBEDDED DIAGNOSTICS
6 ISA EXPANSION SLOTS
UPGRADEABLE TO
PENTIUM TECHNOLOGY
ACCELERATED LOCAL BUS
VIDEO WITH 512KB VIDEO RAM
ULTRASCAN 14C MONITOR
(14", 1024 x 768, .28mm, NI)
ONE DISKETTE DRIVE
(3.5" or 5.25")
MS-DOS 6.0



THE DELL 466/ME
i486 DX2 66MHz SYSTEM
\$3,599

BUSINESS LEASE: \$130/MO.
8MB RAM
450MB (12ms) HARD DRIVE
128KB EXTERNAL CACHE
FLASH ROM EMBEDDED DIAGNOSTICS
2 ISA EXPANSION SLOTS
4 EISA EXPANSION SLOTS
UPGRADEABLE TO
PENTIUM TECHNOLOGY
ACCELERATED LOCAL BUS VIDEO
WITH 1MB VIDEO RAM
ULTRASCAN 14C MONITOR
(14", 1024 x 768, .28mm, NI)
ONE DISKETTE DRIVE
(3.5" or 5.25")
MS-DOS 6.0



THE DELL 425s/L
i486 SX 25MHz SYSTEM
\$1,599

BUSINESS LEASE: \$59/MO.

4MB RAM • 170MB (17ms) HARD DRIVE • FLASH ROM EMBEDDED DIAGNOSTICS
• UPGRADEABLE TO PENTIUM TECHNOLOGY • ACCELERATED LOCAL BUS VIDEO
WITH 512KB VIDEO RAM • ULTRASCAN 14C MONITOR (14", 1024 x 768, .28mm, NI)
• DUAL DISKETTE DRIVES (3.5" AND 5.25") • MS-DOS 6.0/MICROSOFT WINDOWS/MOUSE
PROMOTIONAL PRICE: OFFER EXPIRES 7/31/93

DELL

800-553-6046

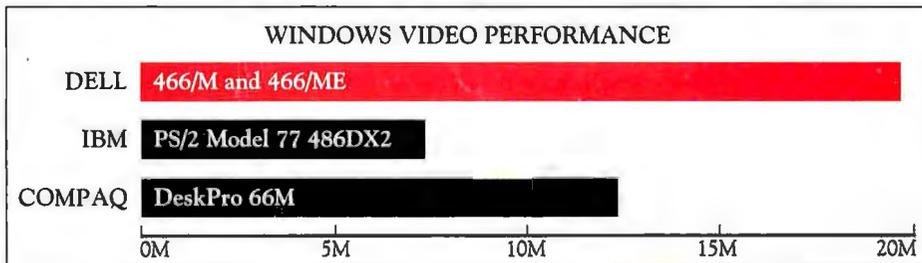
WHEN CALLING, PLEASE REFERENCE #11E98.

HOURS: 7AM-9PM CT MON-FRI, 8AM-4PM CT SAT, 10AM-3PM CT SUN.

IN CANADA, CALL 800-668-3021.

MANY OTHER CONFIGURATIONS AVAILABLE. CALL YOUR DELL REPRESENTATIVE FOR DETAILS.

COMPAQ'S AND IBM'S VIDEO IS BEHIND THE TIMES.



Performance measured by running WINBENCH version 3.1 at 640 x 480, 256 colors. Results measured in millions of WINMARKS. Results for IBM and Compaq as published by PC Magazine in issue dated January 26, 1993. Results for Dell 466/M and 466/ME provided by Dell Performance Measurement Lab, January 1993. DeskPro 66M configured with 8MB RAM, 210MB IDE HD, QVision 1024/E controller with 1MB VRAM. PS/2 model 77 486DX2 configured with 8MB RAM, 400MB SCSI HD, XGA-2 with 1MB VRAM and 256KB cache. 466/M and 466/ME both configured with 8MB RAM, 170MB IDE HD, local bus video with 1MB VRAM, and 128KB cache.

Our Dell 466/M and 466/ME with over 19 million WINMARKS, outran the Compaq DeskPro 66M with QVision and IBM PS/2 Model 77 486 DX2 with XGA-2. That means we're up to 57% faster than QVision and up to 174%



faster than XGA-2. Thanks, of course, to our accelerated local bus video and fast drivers for Windows applications. Both help put the Dell® 466/M a little ahead of its time.



THE DELL 466/M i486™ DX2 66MHz SYSTEM

\$3,149

BUSINESS LEASE*: \$117/MO.

- 8MB RAM • 230MB (17ms) HARD DRIVE • 128KB EXTERNAL CACHE
- FLASH ROM EMBEDDED DIAGNOSTICS • 6 ISA EXPANSION SLOTS
- UPGRADEABLE TO PENTIUM™ TECHNOLOGY • ACCELERATED LOCAL BUS VIDEO WITH 1MB VIDEO RAM • ULTRASCAN™ 14C MONITOR (14" 1024 x 768, .28mm, NI)
- ONE DISKETTE DRIVE (3.5" OR 5.25") • MS-DOS® 6.0

OR CHOOSE THE 466/ME EISA SYSTEM FOR ONLY \$200 MORE

DELL™

800-433-2312

WHEN CALLING, PLEASE REFERENCE #11EF3.

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.



\$999. NO, IT'S NOT A TYPO. (SORRY COMPAQ.)

SAVE \$200

DELL PERFORMANCE SERIES 333s/L
BUSINESS LEASE: \$37/MO.

Contrary to many systems you see advertised for under \$1,000, ours comes complete with a VGA color monitor (14" 640 x 480, .31mm). Plus an 80MB hard drive. Plus 2MB RAM. Plus one diskette drive. Plus MS-DOS, Microsoft® Windows 3.1, and a mouse. Plus 3 ISA expansion slots. Plus 256KB video RAM. Quite a few pluses, wouldn't you say?

CALL AND ORDER TODAY. OFFER EXPIRES 6/30/93.

There's no mistake about it. For a limited time only, you can get the fastest Dell 386SX made for under \$1,000. (That means you'll save up to



\$200.) And it comes complete with a VGA color monitor.

What's more, you also get guaranteed on-site service^Δ and technical support 24 hours a day, 7 days a week—with guaranteed telephone response in under five minutes.* All of which shouldn't surprise you since we were the winner of the latest Dataquest^{®†} Customer Satisfaction Survey, helping us to become the world's third largest industry-standard PC company.

Speaking of fast, take advantage

of our quick shipment program. That way you can receive your new system within three days of ordering it.

So call and order today. Offer expires 6/30/93. Which is one thing in this ad Compaq will be happy to hear.

DELL™

800-553-6039

WHEN CALLING, PLEASE REFERENCE #11E97.

HOURS: 7AM-9PM CT MON-FRI,
8AM-4PM CT SAT, 10AM-3PM CT SUN.