BYTE
A McGRAW-HILL PUBLICATION

7 Tools to Turbocharge Your Database
Page 204

84 BYTE Award Winners, Plus International Picks

Best Products of 1991

Windows Accelerators Compared:
Graphics Boards from Actix, ATI, Artist Graphics, Orchid, STB, and BCC

USER'S COLUMN
Jerry Pournelle on Windows 3.1

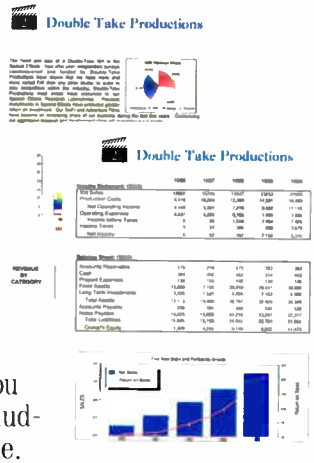
STATE OF THE ART
Developing Applications Across Platforms

PLUS
5 Statistics Packages
The 8-oz. Psion Series 3 Palmtop
ClarisWorks
Microsoft Bookshelf for Windows 3.0
Tektronix Phaser III Color Printer

11550
HEMPSTEAD NY
23 KENSINGTON CT
BILL BURNS
9100 00033518 FEB94 MIA 5684
**********5-DIGIT 11550
02662
0
$3.50 U.S.A./$4.50 IN CANADA
0360-5280

ls 1-2-3 for Windows.

With our "zoom in," "zoom out" and fast print preview features, you can refine and perfect your work before you print. Which means your output will always be just what you want it to be. Without any surprises at the printer.



Unlike the Toolbar™ in Microsoft® Excel, 1-2-3 for Windows actually lets you create your own icons for the tasks that are unique to you.

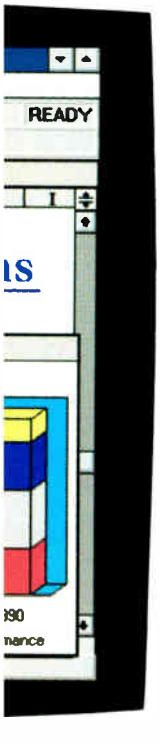
And yes, 1-2-3 for Windows fully exploits the Windows environment. Which means it includes pull down menus, dialog boxes, sizable windows, mouse support, full DDE support and everything else you'd expect in a true Windows application.

What's more, with its interactive graph gallery, you can select by example a wide range of graph types, including true 3D graphs in bar, line, area, stacked bar and pie.

Of course, when you're ready to print, your results will be nothing short of perfection. And thanks to its Auto Compress feature, you can easily make an entire report fit on one page.

Beneath it all, you'll have the complete power of 1-2-3 at work for you. Including 3D worksheets, Solver goal-seeking features and external data access through DataLens.®

And finally, to make the move to Windows a simple one for 1-2-3 users, we've included the 1-2-3 Classic® commands in the program. Where, at the push of the slash key, the familiar 1-2-3 menu will appear, fully functional, on screen. So 1-2-3 for Windows offers you complete file, style, macro and keystroke compatibility with all of the previous versions of 1-2-3.



So see why Lotus 1-2-3 for Windows is more than a great Windows spreadsheet. It's everything you've been looking for in one.

And now, you can upgrade from your current version of 1-2-3 to 1-2-3 for Windows and get both 1-2-3 and Ami Pro 2.0 for just $199.* A suggested retail value of $645. For a free auto demo, or to order your upgrade directly from Lotus,** call **1-800-TRADEUP, ext. 6416.**

These SmartIcons give you "one-click" shortcuts for your most frequently used tasks, such as opening and saving files and printing.

Use them for a variety of activities, from simple functions like auto-summing ranges to more powerful analytical tasks, such as accessing Solver.

SmartIcons give you easy access to Windows functionality like cutting, copying and pasting to and from the clipboard.

Virtually any formatting task you need to do, including pasting one cell's style to a range of cells, is just one click away.

SmartIcons make it incredibly easy to arrange your worksheets in three different views: tile, cascading and 3D perspective.

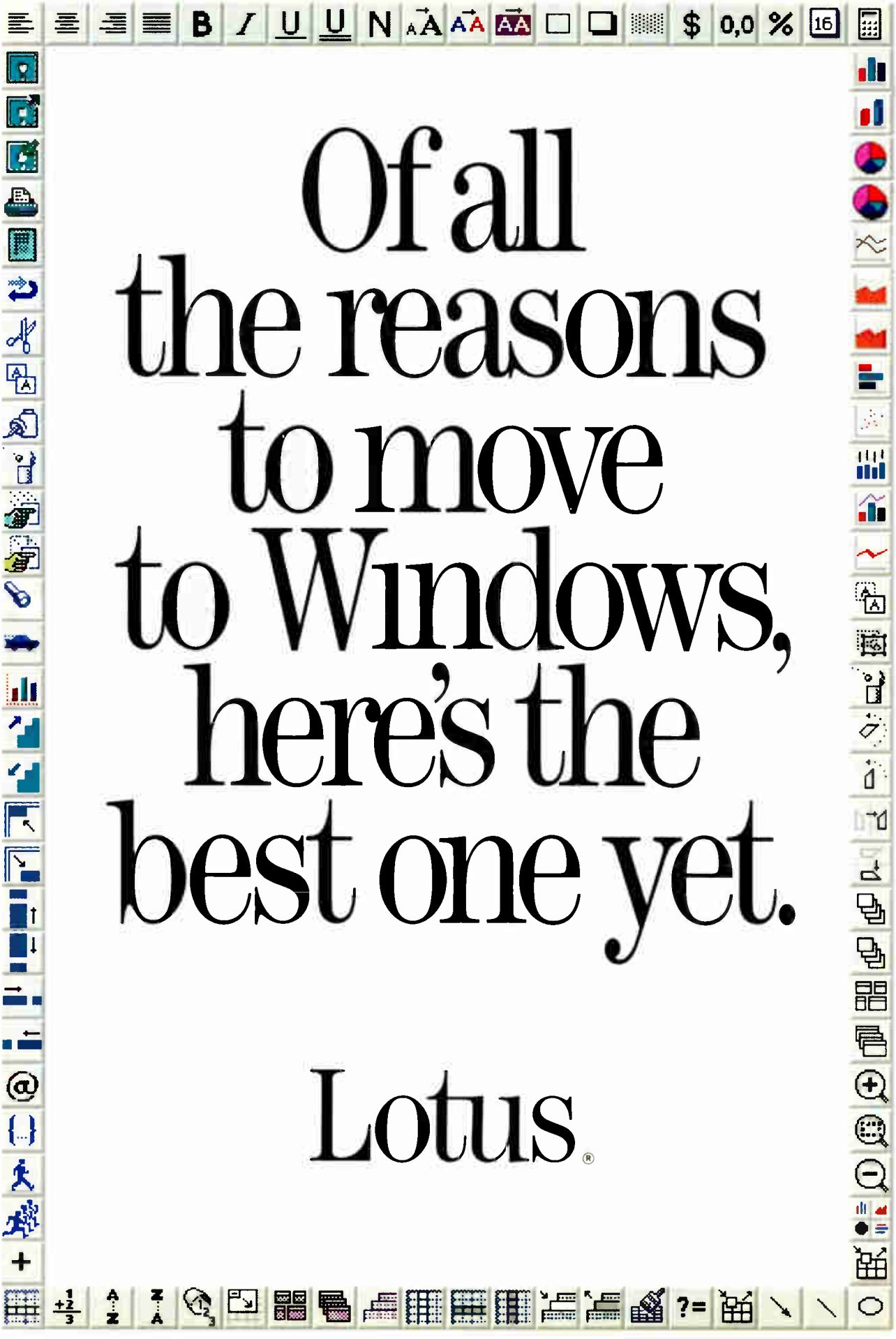
Click this and you'll create charts and graphs automatically. Then the icon palette will change to provide SmartIcons that enhance your graphs.

Run and de-bug macros, select macro keywords, or create your own customized icons for your macros.

1-2-3 for Windows Lotus

nartIcons is a trademark of Lotus Development Corporation. Classic is a registered trademark licensed to Lotus Development Corporation. Ami Pro is a trademark of Samna Corporation. ger and ATM are registered trademarks of Adobe Systems, Incorporated. **Please have your credit card and product package ready when you call. In Canada, call 1-800-668-1509.

World Radio History



World Radio History

Introducing Lotu

It's everything a Windows spreadsheet was meant to be.

After listening carefully to what our customers were looking for in a Windows™ spreadsheet, we developed Lotus® 1-2-3® for Windows with three goals in mind.

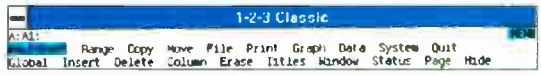
First, make it a full-fledged Windows application.

Second, introduce innovations that deliver a perfect balance of power and simplicity.

And third, make it fully compatible with all of the earlier versions of 1-2-3 that millions of 1-2-3 users are familiar with.

Well, we've done all this. And a whole lot more. Which, no doubt, is why 1-2-3 for Windows was awarded Byte Magazine's *Best New Windows Application* at Comdex/Spring '91.

For starters, the most exciting part of 1-2-3 for Windows is its SmartIcons,™ an innovative "one-click" approach for automating common spreadsheet tasks and fine tuning your working environment for even greater productivity. You'll also find these SmartIcons in all our Windows products, including Ami Pro™ 2.0, our award-winning word processor.



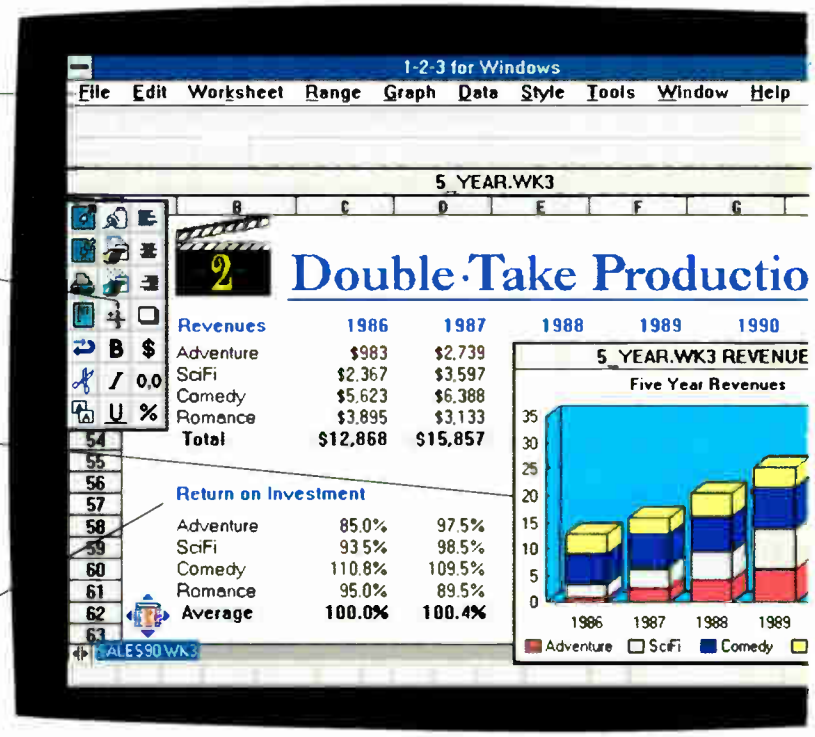
Push the slash key and you'll have instant access to the familiar 1-2-3 menu which will appear in a window on your screen.

You'll feel right at home with our true Windows interface. And you can easily integrate your spreadsheet data with other Windows applications.

Our palette of customizable SmartIcons can be sized and placed anywhere on your screen.

Our interactive graph gallery means you can preview and select by example a wide range of chart and graph types.

The program includes Adobe Type Manager® (ATM), the leading scalable font manager, for outstanding spreadsheet publishing and presentation options.*

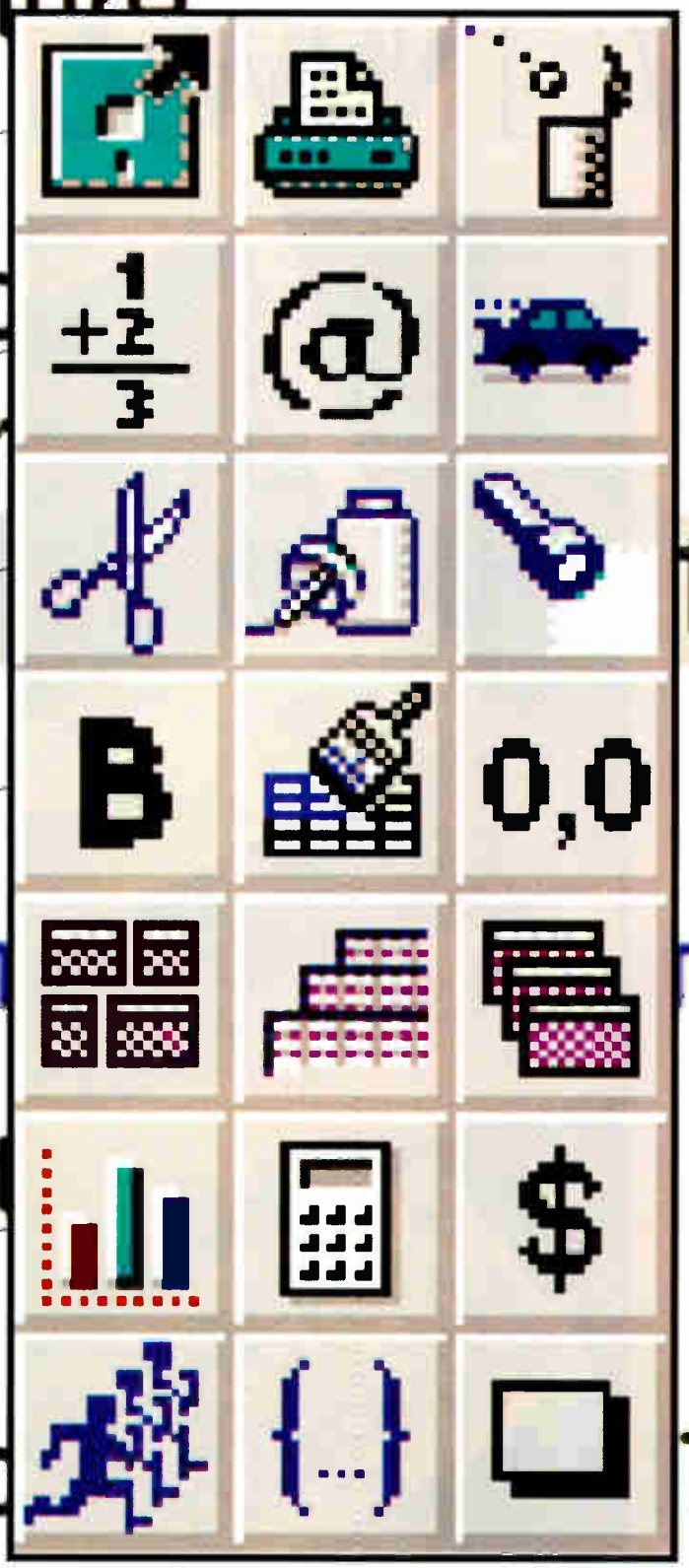


*Suggested retail price. Offer expires December 31, 1991. © Copyright 1991 Lotus Development Corporation. All rights reserved. Lotus, 1-2-3, and DataLens are registered trademarks of a wholly owned subsidiary of Lotus Development Corporation. Microsoft is a registered trademark and Windows and Toolbar are trademarks of Microsoft Corporation. Adobe Type M

World Radio History

Revenues 1986

Adventure	$983
SciFi	$2,367
Comedy	$5,623
Romance	$3,895
Total	**12,868**



Return ment

Adventure	85.0%
SciFi	93.5%
Comedy	110.8%
Romance	95.0%
Average	**100.0%**

World Radio History

Now! New ZEOS

LOTUS SOFTWARE!

Now, for a limited time only, when you buy any ZEOS Windows system you will also receive Lotus *1-2-3 for Windows* plus Lotus' new word processor for Windows, *Ami Pro 2.0!*

These are not some scaled down versions or trial disks. You will receive the complete and fully documented editions of both Lotus *1-2-3 for Windows* and *Ami Pro 2.0!*

America's best hardware *plus* America's best software. You simply can't go wrong! Call us now at 800-423-5891.

World Radio History

Upgradables!

ZEOS. AMERICA'S #1 LINE OF UPGRADABLE SYSTEMS.

For Vertical Systems add only $150.

ZEOS '386 & '486 UPGRADABLES!

Now, ZEOS gives you complete high performance upgradable systems with our amazing '386-25s starting at only $1395 and our '486-33s starting at only $1795! And that's not all.

Every ZEOS Windows® system, such as those featured at the right, comes complete with Lotus *1-2-3® for Windows* and Lotus' new word processor for Windows, *Ami Pro 2.0!* These are the full blown, fully documented editions of the very latest Lotus business software. And they are included with your new ZEOS Windows systems *at no additional charge!*

You get the very latest innovations in hardware, the hot new ZEOS upgradable systems *plus* the very latest in high powered software, Lotus *1-2-3 for Windows* and *Ami Pro 2.0.* And you get them both at one low package price!

MORE FEATURES FROM ZEOS!

When you purchase your ZEOS upgradable systems you have the ability to change processors any time you wish. Starting right with the 386-25 and moving up through the fastest '486 chips available! Pick your power now and in the future!

We take care of your future in other ways as well. Like providing you with *300 watt* power supplies as standard. And 8 expansion slots and our unique seven bay desktop case, still smaller than many five bay cases. Plus *two* whisper quiet cooling fans for even more reliability. *And,* every ZEOS system is *UL® listed* for your safety. High performance, upgradable systems complete with Lotus *1-2-3 for Windows* and *Ami Pro 2.0.* What more could there be? From ZEOS, lots more!

PACKAGES
386-25 $2495
386-33 $2595
486SX-20 $2695
486-33 $2895

24 HOUR TOLL FREE SUPPORT.

Like 24 Hour Support! At ZEOS, we believe support should be more than a part time proposition. That's why *we're here to help you Toll Free 24 Hours a Day, 365 days a year!* You're also going to appreciate your other ZEOS advantages as well.

Because not only do you receive ZEOS 'round-the-clock Support, you're also getting our 30 Day Absolute Satisfaction Money Back Guarantee, One Full Year Limited Warranty and our Express Parts Replacement policy. You're going to be very satisfied. We don't just say it. *We guarantee it!*

YOU SIMPLY CAN'T GO WRONG!

Your new high performance ZEOS upgradables come from a family of systems which have received *Eight PC Magazine Editor's Choice Awards.* And don't forget, for a limited time only, when you purchase any new ZEOS Windows system you'll also receive Lotus *1-2-3 for Windows* plus *Ami Pro 2.0.* So why not give us us a call right now, 800-423-5891!

Purchase orders from Fortune 1000 companies, Governments and institutions subject to approval. Leasing programs available. All prices and specifications subject to change without notice. Please call to confirm pricing, specification and warranty details. The following are trademarks of their respective corporations: ZEOS and Z-Cert of ZEOS International Ltd. © ZEOS International Ltd., 530 5th Avenue, N.W., St. Paul, MN 55112 USA. ZEOS is a publicly traded company, NASDAQ symbol: ZEOS. Lotus is a registered trademark of Lotus Development Corporation. Ami Pro is a trademark of Samna Corporation, a wholly-owned subsidiary of Lotus Development Corporation.

Circle 188 on Inquiry Card.

ZEOS PRESENTS UPGRADABLES FEATURING 4MB MEMORY, 130MB DRIVE AND MORE!

128K Cache Available!

- **The Processor and Speed of your choice plus future upgradability!**
- **4 full Megabytes of Ultra High Speed 53ns DRAM.**
- **Our fast 130MB IDE hard drive with built in cache.**
- **Both Teac® floppies, the 1.2MB and 1.44MB!**
- **Your Diamond VGA Plus card with 1MB DRAM.**
- **ZEOS 14" High Res 1024x768 VGA Color Monitor with Tilt & Swivel Base.**
- **Shadow RAM and EMS support.**
- **ZEOS/RS 101 key Space-Saver keyboard.**
- **Two Serial, one Parallel & one Game Port built right onto the motherboard.**
- **7-16, 1-8 bit expansion slots, 80387 math co-processor support for '386 systems.**
- **ZEOS SpaceSaver case with twin cooling fans for added reliability and product life.**
- **Seven drive bays and our custom 300 Watt power supply for your future expansion!**
- **Lotus 1-2-3 for Windows, plus Ami Pro 2.0, plus Microsoft Windows and DOS 5.0, plus a genuine Microsoft mouse!**
- **Includes ZEOS 24 Hour a Day Toll Free Technical Support and Customer Satisfaction package.**

Options Galore: **Including additional memory, an incredible selection of hard drives and virtually any other add-on you could want. Ask about other special money saving packages as well.**

ORDER NOW TOLL FREE

800-423-5891

FAX Orders: 612-633-1325
Hearing Impaired (TDD) Orders: 800-228-5389
Outside US and Canada: 612-633-6131
MasterCard, VISA, Discover, Am Exp, Z-CARD and COD.
Open 24 Hours a Day, 365 Days a Year!

ZEOS INTERNATIONAL, LTD

World Radio History

BYTE

January 1992 Volume 17, Number 1

COVER STORY

The 1991 BYTE Awards

PAGE 120

NEWS

27 **MICROBYTES**
Chips to the left, chips to the right: Microprocessors and chip sets are delivering more power and functionality in smaller form factors.

40 **FIRST IMPRESSIONS**
Psion's Powerful Pocketable
A full-fledged hand-held computer.

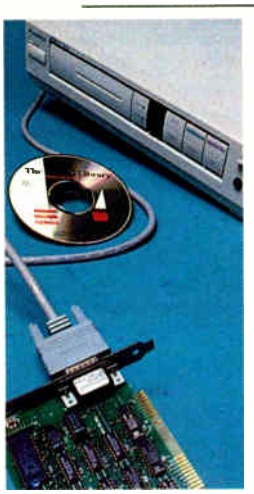
42 **Microsoft Bookshelf for Windows,** a multimedia version of the venerable reference tool

Tandon's PacII, a truly modular system with a twist

Dolch P.A.C. 486-50E, cutting-edge processing power comes at a price

ClarisWorks, a seamless applications environment for the Mac

GT486/40, Falco's small but powerful graphics PC



Magnavox CDD461RS, a CD-ROM drive matched to the way we really work

62 **WHAT'S NEW**
The StarJet printer goes with you anywhere; Microcom's modem ignores line noise; Soft-ICE/W debugs from Windows; and more.

FEATURES

120 **The 1991 BYTE Awards**
BYTE editors and contributors select the best products of 1991.

149 **Classic Languages, Part 5: SNOBOL**
The fifth installment in our Classic Languages series.

STATE OF THE ART

158 **DEVELOPING APPLICATIONS ACROSS PLATFORMS**
Overview: A Moving Target
Cross-platform development presents unique challenges in this era of proliferating platforms and fragmenting standards.

177 **Tributaries and Deltas**
Tracking software change in multiplatform environments.

191 **Let the System Do the Porting**
A new generation of operating systems will help developers write applications for multiple platforms.

201 **Resource Guide: Cross-Platform Application Development Tools**

COVER PHOTOGRAPHY: MEL LINDSTROM © 1992

World Radio History

REVIEWS

204 **SOLUTIONS FOCUS**
Database Building Blocks
Database libraries with the horsepower to build powerful multiuser applications.

226 **BYTE Lab Product Report: DOS Data at Work**
In our first BYTE Lab Product Report, we sample the DOS database market.

250 **Tweaking Windows: New Adapters Boost Speed and Clarity**
Six new graphics adapters promise to make Windows more efficient.

259 **Ample Waves of Data: Five Tools to Help You Stay Afloat**
Five data-analysis programs promise understanding in a sea of information.

273 **Claris Enters the Spreadsheet Wars**
A strong contender for the Macintosh spreadsheet crown elbows in on Excel's and Wingz's turf.

279 **DOS Extenders: Raising the Ceiling**
A look at four toolkits for building protected-mode DOS programs.

285 **The Phaser III Fires Dazzling Colors**
Tektronix's dazzling new color printer.

288 **REVIEWER'S NOTEBOOK**
Supercharged SuperCalc, jaggies relief, and a tool to improve Windows.

HANDS ON

293 **SOME ASSEMBLY REQUIRED**
Finally, a Real Keyboard
A LapLink cable and your desktop's printer port can take the place of a laptop keyboard.

305 **UNDER THE HOOD**
Processor Pipelines
The R4000, RISC System/6000, and 486 pipelines are compared.

319 **SOFTWARE CORNER**
Memory Mapping, Edit II, and an Alarm Clock
Memory control blocks, creating Mac text files, and a Unix utility.

321 **MACINATIONS**
Programming Under System 7.0
by Don Crabb
Finding the best language systems to use under System 7.0.

327 **THE UNIX /bin**
ACEs Wild
by David Fiedler
The low-end workstation world takes on new significance from ACE and Solaris.

333 **NETWORKS**
Coming Soon: Faster LANs
by Barry Nance
Packet burst and 100-Mbps Token Ring technologies could change the face of networking in 1992.

343 **BEYOND DOS**
OLE for Windows 3.1
by Martin Heller
A developer's view of Windows 3.1.

348 **ASK BYTE**
Big RAM disks, COM ports, TSRs, and a patriotic virus.

BYTE (ISSN 0360-5280/92) is published monthly with an additional issue in October by McGraw-Hill, Inc. U.S. subscriber rate $29.95 per year. In Canada and Mexico, $34.95 per year. Single copies $3.50 in the U.S., $4.50 in Canada. Executive, Editorial, Circulation, and Advertising Offices. One Phoenix Mill Lane, Peterborough, NH 03458. Second-class postage paid at Peterborough, NH, and additional mailing offices. Postage paid at Winnipeg, Manitoba. Registration number 9321. Printed in the United States of America. **Postmaster:** Send address changes, USPS Form 3579, and fulfillment questions to BYTE Subscriptions, P.O. Box 551, Hightstown, NJ 08520.

CORNER COVER PHOTOGRAPHY: RICHARD LAYBOURN © 1992

OPINIONS

87 **USER'S COLUMN**
Configuration Tribulations
by Jerry Pournelle
Jerry tries to upgrade to Windows 3.1.

105 **BUSINESS CONNECTION**
Murphy's Law and Interoperability
by Wayne Rash Jr.
Getting your Macs, PCs, and Unix machines connected is simple. Getting them to work together isn't.

115 **ROUNDTABLE**
What Do Benchmarks Really Tell You?
Most benchmark results should not be taken at face value.

404 **PRINT QUEUE**
Dead Chickens A-Wavin'
The New Hacker's Dictionary exhilarates; *Technobabble* indicts.

406 **STOP BIT**
Standards Everywhere
A pithy look at whom and how standards serve.

10 **EDITORIAL**
The Envelope, Please...

18 **LETTERS**
More on safety, Soviets, and C.

READER SERVICE

402 Editorial Index by Company
399 Alphabetical Index to Advertisers
400 Index to Advertisers by Product Category
Inquiry Reply Cards: **397**

PROGRAM LISTINGS
From BIX: Call (800) 227-2983
From Demolink: See ad on page **403**
On disk: See page **322**

INSIDE BYTE

REGIONAL SECTION begins after page 86

World Radio History

INSIDE BYTE

BYTE Topic Index and Author Guide

This index helps you find articles that contain information on each of the listed topics. (The topic list changes each month.) Combined with the table of contents (page 4) and the Editorial Index by Company (page 402), you can identify articles by type, subject, title, author, or product discussed.

BENCHMARKS 115

CELLULAR NOTEBOOK 62

CD-ROM 42, 87

CHIPS 27

COLOR PRINTERS 285

COMMUNICATIONS 62

CROSS-PLATFORM 191

DATA ACQUISITION 62

DATA ANALYSIS 259

DATABASES/DBMSES 62, 204, 226

DEVELOPMENT 204

DOS EXTENDERS 279

FAX/MODEM 62

486 42

GRAPHICS 42

INTEGRATED SOFTWARE 42

INTEROPERABILITY 105, 158, 177

KEYBOARD 293

LANS 62

MACINTOSH 42, 158, 273, 288, 321

MATHEMATICS 87

MEMORY MANAGEMENT 87

MICROSOFT 42

MODULAR 42

MULTITASKING 62

NETWORKS 333

OPTICAL STORAGE 62

OS/2 27, 158, 343

PALMTOP 40

PIPELINE 305

PORTABLES 40

PROGRAMMING 62, 177

RISC 305

SNOBOL 149

SPREADSHEETS 273, 288

STANDARDS 406

THERMAL TRANSFER 285

TRANSPORTABLE 42

UNIX 158, 327

VGA 87

WINDOWS 27, 62, 87, 158, 250, 288

WORKSTATIONS 27, 42, 62

AUTHORS

Allen, Dennis **115**
Allstetter, Billy **27**
Andrews, D. L. **27, 42, 62**
Apiki, Steve **115**
Appleby, Doris **149**
Barron, Janet J. **162**
Blaszczak, Mike **279**
Calem, Robert E. **42**
Crabb, Don **321**
Cronk, Randall D. **177**
Diehl, Stan **115, 226**
Eglowstein, Howard **42, 293**
Fiedler, David **327**
Gibson, Christopher R. **273**
Grehan, Rick **204, 226**
Heller, Martin **27, 343**
Joch, Alan **250**
Kenner, Hugh **404**
Linderholm, Owen **27**
Loeb, Larry **27**
Malloy, Rich **10**
Marshall, Trevor **27, 115**
Miastkowski, Stan **42**
Mitchell, Rob **115**
Nadeau, Michael **115, 120**
Nance, Barry **319, 333**
Osher, Herbert M. **172**
Pountain, Dick **40**
Pournelle, Jerry **87, 115**
Rash, Wayne Jr. **105**
Raymond, Eric S. **406**
Reinhardt, Andy **27, 115**
Ryan, Bob **158**
Sheldon, Ken **115**
Smith, Ben **115, 204, 319**
Swartz, Carol J. **62**
Thompson, Tom **285, 319**
Udell, Jon **168, 204**
Ullman, Ellen **27, 191**
Wayner, Peter **259, 305**

World Radio History

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

Value.

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

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

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

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

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

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

Panasonic
Office Automation OA

Engineered for the office. Designed for people.

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

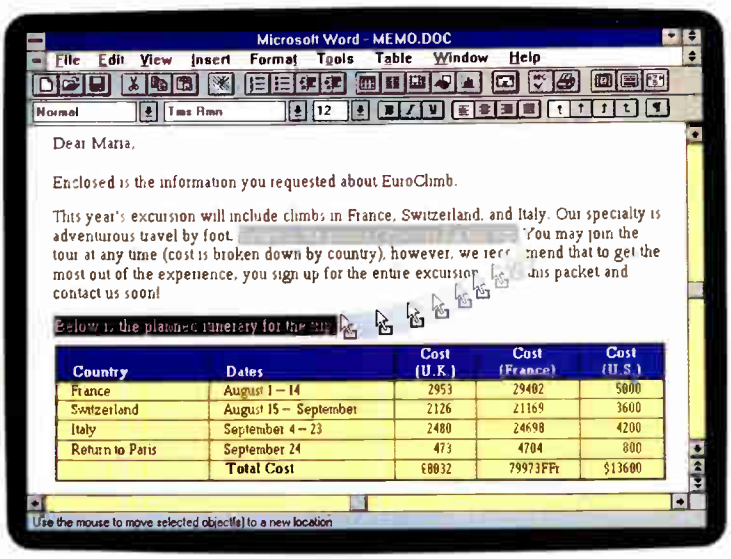
M4-BY

Circle 120 on Inquiry Card.

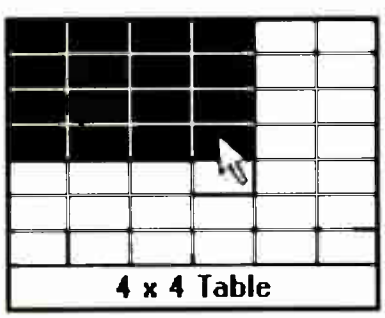
World Radio History

The first wo that works like

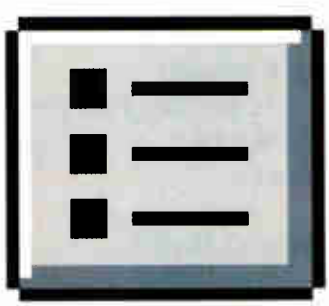
The Toolbar lets you do everyday things with the click of a button.



Rearranging a document couldn't be any easier. With new Word 2.0 you can drag and drop text wherever you want.

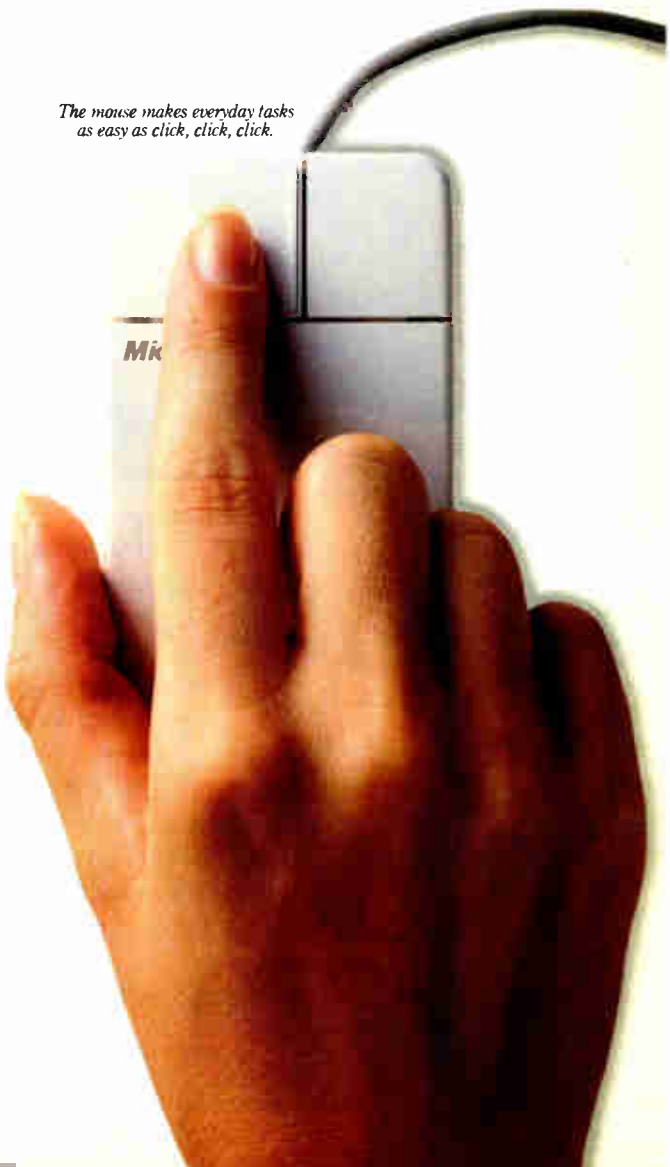


All it takes is one click on the Toolbar and presto, instant tables.



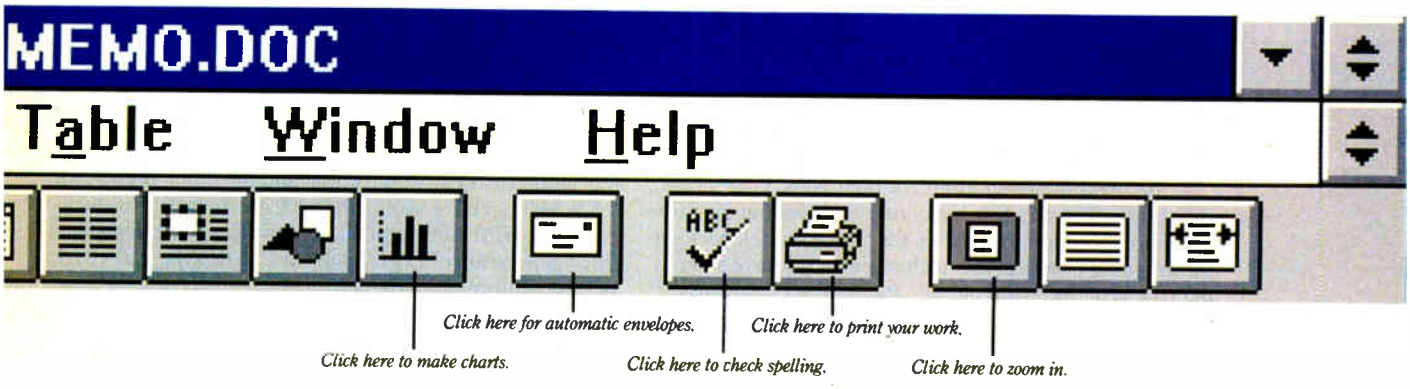
Click this Toolbar button and get instant bullets.

The mouse makes everyday tasks as easy as click, click, click.

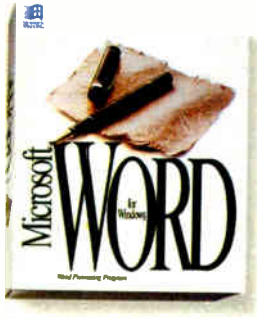


World Radio History

rd processor second nature.



Introducing new Word for Windows 2.0.



When it comes to word processing, really nothing could be more natural than using the all-new Microsoft® Word for Windows.™ You see, Word 2.0 makes those everyday word processing tasks remarkably easy.

Which means you can now concentrate on what you're actually doing. Rather than how you're actually going to do it.

This is possible for a number of reasons. Like our unique Toolbar™ feature. It lets you do those things you do most often with one simple click of a button.

Of course, looks count for something, too. With Word you can bring in a table of numbers from Microsoft Excel. Or with the new built-in drawing, charting and shading features, along with the ability to move anything on-screen with a drag and drop, you'll find yourself adding some very very cool effects.

But best of all, making the move is easy—so easy there is virtually no downtime. Just type in a WordPerfect® keystroke and Word demonstrates the equivalent command right in your document. Plus, your existing WordPerfect files (and other file formats) are perfectly usable in Word.

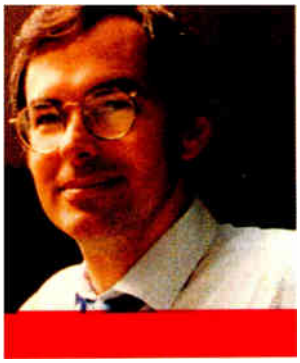
You can get all of this and a lot more when you upgrade to Word for Windows for only $129.* So pick up the phone and call us at (800) 323-3577, Department W3.

You'll quickly see that nothing could be more natural.

Microsoft

*Offer good for current licensees of WordPerfect, MultiMate, WordStar, MS Word for DOS and DisplayWrite. Please allow 2-4 weeks for delivery upon receipt of order by Microsoft. Offer expires 3/31/92. Limit one per customer. Reseller prices may vary. Call for system requirements. Offer good only in the 50 United States. © 1991 Microsoft Corporation. All rights reserved. Printed in the U.S.A. In the United States, call (800) 323-3577, Dept. W3. For information only: In Canada, call (800) 563-9048; outside the United States and Canada, call (206) 936-8661. Microsoft is a registered trademark and Toolbar and Windows are trademarks of Microsoft Corporation. WordPerfect is a registered trademark of the WordPerfect Corporation.

World Radio History



EDITORIAL

RICH MALLOY

THE ENVELOPE, PLEASE...

It's that time of year again. Many people are rushing around doing last-minute Christmas shopping. Some are making preparations for their New Year's celebrations. And a few lucky ones are heading off for a short vacation. But for us it is a time to look back on the amazing products and technologies we have seen in the past year and hand out our annual BYTE Awards.

BYTE's Best of Comdex Awards honor products that are announced at the show

In the past 12 months, we have mentioned roughly 2000 computer products in these pages—by our calculations, more than any other computer magazine around. All the products seemed good, or we wouldn't have spent time on them. Most were very impressive indeed. And some were so impressive that they are worthy of special consideration.

One of the most satisfying aspects of working at BYTE is having the chance to see these products. But even more satisfying is having the chance to disseminate the results of our findings to our readers. With our awards, we are able to give added prominence to those products that clearly deserve it. This process of giving out awards is a heady responsibility, but a gratifying one as well.

Actually, our award season—like the Christmas holiday season—started several weeks ago. At the recent Comdex, we officially kicked off the season by once again giving out awards for the best new products at the show. These Best of Comdex Awards are also known as the Shelly Awards, in honor of the man who created Comdex, Sheldon G. Adelson.

The Shelly Awards focus on the future, on brand-new products that may not be shipping for some time to come. They are our way of previewing the big new products of next year. We look for products or technologies that are innovative, that have had a strong impact on Comdex attendees, and that should have a strong impact on business computer use worldwide. As you can imagine, there was no shortage of products to examine.

Sniffing out the best new products at a show that has 2000 exhibitors is no easy feat. We flew in a team of 25 editors, divided up the show floor, and set them loose. The editors spent a great amount of time on this, braving traffic jams, huge taxi lines, and Las Vegas fast food. But the results were worth it.

We gave out awards in eight categories. Some were no surprise to anyone at the show; all you had to do was look for the largest crowds. The Apple Mac PowerBook 170 notebook was selected as Best Portable. We gave Microsoft two awards: The new Word for Windows 2.0 was named as Best Application, and the much improved LAN Manager 2.1 won as Best Connectivity Product. The Intel/IBM ActionMedia II technology, which is the latest generation of DVI video for CD-ROMs, was cited as Best Multimedia Product.

But the best thing about giving out awards is the chance to honor deserving products that might not have the benefit of a huge promotional budget. We awarded DR DOS 6.0 from Digital Research the prize for Best Utility Software. The Best Peripheral award was snared by JVC for its innovative Personal ROMMaker, the first moderately priced device for producing CD-ROMs. Texas Microsystems won the Best Desktop award for its FTSA PC, a fault-tolerant PC that will surely influence other system manufacturers. The British company Psion won top honors in the Best International Product category for its Psion Series 3 palmtop system. In fact, at the awards ceremony, Psion officials almost sold three of its innovative palmtop systems to the other prize winners.

The most dramatic award was the Best of Show, but there was not much question about who should receive this. We gave this award to Intel and IBM for the ActionMedia II technology, which will probably have an impact on every system manufacturer in one way or another.

The Best of 1991

While Comdex gave us a chance to look at what might be the best products of next year, the closing days of 1991 remind us that we cannot avoid mentioning the best products of this past year. For these products, we have our BYTE Awards of Excellence, Distinction, and Merit, which are the subject of the cover story in this issue.

If picking the best products at a show like Comdex was difficult, picking the best products of an entire year is several times more so. Fellow Executive Editor Michael Nadeau probably deserves an award of his own for helping us sort through the hundreds of products we have examined in the past year.

To the products that have won awards, we raise a year-end toast of congratulations. But we also toast all the products that have come our way and that have made 1991 so interesting and enjoyable.

And now, for the winners of 1991, the envelope, please....

—Rich Malloy
Executive Editor
(BIX name "rmalloy")

World Radio History

NEW! VERSION 3.0

...If you program for a living

New! Borland® C++ & Application Frameworks 3.0 is *the* choice of professional C and C++ programmers for Windows and DOS application development. With unmatched optimizations, powerful tools, unsurpassed Windows development environment and object-oriented application frameworks, Borland C++ & Application Frameworks 3.0 has no equal. Quite simply, if you program for a living, this is everything you need.

OOP, to simplify your life

Borland C++ & Application Frameworks 3.0 simplifies programming by giving you ready-made user interface objects that plug directly into your application. Automatically inherit windows, menus, scroll bars, mouse support and more. Add an editor in just one line. With Object-Oriented Programming (OOP), you get amazing code reusability, extensibility and easier maintenance because applications are built on a base of tested, reliable code.

New features give you incredible programming options!

Just look at some of the enhanced features in Borland C++ 3.0:

- ANSI C and C++ 2.1 and templates
- Global optimizer includes:
  - Global register allocation
  - Local and global common sub-expressions
  - Induction variables
  - Loop and jump optimization
  - Register parameter passing
  - And ten other state-of-the-art optimizations
- Increased C++ compile speed
- Windows and DOS Integrated Development Environments
- Visual ObjectBrowser™ to view class relationships at a glance
- DPMI support for compiler and IDE environments gives you huge capacity
- EasyWin™ library makes it easy to convert your DOS programs to Windows
- Resource Workshop for creating Windows user interfaces visually
- Extensive Microsoft® C compatibility
- WinSight™ message tracking utility
- Turbo Debugger® for DOS and Windows
- Turbo Profiler™ for DOS and Windows
- Object-oriented Turbo Assembler®

And with new Borland C++ & Application Frameworks 3.0 you get all of this, plus:

- ObjectWindows™—the application framework for Windows
- Turbo Vision™—the application framework for DOS
- Source code for runtime library and application frameworks

Optimized for professionals

Borland C++ 3.0 ($495.00*) or Borland C++ & Application Frameworks 3.0 ($749.00*) are optimized for your life-style. But don't wait. Because when it comes to professional programming, there's no better way to earn a living than with Borland C++.

See your dealer today or call now 1-800-331-0877, Dept. 5002

BORLAND

The Leader in Object-Oriented Programming

*Suggested retail price. All prices are in U.S. dollars. Dealer prices may vary. Copyright © 1991 Borland International, Inc. All rights reserved. All Borland products are trademarks of Borland International, Inc. BI 1451

Circle 27 on Inquiry Card (RESELLERS: 28).

World Radio History

Why your next should be a

By now, you're probably aware that an Apple® Macintosh® personal computer was designed from the very first chip to work the same, intuitive way that you do.

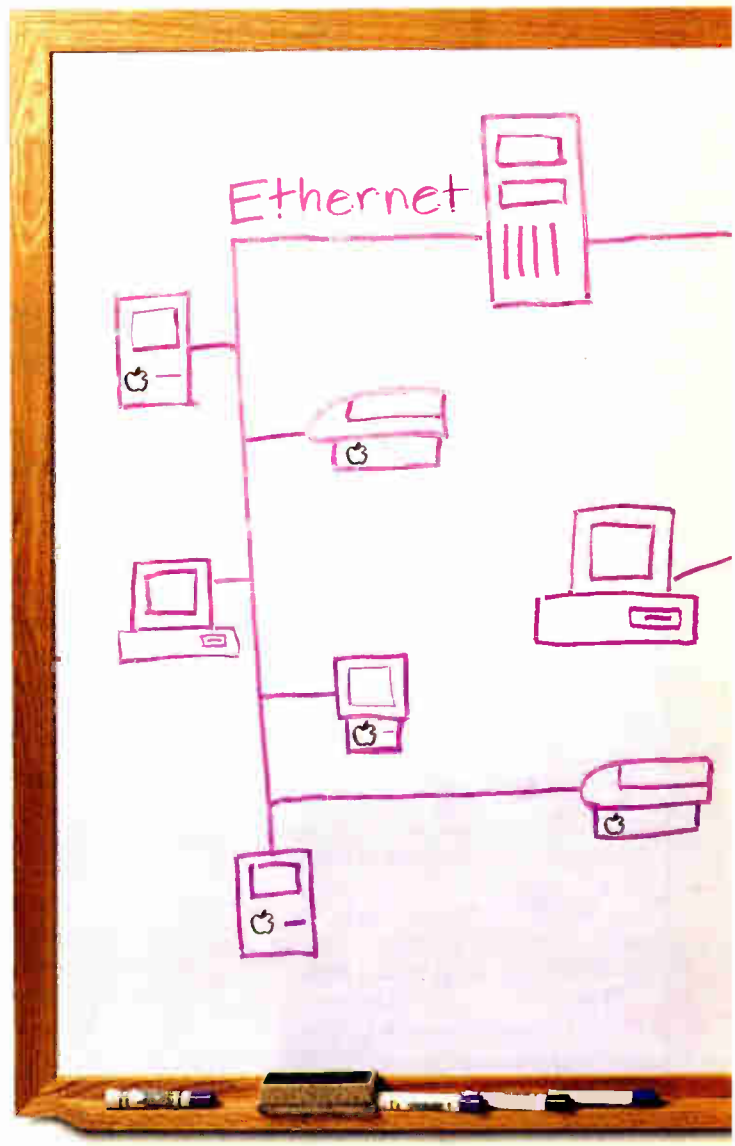
What you may not know, however, is that a Macintosh was also designed to work with other personal computers. Including the MS-DOS PCs you already own.

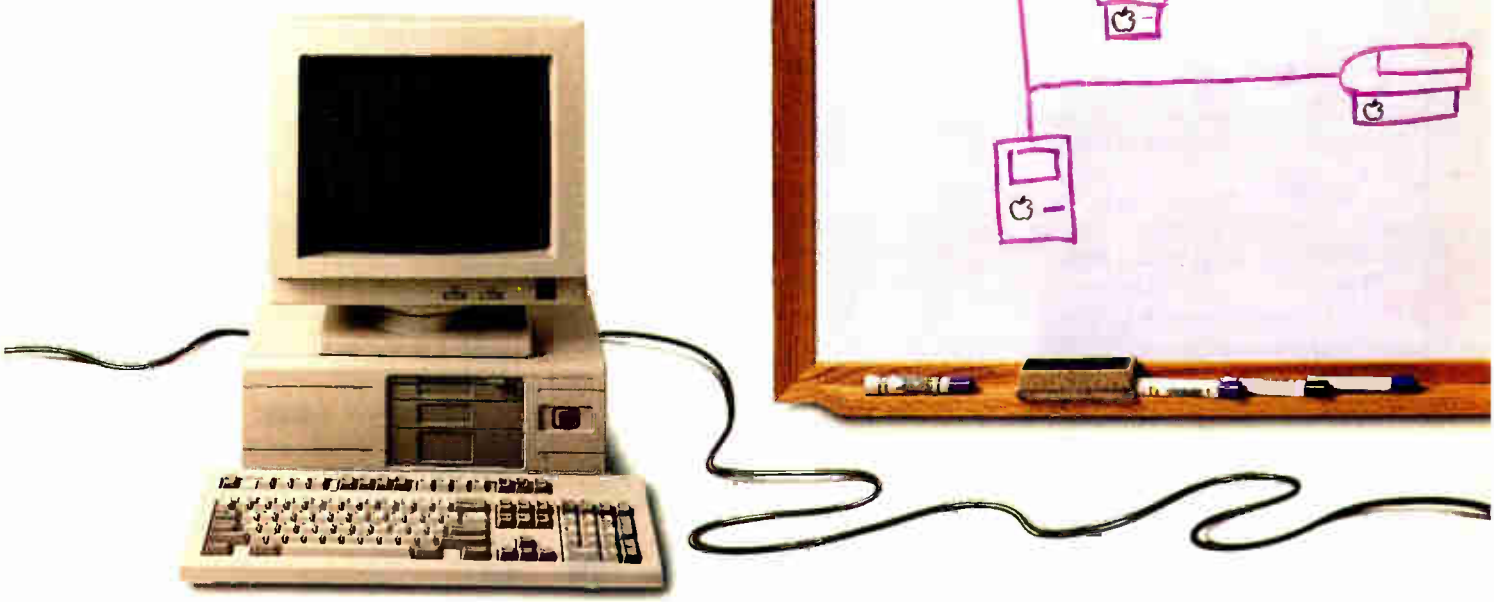
In fact, Macintosh is the only family of personal computers to offer built-in networking and file sharing as standard equipment.

You can use a Macintosh to access almost any mainframe, minicomputer or workstation. Including IBM, DEC, Hewlett-Packard, Prime, Cray and Sun.

You can also access resources such as network file servers and mainframe sessions simultaneously. And then cut, paste and move files between them. (Try doing that on an ordinary DOS computer.)

You can even easily connect a Macintosh with any





All you need is SoftPC, a software based MS DOS emulator from Insignia Solutions Inc. Or one of two cards from Orange Micro, the Mac286 or Orange386. ©1991 Apple Computer, Inc. Apple, the Apple logo, Macintosh and "The power *trademark of Hewlett Packard Company. Prime is a registered trademark of Prime Computer, Inc. Cray is a registered trademark of Cray Research, Inc. Sun is a trademark of Sun Microsystems, Inc. NetWare is a registered*

World Radio History

DOS computer Macintosh.

industry-standard Token-Ring or Ethernet network. And share files and printers over Novell NetWare, Banyan VINES, IBM LAN Server or Microsoft LAN Manager networks.

Best of all, only Macintosh offers a single, consistent, intuitive way of accessing and working with information, no matter what computer it's located on.

And, of course, Macintosh also has the power to run MS-DOS software,* and lets you exchange information with a PC on a standard 3 ½" floppy disk.

Today's family of affordable Macintosh computers offers you more choices and more flexibility than any other personal computer. So your people can work in whatever way works best for them, while you preserve your investment in the networks and PCs you already own.

For the name of the authorized Apple reseller near you, call 800-538-9696, ext. 330. You'll find that Macintosh has the power you can really connect with. The power to be your best.®

to be your best® are registered trademarks of Apple Computer, Inc. IBM is a registered trademark of International Business Machines Corporation. DEC is a trademark of Digital Equipment Corporation. Hewlett Packard is a registered trademark of Novell, Inc. MS-DOS and Microsoft are registered trademarks of Microsoft Corporation. VINES is a registered trademark of Banyan Systems Inc. This ad was created using Macintosh personal computers.

World Radio History

BYTE

PUBLISHER
Ronald W. Evans

EXECUTIVE EDITORS
New York: Rich Malloy
Peterborough: Michael Nadeau

MANAGING EDITOR
Anne Fischer Lent

ASSISTANT MANAGING EDITOR
Lauren A. Stickler

NEWS
New York:
News Editor: Andrew Reinhardt
Peterborough:
Sr. Ed., New Products: Stan Miastkowski
News Editors, What's New: Martha Hicks, Carol Swartz, Amanda Waterfield
Microbytes: D. L. Andrews
San Francisco/West Coast:
Bureau Chief: Kenneth M. Sheldon
Sr. News Editor: Owen Linderholm
Editorial Assistant: Barbara J. Caravello
UK/Europe: *Bureau Chief:* Andrew Redfern

BYTE LAB
Senior Editor & Director: Dennis Allen
Technical Director: Rick Grehan
Technical Editors: Stephen Apiki, D. Barker, Alan Joch, Tom Yager
Testing Editors/Engineers: Raymond G A Côté, Stanford Diehl, Howard Eglowstein, Stanley Wszola
Lab Assistant: Selinda Chiquoine

STATE OF THE ART/FEATURES
Senior Editor: John W. Donovan
Technical Editors: Janet J. Barron, Robert M. Ryan, Ben Smith

SENIOR TECHNICAL EDITORS, AT LARGE
Tom Thompson, Jon Udell

COLUMNS
Senior Editor: Robert Mitchell

SPECIAL PROJECTS
Senior Editor: Gene Smarte

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
Don Crabb, David Fiedler, Martin Heller, Hugh Kenner, Wayne Rash Jr.

CONSULTING EDITORS
Roger C. Alford, Jonathan Amsterdam, Nick Baran, Laurence H. Loeb, Trevor Marshall, Mark J. Minasi, Barry Nance, Dick Pountain, Phillip Robinson, Jane Morrill Tazelaar, Ellen Ullman, Peter Wayner

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

DESIGN
Director: Nancy Rice
Associate Director: Joseph A. Gallagher
Designer: Jan Muller
Assistant Designer: Rebecca Magill

PRODUCTION AND FINANCE
Director: Claudia Flowers

PRODUCTION
Director: David M. Cohen
Production Manager: David R. Anderson
Senior Editorial Production Coordinator: Virginia Reardon
Editorial Production Coordinators: Barbara Busenbark, Denise Chartrand
Systems Manager: Sherry Fiske
Applications Manager: Donna Sweeney
Typesetter: Christa Patterson
Advertising Services Manager: Linda Fluhr
Senior Advertising Services Representative: Lyda Clark
Advertising Services Representative: Dale J. Christensen
Materials Representative: Karen Cilley
Creative Services Mgr: Susan Kingsbury
Production Artist: Lillian J. Wise
Production Coordinator: Rod Holden
Quality Control Manager: Wai-Chiu Li
Operations Assistant: Christine Tourgee
Advertising Services Assistant: Roxanne Hollenbeck

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

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

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

Publisher's Assistant: Donna Nordlund

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

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

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

SOUTHEAST
John Schilin (404) 843-4782

MIDWEST
Kurt Kelley (312) 516-3328

SOUTHWEST, ROCKY MOUNTAIN
Alison Keenan (214) 701-8496

SOUTH PACIFIC
Ron Cordek (714) 753-8140
Alan El Faye (213) 480-5243

NORTH PACIFIC
Bill McAfee (408) 879-0381
Roy J. Kops (415) 954-9728
Leslie Hupp (408) 879-0381

INSIDE ADVERTISING SALES
Director: Liz Coyman (603) 924-2518
Assts.: Susan Monkton, Vivian Bernier

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

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

THE BUYER'S MART (1x2)
Joseph Mabe (603) 924-2658

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

REGIONAL ADVERTISING SECTIONS
Brian Higgins (603) 924-2551
Barry Echavarria (603) 924-2574
Larry Levine (603) 924-2537

BYTE DECK
Ed Ware (603) 924-2596

EURO-DECK
James Bail (603) 924-2533

INTERNATIONAL ADVERTISING SALES STAFF
See listing on page 401.

PERSONNEL
Human Resources Admin.: 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.
WEST COAST: 425 Battery St., San Francisco, CA 94111, (415) 954-9718; 15635 Alton Pkwy., Suite 290, Irvine, CA 92718, (714) 753-8140.
NEW YORK: 1221 Avenue of the Americas, New York, NY 10020, (212) 512-3175.
UK/EUROPE: Wimbledon Bridge House, One Hartfield Rd., Wimbledon, London SW19 3RU, England, 011-44-81-543-1234.
ELECTRONIC MAIL: On BIX, send to "editors." All BYTE editors and columnists also have individual mailboxes on BIX for easy access.
MCI: 250-0135 BYTE Magazine. Many editors also have individual MCI addresses in their own name.
OTHERS: Many editors also are reachable through uunet, AppleLink, CompuServe, and numerous other services.
U.S. fax: Editorial: (603) 924-2550
Advertising: (603) 924-7507
U.K. fax: 011-44-81-540-3833
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.

SUBSCRIPTION CUSTOMER SERVICE

Inside U.S. (800) 232-BYTE; outside U.S. (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, £29 (U.S. $50) for fast surface delivery, £41 (U.S. $70) for air delivery. Non-European countries U.S. $50 for surface mail, or U.S. $75 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 0360-5280/92, $1.50. Copying done for other than personal or internal reference use without the permission of McGraw-Hill, Inc., is prohibited. Requests for special permission or bulk orders should be addressed to the publisher. BYTE is available in microform from University Microfilms International, 300 North Zeeb Rd., Dept. PR, Ann Arbor, MI 48106, or 18 Bedford Row, Dept. PR, London WC1R 4EJ, U.K.

Copyright © 1992 by McGraw-Hill, Inc. All rights reserved. BYTE and BYTE are registered trademarks of McGraw-Hill, Inc. Trademark registered in the United States Patent and Trademark Office.

Member
Audit Bureau of Circulation

BIX BYTE INFORMATION EXCHANGE

DIRECTOR
Stephen M. Laliberte

MANAGING EDITOR
Tony Lockwood

MICROBYTES DAILY
Coordinator: D. L. Andrews *Peterborough,* Rich Malloy *New York,* Nicholas Baran *Sandpoint, ID,* Laurence H. Loeb *Wallingford, CT,* Rick Cook *Phoenix, AZ,* Stephen Banker *Washington, DC,* David Reed *Lexington, KY,* Andrew Reinhardt *New York*

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

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

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

BIX, the "BYTE Information Exchange," is a worldwide, low-cost, on-line information service featuring industry news, downloadable software, powerful electronic mail, previews of upcoming BYTE articles, the full text of published issues of BYTE, and source and/or executable code for BYTE benchmarks and noncommercial software mentioned in feature articles. BIX also offers unmatched "conferences" on virtually every computer-related topic imaginable, where you can share information with thousands of other computer pros. To subscribe via modem, set your communications software to full duplex, 7 bits, even parity, 1 stop bit, and then call 800-225-4129; in MA, call (617) 861-9767. International, call NU1310690157800. Then hit the Enter/Return key and enter "BIX" when asked to log in; then enter "BIX.VILLE" when asked for a name. For current fees and more information, call (800) 227-2983 or (603) 924-7681 on voice phone.

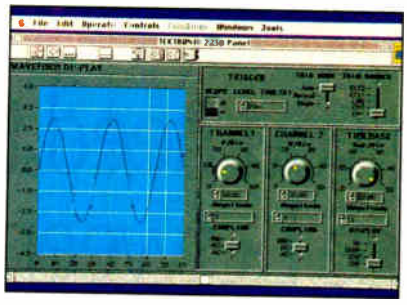
DEMOLINK
BYTE program listings are available at (617) 861-9767 (set modem at 8-1-N, 2400 or 200 bps). Enter Demolink.

OFFICERS OF MCGRAW-HILL, INC.:
Chairman, President and Chief Executive Officer: Joseph L. Dionne, *Executive Vice President, General Counsel and Secretary:* Robert N. Landes, *Executive Vice President:* Walter D. Serwatka, *Senior Vice President, Treasury Operations:* Frank D. Penglase, *Executive Vice President and Chief Financial Officer:* Robert J. Bahash, *Executive Vice President, Administration:* Thomas J. Sullivan, *Senior Vice President, Corporate Affairs, and Executive Assistant to the Chairman:* Mary A. Cooper, *Senior Vice President, Editorial:* Ralph R. Schulz. *Founder:* James H. McGraw (1860–1948).

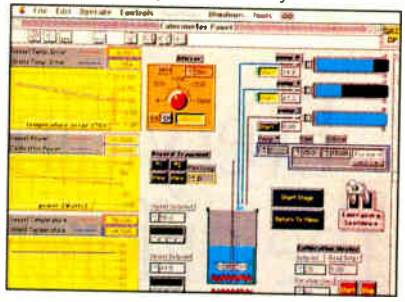
World Radio History

You can automate your system with 30-year old technology, or . . .

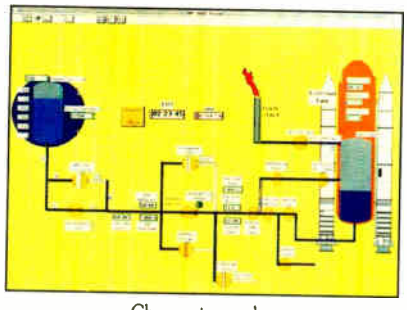
Automated Test



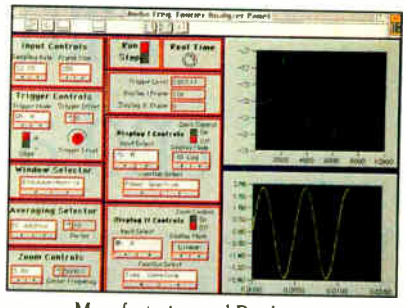
Analytical Chemistry



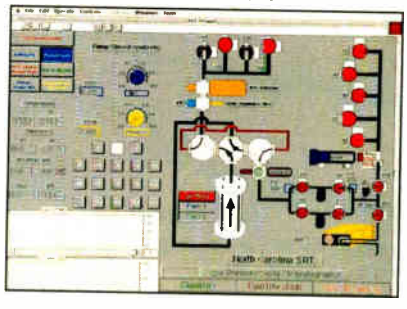
Process Control



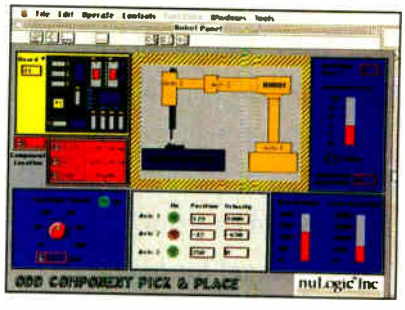
Audio and Vibration



Chromatography



Manufacturing and Production



BRING IT TO LIFE WITH LABVIEW® 2

While PC users wrestle with cryptic text-based programming languages, Macintosh users are getting the job done with LabVIEW 2, the most celebrated application software for data acquisition and instrument control. It recently won the MacUser Magazine Editors' Choice Award. Five years ago, LabVIEW introduced the combination of front panel interfaces and graphical programming. Today, engineers and scientists around the world use LabVIEW 2 and the Macintosh for a broad spectrum of applications.

Unlike other graphical packages, LabVIEW 2 does not sacrifice power and flexibility for ease of use. With LabVIEW 2, you create front panel user interfaces and import pictures to customize your panels. Then you quickly build block diagram programs and add your own blocks to expand upon our libraries. Yet your virtual instruments run as quickly as compiled C programs. Call us to find out how you can bring your system to life with LabVIEW 2.

For a free LabVIEW 2 Demo disk, call:
(512) 794-0100 or
(800) 433-3488
(U.S. and Canada)

NATIONAL INSTRUMENTS®
The Software is the Instrument®

6504 Bridge Point Parkway
Austin, TX 78730-5039

International Branch Offices: Australia (03) 879 9422 Denmark (45) 76 73 22 France (1) 48 65 33 70 Germany (089) 714 5093 Italy (02) 4830 1891 Japan (03) 3788 1921 Netherlands (01720) 45761 Norway (03) 45 86 66 Spain (908) 604 304 Switzerland (056) 43 58 80 U.K. (0635) 523 545

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

Circle 107 on Inquiry Card.

World Radio History

Everything you need to know about the difference between a Compaq PC with Intelligent Modularity and a merely upgradable PC.

These days, a lot of personal computers have upgradable processors and memory. But the new COMPAQ DESKPRO/M PCs have Intelligent Modularity, which goes far beyond ordinary upgradability. This unique design makes these PCs a smart investment for today and tomorrow.

Suggested Resale Price starts at just over $3,000 for this family of four remarkable PCs.

Smart for today— designed for today's needs and today's budgets. Intelligent Modularity puts all vital subsystems on separate boards so you can choose just the performance and features you need.

Since the parts are interchangeable, the whole office can standardize on one platform. And since the parts are easy to access, they're easy and inexpensive to service. Replacement parts cost less, too.

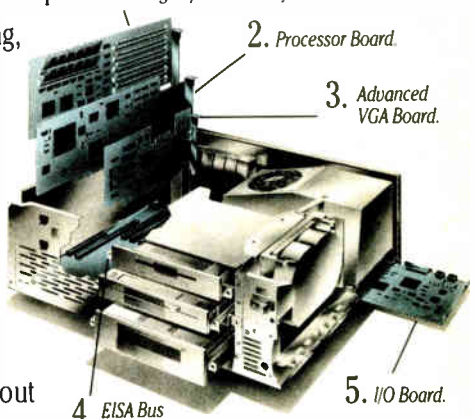
Nobody else gives you all the advantages you get with the COMPAQ DESKPRO/M PCs.	COMPAQ DESKPRO/M FAMILY	ALR BUSINESS VEISA	AST PREMIUM II	DELL POWERLINE DE	IBM PS/2 MODEL 90
1. Five-board modular design	Yes	No	No	No	No
2. Upgradable video without using an expansion slot	Yes	Yes	No	No	No
3. Separate I/O board for potential enhancements and ease of service	Yes	No	No	No	No
4. 14 levels of security including cable-lock provision	Yes	No	No	No	No
5. System configuration and ID number available in memory and accessible remotely	Yes	No	No	No	Yes
6. Power supply adequate for all expansion needs	240w	150w	145w	220w	194w

Keeping track of what's inside each PC is easy with our built-in Asset Management provision. Each COMPAQ DESKPRO/M PC can tell you its serial number, how it's configured and what it has installed. Even remotely, over the network. A big time- and money-saver for MIS managers.

Smart for tomorrow—built to adapt to changing technology and changing needs. With Intelligent Modularity, upgrading and expanding only takes about five minutes.

And, thanks to unique Compaq engineering, you get optimum performance no matter how you configure your system.

The 32-bit EISA expansion bus gets the most out of high-performance processors, expansion boards and peripherals. Superior thermals keep things cool, no matter how many options you add. And the 240-watt power supply can take anything you plug in.



Intelligent Modularity—Five separate subsystems let you upgrade or replace only what you need.

Call your Authorized COMPAQ Computer Dealer and ask to see the wonders of the COMPAQ DESKPRO/M PCs firsthand. Call 1-800-231-0900, Operator 185. In Canada, call 1-800-263-5868, Operator 185.

Trademarks and trade names shown are those of the respective companies designated. COMPAQ, DESKPRO, Registered U.S. Patent and Trademark Office. © 1991 Compaq Computer Corporation. All rights reserved.

World Radio History

Everything the boss needs to know.

1. It's smart.

2. It's easy.

3. It's affordable.

COMPAQ

It simply works better.

World Radio History

LETTERS

FEATURE

Health and Safety First

Monitor Dangers?

While useful in most respects, David A. Harvey's "Health and Safety First" (October 1991) exhibited some muddled thinking about extremely low frequency (ELF) and very low frequency (VLF) emissions from computer monitors. He first says that "it wasn't until recently that hard data began rolling in on the subject." Two paragraphs later, he states that "there is a frustrating absence of hard data."

Indeed, it is precisely the absence of hard data about alleged VDT dangers, along with the lack of any theoretical model of how ELF/VLF fields could be harmful, that has led most scientists to conclude that the dangers are small to nonexistent. This has left the VDT debate largely in the hands of fast-buck artists who make a fortune by scaring the daylights out of people.

Most studies have found no verifiable hazards in the magnetic fields or in non-ionizing radiation emitted by properly functioning computer monitors. A few studies, however, have found statistical evidence that ELF and VLF emissions might pose some small risks.

With over 30 million people in the U.S. getting daily exposure to ELF/VLF-emitting computer monitors, any significant danger would be reflected in an epidemic of VDT-related illnesses. An epidemic has not materialized, which suggests that—at least in the short run—VDT risks are small.

The ELF/VLF radiation issue does need to be studied further. However, BYTE would serve its readers better by presenting a well-researched discussion of the problem.

Scott D. Palmer
Indianapolis, IN

Please see "Of Monitors and Emissions" (September 1990) for an in-depth discussion of this issue.—Eds.

CD-ROM Niche

I am writing in response to "CD-ROM Drives: How Good Is the Third Generation?" by David A. Harvey (September 1991). Hitachi is pleased with the excellent review of its CDR-1750S drive. However, we would like to address Harvey's recommendations against the CDR-1700S based on its performance when playing back animated sequences and its use of a non-SCSI drive adapter to Hitachi's PC or Micro Channel bus interface cards.

Most CD-ROM applications are text-based, with limited use of still graphics and audio. Few CD-ROM applications for DOS computers use animation throughout the application, and even the National Geographic Mammals disc has limited animation sequences. Uneven motion during animation with the CDR-1700S is designed to meet hardware and software compatibility requirements of our installed base, which demands upwardly compatible hardware. Hitachi offers both drive types to meet customer demands. The CDR-1700S performance on applications is competitive with other non-SCSI-bus drives and to the drives in your review.

We hold BYTE in the highest regard and acknowledge the influence it has on the personal computer market. We hope that potential CD-ROM drive customers will not overemphasize animation when text is of primary importance.

Eric Kamayatsu
Multimedia Systems
Hitachi Home Electronics (America), Inc.
Compton, CA

New Soviet Threat?

The threat of a Russian nuclear attack may now be lessened, but some unexpected things may await the U.S. on another battlefront: the computer software market. Soon we may see real competition between Russians and Americans in software development.

Soviet programming potential is like boiling intellect developing inside a rubber balloon. As development advances, the balloon's size increases and pressure rises until the cover bursts (such a moment is not far away). Surely, Russians have a lot to learn from Americans about software creation. But there's no question that Soviet programmers are demonstrating originality in their work. The main areas where Soviets could establish competitive positions are scientific and system software.

I do hope the world software market will be the only battlefield for American and Soviet programmers and that we'll become friends during this new battle now that we've stopped wasting our intellects on the senseless weapons race.

Alexander Beresne
U.S.S.R.

More on COBOL

I enjoyed Doris Appleby's article on COBOL ("Classic Languages, Part 2," October 1991), but I must take issue with one comment she makes about recursion: "COBOL does not support recursion, nor is it likely to in the future."

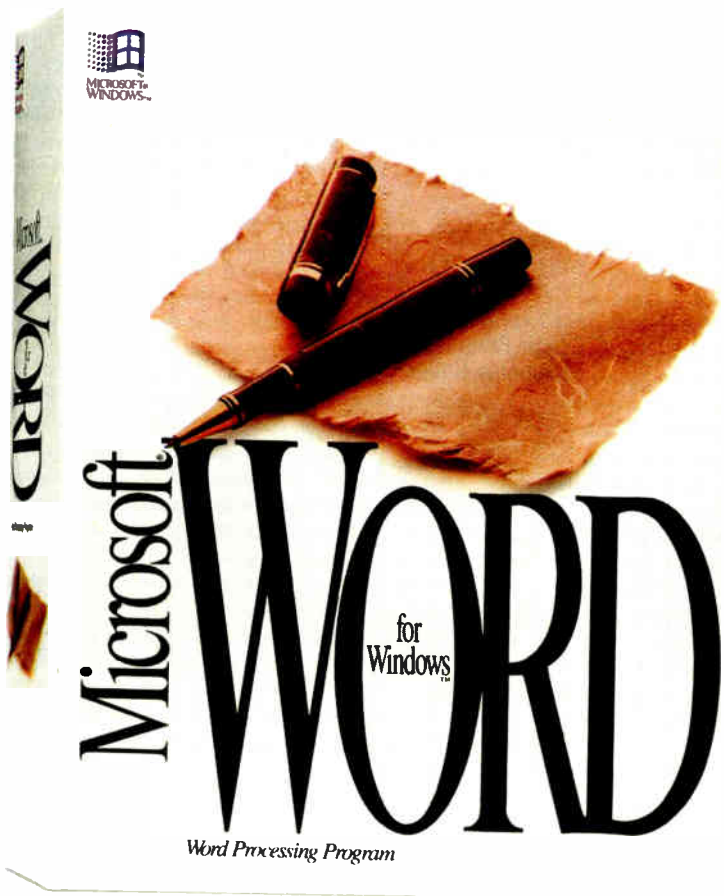
Although it's true that the CODASYL standard does not support recursion, Micro Focus lifted this restriction in the most recent release of COBOL/2. This was done to add features to the language for event-driven programming, specifically in the Windows and Presentation

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

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

World Radio History

Microsoft announces the best upgrade for WordPerfect users.



Special Upgrade Offer $129

If you're ready to join the millions of people moving from DOS* to the Microsoft® Windows™ environment, upgrade to Microsoft Word for Windows, the best-selling word processor for Windows.

While others are releasing their first-generation Windows programs, we've been refining ours. New Word for Windows version 2.0 features our new Toolbar™ that lets you create automatic bullets, envelopes, charts and more. All with a simple click. And our exclusive new "drag and drop" feature lets you instantly move text and graphics around the page.

Plus, moving from WordPerfect to Word is incredibly easy. Use your existing files** in Word without losing any work. With the Help for WordPerfect® feature you can type the WordPerfect command you know and Word automatically demonstrates the equivalent command right in your document. So why not follow our lead? Upgrade now for $129.†

Call (800) 323-3577, Ext. W86 to order Word for Windows version 2.0 directly from Microsoft or for the name of an authorized Microsoft reseller near you.

Microsoft®

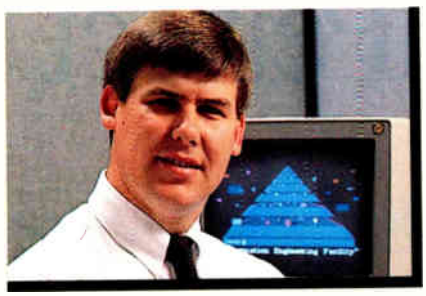
s used herein, "DOS" refers to MS-DOS or PC-DOS operating systems. **File conversions available for WordPerfect versions 5.1, 5.0, 4.2, and 4.1. †Plus freight and applicable sales tax. Offer good for current licensees of WordPerfect, fultimate, WordStar, MS Word for DOS and DisplayWrite. Allow 2-4 weeks for delivery upon receipt by Microsoft. Offer expires March 31, 1992. Limit one per customer. Reseller prices may vary. Call for system requirements. ffer good only in the 50 United States. © 1991 Microsoft Corporation. All rights reserved. Printed in the U.S.A. In the United States, call (800) 323-3577, Ext. W86. For information only in Canada, call (800) 563-9048. Outside ie U.S. and Canada, call (206) 936-8661. Microsoft and MS-DOS are registered trademarks and Windows is a trademark of Microsoft Corporation. WordPerfect is a registered trademark of WordPerfect Corporation.

World Radio History

The IEF™ can help you devel unprecedented quality, prod

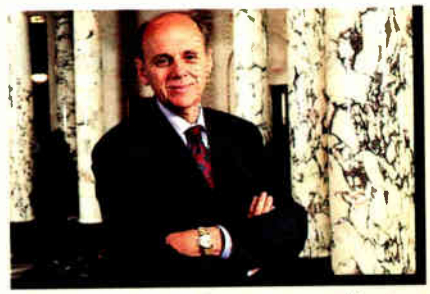
"The IEF is a superior tool for implementing Information Engineering because it integrates the entire process from planning through code generation. We're deploying the IEF throughout the corporation."

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



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

Mark Quinlan
Senior Programmer/Analyst
Huntington National Bank



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

John Pajak
Executive Vice President
Mass Mutual Life Insurance

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

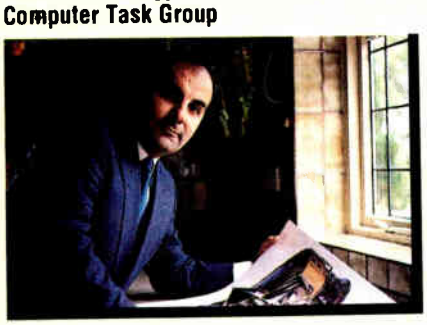
Paul R. Hessinger
Chief Technology Officer
Computer Task Group

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

John F. Mott
President
AMR Travel Services

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

Giorgio Sorani
Division Head – MIS
Lubrizol



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

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

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

Venkat (Vinnie) Tiruviluamala
Director, CPC/CPPC Information Systems
SDNY Corporation

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

Mogens Sorensen
Chief Consultant
Nykredit (Denmark)

World Radio History

op information systems with uctivity and maintainability.

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

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

Study shows zero code defects.

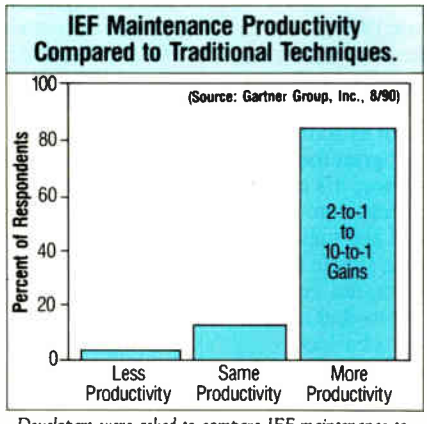
The quality of IEF-developed systems is remarkable. In recent CASE research by The Gartner Group, application developers were asked to report the number of abends they had experienced. (An "abend" is a system failure or "lock-up" caused by code defects.) *IEF developers reported zero defects—not one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

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

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

Specifications always match the executing application.

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



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

Mainframe applications can be developed and tested on a PC.

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

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

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

We are committed to standards.

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

Full-service support.

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

For more information call 800-527-3500 or 214-575-4404.
Or write Texas Instruments, 6550 Chase Oaks Blvd., Plano, Texas 75023.

TEXAS INSTRUMENTS

© 1991 TI
Information Engineering Facility and IEF are trademarks of Texas Instruments. Other product names listed are the trademarks of the companies indicated.

66106

World Radio History

LETTERS

Manager environments.

Programmers find COBOL cumbersome and overly verbose, but it has the advantage of being easier to manage by virtue of readability. This, along with the sheer volume of code currently in production and development in the CASE industry, will guarantee its longevity well into the next century.

Jeffrey Harker
Northridge, CA

Shorthand Warning

In "The Hungarian Revolution" (August 1991) Charles Simonyi and Martin Heller describe yet another shorthand system. As with all such systems, the writer has a distinct short-term advantage. Shorthand may be useful for working documents, such as source code, currently being manipulated by a programmer. However, when read later, even by the author, it's all so much gobbledygook—not even close to Hungarian.

Building systems that can be understood and maintained by others requires coding that is intelligible to people. Let the machines adapt to our norm, not vice versa. Compilers can detect type usage errors and inform the error prone. I'm well aware that systems builders swear that they will document those obfuscated lines of code, but mostly they don't—at least not very well. Source code can be represented as the reality to which the documentation becomes a map. Where they are incongruous, your point is lost.

Writing source code in shorthand is acceptable. It is not acceptable to keep it in that form when future uses are taken into account. We in the computer world have long resorted to various shorthand strategies because of machine limitations. Now that the machines are approaching an understanding of our natural language, let's not lose it. Translate to some commonly recognizable subset of the national tongue, please.

Roger L. Boese
Seoul, Korea

C Notes

From time to time, Jerry Pournelle blames C for the troubles in projects. I don't think the language itself is entirely to blame: It seems that C's reputation for being messy attracts messy programmers. I just taught a guy the first things about C. He knew BASIC and Pascal, but he thought that they were much too difficult to use: all those PEEKs and POKEs you had to do. But then he heard about C being well suited for writing messy, bit-twiddling stuff, and he just loved the thought of it.

The point is, he would write just as messy code in Turbo Pascal. Up to now I've done most of my programming in C, and I have a pretty good idea why some people dismiss BASIC as a language for real programming. I just have to look at my C programs: They're well designed, well structured, well commented, and readable. When I glance at one of my old BASIC programs, I see good old spaghetti-style code.

Anders Munch
Copenhagen, Denmark

I agree that you can write good programs or bad programs in any language. Some, though, encourage good habits, and some do not.—Jerry Pournelle

Having enjoyed Jerry Pournelle's column for many years, I'm sorry that this letter was inspired because my feelings were hurt by something he wrote. I'm referring to his remark that "C is the last attempt of the high priesthood to control the computing business. It's like the scribes and the Pharisees who did not want the masses to learn how to read and write."

Although I am a linguist by profession, I've liked to program ever since I first learned FORTRAN in 1969. Of the languages I know well (FORTRAN, Pascal, Prolog, and C), as well as the languages I know a bit about (Lisp, COBOL, BASIC, and Modula-2), C is the one I like best. And I think that this is probably a major factor in the popularity of C—programmers like it.

One can speculate about why this is so. For me, first of all, C is not cloying. I also find that it is convenient in countless ways: its handy abbreviatory operators, its flatness, and the fact that C code is much easier to read than code in true block-structured languages (an important factor if you are working with someone else's code).

As I'm sure you know, virtually any program written in Pascal receives a 20 percent boost in efficiency when ported to C. A major reason why this is so is that it is easy to use pointers for array manipulations in C and memory is more efficiently accessed and used.

In any event, what hurt me was Jerry's comparison of programmers to some high priesthood. In the first place, programmers are not very high on any company's ladder. I doubt that anyone decides to go into programming because the position of programmer allows one to yield a lot of power. I also doubt that money is any kind of incentive—programmers' salaries are not very high. Finally, I have never met a programmer who was not delighted to explain the details of his or her craft to the uninitiated.

I'm sure that most programmers would agree that programming is healthy for the mind and that, at least in small amounts, it would probably benefit everyone in our society to know how to program. Isn't that the opposite of the attitude of the ancient scribes?

Chet Creider
University of Western Ontario
London, Ontario, Canada

I know that C programmers like C. Alas, few C programmers like real programs that any other C programmer wrote; hence, in recorded history there are probably only about four cases in which a large C program done by one programmer has been maintained by another C programmer without extensive rewriting and revision.

Meanwhile, it's still the case in the world I live in that whenever I hear of a program that has a known but unfixable bug, the chances are very large that it was written in C.

I'm sure C is wonderful, and I've always said it might well be the language of choice for full-time professionals (although it wouldn't be mine), but my goal is to get every PC owner to do some programming—and that isn't going to happen if they have to learn C first.
—Jerry Pournelle ■

World Radio History

We slash interface development time across DOS, UNIX, XENIX, VMS...

(and we can prove it!)

C-Programmers: See for yourself how Vermont Views™ can help you create powerful user interfaces—whatever your environment!

If you want to create sophisticated user interfaces—and save *tremendous* time and effort doing it—Vermont Views is exactly what you need.

Vermont Views isn't just a common interface package. It's a deep, flexible, menu-driven screen designer supported by a C library of over 550 functions. It lets you create the ultimate user interfaces for complex database applications—in a fraction of the time it would take to code them yourself!

With Vermont Views, you create screens *interactively*. Designing is fast, and creative. And changes—both tiny adjustments and huge reworks—are incredibly easy.

Pull-down menus, window-based data-entry forms with tickertape or memo fields, scrollable form regions, choice lists, context-sensitive help... All these interface objects (and more) are immediately accessible. And with Vermont Views, even terminal-based applications can have the elegant features usually found only on micros.

©Copyright 1991
Vermont Creative Software

Fast prototypes, faster applications.

With most systems, you have to throw away your prototypes when coding begins. But with Vermont Views, *prototypes become the actual applications!*

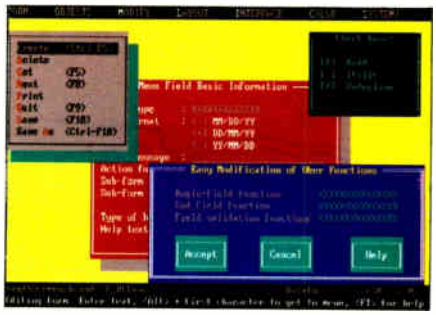
Menus, data-entry forms, and all screen features are usable in the final applications without change. So not only do you avoid creating code from scratch once, you don't have to do it twice!

It's the universal solution.

Vermont Views operates completely independent of hardware, operating system, and database. Any interface you create can be ported easily among DOS, UNIX, OS/2, XENIX, and VMS.

You can use Vermont Views with any database that has a C-language interface (including Oracle, Informix, db_Vista, and C-Tree). You can run it on PCs, DEC, NCR, HP, AT&T, and other systems. You don't have to pay runtime fees or royalties. And full library source is available, too.

What's more, your DOS applications can have full mouse control, and work in



graphics as well as text modes!

Don't take our word for it—put Vermont Views to the test. Call or fax now for your personal, free demonstration kit. It includes a DOS demo diskette and complete instructions for trying Vermont Views on your terminal, via modem. Or order Vermont Views with our 60-day, money-back guarantee.

Either way, you'll see immediately that Vermont Views is a cut above the rest.

Call for your FREE demo kit! 800-848-1248

Vermont Creative Software

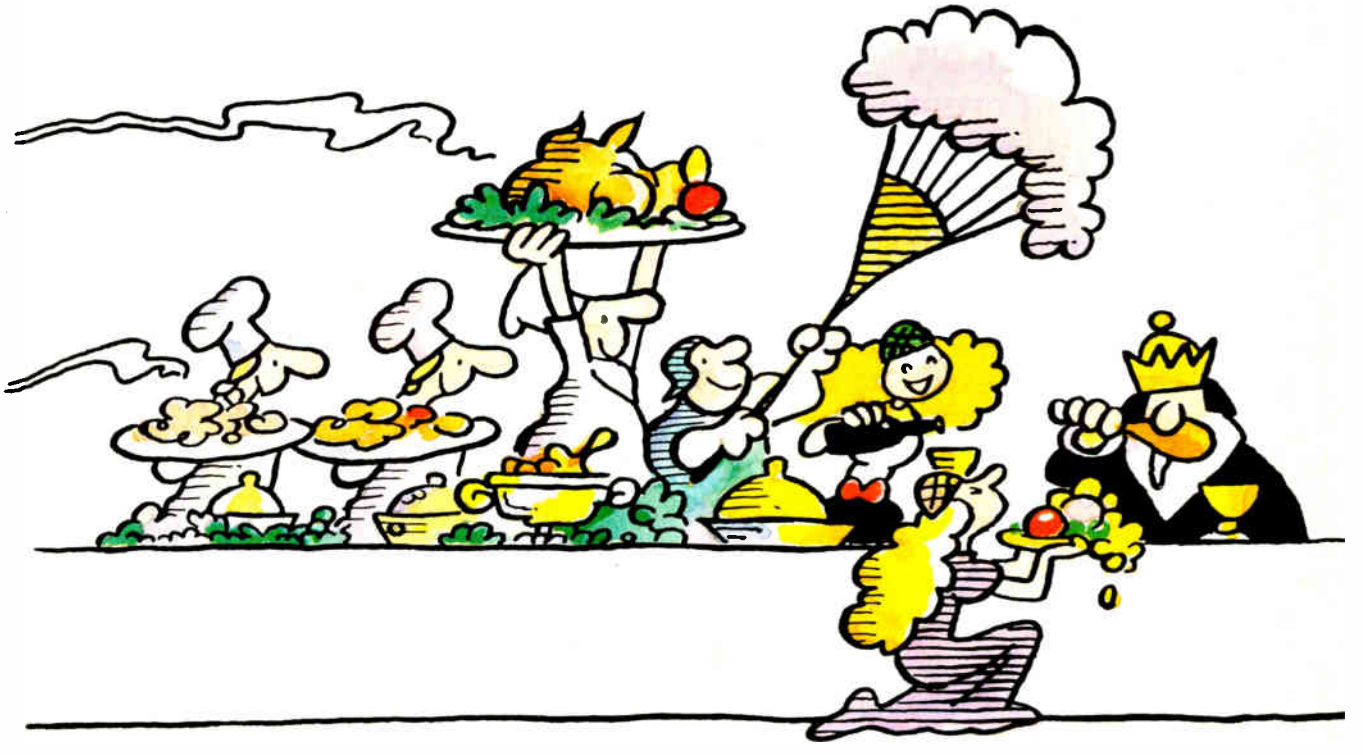
Pinnacle Meadows
Richford, VT 05476 USA
Phone: (802) 848-7731
FAX: (802) 848-3502

(Please Mention "Offer 245")

Circle 175 on Inquiry Card.

World Radio History

IBM presents the that brings



If you're a glutton for productivity, chances are you're considering open systems solutions for your business. But much of the menu is so unfamiliar or limited, it's enough to make you lose your appetite.

The IBM RISC System/6000™ family of POWERstations and POWERservers is for you. It's as open an open system as you'll find anywhere, to help you take a big bite out of communication barriers. With the RISC System/6000, you offer your suppliers and customers broad connectivity and management for IBM and non-IBM networks. And you satisfy your hunger for the latest leading-edge technology, without network or equipment upset.

Naturally, the RISC System/6000 family supports all major industry standards. And it also runs a smorgasbord of over 3,500 key applications. But that's only the appetizer. The family provides the widest range of binary compatible systems, so you're free to put the right level of machine performance and price at every location.

The RISC System/6000 also serves up remarkable performance, capacity and value. The POWERserver 550 runs at speeds you'd expect from a supercomputer, but runs up a tab starting at only $58,000. And

*Prices subject to change. Dealers' prices may vary. IBM and AIX are registered trademarks and RISC System/6000 is a trademark of International Business Machines Corporation. UNIX is a registered trademark of UNIX Systems Laboratories. HAGAR THE HORRIBLE Character(s) © 1991 King Features Syndicate, Inc. © 1991 IBM Corp.

World Radio History

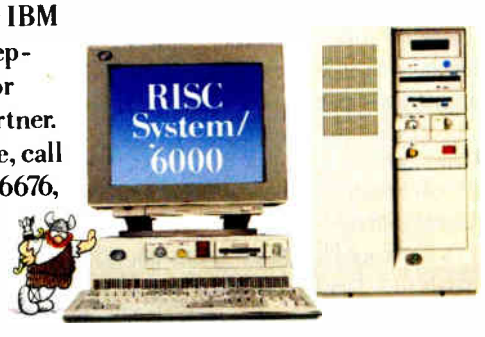
first open system more to the table.

other models' prices start below $14,000*

AIX,® the pièce de resistance. To make UNIX® even easier to swallow, there's AIX, IBM's UNIX operating system. AIX makes it a piece of cake to develop company-wide networked solutions. And it gives companies robust operating software for enterprise-critical applications.

Service with a smile. The RISC System/6000 comes with something you won't find anywhere else—the unparalleled support of IBM. Service 24 hours a day, 365 days a year. But then, at IBM, customer service and support aren't just fillers. They're your just desserts.

To find out more about the IBM RISC System/6000, contact your IBM marketing representative or Business Partner. For literature, call 1 800 IBM-6676, ext. 824.



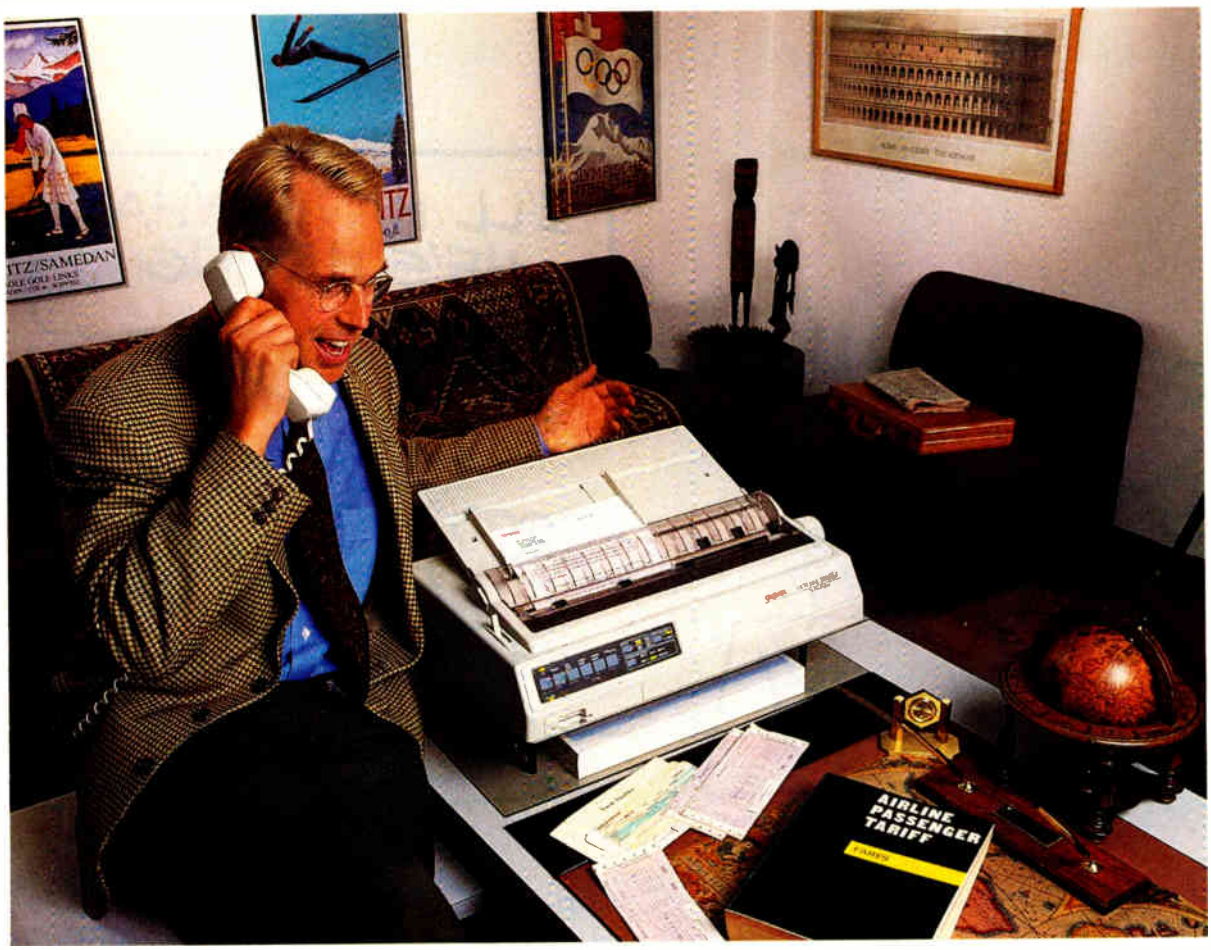
For the Power Seeker.

IBM®

Circle 72 on Inquiry Card.

World Radio History

If your office really gives your printer the business, it better wear the Okidata OK!™



Today, a small business has to be all business to succeed - right down to the printer that keeps the paperwork moving. That single printer has to pretend it's three or four different printers - cranking out professional-looking business correspondence, lengthy proposals, invoices, multi-part forms, payroll checks, envelopes, and shipping labels without skipping a beat.

It's a challenge Okidata dot matrix printers were born to handle. Any one of our 24-pin 390 Series printers can take a whole office's printing demands in stride - they all offer the flexibility of top, bottom, or rear paper feed; high-speed draft or laser-like letter-quality printing; varied type font selection; a paper-saving top-of-form tear-off feature; and paper-park for easy switching between continuous pin-feed forms and single sheets or envelopes.

And to make sure your Okidata printer will keep printing, year after year, we build in dependability from the baseplate up - printhead wires made of the world's hardest metal, a closed-loop positioning system to insure proper alignment even after years of wear and tear, and a case made from the same tough plastic as a pro football helmet.

Finally, we add a feature as important as any item on our spec sheets: the Okidata OK! It's nothing less than our personal pledge to you that every Okidata printer we sell will provide not only acceptable, but outstanding performance; not just adequate, but exceptional value.

In order for your small business to look good, your printer has to wear many hats. That's why it should also wear the Okidata OK!

For more information, call 1(800)OK1-DATA.

OKi OK!

OKIDATA OK!

We don't just design it to work. We design it to work wonders.™

Okidata and Microline are Reg. T.M. and Okidata OK! is a T.M. of OKI Electric Industry Co., LTD. "We don't just design it to work. We design it to work wonders." is a T.M. of OKI America Inc.

Circle 116 on Inquiry Card.

World Radio History

NEWS

MICROBYTES

The PowerPC Club: Not Just a Trio

Last October, when Apple and IBM finally released their plans for personal computing for the next decade, the details were scant regarding the so-called PowerPC, a planned single-chip implementation of IBM's RISC System/6000 processor. Other than that Motorola would manufacture the chip using its own 0.5-micron CMOS technology and 0.5-micron technology licensed from IBM, not much more was known.

Apple, IBM, and Motorola say that they will found an industry organization called PowerOpen that will be modeled after the 88Open group. The organization will actively solicit input (including standards definitions) from other companies in the industry. PowerOpen will define the instruction set for the PowerPC, the Application Binary Interface, and software interfaces. The three companies share a vision that the PowerPC will support the Mac and OSF/Motif operating environments.

According to Phil Hester, director of IBM's Advanced Workstation Engineering Division, the PowerPC RISC architecture has two targets: to get functional chips operating in 1992 and to scale up the chip by mid-1993 so that a high-end CPU more powerful than the current RISC System/6000 chip set will have most of its functions supplied in silicon, while retaining the 128-bit internal bus that gives the RISC System/6000 much of its performance. By 1995, the top-of-the-line model could be capable of 500 SPECmarks.

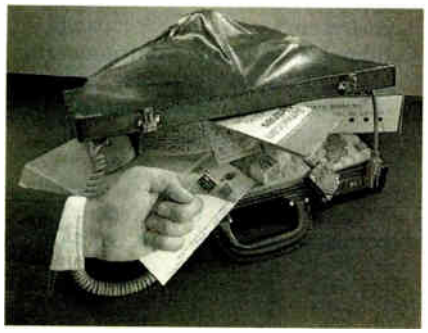
—Owen Linderholm and Trevor Marshall

Editor's note: *BYTE will have more in-depth coverage of the PowerPC in the February issue.*

New Chip Set Puts Your Office on an Airline Tray

An innovative chip set from Cirrus Logic squeezes the capabilities of a modem, a fax machine, and an answering machine into an area that's roughly the size of two postage stamps. Designed for low power consumption and minute form factor, the two-chip set could be an ideal solution for bringing complete telecommunications capabilities to notebook computers, the company says.

The CL-MD1424 Communicator intelligent data/fax/voice modem device set has the capabilities of a 2400-bps Hayes-compatible modem, a 14.4-Kbps Group 3 fax transceiver, and a voice answering machine. It can accept and store messages either through a standard telephone set or through the small speaker often found in a notebook computer.



The Communicator will work in environments such as Windows 3.0 and can operate the modem, fax, and answering machine in background mode. Machines built around the chip set will have the functionality of a fax machine, an external modem, an answering machine, a desktop computer, and a display monitor in a unit that can sit on an airline tray.

The company expects to ship the first samples of the set in the first quarter of this year. At press time, Cirrus Logic hadn't yet announced the names of any design wins, but systems using the chip may appear by the second half of this year.

—D. L. Andrews

NANOBYTES

Macronix (San Jose, CA) has combined a stripped-down version of its fax software with a **MaxLite** portable 9600-bps fax modem and a **Hewlett-Packard 95LX** to create what could be the world's smallest operational fax system. Macronix had to strip out all but the essential features of the program to fit on the HP 95LX's RAM cards. □

Visix Software (Reston, VA), maker of the graphical Looking Glass environment for Unix systems, is offering a new development environment that makes those systems friendlier. The HyperCard-style Unix interface lets you build graphical front ends to command-line programs. □

A ROM-based version of Microsoft Windows 3.1 is in the works, the company says. **ROM Windows** will run all your applications, but manufacturers will be able to configure it to fit on machines with scarce resources. □

Millions of people may soon be using OS/2 every day without even knowing it. Unlike earlier-generation machines based on proprietary hardware and operating systems, **NCR's** new line of automatic teller machines are based on 386SX computers running OS/2. □

A report published by **International Data** estimates that 3.8 million personal computers were shipped in the Asia/Pacific region in 1990, producing revenue of $12.4 billion. The report estimates that of that total, Japan alone accounted for more than 2 million personal computers. □

World Radio History

NEWS

MICROBYTES

Microsoft, Lotus, and Phoenix to Team Up on Companion PC

Larger than a palmtop, lighter than a notebook, and selling faster than a Psion Series 3 or Hewlett-Packard 95LX—that's a description that the developers of the Companion PC hope will come true. The Companion PC is intended to be the small, full-function computer you take everywhere.

Combining products from Microsoft, Lotus, Phoenix Technologies, Intel, and Chips & Technologies, the Companion PC would run on AA batteries and cost under $1000. Unlike notebooks, it would be so light that you wouldn't have to think whether or not to take it with you. Unlike palmtops, the Companion would be a general-purpose machine with a full keyboard, weighing as little as 2 pounds. For a little extra money, you could add a 1.8-inch hard drive or solid-state storage. That's the idea, at least, if OEMs go along with the plan.

Phoenix, Lotus, and Microsoft have announced a cooperative program to help manufacturers build the Companion PC. System manufacturers can buy an integrated hardware/software reference design and BIOS from Phoenix, license DOS 5.0 in ROM from Microsoft, and buy ROM-based personal productivity software from Lotus.

With all these components in hand, manufacturers might not have much design work left to do. The real work may be in finding buyers who can distinguish one Companion PC from another.

—**Ellen Ullman**

OS/2 2.0: IBM Says Hold On Tight, It's Coming

IBM is now saying that its new operating system for the 1990s, OS/2 2.0, will ship this March. The environment will have the Workplace Shell and will run DOS, Windows, and 16-bit OS/2 applications unchanged. Windows applications will run side by side with DOS and OS/2 applications on the same platform.

But wait, you say. Didn't IBM promise to ship OS/2 2.0 by the end of 1991? IBM said it would. The system, however, would not have some of the functions that IBM has publicly demonstrated at various trade shows, such as the ability to run and cut and paste among Windows 3.0 applications, an IBM spokesperson said. The version planned for last December would have DOS capability and the Workplace Shell, but it would support only full-screen Windows applications. The spokesperson added, "A number of our customers have said that Windows doesn't fit into their plans and want [OS/2] 2.0 now."

—**D. L. Andrews**

Ballmer: Windows 3.1 Temporarily Delayed

At a breakfast for press and industry analysts, Steve Ballmer, Microsoft's senior vice president, announced a delayed delivery for Windows 3.1, demonstrated Microsoft's 32-bit Windows NT operating system, and explained the company's Windows strategy. Having once said that he would eat a floppy disk if IBM shipped OS/2 2.0 before the end of 1991, Ballmer was no doubt relieved that he did not have to breakfast on magnetic media.

Although all the planned features have now been built into Windows 3.1, it, too, wouldn't ship because of bugs, Ballmer said. Microsoft's internal estimates of the Windows 3.1 ship date range from an optimistic January to a pessimistic March, "which might really even be April," a source reported. In addition to fixing incompatibilities with Windows 3.0 applications, Microsoft will be adding the Media Control Interface and audio portions of the Windows Multimedia Extensions to the base 3.1 product. As previously announced, Windows 3.1 will include TrueType, Object Linking and Embedding, drag-and-drop capability, and a faster, more robust kernel.

Ballmer showed a misbehaved program called BadApp trying to crash Windows 3.1: Instead of the dreaded unrecoverable applications error, the new version of Windows brought up a box that lets you continue, save your work, and log the error. When the BadApp program deliberately hung up, a Ctrl-Alt-Del sequence let Ballmer close only the errant application and continue with the Windows session. Windows NT is the advanced portable operating system for 80x86 and Mips processors.

—**Martin Heller**

NANOBYTES

IBM has effectively disbanded its Desktop Software unit. The company has turned over the U.S. marketing and distribution rights for the high-end Platinum accounting and management system to **Advanced Business Microsystems**. XyQuest will market Signature, a DOS-based word processor jointly developed with IBM, and Claris now has the marketing and distribution rights for the Hollywood presentation graphics program. The Storyboard Live program is now in the IBM Multimedia Solutions division. □

Fox showed a technology demonstration of **FoxPro 2.0** for Microsoft Windows 3.0 at fall Comdex 1991. Likewise, **Borland** showed a glimpse of **Quattro Pro** for Windows. Borland expects to release Windows versions of dBase and Paradox this year and is now shipping a Windows-hosted version of Borland C++ 3.0. □

Unix Systems Laboratories has agreed to license Silicon Graphics' Iris Graphics Library. USL says that it will support Iris GL 5.0 in its Unix System V release 4.1 operating environment. □

Microsoft's senior vice president **Steve Ballmer** says that IBM has confused software developers with its Apple alliance. "I could not say this a year ago, but they are even less clear than we are on their future direction," he said. □

Quarterdeck has missed its projected December release for its ambitious Desqview/X environment. Quarterdeck now says that it expects to release the environment in the first quarter of 1992. □

The Fifth International Computer Virus & Security Conference will be held March 12–13 at the New York Marriott and Summit. □

World Radio History

If you write software, IBM wants to bring you to your senses.

With sight, sound and motion, you can become a star in the biggest, fastest-growing universe there is. A multimedia star in the universe of IBM and IBM-compatible computers.

Working with IBM MultiMedia will be exciting. Just look at what's been done with the software, "Columbus: Encounter, Discovery and Beyond" and the "Illuminated Books and Manuscripts" series. And think of the programs you can write combining interactive video, dazzling graphics and CD-quality sound. Think of the huge market potential that's barely been tapped. With your creativity and IBM's resources, technical and marketing support, the possibilities are endless.

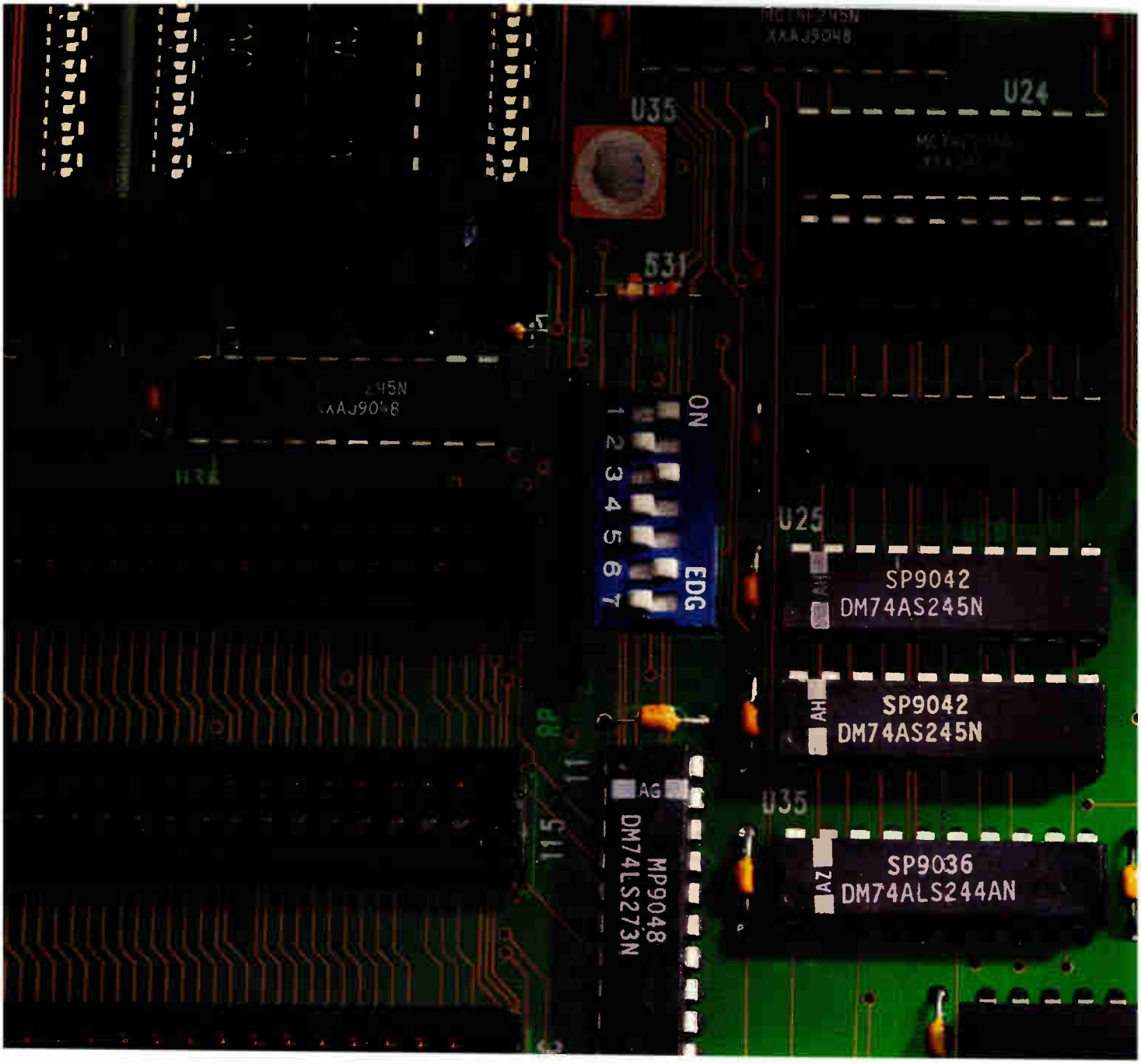
Yes, IBM MultiMedia is designed to appeal to all your senses. Especially your business sense.

Call 1 800 426-9402 to find out all the ways IBM can help.

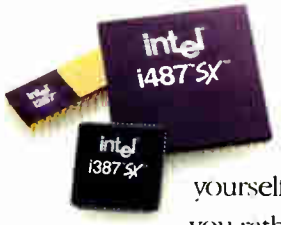
IBM

'BM is a registered trademark of International Business Machines Corporation © 1991 IBM Corp

World Radio History



Ask for genuine Intel or who knows what yo



If you need a math coprocessor to speed your power applications, ask yourself this question: Which would you rather have sitting next to your Intel microprocessor — an Intel Math CoProcessor or something you may know nothing about? Because if you don't specify Intel, that's basically what you're getting — a big question mark. With Intel, however, there's simply no question. You're getting quality.

That's because Intel has the longest track record with math coprocessors. In fact, we've manufactured

©1991 Intel Corporation. i287, i386, i387, i487 and the SX logo are trademarks of Intel Corporation

World Radio History

Math CoProcessors, u'll have to count on.

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

So ask for Intel Math CoProcessors. Or there's no calculating what you'll end up with.

For a free information packet, including our new low prices, call **(800)538-3373.**

intel®

The Computer Inside.™

Circle 78 on Inquiry Card (RESELLERS: 79).

World Radio History

NEWS

MICROBYTES

Bacteria Could Lead to Drives with the Equivalent of 5000 Platters

Researchers seeking the storage medium of the future have found a promising source in nature. Bacteria living in salt marshes produce a molecule that could serve as a three-dimensional storage medium capable of holding a gigabyte of data per cubic centimeter.

The protein bacteriorhodopsin (bR), found on the surface membrane of halobacterium halobium, absorbs light in a process similar to photosynthesis. bR exists in two interchangeable 2-D states: one that absorbs blue light at 410 nm and one that absorbs green light at 570 nm. You can use the two bR states to store information in a binary code.

Researchers have worked with bR films since 1984. Dr. Thomas Birge, director of the Center for Molecular Electronics at Syracuse University, says that he has produced 1-inch-square polymer cubes, laced with uniformly oriented bR. "We now have access to a third dimension," said Birge. "It's as if you had a disk drive with 5000 platters on it." But since each layer is only 3 to 6 microns thick, the 3-D drive occupies almost the same space as a standard drive.

Birge begins with all the bR in the form that absorbs 570-nm light. To encode the information, he aims two infrared (1140-nm) lasers at a tiny region (3 cubic microns containing 10,000 proteins) of the cube. Each laser produces photons with half the energy of a 570-nm beam. Where the two beams meet, their combined photons convert the bR to its alternate form.

"To read it, we essentially write," said Birge. "Then we monitor the effect." As the bR changes forms, it emits a distinctive electrical signal. The bR cube is enclosed in glass, two sides of which are coated with a conducting film of indium-tin-oxide. Birge fires 10-ns laser pulses capable of altering the bR from its green-absorbing state to its blue-absorbing state. The green-absorbing bR will change and emit an electrical impulse; a blue-absorbing bR will not. A second laser pulse returns the green-absorbing form to its original state.

The ability to read the bR with electrical sensors makes the cubes less expensive than media that are read with optical ones, said Birge. The bR is harvested from bacteria grown in culture. "If our technology develops the way we hope it will, the price you now pay for 100 to 200 MB will buy multigigabyte drives," said Birge.

The bR drives are not particularly fast, however. Birge found that he could not maintain accuracy when he moved the laser beams between different regions of the cube. He has to move the cube instead, resulting in a 1-ms access time.

Finding a fast and accurate way to move the cubes is one obstacle to commercial production. So is scaling up the cube production. More problematic, said Birge, will be consistently detecting the electrical impulses emitted by the bR. The signal-to-noise ratio is now running between 5 and 10 dB, too low for commercially reliable signal detection. Applications could also be limited by the fact that bR breaks down at temperatures above 83°C.

—**Billy Allstetter**

Apple: TrueType Is Alive and Well

Sometimes a company does something in the marketplace that users can interpret in exactly the opposite way the company intended. Such seems to be the case with Apple. When Apple announced plans last summer to build Adobe's Type 1 font technology into a future release of the Mac operating system, some observers wondered if this meant that TrueType would become superfluous except to those select few running beta versions of Windows 3.1.

According to Brian Lawley, product manager for type and text at Apple, the company's commitment to TrueType remains as strong as ever. "TrueType will be the design center for [Apple's] next generation of type and imaging capabilities." He said that the installed base of TrueType is now "well over a million" and noted that the LaserWriter IIf and IIg printers come with a built-in rasterizer.

The whole point of the Apple/Adobe announcement was to tell you that eventually "Type 1 fonts will display and print without [your] having to buy ATM and use that separately." A recent coupon offer, where you could get ATM and four typefaces from Adobe for a $7.50 shipping fee, is an interim solution, Lawley said. He said that Apple's Type 1 TrueType strategy is that you "should be free to choose either format and know that it will work."

—**Larry Loeb and D. L. Andrews**

NANOBYTES

Information Builders, Inc., and **Apple** have signed an agreement that will let IBI's Enterprise Data Access/SQL client/server software provide Macs with a solution for accessing nonrelational data from a broad array of databases. □

Nantucket, provider of the Clipper 5.0 business application development system for the PC, now offers a **Cyrillic translation** that is produced in the Soviet Union. □

Guy Kawasaki, author of *Selling the Dream,* had this to say when asked if Apple's embrace of Adobe spelled the death of TrueType: "Do I think TrueType's dead? Well, was it ever born? Two years ago everybody said, 'Adobe's doomed.' Well, here it is two years later, and the world has reversed. So I guess the lesson is, if you wait long enough by the side of the river, all of your enemies will come floating by." He made the comments at a meeting sponsored by Milwaukee's North Shore Computers. □

Following layoffs of 1400 employees, a $70 million third-quarter loss, and the departure of several key executives, including former CEO Rod Canion, **Compaq** says that it will offer a line of **low-cost PCs** that may have processors from other chip manufacturers besides Intel. New CEO Eckhard Pfeiffer says that product design and development procedures have been changed to shorten development cycles and lower costs. □

UserLand Software has posted on major electronic networks the **Frontier Software Development Kit.** The SDK has sample code, libraries, documentation, and sample programs to help Mac developers take advantage of Interapplication Communication protocols. □

World Radio History

GATEWAY 2000 – IT'S A CLEAN SWEEP!

FOUR • FABULOUS COMPUTERS • MORE • SAVVY PC USERS • YOU KNOW WHAT COMPANY GIVES YOU THE BEST VALUE • GATEWAY'S THE ONE

For the first time in the six-year history of *Computer Shopper* magazine's Best Buy competition, one company swept all of the awards in the desktop PC categories. At COMDEX/Fall '91 in Las Vegas, Gateway 2000 was awarded Best Buy honors for 286, 386SX, 386 and 486 systems.

"What's most meaningful about these awards," said Gateway 2000 President Ted Waitt, "is they are given by the readers of *Computer Shopper*, people who are buying and using PCs in the real world."

Shopper readers voted in record numbers: 15,000 people cast over 100,000 votes for products in 27 hardware and software categories. The vote on desktop PCs was a decisive victory for the Midwestern firm customers call the "cow company."

According to *Computer Shopper*, the Best Buy Awards have come to symbolize the best in service, quality, performance, support and product selection. This combination gives you the best value on the market.

Our thanks to Gateway's own Semi-Gold Dancers played by employees from departments throughout the company.

It's really no surprise Gateway 2000 systems were singled out as Best Buys since Gateway sells more computers through the direct channel than any other PC manufacturer. This in itself is testament to the value Gateway 2000 offers. One look and you'll be convinced, too.

Gateway's the one with the best prices on quality, fully-loaded, high-performance systems. Gateway's the one with the award-winning service organization that'll take good care of your system. Gateway's the one that's going to be here for you. And Gateway's the only one with a great PC that comes in a cow-spotted box suitable for use as a rec room end table.

Call a Gateway 2000 sales representative today for all the details on the Best Buy system we'll build just for you.

GATEWAY2000

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

800-523-2000

World Radio History

Las Vegas Convention Center

COMPUTER SHOPPER BEST BUY AWARDS

GATEWAY2000

THE LINE THAT SWEPT 'EM AWAY

16 MHZ 286

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

$1345

16 MHZ 386SX

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

$1445

20 MHZ 386SX

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

$1745

25 MHZ 386

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

$1895

33 MHZ 386

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

$2395

33 MHZ 486

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

$2945

33 MHZ 486 EISA

- Intel 80486 Processor
- 128K Cache RAM
- 8MB RAM
- 1.2MB 5.25" Drive
- 1.44MB 3.5" Drive
- 340MB 15ms SCSI Drive with 128K Multi-Segmented Cache
- 32-Bit EISA SCSI Controller
- 16-Bit VGA with 1MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0
- MS Windows 3.0

$3895

BEST BUYS

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

$2145

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

$2495

INCLUDED WITH EVERY SYSTEM:

• One-year warranty • 30-day money-back guarantee • Lifetime toll-free technical support • Free on-site service to most locations • Free bulletin board technical support • Software and optional peripherals installed at factory • Software diskettes and comprehensive hardware and software manuals provided

Sales Hours: 7am-10pm Weekdays, 9am-4pm Saturdays (CST)
Service Hours: 6am-Midnight Weekdays, 9am-2pm Saturdays (CST)

All prices are subject to change. Prices do not include shipping.

intel inside

GATEWAY2000

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

800-523-2000

610 Gateway Drive • N. Sioux City, SD 57049 • 605-232-2000 • Fax 605-232-2023

GLOBAL RELEAF

©1991 Gateway 2000, Inc. Gateway 2000 and AnyKey are trademarks of Gateway 2000, Inc. All other brand and product names are trademarks or registered trademarks of their respective companies.

World Radio History

NEWS

MICROBYTES

The Palmtop 386 Is Getting Closer

C&T plans to add new functions and power to the PC/Chip, pushing further the level of system integration. This June, the F8680 will add support for VGA displays, augmenting current CGA-compatible display controllers. There will likely be a 386-compatible PC/Chip in 18 months.

C&T is also exploring how the PC/Chip can offer programmable hardware gates, enabling OEMs to build PC/Chip-based devices that could be integrated into consumer electronics systems. With a programmable hardware gate, for example, an OEM could add support for an RCA jack. For the consumer, this would mean a hand-held PC that could plug into a home entertainment center.

C&T also has ambitious plans for pen support. According to C&T, it is working with Microsoft, GeoWorks, and Computer Intelligence on integrating pens into the PC/Chip environment, with Microsoft "at the top of the list." C&T will support the 32-bit interface of Go Corp.'s PenPoint system when a 386SX-compatible PC/Chip is ready. At that time, the company may divide its offerings into two branches: the low-end PC/Chip and high-end 386-based solutions.

—**Ellen Ullman**

IBM and Intel Fight Back with Chip Accord: First Products to Ship in Two Years

Both IBM and Intel have taken their share of lumps recently: IBM has been late to market with new PCs that turn out to be ho-hum when they finally arrive, and Intel is beset by both 386 chip cloners and RISC-chip competitors.

Now, it seems, IBM and Intel have realized that they are each other's best ally. The two companies have signed a 10-year technology agreement under which they will work together to enhance 80x86 architecture chips. Under the terms of the agreement, IBM will gain the right to manufacture 486 chips for internal use, as it has the 386. More important, IBM will be able to enhance current and future 80x86 designs and use the improved versions itself for four months before any other companies can have them. For IBM, which has lately had trouble differentiating its PCs from the sea of clones, this could provide a leg up in the market—in price, performance, or some other attribute.

Intel and IBM estimate that jointly developed products will be broadly available to the industry in about two years. The plan of attack calls for Intel to provide processor design and the 486 architecture, while IBM will add its semiconductor and systems design expertise. Both companies will provide design tools. For Intel, the agreement is a strong response to challenges from 386 cloners like AMD and Chips & Technologies. By tapping into IBM's silicon expertise, Intel may be able to deliver advanced processor designs faster than the cloners can keep up.

—**Andy Reinhardt and D. L. Andrews**

Next Moves in the Real World

It was a busy fall for Next and Steve Jobs, president and CEO of Next. Following a speech at the Unix Expo, Jobs admitted in a question-and-answer session that he hopes to take the company public in the next 12 to 18 months. One week after Jobs told reporters that he expected to sell $60 million worth of equipment in the last quarter of 1991 and that Next is profitable, the company announced that it would lay off about 30 people, or around 5 percent of the company's work force. While the layoffs were certainly not a minor event to those affected, Next's staff trimming was minute compared to the hundreds of people laid off at companies like Compaq, The Santa Cruz Operation, Grid Systems, and Ashton-Tate. In any case, a Next spokesperson said that the company continues to make a profit, "but in these times, you can't carry any extra weight."

The fact that Jobs was there at all was something of a surprise. Once upon a time, Next seemed to be trying to distance itself from the Unix community. Now, Jobs acknowledges and even accepts the idea that Next is a Unix company that must compete in the market against the likes of Sun, IBM, DEC, and Hewlett-Packard. In one example of Next's new openness, Jobs demonstrated a program that lets X Window System–based applications run in a Next window. ■

—**Andy Reinhardt and D. L. Andrews**

NANOBYTES

More than just an operating-system upgrade, **Apple** sees the new **A/UX 3.0** as the basis for the high-end systems that it will be releasing in the future, including those compatible with the PowerOpen platform the company is developing with IBM. The ability to run current Mac applications is crucial, an Apple spokesperson said. Programs running on the new version look just like regular Mac applications. A/UX 3.0 will also support TrueType fonts, the Data Access Manager, the new Finder, and Publish/Subscribe features. Balloon Help is also supported. □

Next is acceding to customer requests for standards compliance. As president and CEO **Steve Jobs** flashed a slide covered with an alphabet soup of Unix acronyms, he joked. "I bet you never thought you'd hear Steve Jobs talking about standards." □

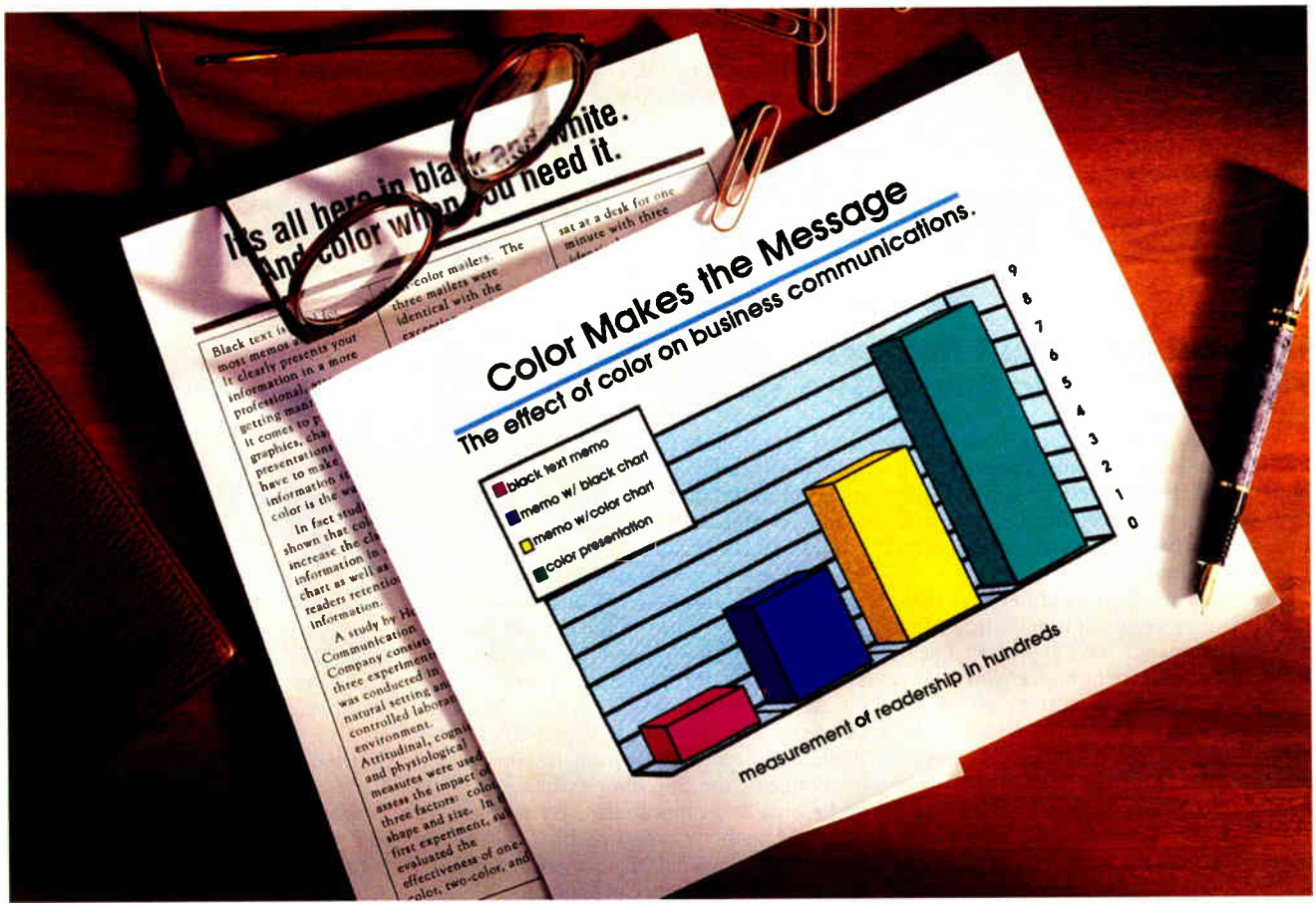
Apple has filed an appeal with the Court of International Trade in Washington, D.C., asking the court to reverse the imposition of a 62.63 percent tariff on imported screens. Apple argues that there cannot have been injury when there is no viable U.S. display industry to injure. □

Philippe Kahn, chairman, president, and CEO of Borland International, says that by 1995, most software companies will be programming in C++. But the language suffers from a standard garbage collector. Object systems, he says, tend to fill up quickly. □

Al Stromberg, president and CEO of Verbex Voice Systems (Edison, NJ), a maker of speech recognition systems, on why the market for speech recognition hasn't taken off yet: "You can't convince people they need a better mousetrap if they don't know they have mice." ■

World Radio History

What's the business world coming to?



Now all users, Macintosh and PC, can get their hands on some color without giving up great black and white. Hewlett-Packard makes it all possible with the DeskWriter C printer for Macintosh and now the HP DeskJet 500C for DOS and Windows applications. Impressive black and white. And thousands of colors. For only $1,095.*

The best features of HP's DeskJet 500 black and white printer haven't changed. You'll still get the crisp, clean, laser-sharp output. The 300 dot-per-inch resolution. And you'll still have all the built-in, scalable fonts and graphic capabilities that can make such a difference in your documents and presentations.

Take all that, add a nearly endless choice of attention-getting colors, and your users have one very valuable partner. One that's a pleasure to work with. You just plug, play, and print. On plain paper or transparency.

With the DeskJet 500C and DeskWriter C, Hewlett-Packard introduces a colorful new generation to its family of inkjet printers. A family that stands for affordable quality. Quality that's backed by a three-year warranty.

*Suggested U.S. list price. †In Canada, call 1-800-387-3867, Ext. 2757. **Offer valid through January 31, 1992. No purchase necessary; void where prohibited. © 1991 Hewlett-Packard Company PE12129

World Radio History

Affordable color. The HP DeskWriter C printer for the Mac.

And the HP DeskJet 500C for PCs.

Only $1,095 each.

So when others ask you what's new, tell them to get ready for a splash of color. For more interesting graphs and charts. For impressive cover pages and for compelling overhead presentations. All for $1,095.

If you'd like to see some sample output from the DeskJet 500C or DeskWriter C, call **1-800-752-0900, Ext. 2757.**† Or visit your nearest authorized HP dealer and sign up for a chance to win a Caribbean cruise for two.** Color has finally arrived.

HP Peripherals
When it's important to you.

HEWLETT PACKARD

Circle 70 on Inquiry Card.

World Radio History

Psion's Powerful Pocketable

DICK POUNTAIN

A proprietary non-DOS operating system isn't a disadvantage when you have a raft of applications in the palm of your hand

Most people's first reaction when I show them the Psion Series 3 is quite simply, "I want one now!" This is not merely a technological gimmick. Psion has succeeded splendidly in designing a pocket computer with sufficient memory, battery life, and processing power to be genuinely useful. It's also easy to use. The Series 3 is not DOS compatible, but its excellent multitasking operating system is far more suitable than DOS is for a pocket machine.

The Series 3 exudes quality at first sight. The plastic case has an attractive matte gray finish and pleasing contours. At 6½ by 3⅛ by 1 inch, it is smaller than an average-size wallet. Its weight, a bit over half a pound (including batteries), makes it quite pocketable. Although the clamshell-style case has no latch, it is held shut by spring tension. The toggle effect of a clever hinge causes the battery compartment at the rear of the case to swing downward and act as a rest that tilts the Series 3 to a comfortable reading angle.

The 8-row by 40-column LCD screen occupies the upper half of the case and rests at a shallow, fixed angle to the keyboard. Psion uses Hitachi's double retardation film LCD technology to get high contrast in all but the poorest of lighting. Battery life is about 120 hours using two AA alkaline batteries; a lithium battery is included as backup.

The Psion Series 3 crams all the parts and pieces of a full-fledged computer into a palmtop package.

Not for Touch-Typists

The tiny keyboard has a PC-style QWERTY layout, complete with twin Shift keys, a space bar, Control and Alt keys, and an inverted *T* cursor keypad (but no numeric keypad). The small square keys use elastomer switches and thus have short travel and almost no tactile feedback (an audio click is provided instead). The keys require quite firm pressure. Even the tiniest of fingers cannot touch-type on this keyboard. Holding the Series 3 in both hands and typing with two thumbs is more effective and very fast after a little practice.

Both ends of the case have a hinged flap that conceals sockets for Psion's proprietary flash memory cards, which behave like solid-state drives called A and B. The machine I used came with a 256-KB flash memory card. You can buy flash memory cards of up to 2 MB or static RAM cards of up to 1 MB. The file system is fully DOS compatible, even though the Series 3 doesn't run DOS programs.

The Series 3 is driven by a 4-MHz NEC V30 (80C86-compatible) processor, putting it in the IBM XT class in terms of power. The operating system and applications are held in 384 KB of ROM, and you can choose from models with 128 KB or 256 KB of main memory. This memory is employed far more efficiently than it would be under DOS. On the 256-KB test machine, I can run all seven built-in applications concurrently and have a 100-KB RAM drive left for data.

A Nonintimidating GUI

The Series 3 operating system works behind a simple GUI that I can only describe as brilliant. You can switch instantly between the built-in multitasking applications by pressing icons printed on a touch-pad below the screen. The leftmost icon (System) puts you into a program manager with screen-based icons. Beneath each icon is a list of the files associated with that application, which you can pick with the cursor bar. Pressing the Tab key brings up an XTree-like file manager, complete with wild-card filters and file tagging. The operating system uses DOS hierarchical

World Radio History

directories and filename extensions, but it hides these from the casual user by automatically associating each application's files with a particular extension.

Inside each application, you press the dedicated Menu key to access Windows-style pull-down menus. Most menu options have key shortcuts using the Psion key. Psion has exhibited enormous ingenuity in making this interface intuitive and orthogonal. You can cut, paste, and copy among all the applications via a clipboard, or you can bring marked text from anywhere without losing the clipboard contents. You can also evaluate an arithmetic expression anywhere (e.g., in the word processor or database) by selecting it and pressing Psion-V.

Full-Featured Miniature Applications

The applications also reveal extraordinary attention to detail. The Series 3 word processor is powerful, with on-screen bold and italic, multiple printer fonts, and even Microsoft Word–compatible style sheets. There is a built-in outlining feature that works via styles; you can define an outline level for each style and then hide all text below a given level. Pressing the Word button toggles hiding on and off, and so collapses and expands the outline. When wisely used, this feature compensates for the small screen size; I use it more as a way of navigating through long texts than as a structuring tool. The Series 3 can drive a number of popular printers, including Epson, HP LaserJet, and Canon BJ-10e, directly via the optional parallel cable.

The Data application is a free-form text database that holds up to 4 KB per record, and you can optionally add field names, which can be toggled on and off down the left margin; the software is cleverly designed so that empty fields will not be displayed. Placing a telephone symbol at the beginning of any line will allow the Series 3 dialer to extract phone numbers from that line (DTMF tone dialing is performed via a small speaker under the Series 3's case, which you hold over a telephone mouthpiece). The phone dialer is cleverly integrated with the World application so that it can prefix the proper international code for an overseas call but omit it for domestic ones; you set "Home City" in World to tell the Series 3 which country you are currently in.

The World application is the best of its kind I've seen. Everybody knows how to display a world clock, but Psion has included a database of practically every country name (pre-U.S.S.R. breakup), and the major towns within countries too (over 70 in the U.S.). What's more, you can add your own towns, with map references, time-zone offset, and phone code. As you browse or search for a town, the cursor shows its position on the world map, together with the local time, phone code, times of sunrise and sunset, and distance from your current home city. Travelers will buy the Series 3 for this feature alone.

The Agenda application includes the functions of calendar, two-week planner, appointments diary, alarm, and to-do list. The one-month calendar and two-week time planner appear on the same screen, through which you navigate using the cursor keys. Pressing Enter switches to a day diary screen with slots for 14 items. You can repeat appointments (by date or day of week), and you can archive old appointments instead of just deleting them as most time planners do. There is a separate screen for day notes, and a to-do list that rolls over tasks from day to day until you remove them.

Communicating with the World

You can communicate with desktop machines and modems via a tiny connector on the left side of the Series 3, using a special cable with a "lump" halfway down it that actually contains the RS-232 circuitry and some ROM programs. When plugged in, this lump appears as drive C to the operating system. When you run Psion's MCLink program on your desktop PC, the PC's drives (named REM::A:, REM::C:, and so on) become directly accessible from the Series 3 as a full network-style remote file system. Drive C also contains a communications program with a full script language based on OPL and prewritten scripts for BIX, CIX, MCI Mail, and more. I enjoyed the surreal experience of downloading my BIX mail into something not much bigger than a bar of soap.

I enjoyed the surreal experience of downloading my BIX mail into something not much bigger than a bar of soap.

The Psion Series 3 is the first pocket computer that I've found genuinely useful, and I shan't leave the house without mine. One criticism is that Psion's flash memory cards are not PCMCIA compatible; however, I don't believe this will prove fatal. Most users will find that a flash memory card is more like a permanent expansion than a removable medium and will not be purchasing any in quantity. I find that the 256 KB of internal memory and a single 256-KB flash memory card handle all my business easily, using my desktop PC to back up and archive. The Series 3 won't replace a notebook PC for power spreadsheet users, but it might replace the rest of the contents of their briefcases. ■

Dick Pountain is a BYTE consulting editor based in London. You can contact him on BIX as "dickp."

THE FACTS

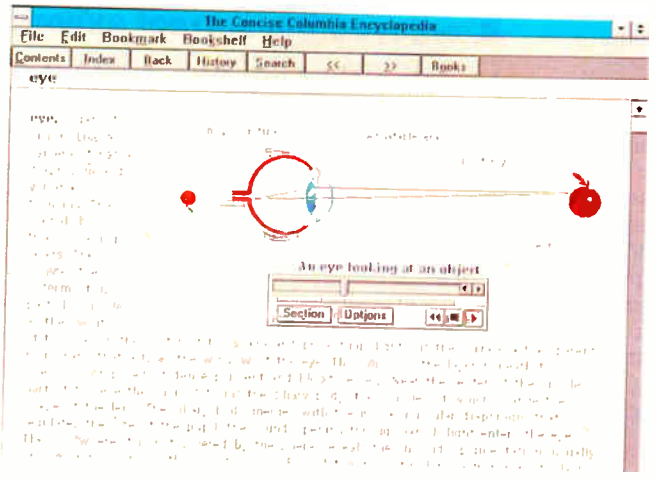
Psion Series 3
with 128 KB, $425;
with 256 KB, $495
Options: Serial cable for PC and Mac file transfers, $99
Internal RAM: 128 KB, $150; 512 KB, $420; 1 MB, $625
Flash EPROM: 128 KB, $105; 256 KB, $150; 512 KB, $255; 1 MB, $420; 2 MB, $775

Psion, Inc.
118 Echo Lake Rd.
P.O. Box 790
Watertown, CT 06795
(800) 548-4535
(203) 274-7521
fax: (203) 274-7976
Circle 1209 on Inquiry Card.

World Radio History

Bookshelf Goes Multimedia

Available since 1987, Microsoft's CD-ROM-based Bookshelf has become an invaluable reference tool for writers and students. Its dictionary, thesaurus, and other sources have been reason enough for thousands of people to invest in a CD-ROM drive. **Microsoft Bookshelf for Windows** is the next generation, adding the splash of multimedia sound, graphics, and animation—assuming you have a multimedia-ready PC.



Bookshelf for Windows contains both plain-vanilla DOS and Windows versions of the program, so you don't need multimedia facilities in order to use it. Both versions contain *The American Heritage Dictionary*, *Bartlett's Familiar Quotations*, *The Concise Columbia Dictionary of Quotations*, *The Concise Columbia Encyclopedia*, *Roget's II: The New Thesaurus*, and *The World Almanac and Book of Facts*. The Windows version, which takes advantage of Microsoft's new Multimedia Extensions for the graphical environment, also contains an electronic version of *The Hammond Atlas of the World*. And that's the first hint of this rendition's greater powers.

The DOS version of Bookshelf has no atlas because it can't do graphics: It's a text-only product. The atlas included with Bookshelf for Windows has, among other features, topographic maps of any region of the globe you choose, shown in 256-color VGA resolution. Other animations can be found in the encyclopedia; some are accompanied by sound lectures that explain and augment the video. The mouse can be used to jump to any part of the animation as well as to control the speed at which it plays back, and all the animations in the encyclopedia can also be accessed directly from a list of animations at the top of the "book."

I particularly enjoyed one listed as Solar System, which shows the planets revolving around the sun, as well as the movements of comets and meteoroids. A voice-over lecture describes the action. Sound is also a feature of the dictionary. It will pronounce the word for you if you click on a megaphone icon in the upper left corner of the definition screen.

Information searches are also possible with both versions of Bookshelf, but here again the Windows version is more flexible. It lets you search all the books at once or deselect some books. The DOS version allows searches only across like books (i.e., the quotation books or the encyclopedia and almanac) for specific terms. The Windows version also allows searches by keyword or topic.

Further, because Windows allows multitasking, it's possible to cut and paste information from a Bookshelf book into any other active Windows application. And that brings me to another neat feature of Bookshelf for Windows: QuicKeys. Essentially a macro generator, QuicKeys is a separate application that comes with Bookshelf and is installed by Setup. It lets you define key combinations that take you directly from any active Windows application to a Bookshelf book and begin a search for whatever word is highlighted in your application. Each book has a unique key combination. Using QuicKeys lets you avoid using the Bookshelf group window to access any of the books.

Also included in Microsoft Bookshelf for Windows are two features that make the package more useful the more you use it. Annotations let you add your own personal notes to any topic in any book. (You can also copy annotations to the Clipboard and use them elsewhere in Windows.) Bookmarks, as the name implies, let you mark a location, setting up a list of frequently accessed topics anywhere within Bookshelf. This lets you go directly to the topic at any time without having to go through the whole search process again.

Bookshelf for Windows is easy to use, but there's a lot to it. To help you get started, there's a well-designed and extensive tutorial that (not surprisingly) makes extensive use of multimedia.

Needless to say, multimedia is in its infancy. Microsoft says that more features are on the way in the next version. According to David Cornfield, lead engineer/program manager for Bookshelf, proposed changes include programwide support for 256-color graphics, instead of the 16-color graphics that are now found everywhere but in the topographic maps. The mix of books on the next release of Bookshelf for Windows may also change.

For now, to run Bookshelf for Windows in all its glory, you need Windows 3.0 with Multimedia Extensions 1.0, MS-DOS 3.1 or higher, Microsoft CD-ROM Extensions 2.2 or higher, a CD-ROM drive, and an audio card (e.g., Media Vision's Pro-Audio Spectrum or cards made by Ad Lib). Bookshelf for Windows works without Multimedia Extensions and the sound card, but you won't get those fun animations or voice-overs.

Microsoft Bookshelf for Windows is an intriguing hint at the future possibilities of multimedia. While the sound and graphics are entertaining, they're only a small part of the program. Still, the wealth of resources on the Bookshelf CD-ROM makes it a truly useful—and highly recommended—tool, whether your PC has multimedia capabilities or not.

—Robert E. Calem

THE FACTS

Microsoft Bookshelf for Windows
$149; upgrade from DOS version, $49.95

Microsoft Corp.
1 Microsoft Way
Redmond, WA 98052
(800) 426-9400
(206) 882-8080
fax: (206) 883-8101
Circle 1210 on Inquiry Card.

World Radio History

Unprecedented 32-Bit Programming Power in a Single Package: WATCOM C8.5/386

Limited-time Introductory offer
$795
Regular price: $995
Suggested retail prices. Dealers may sell for less.

WATCOM C8.5/386 Optimizing Compiler and Tools includes:

- **Royalty-free 32-bit DOS Extender**
- **True 32-bit Windows GUI Application Kit**
- **Fast, Tight, Reliable 32-bit Code Optimizer**
- **Licensed Microsoft Windows SDK Components**
- **Interactive Source-Level Debugger**
- **Execution Profiler**

MICROSOFT WINDOWS

PC MAGAZINE EDITORS' CHOICE
September 13, 1988
Watcom C, Version 6.5

INFO WORLD
BEST IN ITS CLASS
WATCOM C7.0
1989

COMPUTER LANGUAGE PRODUCTIVITY AWARD 1990

COMPUTER LANGUAGE PRODUCT EXCELLENCE AWARD 1990 COLA

Highlights

100% ANSI and SAA compatible: C8.5/386 passes all Plum Hall Validation Suite tests.
Comprehensive tool set includes a debugger, linker, profiler and much more.
Microsoft extensions simplify porting of 16-bit source.
DOS extenders supported include Phar Lap, Rational and Ergo.
Extensive third party support includes products to help with windowing, communications, C++ development and graphics.
AutoCAD ADS development and debugging support.

DOS Extender Features

C8.5/386 includes DOS/4GW, a 32-bit DOS extender developed by Rational Systems and based on the industry-leading technology of DOS/16M, Key features include:

- **Royalty-free runtime license**
- **Virtual memory support up to 32Mb**
- **25K real mode memory footprint**
- **DPMI support** (DOS, Windows DOS Box, etc.)
- **VCPI and XMS** (himem.sys) compatible

32-bit Windows Kit

Develop and debug true 32-bit GUI applications and 32-bit DLL's. Using 32-bit addressing, GUI applications can exploit the flat memory model to overcome inherent Windows memory constraints. Straightforward memory allocation makes Windows application development easier. Key components include:

- **Supervisor** for executing 32-bit applications and DLL's under Windows
- **Debugger** for 32-bit applications and DLL's under Windows
- **Licensed Microsoft SDK components**
- **Access to Windows API** from 32-bit code through special libraries
- **387 math co-processor emulation**
- **32-bit C library** for Windows

WATCOM C8.5/386

• 100% ANSI C Optimizing Compiler
Tools set components:
• Protected-mode version of Compiler • Royalty-free DOS Extender with VMM support • Licensed Components of the Microsoft Windows SDK • Interactive Source-Level Debugger • Linker • Protected-mode version of Linker • Profiler • Object Code Librarian • Object Code Disassembler • MAKE Facility • Patch Facility • Object Module Convert Utility • Windows Supervisor • Bind Facility for Windows Applications • 386 Run-time library object code • Special 32-bit libraries for Windows API • 386 Graphics Library for Extended DOS applications • 386 Run-time libraries for Windows

Also available:

WATCOM FORTRAN 77/386

Includes 100% ANSI FORTRAN optimizing compiler and all tool set components listed above for C8.5/386.

Platforms

Host environments:
DOS, Extended DOS, Windows DOS box, OS/2 1.1 or later
Target environments:
Extended DOS, Windows, Windows DOS box, AutoCAD ADS, embedded systems
Novell's *Network C for NLM's* includes C8.5/386

Price: $995

1-800-265-4555

WATCOM

415 Phillip Street, Waterloo, Ontario, Canada
N2L 3X2 Tel. (519) 886-3700 Fax (519) 747-4971

WATCOM C and Lightning Device are trademarks of WATCOM Systems Inc. DOS/4G and DOS/16M are trademarks of Rational Systems Inc. Other trademarks are the properties of their respective owners. © Copyright 1991 WATCOM Products Inc.

World Radio History

It's Also More Power

Introducing The 40MHz Am386™ Microprocessor— The Speediest 386 On The Planet.

It looks like a mild mannered 386. In fact, it is: A genuine, plug-in replacement for the i386. Except it's faster. Burns less power. Costs no more. And it's available now.

The Am386DX-40 microprocessor can transform any ordinary 33MHz system into an invincible, 25% faster, 40MHz Am386 system. So you can easily offer the world's fastest 386 performance.

It's not only super-fast, it's also super-efficient, thanks to its truly static

901 Thompson Place P.O. Box 3453, Sunnyvale, CA 94088. © 1991 Advanced Micro Devices Inc Am386 is a trademark of Advanced Micro Devices, Inc. All brand or product names mentioned are trademarks or registered trademarks of their respective holders.

World Radio History

ful Than A Locomotive.

operation. That means even notebooks and palmtops can attain breakthrough performance.

Best of all, the 40MHz Am386 microprocessor is available now, available to everyone, and available at surprisingly low prices. How's that for Truth, Justice and the American Way?

So find a phone booth and call AMD at **1-800-222-9323.** And let the world's fastest 386 come to your rescue.

Advanced Micro Devices

"We're Not Your Competition."

Circle 14 on Inquiry Card.

World Radio History

The Pac Is Back

Good ideas don't always become successful immediately—if ever. Sometimes it takes a while. Such is the case with Tandon's **PacII** computer. As Yogi Berra is purported to have once said, "It's déjà vu all over again." If the boxlike module that's sticking out of the computer in the photo looks familiar, that's because Tandon introduced the Pac hard drive concept way back in 1987.

It sounded like a great idea: shock-mounted hard drive cartridges that could be moved from machine to machine or locked away overnight. Although Tandon sold quite a few of them to government agencies and in the international market, the Pac never went over as a mass-market item, largely because the original version used the 5¼-inch floppy drive that was standard back then, making the Pac large and clunky.

Technology has finally caught up with the Pac idea. The new Pacs are smaller, lighter, and easier to handle because they use 3½-inch drives. In addition, today's hard drives are considerably more reliable and shock-resistant. Better late than never.

More and more hard drive makers are introducing removable and transportable hard drives, in a variety of forms. But Tandon was there first, and it's obvious that it has done a great deal of work to perfect the concept.

The MFM and RLL drives used in earlier Pacs have been replaced with higher-performance SCSI drives. Both the 40- and 400-MB drives in my review unit had respectable average access times of about 18 ms.

You can't eject the drives until they've spun down and (automatically) parked their read/write heads. You can also use a software command to keep the drives from being ejected by an unauthorized person.

But there's more. Tandon has integrated the Pac idea into a system that can truly be called modular. Unlike the raft of competitors that let you easily upgrade just the processor, the PacII uses a building-block approach that lets you tailor a system exactly to your needs. Need a more powerful processor? Plug in a new card. A larger hard drive? Plug in a new Pac. You can even add a second dock for an additional Pac. Even the floppy drives are modular. If you need a second one, it snaps on atop the PacII's case.

The PacII's processor, as with so many other "expandable" systems, is on an add-in card that contains the necessary peripheral electronics for the processor that you are using. The processors range from a 386SX/16 up to a 486/33. (A Tandon spokesperson said that a 486/50 should be available by the time you read this.) Prices for the individual processor module upgrades weren't available at press time, but Tandon has promised to price them so that upgrading doesn't cost you as much as a brand-new system.

The PacII is a solidly built, high-quality system. Obviously, to make the system as modular as it is, Tandon had to design it from the ground up, and the quality shows. Priced not much higher than your garden-variety generic clone, the PacII is engineered and built completely by Tandon. The system that I tested came with a 486/33 processor and both 40- and 400-MB hard drives. BYTE Lab benchmark results were solidly in the midrange of what I'd expect for a well-engineered system, neither the fastest nor slowest we've measured.

The importance of system expandability is the subject of lively debate in the PC community. Every company with an expandable system also has surveys showing that virtually everyone wants to upgrade his or her system regularly. I tend to doubt it, especially with systems that upgrade only the processor. Many users need a faster and higher-capacity hard drive before they need a new processor.

Tandon's full-system expandability design makes a lot of sense, and the PacII looks like it's destined to become the system of choice for users who want the option of essentially snapping together systems from matched parts and pieces. It's especially attractive for corporate environments, where a central store of expandable and interchangeable parts can be kept ready for instant access.

Then there's the hard drive concept. It looks like its time has come. Tandon will also have internal (InPacII) and external (SidePacII) docks for Pacs that will let you add Pacability to existing systems. If you have systems in several locations, carrying a Pac (they weigh from 2.7 to 4.4 pounds) with all your work between locations is a logical match to the way that many of us do our work these days.

—Stan Miastkowski

THE FACTS

PacII
Basic system: 386SX-20, $2686; 386SX-20 with cache, $2886; 486SX, $3211; 486/33, $4521
Hard drive Pacs: 40-MB, $349; 100-MB, $599; 200-MB, $799; 400-MB, $1799

Tandon Corp.
405 Science Dr.
Moorpark, CA 93021
(805) 523-0340
Circle 1211 on Inquiry Card.

World Radio History

Introducing the first 486SX laptop computer that comes in 256 colors.

The new ProSpeed® 486SX/C laptop is a breakthrough made possible only by NEC's mastery of active matrix color display technology: the first 486SX laptop computer with a TFT screen capable of displaying 256 colors at 640 x 480 resolution.

The result: some of the most brilliant, photographic-quality images you've ever seen on any computer screen, laptop or otherwise. It also puts on an equally spectacular display of power, thanks to an Intel® 486SX™ microprocessor running at 20MHz, a 120 or 200MB hard drive, and the first 32-bit EISA bus to be found on any laptop. Add to that its full-size keyboard, and a full complement of ports, and you have the perfect solution for any application requiring massive amounts of power—from software demonstrations to sales presentations, complex graphs and diagrams to CAD-CAM, and beyond.

NEC is a world leader in virtually every category of imaging technology: *from the brilliant displays on our laptops, to our MultiSync® monitors, color thermal printers, CD-ROM readers and more.*

ProSpeed is a registered trademark of NEC Home Electronics, Ltd.; and MultiSync is a registered trademark of NEC Technologies, Inc. Intel is a registered trademark and 486SX is a trademark of Intel Corp. © 1991 NEC Technologies, Inc.

intel inside

Because ↑ is the way you want to go. NEC

C&C
Computers and Communications

For more information, call 1-800-NEC-INFO.

Circle 108 on Inquiry Card.

World Radio History

This Lunchbox Isn't for Twinkies

If you plan to buy the **Dolch P.A.C. 486-50E** portable computer, you'd better have some serious work for it to do. With its 50-MHz 486DX processor, 8 MB of RAM (expandable to 32 MB), and a standard 200-MB SCSI hard drive with a caching controller, the 18-pound 486-50E is designed for people who often bite off more than they can chew.

On the outside, the 486-50E is the same Dolch P.A.C. we've reviewed before. The removable keyboard is a cross between the classic 84-key IBM AT keyboard and the Enhanced model. Twelve function keys run across the top, and the Escape key is part of the combined cursor/numeric keypad. The standard gas-plasma monochrome display is sharp and clear. I was able to use this computer for hours without a hint of eyestrain. If you prefer, the 486-50E is available with a Hitachi active-matrix thin-film-transistor color LCD (see "Full Color Comes to LCDs," August 1991 BYTE).

Pop open the lid, and you'll find that the 486-50E is no cream puff. The motherboard has the 50-MHz 486 processor (a 128-KB cache is optional), eight SIMM sockets, three ISA slots, and three EISA slots. Of these, three slots are used by system boards: One holds the EISA SCSI controller with a 4-MB RAM cache on-board, another has the 16-bit VGA card (with 1 MB of video RAM), and the third has the serial/parallel interface. Getting to the slots to add boards is a simple matter of removing three screws. The 225-watt power supply should be more than ample for any boards you're likely to add.

The 486-50E comes standard with a Conner Peripherals 200-MB SCSI hard drive and a 3½-inch 1.44-MB floppy drive. There's no room to add further storage, but you can buy the machine with a larger hard drive. I found the 200-MB drive and the 4-MB caching controller to be an effective combination.

Have you ever seen Windows run in real time? The 486-50E is the *only* machine that I've seen run Windows without noticeable delays. The CPU is running only 50 percent faster than a 33-MHz 486, but it seems much faster than that. On the low-level BYTE benchmarks, the 486-50E turned in excellent results. I tested it next to a Mylex-made 486/33. With a Compaq Deskpro 386/20's performance as 1.0, the Mylex 486/33 had a CPU index of 3.49; the 486-50E had an incredible 4.42. The FPU index of the Mylex was 4.61; the 486-50E's was 6.91.

When you stop to think about it, this latest addition to Dolch's product line seems just a bit eccentric. The thought of carting a $17,000 computer through the slings and arrows of everyday use makes my head spin. (Can you imagine anyone checking this machine as airline baggage?) But obviously, there are uses for a portable computer whose processing would have been unthinkable just a couple of years ago. It's obvious overkill for garden-variety computing tasks like word processing and spreadsheets.

Face it, this is a machine for power users and those affluent "early adopters" who want the latest and greatest status symbol. I wish I had the bucks and an excuse to buy one.

With the P.A.C. family of portables, Dolch has hit upon a combination of features and performance that works. At $16,995 for the basic model, the 486-50E isn't a machine for everyone. It's expensive, and the 50-MHz processor is going to spend a lot of time idling unless you do serious CAD, database, or modeling work. But for users with caviar tastes, the Dolch P.A.C. 486-50E is a machine to savor.

—Howard Eglowstein

THE FACTS

Dolch P.A.C. 486-50E
$16,995

Dolch Computer Systems
372 Turquoise St.
Milpitas, CA 95035
(800) 538-7506
(408) 957-6575
fax: (408) 263-6305
Circle 1212 on Inquiry Card.

More Than the Sum of Its Parts

Remember "integrated software"? That term was all the rage a few years ago and then (thankfully) died a quick and merciful death. It sounded great in theory: Applications worked together in a supposedly seamless manner, letting you easily switch among common applications and share data. Most of the integrated packages quickly disappeared because the individual applications often lacked key features and getting them to work together seamlessly was seldom easy.

After all these years, I've finally used a truly integrated software environment. And somehow I'm not surprised that it's for the Mac. Claris, Apple's software subsidiary, has just released **ClarisWorks,** which integrates word processing, graphics, spreadsheets, charting, database management, and communications into an application that is really and truly seamless. And it works.

The beauty of ClarisWorks is that it doesn't force you to switch among various "modules." Instead, you can access all the tools and features from within a single document simply by clicking on

World Radio History

HOT NEW PRICE!
$1295
1-800-836-6366

OVER $5000 IN VALUE!

BLOCKBUSTER

CORELDRAW!

CD-ROM BUNDLE OFFER

$1495*

The time is now to catch the Corel CD-ROM wave! With this unbeatable upgrade offer* there's no better time to move up to the convenience and flexibility of CD-ROM. CorelDRAW 2.01 on CD-ROM is here with all of CorelDRAW's incredible features as well as over 10,000 award-winning clipart images and symbols in both .CDR and .EPS file formats. Replacing over 500 floppy disks, this CD-ROM saves you time, money, and improves your productivity. Installation is a breeze!

BUNDLE INCLUDES:

1 CorelDRAW 2.01 on CD-ROM

Now even more power, versatility and new features are yours with CorelDRAW on CD-ROM. Over 10,000 clipart images and symbols are included from the libraries of the leading clipart companies in the industry. All this clipart is uncompressed so that it can load up to 10 times faster than the diskette version. Also added are 50 new fonts taking the total to over 200! The entire program can run directly from CD-ROM saving you valuable space on your hard drive.

- **TOTEM GRAPHICS** - 1248 full color, sophisticated images from 13 different subject areas: business, sports, holidays, birds, animals, fish, food, flowers, insects, nautical, transportation, tools and hardware, women.
- **ARTRIGHT IMAGE PORTFOLIOS** - 3500 award-winning realistic, thematic images: people, all the flags of the world plus individual state and historical flagsspace, finance, machinery, medical, technology, arts/entertainment, background/seasonal,borders, animals and more.
  " Incredibly slick stylized images with incredible attention to detail."
  PC Magazine
- **MAPART from MICROMAPS** - 140 highly detailed maps: states, countries, continents, and the world at a glance.
- **ONE MILE UP** - 1300 military and government based images, symbols, insignias, etc., including the Presidential Seal.
- **LIFEART** - 330 detailed medical clipart images from TechPool Studios.
- **IMAGE CLUB** - over 1000 fun graphics and 50 top-quality fonts.

PLUS!

- COREL's own 250 full color clipcharts for business presentations.
- CorelDRAW in 5 languages: English, French, Dutch, Spanish, and German, all on one disk.
- New on-line help and free demo program.
- CorelDRAW in both OS/2 and Windows versions.

2 High Performance Panasonic CD-ROM Drive

The Panasonic CD-ROM drive is available as an internal or external model and is compatible with any industry standard CD-ROM media format. Key features are: fast access time, embedded SCSI interface, head-phone output jacks, and adjustable volume control.

3 CorelDRIVER / CD-ROM Interface Kit

CorelDRIVER for CD-ROM is the latest addition to Corel's industry-leading family of optical storage interface products. Also included is Corel CD-AUDIO (to play your musical CDs) and other useful utilities.

*$1495 FOR INTERNAL CD-ROM DRIVE BUNDLE
$1750 FOR EXTERNAL CD-ROM DRIVE BUNDLE

*AVAILABLE FROM LEADING DISTRIBUTORS AND DEALERS

*LIMITED TIME OFFER

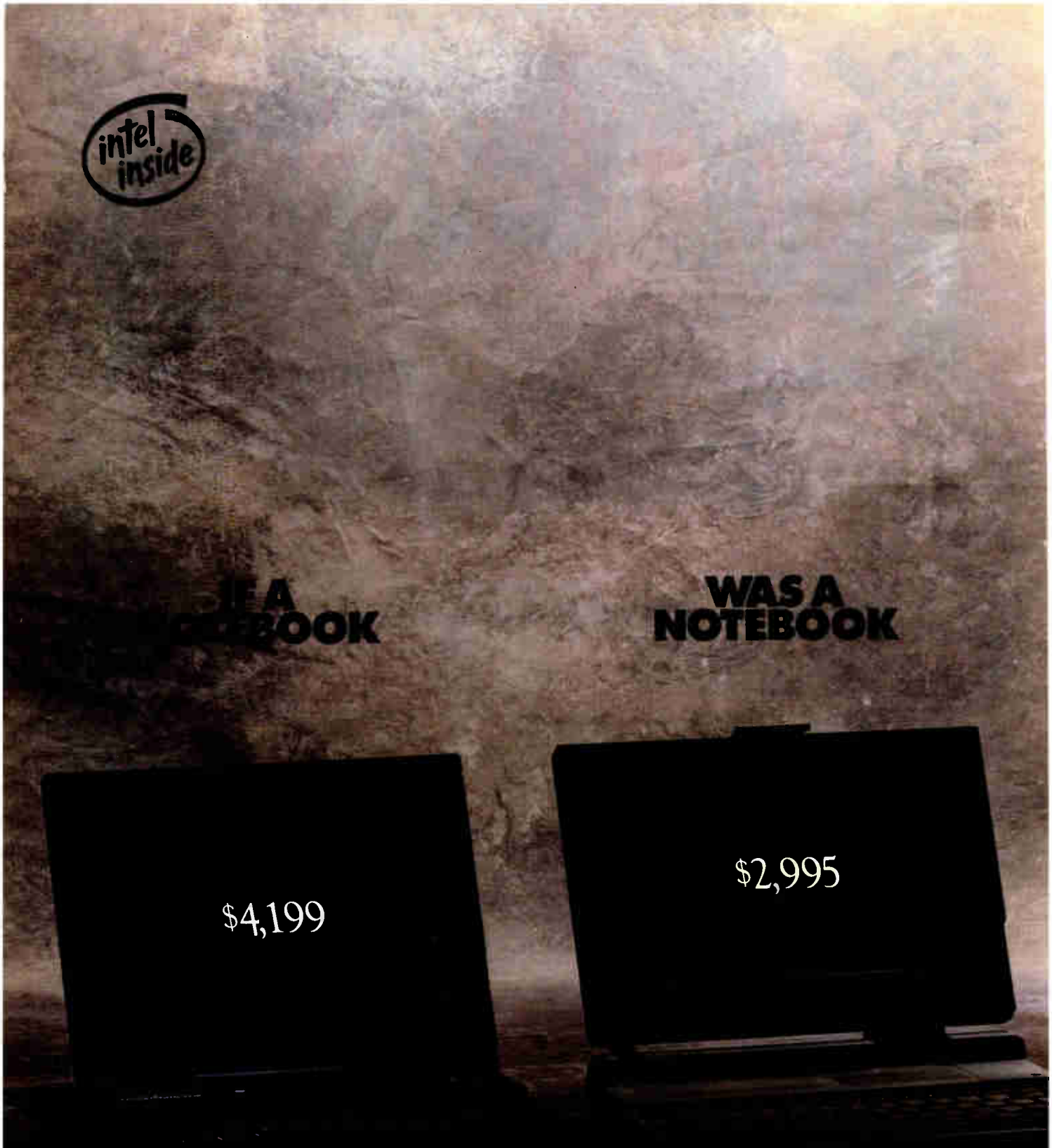
COREL

TEL: (716) 423-8200
(Can) TEL: (613)728-8200 / FAX: (613)728-9790

Enter now and win monthly in the CorelDRAW $1,000,000 World Design Contest!

Circle 41 on Inquiry Card.

World Radio History



*Performance Enhancements: Within the first megabyte of memory, 384 KB of memory is reserved for use by the system to enhance performance. Can be optionally disabled. All prices
◇ Leasing arranged by Leasing Group, Inc. In Canada and Mexico, configurations and prices may vary. i386 and the Intel Inside Logo are trademarks of Intel Corporation. Other trade-
and trade names other than its own. Shipping, handling and applicable sales tax not included in the price. For information on and a copy of Dell's 30-day Total Satisfaction Guarantee

World Radio History

If the one on the right immediately caught your eye, we don't blame you. After all, who wouldn't jump at a great bargain?

But if it's just the price that surprises you, listen to this: the NX20 from Dell is the most notebook you can get anywhere for $1,899.

Weighing in at just 6.8 pounds, the NX20 is packed with features normally found on more expensive machines. Like a 3.5" floppy drive and a big 8.5" VGA black and white display.

WAS A NOTEBOOK, WHICH ONE WOULD YOU CHOOSE?

On the road, this little powerhouse packs all the punch that an i386™SX system running at 20 MHz can deliver. And to complement that power, there's 2 MB of RAM expandable to 6 MB and a choice of 40 or 60 MB hard drives.

So why choose between quality and economy when you can get both by choosing the NX20 from Dell? Call us today.

Because decisions this simple don't come by everyday.

TO ORDER, CALL. PLEASE REFERENCE #11E57.

800-225-4895

HOURS: 7AM-9PM CT M-F 8AM-4PM CT SAT 10AM-3PM CT SUN

IN CANADA 800-668-3021. IN MEXICO 95-800-010-0664.

DELL COMPUTER CORPORATION

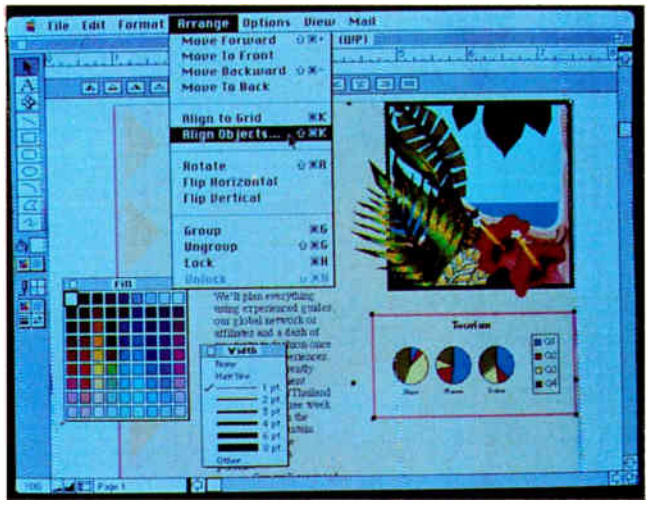
and specifications are subject to change without notice. Dell cannot be responsible for errors in typography or photography. **Payment based on 36-month, open-end lease. marks and trade names are used to identify the entities claiming the marks and names or their products. Dell Computer Corporation disclaims any proprietary interest in trademarks and limited warranty, please write to Dell USA Corporation, 9505 Arboretum Boulevard, Austin, Texas 78759-7299, ATTN: Warranty. ©1991 Dell Computer Corporation. All rights reserved.

Circle 48 on Inquiry Card.

World Radio History

icons in a toolbox. For you PC aficionados, it's not unlike Microsoft's Object Linking and Embedding, which will be an integral part of Windows 3.1, except that, in ClarisWorks, it's here now.

Even though the term *object* has been much overused of late, it does much to explain how ClarisWorks does its job. Each application is an object that communicates with other objects from a *document*, which is the basis of ClarisWorks. A document doesn't necessarily have to be text; you can start out in any application and add other text, graphics, calculations, or charts to it at any time.



ClarisWorks sells for a very reasonable $299, so you wouldn't expect each application to have every feature under the sun, and they don't. But I don't see that as a problem. Raging featuritis is a big problem in the software industry, with the vast majority of users never needing anything but a small subset of the features in their numerous—and expensive—packages.

In fact, each individual module in ClarisWorks is a subset of a well-known Claris application (e.g., MacWrite Pro, MacDraw Pro, Resolve, and FileMaker Pro). It's how Claris picked the most-needed features and got them to work together that's the real news here.

Overall, ClarisWorks gives you the Mac's WYSIWYG approach in all the modules. The word processor is more a desktop publisher than just a way of getting words on paper. Besides having a spelling checker and thesaurus, it allows advanced layout functions (e.g., multiple columns). The spreadsheet has 96 built-in functions, more than most folks will ever need. And you can create and save your own. Of course, the charting application lets you create a variety of charts and graphs from the data.

Even though I do the vast majority of my work with words, one of the interesting things I found about ClarisWorks is that I kept gravitating to its graphics capabilities. Of course, Mac users tend to be a visually oriented group, trained from that ubiquitous Mac GUI on up. The Claris folks have made it so easy to integrate graphics elements into your documents (whatever they may be) that I found myself making charts from boring spreadsheets and popping pictures into documents. That surprised me, because (as a writer) I normally don't think in graphical terms. It's obvious that getting you to think graphically is a key aim of ClarisWorks. Even if you're not graphics-oriented, ClarisWorks will subtly ease you into it. It's not touted as a presentation graphics package, but that's another thing that it shines at. I used ClarisWorks to quickly whip together a presentation and print it to overhead transparencies on my laser printer.

The flat-file database uses FileMaker's "book" metaphor, which I've found to be incredibly intuitive. And the communications package has all the features I'd ever need for communicating via modem.

ClarisWorks comes with a number of helpful manuals, but I found that I seldom needed to pick them up. That's because a Hyperhelp system keeps all the help you'll ever need on-line and easily accessible from anywhere in the package. There's also an on-line tutorial that's designed for first-time Mac users. One manual that I did find particularly useful was a small book intriguingly titled *Possibilities*. It's full of ideas for using ClarisWorks for day-to-day work.

One of the features I like best about ClarisWorks is a selection of over 20 XTND translators. These let you open, insert, save, and edit files from a wide range of the most popular applications across different platforms. Because ClarisWorks is so useful, I found myself importing documents from PC-based applications, working on them, and exporting them back to our in-house network.

This package isn't designed to be all things to all people, but it's perfect for a wide variety of users, from small- to medium-size businesses to students. It's also perfect for users of the newest Mac portables, since it lets you carry all the most-used applications in a minimum amount of disk space. New Mac users will also find ClarisWorks a perfect place to get started. You can be doing productive work with your Mac minutes after opening the box. And for those who are destined to become true power users and eventually might need the advanced features in other Claris packages, ClarisWorks is a perfect training ground.

Of course, ClarisWorks isn't the only integrated program available for the Mac, but I have to conclude that it's far and away the best. Claris is serious about harvesting the universe of Mac users who are currently with competitors. If you use Microsoft Works, Symantec GreatWorks, or RagTime, you can upgrade to ClarisWorks for $99. (The same holds true for AppleWorks users.)

I'd estimate that all but the most feature-hungry Mac users will be able to get 99 percent of their work done using ClarisWorks. The package works on all Macs from the Plus on up and is System 7.0 compatible. I tested the prerelease version on a Mac SE/30 and found it to be very fast.

I have both a PC and a Mac on my desk, and I must admit that my Mac was formerly used for a small portion of my workday. But since I installed ClarisWorks, that's changed. If you want to get some work done without hassling with multiple packages under various GUIs, ClarisWorks is the best excuse I've seen yet to go out and buy a Mac.

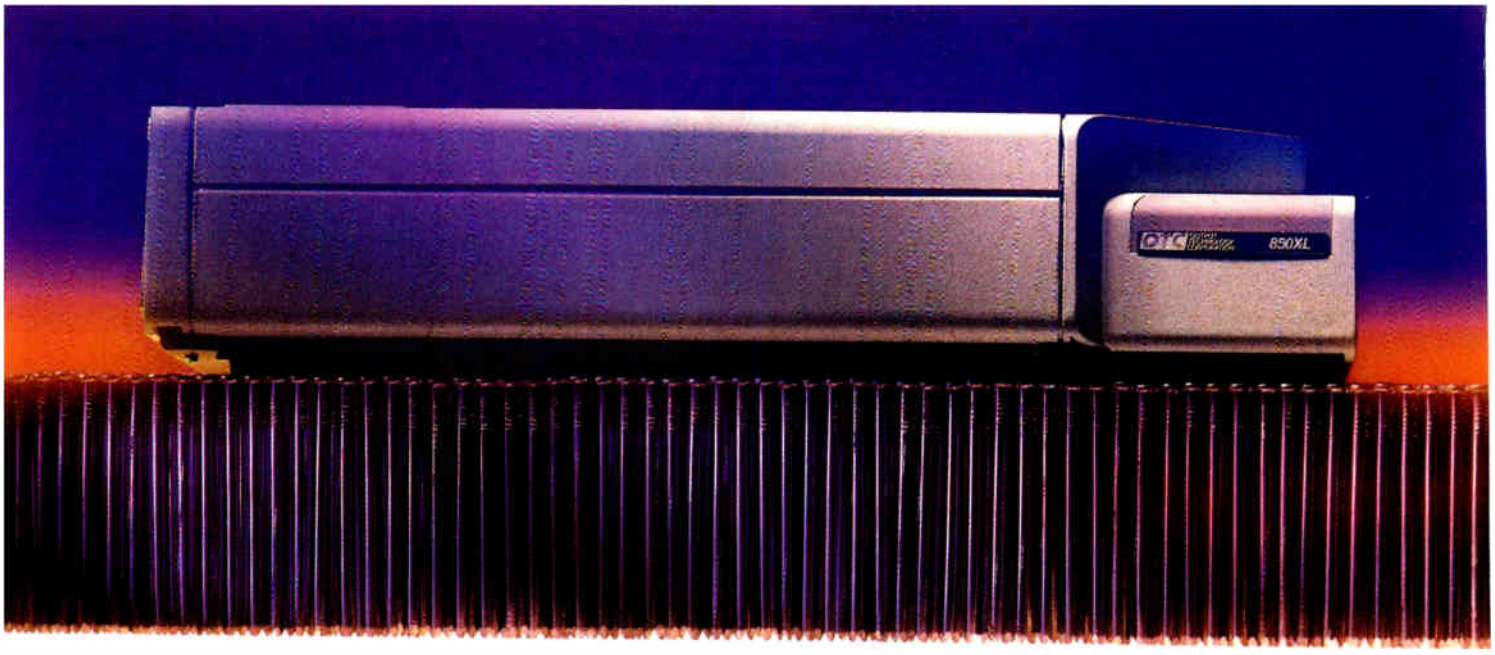
—Stan Miastkowski

THE FACTS

ClarisWorks
$299

Claris Corp.
5201 Patrick Henry Dr.
P.O. Box 58168
Santa Clara, CA 95052
(800) 544-8554
(408) 987-7000
fax: (408) 987-7440
Circle 1213 on Inquiry Card.

World Radio History



850 CPS & TOUGH AS NAILS!

850 CPS. That's right – 850 characters-per-second!

TOUGH AS NAILS. Why take a chance? Thousands of owners use the 850XL printer from 2 to 18 hours per day. It just keeps on printing, day-in. day-out! And, over 50% of all 850XL printers sold are purchased by existing owners. That alone tells the story for this American-made printer.

FREE 30-DAY TRIAL. We offer a free, 30-day trial to any qualified buyer. No strings attached. What other manufacturer believes this strongly in their product?

Call Us Today! **(800) 468-8788**

GSA Pricing: 800-633-9433
GSA Contract #GS00K-91-AGS-5268

NOW UNDER $2,000!

OTC OUTPUT TECHNOLOGY CORPORATION

Should you need service, there are over 400 service locations nationwide to serve you.

2310 N. Fancher Road Spokane, WA 99212-1381

Circle 117 on Inquiry Card.

World Radio History

Falco Blurs a Different Line with the GT486/40

Falco Data Products says that its **GT486/40** further blurs the line between desktop computers and graphics workstations, but I disagree. After spending a few days with this mighty mite (13 pounds) of a system, I'll lean the other way and say that it blurs a different line, the one between desktop computers and notebook PCs. The GT486/40 is about half as tall (2¾ inches) as a can of Jolt. Until you realize that a metal case under the plastic exterior is providing extra support, you wonder why the monitor does not crash right through the unit's housing. Don't be misled by this unit's size, however: It's small, but it offers performance that's more than suitable for CAD, desktop publishing, and graphics applications.

It's not actually a 40-MHz 486 processor inside the machine, of course—there is no such thing. But Falco's integrated design and consideration for aerodynamics let the 486 chip run faster than the rated 33 MHz. The GT486/40 has two thermostatically controlled fans that keep the unit running at a low temperature. Each component within the case acts as an active element in the cooling design, providing an air cross-flow system that moderates the heat of the CPU as well as that of expansion cards, memory chips, and disk drives. The cooling system and integrated design provide an upgrade path to a true 50-MHz 486 processor when it becomes available.

Warning: Do not run the machine for an extended period of time without the cover, because this will throw the cooling system out of whack and can cause the system to overheat. Closing the cover forces air through the system. As I was testing the Falco, I did remove the case to run the BYTE benchmarks, and I noticed that components of the machine soon became very warm. A Falco representative said this was not a good thing to do.

The base model sells for $2909. It features a Super VGA Video Electronics Standards Association graphics card supporting up to 1024- by 768-pixel noninterlaced resolution, 32,000 colors, 1 MB of RAM, and a 3½-inch 105-MB SCSI hard drive. The unit that I tested was the $6042 top-of-the-line model. It includes 32 MB of RAM, a 3½-inch 426-MB SCSI hard drive, an 8514/A graphics card with integrated VGA and support for 1024- by 768-pixel noninterlaced resolution, 1 MB of video RAM, and a 15-inch Super VGA color monitor.

The 2.88-MB floppy drive, compatible with 1.44-MB and 720-KB formats, lets you store large graphics files. The high-capacity floppy drive lets users of CAD and other applications copy large digital images or design files to a floppy disk. An external SCSI-2 port supports up to six peripherals, letting you add storage options such as CD-ROM, optical disc, and streaming tape units. Because of the GT486/40's low profile, you get only three 16-bit expansion slots, one of which is occupied by the graphics card.

All the GT486/40 models have an additional 256-KB write-back static RAM cache as a standard feature. In the write-back cache scheme, data in the cache is not written to memory until it needs to be removed from the cache or until another part of the system requests it. The write-back scheme is faster than other implementations (e.g., write-through).

On the low-level BYTE benchmarks, the GT486/40's performance placed it at about the midpoint between a test 50-MHz 486 unit that we had in the BYTE Lab and a Mylex-made 486/33 with a fast but non-cached SCSI drive. For example, on the CPU test index, the GT 486/40's performance rated almost four times faster than a Compaq 386/20 machine (I performed the benchmarks with the system's cover in place so that the machine could deliver maximum performance). To give you an idea of how fast that makes it, the GT486/40 opened a 50-page document created in PageMaker 4.0 for Windows in less than 4 seconds. Performance like that will be a blessing to anyone who has waited as his or her hard drive trundled seemingly into the night on a graphics file. The GT486/40 didn't quite make Windows run in real time, but it gave it a swift kick in the pants.

I hesitate to say how small and portable the GT486/40 is, because it's a graphics workstation with a small footprint and isn't designed to compete in the portable market. But it wouldn't surprise me if GT486/40 owners decided to shell out a few hundred extra dollars for another monitor and carried the system back and forth between their home and workplace. I took it home with me one night, and if it weren't for the monitor, I wouldn't have thought twice about it. The Falco's small footprint occupied about as much space on my home desk as a laptop but with a much better monitor. If your home desk is as cluttered as mine, with the GT486/40, you're in luck. The GT486/40's diminutive size made me wonder if the firm is working on a docking-station version. With the GT486/40, it seems that Falco is more than halfway there already.

—D. L. Andrews

THE FACTS

GT486/40
$2909 to $6042

Falco Data Products, Inc.
440 Potrero Ave.
Sunnyvale, CA 94086
(800) 835-8765
408) 745-7123
fax: (408) 745-7860
Circle 1214 on Inquiry Card.

World Radio History

"My Dolch 486™ is awesome. . ."

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

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

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

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

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

PC MAGAZINE EDITORS' CHOICE 1988

PC MAGAZINE EDITORS' CHOICE 1989

PC MAGAZINE EDITORS' CHOICE 1990

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

Why Wait?. . .Call today.

1-800-544-IPAC

In Canada call Laptech 1-800-561-4527

Dolch.

ROAD-POWER FOR THE BEST OF US

Dolch Computer Systems
372 Turquoise Street, Milpitas, CA 95035
Tel: 408-957-6575, Fax: 408-263-6305
In the United Kingdom: Dolch Computers Systems, LTD. 0908-690880
In Germany: Dolch GmbH 49-8801-2386

Circle 57 on Inquiry Card.

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

World Radio History

THE MOST POWER

© 1991 Toshiba America Information Systems, Inc. The Intel Inside logo is a trademark of Intel Corporation.

World Radio History

FUL 486SX. GOING.

Behold the new Toshiba T4400SX notebook—the first 486SX computer to offer all the power and performance of a desktop computer while freeing you from the tyranny of the nearest electrical outlet.

For starters, the T4400SX offers a 25 MHz 486SX microprocessor with 8K internal cache, upgradable to a full 486DX. Plus an 80 MB hard drive and standard 2 MB RAM, expandable to 10 MB.

You can use our credit card-sized memory modules to expand standard 2MB RAM to 10MB for added speed and multi-tasking capabilities.

The T4400SX is the only notebook computer that offers a high-speed Gas Plasma screen, which means no mouse blur. And its 100:1 contrast ratio delivers seven times the contrast of a typical LCD display.

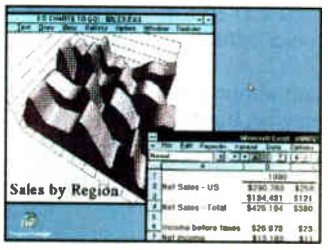
Or if you prefer, you can choose our 9.5" diagonal LCD display, the most state-of-the-art LCD available, with uncompromising clarity from the black and white ultra thin screen.

Both offer a 640 x 480 VGA high-resolution display as well as the graphic versatility of 16 gray scales for the gas plasma screen and 64 gray scales for the LCD screen.

For familiarity and ease of use, the T4400SX has a full-function keyboard with standard size keys and key spacing.

The Nickel Cadmium battery provides more than three hours of computing power. Our AutoResume feature allows you to shut down and start up precisely where you left off.

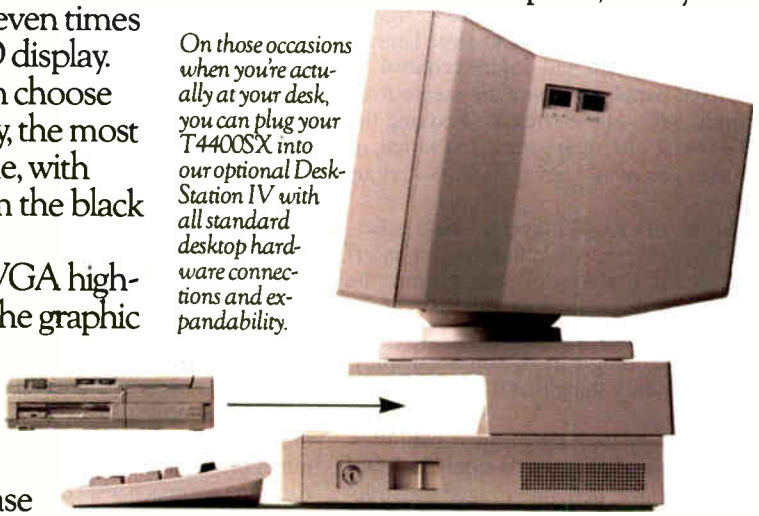
And for added expandability and connectivity, there are built-in parallel, serial, video, keypad/board, mouse and bus expansion ports. There's even a dedicated modem slot for an optional internal cellular-ready, 9600 bps fax or standard modem.



If you choose the 9.5" diagonal LCD display, you get the versatility of 64 gray scales as well as high-resolution 640 x 480 VGA on the black and white ultra thin screen.

All that in an ultra-strong 11.7" W x 8.3" D x 2.2" H carbon fiber-reinforced case weighing only 7.25 lbs that fits into half a briefcase.

If you'd like to know more about the T4400SX notebook computer, or any of our full line of Toshiba portables, call us at 1-800-457-7777.



On those occasions when you're actually at your desk, you can plug your T4400SX into our optional DeskStation IV with all standard desktop hardware connections and expandability.

We'll send you information that can lead to only one conclusion about desktop computers:

Going. Going. Gone.

In Touch with Tomorrow

TOSHIBA

Circle 170 on Inquiry Card.

World Radio History

A Dual-Personality CD-ROM Player

As the variety of available software increases and prices decrease, CD-ROMs are finally becoming viable (read "useful") software tools. Thankfully, prices of both internal and external CD-ROM drives are also falling. This is a fortuitous combination indeed.

There's a dirty little secret about CD-ROM drives. Useful they may be, but just about nobody I know uses them for data full-time. In fact, according to Philips, "research indicates a CD-ROM drive is used in its computer peripheral capacity only about 10 percent of the time." What about the other 90 percent of the time? They're used for playing music.

Most CD-ROM players are designed (not surprisingly) for handling data; playing music CDs is often a pain. With the **Magnavox CDD461RS**, Philips has designed a CD player that you can use for a computer instead of a computer peripheral that can also play CDs.

The Magnavox drive looks more like a CD player than a computer peripheral. But a peripheral it is, with a SCSI port in the back hooked to an add-in card designed for any 8-bit PC expansion slot. There's a headphone jack and volume control on the front panel, and there are stereo line-output jacks on the back for hooking the CDD461RS to a stereo system (which, of course, you would never find in a serious office).

Unlike CD-ROM players, which generally have no controls other than an on/off switch and perhaps an eject button, the Magnavox drive has a complete set of the type of controls you'd see on a music CD player, including a track-number display. About the only thing that it lacks is a time display.

OK, enough with the music capabilities. The CDD461RS is a first-rate CD-ROM player. Its size, heft, and rugged construction mean it will endure full days of hard work.

Installation was a breeze. The add-in board has a single jumper for setting the memory address. The factory setting (340 hexadecimal) works in all but the most loaded systems. Then it's a simple matter of connecting the cable between the board and the drive. On the software side, the Magnavox drive comes with an easy-to-use installation program that installs a device driver for the player and the latest flavor of Microsoft's CD-ROM extensions to MS-DOS.

The prerelease unit that I tested came with a variety of CD-ROMs, including the New Grolier Electronic Encyclopedia, Microsoft Bookshelf, and the PC Globe Electronic Atlas. It also includes the PC-SIG Library—a gold mine of hundreds of public domain and shareware programs. It's a great introduction to the wealth of material available on CD-ROM. A Philips spokesperson says more CD-ROMs will be shipped with the final version of the player at no extra cost.

The CDD461RS doesn't use the cartridge-like CD-ROM carriers that are prevalent with most players these days. Instead, you press a button and a tray slides out. You simply place the CD-ROM on the tray and slide it back into the player. I much prefer this system to the CD-ROM cartridge approach, especially because extra cartridges are expensive and difficult to find. Most cartridge users end up using a single cartridge and continually changing the CD-ROM, which is a genuine pain.

On the technical side, the average seek time of the CDD461RS is about 700 milliseconds. That's pretty much par for the course for today's generation of players. But a more important measure is the drive's average transfer rate, which is a bit over 150 KBps. That figure means that the Magnavox drive is fast enough for intensive multimedia applications, where data (e.g., animation) needs to get to the processor in a fast and continuous stream.

In fact, it's the CDD461RS's multimedia capabilities that make it intriguing, and an excellent investment for the future. As the MPC (Multimedia Personal Computer) standard becomes widespread, as it's sure to be, you'll see more and more CDs that mix computer data along with music. As I was completing this First Impression, I received a copy of Microsoft's "Multimedia Beethoven." It's a tantalizing glimpse of the future of mixed-media CDs.

In the course of doing this First Impression, I tested the CDD461RS extensively with both audio disks and CD-ROMs. It performs admirably for both jobs. One advantage of the high-tolerance laser-positioning electronics needed for reading CD-ROM drives is that they also do a bang-up job of reading even the most finicky music CDs. And in another bow to the music-player orientation, there's even a handy "shuffle" button that plays cuts on a music CD in random order.

Philips is one of the companies that's been instrumental in making CD-ROM drives popular, making both internal and external drives available for several years. That's not surprising, because it was largely responsible for developing both the CD-ROM and audio standards. I have to hand it to Philips for acknowledging that CD-ROM players are used both for business and pleasure, and for building a player that bridges the best of both worlds. My only complaint: Philips could have come up with a better name. CDD461RS doesn't exactly roll off the tongue. ■

—Stan Miastkowski

THE FACTS

Magnavox CDD461RS
$549

System requirements:
IBM PC, AT, PS/2, or compatible with a free 8-bit ISA expansion slot.

Philips Consumer Electronics Co.
1 Philips Dr.
P.O. Box 14810
Knoxville, TN 37914
(800) 722-6224
(615) 475-8869
Circle 1215 on Inquiry Card.

World Radio History

Programmer's Paradise®

800-445-7899

The POWER USER'S Best Software Source!

BLACK & WHITE
Dr. Switch-ASE	153
FaceIt	90

BORLAND
Borland C++	299
& Application Frameworks	CALL
ObjectVision 2.0	95
Paradox 3.5	525
Special Edition	79
Quattro Pro 3.0	329
Sidekick 2.0.	79
Turbo C++	69
w/Turbo Vision	139
Turbo Debugger & Tools	105
Turbo Pascal 6.0	105
Turbo Pascal Pro 6.0	209
Turbo Pascal for Windows	169
World of C++ Video	169

CASEWORKS
CASE:W	435
CASE:W Corporate Edition	929
CASE:PM for C or C++	1895
CASE:PM for COBOL	2395

DIGITALK
Smalltalk/V	99
Smalltalk/V 286	169
Smalltalk/V PM	395
Smalltalk/V Windows	395

DISK SOFTWARE
TGL 2D/3D	239
TGL Professional	389
TGL/Utilities	159

FAIRCOM
c-tree Plus	459
Faircom SQL Server	399
Faircom Toolbox	899
r-tree	239

GENUS MICROPROGRAMMING
GX Effects	179
GX Graphics	179
GX Text	125
PCX Prog. Toolkit	199
Proteus 5.0	225

GIMPEL SOFTWARE
C Shroud	599
C-terp	229
C-terp 386	269
PC-Lint	105
PC-Lint 386	179

GREENLEAF SOFTWARE
Greenleaf Comm ++	289
Greenleaf Comm Library	287
Greenleaf DataWindows	315
Greenleaf Financial Math Lib.	315
Greenleaf Financial Math Lib. ++	155
Greenleaf Functions	179
Greenleaf SuperFunctions	239
Greenleaf ViewComm	319
Greenleaf ViewComm ++	289

GUI COMPUTER
3-in-1 C/C++	CALL
DynamicObject C/C++	CALL
ObjectTable C/C++	CALL

INTERSOLV
PolyMake	149
PVCS Pofessional	419
Sage Professional Editor	249

LAHEY COMPUTER
Lahey EM/32 w/ OS/386	1089
Graphoria for Lahey EM/32	315
Lahey F77L	535
Graphoria for Lahey F77L	225
Lahey Personal Fortran 77 w/ Toolkit	89 115

MEDIA CYBERNETICS
Dr. HALO IV Compet. Upgrade	49
Dr. HALO IV Imaging Pak	105
HALO Desktop Imager	105
HALO F/X	219
HALO Image File Format Lib	189
HALO Professional	279

MICROSOFT
MS BASIC Prof. Devel. Sys.	349
MS C Prof. Devel. Sys.	299
MS COBOL	629
MS Excel for Windows	349
MS FORTRAN	299
MS Macro Assembler	99
MS Office for Windows	499
MS OS/2 Present. Mgr. Softset	105
MS Pascal	199
MS QuickBASIC	69
MS Visual Basic	139

MORTICE KERN SYSTEMS
MKS AWK	89
MKS LEX & YACC	197
MKS MAKE	119
MKS Programming Platform	539
MKS RCS	149
MKS Software Mgmt. Team	239
MKS Toolkit	199
MKS Trilogy	99
MKS VI	125

PERISCOPE
Periscope Debuggers	CALL

PHAR LAP
PharLap 386 Debug	169
PharLap 386 DOS Extender	435
PharLap 386 VMM	259
PharLap 286 DOS Extender	435

SEQUITER SOFTWARE
Code Base 4.2	225
Code Base ++	225

SILVERWARE
SilverClip SPCS	259
SilverComm "C" ASYNC Lib.	215
SilverPaint Library	109
SilverPak	299
SilverWare "C" Interface Lib.	79

SOFTWARE BLACKSMITHS
C-CALL	54
C-CMT	54
C-DOC	169
C-LIST	47
C-METRIC	47
C-REF	47

SOLUTION SYSTEMS
BRIEF	CALL
BRIEF & dBRIEF	CALL
CHARGE	89
C-Worthy	399
w/ Source	579
Sourcerer's Apprentice	399

SOUTH MOUNTAIN SOFTWARE
BreakOut II	189
C Utility Library	199
Essential B-Tree	159
Essential Communications	259
Essential Graphics Chart	179
Essential Graphics GUI	105
Essential Graphics Kernel	149

STERLING CASTLE
BestChoice3	79
Logic Gem	109

SUN COUNTRY SOFTWARE
SHOWCAT Image Catalog	179
SHOWCASE Image Database	535
SUNSCAN Digital Scanware	269
SUNSHOW Advanced Image Toolkit	219
"C" Language Imag Lib.	219
Database Professional	89
Image Converter	225

SYMANTEC
Just Write	179
Norton AntiVirus	99
Norton Backup	99
Norton Commander	99
Norton Editor	85
Norton Utilities 6.0	129
On Target	279
Q&A	349
Time Line 5.0	475
Zortech C++ Dev. Edition	599
Zortech C++ S&E Edition	849

SYSTEMS & SOFTWARE
386 Dev Performance Pak	1299
C6toPROM	129
Link&Locate++ Ext. Ed.	329
Link&Locate 386	629
SoftProbe 86/TX	269
SoftProbe 386/SIM	469
SoftProbe 386/TX	799
TCtoPROM	129

WATCOM
WATCOM C8.5	369
WATCOM C8.5/386	579
WATCOM FORTRAN 77 8.5	449
WATCOM FORTRAN 77/386	579
WATFOR-77 3.1	335

WHITEWATER GROUP
Actor 4.0	199
Actor Professional 4.0	399
ObjectGraphics	159
WINTRIEVE	339
WRT	169

ESSENTIAL GRAPHICS KERNEL AND CHART

Essential Graphics Chart and Kernel provide a complete set of graphics development tools for C. Kernel contains over 250 functions for video drivers, fonts, PCX, dot matrix printers, HP laserjets, paintjets and plotters. Chart provides a complete set of functions for 2-D and 3-D bar, above/below, line scatter and pie graphs. Supports Microsoft C/Quick C, Borland C/C++ and DOS extenders from Phar Lap and Rational Systems. Source code is available. No royalties.

Kernel	List: $199	Ours: $149
w/source	List: $398	Ours: $299
Chart	List: $199	Ours: $179
w/source	List: $998	Ours: $749

FAX*cetera* # 2089-0016 - Kernal
FAX*cetera* # 2089-0017 - Chart

OBJECTVISION 2.0

ObjectVision is the easiest way to create Windows Applications. You simply draw your interface, add logic, and connect to your data - ALL WITHOUT KNOWING ANYTHING ABOUT PROGRAMMING. ObjectVision is a powerful tool that combines popular features from spreadsheets, databases, forms products and front-ends into an easy-to-use WYSIWYG application tool for all Windows users and developers.

List: $149.95 Ours: $95
FAX*cetera* # 1861-0018

BORLAND C++ 3.0

NEW RELEASE!

With full support of ANSI C and C++ 2.1, a powerful global optimizer, templates, and enhanced performance, Borland C++ is the best and most productive systems available for creating high-quality code in either the Windows or DOS environments. Create Windows applications easily from within Windows with the Windows IDE that includes a graphical class browser with speed bars for quick access to common functions. The WinScope utility tracks Windows messages to make debugging easier, and Resource Workshop allows you to visually draw Windows resources. Also includes Turbo Debugger, Turbo Profiler, and the object-oriented Turbo Assembler.

List: $495 Ours: $299
FAX*cetera* # 1861-0016

Call FAX*cetera*™ (908) 389-8173 for instant additional information on the best selling products highlighted in the green shaded areas.

TURN THE PAGE... WE HAVE THOUSANDS MORE PRODUCTS TO CHOOSE FROM!

All products are trademarks or registered trademarks of their respective companies. Prices subject to change without notice.

World Radio History

Programmer's

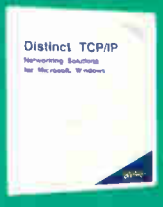
Q+E Database Library

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

List: $395 Ours: $ 279

FAXcetera# 2625-0002

Distinct TCP/IP for Windows



TCP/IP, RPC/XDR and NFS services for Microsoft Windows through small fast dynamic link libraries (DLLs). Includes APIs for Berkeley Sockets, Remote Procedure Call (RPC), Network Windows (NFS client,) TELNET and FTP. Coexists on the same board with either Lan Manager (NDIS) or Novell (packets). Includes data declarations for Microsoft C, Visual Basic, Borland C++ and Turbo Pascal. Supports virtually all Ethernet and Token Ring cards, including 3Com, Western Digital and others. Royalty FREE low cost internal use and commercial licensing available.

List: $495 Ours: $445

FAXcetera# 2994-0002

386MAX™ & BlueMAX™

Qualitas' new memory managers feature SmartMemory™, Automatic Reordering, an integrated graphical interface, disk cache, and system analyzer to give you more memory with better performance than any other memory manager. 386MAX 6 also features ROMsearch™ and VGAswap™. BlueMAX 6 features BIOS Compression technology form IBM PS/2s.

386MAX List: $ 99 Ours: $69

BlueMAX List: $125 Ours: $89

FAXcetera# 1888-0005 & 1888-0006

WindowsMAKER Professional

The fastest way to create Windows applications in C. Generates the Windows .EXE with fully commented source and production files. No royalties. Point and click to define user interface. Preview your design to instantly test look and feel. Make changes on the fly without compiling. Custom code is preserved during code generation. Supports C++. True Visual Programming in C. Highly recommended.

List: $995 Ours: $795

FAXcetera #2602-0003

386/486 Development

Intel 386/486 Code Builder	489
Lahey EM/32 w/OS 386	1089
PharLap 386 Dos Extender	435
PharLap 386 VMM	259
WATCOM C8.5/286 Prof.	579
WATCOM Fortran 77/386 Professional 8.5	579
Zortech C++ Devel. 3.0	CALL

Assembly/Disassembly

Advantage Disassembler	279
DIS DOC Professional	209
MS Macro Assembler 6.0	99
Sourcer w/ BIOS Pre-Proc.	139
Spontaneous Assembly	169
Turbo Debugger & Tools	105

Basic Compilers

MS Basic Prof. Dev. Sys.	349
MS Quick BASIC	69
Visual Basic	139
ZBasic PC	89

Basic Libraries & Utilities

DB/Lib Professional	142
Dialogic	85
GraphPak Professional	129
ProBas	159
ProBas HyperHelp Toolkit	109
ProBas Telecom Toolkit	70
ProBas Toolkit 3.0	109
ProMath	109
ProScreen	89
P.D.Q.	115
QuickPak Professional	179
QuickScreen	129
QuickWindows Advanced	119

C/C++ Compilers

Borland C++	299
& Application Frameworks	469
& Appl Frame w/ Obj Mgr	549
Instant C	419
Microsoft C 6.0	299
w/ PC Lint	409
w/ Wind Dev Toolkit	449
MS QuickC	69
MS QuickC for Windows	125
MS QuickC w/QuickASM	139
Turbo C++	69
w/TurboVision	139
WATCOM C8.5 Professional	369
Zortech C++ 3.0:	
Developer's Edition 3.0	599
Science & Eng. 3.0	849

CASE TOOLS

Analysis Manager 3.0	175
EasyCASE Plus 3.0	449
EasyCASE Professional 3.0	589
Personal CASE	179

C-Code Generators

C Source w/ Source	499
PRO-C	695

C Communications

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

C File Management

Btrieve	359
C Data Manager	259
Code Base 4.2	225
c-tree Plus	459
Essential Btree	159
Faircom SQL Server	399
Toolbox, Prof. Edition	899
Toolbox, Special Edition	569

C General Libraries

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

C Memory Management

"C" EMM	169
HEAP Expander	109
Hold Everything	149

C Screens

C Worthy	399
Greenleaf Data Windows	315
HI-SCREEN XL	299
Panel Plus II	395
Vermont Views	415
Vitamin C	289
VC Screen	125

Programmer's Paradise
FOR SERVICE, SELECTION, AND SAVINGS!

C- Additional Products

Bar Code Library	319
Clear Plus for C	169
Code Check	479
C-Doc	169
MKS LEX & YACC	197
Objective C	225
Oxygen	CALL
PC Lint	105
PCYACC Professional	459
TimeSlicer	279

C-Translators

BAS-C	329
Commercial	789
286 Version	1025
FOR-C	589
w/ Source	849

C++ Libraries/Utilities

3 -in- 1 for C++	179
BrieforC++	CALL
C++Views	419
Codebase ++	225
DynamicObject for C++	179
Greenleaf Comm C++	289
M++	265
M++, addt'l products	CALL
Object Manager	269
ObjectTable for C++	229
Rogue Wave Math.h++	179
Rogue Wave Tools.h++	179
TIER	175
Win++	225
Zinc Library for DOS & Windows	179 / 269

COBOL

Micro Focus COBOL/2 w/ TOOLSET	1199
Personal COBOL	129
MS COBOL	629
Realia COBOL	799

Database Development

Clarion Personal	72
Clarion Professional	525
Clear Plus for dBase	169
Clipper	521
D Clip	192
dBASE III +	475
dBase IV Devel. Edition	845
dBFast Plus	267
dGE	249
Dr. Switch-ASE	160
Flipper	249
FoxBASE	249
FoxPro	489
FoxPro Distribution Kit	CALL
FUNCKy Library	225
Paradox 3.5	525
Q+E Server	219
Q+E Database Library	279
QuickSilver	419
R&R Code Generator	129
R&R Report Writer	219
SilverComm	215
Silver Pak	299
Superbase 4	CALL
UI II Touch & Go	315
UI Programmer II	475

Debuggers

Multiscope Debugger (DOS)	99
Periscope Debuggers	CALL

Documentation

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

DOS Extenders

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

Editors

Brief	CALL
EDIX	155
KEDIT	125
MKS VI	125
Multi Edit	89
Multi Edit Professional	139
Norton Editor	85
Professional Editor	249
SPF/PC	199
Vedit Plus	115
Wylbur	179

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

Embedded Systems

C6 TO PROM	129
Link & Locate ++ Ext.	329
Paradigm LOCATE	CALL

Expert Systems

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

World Radio History

Paradise®

800-445-7899

GUARANTEED BEST PRICES*

FORTRAN

Lahey F77L	535
Lahey Personal FORTRAN	89
MS FORTRAN	299
WATCOM FORTRAN 77 Professional 8.5	449

CALL FOR OUR NEW WINTER CATALOG TODAY!

Graphic Libraries

Baby Driver	229
BLACKHAWK dGT	259
Essential Graphics GUI	219
Essential Graphics Kernal	149
Graf/Drive Plus Developers	269
GrafPrint	219
GSS Graph. Dev. Toolkit	675
GX Effects 2.0	179
GX Graphics	179
GX Text 2.0	125
Halo Professional	279
Menuet	259
PCX Programmer's Toolkit w/ Source	199 479
SUNSHOW Products	CALL
TGL 2D, 3D	CALL
Victor Image Library	179

Hardware/Peripherals

Pioneer Modem	159
Voyager Modem	379
UFO Modem	399

Linkers/Profilers

Blinker	225
Charge	89
Plink86 Plus	335
.RTLink /Plus	355

OS/2

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

Pascal

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

Prototyping

Dan Bricklin's Demo II	215
Proteus 5.0	249
Show Partner F/X	355

Version Control/Make

MKS MAKE	119
MKS RCS	215
PolyMake	149
Professional PVCS	479
Sourcerer's Apprentice	399
TLIB	109

Windows Development

3-in-1 for C	129
Actor	199
Actor Professional	399
CASE:W	435
CASE:W Corporate	839
CODEPAD for Windows	95
dBFAST/Windows	269
DbxSHIELD	359
DialogCoder	435
Distinct TCP/IP for Windows	445
Drover Toolbox/Wind.	239
DynamicObject for C	143
InstallSHIELD	369
KnowledgePro Windows	399
LogSHIELD	369
MemSHIELD	369
MEWEL	259
MS Windows Devel. Tlkit	349
Multiscope for Windows	289
Object Manager	
ObjectTable for C	179
ObjectVision	95
ProtoView	625
RFFlow	115
Smalltalk/Windows	395
Spinnaker Plus	349
ToolBook	329
Whitewater Res. Tlkt	CALL
WindowsMAKER Prof.	795

Utilities

386MAX	69
AboveDISC	64
AboveMEM	75
ASM Flow Professional	179
Blue MAX	89
Central Point Backup	65
Dynamic Memory Ctl.	72
EZ-Install	219
HIJAAK	139
Hold Everything	159
Info Spotter	69
INSTALIT	135
Label Master	399
MKS TOOLKIT	199
Move'em	79
Norton Anti-Virus	99
Norton Commander	99
Norton Utilities 6.0	129
Opt-Tech Sort/Merge	119
Paranet Turbo	72
PC Tools Deluxe 7.0	115

Utilities continued

PreCursor	89
SpinRite II	69
Squish Plus	75
SUNSHOW Image Libry.	CALL
Switch-It	79
Tree86	69
UpShot	149
Zeno	239

Windows Applications Communications

Crosstalk for Windows	129
Dynacomm Asynch	189
Faxit for Windows	129
WIN Connect	82
WinFax	65

Environment

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

Database & Forms

dBFAST/Windows	269
FormBase	CALL
Object Vision for Windows	99
SQL Windows	1199
Superbase 4 Windows	CALL

Graphics/Publishing

Adobe Illustrator/Wind.	299
Adobe Streamline/Wind.	269
Corel Draw 2.0	389
Micrografx Charisma	345
Micrografx Designer	485
MS PowerPoint	349
PageMaker	499
PC Paintbrush/Windows	53
Publisher's Type Foundry	385
Ventura Publisher	585

GUARANTEED BEST PRICES*

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

Terms of offer:

- Offer good through January 31, 1992
- Applicable to pricing on current versions of software listed
- January issue prices only.
- Offer does not apply towards obvious errors in competitors' ads.

*Subject to same terms and conditions

MEWEL

MEWEL is a text-mode window library which gives an application the SAA/CUA look and feel. The API is compatible with the Microsoft Windows for easy porting between Wincows and DOS, OS/2, UNIX and VAX VMS. Can also run in graphics mode. Available for C and various C++ class libraries, including Borland's OWL.

List: $295 Ours: $259
w/source List: $525 Ours: $539
FAXcetera # 1990-0001

WATCOM C8.5/386 Professional for Extended Dos and Windows

Develop and Debug 32-bit applications for extended DOS and Windows with the most complete 32-bit C development package available. C8.5/386 Professional is packed full of tools you need to unleash 32-bit power on your applications at a low package price. Includes the royalty-free DOS/4GW DOS extender by Rational Systems, components from Microsoft Windows SDK, award-winning compiler, protected mode linker, interactive debugger, execution profiler, run-time compatibility with WATCOM FORTRAN 77/386 V8.5 plus numerous development tools. Supports other industry standard 32-bit DOS extenders. Create ADS Applications for AutoCAD or for embedded systems development.

List: $995 Ours: $579
FAXcetera# 1683-0001
FAXcetera # 1683-0001

ATTENTION CORPORATE CUSTOMERS

Call CORSOFT (800) 422-6507

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

CORSOFT is a Division of Voyager Software Corp

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

1-800-445-7899

Corporate: **800-422-6507**
(CORSOFT Division)
International: **908-389-9228**
Customer Service: **908-389-9229**
Canada: **800-445-7899**
Fax: **908-389-9227**
FAXcetera: **908-389-8173**

POLICIES

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

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

FAXcetera (908) 389-8173
Call from your FAX telephone and follow the instructions to receive more information on the products featured above!

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

Returns
Subject to $25 processing charge.

* All prices subject to change without notice.

Circle 92 on Inquiry Card.

World Radio History

A Sandwich to Go

This sandwich-style 386SX notebook includes a 360-dpi bubble-jet portable printer. The system opens like a typical clamshell case, with the keyboard in front of the display; another section opens behind the display and holds the printer. Preconnected cables eliminate the need to hook up components.

With a 20-MHz CPU and 4 MB of RAM (expandable to 6 MB), the unit has a 20-MB hard drive that you can upgrade to 40 or 60 MB. Other features include a backlit 640- by 480-pixel VGA display, a coprocessor socket, an internal modem slot, a 3½-inch floppy drive, two serial ports, one parallel port, and a port for an external monitor.

Price: $3250.

Contact: BEC Computer Corp., 22 Yearling Court, Rockville, MD 20850, (301) 294-2152.

Circle 1271 on Inquiry Card.

BEC Computer's sandwich-style 386SX notebook computer.

Jupiter Brings Power to Your Computing

The Jupiter Class Evolution (JCE) systems in Epic Microsystems' Enhanced Machine Series (EMS) computers support up to 128 MB of on-board RAM and up to 512 KB of cache. The systems use a passive 32-bit EISA motherboard that accepts a processor card in a proprietary slot, leaving seven 32-bit slots open.

The basic JCE 386/40 desktop has 8 MB of RAM, 3½- and 5¼-inch floppy drives, a 160-MB IDE hard drive, an EMS IDE controller with 1 MB of cache, a 1-MB VGA card, one parallel and two serial ports, and a 14-inch VGA color monitor. The JCE 386/40 workstation has 16 MB of RAM, a 3½-inch floppy drive, a 3½-inch 500-MB SCSI hard drive, an EMS SCSI controller with 4 MB of cache, a 1-MB/768-KB video RAM 60-MHz Graphics Xcellerator, one serial and two parallel ports, and a 14-inch VGA color monitor. DOS 5.0, Qualitas 386Max, Windows 3.0, and a Microsoft Mouse are standard with both models.

Price: Desktop model starts at $6219; workstation starts at $8949.

Contact: Epic Microsystems, Inc., 3R Tigertail Cir., Derry, NH 03038, (603) 432-6079; fax (603) 437-6893.

Circle 1272 on Inquiry Card.

The Jupiter Class Evolution system.

Scalable Multiprocessor System

The first of Micronics' Mpro scalable multiprocessor computer systems, the SMP-2000 and SMP-4000 are designed for use with SCO Unix MPX and Banyan Vines SMP. The 486-based system also works with DOS, Windows, NetWare, Unix, and OS/2.

The SMP-2000 runs at 33 or 50 MHz and is upgradable to two CPUs—each with 256 KB of write-back cache—via a second plug-in CPU board. Its 8 MB of on-board RAM is expandable to 128 MB. The system uses 64-bit buses, includes six 32-bit EISA expansion slots and two CPU/memory slots, and supports bus-mastering hardware. It includes four half-height bays, a 3½-inch floppy drive, a VGA video card, and one parallel and two serial ports.

The initial version of the SMP-4000 system has up to four 33-MHz 486 CPUs. In addition to features of the SMP-2000, it supports up to 256 MB of system RAM and has eight EISA expansion and six CPU/memory card slots. The unit comes in a tower case with nine half-height bays and a 3½-inch floppy drive.

Price: Starts at under $10,000 for each system.

Contact: Micronics Computers, Inc., 232 East Warren Ave., Fremont, CA 94539, (510) 651-2300; fax (510) 651-5612.

Circle 1273 on Inquiry Card.

Cellular, Mobile, and Modular

The Grid Cellular Notebook System combines a 386SX-based Grid 1750 notebook computer with PowerTek's model CMI 990 cellular data transmission package. The two units incorporate everything necessary for cellular mobile computing, forming a package that weighs 11 pounds, including batteries.

The system's modular design lets you go on the road with the 6-pound Grid 1750, and then, when you're back in your car or motel room, you can link up the PowerTec CMI to transmit or receive data. The system uses a 9600-bps Microcom Micro-Modem, a Fujitsu transceiver, an intelligent adapter, and a PowerTec cellular interface. It has 1 MB of RAM, a 3½-inch floppy drive, a 60-MB hard drive, a VGA backlit LCD, an auto-sensing power adapter, and DOS 5.01.

Price: $5871.

Contact: Grid Systems Corp., 47211 Lakeview Blvd., Fremont, CA 94537, (510) 656-4700.

Circle 1274 on Inquiry Card.

World Radio History

Multipurpose Portable Printer

With 24 KB of memory and an optional nickel-cadmium battery pack, the 4-pound StarJet SJ-48 multipurpose ink-jet printer prints up to 40 pages without a recharge. Its 64-nozzle print head maintains a 45-dB sound level while it prints with laser quality on a variety of paper.

The SJ-48 has four resident bit-mapped fonts, two 1.2-MB floppy disks of utilities and fonts for desktop publishing, and a driver for Windows 3.0. Able to print graphics at 360 dpi, the SJ-48 prints more than 6½ text pages per minute at 20 cpi. The printer also has a quarter-size mode that lets it print up to 273 characters per line in 20-cpi mode.

Price: $499; optional battery pack, $50.

Contact: Star Micronics America, Inc., 420 Lexington Ave., Suite 2702, New York, NY 10170, (212) 986-6770; fax (212) 286-9063.

Circle 1275 on Inquiry Card.

You get printing flexibility with the StarJet SJ-48.

Speedy Optical Data Storage

Sumo's SS630 rewritable optical data storage subsystem stores 600 MB of formatted data per removable data cartridge and offers unlimited data storage. The system operates at average seek times of 28 ms and average access times as low as 37 ms. It supports data transfer rates as high as 1 MBps.

The SS630 stores data on a 5¼-inch ISO-compatible removable cartridge using magneto-optic recording techniques. Equipped with a SCSI-2 connection, it is easily integrated with IBM, DEC, Sun Microsystems, and Macintosh platforms. The unit includes all software drivers and has automatic on-line formatting.

Price: $4295.

Contact: Sumo Systems, 1580 Old Oakland Rd., S-C103, San Jose, CA 95131, (408) 453-5744; fax (408) 453-5821.

Circle 1276 on Inquiry Card.

TouchMonitors in Two Styles

The GoldStar 1430Plus TouchMonitor, a fully integrated plug-and-play 14-inch VGA touchscreen, is available with your choice of a serial or PC-Bus controller. You also have a choice of an IntelliTouch or AccuTouch screen.

The pure glass IntelliTouch touchscreen uses Surface Acoustic Wave technology in its completely transparent panel; the waves in the glass are absorbed by a finger or other soft pointing object. The panel, which senses touch location as well as touch pressure, can be mounted on CRT or flat-panel displays.

The AccuTouch screen incorporates resistive technology, which uses a transparent polyester coversheet over a glass panel. The layers are separated by tiny transparent dots, each less than 1/1000 inch thick. The facing surfaces of the layers have a clear conductive coating; a light touch registers the touch location by pushing the layers together.

Price: GoldStar AccuTouch 1430Plus TouchMonitor with PC-Bus card controller, $1160; GoldStar IntelliTouch TouchMonitor with PC-Bus card controller, $1280.

Contact: Elographics, Inc., 105 Randolph Rd., Oak Ridge, TN 37830, (615) 482-4100; fax (615) 482-4943.

Circle 1277 on Inquiry Card.

CD-ROM Drive Takes to the Road

The portable TXM-3301P CD-ROM drive, based on Toshiba's XM-3300 Series drive, has a 325-ms average access time and a sealed drive enclosure that excludes contaminants.

The TXM-3301P weighs 3.8 pounds and has an optional battery pack that provides up to 4 hours of operation. The drive features a low-battery detector and indicator and includes an AC power adapter. An optional parallel-to-SCSI cable connects the drive to laptop and notebook computers.

Price: $999.

Contact: Toshiba America Information Systems, Inc., Disk Products Division, 9740 Irvine Blvd., Irvine, CA 92718, (714) 583-3000.

Circle 1278 on Inquiry Card.

The GoldStar 1430Plus TouchMonitor.

World Radio History

NEWS

WHAT'S NEW • ADD-INS

SCSI-2 Drives for the Quadra 900

A family of Hewlett-Packard SCSI-2 internal drives for Apple's Mac Quadra 900 are available in 5¼- and 3½-inch sizes. The drives are targeted for use with CAD/CAM, graphics, and other high-capacity storage environments.

The 3½-inch drive offers 422 MB of formatted capacity with an average seek time of 12.6 ms and an asynchronous burst transfer rate of 1.5 MBps. The 5¼-inch drives have formatted capacities of 1.355 and 1.070 gigabytes and 677 MBps. Their seek time is 13.5 ms, and they have an asynchronous burst transfer rate of up to 1.5 MBps. All drives include HP's Formatter software with full driver support, cables, and trays.
Price: $2695 to $5095.
Contact: Hewlett-Packard Co. Inquiries, 19310 Pruneridge Ave., Cupertino, CA 95014, (800) 752-0900.
Circle 1279 on Inquiry Card.

The HP SCSI-2 drives provide mass storage for the Mac Quadra 900.

XGA Board for PCs

The FlashXGA Accelerated Graphics Adapter for PCs combines a high-performance CRT controller with a bus-mastering graphics coprocessor to create a display adapter similar to the XGA (Extended Graphics Array) for the PS/2. The adapter comes with 1 MB of video RAM.

FlashXGA supports most PC display resolutions up to 1024 by 768 pixels noninterlaced with 256 simultaneous colors. It has a refresh rate programmable to 72 Hz and supports the IBM XGA 16-bit color format for direct display of 65,536 simultaneous colors, as well as the 15-bit Targa format for 32,768 simultaneous colors at up to 800- by 600-pixel resolution.
Price: $649.
Contact: Video Dynamics, Inc., 1550 Bryant St., San Francisco, CA 94103, (800) 243-3527 or (415) 863-3023.
Circle 1280 on Inquiry Card.

TV in a Window

TV-VideoWindows, a single-slot, full-length board for displaying broadcast or cable TV within Windows, integrates Super VideoWindows and Super Tuner functionality. Packaged with all necessary cables and connectors, the board includes VEditor.
Price: $1195.
Contact: New Media Graphics Corp., 780 Boston Rd., Billerica, MA 01821, (508) 663-0666; fax (508) 663-6678.
Circle 1281 on Inquiry Card.

Diagnostic Test Card Fits in a Pocket

The PocketPost diagnostic test card for ISA and EISA computers plugs into any available expansion slot and quickly shows why your computer won't boot. Landmark's PC Certify diagnostic test software, bundled with the card, helps to isolate problems on systems that boot but aren't running smoothly. PC Certify requires 128 KB of memory and can run in remote mode.

PocketPost conducts three major diagnostic tests. For the first, a digital display shows power-on self test codes issued by the BIOS when you switch on the computer's power. For the second test, a built-in voltmeter with five LEDs shows when the proper power level is on and within 90 percent of rated value. In the third test, an LED and jumpers show whether nine vital bus signals are toggling properly.
Price: $249.
Contact: Data Depot, 1710 Drew St., Clearwater, FL 34615, (800) 275-1913 or (813) 446-3402; fax (813) 443-4377.
Circle 1282 on Inquiry Card.

Piggyback Card Surrounds You with Sound

The Surround Sound Module from Ad Lib is a piggyback card that snaps onto the Ad Lib Gold card to give you sound enhancements ranging from stereo depth simulation to artificial reverb and echo. The module is compatible with all applications written with Ad Lib sound support, automatically enhancing the application you're using when you choose an effect from Ad Lib's selection.
Price: $89.95.
Contact: Ad Lib, Inc., 220 Grande-Allée East, Suite 850, Quebec, Canada G1R 2J1, (800) 463-2686 or (418) 529-9676; fax (418) 529-1159.
Circle 1283 on Inquiry Card.

Accelerate Graphics in Windows 3.0

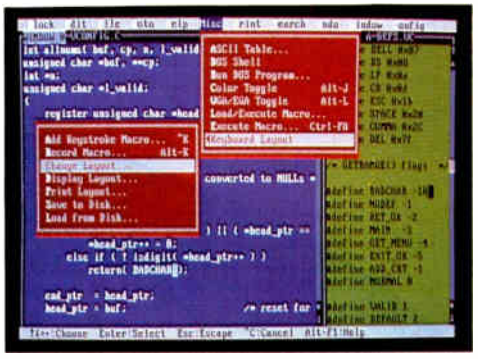
The FlickerFree WindowsVGA 8800 graphics board with Safescan accelerates Windows 3.0 graphics software. With a refresh rate of 70 Hz, the board's Safescan feature eliminates the black border at the edge of your screen, letting you overscan and have 100 percent use of your screen. Other features include resolutions of up to 1280 by 968 pixels, 256 colors, 1 MB of memory, and a GUI accelerator. Genoa says the board's processing speeds are up to 30 times faster than Super VGA standards.
Price: $495.
Contact: Genoa Systems Corp., 75 East Trimble Rd., San Jose, CA 95131, (408) 432-9090; fax (408) 434-0997.
Circle 1284 on Inquiry Card.

World Radio History

The new multi-mode VEDIT PLUS is the only text editor you will ever need!

The most powerful text editor for program development and text processing

- **Drop-down menus, mouse support**
- **Columnar blocks, regular expressions, undo**
- **Also VEDIT for $69, VEDIT Jr. for $29**



The new VEDIT PLUS is today's finest programmer's editor. Small (80K) and lightning fast, it is written entirely in assembly language. VEDIT PLUS is the only programmer's editor that can edit *any* text or binary file you will ever encounter.

Incredibly, VEDIT is over 20 times faster than other editors on just a 3 megabyte file. When editing multi-megabyte files, only VEDIT has the speed to get the job done.

Benchmarks in 3 Meg File	VEDIT	Brief	Sage
Save and continue	52 sec	3:52 min	1:47 min
Load, modify, save, exit	21 sec	49 sec	1:38 min
Block-column copy (40x200)	2 sec	30 sec	2 sec
Delete one column in file	9:58 min	1:50 hour	1:03 hour
60,000 search & replace	3:18min	1:44 hour	1:32 hour

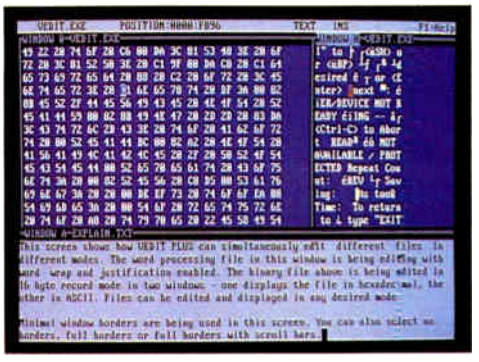
The extensive compiler support runs popular compilers and also your favorite linkers, debuggers and Make from within VEDIT. It even integrates tools from different vendors. When shelling to DOS, VEDIT swaps itself and TSRs out of memory, giving you as much as 620K of available memory for compiling the biggest programs. Only VEDIT gives you the advantages of a powerful editor with the convenience of an integrated environment.

VEDIT PLUS 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.

VEDIT PLUS has the most powerful macro programming language of any editor. It eliminates repetitive editing tasks and lets you create your own editing functions. It includes testing, branching, looping, user prompts, keyboard input, string and numeric variables, complete control over windows plus access to hardware interrupts, memory and I/O ports. Source level debugging helps you develop new macros quickly and easily.

The fastest text editor for mainframe, CD ROM and other huge files

- **Edit up to 2 Gigabyte text, binary, mainframe files**
- **Edit in ASCII, EBCDIC or Hexadecimal**
- **Emulate Wordstar, Word Perfect, Brief, vi, others**



Until now, few PC text editors could even begin to handle huge mainframe, CD ROM, postscript, plotter output and other multi-megabyte files. The new VEDIT PLUS, with its unique virtual memory management, handles them all effortlessly.

Edit in ASCII, EBCDIC or Hexadecimal modes, or split the screen for any combination of modes. File modes support DOS text, UNIX text, binary and many fixed length record formats.

VEDIT PLUS

DOS | QNX | XENIX | FlexOS | UNIX | IBM 4680

An intuitive user interface with drop down menus, hot keys, mouse support, optional scroll bars, context sensitive help, point and shoot file selection, 1000 level undo and unlimited keystroke macros make VEDIT PLUS easy to use, easy to learn. And it can emulate the keystrokes of almost any editor you already know.

Everything in VEDIT PLUS is configurable. The keyboard layout, the screen colors, the way control characters, long lines and window borders are displayed, and much more, is all configured with easy to use menus.

Confidently order your copy of 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: $295; UNIX/XENIX, QNX, FlexOS/IBM 4680 single CPU license: $285. Site license pricing is available.

24-Hour Bulletin Board

A fully functional demo version of VEDIT PLUS and a shareware version of VEDIT Jr. are available on our BBS at 1-313-996-1304.

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 48106

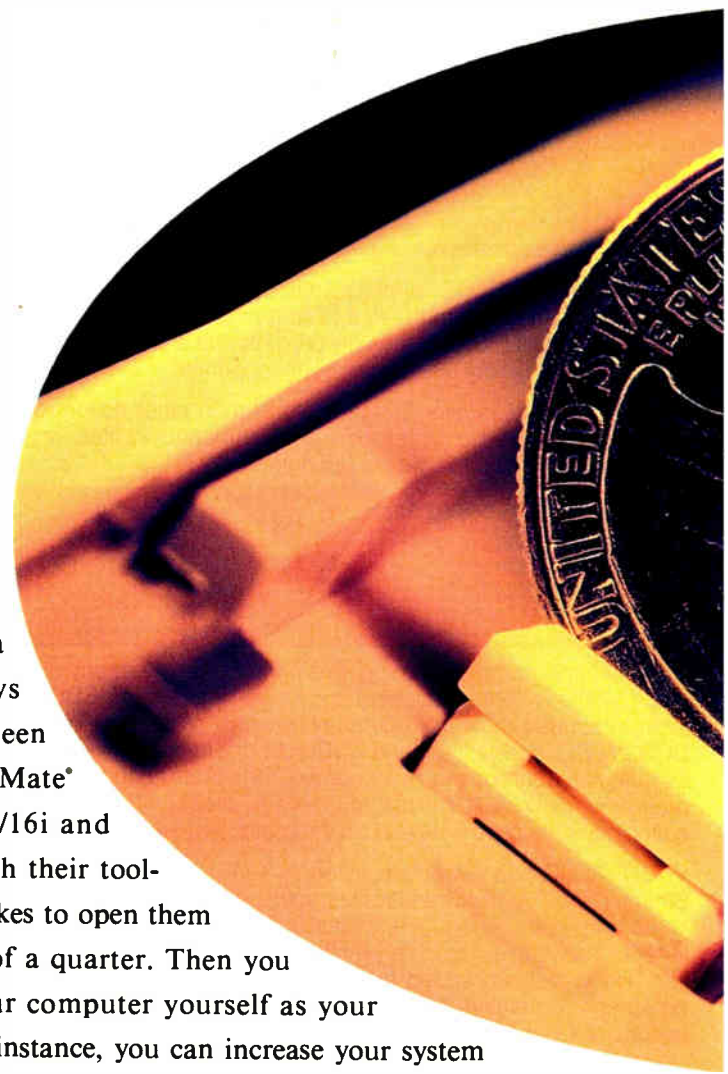
Greenview Data

VEDIT is a registered trademark of Greenview Data, Inc. Brief is a trademark of Solution Systems. Sage Professional Editor is a trademark of Intersolv.

Circle 37 on Inquiry Card.

World Radio History

Perhaps the most ama
PC is that it can



At NEC, we put as much emphasis on affordability as *we do on upgradability. Add a Pinwriter® P3200 and a MultiSync 3FGx to your Image Series PC and you can do high-level computing without paying a high price.*

Anyone who thinks you can't do anything with a quarter these days obviously hasn't seen NEC's new PowerMate® Image™ Series SX/16i and SX/20vi PC's. With their tool-less design, all it takes to open them is the quick turn of a quarter. Then you can customize your computer yourself as your needs change. For instance, you can increase your system or video memory by just plugging in chips. And storage devices easily snap into place, too. We've even made it easier to upgrade your system in the future. Simply send us your old Image motherboard and we'll credit

intel inside

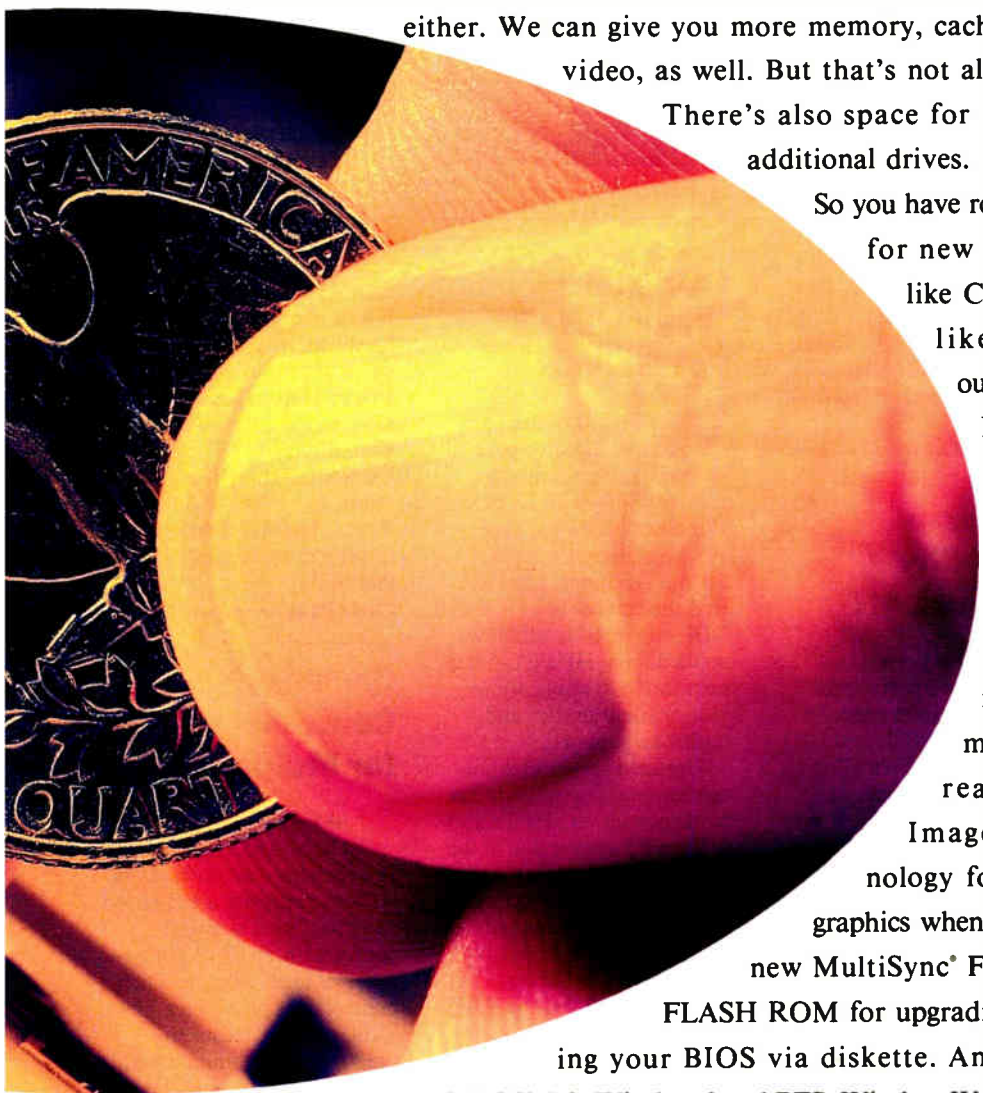
C&C
Computers and Communications

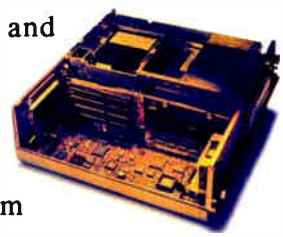
PowerMate, MultiSync and Pinwriter are registered trademarks and ImageSync, Image Series and FG are trademarks of NEC Technologies Inc MS-DOS and Windows are registered trademarks of Microsoft Corporation PFS: Window Works is a trademark of Spinnaker Software Corp

World Radio History

zing thing about our $1,199* be upgraded with a quarter.

its value towards a new one.** And we don't just give you a faster CPU, either. We can give you more memory, cache and video, as well. But that's not all. There's also space for additional drives. So you have room for new technologies like CD-ROM. And like the rest of our Image Series PC's, the SX/16i and SX/20vi come with plugs and jacks that make them multimedia ready. There's ImageSync™ technology for flicker-free graphics when used with our new MultiSync® FG™ monitors. FLASH ROM for upgrading or enhancing your BIOS via diskette. And pre-loaded MS-DOS® 5.0, Windows® and PFS: Window Works.™ For more information, call 1-800-NEC-INFO, or NEC FastFacts at 1-800-366-0476, #IMAGE (46243). After all, a computer isn't worth a dime unless you can upgrade it with a quarter.





Because ⬆ is the way you want to go. NEC

Intel is a registered trademark and the Intel Inside logo is a trademark of Intel Corp. © 1991 NEC Technologies Inc. *Manufacturer's suggested retail price for the PowerMate SX/16. MSRP for SX/20vi is $1,349.00. **See your dealer for complete details.

Circle 109 on Inquiry Card.

World Radio History

Communicate Fast with MNP-10 ACE

The QX/4232bis, a V.32bis modem, uses MNP 10 with Adverse Channel Enhancements (ACE) for communication between computers on dial-up and leased lines. According to Microcom, MNP 10 data transmission enables error-free interactive data transfer over noisy telephone lines.

MNP 10, which provides the reliability to maintain the high speed of V.32bis transmissions, automatically decreases the QX/4232bis transmission rate to establish a stable connection when interference increases. As link quality returns to normal, the modem automatically returns to optimal speed.

Price: $999; bundled with Carbon Copy Plus or Relay Gold, $1099.
Contact: Microcom, Inc., 500 River Ridge Dr., Norwood, MA 02062, (617) 551-1000; fax (617) 551-1007.
Circle 1285 on Inquiry Card.

Smooth Operator Uses Windows

Smooth Operator 3.0 adds a GUI enhancement to its previous release, making it compatible with Windows 3.0. With new user-friendly help screens and the capability to run on most LANs, Smooth Operator 3.0 offers the flexibility to develop application environments and technologies through an open modular approach. FaxRetrieval, an optional fax-on-demand module, is available.
Price: Starts at $22.95; FaxRetrieval, $17.50.
Contact: Compass Technology, Inc., Live Oak Office Center, 2201 Cantu Court, Suite 116, Sarasota, FL 34232, (813) 371-8000; fax (813) 377-5600.
Circle 1286 on Inquiry Card.

Microcom's QX/4232bis modem uses MNP level 10.

Printer Flexibility on Your LAN

A flexible network-printer interface for Hewlett-Packard LaserJet Series II, IID, III, and IIID printers, EtherFlex allows direct printer connection anywhere on a LAN. It provides Apple EtherTalk and NetWare support on a single card that installs in the optional I/O slot of the LaserJet. You choose the protocol you want by setting a switch, which you reconfigure when you want to use the other protocol. The inclusion of BNC and 10Base-T Ethernet connectors gives you LAN connection flexibility.
Price: $695.
Contact: Extended Systems, 6123 North Meeker Ave., Boise, ID 83704, (800) 235-7576 or (208) 322-7575; fax (208) 377-1906.
Circle 1287 on Inquiry Card.

DOS and Windows in a Fax Server

Version 2.0 of the LanFax Redirector peer-to-peer fax server combines compatibility with DOS and Windows in one package. With a new user interface for fax management, LanFax Redirector now has DDE and DDL support for Windows applications, HP PCL-5 support for DOS applications, binary file transfer, and multiline support.

Ugraded server technology supports up to eight fax cards per server, HP PCL-5 to Group 3 conversion at the server, EMS support, and dynamic log-in. In addition to operating systems previously supported, 2.0 supports OS/2 LanServer, LANtastic, 10Net, and DECnet 4.0. A new fax modem supported is LaserJet Fax.
Price: Starts at $995.
Contact: Alcom Corp., 1616 North Shoreline Blvd., Mountain View, CA 94043, (415) 694-7000; fax (415) 694-7070.
Circle 1288 on Inquiry Card.

Share a Modem on the LAN

With CO/Session ACS, any network user can access any modem to send or receive communications. Working in the background on the PC to which the modem is connected, CO/Session ACS is compatible with LAN communications software that supports an Interrupt 14 interface.

CO/Session ACS's low network memory requirements mean that PCs with modems attached to them for sharing require only 9 KB of memory; PCs needing access to a modem attached to another PC require only 6 KB of memory. No special hardware or communications cards are required.
Price: Two-modem version, $295; four-modem version, $590.
Contact: Triton Technologies, Inc., 200 Middlesex Tnpk., Iselin, NJ 08830, (908) 855-9440; fax (908) 855-9608.
Circle 1289 on Inquiry Card.

Caching Controllers for Multitasking

The hyperStore easyCache and easyCache Pro caching disk controllers let you configure a PC-based workstation or network server with up to 12.6 gigabytes of mass storage. Each controller is based on a 16-bit Z280 microprocesor to create a self-contained parallel computer, freeing the PC's CPU for other tasks.
Price: easyCache, $585 to $635; easyCache Pro, $725 to $775.
Contact: Perceptive Solutions, Inc., 2700 Flora St., Dallas, TX 75201, (214) 954-1774; fax (214) 953-1774.
Circle 1290 on Inquiry Card.

World Radio History

Three great reasons to buy dBASE now:

✓ 1. Borland's commitment to dBASE

✓ 2. Borland's commitment to technology

✓ 3. Borland's commitment to customers

Now that it's from Borland, you can buy dBASE® with total confidence. Simply stated, Borland is fully committed to delivering more power, more flexibility and better support to the whole dBASE community.

Borland advances the dBASE standard.

Because Borland is the leader in object-oriented technology, today's dBASE buyer will get more features and new dBASE releases in less time – such as SQL server links, event handling, object-oriented extensions to the dBASE language and compilers that generate fast, tight code.

In addition, dBASE users will be able to effortlessly integrate data from the desktop to the mainframe with our InterBase server.

Borland support means greater customer satisfaction.

Now that dBASE is from Borland, dBASE customers are assured of world class support. In fact, J.D. Power and Associates ranks Borland "Best Application Software in Customer Satisfaction, in small to medium-size and large businesses."

J.D. POWER AND ASSOCIATES®

Borland

"Best application software in customer satisfaction in Small to Medium-sized and Large Businesses"

Borland, your database partner in the 90's.

When it comes to technological innovation and customer satisfaction, Borland leads the way. Borland is committed to advancing the dBASE standard on multiple platforms – DOS, Windows, VAX VMS, Sun, UNIX and Macintosh.

A special offer when you buy dBASE now.

Buy dBASE from any dealer between November 1, 1991 and January 31, 1992, and get a $100 manufacturers rebate. (See the coupon accompanying this ad for details.)

See your dealer today or call 1-800-568-9092 now for rebate information.

B O R L A N D

Software Craftsmanship

CODE MP02

©1991 Borland International, Inc. All rights reserved. Borland, dBASE and the names of other Borland products are registered trademarks or trademarks of Borland International. Some of the product names used herein have been used as identification only and may be trademarks of their respective companies. 1991 J.D. Power and Associates® Computer End User Satisfaction Study: Phase I: Office Based Small to Medium Sized Businesses. Response from Business End Users at 1,784 business sites. Small to medium sized businesses were based on office sites with between 1 and 499 employees. 1991 J.D. Power and Associates® Computer End User Satisfaction Study: Phase III: Office Based Large Businesses. Responses from Business End Users at 1,094 business sites. Large businesses were based on office sites with 500 or more employees. J.D. Power and Associates is a service mark of J.D. Power and Associates. BI 1447

Circle 25 on Inquiry Card (RESELLERS: 26).

World Radio History

NEWS

WHAT'S NEW • PROGRAMMING SOFTWARE

Soft-ICE/W Lets You Debug from Within Windows

Soft-ICE, the 386 debugger that performs insecticidal tasks usually associated with in-circuit emulators, has made the transition from real-mode to protected-mode application debugging. The first debugger for Windows 3.1, Soft-ICE/W lets you debug Windows programs at the system or application level, Nu-Mega says.

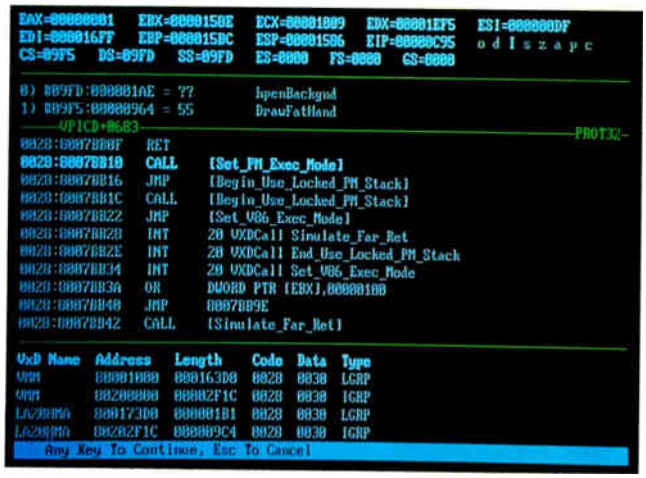
You can use Soft-ICE/W to debug virtual device drivers, DOS virtual machines, device drivers, and applications from within Windows. The program features memory-range and memory-location breakpoints and a back-trace function.

Nu-Mega also offers CV1, which lets you run and display Microsoft's CodeView within a window without having to leave the Windows environment.

Price: Soft-ICE/W, $386; CV/1, $129.

Contact: Nu-Mega Technologies, Inc., P.O. Box 7780, Nashua, NH 03060, (603) 889-2386; fax (603) 889-1135.

Circle 1291 on Inquiry Card.



Soft-ICE/W for Windows can debug programs at the system or application level. Here Soft-ICE/W is debugging a 32-bit Windows virtual device driver.

Clarion Goes Full Speed Ahead

Clarion has licensed the TopSpeed optimizing code generator from Jensen & Partners for use in the Professional Developer 3.0 database applications development tool. The internal computing speed of a Professional Developer 3.0 program is as much as 200 times faster than the same program created with FoxPro 2.0 or Clipper 5.0, Clarion says.

Professional Developer 3.0 also includes replaceable database drivers to let applications access a variety of databases. The package includes drivers for Btrieve, xBase, Paradox, and NetWare SQL. When used on a Novell network, the Btrieve driver automatically supports client-server architecture.

SQL drivers for Oracle, SQL Server, and other database drivers written by Clarion will be available through Clarionet, a toll-free information service that you can access for a $150 annual membership fee.

Clarion says Professional Developer 3.0 lets you enhance and customize vertical-market and accounting packages that use database engines supported by Clarion database drivers. Version 3.0's application generator includes visual templates and supports embedded source code.

Price: $995.

Contact: Clarion Software, 150 East Sample Rd., Pompano Beach, FL 33064, (800) 354-5444 or (305) 785-4555; fax (305) 946-1650.

Circle 1292 on Inquiry Card.

Stand-Alone dBase IV Compiler

A stand-alone compiler for the dBase IV language, Arago Quicksilver produces independent .EXE files from dBase source code. WordTech Systems will not charge any run-time or licensing fees for programs created using the new compiler.

The compiler includes an overlay linker and an automatic run-time environment configuration.

Price: $799.

Contact: WordTech Systems, Inc., 21 Altarinda Rd., Orinda, CA 94563, (510) 254-0900; fax (510) 254-0288.

Circle 1293 on Inquiry Card.

Complex Communications Library

Version 3.2 of the Greenleaf CommLib Level 2 C asynchronous communications library adds seven new drivers, bringing the total to 12. CommLib Level 2 offers support for XMODEM, YMODEM, ZMODEM, Kermit, and ASCII file transfer protocols, XON/XOFF, RTS/CTS (Request to Send/Clear to Send), DTR/DSR (Data Terminal Ready/Data Set Ready) handshaking, and first-in/first-out priority on 16550 universal asynchronous receiver/transmitters.

Greenleaf has also added drivers for the Phar Lap 286| DOS-Extender and Rational Systems' DOS 16M package. These drivers feature bimodal interrupt handlers, 16550 support, and hardware handshaking.

CommLib supports all the popular C and C++ compilers.

Price: $359.

Contact: Greenleaf Software, Inc., 16479 Dallas Pkwy., Suite 570, Dallas, TX 75248, (800) 523-9830 or (214) 248-2561; fax (214) 248-7830.

Circle 1294 on Inquiry Card.

A C Display Manager for DOS and OS/2

C-Display Manager 4.5, which provides support for screens, menus, and data handling, lets you create user interfaces in DOS and use them in OS/2 protected mode without change and vice versa.

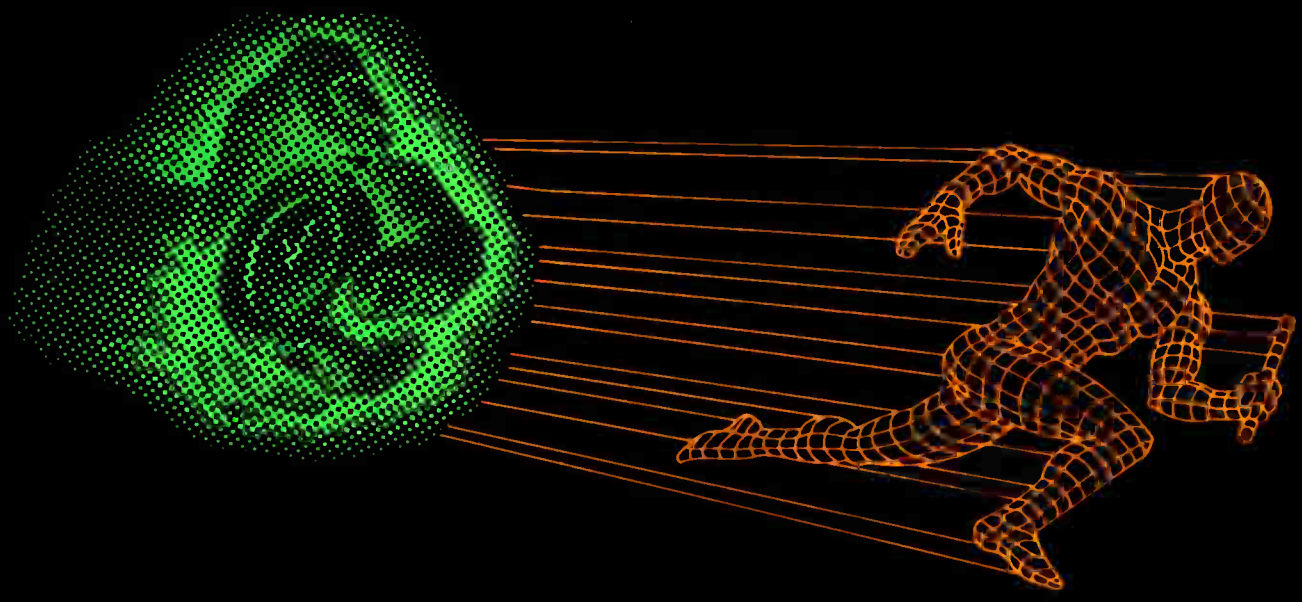
Price: C-Display Manager (without source code), $119; C-Display Manager Advanced (library with source code), $199; C-Display Manager Professional (source code of utilities and design documentation), $599.

Contact: Sydetech System Development Technologies, Inc., 140-74 34th Ave., Suite 1C, Flushing, NY 11354, (718) 321-1572; fax (718) 321-9685.

Circle 1295 on Inquiry Card.

World Radio History

Faster Runtime



Run with ULSI Math Coprocessors

Applications Run Faster

The Math•Co™ 83C87 (DX) and 83S87 (SX) math coprocessors from ULSI Systems are complete double-CMOS, 1-micron technology chips. As a result of this superior architecture, the Math•Co coprocessors can perform floating-point mathematics in fewer clock cycles than needed by the standard Intel 80387.

Keeps on Running— Lifetime Warranty

ULSI Math•Co coprocessors have the industry's best Mean Time Between Failure (MTBF) rating—which is why we're able to offer the industry's only lifetime warranty.

Runs on Everything

Math•Co coprocessors are plug-in compatible with the IBM PC and PC clones. And they're 100% software compatible.

Runs Lean— Low Power Consumption

The Math•Co SX is ideally suited for laptop and portable IBM PC and PC compatible computers. It has a "sleep" mode feature which enables it to draw minimal power while in an idle state.

Operating Speed Availability

DX: 16, 20, 25, 33 and 40MHz
SX: 16, 20 and 25MHz

Math•Co
Advanced Math Coprocessor

Instruction	Math•Co	Intel
Add	3	12
MPY	12	17
DIV	40	77
SQRT	37-41	97
REM	68-72	81

HEADQUARTERS

ULSI Systems, Inc.
58 Daggett Drive
San Jose, CA 95134
Tel: 408-943-0562
Fax: 408-943-0106

NORTH AMERICA SALES & DISTRIBUTION

ULSI Marketing North America
4412 Spicewood Springs Road,
Suite 106
Austin, TX 78759
Tel: 512-795-8033
Fax: 512-795-9959

INTERNATIONAL SALES & DISTRIBUTION

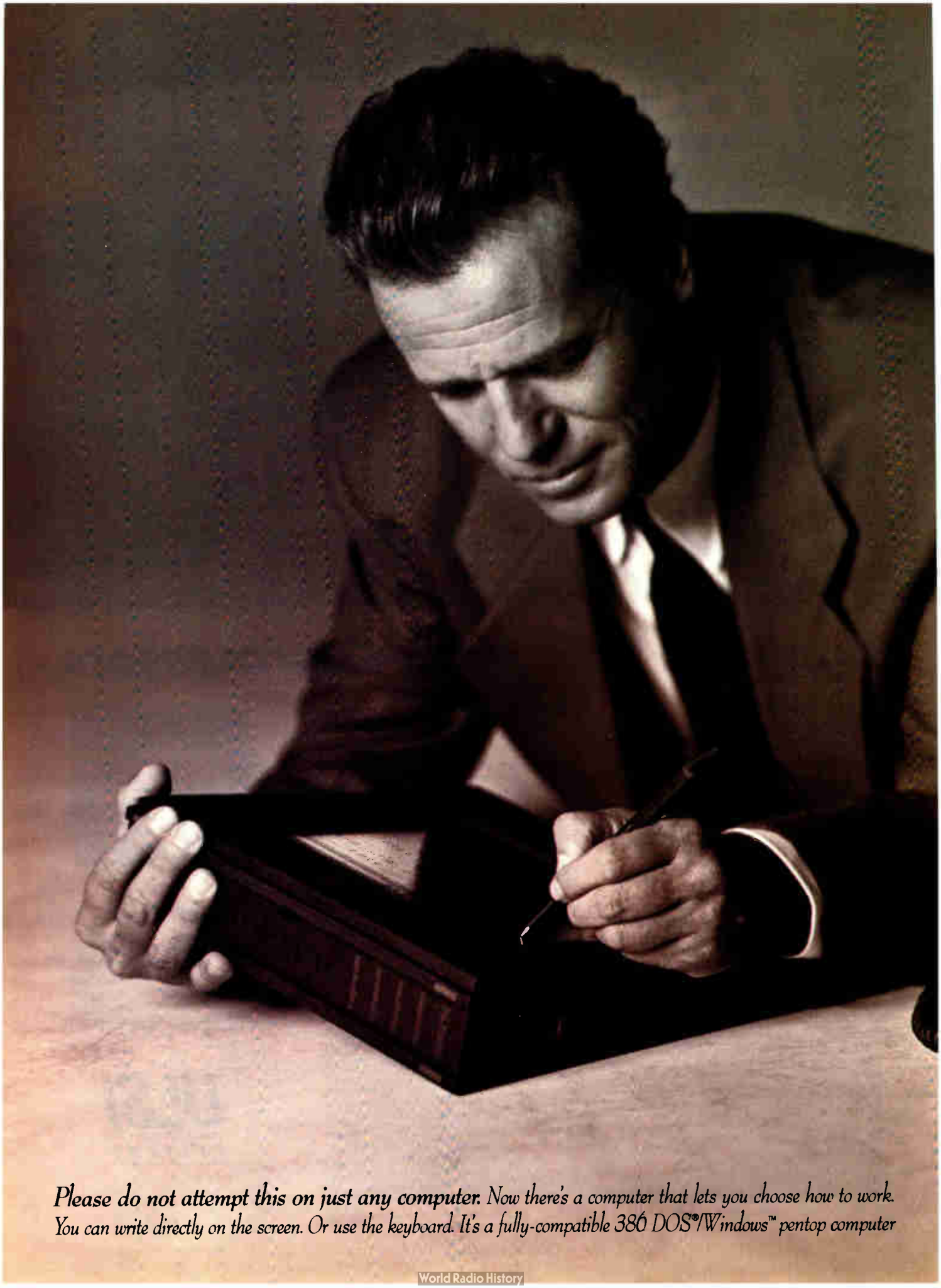
ULSI Marketing Europe
The Old Laundry
70 South View Avenue
Caversham, Reading
Berkshire RG4 0HQ
England
Tel: 0734-462247
Fax: 0734-461920

ULSI SYSTEMS

Math•Co is a registered trademark of ULSI Systems. Other product names are trademarks and/or trade names of their respective manufacturers.

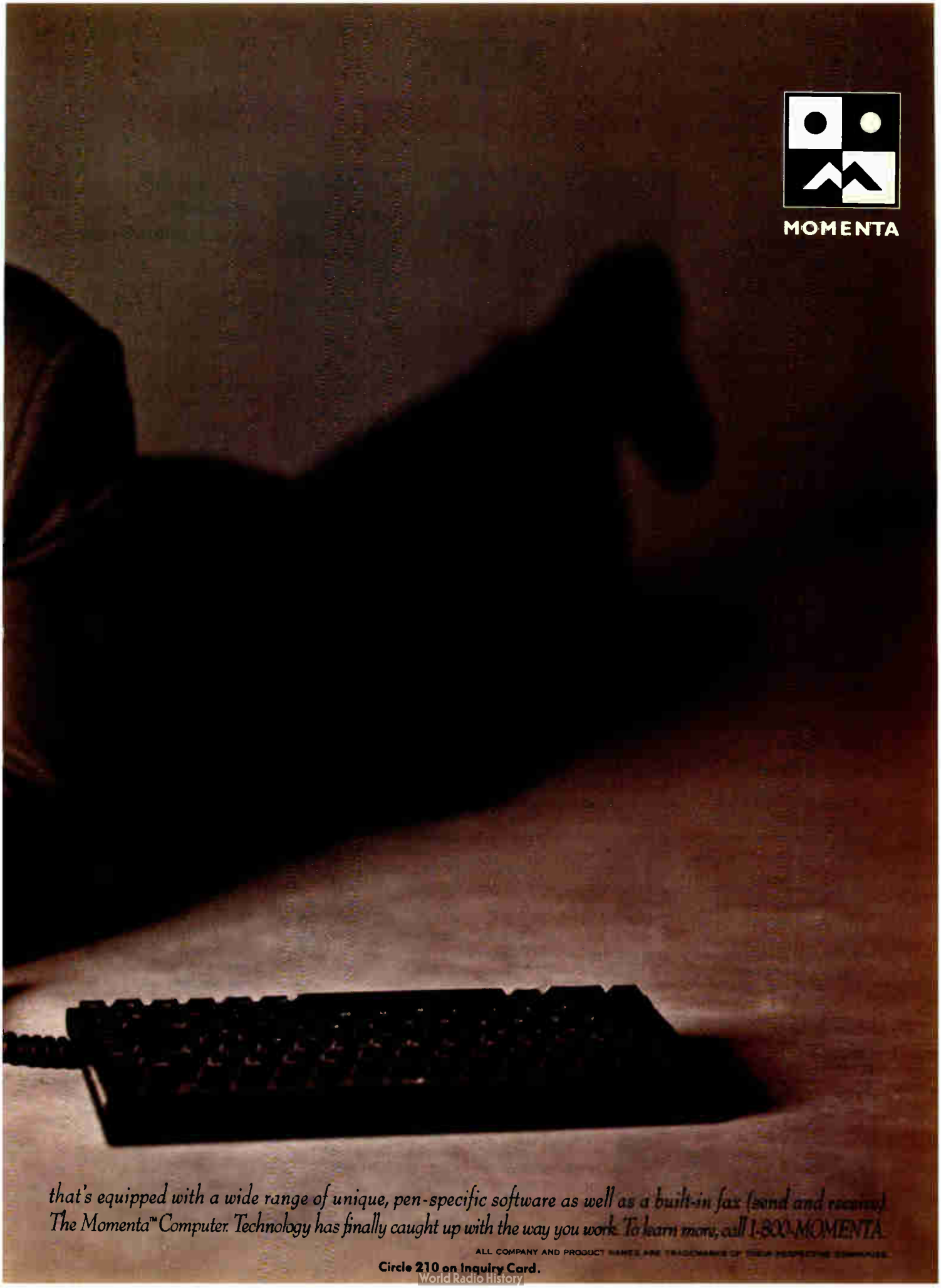
Circle 216 on Inquiry Card.

World Radio History



Please do not attempt this on just any computer. *Now there's a computer that lets you choose how to work. You can write directly on the screen. Or use the keyboard. It's a fully-compatible 386 DOS®/Windows™ pentop computer*

World Radio History



ALL COMPANY AND PRODUCT NAMES ARE TRADEMARKS OF THEIR RESPECTIVE COMPANIES.

Circle 210 on Inquiry Card.

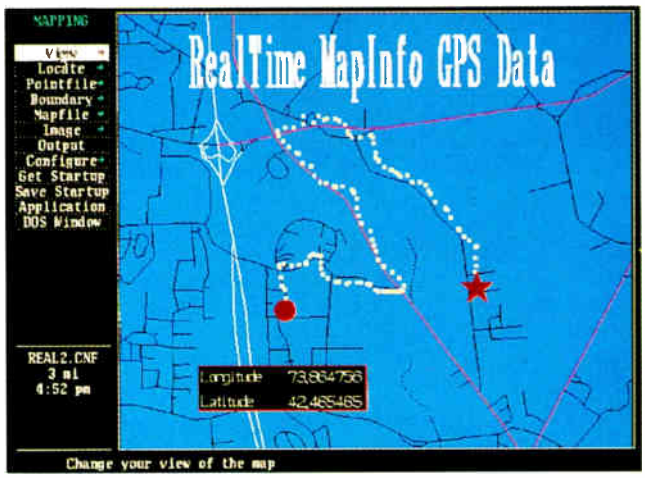
World Radio History

NEWS

WHAT'S NEW • BUSINESS SOFTWARE

Map Your Movement

By integrating with technologies such as the Global Positioning System and LORAN C, a PC-based mapping system called RealTime MapInfo lets you track moving objects on detailed, street-level computerized maps. The program lets you follow changes in status at remote sites such as traffic signals, communications lines, and utility cables. The program adds a real-time component to applications such as dispatching. The real-time program runs with MapInfo for DOS.
Price: RealTime MapInfo with serial communications, $2495; MapInfo for DOS, $995.
Contact: MapInfo Corp., 200 Broadway, Troy, NY 12180, (800) 327-8627 or (518) 274-8673; fax (518) 274-0510.
Circle 1296 on Inquiry Card.

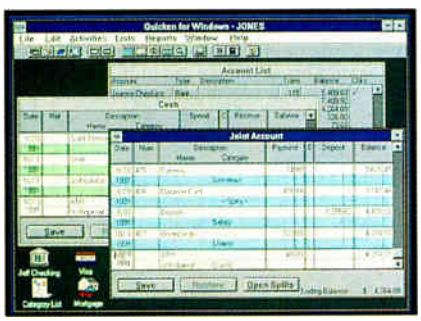


RealTime MapInfo integrates with technologies such as the Global Positioning System to track the exact location of moving objects on electronic street maps. A GPS processor takes readings from three or more satellites to determine longitude and latitude. Then a vehicle equipped with a GPS receiver sends its position to a receiving station via serial port, cellular phone, or hard connection for geographic display on RealTime MapInfo.

Quicken for Windows

The new Windows 3.0 version of the Quicken finance program lets you manage checking and savings accounts, credit cards, cash, assets and liabilities, and investments. Quicken for Windows includes a wide range of predefined reports and financial statements for homes and businesses.

The investment tracking portion of Quicken keeps historical records of investment activities such as buys, sells, dividends, interest, fees, reinvestments, stock splits, and share prices. You can use it to manage certificates of deposit, IRAs, stocks, bonds, and mutual funds. Quicken for Windows also includes CheckFree, an electronic check-paying service, and a wide range of business reports includes cash flow, profit and loss, balance sheets, and payroll summary.
Price: $69.95.
Contact: Intuit, Inc., 155 Linfield Ave., Menlo Park, CA 94026, (800) 624-8742 or (415) 322-0573.
Circle 1297 on Inquiry Card.



Quicken for Windows' support for Windows 3.0's Multiple Document Interface lets you keep multiple accounts open at the same time.

Statistics for the Next Computer

The SAS System of data access, management, analysis, and presentation applications is now available for all models in the Next family of workstations. Applications for the SAS System, which include report writing, statistics, econometric and time-series analysis, data visualization, and mathematics, support the Next machines' multitasking, networking, and NextStep GUI.

By using the SAS/Connect cooperative processing component, you can upload and download data or remotely submit SAS programs for mainframe processing.
Price: Annual fee starts at $825.
Contact: SAS Institute, Inc., SAS Campus Dr., Cary, NC 27513, (919) 677-8000.
Circle 1298 on Inquiry Card.

Syzygy 2.0 Improves Communications

The first major upgrade of the Syzygy multiple-project tracking program for DOS features shared resources and project data. Version 2.0 adds improvements in security and support for expanded and extended memory while requiring less conventional memory than did previous releases (i.e., 425 KB of RAM).

The company says that Syzygy 2.0's server-wide sharing of resources is accomplished through a single list of resources that contains Syzygy users, resources, and contacts, thus strengthening the program in the area of client-oriented project tracking.

To make it easier to transport Syzygy data between installations, version 2.0 adds a new interchange format called SyzIF that lets you export all or part of a Syzygy work map and share it with others, regardless of location.

Syzygy 2.0 offers three levels of security. Administrator, work-map administrator, and user levels offer access only to relevant functionality.

You can edit any task from a to-do list. Syzygy is useful for tracking publication projects, software development, product rollouts, and customer support.
Price: $395; 10-user edition, $1695; each additional five users, $695.
Contact: Syzygy Development, Inc., 5555 Triangle Pkwy., Suite 320, Norcross, GA 30092, (404) 662-5362; fax (404) 662-0908.
Circle 1299 on Inquiry Card.

World Radio History

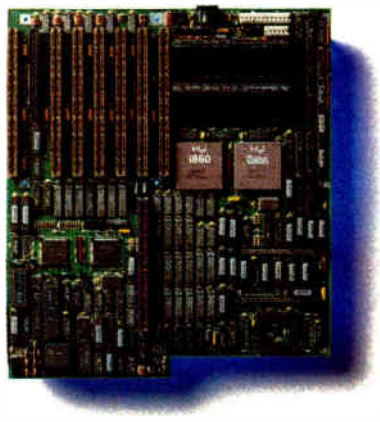
RISC FREE!

NEW! ASK ABOUT OUR NEW LOWER-PRICED INTEGRATED i386 & i486 MOTHERBOARDS

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

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

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



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

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

By adapting Intel's APX (Attached Processor Executive) software to our 4860 MotherBoard, we've created a way to exploit the power of the i860 to give you *practical* multiprocessing. In fact, i860/APX provides a base for entirely new applications made possible by the advent of the i860 RISC processor.

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

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

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

Hauppauge Computer Works, Inc.
91 Cabot Court
Hauppauge, New York 11788
Telephone: 516-434-1600
Fax: 516-434-3198
In Europe (49) 2161-17063
In Australia: (7) 262-3122
In England: 071-378-7309

Hauppauge!

Available at your local computer dealer.

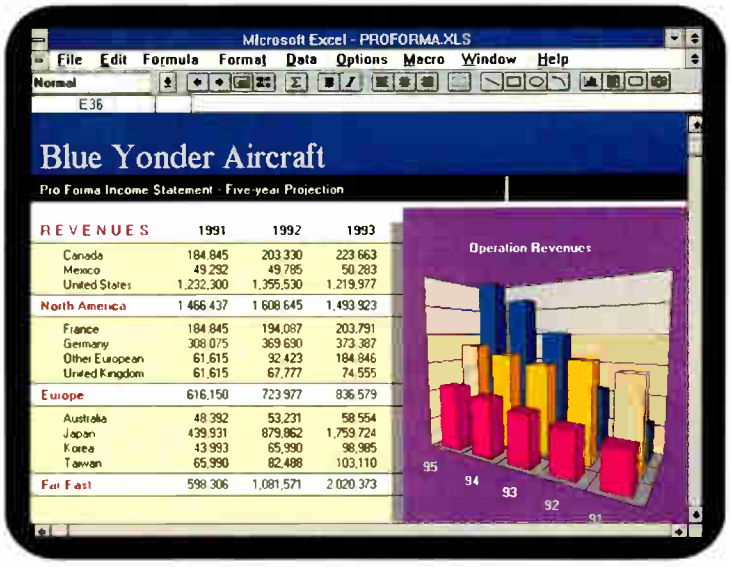
Trademarks: OS/2: IBM • Intel 386, i486, i860 and Turbo Cache 485™: Intel Corp. • DOS and Xenix: Microsoft Corp. • 4860, 4860 MotherBoard: Hauppauge

Circle 68 on Inquiry Card.

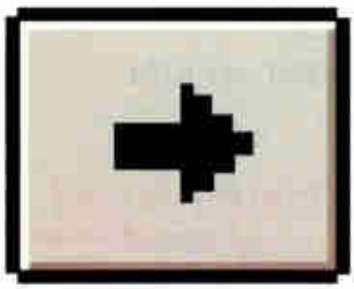
World Radio History

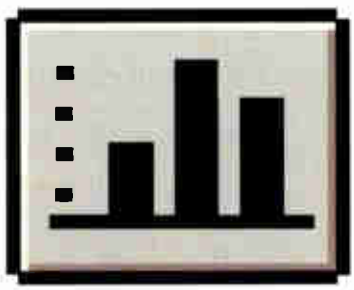
The first sprea you part of

Quick, pick a function. That's how the Toolbar works: easy access to everyday features. For instance, to get a quick column total, simply hit the Autosum™ button, and there you go.



Create an instant report: hit the outlining arrow to collapse or expand your worksheet, showing as much or as little detail as you need to. Then create a chart in one step, display it right on the worksheet, and voila—what you see on-screen is what you get at the printer.





Just a point and a click do the trick: charting, format changes, macros, you name it.

World Radio History

dsheet to make the equation.

Microsoft Excel, the leading Windows spreadsheet.

There's one very important factor that most spreadsheets don't know how to handle: you.

But Microsoft® Excel 3.0 for Windows™ has changed all that.

With plenty of easy-to-use features like the Toolbar,™ you may start to think of Microsoft Excel 3.0 as an extension of your thought process instead of a spreadsheet.

Which makes it easy for you to do some powerful things, such as consolidating up to 255 worksheets at a time, regardless of format or structure.

Or take Solver. It lets you start with a desired result and work backwards to find the variable you need.

It's also easy to share results with other Windows applications, like Microsoft Word for Windows. (Just what you'd expect from the people who pioneered the first Windows spreadsheet.)

And Microsoft Excel reads and writes Lotus® files. And converts 1-2-3® macros. And offers online help to guide you through your transition from Lotus to the friendliest spreadsheet ever seen on the personal computer.

Finally, consider that, even if you are using Lotus 1-2-3, you can upgrade to Microsoft Excel 3.0 for only $129.* Just see your local reseller or give us a call at (800) 323-3577, Dept. W15.

Microsoft Excel and you. It all adds up.

Microsoft®

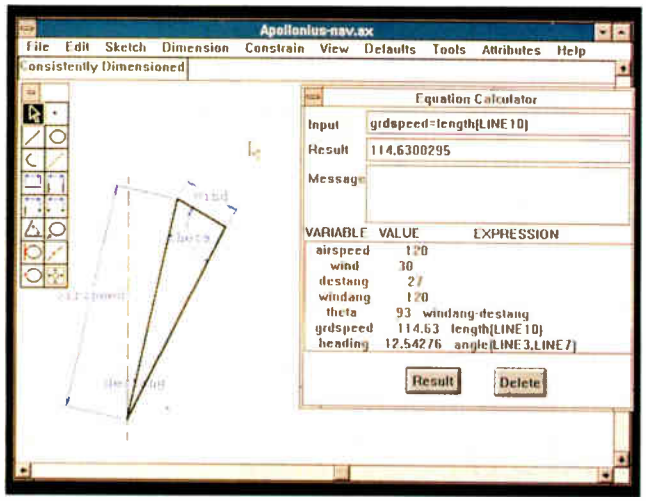
**Plus freight and applicable sales tax. Offer good for current owners of Lotus 1-2-3, SuperCalc,® Quattro® Pro and VP Planner. Please allow 2-4 weeks for delivery upon receipt of order by Microsoft. Offer expires 12/31/91. Limit one per customer. Reseller prices may vary. Call for system requirements. Offer good only in the 50 United States.* *© 1991 Microsoft Corporation. All rights reserved. Printed in the U.S.A.* *In the United States, call (800) 323-3577, Dept. W15. For information only: In Canada, call (800) 563-9048; outside the United States and Canada, call (206) 936-8661. Microsoft and the Microsoft logo are registered trademarks and Autosum, Toolbar and Windows are trademarks of Microsoft Corporation. Lotus and 1-2-3 are registered trademarks of Lotus Development Corporation.*

World Radio History

NEWS

Solve Geometry Problems by Sketching

A new Windows-based geometry solver called Apollonius lets you describe and solve geometry problems by drawing them. Once you sketch out a problem in Apollonius, you can make the problem exact by specifying known distances and angles. The program will then solve the geometry problem by giving unknown distances, angles, and areas. It also provides a scale drawing of the geometry. Two-way DXF links let the program communicate with popular CAD programs.
Price: $98.
Contact: Saltire Software, P.O. Box 1565, Beaverton, OR 97075, (503) 642-1874; fax (503) 642-5705.
Circle 1300 on Inquiry Card.



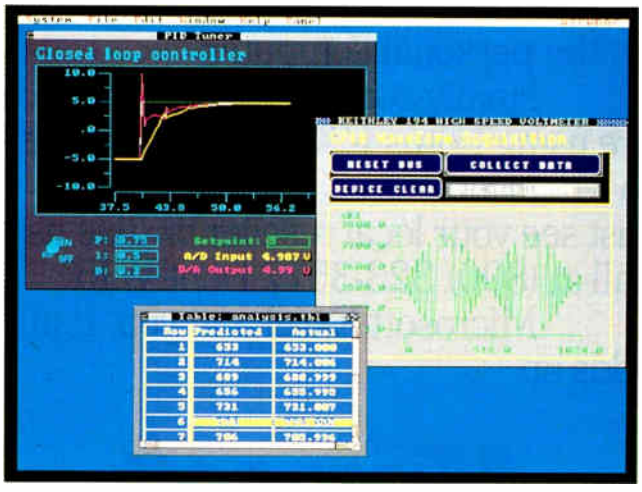
Apollonius for Windows 3.0 can solve geometry problems without requiring you to remember formulas. The program offers a sketch-based drawing package and a variational geometry solver.

Viewdac Adds GPIB, RS-232 Support

Viewdac, the data acquisition, analysis, and graphics program for 386- and 486-based PCs, can now communicate with general-purpose interface bus (GPIB) and RS-232 instruments. Viewdac 2.0 also adds an external language interface, Lotus 1-2-3 I/O, and graphics output to Hewlett-Packard Graphics Language and PostScript plotters and printers.

The GPIB IEEE 488 standard interface offers a way to connect peripherals to the PC through a 24-pin parallel connector. Version 2.0 lets you automate a range of monitoring, test, and experimental applications without programming.

Viewdac 2.0 can control up to 56 GPIB instruments at once. The new external language interface, which lets you import custom analysis routines into the system, supports C and assembly language.
Price: $2495.
Contact: Keithley Asyst Software Technologies, Inc., 100 Corporate Woods, Rochester, NY 14623, (800) 348-0033 or (716) 272-0070; fax (716) 272-0073.
Circle 1301 on Inquiry Card.



Viewdac 2.0, a data acquisition, analysis, and graphics program for 386- and 486-based PCs, integrates its features in a multitasking, window-based system.

Serial Line Analysis for the PC

A new version of DataScope, which transforms your PC into a passive or active RS-232 data- and signal-line monitor and protocol analyzer, lets you run up to four concurrent active displays in any window arrangement. Paladin says that version 2.0 can outperform expensive dedicated hardware line monitors while eliminating the guesswork in working with serial line transmissions and can collect up to 8 MB of data with microsecond time-stamp resolution.
Price: $249.
Contact: Paladin Software, Inc., 3945 Kenosha Ave., San Diego, CA 92117, (619) 490-0368; fax (619) 490-0177.
Circle 1302 on Inquiry Card.

Mac Data Analysis for Oscilloscopes

SuperScope/488, a data acquisition and analysis program for digital-storage oscilloscopes and black-box digitizers, offers a transparent interface between your instrument and the Mac. Using dialog boxes and a front panel that resembles that of an oscilloscope, you can configure the program to transfer data and measurements to the computer for display or processing.

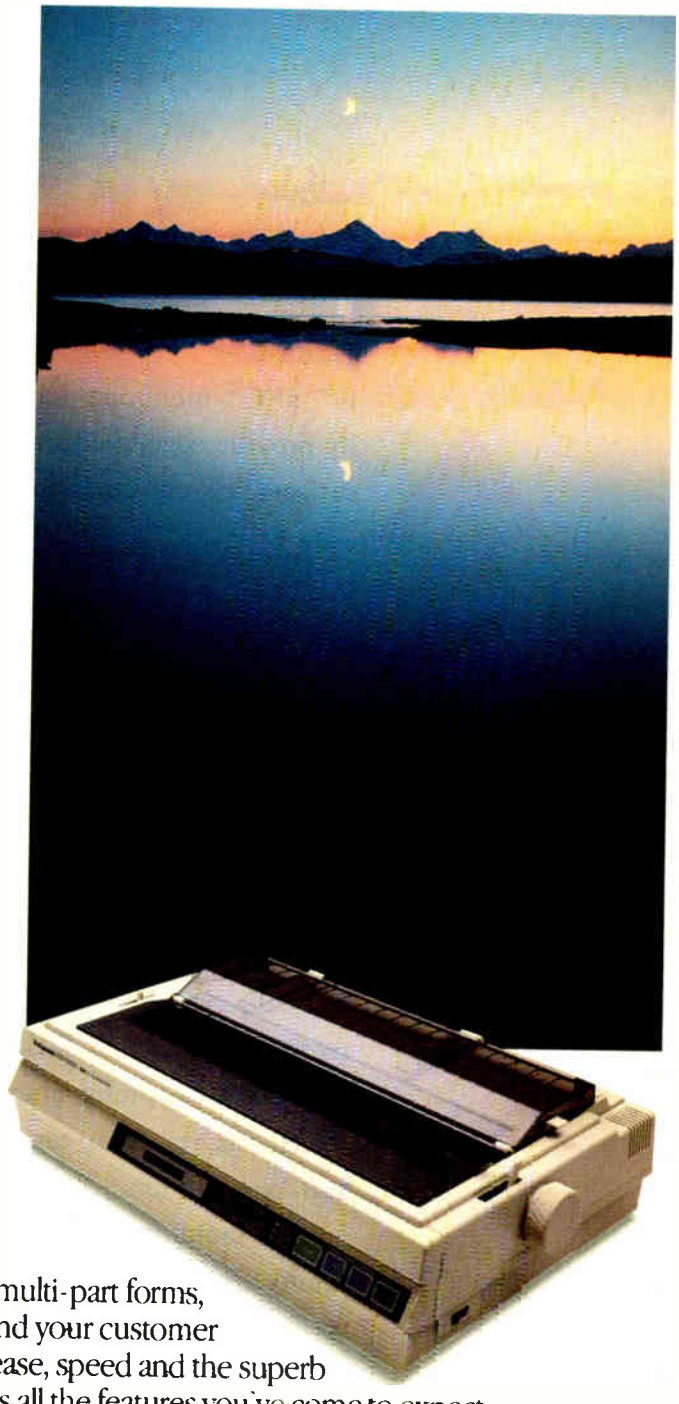
To transfer data from the oscilloscope to the program, you open a channel from within the program. All acquisitions are sent to the program without requiring programming on your part.

SuperScope/488 supports instruments from companies such as Tektronix, Hewlett-Packard, IOtech, Nicolet, and LeCroy. In addition to supporting IEEE 488 instruments, the program supports the MacADIOS line of digitizing hardware.
Price: $990; 488 Instrumentation Library, $290.
Contact: GW Instruments, Inc., 35 Medford St., Somerville, MA 02143, (617) 625-4096; fax (617) 625-1322.
Circle 1303 on Inquiry Card.

World Radio History

This is your dot matrix, printing.

This is our new quiet 2624, printing.



This is the one you've been waiting for. Panasonic® presents the first of a new generation of quiet dot matrix printers.

The KX-P2624 wide-carriage.

It doesn't scream, it whispers. Through multi-part forms, those 'industrial strength' spreadsheets, and your customer correspondence. And does them all with ease, speed and the superb reliability we've built a reputation on. It has all the features you've come to expect from the leader in dot matrix printing. And then some. One super letter-quality and seven letter-quality fonts. Multiple paper paths. An LCD display. A top speed of 300 cps in draft mode, 100 cps in letter quality. A two-year limited warranty on parts and labor.* And serene quiet.

For more information call us toll-free: 1-800-742-8086. Or, better yet, see your Panasonic dealer.

You'll like what you don't hear.

Printers, Computers, Peripherals, Copiers, Typewriters & Facsimiles

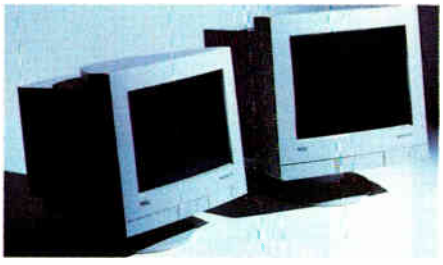
Panasonic
Office Automation OA

PQ8-BY

*See your dealer for details.

Circle 119 on Inquiry Card.

World Radio History



Are you missing the big picture? Do the little things just disappear? The new generation of MultiSync® monitors were designed to solve these problems with a larger, more readable display for windowing environments. Introducing the 15″ 4FG™ and the 17″ 5FG™ monitors. Larger screens combined with our FullScan™ capability provide edge-to-edge images in a much bigger display area. A high-contrast surface delivers exceptionally crisp text and graphics.

The new MultiSync 4FG and 5FG monitors. Images so big and sharp, you'll see more details in more detail.

Our innovations never stop. *The new MultiSync 4FG, 5FG, and 6FG monitors feature our AccuColor™ Control System. An amazing advance in computer monitors that lets you match on-screen colors to printer output, other monitors, and color reference systems such as Pantone®.*

Advanced screen technology gives you a flatter screen both horizontally and vertically, so images appear flat with less distortion at the edges. Higher refresh rates enable flicker-free images. Plus, on-board memory and digital controls store preset graphics modes and automatically size and center screen images. You can also adjust image size, position, on-screen color, and pin cushion.

Both monitors are compatible with MS-DOS based systems and the Mac II family and Quadra.™ The 4FG supports a range of video standards from VGA to 1024 x 768 (70 Hz) non-interlaced. The 5FG supports video standards from VGA to 1280 x 1024 (74 Hz) non-interlaced and many workstation modes.

The all-new 4FG and 5FG. So big, bright, and sharp it's easy to see their advantages.

C&C
Computers and Communications

PCComputing MVP MOST VALUABLE PRODUCT 1991 WINNER
MultiSync 5FG Monitor

MultiSync is a registered trademark and FG, AccuColor and FullScan are trademarks of NEC Technologies Inc. Macintosh is a registered trademark and Quadra is a trademark of Apple Computer Inc. Pantone is a registered trademark of Pantone, Inc. © 1991 NEC Technologies Inc.

World Radio History

PC WORLD BEST BUY

MultiSync 4FG Monitor

Because ↑ is the way you want to go. NEC

Call 1-800-NEC-INFO. (In Canada: 1-800-343-4418.) For immediate info via fax, call NEC FastFacts, 1-800-366-0476. Request 1531 for 4FG and 1741 for 5FG.

Circle 110 on Inquiry Card.

World Radio History

NEWS

WHAT'S NEW • CAD AND GRAPHICS SOFTWARE

What-If Analysis for Claris CAD

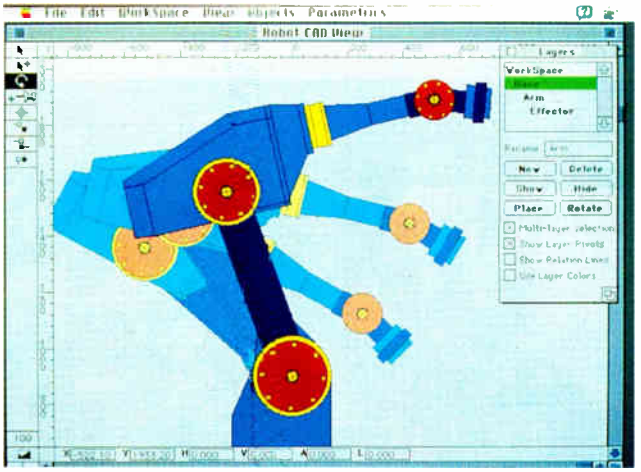
Intended for use as a companion application to Claris CAD for the Mac, Vision Software's designPower lets you focus on the overall structure of your designs and experiment with different aspects of your work. designPower features relational layering, object linking, and parametric or what-if design tools. Geometric Resolver technology ensures that your design conforms to your predetermined specifications.

designPower includes a library of parametric symbols of doors and windows for use in architectural design settings. The program also features MacDraw II and DXF capabilities for integration with other Mac CAD and graphics programs.
Price: $399.
Contact: Vision Software, 3160 De La Cruz Blvd., Suite 104, Santa Clara, CA 95054, (800) 800-8476; fax (408) 748-9584.
Circle 1304 on Inquiry Card.

Create Gigantic Posters

Version 2.1 of S. H. Pierce's poster production program, PosterWorks, lets you create posters in sizes of up to 10,000 square feet. Using the Mac and any PostScript output device, you can use PosterWorks 2.1 to design tiled posters, displays, and billboards. The program lets you adjust imported color type, line-art objects, and scanned images. It also supports System 7.0, 32-bit addressing, and enhancements for AppleTalk devices.

PosterWorks 2.1 lets you import scanned images from Mac and DOS TIFF files and from Scitex CT files.



By moving or rotating designPower's relational layers, you can see how this robotic arm will move.

The program features improved color and image control tools, including imported illustration-correction, type-correction, and image-saturation-control capabilities.

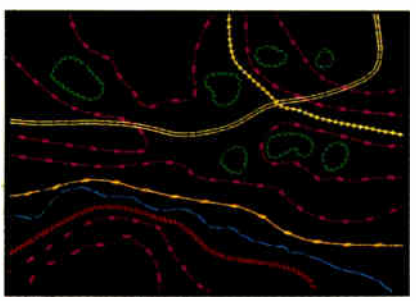
If you opt to have a professional large-format service bureau produce your hard copy, you'll appreciate PosterWorks' BureauFile export option. BureauFile contains the poster layout, imported elements, settings, and font listings in an editable format.

S. H. Pierce also offers a professional version of PosterWorks, designed for use by reprographic service bureaus in producing output on large-format devices. The Bureau Edition has all the features of PosterWorks 2.1 and takes advantage of the Mac's FPU for faster processing.
Price: PosterWorks 2.1, $295; Bureau Edition, $2995.
Contact: S. H. Pierce & Co., Suite 323, Building 600, 1 Kendall Sq., Cambridge, MA 02139, (617) 395-8350; fax (617) 395-1281.
Circle 1305 on Inquiry Card.

Customize Your CAD Linetypes

The professional-looking results of linetype annotation are now available for users of all CAD programs that can read and write DXF files. Originally available only for AutoCAD, Universal C-Line lets you assign meaning to different types of lines and routes in engineering, mapping, and many other applications.

Universal C-Line is available in three versions—Lite, Standard, and Professional—and supplies up to 130 linetypes, depending on which version you use.
Price: Lite version, $295; Standard version, $495; Professional version, $695.
Contact: M. Slinn Engineering Services, Inc., 3158 West 32nd Ave., Vancouver, B.C., Canada V6L 2C1, (800) 663-8045 or (604) 266-5380; fax (604) 266-5348.
Circle 1306 on Inquiry Card.



In this Universal C-Line map, the light blue line represents a stream, pink shows elevation, dark blue shows gas lines, green represents the tree line, and yellow marks a dirt road.

Major Visual Impact, Minor Wallet Damage

Aimed at the nonartistic user who needs an easy tool for producing polished presentation materials, Micrografx's Windows Draw provides a heavily featured illustration program at a relatively low price.

Windows Draw provides Bézier curve editing, outline fonts, and effects such as text on a curve and blending. Drawing tools include freehand, line, and curve, and you can use rotate and reshape functions to alter your view of your work.

Windows Draw includes ClipArt Manager, which lets you search the program's 2600 clip-art images by symbol name or by filename. If all that clip art doesn't meet your needs, you can import images using Windows Draw's 30 import and export filters. You can import 24-bit scanned color TIFF and PCX images for display, manipulation, or printing.
Price: $149.95.
Contact: Micrografx, Inc., 1303 Arapaho, Richardson, TX 75081; (800) 733-3729 or (214) 234-1769; fax (214) 234-2410.
Circle 1307 on Inquiry Card.

World Radio History

WE HAVE A FEW WORDS FOR PEOPLE WHO DEMAND HIGH PERFORMANCE AND EXPECT TO PAY PEANUTS FOR IT.

DELL
COMPUTER
CORPORATION

World Radio History

MORE POWER TO YOU.

You wanted it, you got it.

Introducing the Dell® 486P/20. A computer that gives you an i486™ SX processor at the price of an i386™ DX machine.

An incredible performance boost of up to 40% at virtually no additional cost.

Generating enough processing power to exploit the full potential of future versions of Microsoft® Windows™ and OS/2.

Making whatever software you run, run that much faster.

Giving you quicker recalcs, database compiles and screen refreshes.

In short, getting rid of excess wait.

And if that isn't impressive enough, the Dell 486P/20 comes with an upgradeable processor that can go from a 20 MHz i486SX chip all the way up to a high-end 33 MHz i486DX system, and even beyond.

Which, considering that we're talking about a computer under $2,000, is nothing short of revolutionary.

A true power user's desktop. For its low price, the Dell 486P/20 has a lot of technical innovations you wouldn't expect to find on even higher end machines. Things like programmable Flash EPROMs, for example, that make conventional methods of upgrading system BIOS seem almost obsolete. You won't have to take this computer apart and lose your patience trying to pry out a reluctant chip. Just slip in a diskette—that's all.

Expanding memory is equally convenient. One of the few PCs to support 16 MB SIMMs, the 486P/20 carries 4 memory expansion sockets, on its main board. So as your needs grow, you can keep adding RAM in 1, 4, or 16 MB increments up to a total of 64 MB. That's plenty of room to run your networking software, Microsoft Windows and just about any high-performance graphics application.

And talking about graphics, a small expansion of video memory to 1 MB (512K is standard) will put over *32,000 colors* at your disposal, letting you create images that approach photographic quality.

The 486P/20 also makes those images a lot easier on your eyes. It supports up to 1024 x 768 non-interlaced video at a fast 70 Hz refresh rate for a flicker-free display. Unlike the kind you get on some competitive machines that are limited to 60 Hz non-interlaced.

An i486SX processor with the future built in. Because the Dell 486P/20 upgrades via a processor chip instead of traditional processor cards, upgrading takes the form of a single, economical step:

Just remove one chip and replace it with a higher performance version.

On the other hand, if you never need to upgrade at all, you don't end up having paid a price penalty to get the system in the first place. Either way, you win.

Apart from the processor, the 486P/20 is also designed to allow easy upgrading of hard disks, memory and video capability. So when your needs change, the rest of your computer can, too.

DELL
COMPUTER
CORPORATION

800-545-1580

TO ORDER, CALL. PLEASE REFERENCE #11E56
HOURS: 7AM-9PM CT MON-FRI 8AM-4PM CT SAT 10AM-3PM CT SUN
IN CANADA 800-668-3021. IN MEXICO 95 800-010-0664.

World Radio History

THE MORE YOU GET, THE MORE YOU SAVE.

If your requirements call for a more powerful or specialized system than the one we've just mentioned, here's an amazing fact: feature for feature, you can get an even *better* deal with our higher-end i486 systems. From $248 all the way up to a whopping $1,348, your savings increase with the sophistication of the Dell System* you buy. So go ahead, read on. And if you still have any doubts, call us. We'll be happy to explain how the more our i486 systems cost, the less they actually cost.

MORE VALUE

The Dell 486P/20 is a 20 MHz i486SX general purpose workstation you can upgrade to 33 MHz and beyond.

For a configuration that costs so little, you sure get a lot.

Like programmable Flash EPROMs for easy BIOS upgradeability.

And an 80 MB hard disk drive with 15 ms access time.

And an 8 KB cache built into the processor for increased throughput.

And 4 MB of RAM on 32-bit SIMMs with gold-plated connectors for greater reliability.

And 2 floppy drives.

Surprised? Keep reading.

You'll also get a 1024 x 768 14" color monitor with long persistence phosphors.

And the power to display 32,000 colors simultaneously, if you expand video memory to 1 MB.

And factory-installed MS-DOS® 5.0 and Microsoft Windows 3.0.

And a Microsoft Mouse.

And, considering it's from Dell, a whole lot of peace of mind.

That, by itself, is worth a fortune.

THE DELL 486P/20 20 MHz i486SX SYSTEM.°
SYSTEM INCLUDES 80 MB HARD DRIVE, SUPER VGA (1024 x 768) COLOR MONITOR, 5.25"1.2 MB AND 3.5"1.44 MB FLOPPY DRIVES AND 4 MB RAM.
SAVE $248▽

MORE PRODUCTIVITY

The Dell 486D/25 is a sophisticated productivity workstation that was designed with your future in mind. To upgrade from a 25 MHz i486SX processor to a faster processor when available, all you'll need to do is replace a processor chip. Not a card. And starting with 4 MB, you can keep adding RAM up to a maximum of 64 MB.

This new system is priced on par with 33 MHz i386DX machines, yet performs up to 40% faster. And its sheer processing power is amply backed by a 100 MB hard drive with a 32 KB cache for increased throughput. A dual floppy drive completes the excellent storage arrangement.

A 1024 x 768 14" color monitor with a 70 Hz refresh rate gives you a flicker-free display. With 32,000 colors, if you make a small expansion of video RAM. Should anything go wrong, the built-in SmartVu™ diagnostic display can find the problem, even if the monitor goes down.

The 486D/25 comes with six expansion slots and five drive bays for added flexibility. You'll also get factory-loaded MS-DOS 5.0, Microsoft Windows 3.0 and a Microsoft Mouse.

THE DELL 486D/25 25 MHz i486SX SYSTEM.°
SYSTEM INCLUDES 100 MB HARD DRIVE, ULTRASCAN™ 14C MONITOR, 5.25"1.2 MB AND 3.5"1.44 MB FLOPPY DRIVES AND 4 MB RAM.
SAVE $748▽

MORE SPEED

From desktop publishing to spreadsheet applications, there's one feature that's always welcome, and that's speed. With quick recalcs and lightning fast screen refreshes, you'll get your work done faster with the Dell 486P/33.

The 33MHz i486DX processor generates up to 80% more performance than 33MHz i386DX systems. If that leaves you craving for more, you can upgrade to a faster i486 processor when available.

This 486P/33 configuration features a 100 MB hard drive with a phenomenal 15 ms average access time. An 8 KB cache in the processor boosts performance. And dual floppy drives allow you to read any diskette, regardless of MS-DOS format.

A 1024 x 768 non-interlaced big 15" color monitor with overscan gives you 30% more viewable area than the standard 14" you get with any competitively priced system. For even more versatility on desktop publishing or graphic-intensive applications, just expand video RAM to 1 MB and you'll get a 32,000 color, near-photograph quality display.

The system comes with 4 MB RAM on 32-bit SIMMs with gold-plated connectors, MS-DOS 5.0, Microsoft Windows 3.0 and a Microsoft Mouse.

THE DELL 486P/33 33 MHz i486DX SYSTEM.°
SYSTEM INCLUDES 100 MB HARD DRIVE, ULTRASCAN 15C MONITOR, 5.25"1.2 MB AND 3.5"1.44 MB FLOPPY DRIVES AND 4 MB RAM.
SAVE $948▽

MORE GRAPHICS

The Dell 486D/33 has every high-end feature you'd expect in an outstanding graphics workstation. Except a high-end price tag.

There's a superfast 33 MHz i486DX processor, with 8 KB internal cache. For even greater performance, all you'll need to do is replace a processor chip. So you can upgrade inexpensively as soon as new chips hit the market.

Should your workload, heaven forbid, triple by then, you'll still find the 200 MB hard disk more than adequate.

And as your requirements become increasingly more sophisticated, you can keep adding to the 486D/33's 8 MB RAM. With a maximum of 64 MB, there's plenty of room to grow.

Talking about room, we have a large 15" flat square monitor with 30% more viewable area than a standard 14" monitor, which makes those large spreadsheets and high resolution documents much easier to read.

The Dell 486D/33 comes with factory-loaded MS-DOS 5.0, Microsoft Windows 3.0 and a Microsoft Mouse.

THE DELL 486D/33 33 MHz i486DX SYSTEM.°
SYSTEM INCLUDES 200 MB HARD DRIVE, ULTRASCAN (1024 x 768) 15C MONITOR, 5.25"1.2 MB and 3.5"1.44 MB FLOPPY DRIVES AND 8 MB RAM.
SAVE $1,348▽

▽Savings calculated from Dell retail pricing as of Dec 9, 1991. No other discounts apply. Promotional prices expire 2/29/92. All prices and specifications are subject to change without notice. Dell and Dell System are registered trademarks, UltraScan and SmartVu are trademarks and TechFax is a service mark of Dell Computer Corporation. ◊ Leasing arranged by Leasing Group, Inc. In Canada and Mexico, configurations and prices may vary. ☆Contains an Intel™ microprocessor. Intel is a registered trademark and i386, i486 and the Intel Inside Logo are trademarks of Intel Corporation. FORTUNE 500 is a registered trademark of the Time Inc. Magazine Company. OS/2 is a registered trademark licensed to Microsoft Corporation. MS-DOS and Microsoft are registered trademarks and Windows is a trademark of Microsoft Corporation. 1991 J.D. Power and Associates® Computer End User Satisfaction Study. Phase II- Office Based Small to Medium Sized Businesses. Responses from Business End Users at 1,784 business sites. Small to Medium Sized Businesses were based on office sites with between 1 and 499 employees. Best Personal Computer in Office Based End User Satisfaction in Small to Medium Sized Businesses. J.D. Power and Associates is a registered service mark of J.D. Power and Associates. Dell disclaims proprietary interest in the marks and names of others. △Service provided by third party servicer. On-site service may not be available in certain remote locations. Shipping, handling and applicable sales tax not included in the price. ©1991 Dell Computer Corporation. All rights reserved.

World Radio History

THE DELL 486P/20 20 MHz i486SX SYSTEM.*
SYSTEM INCLUDES 50 MB HARD DRIVE, VGA COLOR MONITOR, AND 2 MB RAM.

Gold-plated SIMMs increase system reliability by eliminating connection-related errors.

There are plenty of companies anxious to sell i486 systems at a low price. All they really need is a supply of parts (the cheaper, the better) and a garage to assemble them in. Once the "production line" gets going, they place a few ads in the paper. After that, of course, it's anyone's guess as to which will last longer: the computer or the "company" it came from.

The 486P/20 is one of the few computers to feature 16 MB SIMMs.

At Dell, on the other hand, we offer lower prices by cutting down on traditional retailer mark-ups, not quality. In fact, we're almost fanatical about the quality of every machine that leaves our state-of-the-art factory. That attitude is reflected in the way we design, test, manufacture and ship our i486 systems.

To see how our i486 systems stand up to air delivery, we use a Black Box. Or, in technical parlance, a portable accelerometer/thermometer. This little device is fitted into a test computer which we then send out through regular delivery channels, much as if you had ordered it yourself. When we bring it back, the "Black Box" tells us exactly what the computer went through, in terms of shock, vibration and temperature. This innovative test is part of a series that's been so successful in helping us improve our packaging, we've won an international award for package design.

Our Black Box test makes sure your Dell computer never arrives this way.

To make our computers more reliable, we cook them. After our computers are fully assembled and configured, randomly selected units are "burned-in" and tested at 104°F.

In perhaps the most grueling temperature test we've ever come up with, pilot Dell systems must survive a storage chamber where temperatures vary rapidly between −40°C and +60°C.

World Radio History

JUST BECAUSE YOU PAY LESS DOESN'T MEAN YOU GET LESS.

And if you think that's rough, consider our shock test. Sample i486 computers are strapped to a guillotine-like apparatus which repeatedly drops them to the ground. This tells us what we can do to improve their shock tolerance level.

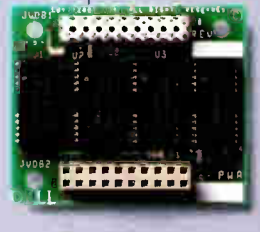
Our power supply units undergo an equally rigorous quality control process. In a test that simulates several years of actual usage, randomly selected test units are switched on and off *1,200 times*; only then can they be approved.

While our testing may seem a little extreme, it's based on a rather simple fact: if our machines don't fail with us, they haven't much chance of failing with you, either.

Our computers have a heart of gold. At Dell, we take quality consciousness so seriously, we fit our i486 systems with SIMMs that have gold-plated connectors. If you're wondering what such expensive components are doing in relatively inexpensive computers, the answer is simple: they cost us a bit more, but by eliminating connection-related errors, they're worth their weight in gold.

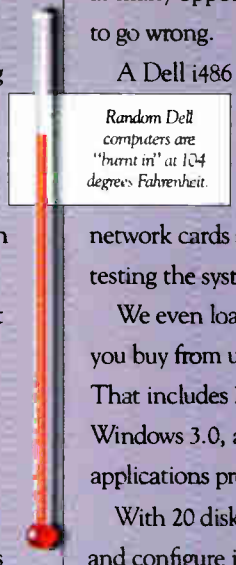
It's exactly this kind of commitment to quality control that's enabled us to meet CSA, UL, TUV-GS, FCC and VDE standards, earning worldwide regulatory approvals.

There are thousands of ways to use a Dell i486 system. Dell i486 systems are tested for compatibility with major peripherals, software applications, network topologies and network operating systems, including Banyan and Novell, in several hundred permutations per system. They're even tested for AS-400 connectivity. So you can use our machines in virtually any environment.



A small expansion of video memory gives you over 32,000 colors for a near photographic quality display.

50% fewer opportunities for things to go wrong. After the traditional computer manufacturer builds a system, it goes to the dealer, who then does his own configuring. That's 2 stages of manufacturing, which means twice as many opportunities for things to go wrong.



Random Dell computers are "burnt in" at 104 degrees Fahrenheit.

A Dell i486 system, on the other hand, is manufactured only once. We custom-configure memory boards, network cards and advanced video, testing the system as a unit.

We even load select software packages you buy from us, at no cost to you. That includes MS-DOS 5.0, Microsoft Windows 3.0, and many popular applications programs.

With 20 diskettes and 2 hours to load and configure just one system, imagine the time you'll save and the potential hassles you'll avoid. Which gives you yet another reason to buy a Dell i486 system:

When you open the box, you're ready to go.

DELL COMPUTER CORPORATION

800-545-1580

TO ORDER, CALL. PLEASE REFERENCE #11E56
HOURS: 7AM-9PM CT MON-FRI 8AM-4PM CT SAT 10AM-3PM CT SUN
IN CANADA 800-668-3021. IN MEXICO 95-800-010-0664.

World Radio History

WE THINK A COMPUTER SHOULD COME WITH MORE SUPPORT THAN THIS.

As a potential buyer, you'll receive lots of attention from most computer companies. Until they receive your check, that is. For all practical purposes, once the sale is closed, so is the company.

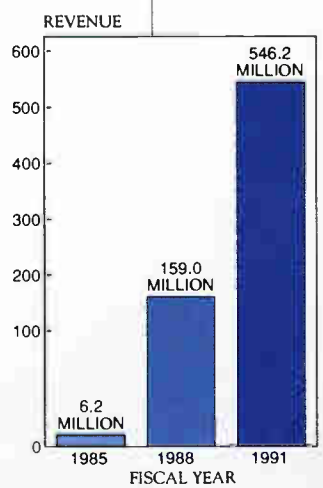
At Dell, on the other hand, half our story begins after you receive your computer. Despite our low prices, we've built a reputation for the highest level of support in the industry.

To begin with, a Dell expert works with you to figure out which computer, with which options, works best for you. We help you arrange financing from a wide variety of credit, lease and lease-to-buy plans. Then we test, pack and ship your personalized personal computer to you via two-day air standard.

In the unlikely event that you have a problem with your computer, it won't last long. Our technical support staff solves 90% of reported problems over the phone. Usually in six minutes or less.

You can also get technical help 24 hours a day via our innovative TechFax℠ line. Just dial up and detailed system information will be automatically faxed back to you from the Dell Technical Library.

We even have a special section on CompuServe's PC vendor forum. So you can view other users' problems, and, more importantly, our solutions. But what makes our bulletin board special is that we constantly monitor what goes on there. Which means we can keep track of any small problems, and stop them before they become big ones.



Dell has built a $546 million dollar business by building a relationship with every customer.

But what if you have a problem that just can't be solved over the telephone?

On-site service is an ambiguous term.

To some enterprising vendors, it conveniently means that the replacement parts, and not the service technician, will arrive on-site. Which isn't as crazy as you may imagine; there are any number of do-it-yourself computer whiz kids in this business.

If you don't count yourself among their

World Radio History

ranks, you'll prefer Dell's way of supporting our machines.

If needed, a trained technician can be at your home or office with a solution in hand, usually by the next business day.△

What's more, every time you call Dell Tech Support an entry is made in our customer database. So over time, we'll know your computer as well as you do. Maybe even better.

And you get all this support without getting a bill. Because the price of your system includes on-site service coverage for a year, and phone support forever.

Every Dell Computer comes with a trained computer staff who knows your computer as well as you do. Maybe better.

Buy a computer and get the company.

By standing firmly behind every machine we've ever sold, we've built up a $546 million company in just seven years, one customer at a time.

On the way, we've acquired quite a following. For example, the editors at *PC Week* have described the Dell service and support package as "overkill." J.D. Power and Associates* ranked Dell "Best PC in Customer Satisfaction in Small to Medium Sized Businesses."

We've won *PC Week*'s Customer Satisfaction Poll an unprecedented eight times.

And in the last 12 months alone, we've collected 53 product awards, including *PC Magazine*'s Editor's Choice, *InfoWorld*'s Buyer's Insurance and *PC World*'s Best Buy and World Class Awards.

Last year, Dell won customer satisfaction polls in the U.S., U.K., Germany and France.

And it's not just the smaller users that are satisfied, either: Dell computers are now used by over two-thirds of the FORTUNE 500.* Overseas, it's been pretty much the same story. We've more than doubled our overseas sales in the last 3 years in a row, and won in customer satisfaction surveys in the UK, Germany and France.

Still can't decide? Take 30 days to make up your mind. Within that time, if you aren't completely satisfied, just return your Dell system and we'll refund your money, no questions asked.

We're proud to add, though, that this unconditional guarantee has been used so sparingly, only 1.2% of the over half a million computers we've sold so far have ever come back.

What does keep coming back, in ever increasing numbers, are our customers. Over 70% of the people who buy a Dell computer buy another. That's perhaps the strongest statement of satisfaction any manufacturer could ever hope to receive.

So before you buy an i486 system, ask around; there are plenty of Dell users out there. And if there's anything you need, call us. But you'd better hurry.

Great computers may last a long time but great deals don't.

Our 53 product awards in 1991 alone make Dell one of the most awarded PC companies in the world.

DELL
COMPUTER
CORPORATION

800-545-1580

TO ORDER, CALL. PLEASE REFERENCE #11E56
HOURS: 7AM-9PM CT MON-FRI 8AM-4PM CT SAT 10AM-3PM CT SUN
IN CANADA 800-668-3021. IN MEXICO 95-800-010-0664.

World Radio History

FAX SHEET

SEND US THE FAX AND WE'LL SEND YOU THE FIGURES.

Fill this out, fax it to us and we'll send back a price quote, spec sheet and any other information you may need on our line of i486 systems.

PROCESSOR
- ☐ i486SX, 20 MHz
- ☐ i486SX, 25 MHz
- ☐ i486, 33 MHz
- ☐ i486, 50 MHz

ARCHITECTURE
- ☐ EISA
- ☐ ISA

CHASSIS
- ☐ Small Footprint
- ☐ Mid-Size
- ☐ Floor-Standing

DISKETTE DRIVES
- ☐ 3.5"
- ☐ 5.25"

MEMORY
- ☐ 4 MB
- ☐ 8 MB
- ☐ 16 MB

HARD DRIVES
- ☐ 50 MB
- ☐ 80 MB
- ☐ 100 MB
- ☐ 200 MB
- ☐ 320 MB
- ☐ 650 MB
- ☐ Other

MONITORS
- ☐ VGA Color, 14", 640 x 480, .39mm dot pitch
- ☐ VGA Color Plus, 14", 640 x 480, .31mm dot pitch
- ☐ Super VGA Color, 14", 1024 x 768, 28mm dot pitch
- ☐ UltraScan 14C, 14", 1024 x 768, .28mm dot pitch non-interlaced, 70 Hz
- ☐ UltraScan 15C, 15", 1024 x 768, .28mm dot pitch non-interlaced, 70 Hz
- ☐ GPD-16C, 16", 1280 x 1024, .31mm dot pitch
- ☐ GPD-19C, 19", 1280 x 1024, .31mm dot pitch

OPERATING SYSTEMS
- ☐ MS-DOS 3.3
- ☐ MS-DOS 4.01
- ☐ MS-DOS 5.0
- ☐ MS-OS/2 1.21
- ☐ Dell UNIX® System V

OTHER (i.e.: tape drive, network card, mouse or modem)

_____

_____

Name _____

Title _____

Company _____ (If Applicable)

Address _____

City _____ State _____ Zip _____

Fax Number _____

Please have a Dell representative call me at

( ) _____

DELL COMPUTER CORPORATION

800-727-8320

FOR MORE INFORMATION, PLEASE FAX US.
#11E56

World Radio History

MenuWorks Keeps Private Data Private

MenuWorks Total Security provides PC security via a wide variety of tools. The program offers security through start-up control, access control, auditing and tracking, and data encryption. Access control is provided through user logon, locking of selected drives and directories, controlling access to individual files, and locking DOS commands.

MenuWorks Total Security provides Data Encryption Standard–compliant encryption through the creation of multiple virtual drives on any one storage device. The administrator designates the virtual drive or drives that are to be encrypted.

Price: $149.95.
Contact: PC Dynamics, Inc., 31332 Via Colinas, Suite 102, Westlake Village, CA 91362, (800) 888-1741 or (818) 889-1741; fax (818) 889-1014.
Circle 1002 on Inquiry Card.

Power-Launch with hDC

The latest offering by hDC is a Windows utility that combines the functionality of a system menu launcher, a virtual screen driver, a command scheduler, and a task manager.

Power Launcher lets you launch, individually or in combination, any application, document, script, or macro with a single click of the mouse. You can expand the desktop's virtual screen to as much as 64 times the current size.

Price: $99.95.
Contact: hDC Computer Corp., 6742 185th Ave. NE, Redmond, WA 98052, (206) 885-5550; fax (206) 881-9770.
Circle 1000 on Inquiry Card.

MenuWorks' password-protection control is one of the utility's many security tools.

Get the Most from Your Memory

StuffIt SpaceMaker incorporates two compression functions in a single software package. The Aladdin product features on-the-fly and automatic background compression capabilities.

To compress a file or folder, you need only attach a preset keyword to the document's name. Once you've attached the keyword, SpaceMaker works transparently.

SpaceMaker's Idle-Time Compression feature automatically compresses data while your Mac is idle. You can specify particular disks, files, or folders that should not be compressed by Idle-Time, or you can turn off the feature altogether.

SpaceMaker compresses most files to half their original size, and it can compress some files, such as graphics and database information, by as much as 98 percent. According to Aladdin, the software works with all Mac applications, and it can compress data at speeds comparable to those of hardware-based compression boards.

You can also create StuffIt Deluxe and self-extracting archives. The program includes Aladdin's StuffIt Engine.

Price: $59.95.
Contact: Aladdin Systems, Inc., 165 Westridge Dr., Watsonville, CA 95076, (408) 761-6200; fax (408) 761-6206.
Circle 1003 on Inquiry Card.

SuperStor removes data redundancy and can automatically compress your files to a third of their original size when you write them to disk. AddStor's new package performs on-the-fly data compression transparently.

Because it is a software-only product, SuperStor does not require an expansion slot or additional hardware. According to AddStor, the program's compression capabilities equal or exceed those of plug-in boards. SuperStor is compatible with any hard drive, Plus Card, Bernoulli Box, or floppy drive running DOS or Windows.

Price: $139.
Contact: AddStor, Inc., 3905 Bohannon Dr., Menlo Park, CA 94025, (800) 732-3133 or (415) 688-0470; fax (415) 688-0466.
Circle 1004 on Inquiry Card.

Keep an Eye on Your Power

Monitoring your computer's power source is a job more easily done with a little help. Systems Enhancement offers two products that provide power monitoring across a host of operating environments.

PowerMon (for OS/2 LAN Manager, 3+ Open OS/2 LAN Manager, and OS/LAN Server) and SmartMon (for SCO Unix, SCO Xenix, System V release 4, DEC VMS, SunOS, and Interactive Unix) alert you to changes in your system's power supply and let you set up a procedure for the monitoring system to follow in the event of a power disruption.

PowerMon comprises software and cables that monitor your uninterruptible power supply (UPS) by constantly checking for power failure. On discovering a failure, PowerMon follows your predetermined directions, which can include a system shutdown.

SmartMon lets you display or print information pertaining to the status of your UPS's batteries and utilities.

Price: PowerMon, $149; SmartMon, $199 and up (depending on operating system).
Contact: Systems Enhancement Corp., 761 Spirit of St. Louis Blvd., Chesterfield, MO 63005, (314) 532-2855; fax (314) 537-2791.
Circle 1001 on Inquiry Card.

World Radio History

NEWS

WHAT'S NEW • WORD PROCESSING

Wang Integrates Non-GUI Applications

Wang's new UpWord 2.0 document-processing program for Windows 3.0 integrates with Windows and non-Windows applications and offers workgroup computing and image management. The program's compound document management capability lets you keep documents and related external images together when copying, renaming, moving, or deleting files.

Wang says that UpWord 2.0's ability to link with non-Windows applications, such as Lotus 1-2-3 and dBase, lets you enjoy Windows document processing without having to shift all your applications to a GUI.

UpWord's workgroup functions support redlining and revision tracking.
Price: $495.
Contact: Wang Laboratories, Inc., 1 Industrial Ave., Lowell, MA 01851, (508) 459-5000.
Circle 1005 on Inquiry Card.

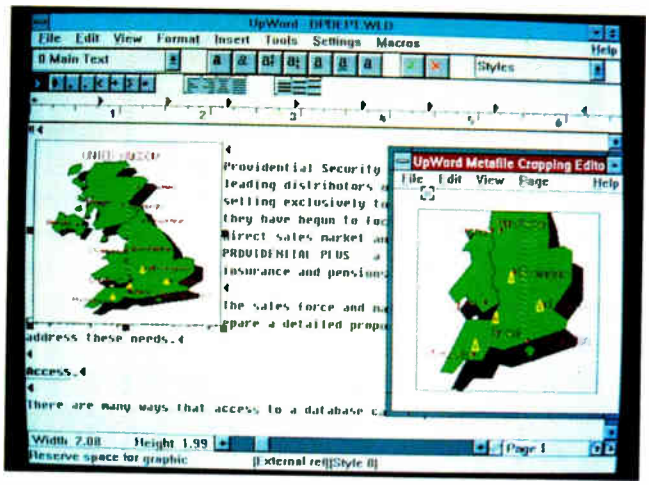
Two DTP Programs for Windows 3.0

Express Publisher for Windows is for the business user who wants to create professional-looking ads, newsletters, brochures, flyers, and other design-intensive documents. The program offers templates called Express Designs that include layouts and styles.

Express Publisher for Windows provides thumbnail previews, which are live thumbnail graphical representations of document templates, clip art, fonts, spacing, and alignment options that you can edit. With Express Publisher for Windows, you can rotate text, text frames, and other page elements. The program comes with Adobe Type Manager, 13 font outlines, and 20 predesigned templates. A built-in spelling checker is also included.
Price: $249.95.
Contact: Power Up Software Corp., 2929 Campus Dr., San Mateo, CA 94403, (415) 345-5900; fax (415) 349-1356.
Circle 1006 on Inquiry Card.

Windows users looking for an inexpensive desktop publishing program can buy PagePlus for Windows for less than $150. The program offers text and image rotation, typographic control, and an electronic pasteboard for creating publications.

PagePlus for Windows lets you control text point sizes from 4 to 250 points in 1/10-point increments, Serif says. The program offers expand, condense, slant, kern, letter-space, outline, and pattern features. It imports text and graphics from a variety of applications.
Price: $149.
Contact: Serif, Inc., P.O. Box 803, Nashua, NH 03061, (603) 889-8650; fax (603) 889-1127.
Circle 1007 on Inquiry Card.



UpWord 2.0 lets you crop, scale, or size images as needed. Within the cropping editor, you can invoke a graphics editor, such as CorelDraw for Windows 3.0, for further image enhancement.

Page Layout for the Amiga

PageSetter III, an enhanced version of Gold Disk's entry-level page layout program, provides text and graphics creation as well as a layout system for the Amiga. Along with a word processor and spelling checker, the program offers a color paint program and clip art.

New output capabilities include PostScript compatibility and color printing of bit maps and art. PageSetter III runs on any Amiga, and it is compatible with Workbench 2.0.
Price: $129.95.
Contact: Gold Disk, 5155 Spectrum Way, Unit 5, Mississauga, Ontario, Canada L4W 5A1, (416) 602-4000; fax (416) 602-4001.
Circle 1010 on Inquiry Card.

Create Font Special Effects

MakeUp, a program for Windows 3.x that lets you create special effects with type, combines text manipulation and graphics for creating logos, illustrations, banners, and mastheads. MakeUp supports PostScript Type 1, TrueType, and Bitstream Speedo type, and it doesn't require a separate font-scaling utility.

MakeUp ships with five typefaces. You can rotate, stretch, flip, and otherwise manipulate text with MakeUp. You can even pour text into customized shapes, Bitstream reports. The program supports color.
Price: $149.
Contact: Bitstream, Inc., 215 First St., Cambridge, MA 02142, (617) 497-6222.
Circle 1008 on Inquiry Card.

Power Up Software's TextAppeal for Windows lets you create more visually interesting documents with custom headlines, logos, bursts, and other text effects. It combines type manipulation, drawing tools, and the ability to import and export graphical images.

With TextAppeal, you can curve, rotate, shadow, and stretch type to create an image for your document. You can combine text with lines, curves, and boxes created with the program's drawing tools and clip art to produce custom logos, bursts, and headlines.
Price: $129.95.
Contact: Power Up Software Corp., 2929 Campus Dr., San Mateo, CA 94403, (415) 345-5900; fax (415) 349-1356.
Circle 1009 on Inquiry Card.

World Radio History

486 33MHz Power!

486/33 Features

80486 33MHZ 32 bit INTEL CPU
4MB RAM-Expandable to 32MB
AMI BIOS with Extended CMOS Setup
256K Static RAM Cache
8 Expansion Slots (ISA 16 bit)
14" SuperVGA Color Monitor, 1024x768, .28mm dot
1MB VGA Card, resolves 1024x768 at 256 colors
1.2 and 1.44 MB Floppy Disk Drives
120MB IDE Hard Drive, 19ms
Desktop Style Case (Tower Option Available)
220W Switching Power Supply
Serial, Parallel, and Game Ports
MS-DOS 5.0, Serial Mouse included
Full 1 Year Limited Warranty-Parts and Labor

EISA System, 32 bit Bus (EISA has 7 32-bit slots, 1 16-bit slot)	add $1000	336MB ESDI (18ms)	add $1150
		760MB ESDI (14ms)	add $1950
Sony 1304 (non interlaced)	add $450	760MB SCSI (14ms)	add $2250
200MB IDE (19ms)	add $300	ESDI/EISA 32-bit Controller	add $795

SHOPPER'S ADVISORY-- If you're finding yourself stuck in the confusing forest of computer dealers, you won't find many that can claim: *1) A Large National Customer Base, 2) Major Corporate Clients, 3) Retail/Mail Order and Wholesale business, 4) An Established Tradition of Customer Support.* But **WE CAN!** Since 1984, we continue our commitment to providing the highest quality components and service at the best price.

Stay on the cutting edge with Lucky Star International!

All LSI Professional Systems Are FCC Certified.

386/25 Super VGA

42MB Hard Drive, 1MB RAM, SuperVGA

80386 25MHZ 32 bit CPU
1MB RAM-Expandable to 16MB
14" SuperVGA Color Monitor
512K Super VGA Card
1.2MB Floppy Disk Drive (add $65 for 2nd Floppy)
42MB IDE Hard Drive, 28ms
Desktop Style Case
220W Switching Power Supply
Serial, Parallel, and Game Ports
Full 1 Year Limited Warranty-Parts and Labor

$1295.00

286 and 386 SX

42MB Hard Drive, 1MB RAM, Mono Monitor

1MB RAM-Exp. to 4MB(286) or 8MB(SX)
12" Monochrome TTL Monitor, 720x348 res.
MonoGraphic Card, Hercules Compatible
1.2MB Floppy Disk Drive
42MB IDE Hard Drive, 28ms
Desktop Style Case, 220W Switching PS
Serial, Parallel, and Game Ports
Full 1 Year Limited Warranty-Parts and Labor

386SX/20 **$845.00**
286/12 **$645.00**
386SX/16 **$795.00**

14" SuperVGA, 512K VRAM	add $350
80MB Hard Drive, 19ms	add $100
120MB Hard Drive, 19ms	add $200
Memory Upgrade (per MB)	add $65

MS-DOS 5.0 (with System Purchase Only)	$65
Logitech Mouseman, Serial	$69
Logitech Mouseman, Bus	$79
Logitech Trackman, Serial	$89
Logitech Grayscale Scanman	$315
TEAC 1.2 Floppy	$65
TEAC 1.44 Floppy w/ bracket	$69
Microscience 8040, 42MB IDE HD, 23ms	$235
Conner 30104, 120MB IDE HD, 19ms	$415
120MB Tape Backup	$275
CM7 SuperVGA, 14" (Interlaced at 1024, .28 dot)	$345
CM8 SuperVGA, 14" (Non-Interlaced 1024, .28 dot)	$475
AM9 SuperVGA, 14" (Sony Tube, Non-Intl., .25 dot)	$575

386/33 Power System

120MB Hard Drive, 4MB RAM, SuperVGA

80386 33MHZ 32 bit CPU
4MB RAM-Expandable to 32MB
64K Cache-Expandable to 128K
14" SuperVGA Color Monitor, 1024x768
512K Super VGA Card, 1024x768 at 16 colors
1.2 and 1.44 MB Floppy Disk Drives
120MB IDE Hard Drive, 19ms
Desktop Style Case
220W Switching Power Supply
Serial, Parallel, and Game Ports
MS-DOS 5.0, Serial Mouse included
Full 1 Year Limited Warranty-Parts/Labor

Limited Time At This LOW LOW PRICE!!! **$1695.00**

Non-Interlaced SVGA, .25mm dot (Sony tube)	add $350
16" Non-Interlaced SVGA, .28mm dot	add $850
20" Non-Interlaced SVGA	CALL

Above Video Upgrades include 1MB VGA Card

Quality Service and Support Since 1984

Locations Nationwide NOW OPEN IN ATLANTA, GA!

Lucky Computer Co.

LUCKY STAR INTERNATIONAL

Retail Hours

Mon-Sat 9am-6pm
Eastern/Central/Pacific Time
Sunday Noon-5pm
Addison, TX
Tukwila, WA
Locations ONLY

MasterCard VISA DISCOVER

Mail Order Hours 9am-6pm Central Time 1-800-966-5825

SOUTHWEST REGION

1701 Greenville Ave #602
Richardson, TX 75081
(214)690-6110

2132 N. Collins
Arlington, TX 76011
(817)265-1883

4151 Beltline Rd. #120
Addison, TX 75244
(214)702-8588

12110 Westheimer
Houston, TX 77077
(713)497-7887

NORTHWEST REGION

10773 SW Bvtn.-Hills. Hwy
Beaverton, OR 97005
(503)671-0961

14220 NE 20th #D
Bellevue, WA 98007
(206)643-2673

17338 Southcenter Pkwy.
Tukwila, WA 98188
(206)575-9060

GREATER ATLANTA
5939 Jimmy Carter Blvd.
Norcross, GA 30071
(404)416-9605

Copyright 1991 Lucky Computer Company. Lucky Star International, MS-DOS, Intel, 486, Microsoft, Windows, Conner, Teac, and Microscience are trademarks of their respective companies. All Prices/Specifications subject to change.

Circle 558 on Inquiry Card (RESELLERS: 559).

World Radio History

Convert Fonts into TrueType

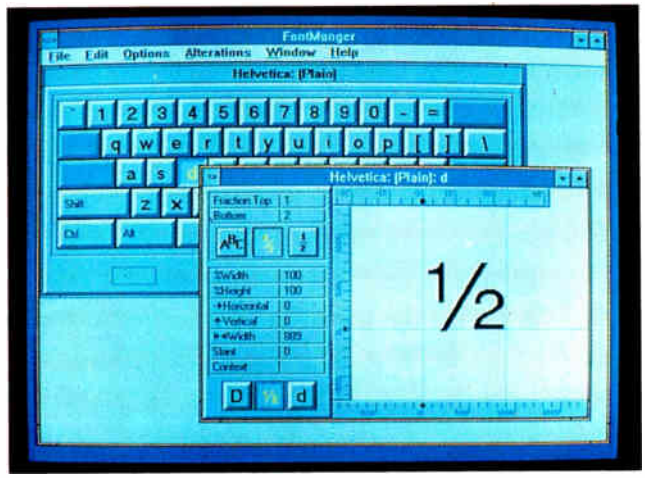
The FontMonger type-manipulation program for PCs lets you convert your existing type library into TrueType format for use with Windows 3.1.

FontMonger converts font files in any direction among the major font formats. It can also automatically convert selected characters or entire fonts into Adobe Illustrator and Encapsulated PostScript file formats (for both Windows and Mac graphics applications) and the Windows metafile format. Like the Mac version of FontMonger, the Windows version offers a blend of type-modification capabilities.

FontMonger enables you to generate inferior and superior characters for mathematical and scientific formulas, pricing, and fractions directly from your keyboard.

Using FontMonger, you can combine type with graphics and merge it back into a font for immediate access and quick placement of frequently used graphics and logos.

Price: $99.95.
Contact: Ares Software Corp., 561 Pilgrim Dr., Suite D, Foster City, CA 94404, (415) 578-9090; fax (415) 378-8999.
Circle 1013 on Inquiry Card.



Using FontMonger's Alter Character window, you can assign specialized characters to specific keys on your keyboard.

Paging Doctor PC

The next time you're feeling ill, try asking your PC for medical advice. Schueler's Home Medical Advisor (HMA) is a reference system that provides information on self-care, preventative medicine, and symptom analysis.

Designed by a team of emergency-room physicians, the program uses an interrogative format to diagnose your problem. HMA's topic files cover symptoms, diseases, injuries, poisons, drugs, medical tests, and specialist referrals.

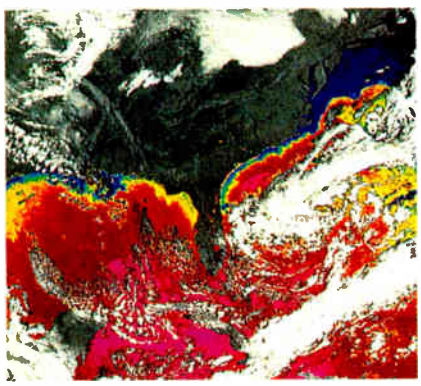
HMA includes hundreds of images to help you distinguish between similar conditions. The program is not intended to be a substitute for the doctor. Once you've consulted HMA, you'll know what to expect when you seek treatment, and you'll be better able to choose specialists.

Price: $99.95.
Contact: Pixel Perfect, Inc., 10460 South Tropical Trail, Merritt Island, FL 32952, (407) 777-5353; fax (407) 777-0323.
Circle 1011 on Inquiry Card.

Weather Images from Space

Now you can receive real-time U.S. and Soviet satellite images on your Macintosh. SatView gathers data from satellites that orbit the earth every 100 minutes, and it displays cloud cover and ocean surface temperatures worldwide. SatView offers image-processing and -analysis software and a NuBus card with an onboard processor for image digitization and storage.

Price: $3950.
Contact: Marisys, Inc., 2905 South Federal Hwy., Suite C-10, Delray Beach, FL 33483, (407) 272-3490; fax (407) 272-3485.
Circle 1015 on Inquiry Card.



U.S. and Soviet polar-orbiting satellites provide the weather feeds to SatView.

Speed Up Your Graphics Windows Display

WinSpeed for Windows 3.0, an alternative to speed-up cards, will boost the speed at which graphical images are displayed on your screen by two to five times. The program supports about 85 percent of the Super VGA cards on the market.

Price: $79.
Contact: Panacea, Inc., Post Office Sq., Suite 4, 24 Orchard View Dr., Londonderry, NH 03053, (603) 437-5022; fax (603) 434-2461.
Circle 1014 on Inquiry Card.

New Authorware Supports Multimedia

With Authorware Professional for Windows, you can develop interactive applications that support CD audio, MIDI, animation, and Windows sound. Authorware says that the Windows 3.0 version is a complement to the Mac version, providing almost 100 percent conversion of application structure and content.

The program comes with an object-authoring interface for nontechnical users. You can build sophisticated applications without scripting, the company reports. As you create your application, Authorware guides you through development with a graphical map.

Price: $8000.
Contact: Authorware, Inc., 275 Shoreline Dr., Suite 535, Redwood City, CA 94065, (415) 595-3101; fax (415) 595-3077.
Circle 1012 on Inquiry Card.

World Radio History

JUST HOW FAST IS PROGRAMMING IN APL★PLUS?

This fast. APL★PLUS streamlines the whole programming process and screams through complex data manipulations with turbo speed.

APL★PLUS notation is like the math you already know. So you can solve problems the way you think about them, instead of wasting time figuring out *how* to solve them. And it's concise. A few lines of APL★PLUS can replace pages of code written in other languages.

Explore complex "what if" scenarios using built-in functions that manipulate tables of data like single objects. Prototype solutions and quickly put them to the test. Develop complete applications in record-breaking time with editing, graphics, screen windowing and communications facilities, mouse support and interfaces to spreadsheets and subroutines written in other languages.

Use our tutorial to jump start the whole programming process. Then, use APL★PLUS' speed and power to zoom through your development cycle so fast it's almost illegal. APL★PLUS. The programming language to use when you have miles of data. And the need for speed. Call today and we'll rush you a *free* demo disk.

APL★PLUS®

(800) 592-0050 Ext. 875

In Maryland (301) 984-5123

APL★PLUS is a registered trademark of STSC, Inc., and is available for IBM PC's and compatibles, UNIX workstations, VAX minicomputers and IBM mainframes. Fax: (301) 984-5094 TELEX: 898085 (STSC ROVE) © 1991 STSC, Inc. Germany: 069-80053-0/0212-33-90-99; France: 01-45-27-20-61; U.K.: 071-436-9481; Canada: 416-369-1630; Spain: 01-556-6056. All other countries, call (301) 984-5412 for the name of a local dealer.

Circle 561 on Inquiry Card.

World Radio History

NEWS

WHAT'S NEW • WINDOWS PROGRAMMING

Expert Systems Through Diagraming

An upgrade of the Adept expert-system development tool lets you model business and technical procedures and turn them into interactive software applications that guide an end user through complex tasks.

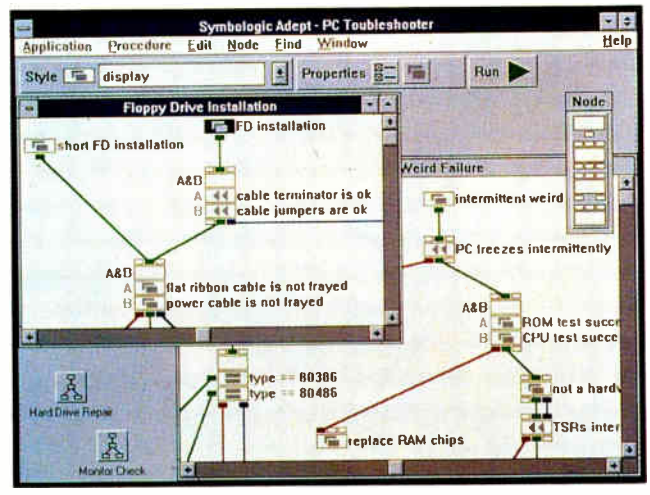
Adept 2.0, which runs under Windows 3.0, lets you create a graphical depiction of expert procedures—much as you would create a flowchart—to develop a clear picture of the choices and the alternatives. Adept 2.0 doesn't force you to create an expert system using if-then statements.

Other new features include graphical debugging and Dynamic Data Exchange. The program uses a visual programming method and lets you insert changes into your system at any point.

Price: $695.

Contact: Symbologic Corp., 15379 Northeast 90th St., Redmond, WA 98052, (206) 881-3938; fax (206) 881-7198.

Circle 1016 on Inquiry Card.



By creating a graphical depiction of the procedures that experts use, Adept 2.0 turns real-life decisions into interactive software programs.

Testing for Unix, OS/2, and Windows

As GUI applications become more complex, especially LAN-based and groupware programs, it's getting harder to find, track, and fix software bugs. Software Quality Automation's SQA:Robot lets you execute a standard test and play back the results during system testing.

SQA:Robot can record all functions of the GUI environment, including mouse and keyboard activities and window moving, resizing, and scrolling. Advanced script logic and test-execution/validation techniques are also included. SQA says the program is integrated with Visual Basic, which lets you interact with nonproprietary scripting languages in modifying test scripts.

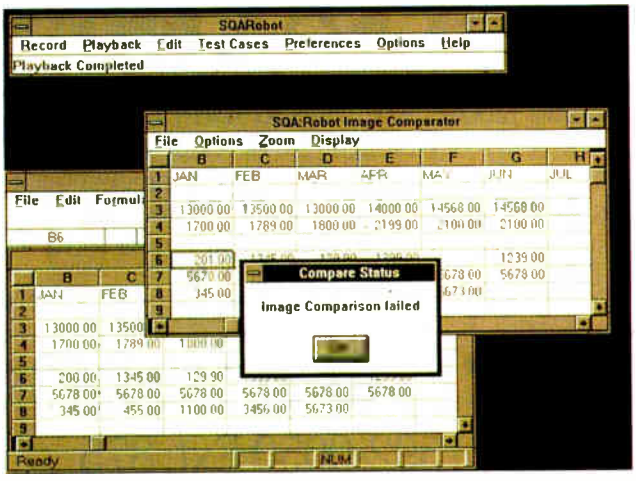
SQA:Robot works with SQA:Manager, SQA's software test management program. SQA:Manager consists of three tools: the test manager, the problem tracker, and the analyzer.

SQA:Manager works under DOS, Windows 3.0, OS/2 Presentation Manager, and the X Window System under Unix. SQA:Robot works under Windows and OS/2.

Price: SQA:Robot for Windows, $695; SQA:Robot for Presentation Manager, $995; SQA:Manager, $3500 and up.

Contact: Software Quality Automation, 1 Parker St., Lawrence, MA 01843, (800) 228-9922 or (508) 689-0182; fax (508) 689-4195.

Circle 1019 on Inquiry Card.



SQA:Robot's record/playback functions let you conduct performance and regression tests on GUI modules. The version for Windows 3.0 is shown here.

Field Validation for Windows Applications

For use with any Windows dialogue editor (e.g., the dialogue editors of the Software Development Kit or WindowsMaker Professional), Magic Fields offers a collection of objects that perform data-field validation. The collection includes objects that perform numeric, text, date, and other data-field validation. Without programming, you can also define fields such as employee number and invoice number.

Price: U.S. version, $295; international version, $369.

Contact: Blue Sky Software Corp., 7486 La Jolla Blvd., Suite 3, La Jolla, CA 92037, (619) 459-6365; fax (619) 459-6366.

Circle 1018 on Inquiry Card.

Learn Windows Programming Fast

An interactive system from IntelligenceWare teaches you Windows 3.0 programming techniques with hypertext, graphical tutorials, and source code annotations and explanations. Source code explanations in WindowsTeach are provided with hypertext clarifications in a multiwindow environment.

WindowsTeach's concepts component explains the structure of Windows, and the programs component offers 21 structured programs, each illustrating a feature of Windows.

Price: $123.

Contact: IntelligenceWare, Inc., 5933 West Century Blvd., Los Angeles, CA 90045, (213) 216-6177; fax (213) 417-8897.

Circle 1017 on Inquiry Card.

World Radio History

To assure you'll get the most for your systems, we offer you:

Pre-Sale Consultation

We believe your thorough understanding of how our systems work for you is vital in making the right purchasing decision. Our consultants are specially trained to ease the decision process by answering even the most intricate questions you may have.

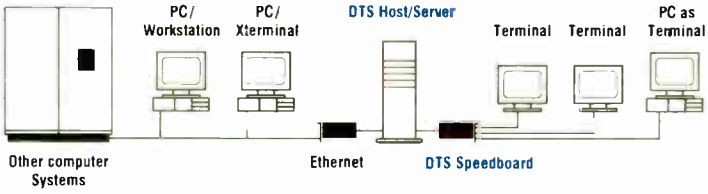
Leasing Program

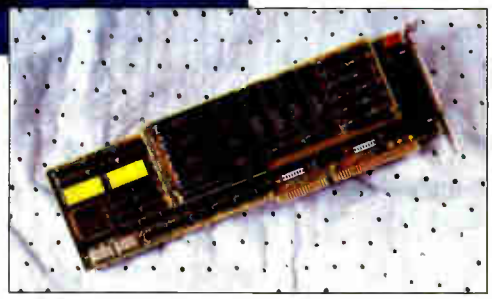
Affordable price is only half the reason why our systems give you the best value. We also offer a leasing program which enables you to make installment payments and get great tax advantages.

Datatrans Express Loaner Policy (One-year free)

For your peace of mind, we offer this bonus with each one of our Host or Server system in addition to the regular one-year warranty. In the unlikely event our Host or Server system has a hardware problem and cannot be resolved over the phone, we will ship you a standard loaner via UPS Next Day Service. And we'll pay for shipping both ways.

Designed for today's growing multiuser environment, our **433e Host/Server** and **433i Host** are equipped with the powerful Intel 80486 CPU and Datatrans Speedboard. Both systems come with SCO UNIX operating system pre-installed and fully tested, so you can get it up and running quickly and easily. Our 433i Host is a truly affordable solution for small-to-medium sized businesses. Our 433e Host/Server is Ethernet ready, thus acts simultaneously as a UNIX multiuser host and a UNIX network server.





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

affordable

The UNIX Multiuser Solution

SCO AUTHORIZED RESELLER

DTS 433i Host

- 80486-33 MHz ISA
- 8 MB RAM (max. 64 MB)
- 1.2 MB 5.25" floppy drive
- 1.44 MB 3.5" floppy drive
- 210 MB hard drive
- 120 MB tape backup
- Monochrome VGA display
- 8-user subsystem (max. 64-user)
- SCO UNIX V/386 OS installed

$4,095

433e EISA Host/Server....Call

DTS 433i Xterminal/PC

- 80486-33 MHz ISA
- 4 MB RAM (max. 64 MB)
- 1.44 MB 3.5" floppy drive
- 90 MB hard drive
- 17" SVGA 1024 x 768 color display, non-interlaced
- Logitech mouse
- SCO PC Xsight-TCP/IP installed
- 3COM Ethernet

$3,495

DTS 433i UNIX/DOS Workstation

- 80486-33 MHz ISA
- 4 MB RAM (max. 64 MB)
- 1.2 MB 5.25" floppy drive
- 1.44 MB 3.5" floppy drive
- 120 MB hard drive
- 14" SVGA 1024 x 768 color display, non-interlaced
- SCO UNIX V/386 OS installed
- MS-DOS installed

$2,549

Call Toll Free

1-800-368-1688

Ask about our 30-day trial offer

Custom configurations and on-site service are available

DATATRANS

Datatrans Systems, Inc.

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

Circle 556 on Inquiry Card (RESELLERS: 557).

World Radio History

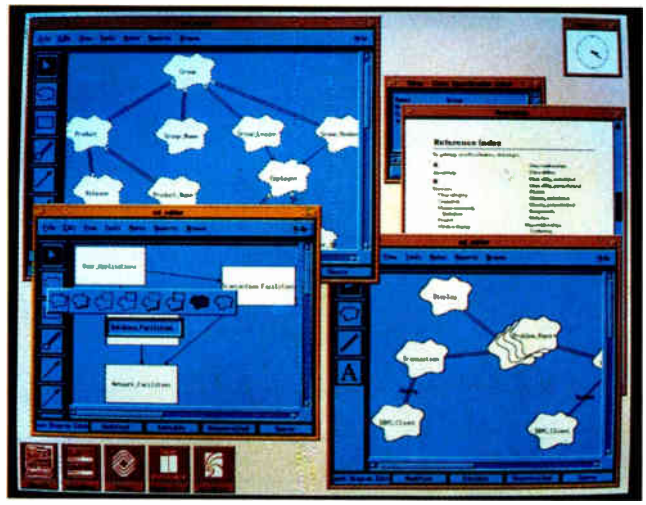
Software Engineering for X

Rational Rose, a graphical object-oriented analysis and design tool, offers a client/server software tool for language-independent analysis and design on the IBM RISC System/6000 and Sparcstation compatibles.

You can access Rose from any X Window System–compliant display running Motif or Open Windows. Rose supports languages such as C++, Ada, Smalltalk, and C. It also supports the Booch programming method.

Rose offers class browsers and reusable libraries. The semantic information stored in Rose's repository is accessible through a set of open interfaces, letting you integrate the program with third-party tools and frameworks.

An object-oriented database and a desktop publishing system come with Rose.
Price: $3995 per license.
Contact: Rational, 3320 Scott Blvd., Santa Clara, CA 95054, (408) 496-3692; fax (408) 496-3638.
Circle 1022 on Inquiry Card.



Rational Rose shows the highest-level view of a problem-reporting system in the class-diagram editor at lower left. The upper left window contains a class-diagram editor that shows a decomposition of one of the class categories—that of user applications. At right, the class specification editor lets you examine the behavior of each class, and the object diagram editor lets you examine key mechanisms and how they work in the system. Also shown at right is the hypertext help system. Rose integrates with applications from Frame and Saber.

Unix Desktop Without Clutter

The new version of the Wish (for Window Iconic Shell) program development and delivery desktop for Unix, Motif, and Network File System distributed computing minimizes the use of screen space and provides file and application management. Non Standard Logics says Wish eliminates the proliferation of windows that you often find in graphical desktops. Wish2 includes Wx2, the company's graphical programming editor for Motif.

Wish2's main window has a current-directory panel and a tool-tray panel for docking frequently used tools, files, and applications. Wish2's command window uses the AutoRecall feature to supply you with lengthy path names automatically. You can type `rm` and click on an icon. Once you click on the file icon, a long command sequence, such as `rm /usr/export/sony/ns/demo/newfile`, can appear on the command line. On-line help is available. Wish2 requires OSF/Motif 1.1.
Price: Starts at $695 (depending on platform and quantity).
Contact: Non Standard Logics, Inc., 4141 State St., Suite B-11, Santa Barbara, CA 93110, (805) 964-9599; fax (805) 964-4367.
Circle 1020 on Inquiry Card.

An X Debugger for Real-Time Unix

A debugging tool for real-time Unix and Posix that operates in the X Window System interface or the ASCII terminal mode, LDB offers source- and kernel-level debugging of multiple threads and processes. LDB's features include signals debugging; support for break, watch, and trace points; stepping; and stack examination. LDB can also debug a program on a remote system via an Ethernet link.

The initial release of LDB supports LynxOS. Versions are planned for standard variations of Unix.
Price: $895.
Contact: Lynx Real-Time Systems, Inc., 16780 Lark Ave., Los Gatos, CA 95030, (408) 354-7770; fax (408) 354-7085.
Circle 1023 on Inquiry Card.

IDB Object Database for Mac and Unix

The IDB Object Database is now available on the Mac, Next workstations, and Hewlett-Packard machines running HP/UX, joining versions for Windows, Sun, and HP/Domain operating systems.

Version 1.1 supports controlled sharing of information across heterogeneous networks with any mix of supported platforms, according to Persistent Data Systems. The program can also store and manipulate complex information.
Price: $2500 for PCs or Macs; $3500 for Next; $6000 for HP/Apollo, HP/UX, or Sun workstations.
Contact: Persistent Data Systems, Inc., 75 West Chapel Ridge Rd., Pittsburgh, PA 15238, (412) 963-1843.
Circle 1024 on Inquiry Card.

Objectworks \ C++ Supports Teamwork

Objectworks\C++, ParcPlace Systems' programming environment for C++, now supports team programming and integrates with popular Unix development tools such as `make`. It runs on the Sun-3 and Sparcstation platforms.

Version 2.4 of the environment is now suited for teams of programmers working on medium to large C++ projects, the company says.
Price: $3000.
Contact: ParcPlace Systems, 1550 Plymouth St., Mountain View, CA 94043, (415) 691-6700; fax (415) 691-6715.
Circle 1021 on Inquiry Card.

World Radio History

GRAND SLAM MATCH

EVEREX
EVER for EXcellence

& MANCHESTER

TEMPO LX
FULL POWER NOTEBOOK COMPUTER

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

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

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

SYSTEMS INTEGRATION
NETWORKING
CONNECTIVITY
CAD/CAM
DESKTOP PUBLISHING

Authorized EVEREX Dealer

MANCHESTER EQUIPMENT COMPANY, INC.

"The Computer Supply and Equipment Experts"

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

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

Circle 560 on Inquiry Card.

World Radio History

NEWS

WHAT'S NEW • BUSINESS TOOLS

Risk Analysis for Excel in Windows 3.0

Crystal Ball, the financial-risk-analysis program that runs inside Excel for the Mac, is now available in a version for Excel for Windows. Crystal Ball generates forecasts that include a range of possible outcomes instead of providing you with a single number.

Crystal Ball for Windows helps you predict the best, worst, and most likely results for an uncertain situation. Through Monte Carlo simulations, the program displays a graph of the relative probabilities of different outcomes.

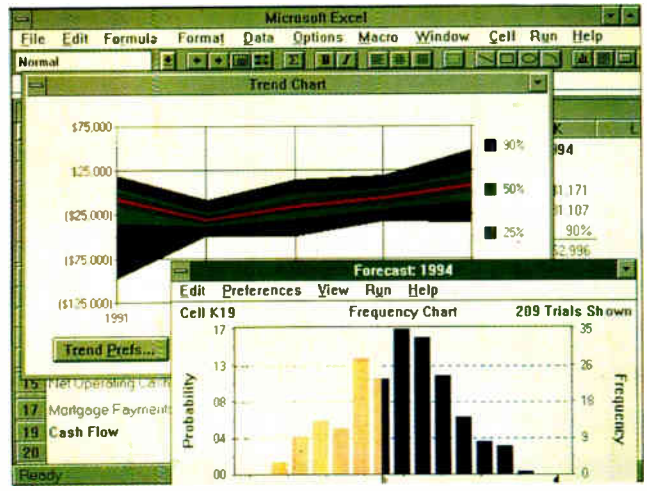
Price: $195.
Contact: Decisioneering, Inc., 1727 Conestoga St., Boulder, CO 80301, (800) 289-2550 or (303) 447-6464.
Circle 1025 on Inquiry Card.

Professional Spreadsheet for the Amiga

Professional Calc, a high-end spreadsheet and graphing program for the Amiga, provides more than 125 functions. A graphical control panel provides fast access to commonly used functions.

The program supports multiple fonts and colors within a spreadsheet. User-definable style tags control attributes such as font and color. An outlining feature lets you collapse and hide rows and columns.

Professional Calc can generate 2-D and 3-D bar graphs and other charts. It can import Lotus 1-2-3 files, Maxiplan files, and dBase text files.
Price: $395.
Contact: Gold Disk, 5155 Spectrum Way, Unit 5, Mississauga, Ontario, Canada L4W 5A1, (416) 602-4000; fax (416) 602-4001.
Circle 1029 on Inquiry Card.



Crystal Ball for Windows offers forecasting and risk analysis for the Excel spreadsheet.

A Database for Surveys and Marketing

As you can guess from its name, Survey 2.0 is designed for marketing, business, and other applications in which you need to collect, review, analyze, and present data from surveys. The program supports form-based data entry, and its editor lets you generate your own surveys.

Analysis capabilities include statistical templates and, for advanced users, cross-tabulation and chi-square options. You can use the program to generate tables and bar and pie charts.
Price: $395.
Contact: Raosoft, Inc., 6645 Northeast Windermere Rd., Seattle, WA 98115, (206) 525-4025; fax (206) 525-4947.
Circle 1030 on Inquiry Card.

An Express Ticket to Financing

Loan Express helps you determine what type of financing is right for your business and generate the required reports to help you secure the loan.

The program's Loan Decision Tree asks you questions to determine what loan is correct for you. Once you answer the questions, Loan Express automates the analysis and produces a proposal with financial schedules, a written report, and graphics.

Not only does the program help you secure financing, but it can help you decide on the best way to use extra funding. The program also helps you answer questions such as how you will pay back the money, how you will use the loan proceeds, and whether your financial projections are reasonable.
Price: $195.
Contact: ValuSource, Inc., 1939 Grand Ave., San Diego, CA 92109, (800) 825-8763 or (619) 483-1172; fax (619) 272-0307.
Circle 1028 on Inquiry Card.

No More ARM Alarm

Recent reports in the financial press say that as many as one-third of all adjustable rate mortgages have at least one mistake made by the lending institution. A new program for the PC called ARM Alarm can check ARM calculations during the life of the loan.

Using ARM Alarm, you can check for errors in your loan by referring to your loan documents for specific information, entering information into the program, and letting it perform the calculations for you.
Price: $79.
Contact: Selfware, Inc., 6734 Curran St., McLean, VA 22101, (703) 506-0400; fax (703) 506-0580.
Circle 1026 on Inquiry Card.

Make Your Connections on the Mac

Connections, a new program for the Mac, gives you instant access to telephone numbers, notes, and addresses, and it integrates scheduling, communications, and note-taking in one program. The group calendar coordinates the schedules of as many as 30 people in a workgroup and is System 7.0–savvy.

You can customize Connections' telephone directory into a contact card file. The program supports instant letter and envelope addressing from the telephone directory.
Price: $199.
Contact: Concentrix Technology, Inc., 1875 South Grant St., Suite 760, San Mateo, CA 94402, (415) 358-8600; fax (415) 358-9742.
Circle 1027 on Inquiry Card.

World Radio History

Built To Evolve.

SUMEX CORPORATION

PUBLICLY TRADING
OTC SYMBOL: **SOMX**

	Upgradable			Non-upgradable	
	SUMEX	AST	ALR	Dell	PCBrand
386SX CPU	25MHz	16MHz	20MHz	20MHz	25MHz
Memory	2MB	2MB	2MB	2MB	2MB
1.2MB FD	Included	Included	Included	Included	Included
1.44MB FD	Included	Not incl.	Not incl.	Included	Included
Hard Disk	40MB	40MB	40MB	40MB	40MB
Serial Port	2	2	1	2	2
Parallel Port	1	1	1	1	1
Mouse Port	1	1	Not incl.	1	1
Mouse	Included	Not incl.	Not incl.	Included	Included
VGA Card	1MB	Not incl.	512KB	1MB	1MB
VGA Monitor	1024x768	Not incl.	800x600	1024x768	1024x768
MS DOS 5.0	Included	Not incl.	Not incl.	Included	Included
Windows	Included	Not incl.	Not incl.	Included	Included
Price	**$1,595**	$2,895	$2,393	$2,516	$1,825

MODULAR, UPGRADABLE SYSTEMS

386DX/33.....$2,395
4MB RAM, 64KB Cache, 120MB HD, SVGA

386DX/40.....$2,595
4MB RAM, 64KB Cache, 120MB HD, SVGA

486SX/20.....$2,595
4MB RAM, 64KB Cache, 120MB HD, SVGA

486SX/25.....$2,795
4MB RAM, 64KB Cache, 120MB HD, SVGA

486DX/25.....$3,195
4MB RAM, 64KB Cache, 200MB HD, SVGA

486DX/33.....$3,395
4MB RAM, 64KB Cache, 200MB HD, SVGA

Add $200 for 256KB Cache systems. All prices are introductory offers.

It has recently become apparent that upgradable, modular computer systems are an excellent approach to preserving a buyer's investment. Upgradable computers have been priced substantially higher than conventional, non-upgradable ones; UNTIL NOW.

30-DAY MONEY BACK* • 1-YEAR WARRANTY • MADE IN USA

SUMEX Corporation is introducing a new, low-cost upgradable computer system line called DATAstation™. It is upgradable from 386SX to 386DX to 486SX to 486DX by changing a single Processor Module. This upgrade procedure is very simple. It does not require any jumper or switch settings. The system will automatically reconfigure. The system memory will also automatically rescale to match the CPU Module (16-bit or 32-bit) so that no "bottle-neck" is created to hinder the CPU performance.

SUMEX Corporation, incorporated in 1985, is engaged in the development, manufacture and marketing of "upgradable, modular computers". Following the current introduction, there will be a high-power, 32-bit EISA-MCA based modular computer product line and many others involving leading-edge, patent pending "modularity" technologies. SUMEX is a company that dares to innovate.

SUMEX Corporation is also poised to grow. The leading-edge technologies, competitive pricing, and commitment to total customer satisfaction are some of the solid building blocks for SUMEX Corporation's growth.

Give us a call today and find out how you can better preserve your computer investment.

SUMEX CORPORATION
Toll Free (800) 257-8639
800-25SUMEX
Hours: 9 AM-6 PM M-F, PST

Tel: (714) 563-7456 Fax: (714) 563-1804
431 N. Brookhurst Street, Unit 130, Anaheim, CA 92801

Prices & specifications subject to change without notice. Call for details of terms & conditions. All trademarks belong to their respective companies. *Refunds do not include shipping & handling charges. Return Authorization Number is required before returning products.

Circle 567 on Inquiry Card (RESELLERS: 568).

World Radio History

NOW YOU CAN COMMUNICATE WITH YOUR MODEM OR FAXBOARD ON MULTILINE, DIGITAL, PBX & HOTEL TELEPHONES

KONEXX is your UNLIMITED CONNECTION product that allows you to connect your modem or faxboard to the OFFICE telephone right on your desk.
No more searching for the wall jack or sharing dedicated phone lines.
CONVENIENT, EASY TO USE, QUICK INSTALLATION, AND SAVES MONEY!
OVER 30,000 IN USE TODAY

MODEL 106- $99.00
Manual VOICE/DATA Switch. Recommended for Laptops, Notebooks, and Portables. A must for computerized sales force.

MODEL 108- $139.00
Supplies telephone line voltage and an AUTOMATIC VOICE/DATA Switch. Recommended for Desktop PC's, Fax machines, and Modems that require voltage.
DIAL YOUR VOICE CALLS WITH YOUR PC!
(Great for Contact Management Software Applications)

Available at
Egghead Discount Software

UNLIMITED SYSTEMS

5555 MAGNATRON BLVD., STE J
SAN DIEGO, CA 92111

CALL 1-800-275-6354

Circle 613 on Inquiry Card (RESELLERS: 614).

World Radio History

FAXALL™

Network Facsimile Servers

Put your best fax forward

ALLFAX, Inc.
3772 Plaza Drive, Suite 3
Ann Arbor, Michigan 48108

Voice: 313/668-7859
Fax: 313/668-7856

ATTN: F. B. Jones, MIS Director

From: C. T. Merryweather, Network Administrator

Message: **Per your request, we've found the way to improve our productivity and image. We can now send faxes from within our word-processors, DTP, CAD tools, etc. We've chosen the FAXALL™ solution because of its ease-of-use, affordability and outstanding features:**

• **Send and Receive**	*complete independent capability at every workstation*
• **Automatic Inbound Routing**	*built-in, efficient, confidential and convenient*
• **Unlimited Users**	*we can start with, and add, as many users as we want, with no additional charges or site fees*
• **Network Neutrality**	*FAXALL™ is compatible with NetBios, Novell, Banyan, etc.*
• **HP Laserjet Emulation**	*faxing is as easy as printing a document to an Epson or HP Laser*
• **Windows Support**	*we're set for the future!*

FAXALL™ has it all. And FAXALL™ does it all. Suggest we call ASAP.

FAXALL™
Clearly the best.

To see the amazing FAXALL™ clarity for yourself, call 313/668-7859.

Circle 564 on Inquiry Card (RESELLERS: 565).

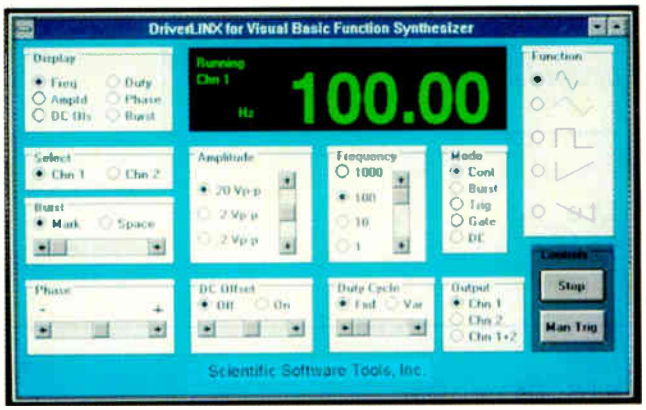
World Radio History

NEWS

WHAT'S NEW • PROGRAMMING

Data Acquisition for Visual Basic

DriverLinx for Visual Basic offers a series of real-time data acquisition engines for third-party, high-speed analog and digital I/O boards. DriverLinx, which takes the form of a custom control that is added to the Visual Basic toolbar, enables you to drop a data acquisition engine into your application. Users can choose from more than 100 functions for creating both foreground and background tasks.
Price: $400.
Contact: Scientific Software Tools, Inc., 30 East Swedesford Rd., Malvern, PA 19355, (215) 889-1354; fax (215) 889-1630.
Circle 1031 on Inquiry Card.



DriverLinx for Visual Basic comes with complete source code for this two-channel function synthesizer to show you how to develop real-time applications.

Nonlinear Modeling in C++

Autodif is a C++ array language extension with automatic differentiation for use in nonlinear modeling and statistics. Derivatives are calculated with the same accuracy achieved by analytical formulas and with minimal overhead.
Price: $99; $149 after April 1.
Contact: Otter Research, Ltd., P.O. Box 265, Station A, Nanaimo, BC, Canada V9R 5K9, (604) 756-0956.
Circle 1033 on Inquiry Card.

Network Routines for BASIC

Patterned after Novell's C Interface, QuickNet consists of more than 250 assembler routines that let you write applications in BASIC that access Novell networks.

QuickNet works with QuickBasic and version 4.0 and higher of Microsoft's BASIC Compilers.
Price: $199.
Contact: Mirage, 8086 South Yale, Suite 1, Tulsa, OK 74136, (918) 251-8086.
Circle 1032 on Inquiry Card.

Award-Winning Protection!

Now for OS/2!

Dr. Solomon's Anti-Virus Toolkit, the first anti-virus package to win both the Byte Magazine Award of Merit *and* PC Magazine's Editor's Choice, introduces another first - virus protection for the OS/2 environment.

Dr. Solomon also leads the pack in quick detection - we're three times faster than the competition!

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

Dr SOLOMON'S ANTI-VIRUS TOOLKIT

Ontrack

1-800-752-1333
International: 612-937-1107 • Fax: 612-937-5815
6321 Bury Drive, Eden Prairie, MN 55346

Network support and Windows compatibility.

World Radio History

PC/Mainframe File Transfers from a Different Point of View

Most systems *require* the end user to initiate the transfer. OUTBOUND is different. Transfers start from a host or a PC without interrupting end users.

OUTBOUND starts a transfer from the mainframe or the PC. This lets you move files to and from the host at your convenience. *Without* involving the end users. In fact, they don't have to be logged on to the host when the transfer takes place.

With OUTBOUND, your host can issue commands to PCs just as if you were seated at the keyboard. You can even have a PC DIRectory sent to your host. It makes taking a software inventory simple.

OUTBOUND operates on IBM mainframes under VM or MVS, using VTAM to communicate with the PCs.

OUTBOUND is ideal for unattended PC backups, distributing software, collecting data, starting PC jobs and much more. It's simple to use, reliable, secure, fast and affordable.

Call Stile Software at 1-800-777-7140 for more information. Call today, and you can start solving your problems from a different perspective.

Stile™

1-800-777-7140

Stile Software, Inc. • PO Box 150 • Orford, NH 03777

Circle 606 on Inquiry Card.

World Radio History

You Deserve A Derby. . .

Power, Price and Performance. All with unparalleled service!

WORRY-FREE ☆ GUARANTEE
30 DAY

WARRANTY
ONE YEAR
PARTS AND LABOR

SINCE 1984

SX/25C-80 PRO

- 80386SX-25
- 2MB RAM, 32K Cache
- 80MB Hard Drive, 17ms with 64K Cache
- 1.2MB 5 1/4" Drive
- 1.44MB 3 1/2" Drive
- 2the Max VGA, 1 MB
- CTX-1024, Super VGA Color Monitor
- 2 Serial, Parallel, Game Ports
- *New* MS-DOS 5.0 & Windows 3.0
- Z-nix Mouse, 400 ppi
- LandMark=30.1Mhz/SI=26.8/Mips=4.25

$1,595

SX/25C-130 PRO

- 80386SX-25
- 2MB RAM, 32K Cache
- 130 MB Hard Drive, 17ms with 64K Cache
- 1.2MB 5 1/4" Drive
- 1.44MB 3 1/2" Drive
- 2the Max VGA, 1 MB
- CTX-1024, Super VGA Color Monitor
- 2 Serial, Parallel, Game Ports
- *New* MS-DOS 5.0 & Windows 3.0
- Z-nix Mouse, 400 ppi
- Landmark=30.1Mhz/SI=26.8/Mips=4.25

$1,695

386/25-80 PRO

- 80386DX-25, 32-bit
- 4MB RAM
- 80 MB Hard Drive, 17ms with 64K Cache
- 1.2MB 5 1/4" Drive
- 1.44MB 3 1/2" Drive
- 2the Max VGA, 1 MB
- CTX-1024, Super VGA Color Monitor
- 2 Serial, Parallel, Game Ports
- *New* MS-DOS 5.0 & Windows 3.0
- Z-nix Mouse, 400 ppi
- Landmark=28.6Mhz/SI=26.4/Mips=4.03

$1,795

386/25-130 PRO

- 80386DX-25, 32-bit
- 4MB RAM
- 130MB Hard Drive, 17ms with 64K Cache
- 1.2MB 5 1/4" Drive
- 1.44MB 3 1/2" Drive
- 2the Max VGA, 1 MB
- CTX-1024, Super VGA Color Monitor
- 2 Serial, Parallel, Game Ports
- *New* MS-DOS 5.0 & Windows 3.0
- Z-nix Mouse, 400 ppi
- Landmark=28.6Mhz/SI=26.4/Mips=4.03

$1,895

386/40C-130 PRO

- 80386DX-40, 32-bit
- 4MB RAM, 64K Cache
- 130MB Hard Drive, 17ms with 64K cache
- 1.2MB 5 1/4" Drive
- 1.44MB 3 1/2" Drive
- 2the Max VGA, 1 MB
- CTX-1024, Super VGA Color Monitor
- 2 Serial, Parallel, Game Ports
- *New* MS-DOS 5.0 & Windows 3.0
- Z-nix Mouse, 400 ppi
- Landmark=65.7Mhz/SI=44.2/Mips=8.27

$1,995

386/40C-200 PRO

- 80386DX-40, 32-bit
- 4MB RAM, 64K Cache
- 200MB Hard Drive, <15ms with 64K Cache
- 1.2MB 5 1/4" Drive
- 1.44MB 3 1/2" Drive
- 2the Max VGA, 1 MB
- CTX-1024, Super VGA Color Monitor
- 2 Serial, Parallel, Game Ports
- *New* MS-DOS 5.0 & Windows 3.0
- Z-nix Mouse, 400 ppi
- Landmark=65.7Mhz/SI=48.2/Mips=8.27

Best Buy

$2,195

486SX/20-130 PRO

- 80486SX-20, 32-bit
- 4MB RAM, 8K Internal Cache
- 130MB Hard Drive, < 7ms with 64K Cache
- 1.2MB 5 1/4" Drive
- 1.44MB 3 1/2" Drive
- 2the Max VGA, 1 MB
- CTX-1024, Super VGA Color Monitor
- 2 Serial, Parallel, Game Ports
- *New* MS-DOS 5.0 & Windows 3.0
- Z-nix Mouse, 400 ppi
- Landmark=90.1Mhz/SI=31.4/Mips=8.9

$1,995

486/33C-200 PRO

- 80486DX-33, 32-bit Co-Pro and 8K Internal Cache
- 4MB RAM, 64K Cache
- 200MB Hard Drive, <15ms with 64K Cache
- 1.2MB 5 1/4" Drive
- 1.44MB 3 1/2" Drive
- 2the Max VGA, 1 MB
- CTX-1024, Super VGA Color Monitor
- 2 Serial, Parallel, Game Ports
- *New* MS-DOS 5.0 & Windows 3.0
- Z-nix Mouse, 400 ppi
- Landmark=150Mhz/SI=51.7/Mips=15.1

$2,695

Performance: By using only high performance components such as Intel, Chinon, Toshiba, Teac, Quantum, Microscience, Maxtor, Focus, and CTX, Derby systems can outperform any comparable system. To ensure the *Highest Quality & Reliability* possible all systems go through our 7-step, 72 hour burn-in, test.

Power: If Power is what you want then Derby is what you need. We use the latest technology in every system, IDE, Cache RAM, and 2the Max VGA (1 Meg Video, 1024x768 resolution with 256 colors, 24-bit Color Option - 32,768 simultaneous colors). All systems include Windows 3.0, which has been pre-loaded and fine-tuned for optimum performance. The *NEW* MS-DOS 5.0 features, advanced memory management, improved graphical shell, full-screen editor and MS-QBasic. ***NOW! All systems come standard in our space saving ergonomic Mid-Tower case.***

Price: While supplying all the *Power and Performance* you demand, Derby also gives you an affordable price.

Conclusion: In the areas of Power, Performance, and Price, no one compares to Derby. With the best service and quality in the industry, why go anywhere else? So, CALL NOW and talk with your own Personal Consultant!

DERBY DELIVERS

- One Year Warranty
- 72 Hour Burn-In Testing
- Life Time Tol Free Technical Support
- All Systems Built In the USA
- 30 Day Money Back Guarantee (Less any shipping charges)
- Shipping & Handling $45.00
- Same Day Shipping
- All Software pre-loaded & fine-tuned
- No Surcharge on Credit Cards
- New sales hours: 9am - 8pm CST M-F
  10am-2pm CST S-S

DISCOVER VISA MasterCard

DerbyTech Computers Inc

1-800-24-DERBY

718 - 15th Avenue / East Moline / Illinois / 61244 / (309) 755-2662

1-800-243-3729

Circle 607 on Inquiry Card {RESELLERS: 608}.

World Radio History

JERRY POURNELLE

CONFIGURATION TRIBULATIONS

This month started with a trip to the World Science Fiction Convention, and it ended with a trip to Washington for a visit to the Pentagon as well as attending the tenth anniversary of the founding of High Frontier. While we were there, we dropped by the Smithsonian, where they still have Ezekial, my old CompuPro CP/M system, on display. Between trips, Larry Niven and I nearly finished *The Moat Around Murcheson's Eye*. Meanwhile, stuff poured into Chaos Manor: alas, much of it experimental, or developmental, or simply not worth writing about.

The result is that this will be a rather odd column, opening with some gripes. But hang on, because there is plenty of good stuff I can recommend, and I'll get to that, too.

Setup Programs

If you have a spare day, you might try updating Windows when you are using Quarterdeck's QEMM-386 and Symantec's Norton Desktop for Windows. It will take at least a day; it took me longer.

My apologies if these comments get out of hand: at the moment, I would like to find and beat senseless the designer of the installation programs for both Windows and Norton Desktop. Then I'd like to burn their houses and sow the site with salt. After that, I might calm down.

For the past 12 hours, I have tried to get back to where I was when I started. I finally managed, and thereby hangs a tale.

Warning!!

If you have Windows working properly and decide to update to a new version, save everything: the Windows subdirectory, all subdirectories (particularly SYSTEM) below that, and all your CONFIG.SYS and AUTOEXEC.BAT stuff. But do not save them on the same machine. I mean that literally. Save them on floppy disks, or use LapLink to connect to a different machine entirely and then disconnect the wires between machines. I wouldn't even leave the computer connected to a network.

In my case, I transferred the CONFIG.SYS, AUTOEXEC.BAT, and other such files to logical drive D, in a subdirectory called C1. I went on to copy the Windows subdirectory to D\C1\WINDOWS and the Norton Desktop subdirectory over to D\C1\NDW as well. That way, I figured, at worst I could get back to where I started.

Wrong.

The Norton Desktop and Windows Setup programs go off and find *all* the previous copies and do things to them. In addition, Windows Setup makes changes to the SYSTEM.INI and WIN.INI files. Exactly what I don't know; if I had known, I would not have wasted the entire day trying to get back to where I was. All I know is that I had no choice but to plunge onward, because attempts to restore by copying the D\C1 subdirectories to the appropriate places on C didn't help: I was unable to enter Windows at all.

There was no help for it: I had to reinstall Windows from scratch. This takes a while, and I didn't do it right at first, so I had to do it several times. Every time I did it, Setup would tell me that I had already installed Windows from those disks, and this was a copyrighted program, and I was probably violating the law.

Mixing the latest versions of some software can put you on the "bleeding edge" of technology

QEMM-386, EMM386, and Doom

Originally, I had Windows 3.0 and a beta version of QEMM-386 6.0. This was installed by a Quarterdeck technician, and it gave me a lot of system RAM. Windows ran Norton Desktop as a shell, and I had a number of customized icons. I had installed the Icon Paks, I'd used the Norton Icon Editor to customize others, and I had grouped everything nicely. I could run DOS games such as The Lost Admiral and Railroad Tycoon under Windows, and I had nice customized icons for those.

Notice I say *had*. Now I can't run any of those programs, my icons are gone, and my files are ungrouped. In a word, I'll have about 3 hours of work to get back to where I used to be. (Actually, it was more like 5 hours; I wrote parts of this as things happened.)

My problems started when I decided to replace my beta QEMM-386 6.0 with the shipping version. Then I wanted to upgrade to a Windows 3.1 beta version. The upgrade setup seemed to work all right—but when it was

ILLUSTRATION: STEVE TURK © 1992

World Radio History

iry Card (RESELLERS: 86).

Kingston's mass storage products offer a variety of disk upgrade solutions for your PCs and workstations.

Internal Winchester Drives
- High speed, high capacity
- Mounting hardware
- Easy user installation

Removable 3½" Disk Subsystems
- SCSI, AT/IDE, ESDI, ST506
- Metal construction
- Key lock & display indicator
- Mounts in 5¼" h.h. slot

Shock Mounted Removable Disk Subsystems
- Rugged desktop subsystem
- Shock absorbing disk carrier
- SCSI, ESDI, ST506
- Key lock & display panel

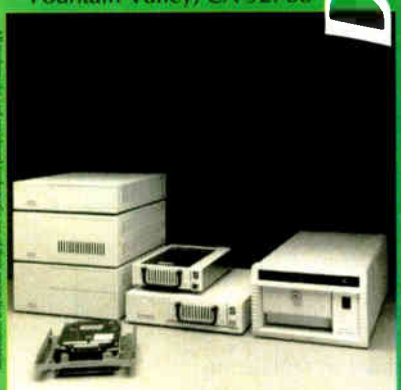
External Mass Storage Expansion
- Compact desktop subsystem
- High speed, high capacity
- Accessories & software

Call Kingston today at:

1-800-835-2545
Ph. 714-435-2600
Fax 714-435-2699

Manufactured by
Kingston TECHNOLOGY CORPORATION
17600 Newhope Street
Fountain Valley, CA 92708

Disk Storage Upgrades



finished, Windows wouldn't work. "Missing some device," the error message said. No clue as to what device, and the system locked up about half the time I booted up.

So I tried to restore from drive D and get back to where I'd been. No joy. After I copied everything back over, I got the exact same error messages. Apparently, the Setup program had gone over to drive D and mucked that up, too. Note that the Mac does that kind of madness all the time. Roberta suggests that Microsoft has hired a bunch of former Apple software designers. Could be.

Roberta stood on one foot like a flamingo while I did the installation of Windows 3.0.

The next thing to do was to erase all that stuff and start over. After all, Norton Desktop would take care of things; or so I foolishly thought. First things first, then: get rid of QEMM-386 and set up with HIMEM.SYS and EMM386.EXE until things are working right. I used the installation program again, noting the infuriating little message about how I had installed from these disks before; and lo!, Windows ran, and Norton Desktop put my old configuration back on-screen. Joy.

Except that most of my applications wouldn't run. There'd be a flash on the screen, something about no ERROR.DAT file, and something about memory. It was too fast to read, so I don't quite know what it said. Just that a bunch of my programs would not run. Eventually I figured it out: they didn't have enough memory.

Oddly enough, I could run Norton Commander—and inside Norton Commander, running under Windows, I could run some of the programs that would not run directly under Windows. Really odd.

Stepping Back

Next thing, then, was to try to make more memory by using QEMM-386 with the updated Windows. No joy. Although QEMM-386 6.0 says that it knows how to make Windows work properly, that isn't true: I can run QWINFIX until doomsday, each time getting the message that all is well, and Windows still won't run. OK, scrub QEMM-386. (I have since learned that QEMM-386 6.0 will work if you start Windows with WIN\D:X.)

Next thing: try 386Max 6.0 from Qualitas. That installs easily, once you get past their obsession with making sure you know about the copyrights—you need the serial number off the box to make it work, and if you throw the box away you're doomed—but then Windows would not work: not enough extended memory. Because my Cheetah 486 has 16 MB of memory, this didn't seem reasonable. It turns out that 386Max defaults to making all your memory into expanded memory, and Windows can't use that. Fortunately, the 386Max documents are clear enough on what to do. I put the notation `EMS=2048` in the CONFIG.SYS line invoking 386Max, and it made 2 MB of expanded memory and 14 MB of extended memory.

Once that was done, the new version of Windows wouldn't work. The error messages, as usual, were completely uninformative. No Windows with 386Max 6.0 or QEMM-386 6.0.

In other words, I could stay with Microsoft's inadequate memory management software so that a lot of my DOS applications wouldn't run under Windows, or I could dump the new version of Windows. There wasn't much choice about that, so I scrubbed everything and went back to Windows 3.0, installing from scratch. I have completely given up on update installations to Windows. Sigh.

Roberta must have become weary of my screaming at the software, because this time, just for luck, she stood on one foot like a flamingo while I did the installation. I asked her why she was doing that. "Why not? It can't hurt," she replied. I recall that when we travel she raises her feet when the airplane takes off: same reason.

Maybe that was it, but the Windows 3.0 installation went very smoothly, and it ran fine. Of course, that was under Microsoft's memory management software, and it produced windows too small for Railroad Tycoon, but at least I had Windows up again. Now to switch to 386Max.

That worked. More than a 600-KB temporary program area, and I was in Windows. Now for the acid test: install Railroad Tycoon as a DOS application and try to run it under Windows.

Voilà! Qualitas has come through: there's more than enough memory to run Railroad Tycoon; indeed, I have six different Railroad Tycoon games running at the same time. Wonderful! Now try The Lost Admiral. . . yep, that runs fine, and

World Radio History

C++ PLUS.

ONLY ZORTECH™ C++ OFFERS A TRUE MULTI-PLATFORM COMPILER AND MUCH MORE.

When it comes to building larger, more complex applications, C++ is the language of choice. And now with Zortech C++, Symantec presents the only C++ compiler that provides professional tools for Windows,™ DOS and OS/2 in a single, integrated package.

Zortech C++ goes well beyond the other C++ and C compilers by delivering more of the tools serious programmers demand—plus a collection of exclusive features designed to increase your productivity and reduce your development time.

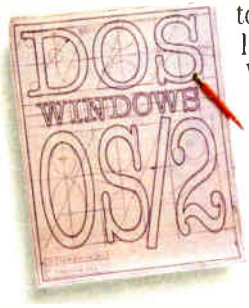
All of which means you'll get your applications to market faster than ever before.

For starters, our unique WINC library automatically converts DOS command line programs to true Windows applications. And you won't need to switch development systems, because you'll have the flexibility of moving to different platforms.

The security of one compiler across multiple platforms has never been more essential. With Zortech C++, developing applications has never been easier or more efficient.

Zortech C++ even includes royalty-free 32-bit and 16-bit DOS extenders, for the cost-effective development of programs with advanced memory requirements.

And since Zortech C++ provides absolutely everything you need to edit, compile, link and debug any Windows application, you won't need to buy the Microsoft Windows SDK. We've also added a help compiler and engine, a resource compiler, Windows header files and libraries, and printed SDK documentation.



Zortech C++ dramatically cuts your multi-platform development time by supporting the complete range of PC architectures.

For unmatched performance, Zortech C++ offers globally optimizing compilers that boost program speed and significantly reduce program size. So regardless of the platform, Zortech C++ delivers performance and security where it matters...in your finished application.

In fact, as the safest choice you can make, Zortech C++ ensures total C++ and ANSI C compatibility. It's also supported by leading third-party utilities, libraries and other tools.

That's probably why more and more corporations are moving to Zortech C++ for their application development.

UPGRADE TO ZORTECH C++ FOR JUST $199.

There's never been a better time to take advantage of the world's first multiple-platform C++ compiler.

Because, for just $199, users of Borland C++ and Microsoft C can now upgrade to Zortech C++ For Windows, DOS & OS/2—that's a savings of $500!*

And if your applications require even greater numerics support, pick up the Zortech C++ Science and Engineering Edition (which offers everything from the Windows, DOS and OS/2 version, along with the M++ array language extension, IEEE-754 and NCEG 91-015 numerical support, and much more).

Zortech's industrial-strength compiler breaks through the DOS 640K barrier, enabling you to develop programs of up to 16MB and beyond.

Either way, you'll get unmatched Zortech quality backed by Symantec's outstanding service and support. So visit your dealer or call us at **1-800-228-4122, Ext. 804Y** for more information about Zortech C++ and our competitive upgrade offer.

SYMANTEC.™

*Promotion ends March 31, 1992. Offer good in the US and Canada only. In Canada, call 1-800-465-2266. For more information in Europe, call 31-71-353111. In Australia, call 612-879-6577. Everywhere else, call 408-252-3570.

© 1991 Symantec Corporation. All rights reserved. Zortech is a trademark of Symantec Corporation. All other brand or product names mentioned are trademarks or registered trademarks of their respective holders.

Circle 192 on Inquiry Card.

World Radio History

it will blow up with no explanation if I reset using EMM386.EXE. Joy.

Fortunately, 386Max does everything it should do, and it makes for bigger DOS windows than QEMM-386 6.0 to boot. I like QEMM-386, and if you use Desqview, you ought to use it. But for use with Windows, at least for the moment, it's 386Max for me. It's easy to install (only do remember to adjust expanded memory size) and seems to work flawlessly. Highly recommended.

ATI Graphics Ultra

Clearly, I like Windows; but do understand, I have the hardware to support it. One of those hardware items is the ATI Graphics Ultra video coprocessor and Super VGA board. This thing takes all the sting out of Windows: it's very fast, the resolution is good, and when it isn't doing Windows, it's an excellent Super VGA board. On the big 19-inch Hitachi monitor, you can actually make use of software and modes that put hundreds of lines of text, or spreadsheet boxes, on your screen.

Moreover, the Graphics Ultra is easy enough to install. It comes with a mouse port and its own three-button mouse. Of course, having a mouse bus on the video board saves a slot (or a COM port).

There's lots of software for using the Graphics Ultra with AutoCAD, Ventura Publisher, and so forth. You get Bitstream scalable fonts. Mostly, you get displays that look as if you have a laser printer right there on your screen.

If I had to do much desktop publishing with a PCompatible system, I'd run out and get the Graphics Ultra. The time saved in proof copies would be significant. This board isn't a memory hog, and it has performed wonderfully for every task we've asked of it. I really like it.

Desqview

I run Windows on a Cheetah 486. That's the machine that Larry Niven uses when he comes to work here: it has an older Zenith keyboard, which Larry prefers to my nice new Northgate OmniKey keyboards. It also has the 19-inch Hitachi screen (which Larry can see without his glasses), an ATI superfast video board, and the Perceptive Solutions superfast hard drive controller.

I run Windows on that machine largely because I like to be able to get at Norton Commander without exiting the word processor. Niven and I use "sneakernet" to transfer text files: when he works on a chapter, he saves that onto the hard disk. When it's time for me to see it, the files are transferred to a floppy disk, which I put into my machine, automatically making a backup copy.

If Larry has made changes to several chapters (each chapter is a file in our system), there are several files to be transferred to a floppy disk, and that is accomplished by using Norton Commander. Thus, what I want available on Larry's machine is a task-switching system that will get me from Q&A Write (configured with Word Finder and the Definitions Plus version of *The American Heritage Dictionary* as TSR programs that are available in background) to Norton Commander.

On my own system, I do that with Desqview; but the problem with Desqview is that the hot key is the Alt key, and Larry Niven is perfectly capable of striking that key inadvertently. When he does, Desqview pops up, and it confuses him. We both hate when that happens; and since Windows was doing the job quite nicely, and Niven is exceedingly unlikely to hit Control-Escape, I used Windows for his machine.

That also means that I can play Railroad Tycoon and switch back to either

Move to Windows, stay with the VAX.™

Considering Windows? But can't afford to lose contact with your host? KEAterm 420 is the solution: DEC VT420 terminal emulation software for Windows 3. Now, you can have the best of both worlds!

KEAterm 420 is a true Windows 3 application which provides the functionality of DEC's VT420, VT320 and VT220 terminals in a window. KEAterm 420 version 2 gives you the features that count: multiple pages, multiple sessions, file transfer, multilingual support (English, French and German), script language and DDE support as well as network connections. Using the familiar Windows interface, KEAterm makes it easy to move between servers, hosts and PC applications. With KEAterm, you can do it easier, do it faster, do it better!

To tie it all together, use KEA's network connection software: KEAlink LAT, KEAlink TCP/IP, and KEAlink IPX for concurrently connecting to your Novell network and your VAX or UNIX host. To eliminate keyboard remapping, select KEA's *PowerStation* VT layout keyboard to plug into your PC. And if you're a DOS or UNIX user, KEA Systems offers the ZSTEM family of VT graphics and text emulation software for desktops running DOS or UNIX.

For superior PC-VAX-UNIX connectivity, call today!

KEA Systems Ltd.
Orders: 1-800-663-8702
Telephone: (604) 431-0727
Fax: (604) 431-0818

KEA

VT Emulation Under Windows

KEA Systems Ltd., 3738 North Fraser Way, Unit 101, Burnaby, BC, Canada V5J 5G1.
The KEA logo, KEAterm, KEAlink, ZSTEM and PowerStation 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. 1991. All rights reserved.

Circle 84 on Inquiry Card

World Radio History

DO YOU MAKE THESE SIX COMMON MISTAKES ON YOUR TAXES?

1. THE SIMPLE ARITHMETIC ERROR.
Just one of these invalidates your return. With all the late-night scrambling, you might be lucky to limit it to just one.

2. THE TRANSCRIPTION ERROR.
Juggling all those figures from one schedule to another, it's easy to put a digit or two in the wrong spot or enter it incorrectly.

3. THE OMITTED FORM.
Even ordinary returns now require as many as a dozen forms, so it's easy to miss one.

4. THE MISINTERPRETED DIRECTION.
Some IRS instructions baffle the best of us, leading to the wrong number at the bottom line.

5. THE OVERLOOKED DEDUCTION.
Few people know all the deductions they're entitled to. Fewer still remember them all on April 15.

6. THE EXCEEDED GUIDELINE.
Go beyond "normal" deduction ranges for certain items, and your return may be pulled for closer scrutiny. Some taxpayers trigger an audit simply because they don't know what the IRS looks for.

WHAT CAN RESULT FROM SUCH OVERSIGHTS?

Delays, for sure. Lost tax-saving opportunities. More questions than you might expect. Perhaps a full-blown IRS audit of your current and past returns.

Considering the potential cost in worry, time and money... wouldn't it be better to eliminate errors like these altogether?

THE TURBOTAX® SOLUTION.

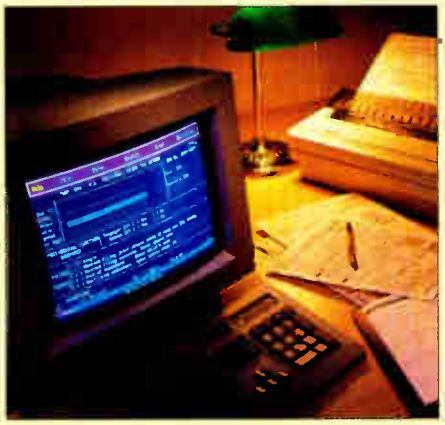
Do your taxes with TurboTax software on your own PC or Mac, and mistakes and misunderstandings are virtually impossible. Filing accurate, reliable tax returns has never been easier or quicker.

The program asks you simple questions in plain English – gathering all the facts and figures it needs. Your receipts and other records don't even have to be organized. TurboTax does the organizing for you, then makes all the calculations flawlessly.

Every number is checked for consistency, then placed on the right line on the right form. Arithmetic and transcription errors simply can't happen in TurboTax.

Every form required for your return is printed out by TurboTax in an IRS-approved format on your own printer—ready to sign and mail (or transmit electronically if you prefer). Everything you need to file a complete, legal return is included. There's no chance of you leaving out an obscure form because you couldn't locate it or didn't know about it. TurboTax walks you through selecting the forms you need.

© ChipSoft Inc., 1991, 1992. All rights reserved.
TurboTax is a registered trademark of ChipSoft Inc.
MacInTax is a registered trademark of ChipSoft, CA, Corp.



TURBOTAX KNOWS ABOUT DEDUCTIONS, TOO.

Like a good tax advisor, TurboTax helps you identify relevant deductions—along with a wealth of other tax-saving guidance and tips—ensuring that you don't pay the government a penny more than you must.

Best of all, TurboTax helps you avoid setting off audit alarms by exceeding IRS guidelines. If an item seems out of line, TurboTax lets you know, so you can make an informed decision before you file.

America's #1 tax software.

Not only does TurboTax protect you from dozens of potential mistakes, large and small—it makes the whole business quicker and easier than you ever imagined possible. *PC Magazine* says "It makes doing your taxes almost fun."

Tax paying consumers resoundingly agree. They've made TurboTax America's top selling tax software by far. Last year over 6 million returns were prepared using TurboTax—and it's won more top awards than any other tax software you can buy!

NOW TRY IT FREE..FREE BONUS TOO!

TurboTax is so powerful, foolproof and simple to use, the software itself is its own best salesman. That's why we'll send you a preview copy now on an unconditional free trial basis. Plus, when you pay for it you'll get a FREE bonus, Norton Utilities (a $179 retail value).

Your FREE Norton Utilities is today's best selling automatic disk maintenance and data recovery program. It performs the most extensive diagnosis and recovery of any utility product for the PC and Macintosh. And, you'll be glad you have Norton because backing up important files like your tax return is critically important.

For fastest service **call TOLL-FREE**
1-800-487-8297 ext. 719
or mail coupon to: **TurboTax**, Personal Order Dept., P.O. Box 85709, San Diego, CA 92186-5709

FREE! SOFTWARE BONUS
Not valid with any other offer. Offer expires 4/15/92.

☐ **YES.** Please send me a FREE *trial copy* of TurboTax®. Bill my credit card just $8.50 now (not refundable) for shipping and handling. If I don't like it I'll just send it back. Otherwise, after 30 days, bill my card for the version specified below and send my FREE copy of Norton Utilities ($179 regular price).

or ☐ **YES.** I'm already convinced about TurboTax, and I'd like to get going with Norton Utilities right away. Charge my credit card now for the version I've specified (or check enclosed), and send everything right away. I save shipping and handling charges. And if I'm unsatisfied, I'll return everything within 30 days for a full refund.

Send me the following:
☐ 5 ¼ inch disks - OR -
☐ 3 ½ inch disks

☐ TurboTax for DOS ($69)
☐ TurboTax for Windows ($79)
☐ MacInTax for the MacIntosh ($79)

Payment Method: ☐ Check enclosed payable to TurboTax (full payment only–save S&H)
Please charge my: ☐ Visa ☐ Mastercard ☐ Discover
Account Number: _____ Exp. Date: _____
Signature: _____
Day phone: (____) _____ (If we have questions about your order)

Name _____
Address _____
City _____ State _____ Zip _____

For faster service call Toll-Free
1-800-487-8297
ext. 719
or mail coupon to:
TurboTax
Personal Order Dept.
P.O. Box 85709
San Diego, CA 92186-5709

SYSTEM REQUIREMENTS: Requires IBM XT, AT, PS/1, PS/2, or compatible with a hard disk. Also requires 512K RAM, DOS 2.0 or higher. Windows Version requires Windows 3.0 with 1MB RAM and a hard drive. Macintosh requires Macintosh System 4.2 or greater with 1 MB RAM and a hard drive. Offer expires 4/15/92

World Radio History

Q&A, Norton Commander, or to a database (when I play Railroad Tycoon, I tend to be *serious*).

However, my own machine, a Cheetah 386, still has Desqview. I'm used to it; and, indeed, Desqview really is more flexible than Windows, and once you have some experience with it, it's easier to use. Among other things, you can close a Desqview application much more easily than you can get rid of a Windows application; and you can quit Desqview regardless of whether other applications are running.

I suppose over time Windows will replace Desqview. It does have some advantages; but for the moment, I am content to use Desqview—except that once more I have a weird problem to relate.

My Cheetah 386 runs DOS 3.3, and thus my hard drive is partitioned into logical drives C through L. This isn't a real hardship except that sometimes I forget where a file has gone.

I have two large TSR drivers set up with my Cheetah 386: a Hitachi CD-ROM and LANtastic. With LANtastic, I can access the Pioneer Minichanger CD-ROM drive and the Pioneer read/write optical drive that doubles as a WORM; and, of course, I can send stuff to the network server for backup on the Palindrome tape drive, as I described last month. All these assets are available in all Desqview windows, and my windows can be 544 KB in size, which isn't really enough, but it will serve.

If you do change to Windows, get Norton Desktop.

However, I keep thinking I ought to have larger windows and that I can get them by switching to DOS 5.0. But whenever I do that, I have much *smaller* Desqview windows. This doesn't make much sense; but I have twice changed to DOS 5.0, and each time I have fished out the DOS 5.0 uninstall disk and gone back to the old system. More when I learn more, because I really do like DOS 5.0. Sigh.

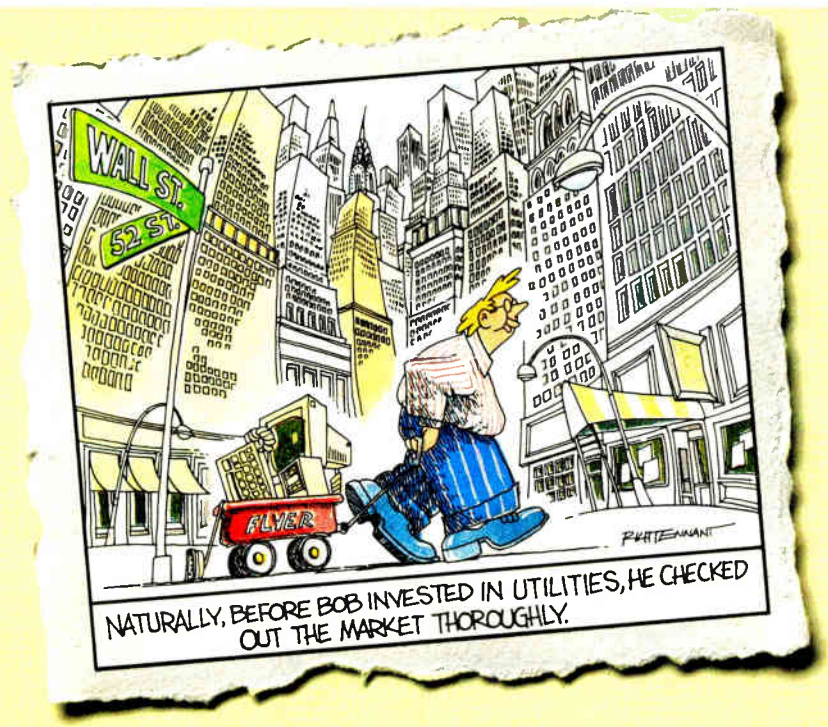
Norton Desktop for Windows

If you do change to Windows, get Norton Desktop. It makes Windows a lot more fun, as well as easier to work with. There's even an icon editor to let you customize things, and a fast-open panel that's quite nifty for getting things started in a hurry. It does take up a lot of disk space—about 5 MB. I think it's worth it, but then I have a lot of disk space.

One caution: if you update your version of Windows, you may lose all the work you did with Norton Desktop in making things pretty. In theory, you can save things; but in practice, I was not able to do that.

If you do reinstall with the notion of getting some of the saved stuff back, forget it. I saved mine in D\C2\NDW, and the Norton installation program went over there and found it and insisted on working with that no matter how much I told it not to. The designer of that installation program is another prime candidate for mayhem.

Except for the installation program, though, I really like Norton Desktop for Windows, and I think you will, too. Recommended.



GOLD UP A

All the experts agree, the value of Gold is up. Over a million computer users have invested in XTree for improved productivity because it's the industry's most logical and easy-to-use high performance file and disk management software. And XTreeGold 2.5 is the one file and disk management utility that builds on the strengths of every MS-DOS package, including DOS 5.0.

To list just a few highlights in our XTree Gold 2.5 portfolio; there's unsurpassed power and speed to enhance your PC performance and productivity, including a wealth of viewers – over 50 for spreadsheets, database, word processing

XTree Easy, the file and disk management choice for laptop users and those new to computing.

ViruSafe catches viruses *before* they have a chance to attack your PC. And **ViruSafe/LAN** protects the PC's on your network.

AllSafe, the comprehensive security product that includes virus protection, access control and security reporting.

World Radio History

More Goodies

Although you don't *need* them for Windows, a few other products make it a great deal more fun. Icon Paks I and II provide all kinds of nifty little icons—balloons, birds, government buildings, trains, tanks, flags, programmer symbols, you name it. After Dark, the famous Flying Toasters screen blanker, will put fish, lightning, and other stuff, including messages, on your screen when you're not using it.

One reason to adopt Windows is that it helps make PCompatible computers fun again. Maybe not quite as much fun as a Mac, but it's getting there. One warning: once you start customizing your icons, it's hard to know where to stop.

And Yet More

One problem with Windows is that the standard fonts are, if not really yucky, at least not very sparkling. The Graphics Ultra board comes with some better fonts, but there aren't enough of them.

There's an easy fix for this: More Fonts gives you scalable typefaces, about as many as you'll ever want, with more coming. They look nice, especially with the Graphics Ultra board. There's a wide variety, from formal to fun, with patterns, outlines, shadows, reverses, and all the other stuff you'd expect. They're easy to install, and they work fast and efficiently. If that's not enough, there's also Display Faces, 26 more typefaces ranging from Geneva to cursive script to Zbats, which are Dingbats for the PC. What more could you want? Recommended.

It's Me, Blast You!

I like MathCAD. It's easier to use than most other math programs, and MathCAD makes it a *lot* easier to create documents that have numbers in them. If you're looking for a present for a computer-using high school or college student—regardless of major—I have no hesitation in recommending this program. I would have killed for it when I was in school.

MathCAD lets you simply muck about with numbers and equations, doing complicated things and getting the right answer. In other words, it lets you get a feel for how mathematics works to describe the world. That's terribly important for any educated person, whether he or she is going to teach English, go into accounting, become a physicist, or just wants to understand the world better. The new version of MathCAD for Windows integrates into the Windows environment nicely, and on a 386 or a 486 with a math chip, it runs so fast you hardly notice the delays.

I'm fond of MathCAD, but this seems to be a month for complaints. When I installed the program, it insisted that I give it my name. All right, that's becoming a common way of trying to control software piracy, and I don't disapprove. Then it wanted a company name.

I'm not a company. I'm just me. Sure, there's a legal entity known as J. E. Pournelle & Associates, but I don't need that splattered over every program I have. So I put in my name and left the company name blank; it wouldn't install. I tried spaces. Same story. I finally typed in BLAST YOU!!, and that worked fine; so now my copy of MathCAD for Windows identifies itself as being used by Jerry Pournelle, BLAST YOU!! Oh, well. MathCAD isn't the only program with silly installation rules. Highly recommended.

Math Blaster Plus

We have a whole slew of new educational software. I generally let Roberta pick

HALF REST OF MARKET UNCHANGED.

XTreeGold file archiving lets you compress files into the industry standard Zip format to free up disk space, making storage simpler

and all the popular graphics file formats like TIFF, PCX, GIF, AutoCAD (DWG and DXF), Postscript (EPS), Microsoft Windows Paint and more. Then there's the integrated file compression with Zip archives that'll save all kinds of space on your hard disk. You can even create self-extracting Zip files! And with your investment in Gold you get an enhanced Application Menu with *AutoBuild* that installs, displays and runs more than 1,000 programs. Plus the *Compare/Search* function that lets you easily find old or duplicate files. As well as the *Undelete* command that will recover accidentally deleted files. Whew! The list goes on and on.

Now XTreeGold lets you view graphics file formats in all the original colors and free of any screen distortion, plus you're given size, dimension and color spec information, too.

Plus you'll find all the 24 karat features that have made XTreeGold the international standard for file and disk management, like pull-down menus, fast, single-keystroke commands, integrated mouse support, text editor, context-sensitive help and extensive, easy-to-follow documentation.

So put away your wagon; ask your software broker about XTreeGold 2.5 – the investment with built-in productivity to get you moving and shaking faster. For the name of the XTree broker nearest you, call **(800)843-6888 Ext. 550.**

Buying "GOLD" pays interest! Registered XTreeGold investors can upgrade anytime to XTreeGold 2.5 for as little as $19.95. Anyone can sell short other file managers and receive XTree Gold 2.5 for $49.95. Call (800)282-5003 Ext. 975.

XTreeNet simplifies file and network management for Novell® Netware administrators.

xtree for UNIX® systems, the first easy-to-use file and disk management system for the multi-user UNIX environment.

XTREE COMPANY

4330 Santa Fe Road, San Luis Obispo, CA 93401

Circle 185 on Inquiry Card (RESELLERS: 186).

World Radio History

World Radio History

Used to be, when your hard disk got full you had to empty your wallet and buy a bigger one.

Or, you could buy yourself some time by deleting a bunch of your files.

At Stac,™ we didn't think this was much of a choice. So we invented Stacker.™

In the process, we created an instant bestseller. Which isn't surprising, considering that Stacker instantly gives you twice the disk capacity you had before.

Now, aren't you glad you didn't rush out and buy a new hard disk?

How?

By compressing all the files on your disk–applications, utilities, documents, spreadsheets, data, everything–using our patented Stacker LZS data compression technology.

Don't know a thing about data compression?

Don't worry. You don't have to.

In fact, you don't have to think about Stacker at all.

Stacker works behind the scenes, expanding your data when you need it and compressing it again as it goes back to disk.

Automatically.

It doesn't even matter what kind of software you use. Because Stacker is 100% compatible with everything from business and graphics programs to undelete utilities and low-level formatters.

Not to mention the latest versions of DOS® and Windows.™

If you think doubling your disk capacity will slow you down, think again.

As data is stored on your disk, Stacker instantly compresses it. Then, when your PC reads the data, Stacker instantly expands it. You don't have to do a thing.

You see, Stacker is fast. So fast, in fact, that it actually improves the performance of many of your applications.

Stacker is also 100% safe–something no other data compression product on the market can say.

Which explains why every leading utility software publisher and tape drive manufacturer uses our technology in their own products.

Speaking of software publishing and hardware manufacturing, we do both.

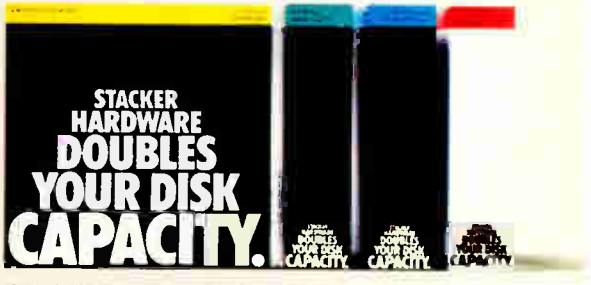
Which means we give you a choice.

If your PC can't spare a slot, or if your PC is a portable, a laptop or a notebook, the software on the opposite page is just what you need.

But if you're one of those who insist on smaller driver size and the highest possible speed and compression ratio, you'll want to install one of our three hardware versions.

Installation, by the way, is a snap. Just plug the board into any slot–no jumpers or switches to set.

The software practically installs itself. It even optimizes your disk for you.



In addition to the software-only version, Stacker is now available in three co-processor-with-software versions: Stacker XT/8, Stacker AT/16 and Stacker MC/16, each featuring the unique Stacker LZS chip.

To find just how much Stacker can do for your disk, your data and your wallet, call 1-800-522-7822 Ext. 298. Or ask your dealer for a demonstration.

And see how well we Stac up.

STAC

The Data Compression Company

Circle 156 on Inquiry Card.

World Radio History

through that pile to see what she'll recommend. One she likes is Math Blaster Plus for the Mac; this evaluation is based on her notes.

The start-up program is a snap. Enter your name at the prompt, and Blasternaut and his robot Spot invite you to join them in outer space, where ships race across the sky. The program is built around four adventure games. The graphics are neat, even on the tiny Mac SE screen.

The 750 math facts cover most elementary school arithmetic facts, from addition through percentages. The program is far from perfect. The error loops aren't as well thought out as we'd like, and sometimes it will tell you that you got a perfect score when you didn't. You'll always reach the Hall of Fame no matter how lousy you do.

However, Math Blaster Plus does make flash-card drill more palatable. There's an editor, so a teacher or parent can customize the drills to concentrate on areas where more work is needed. Probably nothing is going to make math drill really fun, but this gets closer than most methods. If you have a Mac and a child in the relevant grades, this will likely do some good.

Disney World

For best results with Disney software, first buy the Disney Sound Source. This is a little speaker that plugs into your PCompatible's printer port (you can do this while your printer is still active; install Sound Source and forget it). It didn't come with any software, so its only use seems to be to run Disney software, but that's quite enough reason to have one.

One Disney program is Mickey's ABC's: A Day at the Fair. It comes in living color with music and speech. Roberta says: "The ABC program is recommended for preschool kids ages 2 to 5. Installation takes only three steps. Beware of the copy-protection scheme. The adult installing the software needs to match up a black drawing of Mickey in a particular pose on brown paper with a cartoon cell on the screen. The black drawing is almost impossible to see on the very deep brown paper. Don't give up on this, because the part designed for the kids is worth it."

In fact, she says a lot more, all enthusiastic. The program is self-prompting: if you do nothing, a female voice gives you directions. Then Mickey talks to you, leads you around the house, and generally does things in response to your typing in letters. This is about as painless a way to learn the alphabet as you'll find.

Roberta continues: "Pressing a letter can initiate different actions depending on Mickey's location. Press the uppercase or lowercase *F*, and Mickey slides down a firepole in his bedroom floor (every boy's dream) and he's off to the fair. He meets different animals at the fair and competes with Donald Duck. Donald or Mickey wins the contest depending on the sequence, and Goofy shoots the starting gun, which presents the word *bang*, like in a vaudeville scene. After the contest, Goofy presents the prize ribbon." And so forth.

The cartoons are Disney quality, the voices are true to the characters, and the various actions you get from pressing different letters are fun to watch. All told, it's another painless way to get kids to do alphabet drills.

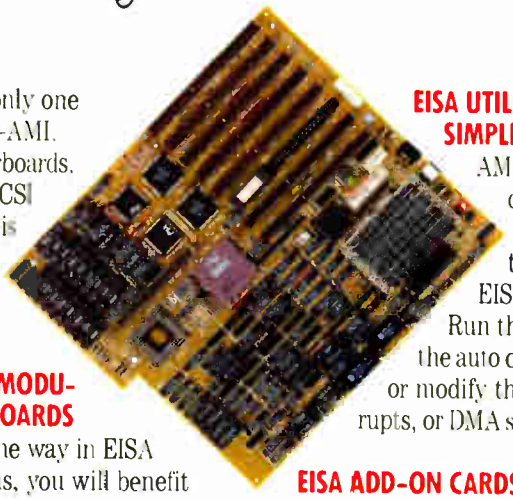
Roberta, who has taught about 15,000 people to read, sums it up this way: "This software is a step in the right direction and would probably have enough variety to keep most children's interest at that age. No software designed for this age group will last very long. Learning that letters have sounds is the first step in learning to read. This software can help you explore

Circle 64 on Inquiry Card (RESELLERS: 65).

World Radio History

AMI EISA

The Only Game In Town



For EISA, there is only one player to consider—AMI. Whether it's motherboards, BIOS, utilities, or SCSI host adapters, AMI is the single source for advanced EISA technology.

ADVANCED EISA & MODULAR CPU MOTHERBOARDS

With AMI leading the way in EISA motherboard designs, you will benefit from bulletproof performance and proven reliability.

- EZ-Flex—A new modular CPU design offering easy upgrades to future technology.
- Enterprise II—A proven EISA performer, popular for critical applications.

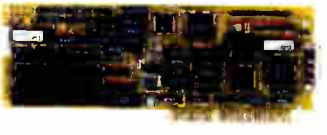
THE LEADING EISA BIOS

AMI is the worldwide standard for BIOS. AMI's EISA BIOS provides the reliability, compatibility, and features you desire. Plus, it's compatible with AMI's BIOS Configuration Utility, providing on-site customization for the Integrator or OEM.

EISA UTILITIES MAKE THE JOB SIMPLE

AMI designed and developed the EISA Configuration Utility to make configuring EISA products a snap. Run the ECU and select the auto configuration option, or modify the I/O ports, interrupts, or DMA settings as you desire.

EISA ADD-ON CARDS



The Fast Disk EISA SCSI Host Adapter, with a combination of 16 MB cache, and intelligent 386SX I/O management, is the fastest SCSI host adapter on the market today. Look to AMI for other EISA cards in the near future.

THE AMI DIFFERENCE

AMI's expertise covers the entire EISA environment. With research, engineering and support functions under one roof, AMI is unmatched in knowledge and support. Call AMI, and you will understand why AMI's "monopoly" on EISA makes it the only game in town.

AMI

SINGLE SOURCE TECHNOLOGY

Circle 15 on Inquiry Card (RESELLERS: 16).

AMERICAN MEGATRENDS, INC.
800-U-BUY-AMI or 800-828-9264, 404-263-8181, fax 404-263-9381

GO

START HERE

Cheap board fails in UNIX system
GO BACK 3 SPACES

Select Dependable AMI EISA motherboards
EIGHT AHEAD OF THE GAME

No AMI EISA BIOS
LOSE TURN

Discount boards not worth the savings

GO TO BANKRUPTCY

Discount EISA boards have high failure rate
GO BACK 3 SPACES

Discount board has slow video speed
LOSE TURN

Use highly compatible AMI EISA BIOS
PROFITABLE PARKING

Slow SCSI interface ruins reputation
GO BACK 3 SPACES

Use AMI EISA for reliable network file server
MOVE AHEAD 2 SPACES

Imported board proves unreliable
GO BACK 1 SPACE

Cheap EISA products force bankruptcy
NOBODY WILL VISIT YOU HERE

Discount board has compatibility problems
GO BACK 1 SPACE

Imported EISA board has no tech support
START OVER

World Radio History

ITEMS DISCUSSED

After Dark $49.95
Berkeley Systems, Inc.
2095 Rose St.
Berkeley, CA 94709
(800) 877-5535
(510) 540-5535
fax: (510) 540-5115
Circle 1151 on Inquiry Card.

Desqview 2.4 ..... $129.95
Desqview 386 2.4 ..... $219.95
QEMM-386 6.0 ..... $99.95
Quarterdeck Office Systems
150 Pico Blvd.
Santa Monica, CA 90405
(800) 354-3222
(213) 392-9851
fax: (213) 399-3802
Circle 1152 on Inquiry Card.

Disney Sound Source $39.95
Mickey's ABC's: A Day at the Fair $39.95
Walt Disney Computer Software, Inc.
500 South Buena Vista St.
Burbank, CA 91505
(800) 688-1520
(818) 841-3326
fax: (716) 873-0906
Circle 1153 on Inquiry Card.

Graphics Ultra
with 512 KB $599
with 1 MB $799
ATI Technologies, Inc.
3761 Victoria Park Ave.
Scarborough, Ontario
Canada M1W 3S2
(416) 756-0718
fax: (416) 756-0720
Circle 1154 on Inquiry Card.

Harpoon $59.95
Three-Sixty
2105 South Bascom, Suite 380
Campbell, CA 95008
(408) 879-9144
fax: (408) 879-9739
Circle 1155 on Inquiry Card.

Icon Pak I $49.95
Icon Pak II $99.95
Software Workshop
75 South Mountain Way Dr.
Orem, UT 84058
(800) 762-9550
(801) 224-6865
fax: (801) 224-8121
Circle 1156 on Inquiry Card.

Knowledge Finder ..... $495–$4995
Aries Systems Corp.
One Dundee Park
Andover, MA 01810
(508) 475-7200
fax: (508) 474-8860
Circle 1157 on Inquiry Card.

The Literacy Connection $100
The Literacy Connection
3960 Laurel Canyon Blvd., Suite 372
Studio City, CA 91604
Circle 1158 on Inquiry Card.

The Lost Admiral $59.95
Quantum Quality Productions, Inc.
1046 River Ave.
Flemington, NJ 08822
(908) 788-2799
Circle 1159 on Inquiry Card.

Magazine Rack CD-ROM $89.95
Bureau of Electronic Publishing, Inc.
141 New Rd.
Parsippany, NJ 07054
(800) 828-4766
(201) 808-2700
fax: (201) 808-2676
Circle 1160 on Inquiry Card.

Math Blaster Plus $59.95
two-disk teacher's edition $69.95
five-disk lab pack $179.95
Davidson & Associates, Inc.
3135 Kashiwa St.
Torrance, CA 90509
(800) 545-7677
(213) 534-4070
fax: (213) 534-3169
Circle 1161 on Inquiry Card.

MathCAD $495
MathSoft, Inc.
201 Broadway
Cambridge, MA 02139
(800) 628-4223
(617) 577-1017
fax: (617) 577-8829
Circle 1162 on Inquiry Card.

More Fonts $149.95
MicroLogic Software, Inc.
1351 Ocean Ave.
Emeryville, CA 94608
(800) 888-9078
(510) 652-5464
fax: (510) 652-5040
Circle 1163 on Inquiry Card.

Norton Desktop for Windows $149
Symantec Corp.
10201 Torre Ave.
Cupertino, CA 95014
(800) 441-7234
(408) 253-9600
fax: (408) 252-4694
Circle 1164 on Inquiry Card.

386Max 6.0 ..... $99.95
Qualitas, Inc.
7101 Wisconsin Ave., Suite 1386
Bethesda, MD 20814
(800) 733-1377
(301) 907-6700
fax: (301) 718-6060
Circle 1165 on Inquiry Card.

the sound/symbol connection requisite to learning to read. Highly recommended."

The Literacy Connection

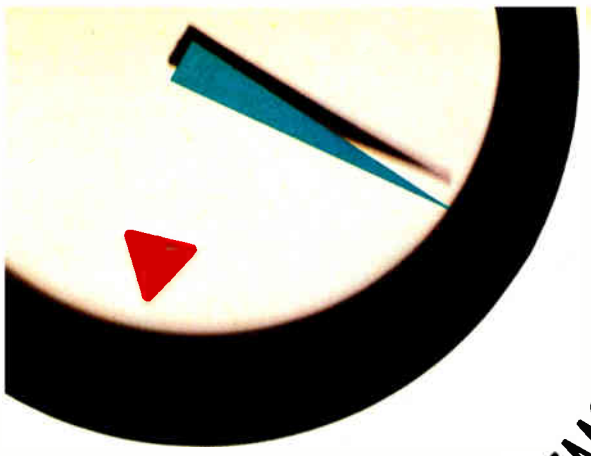
You're probably tired of my mentioning it, but Roberta's reading program, known as The Literacy Connection, continues to get results in field tests. She's got it in half a dozen schools now. Teaching reading is tricky, because a lot of kids—between 25 percent and 33 percent—are "natural readers" who pretty well learn without instruction. Another 25 percent or so will learn quickly and easily. The rest have problems, and the worse the problem, the more important it is to be systematic about reading instruction. Unfortunately, given today's classroom problems, being systematic is precisely what many teachers cannot do.

Roberta's program proceeds systematically. It has 70 lessons. Most children don't need them all. Somewhere around lesson 35, they take off on their own—which is, after all, what you want to happen. We've never heard of anyone who got through all 70 lessons and was still unable to read. But then when Roberta was the teacher of last resort in the L.A. Juvenile Justice system, she got plenty of "hopeless cases" and never failed to teach any of them, either.

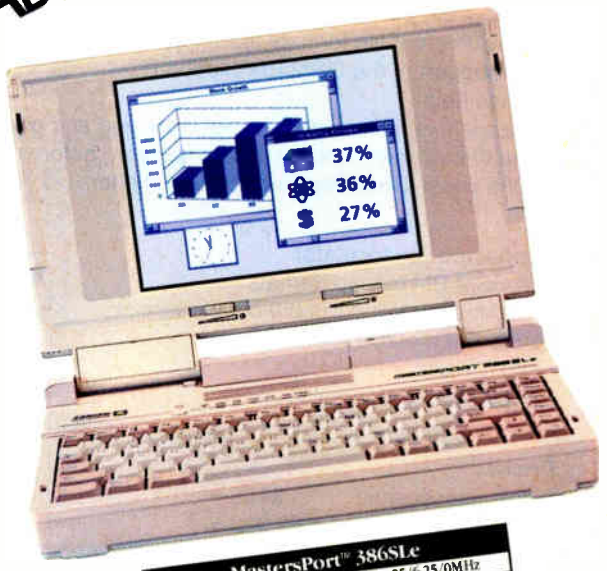
Winding Down

The big problem with CD-ROMs is that the access/retrieval software isn't up to

World Radio History



ZENITH DATA SYSTEMS HAS THE POWER TO MAKE YOU FORGET ABOUT BATTERY LIFE.



Discover the MastersPort 386SL and MastersPort 386SLe. The first notebook PCs with the intelligence to manage power for you, so you can use them hour after hour without giving battery life a moment's thought.

The MastersPort 386SL was first to set the standard for notebook performance. Stretching Intel's revolutionary i386 SL microprocessor to offer you up to 8 hours* on a single charge.

Now the MastersPort 386SLe takes the revolution one step further. Setting the pace with 25 MHz and a standard 85MB hard drive.

Plus both let you recharge the battery in less than 2 hours, press one key and continue where you left off. The advanced rest mode always brings you back to where you were, no matter what operating environment you're in.

For more information and the name of your nearest Zenith Data Systems Medallion Reseller, call **1-800-523-9393** in North America.

NEW!

MastersPort™ 386SLe	
Processor – Speed	i386™ SL – 25/6.25/0MHz
Co-Processor	80387™SX socket
Memory (Std./Max.)	2MB/8MB (64K cache)
Hard Disk Drive	85MB
LCD/Size	Backlit/8.85"
Video/Gray Scales	VGA/32
Power Management	*Premier System Management*™ – Standby/Resume – Rest /Resume – Panic Save – Unattended Communications
Software	MS-DOS® pre-installed. Microsoft® *Windows*™ v. 3.0 included
Weight (with battery)	7.0 lbs

intel inside

POWER FROM A NEW PERSPECTIVE. YOURS.

ZENITH data systems

Groupe Bull

i386 and the Intel Inside Logo are trademarks of Intel Corporation. MastersPort and Premier System Management are trademarks of Zenith Data Systems Corporation. MS-DOS and Microsoft *Windows* are trademarks of Microsoft Corporation.

*Under normal rest/resume conditions. Battery life varies with application, CPU clock speed, memory configuration, peripheral options attached, hard disk access, and display settings.

Copyright © 1991 Zenith Data Systems Corporation

Circle 187 on Inquiry Card.

World Radio History

Circle 178 on Inquiry Card.

VSRSNAP
version 1.03 for OS/2 PM
The PM capture program

VSRSNAP, the handy screen snapshot utility for capturing screens, windows or parts of a screen in the OS/2 PM environment

Features:
- The whole desktop or any area of the screen can be captured
- The current pointer shape is always captured
- Many different file formats are supported
- Full support of the OS/2 PM clipboard
- Online help
- Changeable time lapse between choosing and grabbing, giving you time to pull down a menu, select text etc., before capturing
- Runs under OS/2 PM version 1.2 or higher

Supported file formats:
- All OS/2 PM bitmap formats
- All Microsoft Windows 3.0 bitmap formats
- OS/2 PM metafile format
- TIFF 24 bits
- ZPIXMAP (X_Windows)

Prices:
Single user license $195.=
Site license $3,900.=

To order VSRSNAP write or fax to:

VSR Holland
P.O. Box 2584,
3500 GN Utrecht
The Netherlands
Fax: +31 30 31 04 26
(Phone: +31 30 32 49 44)

All products are registered trademarks of their respective manufacturers

QuickTrace™ for Windows 3.0

The Scan & Paint & Autotrace Program

Bit Map

Vector Based Graphics

NEW

Now you can scan, create, edit, print and even vectorize images — all with one program. You can work easily and quickly with large black-and-white images upto 4Mbytes such as logos, maps, clip arts and drawings.

QuickTrace for Windows supports ScanJet and Scan Man scanners with full painting functions, and handles TIFF, PCX and Windows bitmap image Files, automatically converts into CGM, EPSF, DXF, Micrografx PIC/DRW and Adobe AI vector Files.

for Windows $295
DOS versions (supports Autotrace function only)
for DTP (Illustrator, PageMaker, Harvard Graphics, DrawPerfect) $245
Convert into EPSF, CGM, Micrografx PIC, DRW
for AutoCAD DXF $295
for Lotus Freelance Plus $245

PLEASE CONTACT: 212-605-2339
OR SEE EGGHEAD NEAREST YOU IN U.S.
CONTACT REFLEX IN U.K.: 0734-314611

Developed by
Information & Control Lab. Co.
Nakajima Bldg., 5F, 11-22, Shinjuku 5-chome,
Shinjuku-ku, Tokyo 160, Japan
Phone: 3-5379-7470 / Fax: 3-5379-7471

Mitsubishi International Corporation
Technology Affairs Dept.
520 Madison Avenue, New York, NY 10022
Phone: 212-605-2339 / Fax: 212-605-1847

●Quicktrace can input images scanned by Niscan, Logitec ScanMan and etc. ●OEM inquiry welcome

the technology. However, I recently received a disk from Aries Systems that demonstrates their Knowledge Finder software; this one is for a very large medical-reference text database. Knowledge Finder is neat stuff, and if you're contemplating making a CD-ROM, you will want to look into it.

The CD-ROM of the month is Magazine Rack, which is published by Information Access (355 Lakeside Dr., Foster City, CA 94404, (800) 227-8431 or (510) 378-5000) and is available from the Bureau of Electronic Publishing. It includes about 100,000 articles from 300 different publications, indexed to make things fairly easy to find.

While I'm at it, Meckler (11 Ferry Lane W, Westport, CT 06880, (203) 226-6967) has a book that if you need it, you need it bad: *CD-ROM Research Collections, An Evaluative Guide* by Pat Ensor (1991, ISBN 0-88736-779-8). This lists nearly every known CD-ROM database—and there are a lot of them—along with addresses, prices (if known), equipment requirements, and some comments on usefulness. It covers everything from chemicals to sports to psychiatry collections.

The book of the month is Lois MacMaster Bujold's *The Warrior's Apprentice*, action adventure science fiction of the old school. The woman can write.

The game of the month is The Lost Admiral. It has some flaws and probably is the silliest role-playing game I have ever seen, but as a game it grows on you. The game mechanics are simple enough to learn, even from the wretched documentation. This is a game, not a simulation, but most of the principles of naval war can be applied.

Of course, if you want modern naval realism, get Harpoon. It has some new scenarios.

All told, a good month, and I learned something: you can install Windows with no trouble at all, provided that your Very Significant Other doesn't mind standing on one foot like a flamingo. . . . ■

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 "jerryp."

Circle 74 on Inquiry Card

World Radio History

The "Notebook Of The Year" And Two Powerful Sequels.

Premium® Exec™ 386SX/20 Model 43V

New Lower Pricing!

$2395

20 MHz, 386SX Processing
2 MB RAM, 40 MB Hard Drive
VGA Monochrome Display
With 32 Gray Shades

Premium Exec 386SX 25C Color Model 63V 4

$4995

25 MHz, 386SX Processing
4 MB RAM, 60 MB Hard Drive
VGA Color Display
With Up To 256 Colors

Premium Exec 386SX 25 Model 63V 4

New Lower Pricing!

$2995

25 MHz, 386SX Processing
4 MB RAM, 60 MB Hard Drive
VGA Monochrome Display
With 32 Gray Shades

Only one year after its introduction, the Premium Exec 386SX/20 has become one of the most popular notebook computers today, with sales of more than 70,000 units and climbing.

And among industry experts, the Premium Exec 386SX/20 is winning such coveted awards as "Notebook of the Year," "Analyst's Choice," "Best Buy" and the "VIP Award."

So, you can be assured AST delivers the best combination of price, performance, quality and customer support on the market today.

And if you need a color display, or 25 MHz processing power, here are two more winners to meet your specific portable computing needs:

Premium Exec 386SX/25 For Split-Second Processing — When every minute counts, ask for this speed demon. It delivers super-fast 25 MHz speed to conquer any number of applications with ease. And at a cost comparable to other manufacturers' 20 MHz systems, AST's Premium Exec 386SX/25 gives you a 25% increase in performance. Now that's value.

Premium Exec 386SX/25C For Fabulous Color At A Fabulous Price — Here's your chance to take advantage of a top-notch 256-color notebook with 25 MHz processing for only $4995. Its bright, fast VGA display offers a resolution of 640×480, perfect for Windows-based software.

Backed By AST's Award-Winning Service And Toll-Free Support

For More Information On AST Products Call

1-800-876-4AST

Made In America To Stringent Quality Standards — Designed and manufactured right here in the U.S., our Premium Exec notebooks offer state-of-the-art features and performance.

Backed By Award-Winning AST Service and Support — We're never out of touch. Whether you need to reach us by computer, telephone, mail, or even by FAX, you can count on AST for a full range of service and support programs. This includes ExeCare,™ an optional program which guarantees your Premium Exec will be replaced within 24 hours.

Ask For The "Notebook Of The Year" — For the best all-around notebook computer, look to the experts. Their choice is unanimous — the Premium Exec. For more information, or the name of the dealer nearest you, call AST today at **1-800-876-4AST.**

AST®
COMPUTER
The Power Of Choice.

Prices are MSRP, dealer prices may vary. Awards: Notebook Of The Year, *PC LapTop*, December 1991; VIP, *Portable Office*, November 1991; Analyst's Choice, *PC Week*, April 1991; Best Buy, *PC Magazine* (British Edition), April 1991.

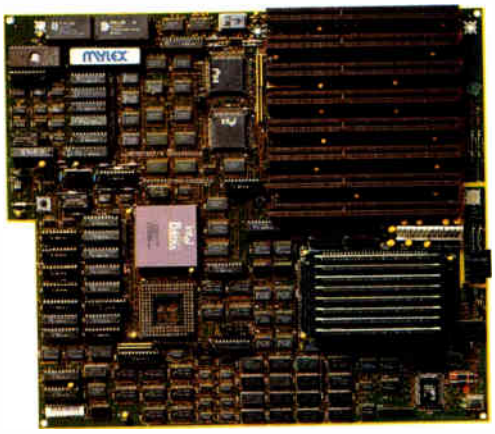
AST markets products worldwide, outside of the United States and Canada call AST International on (714) 727-9292 or FAX to (714) 727-8585.
AST, AST logo and Premium registered, Exec, ExeCare trademarks AST Research, Inc. Copyright © 1991 AST Research, Inc. All rights reserved.

Circle 19 on Inquiry Card (RESELLERS: 20).

World Radio History

When It Comes To Offers The Com

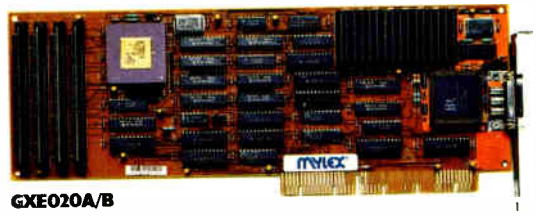
System Boards



MNE486

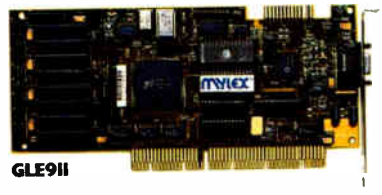
High-Performance EISA 486 System Board
- 486 25/33MHz (Upgradable to 50/66MHz)
- 128KB of external write-back cache
- IDE, floppy, S/P, PS2 mouse ports
- Mylex BIOS, surface mount design
- 50MHz available Q1, 1992

Graphics Controllers



GXE020A/B

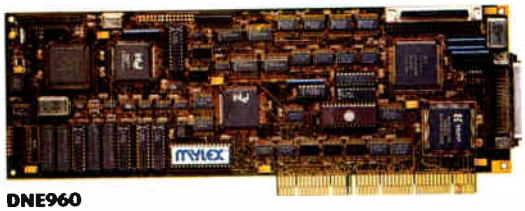
High-Resolution EISA Graphics Controllers
- TI 34020 32/40MHz graphics processor
- 1600 x 1200 or 1280 x 1024 resolution, 8 bit, 256 colors
- TIGA 2.05, Windows 3.0, AutoCAD, X-Window support



GLE911

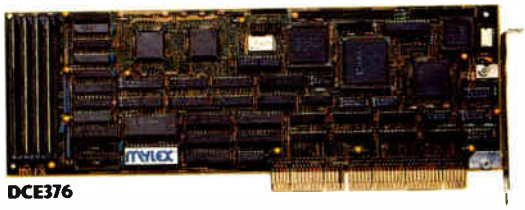
Fast EISA Graphics Accelerator
- S3 graphics accelerator
- 1280 x 960 x 16 or 1024 x 768 x 256 resolution
- Windows 3.0, GEM 3.1, AutoCAD, X-Window, AutoShade

SCSI Host Adapters



DNE960

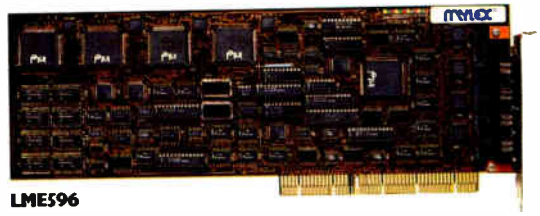
EISA SCSI-2 Host Adapter
- SCSI-2 (fast and wide), 20MB/s peak throughput
- EISA bus-master transfer rates up to 33MB/s
- Support for all popular SCSI devices
- Disconnect/reconnect, scatter/gather, synchronous drive support, disk mirroring and duplexing
- DOS, OS/2, UNIX, NetWare support



DCE376

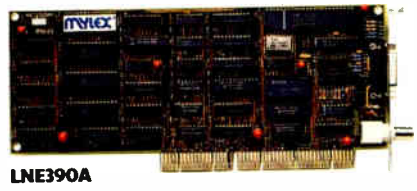
EISA Caching SCSI Host Adapter
- Intel 80376, up to 8MB cache, bus-master transfer rate up to 25MB/s
- Disconnect/reconnect, scatter/gather, mirroring, duplexing, tape backup
- DOS, OS/2, UNIX, SCO UNIX, NetWare, Windows 3.0

Ethernet LAN Adapters



LME596

Multi-Channel EISA Ethernet LAN Adapter
- Four 10Base-T Ethernet ports
- Four Intel 82596 32-bit Network Interface Controllers (NIC)
- 256KB dual-ported SRAM (64KB per NIC)
- Up to 16 individual 10Mbps Ethernet 10Base-T ports per host
- Supports Novell NetWare 3.11, UNIX TCP/IP and NDIS



LNE390A

EISA Ethernet LAN Adapter
- DP8390 Network Interface Controller
- EISA shared-memory up to 16MB/s
- Novell certified
- NetWare v2.15, 2.2, 3.0, 3.1 and 3.11, UNIX, OS/2 LAN Manager

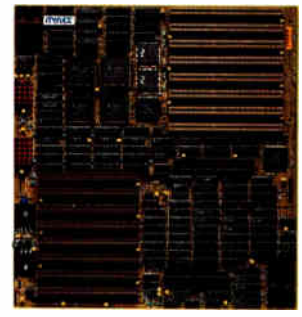
World Radio History

EISA, Only Mylex plete Solution.

Multiprocessing System

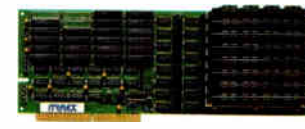
Available Q1, 1992

- 64-bit 267MB/s fully symmetric multiprocessing bus
- Four 486/50 CPUs with up to 512KB of write-back cache
- All EISA peripherals available from Mylex, Mylex BIOS
- UNIX V4, Novell Netware 286/386, SCO MPX, MS-DOS, Windows 3.0, LAN Manager support

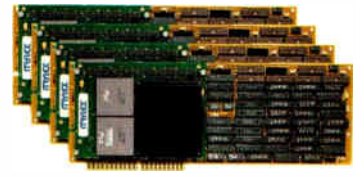


EISA Bus Interface Backplane

Multiprocessor Interrupt Controller



ECC Memory Controller

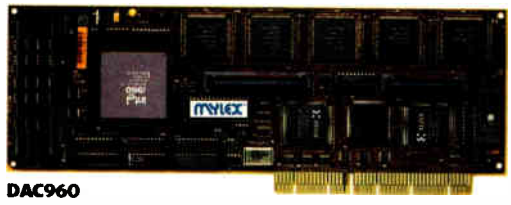


CPU Board

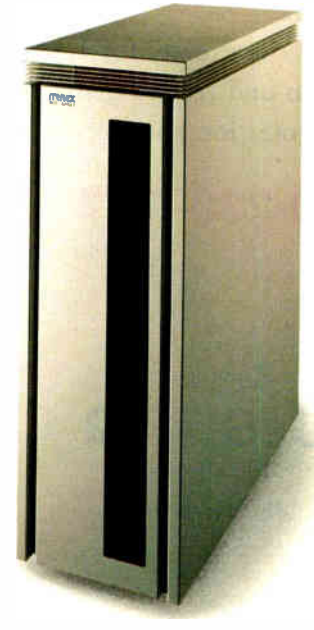
Disk Array Subsystem (Multi-Channel)

Available Q1, 1992

- The most advanced and unique disk array subsystem– includes disk array enclosure, controller, host adapter and software
- Five fast and wide SCSI-2 channels on a single-host adapter card– each channel supports up to 20 MB/s peak throughput
- EISA SCSI host adapter uses Intel i960CA 32-bit RISC processor
- Up to 64MB of write-back cache provided
- Striping with built-in support for various RAID levels
- Fault tolerance features including automatic drive failure detection, hot replacement and transparent rebuild



DAC960



Circle 306 on Inquiry Card (RESELLERS: 307).

For more information on these or any Mylex products, please contact us at 1-800-77-MYLEX or 1-510-796-6100. Or, fax the domestic sales department at 1-510-745-8016 and international sales at 1-510-745-7521.

MYLEX

All trademarks are the property of their respective holders. ©1991, Mylex Corporation. Specifications subject to change without notice.

World Radio History

Rely On The MINUTEMAN UPS For LAN Protection

Spikes. Surges. Overvoltage. Undervoltage. Brownouts. These things happen. And they can do irreparable damage to your equipment and data — unless you're protected with MINUTEMAN Uninterruptible Power Supplies.

MINUTEMAN protects all your equipment and data. All the time. In fact, in the event of power failure, it will safely and automatically shut down an unattended network.

No matter what your needs are, MINUTEMAN can protect and interface with everything from a stand alone workstation to the largest of the IBM AS/400s. We also provide 220-volt international models and Automatic Voltage Regulators.

So call the experts for LAN protection and receive a free power protection package.

1-800-238-7272

MINUTEMAN detects power failure, alerts network and continues to provide computer grade power until shut down command is issued.

STANDBY UPS MODELS
300 VA to 2300 VA
Sinewave output
Small, lightweight design

ON-LINE UPS MODELS
500 VA to 10,000 VA
True double conversion
Static by-pass standard
Sinewave output
Lower pricing than ever

UNATTENDED SHUT DOWN
MINUTEMAN UPSs are network ready for unattended, orderly shut down of **every available operating system.**

See us at
CeBIT '92
Hall 17
USA Pavilion

MINUTEMAN®
UNINTERRUPTIBLE POWER SUPPLIES

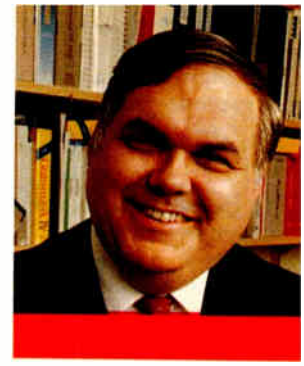
FOR LAN
NOVELL LABS
TESTED AND APPROVED
NetWare Compatible

Novell approved UPS monitor boards

© Para Systems, Inc. 1455 LeMay Drive, Carrollton, Texas 75007 Phone: 214-446-7363 FAX: 214-446-9011

Circle 121 on Inquiry Card.

World Radio History



WAYNE
RASH JR.

MURPHY'S LAW AND INTEROPERABILITY

Many people in the computer industry have a deep and abiding interest in Murphy's Law. They firmly believe that when you examine something up close, much of it doesn't work. These people are pessimists, of course. Unfortunately, they're frequently right.

For those of us who have had to deal with moving complex information between platforms, it's clear that the person who first wrote "interoperable systems won't" knew what he was talking about. For years, interoperability was an unrealized dream, and so-called compatible hardware and software packages frequently weren't.

Times have changed. It's now possible to find implementations of popular PC programs for a variety of computer systems. You can use the same spreadsheet package on your Mac, your DOS PC, and your Unix system. You can process your prose on the same word processing program, whether you're using a PC, a Mac, or even a VAX. No longer do you have to worry about finding ways to convert files. After all, you're using the same package on different systems. Or are you?

Defining "Compatible"

One of the best ways to ensure software compatibility between systems would seem to be to use the same applications software across platforms. Using WordPerfect on your DOS, OS/2, Mac, and Unix personal computers and on your DEC, Data General, and IBM host systems should guarantee common access to any word processing file from any machine. That's true, but using the same software on all platforms doesn't necessarily ensure total interoperability. The problem is that there are several levels of compatibility.

The ability to transfer files between two word processing packages means only that you don't need to retype the document text. You probably won't be able to preserve any special characters, formatting commands, or other attributes, although in some cases a word processor from one vendor, for example, will recognize some or all file attributes of another.

Applications that run on several platforms may support all file attributes across all systems. Often, however, the different versions are out of sync. That means that features available to PC users may not yet be available to Mac or Unix clients, or vice versa.

Still other packages have incompatible file formats, and nothing you can do short of custom programming will allow you to exchange data between them. You might find yourself in this situation if you try to exchange data between a financial package running on an IBM mainframe and a DOS word processor.

Work-Flow Changes

The reason that there's something of a gap between the way applications treat foreign files and the way users want them treated has a lot to do with apparent differences between the way users work in groups and the way applications developers write applications. When people work in teams—project teams, departments, hierarchies, or whatever—they normally share responsibility for the ultimate work product. They may, for example, parcel out sections of a report-writing project and then assemble the sections for final editing. Other companies delegate the initial work on a project to a junior member, who then passes it to others who edit, add material, or otherwise change it.

Sharing files among the many systems and applications in today's office inevitably leads to confusion

Once the initial writing for a product is complete, it passes to final production, where it gets a final scrub for formatting changes, minor corrections, and layout before taking its final form. So the document, spreadsheet, or other work file passes through many hands before it shows up in finished form. Until recently, most office workers performed these functions on paper, and a secretary did most of the work. Now, with the popularity of heterogeneous LANs, electronic versions of a document pass among many users who are often on different systems and running different application programs. The file changes its form many times as it passes through this process. Often, something gets lost in the shuffle.

Common Denominators

LANs make exchanging files very easy. That's why it is so important for applications to handle conversions

ILLUSTRATION : MICHAEL MACLAUGHLIN © 1992

World Radio History

Circle 29 on Inquiry Card (RESELLERS: 30).

CD-ROM

BUREAU OF ELECTRONIC PUBLISHING

MPC Multimedia PC

NEW

Multimedia CIA World Tour
MPC Title! With info straight from the CIA -- Plus Maps from Hammond, Inc. and flags & National Anthem segments New Version! $99

Monarch Notes on CD-ROM
Over 200 Notes on One CD-ROM Disc
The Entire Collection (many out of print) Only $99
The definitive multimedia source for understanding the world's greatest literature PC & Mac

Greatest Books Ever Written
The Ultimate Electronic Book PC & Mac $295

Countries of The World
Full text of over 100 Study Books, Maps, National Anthems, Flags & more! PC & Mac $495

U.S. History on CD-ROM
WINNER 1991 OPA B.'ST EDUCATIONAL PRODUCT
Text & Images PC/Mac *$50 rebate-final cost $349

Pioneer CD-ROM 6 Pak
6 PC/MAC DISCS BUNDLED FOR ONLY $395!
• U.S. History • Countries/World • Shakespeare • Holmes • Birds • Software Potpourri
Six Pack & Minichanger (Save over $1000) $1489

SONY Laser Library Enhanced BUNDLES! With Monarch Notes! CALL

High Performance SONY CD-ROM Drive Kits
Fast, MPC compatible drive kits in-stock

SONY CDU-535 kit (internal)	CALL
SONY CDU-541 kit (internal) MPC ready	CALL
SONY CDU-7201 kit (desktop)	CALL
SONY CDU-7211 kit (desktop) MPC ready	CALL
SONY Disc Caddies (5 or more)	$10 each

Also: Pioneer Minichanger, CDT, NEC, Hitachi, WORM & Erasable drives, in-stock - Call

Multimedia CD-ROM Titles

Microsoft Bookshelf best selling CD-ROM disc	Best Price
Mixed Up Mother Goose 'fun' educational disc	$59
Beethoven's Multimedia MPC classic disc	$79
Grolier's Encyclopedia 21 volumes, VGA pictures	Call
Mammals - Nat. Geographic/IBM pictures & text	Call
Compton's Multi-Media Encyclopedia	795

Libraries / Science / Business

Between Heaven & Hell II even stronger	$99
Magazine Rack 100's of current magazines	78
Voyage to the Planets astounding Voyager trip	119
Coates Art Review colorful, classic art	129
TIME Magazine Compact Almanac 5,000 articles	Call
Family Doctor home medical guide	98
Variety Video Directory Home video reference	189
Zip++ Every US address	195
McGraw-Hill Ref. Set 100,000 terms, 7,300 articles	495
Speed Dial entire U.S. Yellow Pages on one disc	Sale
Oxford Textbook of Medicine general reference	595
PC-Sig Library new edition, newest version	Call
Oxford English Dictionary over 250,000 headwords!	889
Phonedisc USA Telephone Directory - East or West	989

* MORE! Over 300 different titles available *
LOWEST PRICES! Free tech support
Bureau On-Line CD-ROM Library. FREE access to 12 different CD-ROM Discs. CALL!!!
GSA# GS00K91AGS5280
HOURS M-F 8:30am - 6:30pm EST

VISA DISCOVER AMERICAN EXPRESS

Same Day Shipping

Bureau of Electronic Publishing, Inc.
Dept. B, 141 New Road, Parsippany, NJ 07054
FAX # 201-808-2676
CALL: 800-828-4766 ORDERS
201-808-2700 INFORMATION

transparently. Unfortunately, the process usually isn't transparent. Often, complete conversions aren't possible, and you may have to settle for conversions to and from ASCII as the least common denominator.

Most applications can convert files to and from ASCII. You might, for example, convert a Microsoft Excel spreadsheet to ASCII in order to import it into a WordStar document. You retain the numbers but lose special characters, formatting, and formulas. Even ASCII doesn't always work as an intermediary, because some programs still don't support it. In that case, you'll need a conversion utility to serve as an intermediary. It's unfortunate that a file must pass through all those permutations just so you can get a plain text copy.

Fortunately, there is life beyond ASCII. For example, Lotus 1-2-3 can read dBase files, and Excel can read Lotus 1-2-3 files. The program importing the file converts it directly into the native file format. This works better than converting to ASCII, but you still usually lose some attributes. There are exceptions: Excel, for example, can interpret formulas and other attributes from Lotus 1-2-3 and a few other spreadsheet file formats.

Some developers design their packages to work with other programs. When I wrote my recent book *WordPerfect Office 3.0: The Basics* (John Wiley & Sons, 1991), I sent WordPerfect 5.1 files to the publisher, who used PageMaker for the page layout. The typesetting equipment accepted the text from PageMaker but rejected the embedded WordPerfect graphics-format illustrations. I had to use Inset Systems' HiJaak to convert these images to TIFF.

In such a vast wilderness of file formats, you'd think that the best salvation would be to use the same software on all the computers at your business. If you're using WordPerfect on your IBM clones, for example, perhaps you should use WordPerfect on your Macs and your VAX as well. Then you'd be able to move documents around with no problems of any kind whatever. Right? Not quite.

The Big Iron

Differences between platforms become more noticeable when you move into the world of minicomputers and mainframes. Companies like Lotus and WordPerfect also make software for larger computers outside of the personal computer market. WordPerfect got its start writing word processing software for Data General minicomputers. Regardless of their background, though, differences between software versions remain.

You can create a WordPerfect file on your personal computer that you can't use with the version of WordPerfect that's running on your VAX down the hall. Why? Because the versions for the minicomputer and mainframe worlds tend to lag behind the personal computer versions. WordPerfect 5.1 for the PC was out months before VAX customers using version 5.0 received their upgrade. The spread between WordPerfect versions for some versions of Unix is even wider, so choosing WordPerfect for a corporate standard may still require file conversion.

Some companies respond by ignoring the problem, but most companies can't do that. Others plan to convert everyone to one system. Unfortunately, many companies have such a large investment in the central computer and its attendant terminals that conversion to personal computers proceeds slowly. It's not at all unusual to find workgroups in which some users have computers while others are still using dumb terminals. For these groups to work

ITEMS DISCUSSED

HiJaak
Inset Systems
71 Commerce Dr.
Brookfield, CT 06804
(203) 740-2400
Circle 1239 on Inquiry Card.

Lotus 1-2-3
(Unix, DOS, Windows, IBM System/370)
Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
(617) 577-8500
Circle 1240 on Inquiry Card.

Microsoft Word
(Windows, DOS, Macintosh, Unix)
Microsoft Excel
(Windows, Macintosh)
Microsoft Corp.
1 Microsoft Way
Redmond, WA 98052
(206) 882-8080
Circle 1241 on Inquiry Card.

WordPerfect
(Windows, DOS, Macintosh, Unix, VMS, IBM System/370, Data General)
WordPerfect Corp.
1555 North Technology Way
Orem, UT 84057
(801) 225-5000
Circle 1242 on Inquiry Card.

World Radio History

What a racket!

$ 3,000 bucks for a CAD program? Are you kidding?

DesignCAD 2D is only $349, and it has more and better features than the other CAD programs that cost $3,000!

And, if you're ready for a three dimensional CAD program, there is the state-of-the-art DesignCAD 3D . . . for only $499!

DesignCAD is the software used in the design of Andre Agassi's tennis rackets, the Patriot missile, and scores of other high tech, low tech, and no tech products.

So what's all the racket about? It's because we believe that it's silly to spend more on a CAD system than you would on a word processor. Agree? Well, the ball's in your court.

Your product designed with DesignCAD? Let us know, and maybe we'll put it in one of our ads.

BUYERS ASSURANCE SEAL

CAD/CAM Software

PC MAGAZINE EDITORS' CHOICE

PC MAGAZINE EDITORS' CHOICE

For a *free* demo disk and 16 page color brochure, contact:

American
Small Business Computers, Inc.
One American Way • Pryor, Oklahoma 74361
(918) 825-4844 • FAX (918) 825-6359

Circle 18 on Inquiry Card.

European Headquarters:
102 Rue La Fontaine • 75016 Paris, France
Phone 331 4520 6540 • FAX 331 4520 6539

Other offices in:
Amsterdam • Brussels • Bucharest • Istanbul • London
Mexico City • Paris • Prague • Sao Paulo • Tokyo • Warsaw

Also Available for Macintosh

World Radio History

Circle 87 on Inquiry Card .

People are talking about us.

F77L-EM/32 & Lahey Ergo OS/386

Port mainframe programs as large as 96MB to 386/486's with this 32-bit DOS-Extender compiler. The Winner of *PC Magazine's* 1988 Technical Excellence Award just got better. New Version 4.0 includes: Programming Tools, Popular Fortran 90 features, Virtual Memory Support, DESQview Support, New Documentation and Free Unlimited Runtime Licenses. F77L-EM/32 $995 OS/386 $395

F77L

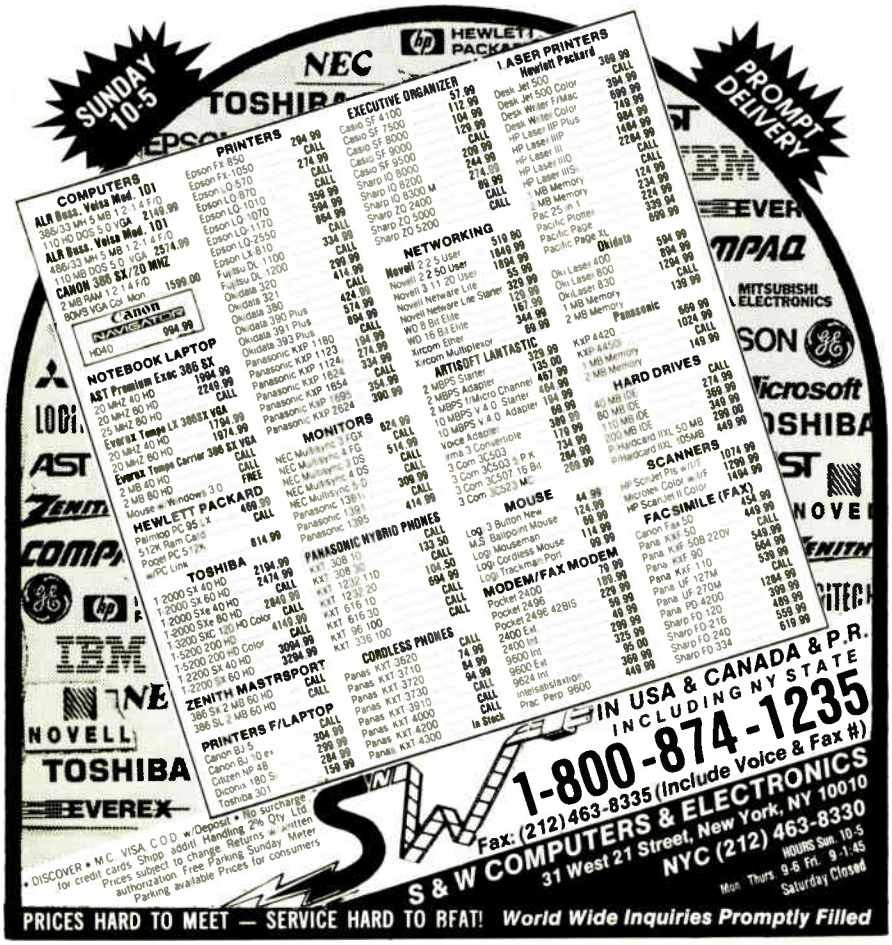
The fastest real-mode compiler available. F77L can take advantage of your 386 PC by generating 32-bit instructions. New Version 5.0 includes: Fortran 90 features, Weitek support, and Video Graphics. $595

Lahey Personal Fortran 77

Version 3.0: Full ANSI 77, Editor, Debugger, Linker, Library Manager, Microsoft and Borland C interfaces. A great learning tool at an unbeatable price. $99

Contact us to discuss our products and your needs. **(800) 548-4778**
Lahey Computer Systems, Inc. P.O. Box 6091, Incline Village, NV 89450
Tel: (702) 831-2500 FAX: (702) 831-8123

FORTRAN IS OUR FORTE



Circle 148 on Inquiry Card .

together, they must share information bidirectionally. What should be a simple task, such as sending a page of text from one user to another, may require a file conversion, a file transfer, or even an upload to the host system, followed by a file conversion. For the process to be useful, it needs to work effectively. Often it doesn't.

What's the bottom line? There's no way to be certain that you can use the same software on multiple platforms transparently unless you can find someone who has done it already. About the only thing you can assume is that there will be glitches, but hopefully minor ones, from time to time.

Coping with the Confusion

Clearly, you'll find no magic solution if you're dealing with users and workgroups that must work together yet have evolved with their own unique systems and applications. But that should be no surprise by now. What you can do is manage the situation by recognizing these limitations and restructuring your work flow and the resources you use to avoid them. You have three basic choices. Your approach depends on your business situation, your corporate culture, and your current investment in hardware.

Solution 1: You can simplify your situation by restricting everyone's choice of computers and software and by replacing those systems that don't fit. If everyone has DOS PCs running WordPerfect, Lotus 1-2-3, and PageMaker, you won't have any problems. This solution avoids compatibility and file-conversion problems and minimizes training and upgrade procedures. It's a bit rigid, though, and can get quite expensive if you have to replace much of your computer equipment. It might also make some operations in the work-flow process less efficient: Mac users in the production department won't enjoy learning to use a PC. Nevertheless, a company that depends heavily on moving documents from one user to another may find compatibility to be more important than flexibility.

Solution 2: Let each user retain his or her chosen system but choose software for each platform that's interoperable with your other applications. This more relaxed approach is more suitable to the way many businesses work. You might select Microsoft Word as your word processor and Excel as your spreadsheet if your workgroups consist of Macs and PCs running Windows 3.1, for example. This works well only if the applications you need are available on all your systems. Be prepared, however, for unforeseen difficulties. You'll maintain workgroup efficiency, but you

World Radio History

When there's only one LaserJet® to go around...

It's a lesson you learned long ago — how to share with others. But unfortunately, no one ever informed you of the ways to share a LaserJet® printer.

...you learn how to share.

So now you've got several people in an office all vying for the rights to a single printer. What do you do? Learn to share with **Pacific Connect**™.

This printer sharing device for the HP LaserJet Series II, IID, III, and IIID is perfect for environments with several PCs and/or Macintoshes. Why spend money on multiple LaserJet or PostScript® printers when you can share one LaserJet with up to five PC and Macintosh users?

Pacific Connect slips conveniently into the optional I/O slot on a LaserJet printer. So it's easy to install and easy to use. No other LaserJet printer sharing device comes complete with all the cables, adapters and Macintosh support needed. Of course, PostScript operation requires Pacific Data Products' award-winning PostScript language emulation cartridge, PacificPage™ and the additional printer memory needed for printing PostScript files.

As if each user were printing to his own printer, **Pacific Connect** eliminates the need for mechanical switch boxes or networking software. And print jobs are placed in the user-upgradeable buffer memory of 256k or 1.25 MB, and printed in the order that they are received.

For product information contact Pacific Data Products at 9125 Rehco Road, San Diego, CA 92121, USA, (619) 597-4609 FAX (619) 552-0889.

PACIFIC
DATA PRODUCTS

ific Connect and PacificPage are trademarks of Pacific Data Products, Inc. HP and LaserJet are registe ed trademarks of Hewlett-kard Co. PostScript is a registered trademark of Adobe Systems Incorporated. Macintosh is a registered trademark of Apple mputer Inc. **EUROPEAN HEADQUARTERS: Switzerland** Tel (41) 22-41-2650, Fax (41) 22-410682
991 Pacific Data Products, Inc.

World Radio History

may still lose some flexibility as files pass between groups.

Solution 3: Go for total flexibility. Allow users on each platform to use the best possible application for their task, and live with the limitations. You'll have to accept the fact that moving information between platforms might be a cumbersome process, and you'll have to be willing to live without some file attributes that simply aren't recognized by other applications further down in the work-flow process.

You might, for example, end up with software that can read the data format of another application, or you might select conversion software—such as HiJaak—that will perform such conversions for you. If you don't move many files, don't transfer much data between groups, or don't need a lot of nontransferable file attributes, this approach makes sense.

What's Ahead

There was once a time when data compatibility wasn't a problem. People transferred their documents on paper. If they had to move information in electronic form, they did so by modem or by passing along a floppy disk. Now, word processing documents, spreadsheets, and graphics files are immediately accessible to everyone on a network. Work flow is now an electronic process, and file compatibility is a big issue.

WordPerfect and other vendors are rushing versions of their packages for Mac, DOS, Windows, and Unix users to market. They're not, however, rushing to support other vendors' file formats or to develop a better intermediate file format. Why isn't there a better least common denominator for file interchange than ASCII? The reasons lie partly in the difficulty of determining such a standard, partly in selfish marketing concerns, and partly in a lingering vendor ignorance of how computer networks have changed the work-flow process. Why encourage a customer to buy anything but your product? Ultimately, products that attempt to lock in users in this way will find themselves locked out of tomorrow's LANs.

The more egregious file compatibility problems should be solved soon. There's no good reason for Mac, Unix, and Windows versions of the same word processing program to have problems exchanging data. And users shouldn't have to go through an arcane conversion process in order to read common file formats such as ASCII.

Today's software manufacturers are much better at allowing users to move their information between platforms, but they have a long way to go before file exchange between applications becomes transparent. Until the industry gets there, you'll have to balance the desires of your employees against the efficiency of moving information around and against the flexibility you need to match computing resources to needs. ■

Wayne Rash Jr. is a contributing editor for BYTE and a principal and technical director of the Network Integration Group of American Management Systems, Inc. (Arlington, VA). He is coauthor of two books for business network users: The Executive Guide to Local Area Networks *and* The Novell Connection. *You can contact him on BIX as "waynerash," or in the to.wayne conference.*

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

You Build the Bitmaps. We Build the Show.

Images courtesy Tibor, Kansai, Kevin McCabe, AT&T, GSL

If you need to show true-color images for your technical seminars or client presentations, ImageQ™ for Windows gives you the power to get the show on the road. Whether it's a simple slide show or a fully interactive presentation, use the programmability, speed and quality of ImageQ to display your 24-bit TARGA, BMP or TIFF files. Use ImageQ to communicate your visuals with the clarity they deserve.

IMAGE Q

ImageQ offers you: High speed display of images from disk ▪ Visual slide sorting ▪ Portable presentations ▪ 'On-the-fly' conversion of true-color images to super VGA ▪ Powerful control scripting language ▪ Transitions between images with control over direction and style ▪ Support for PCX, GIF, TIF, BMP, TGA, VST, VII and others ▪ Cut and paste of text and images from other Windows applications ▪ Automatic creation of presenter notes and viewer handouts

ImageQ $349 ImageQ Demo $19.95 Contact: 1-800-363-3400

Image North Technologies Inc. ▪ 180 King St. S., Suite 360 ▪ Waterloo, Ontario, Canada ▪ N2J 1P8 ▪ Dealer inquiries welcome

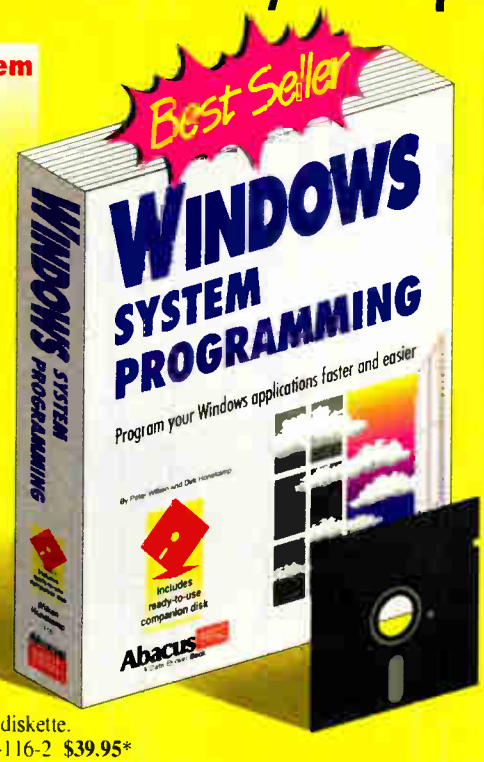
World Radio History

Circle 211 on Inquiry Card (RESELLERS: 212).

More Computing Know How

Get the most from your computer– our books show you how.

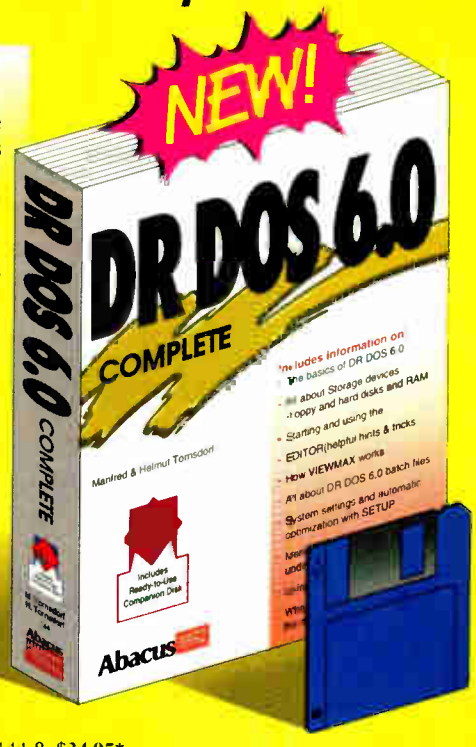
Windows System Programming



The bible for Windows programmers. Includes the tools you need to program professional applications for operation under Windows. Contains sample applications with exhaustive documentation and background information with programming examples in C. Topics include using GDI, bitmaps and the color palette manager; using DDE (Dynamic Data Exchange) between applications; Windows memory management; the DDL (Dynamic Link Libraries) concept and much more. 740 pages with companion diskette.

#B116 ISBN 1-55755-116-2 **$39.95***

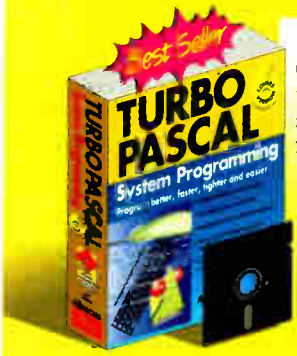
DR DOS 6.0 COMPLETE



DR DOS 6.0 Complete is an everyday user's guide to running Digital Research's brand new DR DOS 6.0 operating system. An encyclopedia of practical info makes this the most authoritative DR DOS 6.0 reference book available. Shows you how to use DR DOS 6.0's new features including: SuperStor disk compression, MemMAX memory saving, FileLink data transfer and more. Both beginning and advanced users will find that the techniques presented will make them more productive with DR DOS 6.0. Includes 3.5" companion disk.

#B144. ISBN 1-55755-144-8. **$34.95***

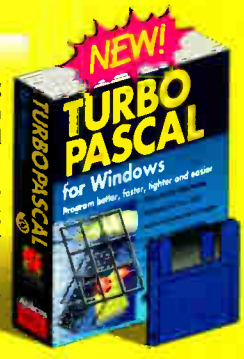
Turbo Pascal System Programming



Gives you "know how" to program faster, easier, tighter and better. Find out how to use Turbo for system programming tasks; writing TSRs; performing multi-tasking; using SAA windowing and implementing expanded and extended memory. Learn how Turbo generates machine code, handles the mouse, scans the keyboard, uses UNITS and OOPS, performs fast screen display and more. 750 pages with companion diskette of more than 800K of source code.

#B124 ISBN 1-55755-124-3 ~~$44.95~~*

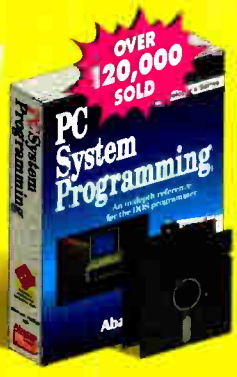
Turbo Pascal for Windows



Provides an in-depth look at programming using this popular development system. Includes an extensive introduction to the integrated developmental environment and a practical overview of the fundamentals and special features of Pascal programming under Windows including Object Windows. Also includes techniques for using Units - a vital topic for understanding object-oriented programming. Includes 3.5" companion diskette

#B141 ISBN 1-55755-141-3 **$39.95***

PC System Programming



An encyclopedia of PC technical and programming knowledge. Features parallel working examples written in Pascal, C, Assembly and BASIC. Explains how to use extended and expanded memory, hard disks, PC ports, mouse drivers, graphics and sound. Also explains memory layout, DOS operations, fundamentals of BIOS and TSR programs. Includes complete appendices. 920 pages and 2 companion disks with over 1 MB of programs.

ISBN 1-55755-036-0 **#B036 $59.95***

In US & Canada Order Toll Free 1-800-451-4319 EXT. 21

For fast delivery Order Toll Free 1-800-451-4319 EXT. 21, or FAX (616) 698-0325

❑ Yes, please rush the following items ❑ Yes, please rush your free PC catalog

Apply to my: ❑ Visa ❑ Master Card ❑ Am.Express / ❑ I have enclosed a check / M.O.

___ PC System Programming	$59.95	___ DR DOS 6.0 COMPLETE	34.95
___ Turbo Pascal for Windows	39.95	___ Windows System Programming	39.95
___ Turbo Pascal System Prog.	44.95		

In US and Canada add $5.00 Postage and Handling.

*Foreign orders outside North America add $13.00 surface rate or $20.00 air mail per book.

Card#:_____ Expires:_____

Signature:_____

Name:_____

Company _____

Address:_____

City:_____ State:_____ Zip:_____

Phone#:_____ Dept. B1

Available at most B. Dalton Booksellers, Waldensoftware, and Software Etc. and other bookstores nationwide. In the UK contact Computer Bookshops 021-706-1188 • In Australia contact Paxtronics 02-748-4700

Abacus Dept. B1, 5370 52nd Street SE Grand Rapids, MI 49512

Orders: 1-800-451-4319 • Phone: (616) 698-0330 • Fax: (616) 698-0325

In US and Canada add $5.00 Postage and Handling. *Foreign orders outside North America add $13.00 surface rate or $20.00 air mail per book.

We accept Visa, Master Card or American Express. Call or write for your free catalog of PC Books.

Circle 8 on Inquiry Card (RESELLERS: 9).

World Radio History

NATURAL

A Wider Vista of Reliable Electronic

South Sister, Middle Sister, and Broken Top Mountains – Oregon Cascades

Fans, Enclosures, and Components

Toshiba 1.44MB 3.5" Floppy Disk Drives

Weller Soldering Stations

Jameco 8088, 80286 and 80386 Computer Kits

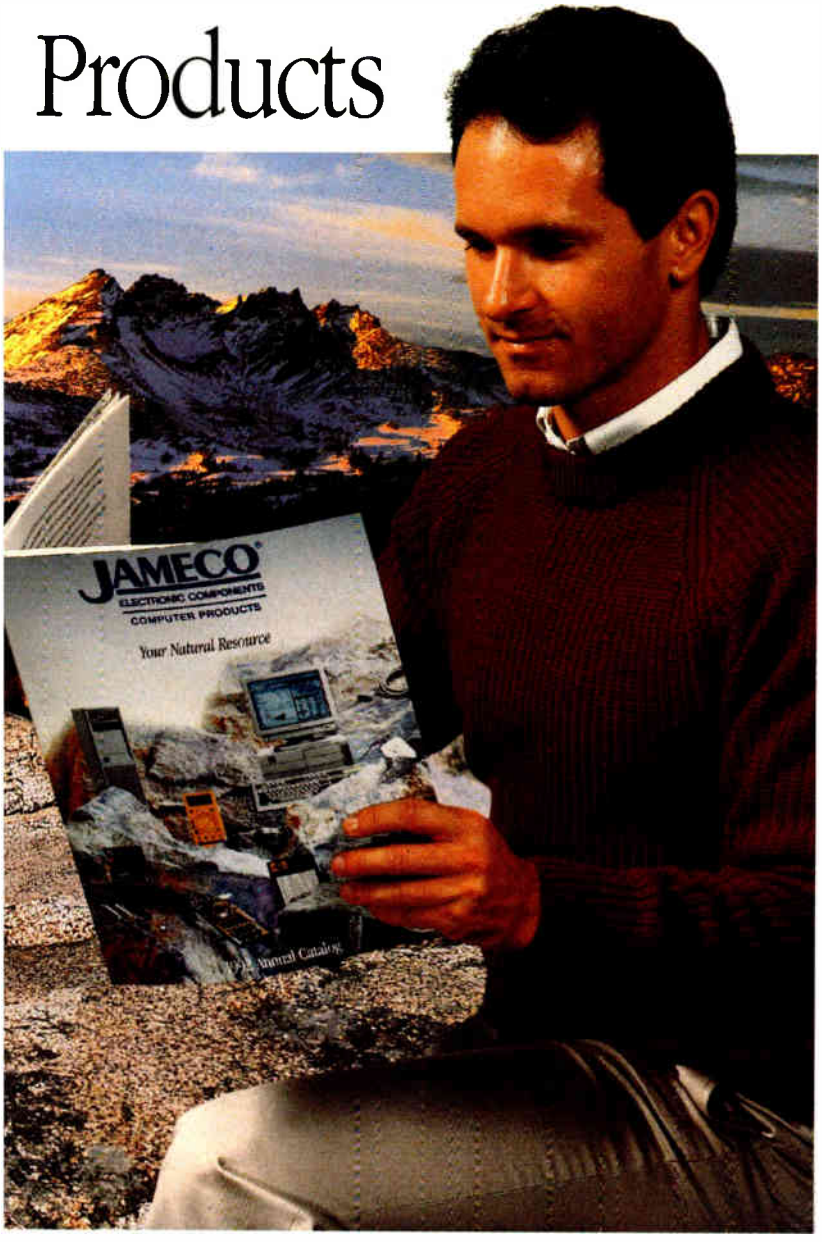
Please refer to **Mail Key 1** when ordering

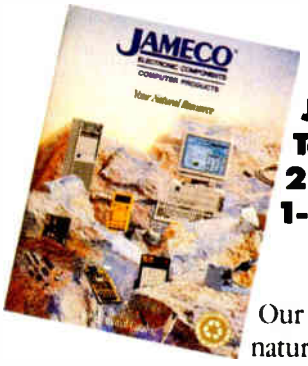
Terms: Prices are subject to change without notice. Items subject to availability and prior sale. Complete list of terms/warranties is available upon request.

World Radio History

RESOURCE.

Products



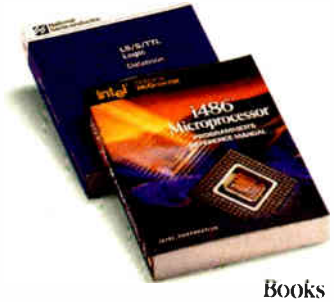


Get Your Free Jameco Catalog Today. Call Our 24-Hour Hotline 1-800-831-4242

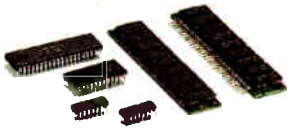
Our catalog is a natural resource for all your computer and electronic product needs. You'll find over 4000 different items in this easy-to-use source book. Whether you want the latest computer kit, computer upgrade component, or accessory..... integrated circuits, test and measurement equipment or a special technology book, you'll find it at the most competitive price. And this wide selection is backed by our record of assured quality and solid customer support.

For 16 years, Jameco has been the resource of choice for large and small businesses, schools and universities, government, and individuals. And we make buying as natural as one phone call. Use our 24-hour order processing, toll-free 800 number and fax, BBS access and expedited shipping.

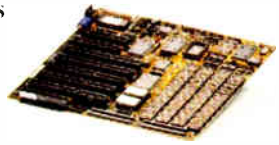
Let us become your natural resource today. Call now for our latest catalog. When you're ready, shop by phone or stop by our catalog-store/headquarters located in Belmont, CA, serving Silicon Valley and the Stanford Technology Park area.



Books



Integrated Circuits and RAM Modules



Jameco 16MHz 80386SX Motherboards

JAMECO®
ELECTRONIC COMPONENTS
COMPUTER PRODUCTS

1355 Shoreway Road, Belmont, CA 94002
1-800-831-4242 (415) 592-8097
FAX: 1-800-237-6948

Circle 83 on Inquiry Card.

All trademarks are registered trademarks of their respective companies. © 1/92 Jameco Electronic Components/Computer Products

World Radio History

See the Difference.

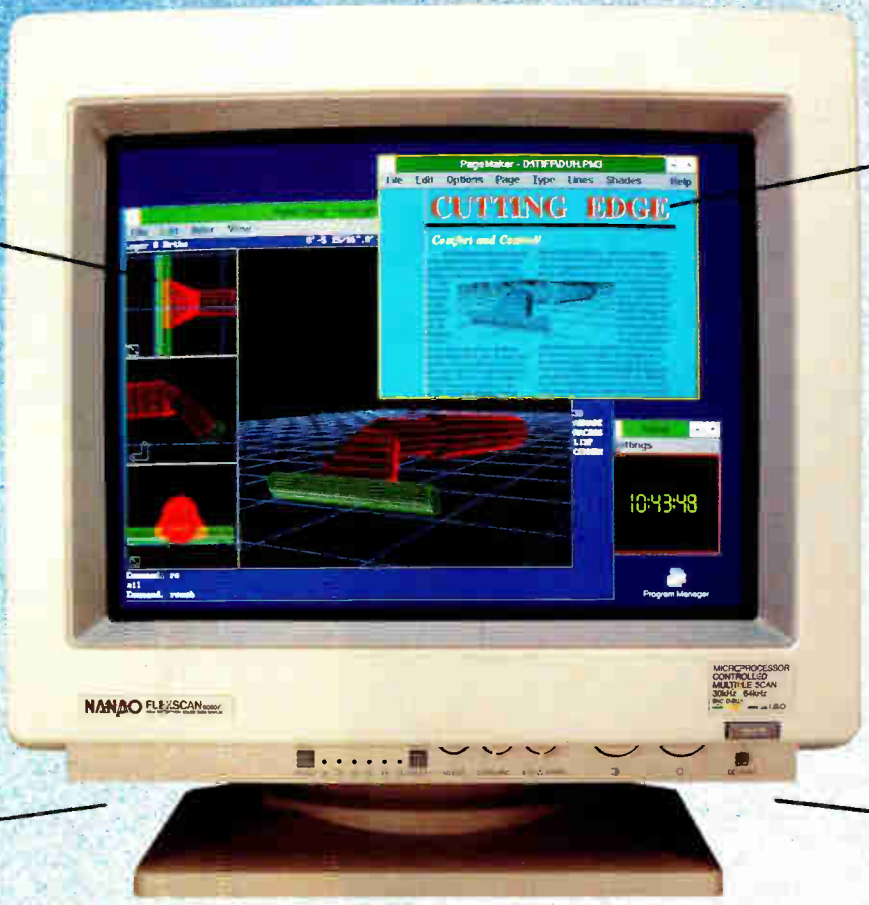
'91 INFO WORLD ranks Nanao #1

"Using each adapter at VGA, 800-by-600 and 1,024-by-768 pixel resolutions, all test images were displayed crisply."

-- PC Week

"The image is the brightest we've ever seen, even in the brightly-sunlit new CADalyst office."

-- CADalyst



"The intelligence built into this monitor eliminates all of the arm stretching and wheel turning so often associated with video mode changes."

-- PC Magazine

"Nanao thoughtfully places the seven most-used controls on the front of the monitor, unobtrusively tucked below the faceplate."

-- Macworld

See the difference that the industry experts agree has set the **Nanao Flexscan 9080i** apart from other monitors.

The Difference Will Impress You.

Color yourself impressed by the Nanao Flexscan 9080i's multiscanning abilities and high resolution. The 1280 x 1024 non-interlaced resolution increases productivity and enhances graphics applications beyond compare. Its high refresh rate (74Hz) is easy on the eyes. And with sharper text and brighter colors, the 9080i delivers the high quality professionals need...and want!

The Difference Will Excite You.

Get excited about doing what you've always wanted to do with Windows on the 9080i's larger 16-inch screen area. Highly compatible, in compliance with the Video Electronics Standards Association. Convergence & pin-cushioning controls. Dual inputs for two computers or two boards. The little differences that make for an exciting new monitor.

The Difference Will Comfort You.

Sometimes for high performance you need to give up creature comforts. But not with the 9080i. Sit back and relax in front of your Nanao monitor and its convenient front control panel. Almost every adjustment is within your reach. Nanao Flexscan monitors even align themselves with the Swedish MPR standards of low radiation emissions and give you an anti-static coating, fulfilling your ergonomic needs.

See the family of monitors ready for the next step in high resolution. To see the difference for yourself, contact your local Nanao dealer or call us at **1-800-800-5202.**

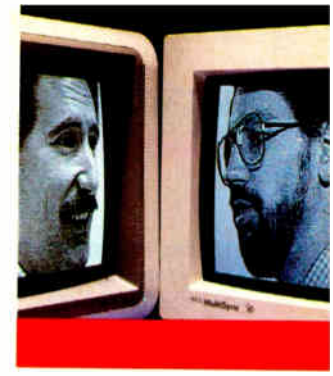
NANAO®

NANAO U.S.A. CORPORATION
23535 Telo Avenue
Torrance, California 90505
(213) 325-5202

Circle 104 on Inquiry Card (RESELLERS: 105).

"Cutting Edge" images created by Joe Lorenzini; Valerie Bernescut, Huntington Beach. "Living Room" image created by Neolux, Pasadena. NANAO and FLEXSCAN are registered trademarks of Nanao U.S.A. Corporation.

World Radio History



BYTE columnists, staff, and contributors debate the issues

WHAT DO BENCHMARKS REALLY TELL YOU?

Roundtable is a forum in which BYTE editors, columnists, and contributors debate key issues that affect how you purchase and use hardware and software. The "conversations" take place on BIX, where you can participate in the round.table conference.

KEN SHELDON: Benchmarks: You can't live with 'em, and you can't live without 'em. Or can you?

BYTE spends much time and effort making sure that its benchmarks are fair, are sensible, and produce meaningful results. It takes a lot of work and isn't a lot of fun; anyone who dares release a suite of benchmarks is almost begging the world to take potshots at their efforts.

Some companies optimize their products specifically so that they'll get good ratings on benchmarks. And with the rapid rate of technological advance, today's benchmarks are outdated tomorrow. In view of that, does benchmarking make sense?

DENNIS ALLEN: Let me start by clarifying what benchmarks and benchmark tests are. A benchmark is nothing more than a standard used for comparison. A benchmark test, on the other hand, is a test or a suite of tests that provides measurable results that you can compare back to the original benchmark. For example, the BYTE low-level benchmarks tell you precisely how fast a system performs discrete functions that exercise the CPU, memory, video, and hard drive subsystems. BYTE's DOS application benchmark suite consists of a variety of popular application programs that exercise the system as a whole. By comparing the test results from, say, a notebook PC to the test results of BYTE's IBM AT benchmark system, you can gauge its relative performance.

How important is that? Assuming that performance is a critical issue for the work you do on your computer, those benchmark test results are invaluable. They provide an insight to the type of performance you can expect on a given system. Other considerations depend mostly on the applications you run. But benchmark tests provide a meaningful starting place for evaluating systems.

BEN SMITH: Benchmarks invaluable? Piffle! The only true evaluation of performance is to actually run the applications that you intend to use in the environment in which you intend to use them with the data that you will be handling. The value of a benchmark is determined by how closely the benchmarking method approximates your actual needs.

STAN DIEHL: Benchmarks give you objective data to cite when talking about performance. I put more stock in the product rating of a reviewer who runs a specific suite of tests than that of a reviewer who merely runs a few applications and concludes that "the system seemed kind of pokey under Windows." A good benchmark will consistently expose poor performers and reward the good ones.

We recently tested a 486 system that consistently returned abnormally poor benchmark results. The vendor finally admitted that it was using a 16-bit data path between the CPU and memory. It helped to have hard, tangible numbers to back up our assertion that the machine ran like a dog.

SMITH: I'm not saying that benchmarks are without value; just that they can be misleading if you don't know what they represent. Indexes force the confusion onto the reader. And even knowing this, I will often refer to an index as an indicator of a system's performance. Why? Because it is convenient; not because it is informative.

TREVOR MARSHALL: No single performance index is useful, but I use benchmarking daily to judge performance improvements in the systems I'm designing. Say an engineer comes to me and says, "I have this neat idea for improving our RAM interface." My reaction is to try and identify how much better it is than the current technique. The only way to do this is to use benchmarks.

DENNIS ALLEN
Senior Editor and Director, BYTE Lab

STEVE APIKI
Technical Editor, BYTE Lab

STAN DIEHL
Testing Editor/Engineer, BYTE Lab

TREVOR MARSHALL
Consulting Editor

ROB MITCHELL
Senior Editor, Columns

MICHAEL NADEAU
Executive Editor

JERRY POURNELLE
Senior Contributing Editor

ANDY REINHARDT
News Editor

KEN SHELDON
West Coast Bureau Chief

BEN SMITH
Technical Editor

World Radio History

Having an adequate repertoire of tests and knowing which tests are likely to detect the changes you've made is the art of a good systems designer.

ROB MITCHELL: BYTE's low-level and DOS application benchmark indexes show the reader the tip of the iceberg. The graphical presentation of index numbers gives only a general impression of how a machine has performed. The BYTE Lab goes over the raw benchmark numbers to pick up any unusual events, such as particularly slow doubleword moves, that need mention. In some cases, above-average performance on one set of tests will compensate for below-par performance in another category. That means that two computers with similar CPU indexes, for example, might not truly perform similarly. We always try to point these things out in a review.

MICHAEL NADEAU: The benchmark tests do no more than indicate whether a machine is fast enough for a given task. The problem lies in how benchmarks are represented, and both purveyors of benchmarks and system vendors share the blame. Benchmark graphs provide nice visuals, but magazines should explain how to interpret them; that doesn't always happen.

Vendors promote good benchmark scores heavily, sometimes to the exclusion of other selling points. This creates the impression in some buyers' minds that benchmarks are the most important purchasing factor.

JERRY POURNELLE: The problem with benchmarks is that it is often possible to work around them. If you know enough about the benchmark, you can design to it; and that has been done, since getting a high score on benchmarks has, in the past, been worth considerable prestige and, thus, money in this competitive business.

Years ago, I devised what I called "a benchmark of sorts" that consisted of generating some matrices, their floating-point multiplication, and then the floating-point summation of the elements of the answer. I generated the matrices by taking reciprocals of numbers, thus making for considerable division. That, at least, had both integer and floating-point loops and numerical calculations, meaning that it would be hard to design to that test and not produce a useful machine. It wasn't perfect, but it seemed better at the time than most benchmarks I knew then.

Not long ago, I heard a tale of horror about how, if you know what you are doing, you can make a crippled machine score as well on one famous magazine's benchmark set as another machine that's not crippled will perform. Even today, benchmarks can indicate only one data point in comparing systems.

MARSHALL: The ultimate benchmark is real life, but whose life? A scientist would be a fool to look at benchmark tests constructed to show spreadsheet performance. He or she needs data on arithmetic speed and accuracy. No one set of benchmarks can cover all cases.

This is the failing with SPEC, but there are many other benchmark suites out there that give potential purchasers some idea of what they're getting. Knowing which to use is still an art form.

Graphics benchmarks are even worse, but heaven knows we need them. How do you benchmark the performance of the X Window System, for instance? And what about the Windows accelerators that everybody is talking about? How much faster are they in real life? You could just say, "Well, the accelerator from company X looks a lot faster when running the Turbo Pascal editor," or you could construct benchmarks to give a quantitative assessment. I prefer the latter approach.

NADEAU: SPEC is not perfect, but it is effective for providing a quick-and-dirty performance ranking of workstations.

MARSHALL: SPEC is good for workstation comparisons but was designed only for Unix systems. You also have to assign at least two programmer-months to compile and run them all, and you need to assign your in-house compiler group to the continuing task of optimizing your compilers for a better SPECmark. (Remember when a recent software upgrade gave IBM a huge boost in its RISC System/6000 SPECmark?) Both these investments are beyond what smaller computer manufacturers can afford.

ANDY REINHARDT: The RISC System/6000's performance boost didn't represent an increase in CPU power, but if a company can achieve a performance increase by introducing a new FORTRAN compiler (whose benefits would also accrue to any other program recompiled with it), that represents a fair and legitimate expression of system performance. The importance of a good optimizing compiler in RISC systems—especially ones with the parallelism of the RISC System/6000—is paramount. It's not a sleight of hand.

MARSHALL: I am a skeptic. I know that the fastest compilers are designed specifically to recognize the code constructs that Dhrystones and Whetstones benchmarks use. Those changes may not affect the code that you or I write.

REINHARDT: I would like to see a price/performance rating in which the cumulative score on the BYTE high-level benchmark tests is divided into the price of the review system, as configured for the test. The end result would be to show which systems provide not just the best performance but also the most for your money. This raises all kinds of problems, though—among them the issues of "suggested list price" versus "street price" and configuration differences.

STEVE APIKI: The primary problem with this approach is that many systems we receive include goodies that aren't performance related. Say we get a 486 with a CD-ROM drive, a Super VGA monitor, and 16 MB of system RAM. What price do we use for the price/performance ratio? We can eliminate the CD-ROM drive right off. But additional memory translates to increased performance under Unix, and the full complement of 16 MB allows for memory interleaving, where the standard 1-MB version does not.

Does the Super VGA monitor mean you test applications using Super VGA drivers? If not, I could argue that your application benchmarks are unrealistic, because most users will run the machine in Super VGA mode. Price/performance would be nice to report, but coming up with a fair system for doing so is an intractable problem.

MITCHELL: BYTE does ask for exactly the same configuration for all machines in a head-to-head comparison. But if the configuration it requests is different from how the vendor typically sells the system, BYTE may bend the rules a bit. In this case, a price/performance ratio would be meaningless.

What makes BYTE different is that it doesn't publish price/performance numbers. Computer systems are much too complicated to reduce to a single ratio. Which index number would be used for the performance denominator? Which price and configuration would be used as the numerator?

Benchmark numbers make for good graphics, but the real story lies in the telling. Why did a machine do extremely well in the low-level video tests yet not excel in the application tests? Why did a machine with a SCSI caching hard drive controller not perform better than others with standard IDE hard drives? A good reviewer puts the numbers in perspective for the reader. ■

World Radio History

SOFTWARE DEVELOPERS

Rainbow Technologies Protects Software Better. In More Places. For More Developers. And For More Good Reasons.

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

THE PRODUCTS

Rainbow Technologies features:

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

1-800-852-8569

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

THE COMPANY

Rainbow Technologies provides:

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

AVAILABLE NOW!!!

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

RAINBOW TECHNOLOGIES

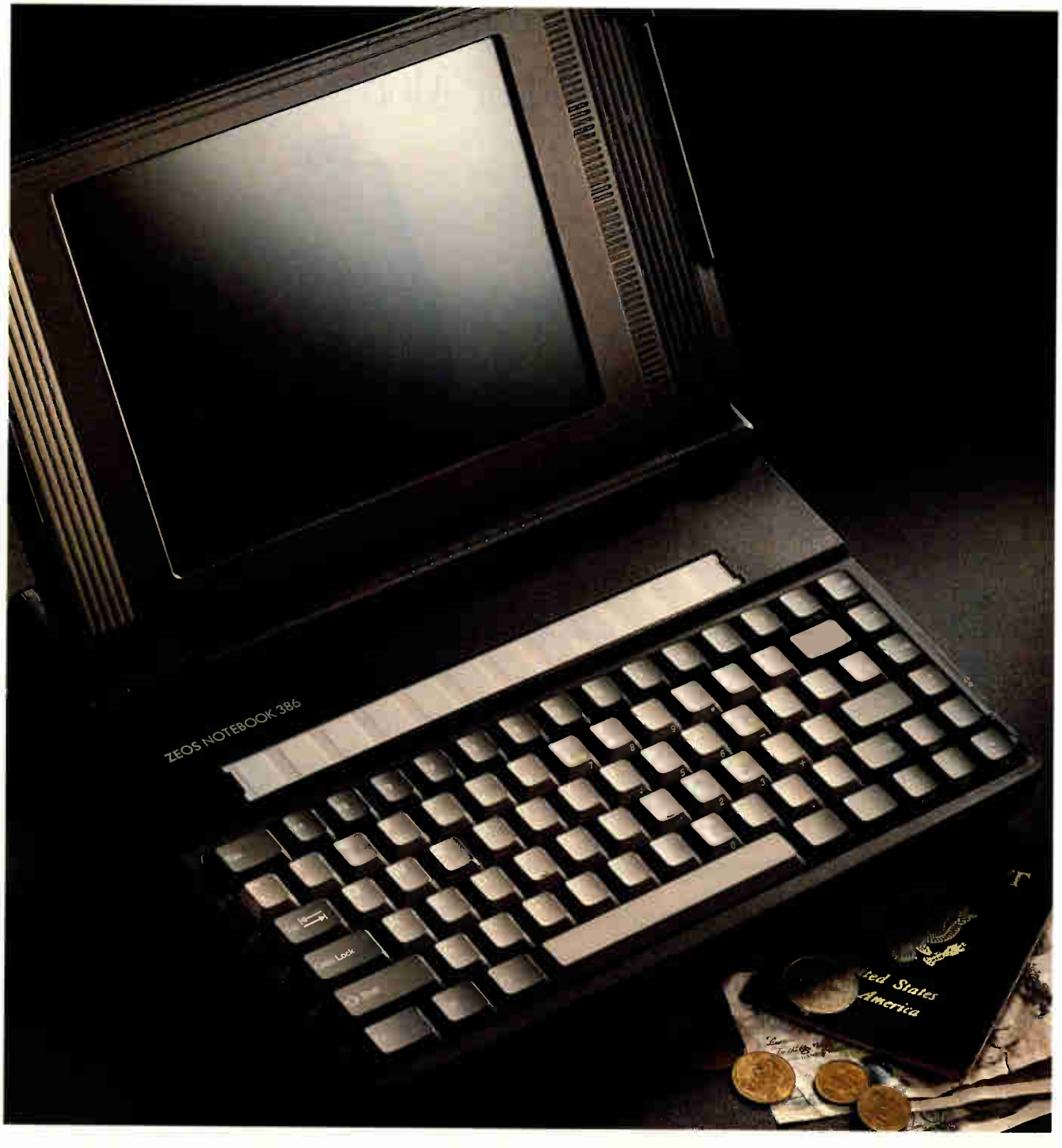
Copyright ©1991 Rainbow Technologies, Inc. All product names are trademarks of the respective holders.
Rainbow Technologies stock is traded on NASDAQ-RNBO

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

World Radio History

The ZEOS® '386 SX

Now 20 MHz Only $1995! 16



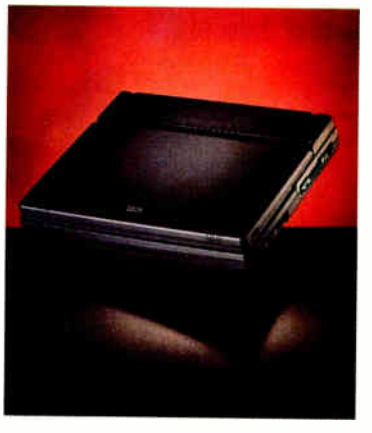
World Radio History

Notebook.

MHz Only $1795!

"THE HOTTEST DEAL ON THE NOTEBOOK MARKET"—PC MAGAZINE

"King of the Hill... Sensational... The best price-performer ... Astonishing value ... The number one contender..." The praise goes on and on. Winner of PC Magazine's Editor's Choice Award *and* PC World's Best Buy Award, the experts love the ZEOS Notebook. And you'll love it too. Because as PC Magazine said, the ZEOS Notebook is simply "the hottest deal on the notebook market."



INCREDIBLE DESKTOP FEATURES IN A NOTEBOOK.

Pick your power. Choose our '386SX-16MHz version or go for the incredible new ZEOS '386SX-20MHz version. Combine that with our high speed hard disk, built in 1.44MB floppy drive, VGA and more—you've got the greatest notebook going at any price!

Look closely at the details. Like our crisp 10" VGA display. The ultimate in sparkling clarity featuring advanced fluorescent backlighting for vivid VGA graphics. And then the drives.

Two drives are better than one! First, you're getting our whisper quiet high speed, high capacity hard disk. Then we've built in an industry standard 1.44 Megabyte, 3.5 inch floppy as well. And we don't stop there.

DETAILS MAKE THE DIFFERENCE!

For instance, the battery system of your new notebook is the most advanced on the market. You can quick charge, or trickle charge, any time your system is plugged in. Or, you can use the optional charging stand if you wish.

Either way, you're sure to appreciate our light weight snap-in, snap-out battery packs. They're so light and easy to use, you can easily take an extra one with you on those really long trips. Plus, you can get even more life out of a single charge by using our programmable power management system. Hour upon hour of Notebook computing power!

CONNECTIVITY TOO!

Your new ZEOS notebook is a great connectivity tool! Using our optional built-in 2400 baud MNP® Class 5 modem, connectivity buffs will find themselves logging on at every turn.

And speaking of connectivity, we've kept the I/O easy to use too. Because unlike many of the others, your new ZEOS notebook has the same industry standard port connectors you'll find on your larger desktop system. Serial and Parallel ports; even an external VGA connector. Completely compatible!

ZEOS 24 HOUR A DAY SUPPORT.

Don't forget your new ZEOS notebook is backed by the best Technical and Sales support in the industry, 24 Hours a Day. We're always here to help, *any time* of the day or night. And we don't stop there either.

Your new notebook is also backed by our 30 Day Absolute Satisfaction Money Back Guarantee and One Full Year Limited Warranty. You're going to be very satisfied. We don't just say it. *We guarantee it.*

ORDER YOUR OWN ZEOS NOTEBOOK NOW!

You can order your own ZEOS Notebook *right now*. Simply pick up the phone and give us a call now at 800-423-5891. Larger hard drives, carrying cases and more are also available! At last, a full featured notebook that lets you compute anywhere. You're going to love it!

ORDER NOW TOLL FREE:

800-423-5891

Purchase Orders from Fortune 1000 companies, Governments and institutions subject to approval. Leasing Programs are available. All prices and specifications are subject to change without notice. Please call to confirm pricing, specifications and warranty details. The following are trademarks of their respective companies: ZEOS (ZEOS International, Ltd.), MNP (Microcom Systems, Inc.); © 1991, ZEOS International, Ltd., 530 5th Avenue, N.W., St. Paul, MN 55112 USA. ZEOS is a publicly traded company (NASDAQ symbol: ZEOS).

NOW. YOUR COMPLETE '386SX-16 NOTEBOOK! VGA, 20MB HARD DRIVE, 1.44MB FLOPPY AND MORE. LIGHT AND LOADED! INCREDIBLE.

ONLY $1795!

20MHz ONLY $1995!

- '386SX-16 or '386SX-20.
- 1MB DRAM, expandable to 3 or 5MB.
- 20MB High Speed HDD.
- Built in High Density 3.5" 1.44MB floppy drive.
- High resolution VGA display. Fluorescent backlit 640x480, 32 grey scales. Bright and clear!
- Removable quick charge NiCad battery. Two hour plus battery life typical, more using Programmable Power Management!
- Quick charge or trickle charge using included AC power adapter.
- Extra battery packs and external charging stand available.
- 82 key keyboard. True 101 key emulation.
- Industry standard Serial and Parallel Ports.
- VGA port for external VGA color display. Great for demos!
- Total system weight 7 lbs. with battery.
- 30 Day Absolute Satisfaction Money Back Guarantee and ZEOS Customer Satisfaction Package.
- One Full Year Limited Warranty.
- 24 Hour a Day Toll Free Technical Support, 365 Days a Year.

ORDER NOW TOLL FREE

800-423-5891

FAX Orders: 612-633-1325
Minnesota: 612-633-4591
Hearing Impaired (TDD) Orders: 800-228-5389
Outside US and Canada: 612-633-6131
MasterCard, VISA, Discover, Am Exp, Z-Card and COD.
Open 24 Hours a Day, 365 Days a Year!

ZEOS INTERNATIONAL LTD

Circle 189 on Inquiry Card.

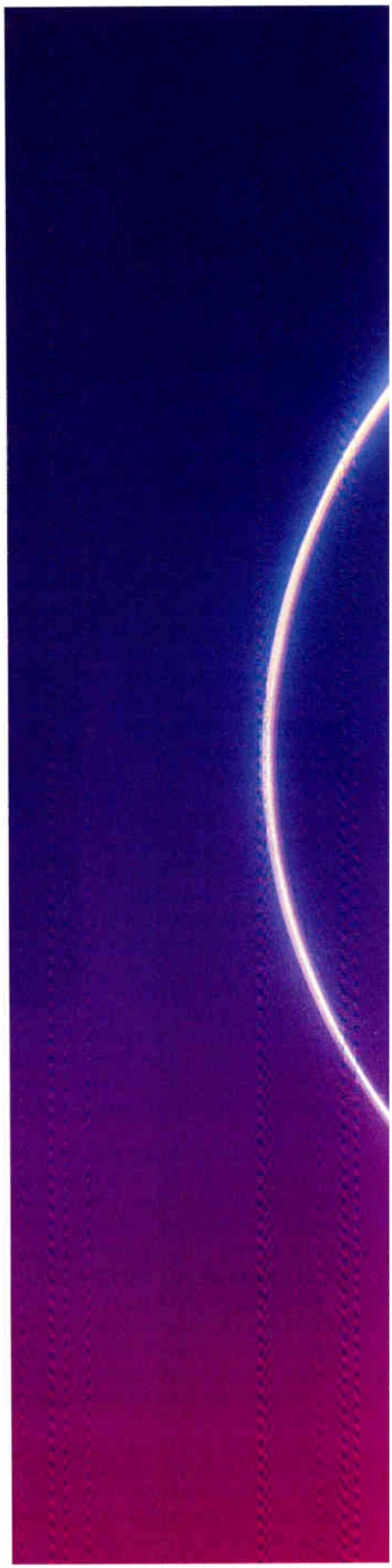
World Radio History

COVER STORY

FEATURE

THE 1991 BYTE Awards

The best products of the last year get the recognition they deserve



The 1991 BYTE Awards provide a snapshot of the most important events that occurred in the computer industry last year. Each of the 84 winners represents an achievement in its category that pushed the industry forward. Apple, for instance, answered the challenge posed by Microsoft's Windows 3.0, last year's top vote-getter, with its System 7.0, this year's number-one winner.

Meanwhile, Microsoft was busy producing products to support Windows. Three of those packages, Visual Basic, Word for Windows 2.0, and Excel 3.0, are among the award winners for 1991. Apple, in turn, built on System 7.0 with QuickTime 1.0.

Many products in the portable category won awards, including two notebooks from Toshiba, Psion's 8-ounce hand-held system, Citizen's PN48 portable printer, and Zenith's Mastersport 386SL. The most important winners in this area are not end-user products, however. Chips & Technologies and AMD introduced CPUs that should provide a shot in the arm for portable system developers.

Criteria

To be eligible for the 1991 BYTE Awards, a product must be new within the last year, and we must be reasonably sure that it will be commercially available by the time you read this. We chose products or technologies based on their impact; specifically, we looked for innovation, superior performance, and price breakthroughs.

BYTE editors and contributors nominate products or technologies for awards. Each editor or contributor then votes for his or her 10 most important products of 1991. Products with the highest number of votes receive Awards of Excellence, and mid-range vote-getters receive Awards of Distinction. Those products receiving the fewest votes are given Awards of Merit. No awards are given to nominees that do not receive any votes.

A World View

BYTE has many licensees around the world. These publishers reprint BYTE articles in their native languages. This year, we invited all BYTE licensees to participate in the 1991 Awards. We received lists of winners from three: *Nikkei BYTE* from Japan, *RAM* from Greece, and *Binary* from Spain.

The editors of these magazines chose winners based on their importance to the regional computing community. Many of their selections match those of the BYTE staff's. This represents the increased globalization of the computer industry. Products today are more likely to be launched on a worldwide scale than in only one particular region. We hope you find the selections of *Nikkei BYTE*, *RAM*, and *Binary* as fascinating as we did.

—Michael Nadeau

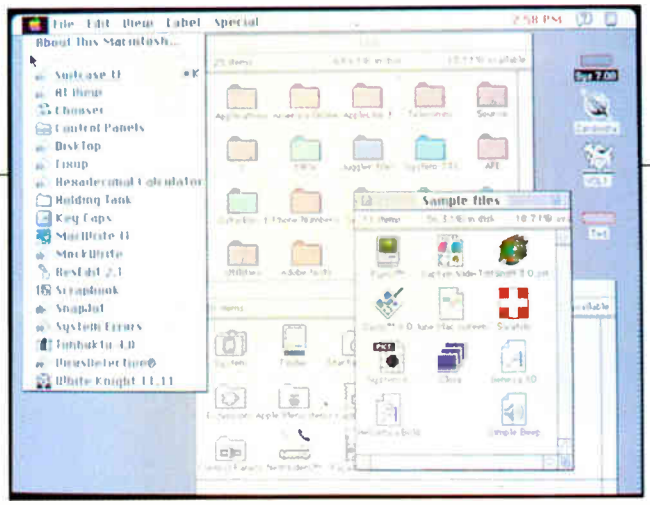
World Radio History

PHOTOGRAPHY, MEL LINDSTROM © 1992

World Radio History

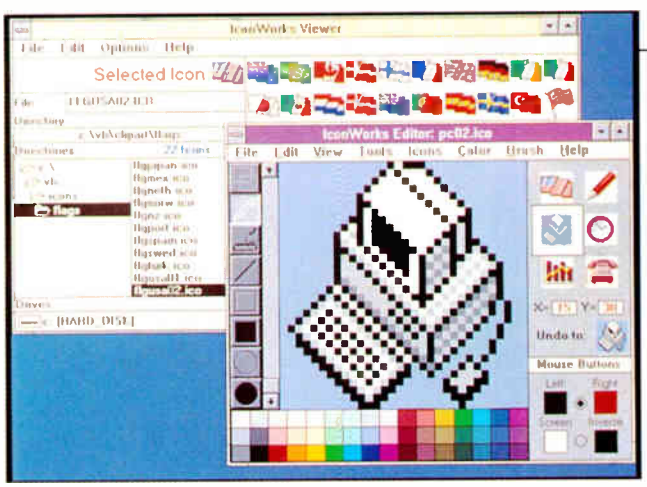
BYTE AWARDS

EXCELLENCE



System 7.0, *Apple Computer*

The delayed release of Apple's System 7.0 was worth the wait: It offers an easier-to-use interface that includes a built-in file-search capability and icons that represent file aliases to often-used applications, files, or remote volumes. Internally, System 7.0 provides enhanced communications functions, 32-Bit QuickDraw, virtual memory, Ethernet and token-ring drivers, and the ability to share hard disks or folders with other networked users. Its Interapplication Communication and Open Scripting Architecture provide mechanisms for dynamically sharing information and automating repetitive tasks. Another bravura performance by Apple's software engineers.



Visual Basic, *Microsoft*

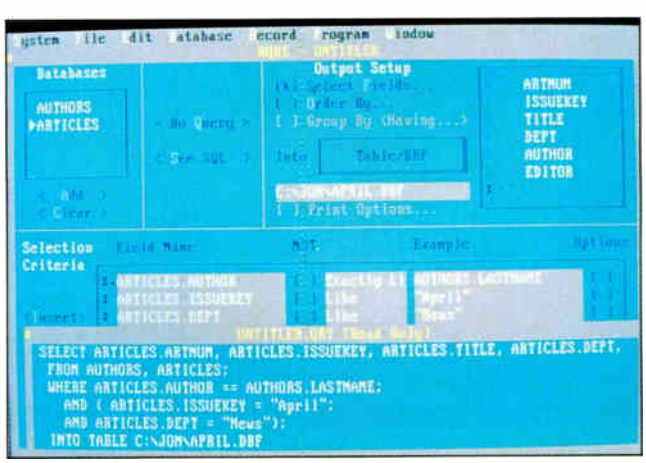
With Visual Basic, Windows programming becomes almost easy. Visual Basic combines a structured version of BASIC with a user interface for designing the graphical elements of an application. You can create windows; drop in text boxes; and position command buttons, radio buttons, and other graphics-control elements. You can then double-click on the control element (e.g., a menu or a check box) and write the BASIC code that defines the function of each element. Visual Basic combines your BASIC code with the Windows interface code. You can compile the code to create an executable Windows program. You never have to know the nitty-gritty of Windows; you just need some experience with BASIC programming.

FoxPro 2.0, *Fox Software* ▽

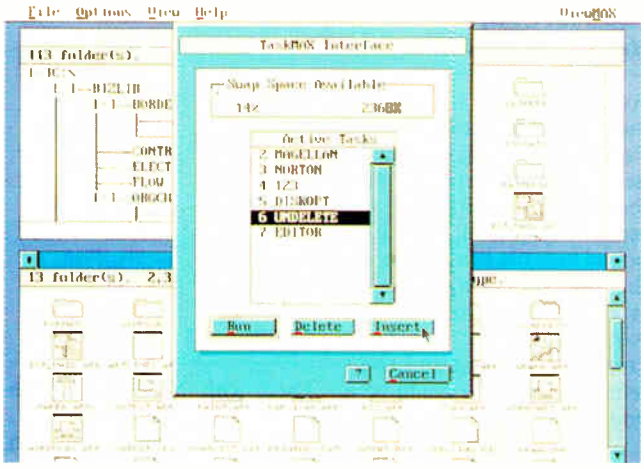
FoxPro is the acknowledged speed leader among dBase-compatible database programs and deserves the 1991 "most improved" award for its remarkable version 2.0. A new retrieval technology called Rushmore crunches through million-record databases with stunning speed. Other major enhancements include compressed compound indexes, a Structured Query Language subsystem, a WYSIWYG screen builder, a project manager, an interface to Watcom C, and an extended-DOS version.

PCMCIA 2.0 △

PCMCIA 2.0 is the specification that could launch tiny IC cards into wide use as interchangeable storage devices for personal computers, palmtops, and hundreds of other noncomputer applications. The specification now defines how IC cards can execute programs directly, rather than your having to load software into main memory, and spells out how you can use PCMCIA slots for general I/O devices like modems or printer ports.

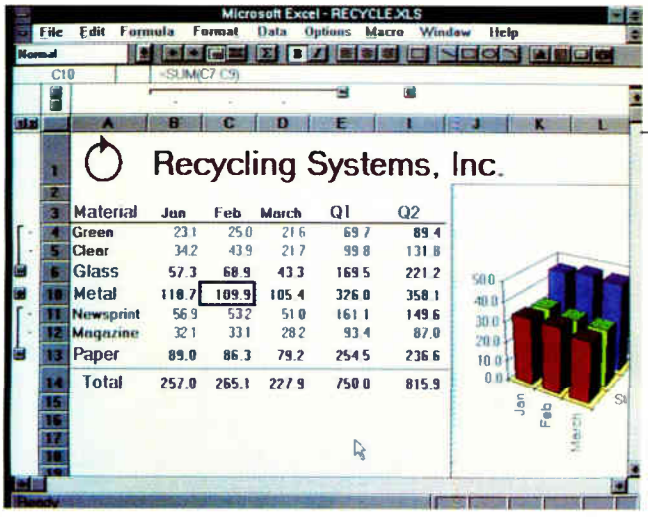


World Radio History



DR DOS 6.0, *Digital Research* △

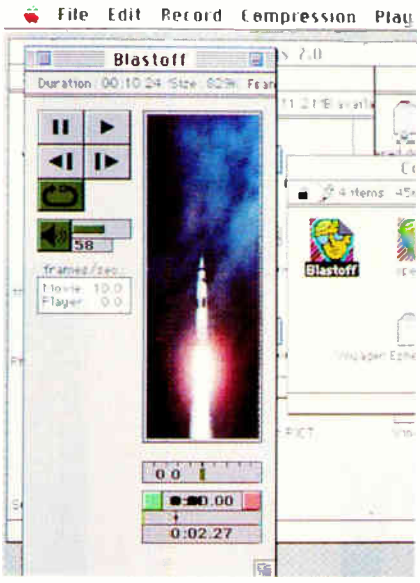
It has taken a while, but Digital Research's DR DOS 6.0 seriously threatens to dethrone MS-DOS as king of the text-based operating systems. It features a better memory manager, a task switcher, and proven utilities for disk caching and file compression. Free lifetime support is another plus. DR DOS also comes with several networking tools, which suggests that new owner Novell might have even more interesting things in mind for this DOS challenger.



GatorBox CS, *Cayman Systems* ▷

Cayman Systems' GatorBox CS is simply the easiest way to tie together networks of Mac and Unix systems. For network administrators grappling with the thorny issues of interoperability, the GatorBox is a refreshingly elegant solution in a realm that usually requires working with partial solutions from a number of vendors that never quite dovetail. The GatorBox CS is a plug-and-play LocalTalk/Ethernet gateway that supports AppleTalk Phase 1 and 2, TCP/IP, and DECnet Level 1 protocols. Optional GatorShare software takes the link one step further by offering Network File System hosts (disguised as AppleShare volumes) to Macs on the connected LAN.

QuickTime 1.0, *Apple Computer*



Apple's system software has always been outstanding, and now QuickTime 1.0 sets the stage for a marked advance in the use of multimedia technology in practical applications. With its new movie file format, QuickTime allows a standard way for applications to dynamically exchange data from one computing platform to another.

Excel 3.0, *Microsoft*

You really can improve an application years after it first arrives. Microsoft's Excel 3.0 represents a quantum leap over its predecessor, adding new icons, an auto-sum feature, best-fit column sizing, and a new outlining capability that lets you shrink your view of the spreadsheet. Most important, Excel 3.0 embraces direct manipulation, making it by far the most graphical spreadsheet available.

World Radio History

BYTE AWARDS

EXCELLENCE

▽ LaserJet IIISi, *Hewlett-Packard*

As it has in other segments of the printer market, Hewlett-Packard is leading the way in network laser printers with the LaserJet IIISi. Fast and reasonably priced, this 106-pound beast is heavy duty all the way, yet its output quality is excellent. If your current workgroup laser printer is creating long lines and short tempers, the IIISi could be a godsend.

NetWare 3.11, *Novell*

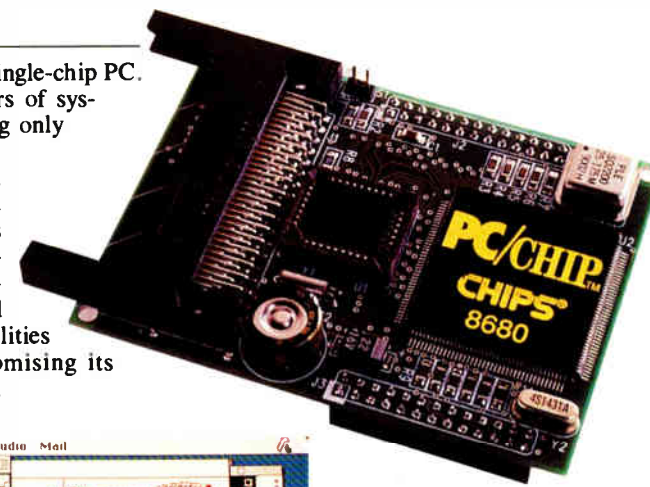
Used with NetWare for the Macintosh, NetWare NFS, and NetWare FTAM, the 386 version of NetWare now supports Mac, Unix, and PC client types (e.g., DOS and OS/2). NetWare 3.11's "name spaces" feature maintains machine-specific name information for each client type, preserving data and resource-fork information on the Mac and extended attributes on OS/2 clients. NetWare 3.11 is an expensive—but fast and reliable—LAN operating system for users who need to integrate multiple client types.

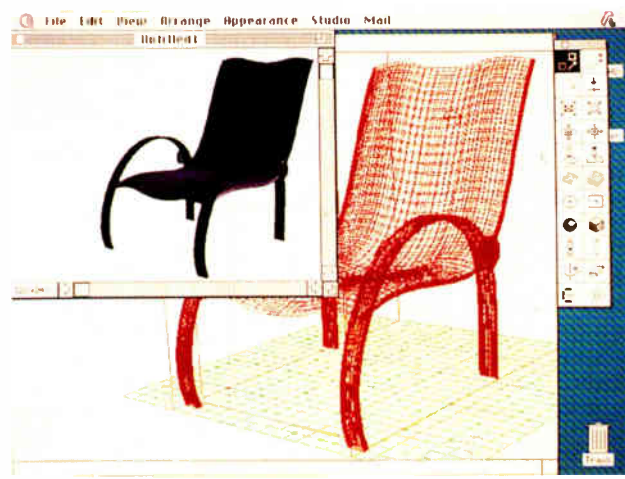
PenPoint, *Go Corp.* △

PenPoint is the first operating system for pen-based computers designed from the very beginning for a new and revolutionary input method. At every stage, Go Corp. considered how the operating system and the machines and applications using it would interact with users and their pens. As a result, PenPoint-based systems feel truly natural when operated with a pen—there are no awkward or uncomfortable compromises. PenPoint is also a truly object-oriented operating system that has not had to accept any of the limitations imposed by having to work with existing software.

PC/Chip, *Chips & Technologies* ▷

The PC/Chip is the first true single-chip PC. It finally allows manufacturers of systems to build a computer using only one chip plus some memory. That alone would be an achievement, but Chips & Technologies has added to this with its architectural innovation of SuperState—a way to extend the PC architecture and add all kinds of new capabilities without affecting or compromising its compatibility with the original.





Sketch, *Alias Research*

The Mac-based Sketch is one of the fastest and coolest three-dimensional CAD/solids modelers we have ever seen. With such features as its Curve-o-Matic tools, you can produce complex 3-D wireframe models using 2-D techniques. It is coming soon in a Windows version, too.

World Radio History

NOW YOU CAN BE OUT IN THE FIELD, BUT NOT OUT OF TOUCH.

Safari NSX/20 Notebook Computer

Mobile Computing. It's the hot new buzzword for people whose business takes them out of the office. But when it comes to connectivity, you can find yourself stranded.

That's where the AT&T Safari comes in. It's the first notebook PC designed for *Mobile Networked Computing,* so you can network anywhere, to anyone. With the 386SX power you need to run most any application. An integrated modem and optional pocket LAN adapter for wired communication. And innovative *Mobile Mailbox* data pager for wireless E-mail, plus cellular modem to deliver two-way connectivity.

See how easy it can be to stay in touch in the field. Call **1-800-247-1212, ext. 836V,** for the name of your nearest authorized Safari reseller.

Circle 313 on Inquiry Card.

SAFARI®

PORTABLE SOLUTIONS

POWERFUL 20MHz 80386SX PROCESSOR • 40MB DRIVE WITH 2 TO 6 MB OF RAM OR 80MB DRIVE WITH 4 TO 8 MB OF RAM • 1.44MB FLOPPY DRIVE
COMMUNICATES FROM ANYWHERE INTEGRATED 2400BPS MODEM (40MB VERSION) • INTEGRATED 2400BPS DATA/ 9600BPS FAX CELLULAR MODEM (80MB VERSION) • POCKET LAN ADAPTER • MOBILE MAILBOX (WIRELESS E-MAIL) **EASY TO USE** DUAL BATTERY PACK (UP TO SIX HOURS OF OPERATION) • PORTABLE MOUSE • PRELOADED SOFTWARE: MS-DOS 4.01, MS-WINDOWS 3.0, AT&T MAIL, TOURGUIDE TUTORIAL, UTILITIES

AT&T

Safari is a registered trademark of AT&T. All other product names are trademarks or registered trademarks of their respective companies.

World Radio History

BYTE AWARDS

DISTINCTION

Am386, *Advanced Micro Devices*
The Am386 does not break new ground—it is a faster clone of the Intel 386DX—but it certainly has lit a fire under Intel. It is probably the main reason we now have 486SX-16, -20, and -25 machines.

Grolier Electronic Encyclopedia (1991 edition), *Grolier Electronic Publishing*
With the addition of sound and more pictures, this CD-ROM is an inexpensive and useful introduction to multimedia. It is a great excuse for buying a CD-ROM drive.

NCR 3125, *NCR*
The first (but not the last) pen-based computer designed to run both Go Corp.'s PenPoint and Microsoft's Windows for Pen-Based Computing. The NCR tablet features a clear screen, a wireless stylus, and good power management.

Norton Desktop for Windows, *Symantec*
An essential add-on to Windows, Norton Desktop for Windows replaces the clumsy Program Manager and File Manager with an elegant drag-and-drop desktop. It also tosses in a grab bag of goodies ranging from Norton Utilities and Backup to a file shredder and screen saver.

PN48 Professional System, *Citizen America*
Small and cute, the PN48 represents a big improvement in output quality for portable printers. If appearance is everything to you, this is the printer you want as a travel companion. ▽

Quest for Windows, *Gupta Technologies*
Getting information from a relational database usually involves constructing queries in Structured Query Language—a language that does not enjoy a sterling reputation for user-friendliness. Quest, a Windows 3.0–based graphical data-access tool, changes that. It allows you to create SQL queries simply by pointing and clicking with your mouse. You can use the data-access tool to access everything from the tool's built-in relational database engine to your corporate DB2 database. Client-server computing has never been so easy.

Stacker 2.0, *Stac Electronics*
Couple a compression utility that's 30 percent faster than version 1.0 with a 16-bit AT add-in card, and you can double the size of your hard disk with no performance degradation.

T2200SX, *Toshiba*
To borrow an automaker's advertising slogan, the Toshiba T2200SX "just feels right." The company has made the notebook as small as is practical, while providing a superb keyboard, an excellent screen, and a durable carbon-reinforced case.

The Network Archivist 2.0, *Palindrome*
Palindrome's latest release adds workstation backup capability, Mac file support, and tape diagnostics to an already outstanding backup product. TNA 2.0 retains the support for different storage levels and automatic file migration that distinguished earlier versions.

Word for Windows 2.0, *Microsoft*
The folks who designed Windows prove again that they are the ones who best understand the concept of Windows applications. While Word for Windows 2.0 is filled with every feature you'd ever imagine, its biggest claim to fame is an elegant interface that lets you get useful work done with a minimum of effort.

Ami Pro 2.0, *Lotus Development*
Lotus's unique SmartIcons make this powerful word processor easy to use and highly customizable.

The Far Side Computer Calendar, *Amaze*
Couple Gary Larson's offbeat cartoons with a good personal information manager, and you get a useful application that's fun, too.

LaserWriter IIf and IIg, *Apple Computer*
These two 68030-powered laser printers are optimized to incorporate graphics and photos with top-quality text. Both networkable, the IIf and IIg feature PostScript Level 2, an 8-page-per-minute Canon laser engine, and an 800-dot-per-inch equivalent output via Apple's Photograde technology.

PowerBook 170, ▽ *Apple Computer*
Torquing at 25 MHz, Apple's PowerBook 170 puts the company smack into the middle of the mainstream notebook market. Better yet, it can do what no 386SX notebook can do—run Apple's System 7.0 operating system.

Mac Quadra 900, *Apple Computer*
What comes after "wicked fast?" A lot of memory and board expansion, as well as the killer 68040 processor.

Moby Brick, *Ergo Computing*
Classy-looking and powerful, the 486-powered Moby Brick is a great high-end solution for travelers who need all the capabilities of a desktop while on the road.

Net Satisfaxtion 1.0, *Intel*
The best of the non-stand-alone fax servers. You get fax management, a scanner port, and a communications coprocessor for the amazingly low price of under $500.

Psion Series 3, *Psion*
Although it weighs 8 ounces, the Series 3 is arguably the most useful pocket computer you can buy today. Using a proprietary MS-DOS-like operating system, it can multitask up to 28 operations simultaneously.

Sparcstation IPX, *Sun Microsystems*
A machine that's everything a workstation (or any computer, for that matter) should be—small, fast, loaded, and reasonably priced.

World Radio History

Who says a good idea can't be rushed?

Maybe we can't speed up your creative juices. But we can speed up your output. And free up your computer quicker than before.

All with the new ColorPoint PSX color printer.

Besides being PostScript language compatible, it comes with a faster chip, a bigger memory and a new memory management scheme.

Which, in English, means it'll 'remember' your entire job – not to mention everyone else's. As well as process one image while printing another.

Call 1-800-873-4561, dept. SI-J6, to find out more.

About how your good – no, great – ideas can be rushed, after all.

Introducing the ColorPoint PSX printer.

SII
Seiko Instruments

Circle 146 on Inquiry Card.

This 11.7" x 17.1" image was printed on the PSX. Total print time just 5 minutes, computer free to use after 49 seconds. © 1991 Seiko Instruments.

World Radio History

BYTE AWARDS

DISTINCTION

CDR-1000, *Tandy*
Another example of Tandy's aggressive push to make multimedia common in the computer community. At $399, it's hundreds of dollars less expensive than its competitors and has the high-speed data transfer needed to handle Microsoft's multimedia extensions to Windows.

IBM 3.5" Rewritable Optical Drive, *IBM*
The storage wave of the future. IBM has managed to combine, in one device, support for both rewritable (magneto-optical) and optical read-only 3½-inch discs, opening up new possibilities for software and data distribution, as well as local and network data storage.

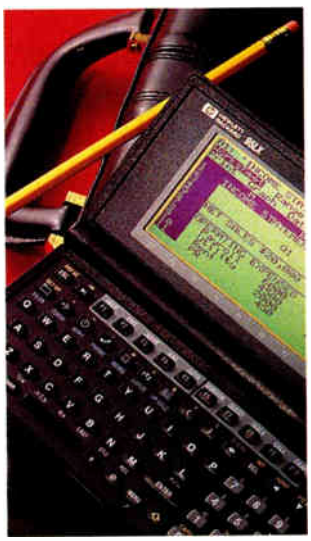
Borland C++ 3.0, *Borland International*
The combination of C++ 2.0, the Integrated Development Environment, the Object Windows Library (the C++ application framework for Windows), and Turbo Vision (the C++ application framework for character-mode DOS GUIs) makes for a stupendous offering.

CorelDraw 2.0, CD-ROM edition, *Corel Systems*
Despite fierce competition in the Windows illustration package market, CorelDraw 2.0 consistently comes out ahead: It manages to combine professional-level power with usability by mere mortals. The CD-ROM edition has over 4000 clip-art images and symbols, along with all the drawing, type manipulation, special effects, and tracing features of the standard edition.

AddressWriter, *CoStar*
The logical extension to label printers. It makes the pesky job of printing envelopes almost a pleasure.

Full Page Pivot, *Radius*
Radius brings its unique portrait and landscape monitor technology—the only way to do serious word processing and desktop publishing work—from the Mac to the PC platform.

GT486/40, *Falco*
If you push a 486 to 40 MHz, couple it with 32 MB of RAM, a 426-MB hard drive, a 1024- by 768-pixel graphics system, and put it all in a box that's the size of a large book, you have an ultimate graphics system that will easily compete with high-ticket Unix workstations—for $6000.



HP 95LX, △
Hewlett-Packard
Yes, the keyboard is not good and the screen is small, but this is an incredible pocket-size computer. It is also the only system of any size with built-in Lotus 1-2-3 and infrared connectivity.

HP Apollo 9000/Series 700, *Hewlett-Packard* ▷
Defying the trend toward building Unix workstations and servers around standard processor platforms, Hewlett-Packard came out with a new generation of its homegrown Precision Architecture RISC chips and blew the lid off the competition. The HP Series 700 family of systems offers the best price/performance on the market, and it puts HP squarely back in the workstation race.

Iris Indigo, △
Silicon Graphics
Petite yet powerful, the Iris Indigo brings three-dimensional graphics computing to an affordable level. Silicon Graphics has sacrificed little in the process. The Iris Indigo has a 33-MHz Mips R3000A CPU and a proprietary backplane and bus that allow a 133-MBps transfer rate.

LapLink Pro 4.0, *Traveling Software*
Traveling Software's venerable file transfer utility steps into the 1990s with a new interface and even faster speed, keeping the package comfortably ahead of its competitors.

MS-DOS 5.0, *Microsoft*
It is not just the extra 40 KB of workspace that makes MS-DOS 5.0 a significant product; it's also the integration of the Smartdrive disk cache, the ability to handle large disk volumes fast, and the Undelete feature. Unlike Windows, this package was largely bug free.

NuVista+, *Truevision*
This NuBus video board for the Mac does everything—composite/RGB/S-video in, composite/RGB/S-video out, multiple programmable resolutions (both interlaced and noninterlaced), and the ability to be programmed for digital effects. It also includes a built-in chromakey.

286|DOS-Extender, *Phar Lap*
The Phar Lap 286|DOS-Extender now supports Borland C++ and Microsoft FORTRAN as well as Microsoft C. That'll make it a cinch for programmers writing hordes of DOS applications to have those applications run in protected mode and, thanks to the DOS Protected Mode Interface, to multitask under Windows enhanced mode.

PowerLAN 2.10, *Performance Technology*
The fastest peer-to-peer LAN available today.

Rapport, *Clarity*
A Unix document processor, spreadsheet, E-mail utility, drawing program, and audio editor. Rapport does a number of things and links them together nicely.

Nanao T560I, *Nanao USA*
Nanao's 17-inch T560i sets a new standard for desktop displays. Once you've seen Windows at 1280 by 1024 pixels (with 70-Hz refresh), you'll never go back.

World Radio History

Imagine getting twice the Bernoulli for two-thirds the price.

The new Bernoulli 90MB.

BERNOULLI MEANS SECURITY FOR YOUR DATA

Welcome to the next generation of removable storage, the new Bernoulli® 90 from Iomega®.

At 90 megabytes per removable disk, we've more than doubled our capacity. Yet the new Bernoulli 90 is actually less expensive than the Bernoulli 44. A lot less. And with a new, 19-msec* effective access time, a lot faster, too.

The best part is, it's all Bernoulli. Rugged, reliable, endless storage. Just what storage-intensive users—like Windows users—demand.

Welcome to the 90s.

More value.

If you need more storage, you'll welcome the Bernoulli 90, since it's now comparable in price to a hard disk upgrade. So why not buy a hard disk? Consider what you *don't* get with a hard disk.

You don't get infinite storage in 90-megabyte increments—hard disks fill up. You don't get 180MB of easy backup. You don't get the physical security of removable data disks, or head-crash-resistant technology. You don't get compatibility with all major operating systems, and workstations. And you don't get Central Point's Backup software.

In short, you don't get a Bernoulli.

More recognition.

Leading publications have given us welcome recognition, but with a 98 percent satisfaction rate, our biggest supporters are Bernoulli users.

Our users enjoy worldwide support and a 24-hour** drive replacement service. To further protect their investment, we've designed the Bernoulli 90 to read 44MB disks. And we're instituting an upgrade program to help get every Bernoulli user into the 90s.

Call 1-800-777-4084†.

Questions? We don't blame you. There's a lot more you should know about—like our free, 90MB disk offer, drive configurations, Bernoulli Technology® and specific pricing. So we've prepared a brochure that's yours with a phone call. Find out what a welcome change Bernoulli can be. Before the 90s leave you behind.

IOMEGA®
Makers of Bernoulli

Circle 81 on Inquiry Card (RESELLERS: 82).

© 1991. Iomega, the Iomega logo, Bernoulli and Bernoulli Technology are registered trademarks, and Bernoulli Means Security For Your Data is a trademark of Iomega Corp. All other products are registered trademarks of their respective companies. *Less than 13 msec with included caching software. **U.S. only. †Phone number for U.S. and Canada. Internationally, call 322-720-99-16. For customer service questions, call 1-800-456-5522.

World Radio History

BYTE AWARDS

MERIT

Lotus 1-2-3 for Windows, *Lotus Development*
This is a key product that Windows users have been waiting for.

4th Dimension 2.1, *Acius*
The most powerful relational database development system available for any microcomputer.

386Max 6.0, *Qualitas*
Neither MS-DOS 5.0 nor Windows 3.0 can yet match the memory management capabilities of this utility.

ATI 8514-Ultra, *ATI*
An inexpensive, fast, high-resolution graphics adapter that helps deliver the promise of Windows 3.0.

Adobe Illustrator 3.0, *Adobe Systems*
The premier professional graphics package for the Mac gets even better. Now there is a Next version, too.

Altair, *Motorola*
Altair uses microwave radio in the gigahertz region, giving it bandwidth high enough to support Ethernet at full (10-Mbps) speed.

Chaos: The Software, *Autodesk*
A cutting-edge application that lets you explore the new science of chaos.

ClarisWorks, *Claris*
Integrated software for the rest of us—powerful, inexpensive, and easy to use.

Distributed Computing Environment, *Open Software Foundation*
DCE is a solution to the seemingly intractable problem of getting all your different types of computers to work together.

Dr. Solomon's Virus Toolkit, *Ontrack Computer Systems*
Good medicine for when your personal computer catches the flu.

EktaPlus 7016 Printer, *Eastman Kodak*
A hybrid printer and copier that demonstrates innovative engineering by Kodak.

Harvard Graphics for Windows, *Software Publishing*
This package offers the best compromise between ease of use and presentation power.

MacDraw Pro, *Claris*
A Mac-based drawing package upgraded to handle 32-bit color.

Mac Topas and Topas VGA, *AT&T Graphics Software Lab*
Two affordable, feature-packed three-dimensional rendering and animation programs for the Mac and the PC.

Mastersport 386SL, *Zenith Data Systems*
The first 386SL notebook, and still one of the best SL designs.

Apple Mode32, *Connectix*
Apple Mode32 patches Mac II, IIx, and SE/30 ROMs to make them 32-bit clean. Apple now distributes it for free.

Momenta Pen System, *Momenta*
The first notebook PC to provide practical pen-assisted applications.

Nisus 3.06, *Paragon Concepts*
This slick Mac word processor continues to get better and better.

ObjectVision, *Borland International*
ObjectVision allows visual programming of forms and includes a Paradox-compatible database manager.

On-Target, *Symantec*
The first project management package that lets you get serious planning work done without needing a master's degree in the subject.

Outbound Notebook System Model 2000, *Outbound Systems*
The first Mac-compatible notebook PC gets better.

PacificPage XL, *Pacific Data*
For $999, this hardware and software package turns your Hewlett-Packard LaserJet into a blisteringly fast PostScript printer.

PageMaker 4.0, *Aldus*
Aldus got rid of many of PageMaker's limitations in this new release. It can now handle larger documents and multiple documents.

QuickC for Windows 1.0, *Microsoft*
The decision to include a simple applications generator will probably push this tool to the number-one spot among Windows developers in a hurry.

Realizer, *Within Technologies*
BASIC for Windows programmers, amateur and professional alike.

Safari NSX/20, *AT&T Safari Systems*
A snazzy notebook PC with well-integrated communications capabilities.

HP ScanJet IIc, *Hewlett-Packard*
Hewlett-Packard brings full-page and full-color 24-bit scanning to both the PC and the Mac at a low price.

Shortcut, *Aladdin Systems*
Performs file searches on a Mac using multiple criteria, even from archived files.

T4400, *Toshiba*
Only slightly taller than the T2200SX, the T4400 is a 486SX system with long battery life.

The World of C++, *Borland International*
Borland's irrepressible David Intersimone takes much of the pain out of learning essential object-oriented programming concepts.

Thunder/24, *SuperMac Technology*
This is a 68040-compatible accelerated display board for the Mac.

Timbuktu 4.0 and Timbuktu/Remote 3.0, *Farallon Computing*
These packages allow you to view and control remote Mac screens.

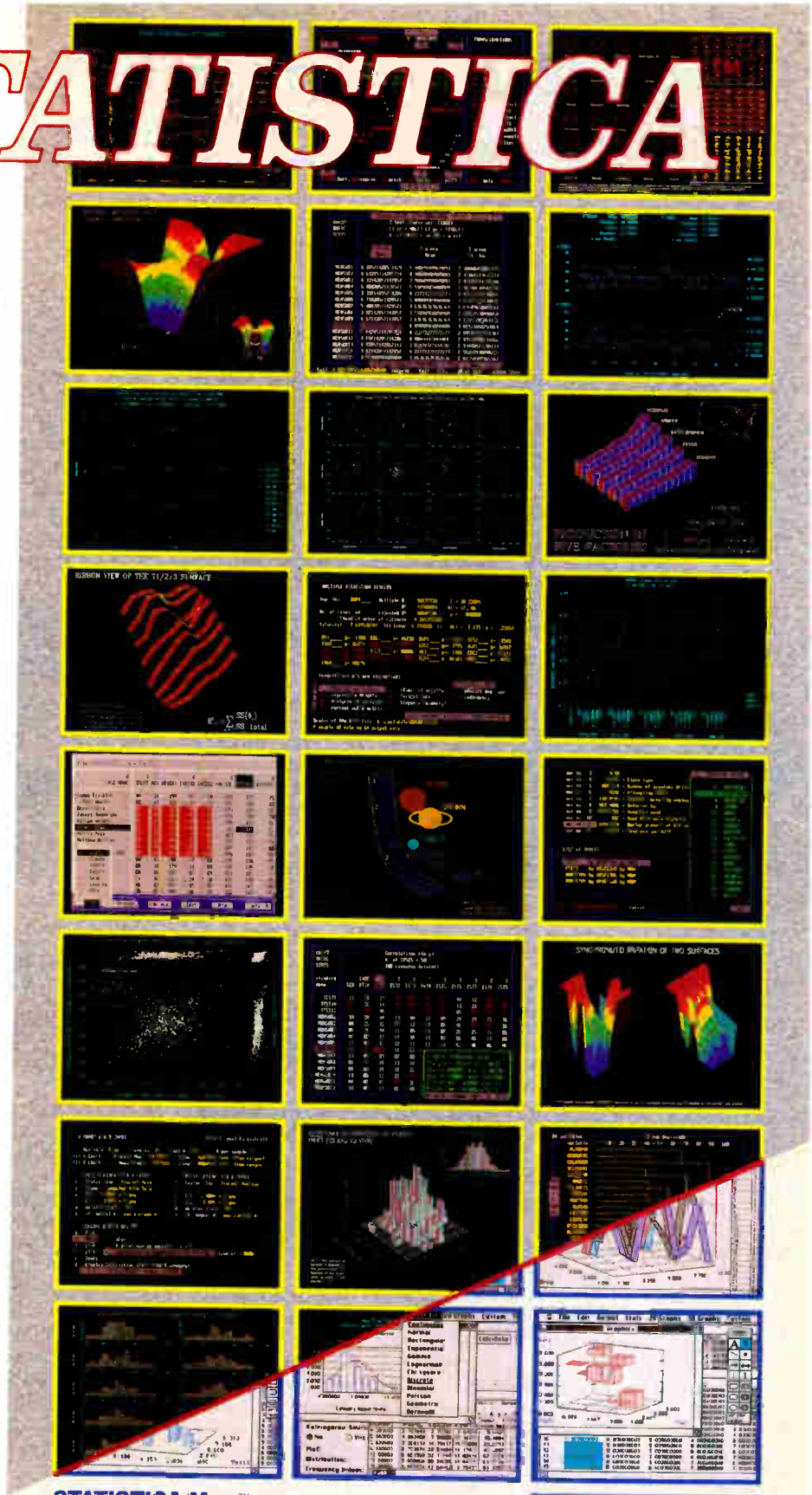
Ashlar Vellum for Silicon Graphics, *Ashlar*
An excellent CAD program that shines on a serious workstation like the Silicon Graphics Iris Indigo.

WinPrinter 400, *LaserMaster*
The first laser printer designed to work specifically with Windows. It is host-based, using your PC's CPU for processing power.

Z-Mail 2.0, *Siren Software*
A Unix GUI-based mail program that sets new standards in simplicity, programmability, features, and performance.

World Radio History

CSS:STATISTICA



CSS/3™ Complete Statistical System with over 1,000 presentation-quality graphs fully integrated with all procedures and on-screen graph customization ■ The largest selection of statistics in a single system: in-depth, comprehensive implementations of: *Exploratory techniques; multi-way tables with banners; nonparametrics; distribution fitting; multiple regression; general nonlinear estimation; logit/probit analysis; general ANCOVA/MANCOVA; stepwise discriminant analysis; log-linear analysis; factor analysis; cluster analysis; multidimensional scaling; canonical correlation; item analysis/reliability; survival analysis; time series modeling; forecasting; lags analysis; quality control; process analysis; experimental design (with Taguchi);* and much more ■ Manuals with comprehensive introductions to each procedure and examples ■ Integrated Stats Advisor expert system ■ Extensive data management facilities (powerful spreadsheet with formulas; relational merge; data verification; flexible programming language) ■ Optimized (plain English menus/mouse) user interface: even complex analyses require just few self-explanatory selections (CSS can be run without manual; Quick Start booklet explains all basic conventions) ■ Macros, batch/commands also supported ■ All output displayed in Scrollsheets™ (dynamic tables with pop-up windows and instant graphs) ■ Extremely large analysis designs (e.g., correlation matrices up to 32,000x32,000) ■ Unlimited size of files; extended precision; unmatched speed (Assembler, C) ■ Exchanges data (and graphics) with many applications (incl. Excel®, Lotus 3®, dBASE IV®, SPSS®) ■ Highest resolution output on practically all printers (incl. HP, Postscript), plotters, recorders, typesetters ■ IBM compatibles, 640k or more ■ Price: **$595.**

Quick CSS™ Subset of CSS/3: all basic statistical modules (incl. data management) and the full, presentation-quality graphics capabilities of CSS/3 ■ Price: **$295.**

CSS:GRAPHICS™ A comprehensive graphics/charting system with data management ■ All graphics capabilities of CSS/3 and, in addition, extended on-screen drawing, 19 scalable fonts, special effects, icons, maps, multi-graphics management ■ Hundreds of types of graphs ■ Interactive rotation and interactive cross-sections of 3D graphs ■ Extensive selection of tools for graphical exploration of data; fitting; smoothing; spectral planes; overlaying; layered compressions; marked subsets ■ Unique multivariate (e.g., 4D) graphs ■ Facilities to custom-design new graphs and add them permanently to menu ■ Import/export of graphs and data, 15 formats ■ Optimized (menu/mouse) user interface; even complex graphs require few keystrokes: all graphs on this page can be produced from raw data in less than 20 minutes ■ Macros, batch/commands also supported ■ Unlimited size of files ■ Highest resolution output on all hardware (see CSS/3) ■ IBM compatibles, 640k or more ■ CSS:GRAPHICS is included in CSS:STATISTICA (available separately for **$495**).

Megafile Manager™ Comprehensive analytic data base management system ■ Unlimited size of files (up to 32,000 fields or 8 MB per record) ■ Megafile Manager is included in CSS/3 and CSS:STATISTICA (separately: **$295**).

CSS:STATISTICA™ A fully integrated system that combines all the capabilities of CSS/3 and CSS:GRAPHICS into a single extremely comprehensive data analysis system ■ Price: **$795.**

Domestic sh/h $7 per product; 14-day money back guarantee.

Circle 157 for DOS. Circle 158 for MAC.

StatSoft™

2325 E. 13th St. • Tulsa, OK 74104 • (918) 583-4149
Fax: (918) 583-4376

STATISTICA/Mac™ A CSS-compatible, comprehensive data analysis and graphics system designed for the Macintosh ■ Large selection of statistical methods fully integrated with presentation-quality graphics (incl. EDA, multiplots, a wide selection of interactively rotatable 3D graphs; MacDraw-style tools) ■ Unlimited size of files ■ Exchanges data with Excel and other applications ■ Price: **$495.**

Quick CSS/Mac™ A subset of STATISTICA/Mac: all basic statistical modules and the full, presentation-quality graphics capabilities of STATISTICA/Mac ■ Price: **$295.**

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: 613-866-1766, fax: 613-866-3318; **StatSoft Canada-CCO** (Ontario), ph: 416-849-0737, fax: 416-849-0918. Available from: CORPORATE SOFTWARE and other Authorized Representatives Worldwide: Holland: Lemax BV 02065-98701; France: VERSION US (1) 40590913; Sweden: AkademiData 018-240035; Spain: **ADDLINK, SRL**; ph: 34-3-459-0722.

CSS, CSS/3, CSS:GRAPHICS, Megafile Manager, Quick CSS, STATISTICA, StatSoft, dBase IV, Excel, Lotus, MacDraw, Macintosh, Postscript are trademarks of their respective companies. SPSS is a registered trademark of SPSS, Inc.

World Radio History

BYTE AWARDS

NIKKEI BYTE

EXCELLENCE

FM R-Card, *Fujitsu*

The Fujitsu FM R-Card fits in a briefcase and offers the features of a desktop machine. It weighs only 2.2 pounds, measures 11.6 by 8.3 by 1.04 inches, and has a full-size keyboard. It runs for 8 hours on two AA-size alkaline batteries—the result of major new technologies, like dropping the operating voltage to 3 volts and halting the supply of power to circuits not in use. It costs 238,000 yen.

DD-DR1, *Sony* ▽

The Sony DD-DR1 is an electronic book—a CD-ROM drive handling 8-cm discs. It is linked through an RS-232 interface for read processing. This makes it possible to insert CD-ROM data into PC files. The system also has a 256- by 200-mm dot-pitch monochrome graphics display and an ADPCM (adaptive differential pulse-coded modulation) audio playback function (a subset of the CD-ROM XA standard).

DISTINCTION

PTC-300, *Sony* ▷

The Sony PTC-300 is the third model in Sony's palmtop line of pen computers. While the previous models were designed to fit in an attaché case, the PTC-300 fits in your pocket, measuring only 105 by 165 by 28 mm and weighing 355 grams. It costs 65,000 yen, or about US$400, and will run for about 9 hours on two AA cells.

In spite of its size, the PTC-300 is a full-fledged computer with an 8-MHz 68000 CPU, 2.5 MB of ROM, and 288 KB of RAM.

DOS J4.0/V (Japanese version), *IBM Japan*

DOS J4.0/V is an epoch-making new technology that allows the display of Japanese language on IBM AT–compatible machines equipped with a VGA display. No specialized hardware, such as a Japanese language character generator, is required. This means that if you use DOS J4.0/V, you can purchase inexpensive IBM compatibles from overseas. It spells an acceleration of the reduction of PC prices in Japan.

BYTE AWARDS

RAM

EXCELLENCE

MS-DOS 5.0, *Microsoft*

The new full-featured edition of the world's most popular operating system is a major upgrade that conforms well to the elevated needs of today's applications software. Several application programs can use extra breathing space; MS-DOS 5.0 provides that. With MS-DOS 5.0, the average user has a flexible and powerful set of commands and tools available right at the DOS prompt.

Excel 3.0, *Microsoft*; **Lotus 1-2-3 for Windows,** *Lotus Development*

The new generation of graphical spreadsheets for Windows offers a whole new class of capabilities combined with a much higher level of ease of use than previous generations. Even novice users can now comprehend the basics of spreadsheets and start using them in a few hours. By using Windows' Dynamic Data Exchange, you can integrate Lotus 1-2-3 for Windows and Excel with other applications in a modern and powerful desktop environment that improves productivity considerably.

System 7.0, *Apple Computer*

The long-awaited System 7.0 delivers countless new features to the Mac. It is very stable and has few compatibility problems. It requires as little as 2 MB of RAM and runs without problems even on a Mac Plus.

World Radio History

Quality

Speed

Value

HOT WINDOWS PRINTING!

Affordability

Compatibility

WISH LIST TECHNOLOGY

Wish all you want, but your standard 300-dpi business printer just isn't designed to be a high-performance Windows™ printer. That's why LaserMaster™ created our new WinPrinter™ line—the first business printers specifically designed for optimal Windows printing. Our new WinPrinters give you:

✓ FAST WINDOWS PRINTING

Our new WinPrinters give you the fastest Windows printing in the industry. Even your complex pages print in seconds, not minutes.

✓ 400 OR 800 dpi QUALITY

Today's graphically rich business documents need more than 300-dpi resolution. Our new WinPrinters provide 400- or 800-dpi output for sharper text and crisper graphics to make all your documents more effective.

✓ UPGRADABLE TECHNOLOGY

The WinPrinter's power comes from intelligent software instead of an expensive controller. This technology taps into the existing processing power of your '386 or '486 for increased printing performance without reducing your system performance. This design also gives you three ways to upgrade your WinPrinter: (1) when you upgrade your CPU, you'll automatically upgrade your WinPrinter, (2) as Windows improves (Version 3.1), so will the performance of your WinPrinter, and (3) you can add future WinPrinter advances with a simple software upgrade.

✓ THREE PRINTERS IN ONE

Our new WinPrinters are really three printers in one. You can get fast, high-resolution printing from PostScript,® a direct Windows GDI driver, or PCL print modes.

✓ EXPANDED FONT CAPABILITY

All WinPrinters come with 50 premium PostScript Type 1 typefaces so you can give your message the perfect typographic look. And our advanced font-management technology means never having to download fonts again.

✓ AFFORDABLE WINDOWS PRINTING

Whatever your need, LaserMaster has a WinPrinter for you. Our *WinPrinter 400* provides fast, 400-dpi output at just $1,995. Our *WinPrinter 800* provides fast, 800-dpi output at just $2,795. And our $995 *WinJet™ 800* gives you the option of using your HP LaserJet II or III as a fast, full-featured, 800 dpi WinPrinter.

LASERMASTER can make your business printer dreams come true. Call us today to see how our WinPrinters can turn *your* Windows printing wishes into reality.

CALL TODAY:
800-365-4646
OR
612-944-9330

DEPT. 02B

LM® LaserMaster™
TURBORES PRINTER DIVISION

Circle 88 on Inquiry Card (RESELLERS: 89).

MORE: SPEED, FONTS & RESOLUTION!

©1991 LaserMaster Corporation. LaserMaster is a trademark and the LM Logo and TurboRes are registered trademarks of LaserMaster Corporation. PostScript is a registered trademark of Adobe Systems, Inc. All other product or brand names are trademarks or registered trademarks of their respective holders.

World Radio History

BYTE AWARDS

RAM

HP LaserJet IIIp, *Hewlett-Packard*

By providing its classic 4-page-per-minute "p" box with PCL-5 and resolution enhancement capabilities, Hewlett-Packard has once again redefined the basic, low-cost laser printer.

HP LaserJet IIISi, *Hewlett-Packard*

The new top-of-the line Hewlett-Packard laser printer offers a 16-page-per-minute printing engine, PCL-5 with resolution enhancement, and elevated processing power, giving network users a much-needed tool.

PowerBook 170, *Apple Computer*

The most powerful of Apple's new notebook trio, the PowerBook 170 packs all the characteristics you can imagine in a very compact and light case. Its price is high, but it offers advanced technology, a 25-MHz 68030 processor, and the best black-and-white screen you can buy for a portable computer: Apple's backlit AMLCD.

Quadra 700, *Apple Computer*

Even though Quadra is not Apple's flagship, it offers the best price/performance ratio for those who really need power. Almost two times faster than the IIfx, it is the ideal machine for demanding applications such as CAD and desktop publishing.

Visual Basic, *Microsoft*

Microsoft's Visual Basic has brought Windows programming to thousands of BASIC users. It offers programmers all the necessary tools for designing a Windows application. With Visual Basic, it is easy to create the user interface, one of the most complex and time-consuming tasks of the GUI environment.

Turbo Pascal for Windows, *Borland International*

Borland has done it once again. In fact, it has kept its promise with a highly extended version that remains compatible with the last Turbo 6.0. Turbo Pascal for Windows offers a completely integrated environment. The programmer has a powerful language with object extensions that ease the job and invoke creativity.

DeFacto, *Computer Logic*

DeFacto from Computer Logic is a business software package targeted to medium- and big-scale companies. DeFacto deals with the whole process of a business: It takes incoming orders, controls customer support, keeps information on cash flow, has a fully featured inventory control, and produces the invoices in an easily adaptable format.

Photoshop 2.0, *Adobe*

The original version of Adobe's Photoshop received worldwide acclaim and also won a 1990 BYTE Award of Excellence. Now, Adobe outperforms itself with the second release of Photoshop, which gives artists incredible power. Direct CMYK (cyan, magenta, yellow, black) editing is supported, and you can import Illustrator 3.0 files. Photoshop 2.0 can easily match the power of dedicated prepress systems like Hell or Scitex.

3D Studio, *Autodesk*

The name *Autodesk* is usually associated with hallmark products in the CAD category, with AutoCAD being the most famous example. The same seems to be happening in the area of animation. 3D Studio seems to be the first mainstream PC-based application that allows the production of professional-looking applications.

DISTINCTION

Sharp TFT, *Sharp Electronics*

Sharp has amazed everyone with this TFT color LCD screen for the PC-8500 portable computer. The price is high, but so is the temptation.

CorelDraw 2.0, *Corel Systems*

CorelDraw 2.0 offers outstanding capabilities to the graphic artist and the novice alike. Besides its excellent handling of type, it offers a large number of clip-art images and symbols.

XGA Video Adapter, *IBM*

IBM's new video adapter offers improved resolution, a wider choice of colors, and some local processing. IBM has also popularized the standard by permitting its free use by manufacturers.

AutoCAD release 11, *Autodesk*

The latest release of the best-known design program has an environment that facilitates the development of the already-numerous add-on programs that are in the market.

SCO Unix MPX, *The Santa Cruz Operation*

The MPX extension of Unix from SCO takes full advantage of the new double-processor structure of today's top machines. It can allocate the jobs to be executed to either processors, thus better utilizing the system.

OLE Specification, *Microsoft*

The Object Linking and Embedding specification, although not fully implemented at the moment, is a great step forward. No application is an island anymore, and this specification allows applications to interact seamlessly.

QuickTime 1.0, *Apple Computer*

Apple is setting new standards for multimedia with this excellent piece of software. On a Mac, QuickTime 1.0 ensures that all movies are played at the same speed.

Canvas 3.0, *Deneba*

Deneba's popular drawing program is now even more powerful. Fully supporting System 7.0, with a huge library of add-ins, Canvas 3.0 is an excellent tool for everyone—novice or professional.

Tekton, *LH Software*

This design program provides three-dimensional tools that help an architect easily design and edit natural objects, such as a wall, roof, or staircase.

WordPerfect 5.1, Greek edition *WordPerfect*

WordPerfect 5.1 is the first major player in the word processing market to appear with full support of the Greek language.

PC Tools 6.0, *Central Point Software*; **Norton Utilities 5.0,** *Symantec*

PC Tools and the Norton Utilities are a pair of packages that can save valuable data that has been struck by computer gremlins. Both programs are a must for every computer user.

ScanMaster 1850S, *Microtek*

Microtek's 35mm slide scanner is a real breakthrough in price and performance. With a street price close to that of a color scanner, the ScanMaster can be the slide scanner for everyone.

SuperBase 4, *Precision Software*

SuperBase 4 offers a powerful and integrated platform for developing applications under Windows 3.0.

Am386, *Advanced Micro Devices*

Besides being the fastest 386 processor, the Am386 has also established a price/performance ratio that is better than ever before.

World Radio History

HMA DOS 5.0 XMS BUFFERS UMB 386MAX 486SX DRIVERS 386SX NETWORKS TSRs BLUEMAX C&T 286
RAM PAGEFRAME IPX MEMORY BIOS CACHE VGA MOUSE 386 DPMI HIGH DOS EGA INITIALIZE 486
ROM LIM EMS

DOS 5.

DOS 5 with MAX 6.

There's no doubt about it. DOS 5 is the sleekest, most convenient, most powerful DOS upgrade in history.

And it's a great place to start if you really want to get the ultimate in PC performance—without even lifting a finger.

New MAX 6—the driving force in automatic memory management.

Top performance requires as much conventional memory as possible. So applications can run faster. And so you can load Windows, TSRs, even a network, and have memory to spare.

Of course, DOS 5 helps with its smaller program size. And it does let you load programs high—if you want to do it by hand.

But for optimal memory management that's totally automatic, you need new MAX version 6—386MAX® for PC compatibles, and BlueMAX™, the only memory manager designed to recover up to 250% more high DOS memory on IBM PS/2s.

They're the dramatically advanced versions of the fastest growing brand of memory managers in the world. Now with better memory recovery, superior optimization, and amazing ease of use.

Intelligent, thoughtful, and totally reliable.

Just type *maximize*, and MAX takes over with its automatic memory management tools.

Like new 386MAX ROMsearch™ that recovers massive holes of unused system BIOS memory. New 386MAX VGAswap™ that creates more contiguous memory on all VGA/EGA systems.

Like SmartMemory™ that takes care of memory allocation for you, so you'll never again have to think about what kind of memory your computer needs. And new Maximize Reordering that helps fit more programs into high DOS by automatically arranging programs for optimal loading, every time.

And using MAX 6 is a cinch thanks to the new graphical interface, complete with pull-down menus, mouse support, and context-sensitive help. There's even a new improved version of ASQ™, the intelligent system analyzer and tutorial, right on board.

The ultimate in power and luxury is more affordable than ever.

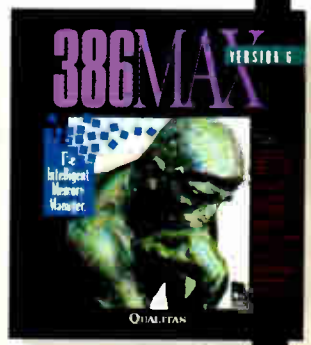
New 386MAX 6 for 286*, 386, and 486 PC compatibles is now just $99.95. And new BlueMAX 6 for 386 and 486 IBM PS/2s is only $124.95.

Frankly, whether you use DOS 5 or not, only MAX 6 will have you on your way to maximum PC performance with an absolute minimum of effort.

See your dealer or call toll-free today.

1-800-676-0386

Call to upgrade for just $29.95 plus $5 S&H**



The Intelligent Memory Managers™

© 1991, 1992 Qualitas. Qualitas, 7101 Wisconsin Avenue, Suite 1386, Bethesda, MD 20814. *All company and product names are trademarks or registered trademarks of their respective owners.* System Requirements: Any 386 or 486 PC or PS/2, min. 256K of extended memory, DOS 3.0 or higher, and hard disk drive. **386MAX supports 286 systems with Shadow RAM. Feature availability and memory recovery may vary. **Offer valid in North America only.*

QUALITAS®

Circle 135 on Inquiry Card.

World Radio History

BYTE AWARDS

RAM

Open, *Singular*
Open from Singular is a commercial program generator that uses the "open" concept. It consists of basic rules and entities for each business package, and a fully flexible, adaptable, and customizable environment for the user and programmer. Although it runs under DOS, the user interface is very well designed.

High Refresh Specification, *VESA*
The vertical refresh rate of 72 Hz proposed by the Video Electronics Standards Association deserves praise for its comfortable way of interfacing humans with computer monitors. Whatever combination of resolution and colors you use, there's no flickering on the sides of the screen.

MERIT

Touchbase Worldport Fax/Modem 2496, *USRobotics*

FrameMaker 3.0, *Frame Technologies*

PN48 Professional System, *Citizen America*

LaserWriter IIg, *Apple Computer*

Trackball, *Microsoft*

Radius Rocket Accelerator Card, *Radius*

Personal R:Base, *Microrim*

Now Utilities 3.0, *Now Software*

BYTE AWARDS

BINARY BYTE AWARDS

EXCELLENCE

Visual Basic, *Microsoft*

Norton Desktop for Windows, *Symantec*

MS-DOS 5.0, *Microsoft*

System 7.0, *Apple Computer*

IBM PS/2 Model P75, *IBM*

LSX-5000, *Olivetti*

DR DOS 6.0, *Digital Research*

Excel 3.0, *Microsoft*

Sony 128-MB rewritable optical disks, *Sony*

NetWare Lite, *Novell*

Desqview/X, *Quarterdeck*

Teac 2.88-MB floppy drives, *Teac America*

WordPerfect for Windows, *WordPerfect*

QuickTime 1.0, *Apple Computer*

DISTINCTION

NEC MultiSync 3FG, 4FG, *NEC*

NCR System 3125, *NCR*

Canon Ion, *Canon*; **Photoman,** *Logitech*

Phaser II PXI, *Tektronix*

Zortech C++ 3.0, *Symantec*

PC Tools 7.0, *Central Point Software*

PowerBook, *Apple Computer*

HP LaserJet IIISi, *Hewlett-Packard*

Idea I + D, *WinLogo*

FasMath, *Cyrix*

Dell 325NC, *Dell*; **NB-SL/25c,** *Epson*

PenPoint, *Go Corp.*

3D Studio, *Autodesk*

NetWare 3.11, *Novell*

PC/Chip F8680, *Chips & Technologies*

Am386DXL-40, *Advanced Micro Devices*

HP 95LX, *Hewlett-Packard*

HP DeskJet 500 Color, *Hewlett-Packard*

CorelDraw 2.0, CD-ROM edition, *Corel Systems*

MERIT

Mathematica for Windows, *Wolfram Research*

Ventura Publisher 4.0 for Windows, *Ventura Software*

Hercules Graphics Station Gold, *Hercules Computer Technology*

NetWare 2.2, *Novell*

Borland C++ 2.0, *Borland International*

IBM XGA Display Adapter/A, *IBM*

Mastersport 386SL, *Zenith Data Systems*

QuickC for Windows, *Microsoft*

Ultra 144, *Hayes*

Dell 450DE, *Dell*

Iris Indigo, *Silicon Graphics*

Quattro Pro 3.0, *Borland International*

Ami Pro 2.0, *Lotus Development*

Lotus 1-2-3 for Windows, *Lotus Development*

SCSI-2 standard

T2200SX, *Toshiba*

HP Apollo Series 9000 Model 42, *Hewlett-Packard*

SoundBlaster Pro, *Brown-Wagh Publishing*

HP ScanJet IIc, *Hewlett-Packard*

Lotus Notes 2.0, *Lotus Development*

CodeBase 4.2, *Sequiter*

MultiAccess Series 3000, *Advanced Logic Research*

FoxPro 2.0, *Fox Software*

GeoWorks Ensemble, *GeoWorks*

TrackMan Portable, *Logitech*; **BallPoint,** *Microsoft*

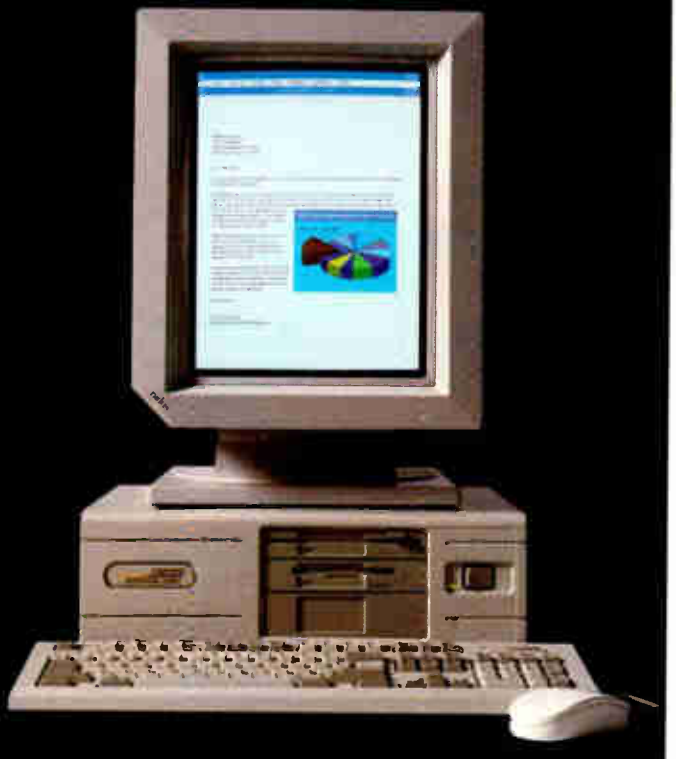
VRAM II, *Video Seven*

PhotoStyler, *Aldus*

HP LaserJet IIIp, *Hewlett-Packard*

Readers may send comments or queries to Nikkei BYTE, RAM, *or* Binary *c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.*

World Radio History



BUY THE ONLY FULL PAGE COLOR DISPLAY, AND ...

NOW FOR $1249 you can own the only color portrait display for the PC. Introducing the Radius Full Page Pivot, the display that shows you an entire page at one time. Pivot displays 65% more information than standard 12" or 13" monitors, so you can see a letter or full page layout from top to bottom. Image quality is superb – anywhere from VGA resolution all the way up to 1024 x 768. ● You can also rotate Pivot into landscape mode to view a complete spreadsheet. Pivot combines with the advanced Radius SVGA MultiView Interface for real-time pivoting. When given a gentle turn, Pivot automatically reorganizes your application, so you can quickly and gracefully go from one orientation to the other. ● In addition, Pivot with MultiView provides 100% VGA and SVGA compatibility, offers high resolution full-page drivers for Windows 3.0, WordPerfect, Lotus 1-2-3, AutoCAD and others, displays up to 32,768 colors and meets the Swedish standards for low ELF/VLF magnetic emissions. We might also mention that MultiView–the fastest SVGA card you can buy today–works with a variety of multi-frequency displays, sells for $449 and comes with a seven-year warranty. ● If the combination of Full Page Pivot and SVGA MultiView sounds like the perfect display system for all your applications, it's probably because it is. Pivot and MultiView are available from Radius, the leading manufacturer of high resolution graphics systems for personal computers. To find your nearby Radius reseller or to receive a Full Page Pivot video tape, call 1-800-227-2795.

TURN IT INTO A SPREADSHEET DISPLAY FOR FREE.

radius

Circle 139 on Inquiry Card.

©1991 Radius Inc. Radius, the Radius logo, Full Page Pivot, and SVGA MultiView are trademarks of Radius Inc. All other products are trademarks or registered trademarks of their respective owners.
For the name of your Radius International Distributor, call 408-434-1010. Screen image courtesy of Don Baarns' Excel Team.

World Radio History

The Fourth Annual BYTE Award Winners

Acius, Inc.
4th Dimension 2.1
10351 Bubb Rd.
Cupertino, CA 95014
(408) 252-4444
(408) 252-0831
Circle 985 on Inquiry Card.

Adobe Systems, Inc.
Adobe Illustrator 3.0
1585 Charleston Rd.
P.O. Box 7900
Mountain View, CA 94039
(800) 833-6687
(415) 961-4400
fax: (415) 961-3769
Circle 986 on Inquiry Card.

Advanced Micro Devices
Am386
P.O. Box 3453
Sunnyvale, CA 94088
(800) 222-9323
(408) 732-2400
Circle 987 on Inquiry Card.

Aladdin Systems, Inc.
Shortcut
165 Westridge Dr.
Watsonville, CA 95076
(408) 761-6200
fax: (408) 761-6206
Circle 988 on Inquiry Card.

Aldus Corp.
PageMaker 4.0
411 First Ave. S
Seattle, WA 98104
(206) 622-5500
fax: (206) 343-4240
Circle 989 on Inquiry Card.

Alias Research, Inc., Style Division
Sketch
110 Richmond St. E
Toronto, Ontario,
Canada M5C 1P1
(800) 267-8697
(416) 362-9181
fax: (416) 362-0630
Circle 990 on Inquiry Card.

Amaze, Inc.
The Far Side Computer Calendar
11810 115th Ave. NE
Kirkland, WA 98034
(206) 820-7007
fax: (206) 823-0568
Circle 991 on Inquiry Card.

Apple Computer, Inc.
LaserWriter IIf and IIg
Mac Quadra 900
PowerBook 170
QuickTime 1.0
System 7.0
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010
Circle 992 on Inquiry Card.

Ashlar, Inc.
Ashlar Vellum for Silicon Graphics
1290 Oakmead Pkwy., Suite 218
Sunnyvale, CA 94086
(408) 746-1800
fax: (408) 746-0749
Circle 993 on Inquiry Card.

ATI Technologies, Inc.
ATI 8514-Ultra
3761 Victoria Park Ave.
Scarborough, Ontario,
Canada M1W 3S2
(416) 756-0718
fax: (416) 756-0720
Circle 994 on Inquiry Card.

AT&T Graphics Software Lab
Mac Topas and Topas VGA
3520 Commerce Crossing, Suite 300
Indianapolis, IN 46240
(317) 844-4364
fax: (317) 575-0649
Circle 995 on Inquiry Card.

AT&T Safari Systems
Safari NSX/20
14K World Fair Dr.
Somerset, NJ 08873
(908) 302-5800
fax: (908) 469-4578
Circle 996 on Inquiry Card.

Autodesk, Inc.
Chaos: The Software
2320 Marinship Way
Sausalito, CA 94965
(415) 332-2344
fax: (415) 331-8093
Circle 997 on Inquiry Card.

Borland International, Inc.
Borland C++ 3.0
ObjectVision
The World of C++
1800 Green Hills Rd.
P.O. Box 660001
Scotts Valley, CA 95067
(408) 438-8400
fax: (408) 439-9344
Circle 998 on Inquiry Card.

Cayman Systems, Inc.
GatorBox CS
26 Lansdowne St.
Cambridge, MA 02139
(800) 473-4776
(617) 494-1999
fax: (617) 494-9270
Circle 999 on Inquiry Card.

Chips & Technologies
PC/Chip
3050 Zanker Rd.
San Jose, CA 95134
(408) 434-0600
fax: (408) 934-1552
Circle 1062 on Inquiry Card.

Citizen America Corp.
PN48 Professional System
2450 Broadway, Suite 600
Santa Monica, CA 90404
(213) 453-0614
fax: (213) 453-2814
Circle 1064 on Inquiry Card.

Claris Corp.
ClarisWorks
MacDraw Pro
5201 Patrick Henry Dr.
Santa Clara, CA 95052
(408) 987-7000
Circle 1065 on Inquiry Card.

Clarity Software, Inc.
Rapport
2700 Garcia Ave.
Mountain View, CA 94043
(415) 691-0320
fax: (415) 964-4383
Circle 1066 on Inquiry Card.

Connectix
Apple Mode32
2655 Campus Dr.
San Mateo, CA 94403
(415) 571-5100
fax: (415) 571-5195
Circle 1067 on Inquiry Card.

Corel Systems
CorelDraw 2.0, CD-ROM edition
1600 Carling Ave., Suite 190
Ottawa, Ontario,
Canada K1Z 8R7
(613) 728-8200
fax: (613) 728-9790
Circle 1068 on Inquiry Card.

CoStar Corp.
AddressWriter
22 Bridge St.
Greenwich, CT 06830
(203) 661-9700
fax: (203) 661-1540
Circle 1069 on Inquiry Card.

Digital Research, Inc.
DR DOS 6.0
Box DRI
70 Garden Court
Monterey, CA 93942
(800) 395-2480
(408) 649-3896
fax: (408) 646-6248
Circle 1070 on Inquiry Card.

Eastman Kodak Co.
EktaPlus 7016 Printer
Personal Printer Products
901 Elm Grove Rd.,
First Floor, Building 14
Rochester, NY 14650
(800) 344-0006
fax: (716) 726-3108
Circle 1071 on Inquiry Card.

Ergo Computing, Inc.
Moby Brick
1 Intercontinental Way
Peabody, MA 01960
(800) 633-1925
(508) 535-7510
fax: (508) 535-7512
Circle 1072 on Inquiry Card.

Falco Data Products, Inc.
GT486/40
440 Potero Ave.
Sunnyvale, CA 94086
(800) 325-2648
(408) 745-7123
fax: (408) 745-7860
Circle 1073 on Inquiry Card.

Farallon Computing, Inc.
Timbuktu 4.0 and Timbuktu/Remote 3.0
2000 Powell St., Suite 600
Emeryville, CA 94608
(510) 596-9100
fax: (510) 596-9023
Circle 1074 on Inquiry Card.

Fox Software
FoxPro 2.0
134 West South Boundary
Perrysburg, OH 43551
(419) 874-0162
fax: (419) 874-8678
Circle 1075 on Inquiry Card.

Go Corp.
PenPoint
950 Tower Lane, Suite 1400
Foster City, CA 94404
(415) 345-7400
fax: (415) 345-9833
Circle 1076 on Inquiry Card.

Grolier Electronic Publishing
Grolier Electronic Encyclopedia
Sherman Tpke.
Danbury, CT 06816
(800) 356-5590
(203) 797-3500
fax: (203) 797-3197
Circle 1077 on Inquiry Card.

Gupta Technologies, Inc.
Quest for Windows
1040 Marsh Rd.
Menlo Park, CA 94025
(415) 321-9500
fax: (415) 321-5471
Circle 1078 on Inquiry Card.

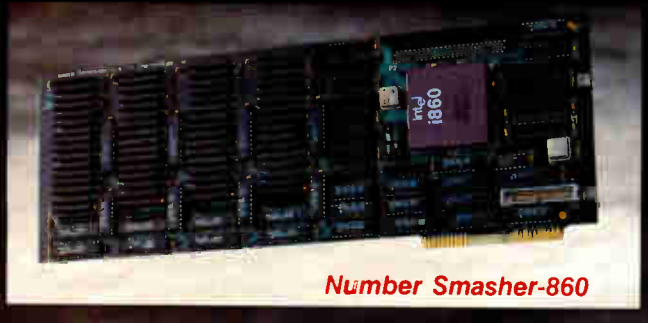
Hewlett-Packard Co.
HP Apollo 9000/Series 700
HP LaserJet IIISi
HP ScanJet IIc
19310 Pruneridge Ave.
Cupertino, CA 95014
(800) 752-0900
Circle 1079 on Inquiry Card.

World Radio History

486-B²T

486/860 Speed... Microway Quality.

Microway has engineered four distinctive black tower systems. The **486-B²T** is designed for high-end users. It comes standard with American 486 motherboards and power supplies, yet has a reasonable starting price of $2,195. A broad range of options can be installed including high speed and capacity hard disks, intelligent serial controllers, tape back-up units, high end graphics adapters and our *Number Smasher-860*. These systems are ideal for configuring Novell or UNIX file servers, multiuser systems, and workstations for graphics, CAD and scientific uses. The **486-B²T** comes with dual fans, *Across the Board*™ Cooling and American industrial grade power supplies. All systems are thoroughly tested, burned in and include the best technical support in the industry, which we've provided since 1982.



Number Smasher-860

The key to attaining workstation performance is Microway's 40MHz *Number Smasher-860*. It features a four-way interleaved 64-bit memory system that runs at 160 megabytes/sec. The *Number Smasher's* i860 has been clocked at 80 megaflops doing matrix multiplies, 67 megaflops doing FFTs and 11.8 Double Precision Linpack Megaflops on large arrays—ten times the speed of a 486 and twice the speed of a Cray 1F! One happy user recently reported that his "Baby Cray" was happily humming away saving him thousands of dollars per month in 3090 rentals. The *Number Smasher* comes with the finest i860 compilers on the market, your choice of Microway's NDP™ FORTRAN, C|C++ or Pascal.

Call or write today for more information on Microway's new black tower systems.

Microway®

Technology You Can Count On

Corporate Headquarters, Box 79, Kingston, MA 02364 USA • TEL 508-746-7341 • FAX 508-746-4678 • U.K./Eurcpe 081-541-5466
France 01 43 2 69593 • Germany 069-75-2023 • Holland 40 836455 • Italy 02-74.90.749 • Japan 0474 23 1322 • Norway 6-892020

World Radio History

The Fourth Annual Byte Award Winners (continued)

Hewlett-Packard Co.
HP 95LX
1000 Northeast Circle Blvd.
Corvalis, OR 97330
(800) 443-1254
fax: (503) 750-4689
Circle 1080 on Inquiry Card.

IBM
IBM 3.5" Rewritable Optical Drive
U.S. Marketing and Services
1133 Westchester Ave.
White Plains, NY 10604
(800) 426-2468
Circle 1063 on Inquiry Card.

Intel Corp.
Net Satisfaxtion 1.0
5200 Northeast Elam Young Pkwy.
Hillsboro, OR 97124
(503) 696-7086
Circle 1081 on Inquiry Card.

LaserMaster Corp.
WinPrinter 400
6900 Shady Oak Rd.
Eden Prairie, MN 55344
(800) 365-4646
(503) 629-7000
fax: (612) 944-0522
Circle 1082 on Inquiry Card.

Lotus Development Corp.
Ami Pro 2.0
Lotus 1-2-3 for Windows
55 Cambridge Pkwy.
Cambridge, MA 02142
(617) 577-8500
fax: (617) 693-1197
Circle 1083 on Inquiry Card.

Microsoft Corp.
Excel 3.0
MS-DOS 5.0
QuickC for Windows 1.0
Visual Basic
Word for Windows 2.0
1 Microsoft Way
Redmond, WA 98052
(800) 426-9400
(206) 882-8080
fax: (206) 883-8101
Circle 1084 on Inquiry Card.

Momenta Corp.
Momenta Pen System
295 North Bernardo Ave.
Mountain View, CA 94043
(415) 969-3876
fax: (415) 969-3877
Circle 1085 on Inquiry Card.

Motorola, Inc.
Altair
Altair Product Operations
3215 Wilke Rd.
Arlington Heights, IL 60004
(800) 233-0877
(708) 632-4723
fax: (708) 632-7811
Circle 1086 on Inquiry Card.

Nanao USA Corp.
Nanao T560i
23535 Telo Ave.
Torrance, CA 90505
(800) 800-5202
(213) 325-5202
fax: (213) 530-1679
Circle 1087 on Inquiry Card.

NCR Corp.
NCR 3125
Workstation Products Division
1601 South Main St.
Dayton, OH 45479
(800) 225-5627
(513) 445-6160
fax: (513) 445-2008
Circle 1088 on Inquiry Card.

Novell, Inc.
NetWare 3.11
122 East 1700 South
Provo, UT 84606
(800) 346-7177
(801) 429-5900
fax: (801) 429-5155
Circle 1089 on Inquiry Card.

Ontrack Computer Systems, Inc.
Dr. Solomon's Virus Toolkit
6321 Bury Dr.
Eden Prairie, MN 55346
(800) 752-1333
(612) 937-1107
fax: (612) 937-0196
Circle 1090 on Inquiry Card.

Open Software Foundation
Distributed Computing Environment
11 Cambridge Center
Cambridge, MA 02142
(617) 621-8700
Circle 1091 on Inquiry Card.

Outbound Systems, Inc.
Outbound Notebook System
Model 2000
4840 Pearl East Cir.
Boulder, CO 80301
(800) 444-4607
(303) 786-9200
fax: (303) 786-8611
Circle 1092 on Inquiry Card.

Pacific Data Products
PacificPage XL
9125 Rehco Rd.
San Diego, CA 92121
(619) 552-0880
fax: (619) 552-0889
Circle 1093 on Inquiry Card.

Palindrome Corp.
The Network Archivist 2.0
850 East Diehl Rd.
Naperville, IL 60563
(708) 505-3300
fax: (708) 505-7917
Circle 1094 on Inquiry Card.

Paragon Concepts, Inc.
Nisus 3.06
990 Highland Dr., Suite 312
Solana Beach, CA 92075
(800) 922-2993
(619) 481-1477
fax. (619) 481-6154
Circle 1095 on Inquiry Card.

Performance Technology, Inc.
PowerLAN 2.10
800 Lincoln Center
7800 IH 10 W
San Antonio, TX 78230
(800) 327-8526
(512) 349-2000
fax: (512) 366-0123
Circle 1096 on Inquiry Card.

Phar Lap Software, Inc.
286|DOS-Extender
60 Aberdeen Ave.
Cambridge, MA 02138
(617) 661-1510
fax: (617) 876-2972
Circle 1097 on Inquiry Card.

Psion, Inc.
Psion Series 3
57 River St.
Wellesley, MA 02181
(617) 237-8538
fax: (617) 431-2155
Circle 1098 on Inquiry Card.

Qualitas, Inc.
386Max 6.0
7101 Wisconsin Ave., Suite 386
Bethesda, MD 20814
(301) 907-7400
fax: (301) 718-6060
Circle 1099 on Inquiry Card.

Radius, Inc.
Full Page Pivot
1710 Fortune Dr.
San Jose, CA 95131
(800) 227-2795
(408) 434-1010
fax: (408) 434-0770
Circle 1100 on Inquiry Card.

Silicon Graphics, Inc.
Iris Indigo
2011 North Shoreline Blvd.
Mountain View, CA 94043
(415) 960-1980
fax: (415) 961-0595
Circle 1257 on Inquiry Card.

Siren Software Corp.
Z-Mail 2.0
750 Menlo Ave., Suite 200
Menlo Park, CA 94025
(415) 322-0600
fax: (415) 322-4023
Circle 1258 on Inquiry Card.

Software Publishing Corp.
Harvard Graphics for Windows
3165 Kifer Rd.
Santa Clara, CA 95051
(408) 986-8000
fax: (408) 980-0729
Circle 1259 on Inquiry Card.

Stac Electronics
Stacker 2.0
5993 Avenida Encinas
Carlsbad, CA 92008
(619) 431-7474
fax: (619) 431-0880
Circle 1260 on Inquiry Card.

Sun Microsystems, Inc.
Sparcstation IPX
2550 Garcia Ave.
Mountain View, CA 94043
(415) 960-1300
fax: (415) 969-9131
Circle 1261 on Inquiry Card.

SuperMac Technology
Thunder/24
485 Potero Ave.
Sunnyvale, CA 94086
(408) 245-2202
fax: (408) 735-7250
Circle 1262 on Inquiry Card.

Symantec Corp.
Norton Desktop for Windows
On-Target
10201 Torre Ave.
Cupertino, CA 95014
(800) 441-7234
(408) 253-9600
fax: (408) 253-4092
Circle 1263 on Inquiry Card.

Tandy Corp.
CDR-1000
700 1 Tandy Center
Fort Worth, TX 76102
(817) 390-3300
fax: (817) 878-6508
Circle 1264 on Inquiry Card.

Toshiba America Information Systems, Inc.
T2200SX
T4400
Computer Systems Division
9740 Irvine Blvd.
Irvine, CA 92718
(800) 334-3445
(714) 583-3000
fax: (714) 587-6034
Circle 1265 on Inquiry Card.

Traveling Software, Inc.
LapLink Pro 4.0
18702 North Creek Pkwy.
Bothell, WA 98011
(800) 343-8080
(206) 483-8088
fax: (206) 487-1284
Circle 1266 on Inquiry Card.

Truevision
NuVista+
7340 Shadeland Station
Indianapolis, IN 46256
(317) 841-0332
fax: (317) 576-7700
Circle 1267 on Inquiry Card.

Within Technologies
Realizer
Laurel Corporate Center, Suite 201 S
8000 Midlantic Dr.
Mount Laurel, NJ 08054
(609) 273-8881
fax: (609) 231-8991
Circle 1268 on Inquiry Card.

Zenith Data Systems
Mastersport 386SL
2150 East Lake Cook Rd.
Buffalo Grove, IL 60089
(800) 553-0331
(708) 808-4300
Circle 1269 on Inquiry Card.

World Radio History

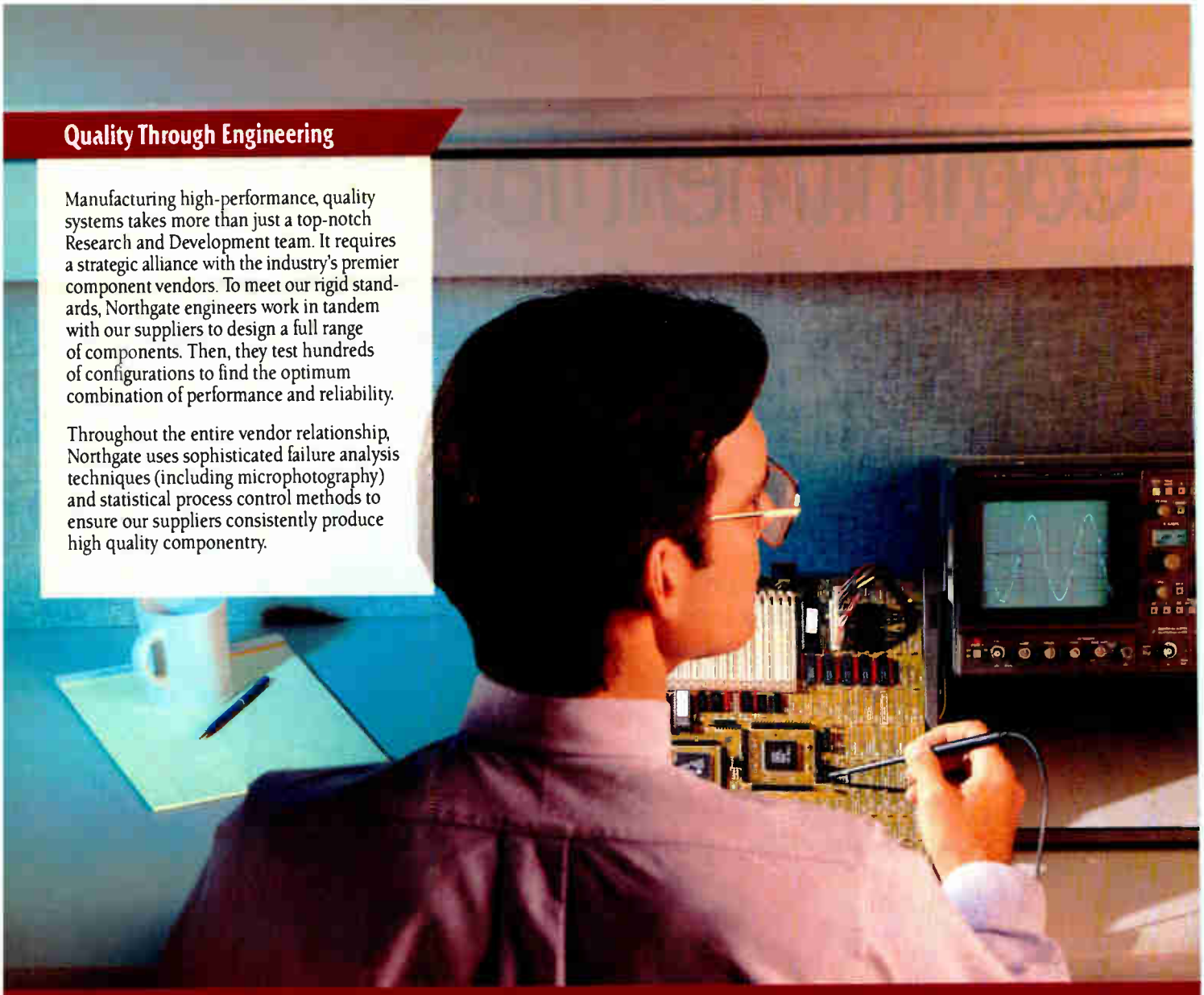
Why Is Northgate® Going Public With Confidential Information?

World Radio History

Quality Through Engineering

Manufacturing high-performance, quality systems takes more than just a top-notch Research and Development team. It requires a strategic alliance with the industry's premier component vendors. To meet our rigid standards, Northgate engineers work in tandem with our suppliers to design a full range of components. Then, they test hundreds of configurations to find the optimum combination of performance and reliability.

Throughout the entire vendor relationship, Northgate uses sophisticated failure analysis techniques (including microphotography) and statistical process control methods to ensure our suppliers consistently produce high quality componentry.



New Northgate 386 and 486™ Systems

Northgate 386SX™/16 or 20

- Intel® 80386SX/16 or 20 MHz Processor
- 1MB RAM (Expands to 16MB)
- 52MB IDE Hard Drive with 17 ms Seek Time
- Five-Bay Case; Three 5.25" and Two 3.5" Bays
- Six 16-Bit Expansion Card Slots
- Choice of 1.2MB 5.25" or 1.44MB 3.5" Floppy Drive
- Exclusive *OmniKey*® Keyboard
- VGA 800 x 600 Card and Color Monitor
- MS-DOS 3.3, 4.01 or 5
- FCC Class B Certified

$1599⁰⁰/$1699⁰⁰

Northgate 386DX/25 or 33

- Intel 80386DX/25 or 33 MHz Processor
- 2MB RAM (Expands to 32MB)
- 52MB IDE Hard Drive with 17 ms Seek Time
- 64K Cache
- Choice of 1.2MB 5.25" or 1.44MB 3.5" Floppy Drive
- Six 16-Bit and Two 8-Bit Expansion Card Slots
- Five-Bay Case; Three 5.25" and Two 3.5" Bays
- Exclusive *OmniKey* Keyboard
- VGA 800 x 600 Card and Color Monitor
- Microsoft® Windows™ 3.0 and Mouse
- MS-DOS 3.3, 4.01 or 5
- FCC Class B Certified

$2099⁰⁰/$2199⁰⁰

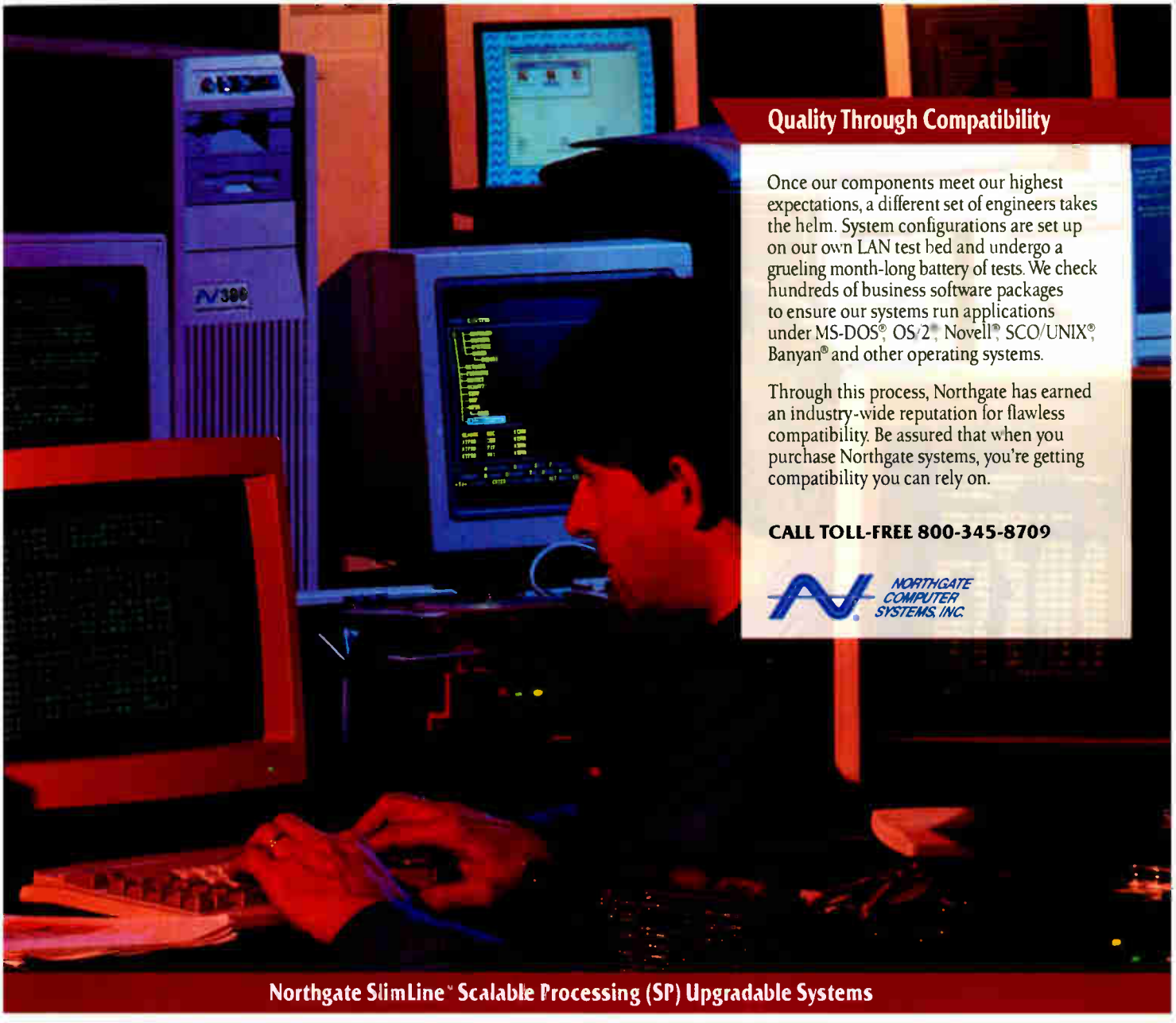
Northgate 386DX/40

- AMD 386DX/40 MHz Processor
- 4MB RAM (Expands to 32MB)
- 52MB IDE Hard Drive with 17 ms Seek Time
- 64K Cache
- Choice of 1.2MB 5.25" or 1.44MB 3.5" Floppy Drive
- Six 16-Bit and Two 8-Bit Expansion Card Slots
- Five-Bay Case; Three 5.25" and Two 3.5" Bays
- Exclusive *OmniKey* Keyboard
- VGA 800 x 600 Card and Color Monitor
- Microsoft Windows 3.0 and Mouse
- MS-DOS 3.3, 4.01 or 5
- FCC Class B Certified

$2399⁰⁰

Circle 113 on Inquiry Card (RESELLERS: 114).

World Radio History



Quality Through Compatibility

Once our components meet our highest expectations, a different set of engineers takes the helm. System configurations are set up on our own LAN test bed and undergo a grueling month-long battery of tests. We check hundreds of business software packages to ensure our systems run applications under MS-DOS®, OS/2®, Novell®, SCO/UNIX®, Banyan® and other operating systems.

Through this process, Northgate has earned an industry-wide reputation for flawless compatibility. Be assured that when you purchase Northgate systems, you're getting compatibility you can rely on.

CALL TOLL-FREE 800-345-8709

NORTHGATE COMPUTER SYSTEMS, INC.

Northgate SlimLine™ Scalable Processing (SP) Upgradable Systems

Northgate SlimLine SP™ 386/25 or 33

- Intel 80386DX/25 or 33 MHz Processor on Power Module
- Fast, Affordable Upgrades – Simply Replace Power Module
- 4MB RAM (Expands to 32MB)
- 52MB IDE Hard Drive with 17 ms Seek Time
- 64K Cache Memory
- Continuous Edge Graphics Chip
- 1.2MB 5.25" and 1.44MB 3.5" Floppy Drives
- Exclusive *OmniKey* Keyboard
- VGA 1024 x 768 Color Monitor
- Microsoft Windows 3.0 and Mouse
- MS-DOS 3.3, 4.01 or 5
- FCC Class B Certified

$2799.00/$3099.00

Northgate SlimLine SP 486SX/20

- Intel 80486SX/20 MHz Processor on Power Module
- Fast, Affordable Upgrades – Simply Replace Power Module
- 4MB RAM (Expands to 32MB)
- 52MB IDE Hard Drive with 17 ms Seek Time
- 64K Cache Memory
- Continuous Edge Graphics Chip
- 1.2MB 5.25" and 1.44MB 3.5" Floppy Drives
- Exclusive *OmniKey* Keyboard
- VGA 1024 x 768 Color Monitor
- Microsoft Windows 3.0 and Mouse
- MS-DOS 3.3, 4.01 or 5
- FCC Class B Certified

$3149.00

Northgate SlimLine SP 486DX/33

- Intel 80486DX/33 MHz Processor on Power Module
- 4MB RAM (Expands to 32MB)
- 52MB IDE Hard Drive with 17 ms Seek Time
- 64K Cache Memory
- Continuous Edge Graphics Chip
- 1.2MB 5.25" and 1.44MB 3.5" Floppy Drives
- Exclusive *OmniKey* Keyboard
- VGA 1024 x 768 Color Monitor
- Microsoft Windows 3.0 and Mouse
- MS-DOS 3.3, 4.01 or 5
- FCC Class B Certified

$3329.00

Circle 113 on Inquiry Card (RESELLERS: 114).

World Radio History

Quality Through Manufacturing

Northgate has studied manufacturing methods and has selected a process that gives the greatest quality and productivity.

Our technicians are skilled in all phases of manufacturing. Working in teams of four, they bring the elements of quality together with craftsmanship that knows no equal. A detailed system of checks and balances ensures strict adherence to our rigid quality control standards. When all is complete, comprehensive burn-in and final testing begin.

Northgate Elegance™ Scalable Processing (SP) Upgradable Systems

Northgate Elegance SP™ 386/25 or 33

- Intel 80386DX/25 or 33 MHz Processor on Power Module
- Fast, Affordable Upgrades – Simply Replace Power Module
- 4MB RAM (Expands to 32MB)
- 106MB IDE Hard Drive with 17 ms Seek Time
- 64K Cache Memory
- Desktop Case
- 1.2MB 5.25" and 1.44MB 3.5" Floppy Drives
- Exclusive *OmniKey* Keyboard
- VGA 1024 x 768 Card and Color Monitor
- Microsoft Windows 3.0 and Mouse
- MS-DOS 3.3, 4.01 or 5
- FCC Class B Certified

$3299⁰⁰/$3399⁰⁰

Northgate Elegance SP 486SX/20

- Intel 80486SX/20 MHz Processor on Power Module
- Fast, Affordable Upgrades – Simply Replace Power Module
- 4MB RAM (Expands to 32MB)
- 106MB IDE Hard Drive with 17 ms Seek Time
- 64K Cache Memory
- Desktop Case
- 1.2MB 5.25" and 1.44MB 3.5" Floppy Drives
- Exclusive *OmniKey* Keyboard
- VGA 1024 x 768 Card and Color Monitor
- Microsoft Windows 3.0 and Mouse
- MS-DOS 3.3, 4.01 or 5
- FCC Class B Certified

$3699⁰⁰

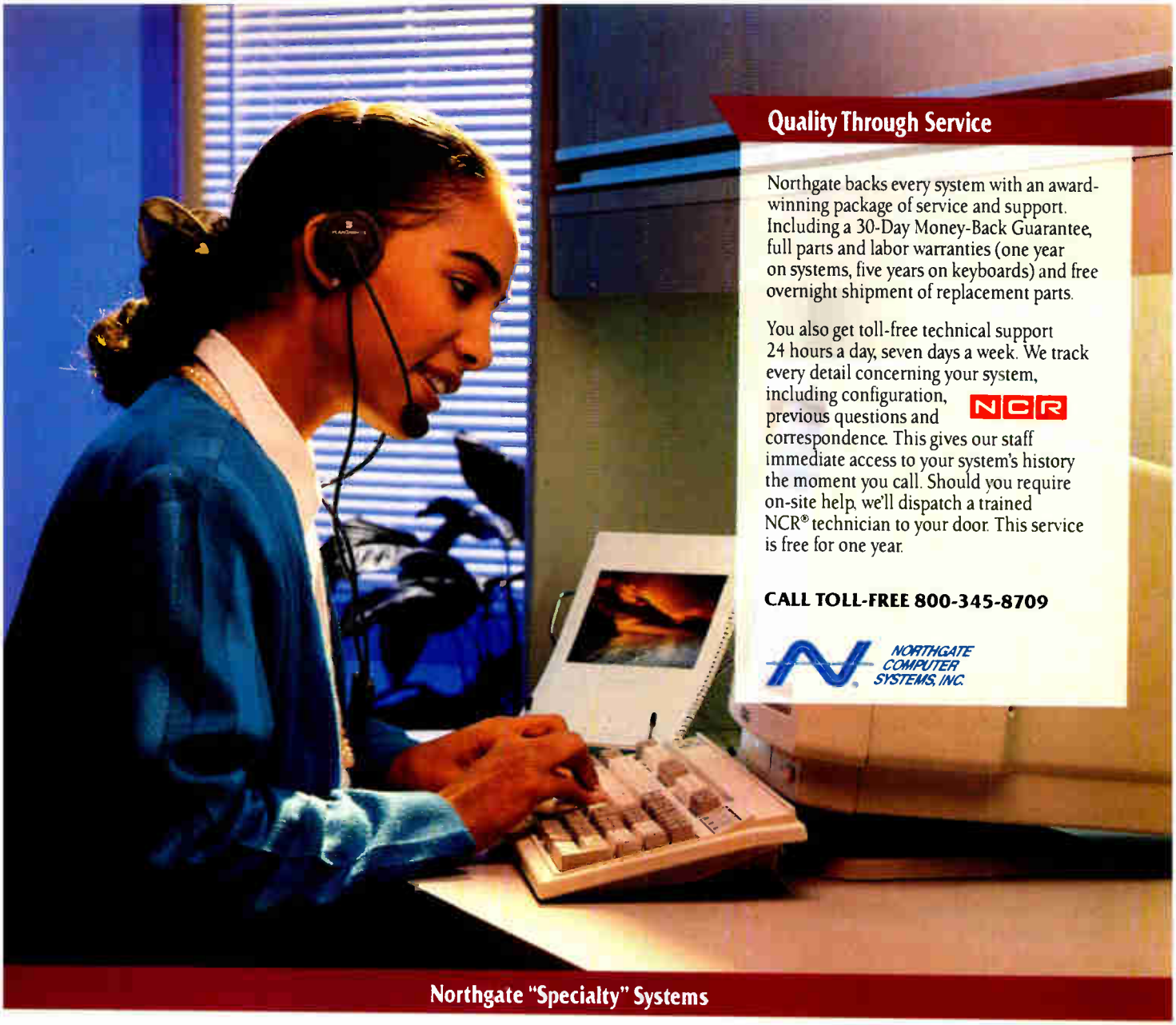
Northgate Elegance SP 486DX/33

- Intel 80486DX 33 MHz Processor on Power Module
- 4MB RAM (Expands to 64MB)
- 106MB IDE Hard Drive with 17 ms Seek Time
- 64K Cache Memory
- Vertical Power Case
- 1.2MB 5.25" and 1.44MB 3.5" Floppy Drives
- Exclusive *OmniKey* Keyboard
- VGA 1024 x 768 Card and Color Monitor
- Microsoft Windows 3.0 and Mouse
- MS-DOS 3.3, 4.01 or 5
- FCC Class B Certified

$3999⁰⁰

Circle 113 on Inquiry Card (RESELLERS: 114).

World Radio History



Quality Through Service

Northgate backs every system with an award-winning package of service and support. Including a 30-Day Money-Back Guarantee, full parts and labor warranties (one year on systems, five years on keyboards) and free overnight shipment of replacement parts.

You also get toll-free technical support 24 hours a day, seven days a week. We track every detail concerning your system, including configuration, previous questions and correspondence. This gives our staff immediate access to your system's history the moment you call. Should you require on-site help, we'll dispatch a trained NCR® technician to your door. This service is free for one year.

NCR

CALL TOLL-FREE 800-345-8709

NORTHGATE COMPUTER SYSTEMS, INC.

Northgate "Specialty" Systems

Northgate Elegance 486/25 or 33 EISA

- Intel 80486DX 25 or 33 MHz Processor
- 4MB RAM (Expands to 32MB)
- 200MB IDE Hard Drive with 15 ms Seek Time
- 128K Cache
- EISA Bus
- 1.2MB 5.25" and 1.44MB 3.5" Floppy Drives
- Vertical Power Case
- Exclusive *OmniKey* Keyboard
- VGA 1024 x 768 Card and Color Monitor
- Microsoft Windows 3.0 and Mouse
- MS-DOS 3.3, 4.01 or 5
- FCC Class B Certified

$4599.00/$5599.00

Northgate SlimLite™ 386SX/20

- Intel 80386SX/20 MHz Processor
- 1MB RAM (Expands to 5MB)
- 40MB Hard Drive
- 1.44MB 3.5" Floppy Drive
- 84-Key Keyboard Emulating 101
- 8.5" LCD Screen Supports 32 Shades of Gray; VGA 640 x 480
- 11.7" x 8.25" x 1.9"; 6.1 Lbs.
- AC Adapter
- Stacker™ Software (Provides up to 80MB of Storage)
- Magic Cursor™ for Windows or No-Squint II™ for DOS
- MS-DOS 4.01 or 5
- FCC Class B Certified

$2399.00

Northgate OmniArray™

- RAID-3 Parallel Drive Array with 1.1GB to 4GB Data Storage
- Four Data Drives with 512K Total Cache; One Redundant Drive with 128K Cache
- Fast SCSI Engineering Delivers 10MB/Second Performance
- ISA/EISA SCSI Adapter for NetWare® File Servers
- Novell Certified for NetWare 386 3.11
- Failed Drive Supports Keeps Unit Operational with Single Drive Failure; Rebuilds Data on Replacement Drive
- SCSI Cable and Terminator
- Vertical Power Case

Call For Pricing

Circle 113 on Inquiry Card (RESELLERS: 114).

World Radio History

Quality Custom Configurations

Northgate custom configures every system to meet your most demanding needs. We offer a comprehensive range of top quality components, giving us the capability of tailoring a system over 3,000,000 ways. To find out which is best for you, call one of our Systems Consultants toll free.

Hard Drives
Options include IDE hard drives with capacities of 52MB, 100MB, 200MB or 340MB. Also available are ESDI and SCSI hard drives with capacities as high as 1.2GB. Call for other drive size options.

Memory Expansion
Northgate systems have a variety of memory expansion capabilities. Our Systems Consultants can help you decide how much memory you need for both current and future applications.

Monitors
Northgate offers 12″ VGA monochrome, 14″ monochrome (amber), 14″ VGA monochrome, 14″ VGA color, 16″ VGA color and 19″ VGA color monitors. Resolutions include 640 x 480, 800 x 600, 1024 x 768, and 1280 x 1024. NEC 15″, 17″ and 21″ flat-screen, low-radiation monitors also available.

Math Coprocessors
Speed up processor-intensive business applications with an Intel or Weitek® math coprocessor. A Northgate Systems Consultant can help you select the right one for your system.

Tape Backups
To protect your valuable data, Northgate offers an array of high-speed tape backup devices. Choose internal or external designs in the following capacities: 40/120MB, 80/304MB, 80MB, 150MB, 300MB and 1.3GB.

Communications
Northgate has the right equipment to link your system to other computers or fax machines. Products include internal and external MNP-5 modems in 2400 and 9600 baud speeds. Also available is Northgate FaxIt for Windows, a revolutionary fax card designed to work from within your Microsoft Windows applications.

Printers
The best thing to have beside your computer is a printer from Northgate. Printer options include low-cost 9-pin and 24-pin dot matrix printers as well as laser printers and PostScript-compatible laser printers for the very best print quality.

Floppy Drives
Floppy drive options include 5.25″ models in 360K and 1.2MB designs and 3.5″ models with capacities of 720K and 1.44MB.

CD-ROM & Other Hardware
We can also configure your Northgate system with many other hardware options, including CD-ROM drives, high end video cards, and I/O cards. Call and ask a Northgate Systems Consultant for the latest options and prices.

PC MAGAZINE EDITORS' CHOICE

PC WORLD PRODUCT OF THE YEAR 1990

BYTE

COMPUTER SHOPPER Best Buy

CALL TOLL-FREE
24 HOURS EVERY DAY 800-345-8709

Major corporations, volume purchasers and government agencies call National Business Accounts: **800-545-6059**
Fax your order! 800-323-7182
Notice to the Hearing Impaired: Northgate has TDD capability. Dial 800-535-0602.

NORTHGATE COMPUTER SYSTEMS, INC.

"Smart Tools For Business"™
7075 Flying Cloud Drive, Eden Prairie, Minnesota 55344

Northgate *OmniKey* Keyboards – Quality Designs No System Should Be Without!

OmniKey/101NI
- 12 F-Keys On Top
- Alps Click/Tactile Key Switches
- Independent Inverted T Cursor Control And Numeric Keypads
- Rate Select From 3-120 CPS
- Period/Comma Lock Key Locks out < > Even When Shifted
- Interchangeable CTRL, ALT, CAPS LOCK Keys
- Unmatched IBM® Compatibility
- FCC Class B Certified

$89.00

OmniKey/102
- 12 F-Keys On Left
- Alps Click/Tactile Key Switches
- Independent Inverted T Cursor Control And Numeric Keypads
- Rate Select From 3-120 CPS
- Period/Comma Lock Key Locks out < > Even When Shifted
- Interchangeable CTRL, ALT, CAPS LOCK Keys
- Unmatched IBM Compatibility
- FCC Class B Certified

$89.00

OmniKey/ULTRA
- 12 F-Keys On Left And Top
- Alps Click/Tactile Key Switches
- Independent Inverted T Cursor Control And Numeric Keypads
- Rate Select From 3-120 CPS
- Period/Comma Lock Key Locks out < > Even When Shifted
- Interchangeable CTRL, ALT, CAPS LOCK Keys
- Unmatched IBM Compatibility
- FCC Class B Certified

$129.00

© Copyright Northgate Computer Systems, Inc. 1991. All rights reserved. Northgate, *OmniKey*, Elegance, OmniArray, SlimLine, *SlimLite* and the Northgate 'N' logo are trademarks or registered trademarks of Northgate Computer Systems. 80386SX, 80486SX, 80486 and the Intel Inside logo are trademarks of Intel. IBM is a registered trademark of International Business Machines Corp. MS-DOS, Microsoft, Windows and OS/2 are trademarks or registered trademarks of Microsoft Corporation. All other products and brand names are trademarks and registered trademarks of their respective companies. Prices and specifications subject to change without notice. Northgate reserves the right to substitute components of equal or greater quality or performance. All items subject to availability. We support the ethical use of software. To report software copyright violations, call the Software Publishers Association's Anti-Piracy Hotline at 1-800-388-PIRB

Circle 113 on Inquiry Card (RESELLERS: 114).

CODE: B1401

World Radio History

FEATURE

CLASSIC LANGUAGES, PART 5

SNOBOL

A classic language for character-string manipulation

DORIS APPLEBY

Of the languages considered so far in this series—FORTRAN, COBOL, Lisp, and APL—each has associated with it a published standard that has been agreed upon by the interested parties and approved by the ISO. The main purpose of such standardization is portability: Any program conforming to the standard will compile and run, producing the same results, regardless of the language implementation you use.

SNOBOL, on the other hand—a language that implements pattern matching—has neither a standard nor any group working toward such uniformity, and it still has one version in the public domain. According to Ralph Griswold, one of SNOBOL's inventors at Bell Labs in 1962, it was named as a joke. His coworker, Dave Farber, believed that this new language didn't have a "snowball's chance in hell" of surviving. Thus it was named SNOBOL. Later, a phrase—String-Oriented Symbolic Language—was thought up that made the name into an acronym. To some of the personnel at Bell Labs, the name SNOBOL was an improvement over the language's former name, SEXI, but the puns have continued, with other versions named ELFBOL, SPITBOL, and even SLOBOL.

Who Uses It?

SNOBOL is used largely as a research tool, rather than for commercial applications. Daryl Gibb, a computational linguist, has written SNOBOL programs for clients here and abroad. He carried out one of his latest projects at the Moscow Linguistic University, where a thesaurus based on Margaret Thatcher's public speeches was being developed. Before that, he spent two years in Finland developing bilingual dictionaries. Another of his SNOBOL applications reformats publisher's files into dBase III format. It took him about a month to write SNOBOL code for this last application, but Linguatech of Orem, Utah, expects to spend about a year rewriting the code in C for a marketable product.

Zonda Freese, a student of Alan Forte at the Yale School of Music, uses SNOBOL to analyze posttonal (not based on any fixed scale pattern) music. Using the Mengelberg coding system, which translates two-dimensional music scores into conventional computer-readable strings, Freese's programs pick out hexachords (six notes) from a score and break them down further into trichord (three-note) subsets. Forte has devised a method of grouping trichords into sets called *genera*. He did much of the analysis for his book *The Structure of Atonal Music* (Yale University Press, 1973) in SNOBOL3. He has since switched to SNOBOL4 and finds that SPITBOL (for speedy implementation of SNOBOL), which is compiled for 386 and 486 machines, eliminates the problems of slowness encountered with the interpreted SNOBOL code.

The analysis of literature sometimes involves, for example, word counts and typical sentence length or the development of concordances, dictionaries, and thesauri. SNOBOL is the language of choice for such activities. It is also useful for comparative language studies or the development of computer-assisted instruction. There is no other computer language whose string-handling capabilities approach SNOBOL's level (except, perhaps, its successor—Icon).

None of these linguists, musical theorists, and language experts have found SNOBOL a difficult language to master, even though their prior computer experience was either minimal or nonexistent. Computer experts also find SNOBOL useful when a job involves pattern matching. Database programs do not always provide the particular procedure you might want, but writing a quick SNOBOL program to reorganize a text file will often prove productive.

continued

BYTE ACTION SUMMARY

If your work is primarily with analysis of text or languages, then SNOBOL or one of its descendants is the language for you. It is unique in its use of the pattern as a data type.

ILLUSTRATION: CATHARINE BENNETT © 1992

World Radio History

Unquestionably
the most powerful pocket-sized computer in the world

The new standard for palm top computers!
PSION SERIES 3

Winner – Best International Product at Best of COMDEX/Fall Awards!

Psion Series 3 Features:

- 16 bit, 80C86, 3.84 Mhz processor
- Internal Memory:
  - ROM: 384K multitasking, window operating system, MS-DOS Flash Filing System, and software applications
  - RAM: 128K or 256K
- 2 Plug in SSD's provide up to 4Mbytes removable storage
- 240 X 80 graphics screen, 40 characters by 8 lines
- 58 Key QWERTY computer style keyboard
- 8 Touch sensitive keys for built in task selection
- Loudspeaker with DTMF autodialing
- Powered by 2-AA size Akaline Batteries, 2-4 months life
- Standard Lithium backup cell protects RAM
- Optional AC Adapter
- Dimensions (6.5" X 3.3" X .9"), Weighs 10 ounces
- Built in Software includes:
  - Word Processor (Microsoft Word compatible)
  - Outliner
  - Database Filing and Management
  - Agenda Scheduler
  - Scientific, Programmable Calculator
  - Time and Alarm
  - World Information
  - Powerful OPL Programming language
- Connectivity:
  - Optional Serial RS232 Comm (IBM-PC or Macintosh)
  - Optional Parallel Interface for Parallel Printers
  - Built in printer drivers for BJ-10E, Epson Dot Matrix, and IBM Proprinter Printer and many Lasers

Now you can have it all!
Put the concentrated power of a desk top computer and its software into your pocket!

Distributed by

XEC Computer Products, Inc.
13630 58th Street North, Suite 103
Clearwater, FL 34620
Tel: (813) 531-1422 Fax: (813) 530-5975

Dealer Inquiries Welcome

Listing 1: *An example of SNOBOL using tables and arrays. The spaces in the SNOBOL program are all meaningful—especially those at the beginning of lines.*

```
1.          &TRIM =1
2.          UCASE ="ABCDEFGHIJKLMNOPQRSTUVWXYZ"
            LCASE ="abcdefghijklmnopqrstuvwxyz"
3.          WRDPAT=BREAK(LCASE) SPAN(LCASE "-'") . WORD
4.          TALLY =TABLE()

*Read a line, convert uppercase letters to lowercase
5. READ     LINE  =REPLACE(INPUT,UCASE,LCASE)    :F(SORT)

*Get and remove next word from LINE,
*place in variable WORD
6. NXTWRD LINE    WRDPAT =                       :F(READ)

*Increment the count for this word
7.          TALLY[WORD]    = TALLY[WORD] + 1     :(NEXTWRD)

*Convert the table to an array, and sort the words
8. SORT     RESULT=SORT(TALLY)

*Display the results
9.          OUTPUT="Word Counts"
                 I=1
10. PRINT OUTPUT=RESULT[I,1] " - " RESULT[I,2] :F(END)
                 I=I + 1                        :(PRINT)
    END
```

Data Types and Patterns

The basis of SNOBOL is its three data types: integers, reals, and patterns. This last type defines a class of strings, with substrings matching the pattern. If a pattern is defined as `PAT = 'A'`, any string containing an uppercase *A* would be included in the class of strings containing `PAT`. The following are two types of statements involving patterns:

[label] subject pattern [:goto]

and

[label] subject pattern = [pattern to be substituted]

If the *pattern* is found in the *subject* string of the first type of statement, the match succeeds; otherwise, it fails. The *goto* can be *:(label)*, *:S(label)*, or *:F(label)*, where the *label* indicates where program control continues unconditionally or upon success (S) or failure (F) of the match. If the *goto* is omitted, execution defaults to the next line of code. In the second type of statement, if the *pattern* is found in the *subject*, *pattern* is replaced in *subject* by *pattern to be substituted*. If there is no *pattern to be substituted* after the =, *pattern* is deleted from *subject*.

Associative Features

Associative programming involves the association of objects with other objects in an arbitrary way. The simplest associative feature of SNOBOL is its ability to assign objects of any type to any variable. But two more unusual associative features are the *indirect reference operator*, $, and an array with completely unrestricted indexes, called a *table*. The SNOBOL fragment

```
X = 'Y'
Y = 'Z'
```


Circle 183 on Inquiry Card (RESELLERS: 184).
World Radio History

CompuServe puts the whole world at your fingertips.

When you connect your computer to CompuServe, you join the world's largest international network of people with personal computers. You have access to more than a thousand services that offer a source of support, information, entertainment, communications, and benefits of all kinds.

A world of advantages.

CompuServe lets you take advantage of your personal computer in a thousand different ways.

For instance: communication. You'll get invaluable personal computer software and hardware support from other CompuServe members, as well as product manufacturers, all over the world. Meet in special interest forums to discuss everything from science fiction to sharing software. And keep in touch through electronic mail and faxes, as well as by "talking" over 72 CB Simulator channels.

CompuServe also lets you shop coast-to-coast at hundreds of nationally known stores and take advantage of a world-class reference database. It gives you access to the latest national and international news. And our special financial files offer complete statistics on over 10,000 NYSE, AMEX, and OTC securities. You can even trade online with local discount brokers.

Global travel and world-class fun.

CompuServe also offers airline schedules, so you can check out the bargains and book your own flights on almost any airline worldwide. You can get travel news, frequent flier information, and country and travel facts. As well as listings from over 30,000 hotels.

Plus, there are games. Sports, trivia, educational, space fantasy... you can go it alone or compete against players from all over the world. Only on CompuServe can you test your wits in the only online TV-style game show with real prizes, or leave the earth entirely in one of our interactive space adventures.

Just give us a call.

To become a CompuServe member, you need a computer and a modem. We'll send you everything else, including a $25.00 usage credit with your Membership Kit. In most places, you'll be able to go online with a local phone call.

To buy a CompuServe Membership Kit, see your nearest computer dealer. To receive our informative brochure or to order direct, call us today.

And put the whole world at *your* fingertips.

CompuServe®

800 848-8199

Outside U.S. and Canada: 614-457-0802

Circle 36 on Inquiry Card.

World Radio History

Space-Savers

NEW!

Stand-Alone LCD Monitor $995.00

Featuring Sharp's brightest 640 x 480 resolution black on white 10" diagonal screen with high refresh rate and triple super twist nematic technology for a wide viewing angle this new DATALUX monitor occupies desk space of only 29.0 x 14.1 cm. With easy adjustability it also folds for transport or mounts on a vertical surface. Included with the unit is a 1.5m cable and its own VGA adaptor card. No external power is required. IBM AT compatible. Select this monitor also for its flicker-free image and low radiation.

Popular Space-Saver Keyboard $124.50

First successful alternative to conventional keyboard saves 60% desk space with a footprint of 27.3 x 15.2 cm. Has full travel tactilly responsive keys with standard left-right spacing for easy touch typing. 100 keys, compatible with IBM XT/AT PS/2. Many language versions available.

9" VGA Monochrome Monitor $198.00

640 x 480 resolution black on white screen with a footprint to match the Space-Saver Keyboard of only 25.0 x 25.7 cm. Tilt and swivel stand. No adaptor card included.

To Order Call Toll Free **1-800-328-2589**

1 year warranty on all products shown. Order direct from stock with 15 day full return privileges. Visa, Mastercard, AmEx charges and COD accepted.OEM and reseller volume discounts available.

Spec Sheets Sent By Automatic 24 hr. FAX Transmission **1-703-662-1675**

The First Choice In Space-Saver Peripherals

DATALUX

2836 Cessna Drive • Winchester, VA 22601
Phone 703 662-1500 • Fax 703 662-1682


```
Z = 'Julie Andrews'
OUTPUT = $$X
```

will produce `Julie Andrews`.

A table differs from an array in two important ways: First, a table's size is not fixed, and its indexes can be anything—not just integers, as in an array. Listing 1 is an example of tables and arrays. An example of output is

```
Word Counts
a - 147
able - 18
above - 3
aren't - 2
```

SNOBOL has a variety of useful housekeeping functions for dealing with textual input and output. One of these, `&TRIM`, is a toggle function. When `&TRIM` is set to 1, trailing blanks are removed from any input. `UCASE` and `LCASE` are strings of possibilities for the built-in function `REPLACE`, which will scan and replace uppercase letters with lowercase letters in the entire input line `LINE`. `BREAK(LCASE)` matches up to—but does not include—any character in `LCASE`, and `SPAN(LCASE "-'")` matches the longest subsequent string of lowercase letters, including possible hyphens or single quotation marks. Thus, `WRDPAT` will match a single word in `LINE`. Lines 5 and 6 form a loop, which transfers to line 8 when `INPUT` fails. Lines 6 and 7 also form a loop, which returns to line 5 at the end of each line. These loops behave like

```
while not EndOfFile do
  while not EndOfLine do
    for each word do
      Tally word.
```

As the interpretation of the program progresses, `TALLY` acquires as indexes the words from the input file, with values that are equal to the frequency of each word. The built-in function `SORT` converts the table `TALLY` into a fixed-size 2-D array with integer indexes called `RESULT`. An element of `RESULT` will be `RESULT[i] = (word, frequency)`, with sorting on *word*. Note that `RESULT` was created at run time, after the size of `TALLY` became known.

History

The SNOBOL language was designed to process nonnumeric data, including text and symbolic expressions, and it was a first. Its pattern-matching facilities remain unsurpassed by any language today. Areas of mathematics such as algebra, calculus, and graph theory include methods that follow rules—for example, $(x + 1) \times (x + 2) = x^2 + 3x + 2$. Such computations should be easily solved by computer, but because they are symbolic problems rather than numeric problems, they are good candidates for SNOBOL rather than a numeric-intensive language like FORTRAN.

The designers of SNOBOL chose the string (i.e., a sequence of characters) as their fundamental data type, because almost anything can be considered a string, including all existing computer programs. One of the first practical applications for SNOBOL was to generate a FORTRAN program to analyze telephone networks.

SNOBOL matured at Bell Labs through three versions, with SNOBOL4 in 1967 representing a marked change. It was designed using string macros, which realized a virtual SNOBOL machine that could be implemented on a variety (at that time) of

Circle 45 on Inquiry Card (RESELLERS: 46).

World Radio History

Power Packed & Built To Last.

STANDARD 200XT $69

Economical This UL approved, fully tested unit is one of the best generic 200s available. Costs no more than our Standard 150 it replaces.

SILENCER 200 $129

Ultra-Quiet Stop that irritating noise with the Silencer 200. Its large, low speed, German fan keeps your system 5° to 15° cooler and 84% quieter. Virtually inaudible! Great in the executive suite or home office.

TURBO-COOL 200 $169

High Performance Put AT power and 200% more cooling under the hood of your PC/XT with our UL approved Turbo-Cool 200. Its patented twin fan, sloped-cover design keeps your system 30° to 45° cooler, preventing data errors and other heat-related problems. Perfect for hot rod PCs and Mini ATs!

TURBO-COOL 300S $169

Slim and Powerful Give your Slimline or Mini-Tower computer up to 100% more power and cooling with our low profile, direct replacement Turbo-Cool 300S. With a peak capacity of over 350 watts, it will easily start even the largest hard drives and peripherals!

Silencer, Turbo-Cool, and InnerSource are trademarks of PC Power & Cooling, Inc. Compaq and Deskpro are registered trademarks of Compaq Computer Corporation.

STANDARD 220 $99

Economical This UL approved, fully tested unit is one of the best generic 220s available. Ideal for basic systems.

SILENCER 220 $139

Ultra-Quiet Unrattle your nerves with the Silencer 220. Its custom, *thermostatically-controlled* fan maintains the correct system temperature while reducing noise by up to 95%. Great in the executive suite or home office.

TURBO-COOL 300 $189

High Performance Upgrade your AT/386 with our powerful Turbo-Cool 300. This popular OEM unit features built-in line conditioning, UL/CSA/TUV approval, 2-year warranty, and a high-capacity, *thermostatically-controlled* fan that automatically keeps your system up to 35° cooler. Great value!

TURBO-COOL 450 $349

Maximum Performance The choice of PC professionals, our Turbo-Cool 450 features built-in line conditioning, autoselect input, independent regulation, external DC voltage adjustment, triple-stage output filter, 50cfm cooling fan, UL/CSA/TUV approval, 100,000 Hr. MTBF and 2-year warranty! Ideal for high-end workstations and network file servers.

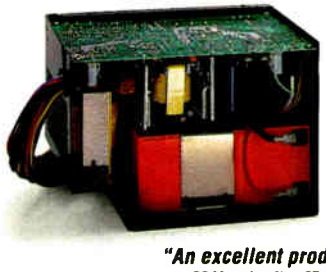
CP160 $169

Original Portable Upgrade Double your power with our direct replacement CP160. Allows 286, 386, and hard disk upgrades.

CD270 $249

Deskpro Upgrade The power user's power supply! Our direct replacement CD270 gives your 8086/286/386 Deskpro up to 70% more power and the reliability it deserves. Prevents nuisance rebooting. Advanced design includes autoselect 110V/220V. 2-year warranty.

INTERNAL UPS!



"An excellent product"
– PC Magazine, Nov. 27, 1990

Our UL approved InnerSource is the first AT/386 power supply with a *built-in* UPS. Its auto-recharge battery provides up to 15 minutes of reliable backup power for both your PC and monitor. This integrated protection costs less than a bulky 550VA external UPS, and it saves space, too. A Novell NetWare interface is available. **$395**

Most orders shipped same day. We accept Visa, MC, COD or PO on approved credit.

PC POWER & COOLING, INC.

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

Circle 123 on Inquiry Card (RESELLERS: 124).

World Radio History

mainframes. However, when a language like SNOBOL4 tries to be machine independent, efficiency must be sacrificed significantly. Thus, today's versions, although similar, do not conform to any formal standard and have been designed to take advantage of a particular machine's characteristics.

The main source of SNOBOL implementations today is a company called Catspaw of Salida, Colorado, which markets SNOBOL4+ for MS-DOS systems from 8088s to 486s. There is a freeware version called Vanilla SNOBOL4 with documentation included on the disk. Catspaw also offers a 32-bit SPITBOL for the Macintosh, 386 and 486, Sun-4/SPARC, and some 680x0 Unix platforms, such as the Apollo 3000 and the Sun-3. SPITBOL's compiler is written in MINIMAL and compiles SNOBOL code into an intermediate assembly language called ITC (for Indirect Threaded Code), which is interpreted when the program runs. (A Macro SPITBOL compiler for the IBM PC is available from Robert B. K. Dewar, 73 Fifth Ave., New York, NY 10003.)

I talked with several researchers in the humanities who claim that much of the success they have had with SNOBOL is due to Mark Emmer, president, consultant, hand-holder, and chief guru at Catspaw. He persists, as he says, "out of love and loyalty to the language," and, I might add, to his customers, for whom SNOBOL remains the language of choice.

Icon

Griswold, who has always been a researcher rather than a language developer, has moved on to develop a SNOBOL successor, Icon, that continues the emphasis on string manipulation and pattern matching but differs enough from SNOBOL to warrant a new name. He has added control structures, such as IF...THEN...ELSE, WHILE...DO, EVERY...DO, and CASE...OF, removing the need for SNOBOL's heavy reliance on GOTOs.

Icon programs are broken into procedures as in Pascal or C, while allowing a process to succeed or fail as in SNOBOL. Pattern-matching functions have been fully integrated into the language, eliminating the need for declaring patterns such as LCASE, UCASE, and WRDPAT in the SNOBOL program shown in listing 1. All versions of Icon (the current one is 8) have been put in the public domain and are available from the Icon Project at the University of Arizona for essentially the cost of copying, shipping, and handling. Catspaw also has a version of Icon, called ProIcon, for the Macintosh.

SNOBOL has never been much of a commercial success, but there is a devoted and long-lasting community of users who continue to train their followers in SNOBOL as well. Emmer believes that Griswold and his colleagues created in SNOBOL a language that parallels the workings of part of the human brain. It seems to parallel the associative and intuitive aspects of human thinking. ■

Doris Appleby writes about mathematics, computer science, and pedagogy. She is also the chairperson of mathematics/computer science/information systems at Marymount College in Tarrytown, New York, and the author of Programming Languages—Paradigm and Practice *(McGraw-Hill, 1991). You can reach her on BIX c/o "editors."*

NEW!
RS-232 DATA MONITOR
LETS YOU SEE WHAT'S
ON THE LINE
$595!

- **Diagnose** comm problems
- **Install** new equipment
- **Determine** baud rates
- **Reduce** development time
- **Troubleshoot** faster
- **RS-422** option available
- SDLC, HDLC, X.25. BISYNC • Parity & CRC check
- 40 hours on 9v battery • 8K buffer with printer dump

BitView shows you bidirectional data in ASCII, EBCDIC, or Hex for async and sync data lines at baud rates from 110 to 64 Kbaud. Now find your comm problems in minutes instead of hours!

Call (212) 229-2141 or Fax (212) 229-2938
MEASUREMENT & CONTROL PRODUCTS, INC.
126 W. Twenty-Third St., New York, NY 10011

M&CP

Circle 95 on Inquiry Card (RESELLERS: 96).

AccSys™ for
C
dBASE

- Set of C libraries for easy access to dBASE data and index files.
- Source available but not required.
- Increased performance shortens processing time.
- Total control over data memo, MDX and NDX index files.
- Network and single-user versions available.

Copia International Ltd.
Wheaton, Illinois 60187
708/682-8898 FAX: 708/665-9841
Instant info. via FaxFacts: 708/924-7465 Press: 889832#

World Radio History

WINNER PC WEEK LABS SHOOT-OUT

INTERNATIONAL ALLIANCE IBM AD/Cycle™

WINDOWS AND OS/2: PROTOTYPE TO DELIVERY. NO WAITING.

In Windows and OS/2, you need prototypes. You have to get a sense for what an application is going to look like, and feel like, before you can write it. And you can't afford to throw the prototype away when you're done.

With Smalltalk/V, you don't.

Start with the prototype. There's no development system you can buy that lets you get a working model working faster than Smalltalk/V.

Then, incrementally, grow the prototype into a finished application. Try out new ideas. Get input from your users. Make more changes. Be creative.

Smalltalk/V gives you the freedom to experiment without risk. It's made for trial. And error. You make changes, and test them, one at a time. Safely. You get immediate feedback when you make a change. And you can't make changes that break the system. It's that safe.

And when you're done, whether you're writing applications for Windows or OS/2, you'll have a standalone application that runs on both. Smalltalk/V code is portable between the Windows and the OS/2 versions. And the resulting application carries no runtime charges. All for just $499.95.

So take a look at Smalltalk/V today. Call your local software dealer, or call Digitalk at (800) 922-8255 for more information. It's time to make that prototyping time productive.

Smalltalk/V

Smalltalk/V is a registered trademark of Digitalk, Inc. Other product names are trademarks or registered trademarks of their respective holders.

Digitalk, Inc., 9841 Airport Blvd., Los Angeles, CA 90045
(800) 922-8255; (213) 645-1082; Fax (213) 645-1306

DIGITALK

LOOK WHO'S TALKING

HEWLETT-PACKARD

HP has developed a network trouble-shooting tool called the Network Advisor. The Network Advisor offers a comprehensive set of tools including an expert system, statistics, and protocol decodes to speed problem isolation. The NA user interface is built on a windowing system which allows multiple applications to be executed simultaneously.

NCR

NCR has an integrated test program development environment for digital, analog and mixed mode printed circuit board testing.

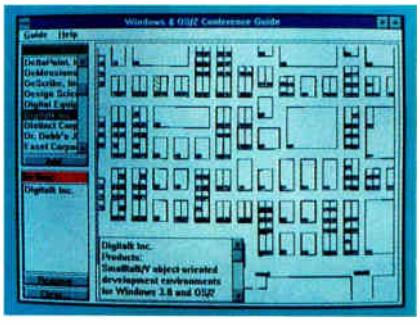
MIDLAND BANK

Midland Bank built a Windowed Technical Trading Environment for currency, futures and stock traders using Smalltalk/V.

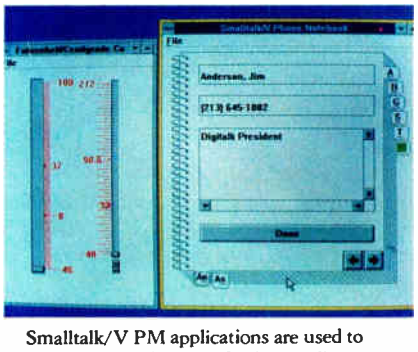
Circle 52 on Inquiry Card.

KEY FEATURES

- World's leading, award-winning object-oriented programming system
- Complete prototype-to-delivery system
- Zero-cost runtime
- Simplified application delivery for creating standalone executable (.EXE) applications
- Code portability between Smalltalk/V Windows and Smalltalk/V PM
- Wrappers for all Windows and OS/2 controls
- Support for new CUA '91 controls for OS/2, including drag and drop, booktab, container, value set, slider and more
- Transparent support for Dynamic Data Exchange (DDE) and Dynamic Link Library (DLL) calls
- Fully integrated programming environment, including interactive debugger, source code browsers (all source code included), world's most extensive Windows and OS/2 class libraries, tutorial (printed and on disk), extensive samples
- Extensive developer support, including technical support, training, electronic developer forums, free user newsletter
- Broad base of third-party support, including add-on Smalltalk/V products, consulting services, books, user groups



This Smalltalk/V Windows application captured the PC Week Shootout award—and it was completed in 6 hours.



Smalltalk/V PM applications are used to develop state-of-the-art CUA-compliant applications—and they're portable to Smalltalk/V Windows.

World Radio History

World Radio History

ILLUSTRATION JIM LUDTKE © 1992

A MOVING TARGET

Windows, Macintosh, assorted Unix flavors, and GUIs—how do you deal with all the platforms that make up today's computing environment?

BOB RYAN

Developing computer applications used to be a breeze—relatively speaking. Back when *computing* was synonymous with IBM 360/370 mainframes, MIS organizations and commercial developers didn't have to worry about supporting multiple platforms for their software—most computing environments were homogeneous and proprietary.

Today, the situation has changed radically. Organizations typically employ a smorgasbord of computers—micros, minis, and mainframes—from many different companies running lots of different operating systems. This situation makes developing and supporting mission-critical applications a daunting task. Cross-platform development has become a way of life for MIS departments and commercial developers alike. Too often, however, it is a way fraught with setbacks and peril.

This article and the two that follow it examine many of the aspects of cross-platform development in the 1990s. No longer is it enough to have a standard compiler for each platform. As complex GUIs and distributed processing take the place of character-based PCs and dumb terminals, the problems of supporting a heterogeneous environment grow exponentially. The challenge is to develop a cross-platform strategy and acquire a standard set of tools that can deal with multiple platforms and let you adapt to rapid changes in technology.

As the Intel/IBM/Microsoft monolith fragments and more and more applications migrate from the "big iron" to the desktop and LAN server, confusion will reign both in the marketplace and inside organizations of all sizes. The ability to make sense of the results will differentiate the winners from the losers.

Issues and Answers

Cross-platform development encompasses so many different ideas that it is impossible to define simply. In its purest sense, it means writing programs that perform the same functions on different hardware and operating-system platforms. As networks become more pervasive and organizations become more thoroughly connected, the need for different applications to share common data or even common computing resources will grow in importance. Cross-platform development will become an integral part of any cooperative or distributed-processing environment.

One major issue in development across various types of systems is how to develop applications that will run identically—or nearly so—on several different platforms. Many large commercial developers have multiplatform marketing strategies: They support as many different popular platforms (e.g., DOS, Windows, Macintosh, and Unix) as their resources permit. Consequently, their cross-platform development tools and tactics have become strategic assets. The ability to deliver applications for many different platforms in a timely manner gives a company a major competitive advantage: Its applications have lower development costs, and they are quicker to market.

For example, Lotus Development (Cambridge, MA) has stated that it intends to make its flagship product, Lotus 1-2-3, available on all major computing platforms. At first, Lotus went with a straight porting strategy to achieve this goal,

A Moving Target
BY BOB RYAN
158

Tributaries and Deltas
BY RANDALL D. CRONK
177

Let the System Do the Porting
BY ELLEN ULLMAN
191

Resource Guide: Cross-Platform Application Development Tools
201

World Radio History

Circle 33 on Inquiry Card

with software engineers translating code developed originally for the DOS environment to run on other platforms. It wasn't too long before the company realized that straight ports were not the way to achieve a reasonable time to market. Lotus decided that it had to build cross-platform capabilities into its code.

According to Eileen Rudden, director of spreadsheet marketing for Lotus, the company uses one code base for Lotus 1-2-3, with a high percentage of the code shared among different versions of the program (the exact percentages are a trade secret). Lotus is building a development environment that consists of a set of high-level application programming interfaces (APIs) that access a platform-specific layer above the core application. Platform-specific functions provide the glue between Lotus 1-2-3 and the different platforms. All custom development takes place at this layer.

As Rudden puts it, "The application itself is not ported. Our energy goes into the platform-specific layer. The reason we can do it this way is that we've engineered our application to recognize that certain services are handled differently on different platforms." So, Lotus takes a proactive approach to cross-platform development. It starts with an application that is "cross-platform-aware" so that it can devote its energies to refining the platform-specific parts.

Of course, even the best cross-platform development system can't save you if you misread the market. Lotus is currently playing catch-up in the booming Windows software market—not because of any major weakness in its cross-platform efforts, but because it made an early commitment to OS/2 and Presentation Manager (PM). Only after seeing that the business world was choosing Windows over OS/2 by a wide margin did Lotus give priority to its Windows development efforts.

Wolfram Research (Champaign, IL), publisher of Mathematica, is another company that pursues an aggressive multiplatform strategy. Wolfram supports dozens of different platforms by cleanly separating interface code from the computational engine. The result is a system that makes it possible to automatically update and maintain versions of a program for many different platforms (see the text box "Concurrent Multiplatform Development" on page 162 for more details).

Local Concerns

Cross-platform development is not the exclusive domain of big-time commercial developers. In-house developers also must suppport many different desktop standards. The days when MIS departments dared—or cared—to dictate one hardware standard and one operating-system standard for every desktop in a medium or large organization are rapidly disappearing. The computing infrastructure in most companies consists of a heterogeneous mix of desktop platforms and networks. With end users clamoring for greater access to data repositories from their desktops, many MIS departments confront the task of supporting a variety of platforms in their in-house development efforts.

When developing across platforms, you have to decide how closely you wish to support the native environment of each one. This is a concern mainly for in-house developers; commercial developers who don't fully support the interface standards and capabilities of different platforms usually find a limited demand for their products.

On the other hand, in-house developers have a choice: They can adhere to the standards of each platform, or they can try to make their applications appear the same on every platform. The approach you take depends entirely on the goals of your organization and the needs of its end users.

If, for example, it is the goal of your company to supply the same interface to corporate data from every desktop to save on training and software-support costs, you'll want to create a common interface across platforms. But if seamless integration of in-house and commercial applications on each platform is the stated goal, you'll have to tailor in-house development to the needs of the different supported platforms.

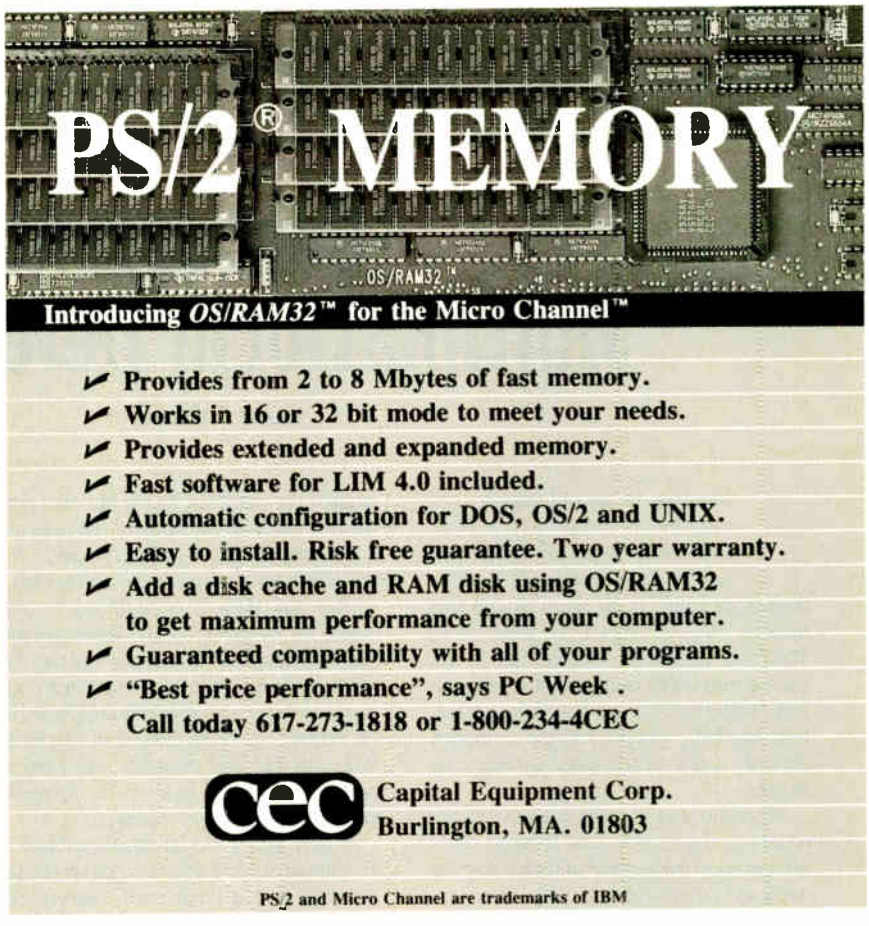
The decision may come down to the

BYTE ACTION SUMMARY

In today's multiplatform world, you can no longer write for one platform and ignore the rest. We all want the freedom to put our favorite type of system on our desk. With that freedom, cross-platform development is a necessary complication of the modern computing world.

World Radio History

Circle 34 on Inquiry Card



relative importance of commercial and in-house applications in your computing environment. If most of the work in your organization is performed with commercial tools, you'll probably want a "go native" cross-platform strategy. If most people are running homegrown applications, the one-size-fits-all strategy may be the way to go.

Two Looks for Smalltalk

The strategies employed by the two principal publishers of Smalltalk illustrate these two distinct approaches to cross-platform development. ParcPlace Systems (Mountain View, CA) takes the approach that an application should always look exactly the same, regardless of the platform on which it is run. Digitalk (Los Angeles, CA) approaches the problem differently. It believes that an application should reflect the standard interface and use all the special facilities of each specific platform. Assuming that you use either ParcPlace's or Digitalk's version of Smalltalk to develop your applications, you will, by default, adopt that publisher's philosophy.

If you choose ParcPlace's Smalltalk, your porting work will be essentially complete once you have written your application on one machine. Your Smalltalk code will look and operate the same on any machine that has ParcPlace's Smalltalk. The price you pay for this convenience is the difficulty you encounter in taking advantage of the special attributes of the host platforms. For example, it is not a trivial task to take complete advantage of Windows dynamic link libraries (DLLs) with ParcPlace's Smalltalk.

Having your application always take on the ParcPlace look has advantages and disadvantages, depending on your reasons for developing on multiple platforms. If you are porting a commercial application from Windows to the Macintosh, you want your application to follow the Macintosh style guidelines: You want your Macintosh version to look and act like all other Macintosh applications. After all, the common look and feel among Macintosh applications is a major reason for the machine's success. But if your application is developed with ParcPlace's Smalltalk, your program will look like a ParcPlace program running inside a Macintosh window—kind of a kludge.

On the other side of the argument, once people have learned to run a ParcPlace application on one system, they are totally familiar with it no matter what system they happen to be using. This cuts down on retraining. The ParcPlace philosophy is attractive if your application is for in-house use, especially if your "house" uses many different kinds of systems. You can train users for all systems in the same course.

If, however, you choose Digitalk's version of Smalltalk, porting an application can require a major effort. After you have written the code that is common to all computer platforms, you then have to write separate code that takes advantage of each of the distinct operating systems and user interfaces of the individual platforms.

On the bright side, Digitalk's class designs reach deep into each host's GUI and operating system with common methods and classes, but you still have to write some of the expected behavior methods for each environment. On the dark side, Digitalk itself has become victim to one of the pitfalls of cross-platform development: It has not produced concurrent revisions for all the platforms that it supports.

The Impact of GUIs

One reason that cross-platform development has grown more complex in the past few years is the growing demand for applications to sport a graphical interface. GUI applications are inherently more difficult to develop—and hence to port—than are text-based applications. Mastering a single GUI is difficult enough for an individual or an organization; mastering multiple GUIs is even more difficult.

As a consequence, a number of companies provide toolkits to aid in developing cross-GUI applications. These toolkits are analogous to the cross-platform compilers and assemblers that were the only cross-development tools you needed when the computer world was younger—and the choices fewer.

The best known of these toolkits is the Extensible Virtual Toolkit (XVT Software, Boulder, CO). Consisting of C libraries for Windows, Motif, PM, Macintosh, and character-based interfaces, XVT lets you write an application once and compile it on the different target platforms. In effect, you write to the XVT API rather than to the individual target APIs.

Tools like XVT have a common shortcoming: the least common denominator. Creating a portable library that accesses the functions of many different GUI platforms means that you can include only those elements that all the platforms share. The platform-specific functions and features (e.g., the DLLs of Windows or Publish/Subscribe on a Macintosh) must be added after the common application is built. For in-house development, the least common denominator approach

World Radio History

Concurrent Multiplatform Development

Janet J. Barron

According to an old saying, you can't be all things to all people. Evidently, when Wolfram Research first developed Mathematica in 1986, it chose to ignore this homily. When they started their firm, Wolfram's leaders decided not to get locked into using only two or three platforms internally or having their application available outside of the company for only a few of the most popular machines.

Wolfram was already sensitive to the trends in the market that showed rapid acceleration in the pace of technology in desktop systems. Historically, every six months there is a new generation of machines with a new level of performance. The firm wanted to make sure its software would continue to be consistently compatible with the technology as it changed.

Market Requirements

Looking at its primary potential customers—scientists, educators, and engineers—Wolfram noted that people in these disciplines are not bound to one machine. They might use one machine in their office, another at home, and a combination of systems in the laboratory. It made sense to provide them with the flexibility to develop a Mathematica application on one machine and to be able to run it on another.

Prem Chawla, chief operating officer of Wolfram, says that before it came out with Mathematica, Wolfram not only studied the domestic scene but also performed an in-depth study of the international market. It found that, in the U.S., one platform dominates the market for a while, and then it is replaced by another. In contrast, in the international market, people in specific countries develop a consistent loyalty to certain platforms; temporal considerations have little impact on their choice of systems. Wolfram decided to make sure Mathematica was useful in both the domestic and the international markets.

When you look at Mathematica's architecture, you see two major parts, a kernel and a front end, Chawla explains. "The front end is very specifically machine-bound; the kernel is very portable. The way we made it very portable was to use dual coding—reasonably modular techniques. At the same time, we coded the kernel in C so we could take it from machine to machine.

"Both the kernel and the front end are very discrete pieces, and they don't have to run on the same machine. The front end can take advantage of a specific GUI environment, such as the graphical interface of the Macintosh or Windows. If there isn't a GUI environment available on a platform, we provide an X Window System–based interface that is consistent across the board."

The cost of porting to many machines is quite high, Chawla explains. "Basically, we do primary development of the code on Sun and Next machines. In 1986, when we started this project, we set up a network of all the various platforms. Every night, after our developers have added new functionality and features, the changes are compiled on the Sun. Immediately, new versions of the software are built on all the different platforms. Every day, we can literally have a new version of the product that was created automatically the night before."

According to Chawla, this approach to cross-platform applications development provides major benefits to the customer. "If you want to use Mathematica," he says, "you don't have to worry about the hardware—you'll be hardware independent. With new hardware, you can get up to speed fairly fast, and you can keep up with the technology. You don't have to be stuck with old technology."

With Mathematica, the kernel that runs on one machine is the same kernel that runs on another. Every machine has the same functionality. Files that are supported by Mathematica are all text-based, so you don't have to do any file conversion from one platform to another.

"Another reason our front end plays a very important role," says Chawla, "is that one of our front-end design criteria was that you should be able to take what is created on one platform—say a Macintosh—load it on a Windows platform, and run it without any change.

"Suppose you are writing a technical report in Mathematica on a Macintosh

may be OK, but for commercial development, it usually isn't.

Beyond cross-platform toolkits lies the realm of cross-platform operating systems. In the past year, a slew of initiatives, consortia, and joint ventures have cropped up that promise to provide cross-platform interoperability between industry-standard Intel-based PCs and one or more of the latest RISC platforms (see "Let the System Do the Porting" on page 191). Pink (the Apple-IBM joint venture), the Advanced Computing Environment (with Mips, Microsoft, DEC, Compaq, et al.), and Solaris from Sun Microsystems all promise cross-platform interoperability, but who is going to provide interoperability *among* them?

Pulling Together

Beyond running the same application on different platforms, cross-platform development has also invaded the domains of cooperative and distributed processing. Before computing environments became heterogeneous, computing over a network was a challenge; today, it can be a nightmare. Even here, however, a new generation of tools is making it easier to share data and computing cycles.

In its simplest definition, *cooperative processing* describes the sharing of data by many computers over a network.

World Radio History

and you want to distribute that report in electronic form to your colleagues who have IBM PCs running Windows. They can take that format as it comes out and run it, because they will get exactly the same graphics, equations, scientific text, and compound documents—all the things you have created on the Macintosh."

Build and Test

Rory Murtagh, Wolfram's director of engineering, addresses some other issues associated with in-house and external cross-platform development efforts.

"In-house," says Murtagh, "we run on about 30 platforms, most of them Unix, a few DOS. A couple of platforms that we dial out to are Convex and Alliance, and we contact them by Internet 2. In-house, all our machines are connected by Ethernet. For DOS machines, we use PCNetwork File Server, which shares Unix file systems with PCs. On the Mac, we do equivalent things on the Hierarchical File System.

"Our core product consists of about 300,000 lines of source code—that comes out to one large binary [file] and several small binaries. We have a public domain software-control system called Revision Control System. RCS keeps a history of added changes to the source code files so we can progress and regress.

"In the Unix environment, the RCS builds a new binary nightly. More than 20 machines concurrently update their own copies of the source codes; they synchronize a local copy of the source codes with a master copy and build a new version of the product. Then, our software engineers can test it on any platform with the latest copy. By building it as frequently as possible, it will show machine-specific problems right away, because it will fail to compile."

An early method Wolfram employed was to build on the same file system using a network. When this procedure was performed several times simultaneously using a shared file system, however, the network bogged down. A year and a half ago, the firm changed to its current method, which is working fine. "Some other software houses—such as Lotus, Microsoft, and Oracle—do this number of platforms, but most vendors do only a few," says Murtagh.

Regarding upgrading Wolfram's system, Murtagh explains that if the firm had unlimited funds, it would use software network technology (e.g., Fiber Distributed Data Interface), but that technology is still very expensive.

"We are dealing with concurrent development. Several developers can work on the same code at the same time using Concurrent Version System, which runs on top of RCS. We are just beginning to use it, but it's a definite improvement.

"Earlier, Wolfram had one canonical source code, and several developers would work on it. Theoretically, one developer could preempt the others. Now, each developer gets a copy of all the source codes (one person works on a particular algorithm) and has to wait until that copy is in a consistent state and is ready for testing. Then those changes are committed to a central repository.

"If more than one person is working on the same part of the code, the system will warn them and help merge the two [sets of] changes. This process is much better than it was when we were constantly overwriting each other's work or when we had to lock our files. You want to make point changes to many source code files, particularly in porting. Logistically, that was kind of a problem."

Janet J. Barron is a technical editor for BYTE. You can reach her on BIX as "neural."

When every computer in your department or enterprise shared the same architecture and operating system—and was connected by a single-protocol network—cooperation between applications that accessed the same body of data was not too difficult. Today, sharing data over a network is more of a challenge, although the rewards can be well worth the effort.

Cooperative processing in practical terms means common access to a relational database that resides on one or many servers. These servers can be other workstations, a LAN server, a large minicomputer, or a mainframe. Today, the most popular way to access a relational database is via Structured Query Language.

SQL is a nonprocedural language used to create and access relational databases. It is supported by all major database

Circle 159 on Inquiry Card

BACK BY POPULAR DEMAND!

SpeedStor for DOS
Hard Drive Installation, Management And Diagnostic Software

- Install and partition hard drives in minutes
- Maximize speed, capacity and efficiency with advanced utilities
- Comprehensive diagnostics not found in DOS

NEW v6.0 FEATURES!
- DOS 5.0-compatible
- Supports 8-, 16- and 32-bit controllers
- Works with memory managers

$99.95* SRP $29.95* Upgrade
*Plus tax, postage and handling

To order, call
800-967-4246 Ext. 2

OVER 700,000 INSTALLED

STORAGE DIMENSIONS
The Industry Leader In Storage Solutions

UPGRADE $29.95*

World Radio History

The Vertical View

Most of us take a horizontal view of cross-platform development. We worry about getting the same software up and running on both a Sun workstation and a Windows-based desktop PC. Such concerns can seem positively provincial when you consider the cross-platform dilemma facing MIS organizations. Their concerns are more universal in scope: how to create and maintain software systems that span the gaps among mammoth mainframes, slick personal computers, and workstations.

John Tibbetts sees these concerns firsthand. He is a principal of Kinexis, a San Francisco–based consulting firm that works with companies to develop cooperative-processing systems that span personal computers, LANs, and mainframes. He has a valuable perspective on the issues you face when integrating personal computers and mainframes—one that is not often heard in the community of personal computer users.

"My impression of the world right now is that we've seen the first phase of computing development, where over a couple of decades mainframe activity spread and we knew how to use only these big, centralized machines. Phase two, of course, was the personal computer and LAN revolution, which really represented a different culture—a 'power to the user' culture. That is where a lot of people still are today, certainly in the downsizing arena.

"I work with what happens next, with what happens when those two environments hit. This is more than a technical collision; it's a cultural collision. How do you put all these pieces together into unified applications that can tie into transaction-intensive terabyte databases on the one hand but still give power to the user on the other? How do you think about the roles of each platform as you proceed from enterprise server to LAN server to client?"

Enterprises and Clients

Unlike many observers, Tibbetts does not think that LAN-based client-server architectures, taken alone, are a complete solution to the problems of providing both community-level processing and corporate computing, although he does see client-server computing as a component of corporate computing. While the economics are obviously attractive, Tibbetts also sees the downside to moving all processing to desktops.

"You need to deal with environments that contain machines whose job it is to represent the concerns of the enterprise and its accompanying security and integrity constraints. You also want to incorporate the power-to-the-user movement. Personal computers and workstations have allowed individuals to exercise more initiative and creativity in solving their own problems. You have to be able to put that together into a meaningful environment without open warfare breaking out. In a lot of organizations right now, open warfare has broken out between [the Information Systems (IS) department] and desktop users.

"I have a client—one of the world's largest chemical companies—that has an old mainframe environment that isn't very responsive to its needs. The company's order volume is projected to increase by a factor of 10 over the next decade, and the current teleprocessing system on the mainframe is at capacity. The IS organization has responded by fielding a huge project to rebuild the system. It is in the second year of a seven-year study, preliminary to doing the design work that will replace the system.

"In the meantime, there is this really dynamic guy, probably five years away from retirement right now, who learned how to program Lotus a few years ago, an event that completely changed his life. He happens to be in charge of international operations at this company, and he's now brought up three countries doing order entry using Lotus 1-2-3. In my judgment, that is a completely inappropriate tool, although he solved the problem using guerilla tactics, using these very-easy-to-manipulate personal computer tools along with bulletin-board software to send the data.

"This is very typical of what you see. There are two camps at war: The personal computer people see the LAN as everything in computing, and they see mainframes—if they survive at all—serving as disk-farm handlers. Mainframe people look at the same platforms and see the mainframe as everything, and they look at the personal computer as a way to put pretty new front ends on [the mainframe]—but don't let personal computers get near the data. The idea is to build a negotiated settlement between the two environments."

Tibbetts sees the need for organizations to determine what is the best role for all types of platforms in an organization. In his view, desktop computers and mainframes have very different but complementary roles.

"At one extreme, you have highly trusted back-end community processors whose job it is to hold the enterprise data, something everyone recognizes as important. I think that it is also the job of the back end to be a repository for enterprise *function* as well. This is less recognized right now. For example, when considering distributed databases, a lot of people view the back-end machines as exclusively database engines. I disagree with that view. In a cooperative environment, they ought to be viewed as transaction engines. They hold not only enterprise data, but also those transactions whose job it is to ensure that data's integrity. The back end does not just hold the credit table; it owns the credit-check procedure."

Freedom to the Desktop

Tibbetts adds, "At the other extreme, the client level, we have a whole culture of powerful tools and proficient users. The focus of the front end is not integrity, reliability, and security. Just the opposite: Everything about personal computers is about accessibility—even the way they are screwed together. Their beauty is that they make computing resources accessible. That's what makes them great.

"I believe that in most corporate computing environments, you want to keep those machines free. You maintain the ability to run programs of your choice,

continued

World Radio History

LOOK WHAT PC MAGAZINE HAD TO SAY ABOUT A VERY GRAPHIC AND RACY SUBJECT.

World Radio History

The Vertical View *(continued)*

to boot up your own machine, and perhaps to have a medium such as a disk for moving data and programs on and off the machine.

"To the extent that they are free, those machines should be considered untrusted—not untrustworthy, but untrusted by virtue of their openness and accessibility. One of the flaws in the client-server model is the notion that the application moves down to where the client is. The problem is that the application is every bit as valuable an enterprise asset as is the data. It's not only valuable to keep information about how much somebody has spent; it's just as valuable—just as important as an enterprise asset—to deal with the ownership of the rule that runs a credit check. To that extent, you don't want to be putting enterprise assets onto machines that you can stick screwdrivers into, just as you wouldn't put a cash box out in the middle of a bank lobby.

"I believe it's the role of clients to be untrusted but free. Their job is to provide very high powered, object-oriented user-interface environments that send messages toward the enterprise—the mainframe or the LAN server. I label these messages PUOWs, for proposed units of work. Their role is not to participate in transactions, but to simply suggest to the enterprise that a transaction [should] occur.

"Once you make this leap, you see that you can still let the client machine be very free. You don't have to worry about viruses and things like that, because the only communication, the only hook between the client and the next level up, is a message stream that is making suggestions.

"I believe that the personal computer should be viewed architecturally as the agent of the user, not the agent of the enterprise, which is to say its job is to amplify the capabilities of the user, whether the user is smart or dumb, honest or malicious."

Where you draw the line between freedom and trust varies from organization to organization. In most instances, Tibbetts sees the trust line falling in between mainframes and micros: at the LAN server.

"That implies a couple of things. First, the LAN server should be locked up—at least that server that is the gateway to the enterprise. Obviously, you do not want to lock up a print server. Architecturally, you can do a lot of nice things if you make the LAN server trusted. For instance, you can download some of the enterprise transactional rules and have them close and quick to the clients.

"There are environments, however, where you can't trust the LAN. I've recently been looking at an environment in a government agency that has about 2000 LANs connected to a mainframe. They don't think they can administer 2000 trusted LANs. So, in that case, they've moved the trust boundary up to the mainframe.

"When we do these designs, the trust line is not static. If you move it further down toward the client, you start restricting freedom but creating more trust. You have to tune it to the type of application and the type of human structure you're modeling with the information system."

The Role of Objects

Recognizing the nature of the different platforms in a cooperative-processing environment clarifies many design issues. In the end, however, you have to implement your design. Tibbetts sees object orientation as the paradigm that will make enterprise-wide cooperative processing an attainable goal for any organization.

"The place where object orientation is so great that it has an unfair advantage over any other alternative is at the user interface. Object-oriented user interfaces are incredibly powerful. I recommend that organizations be very aggressive and use tools—Smalltalk or [some powerful object-oriented GUI builder]—that can support multiple windowing environments. It gives you enormous productivity. The closer you get to the user interface, the more aggressive you should be with objects. However, at some point in the system—usually about the LAN server area—you're going to discover that an object-oriented infrastructure does not exist for the type of community processing needed at this level."

In Tibbetts's view, the lack of a formal object-oriented infrastructure at the back end doesn't mean you should jettison the object paradigm.

"Although the formal infrastructure isn't there, object orientation is still a useful paradigm as you move away from the user interface. In fact, the easiest place to see this is at the back end of the system, where the database lives. However, I think the relational data model will be with us for a long time, because it provides unbiased views of the data. I also believe an object-oriented shell around a relational database makes a lot of sense. Many people who take an object-oriented approach to the front end are also taking a 'wrappering' approach to the relational database.

"You can create object wrappers that render a particular view of the database as a particular hierarchy and use your transaction manager to put rules and behavior around it, making a simulated object, or a set of simulated objects, that wraps the relational database. I think that's a very effective approach, and it's one that preserves a lot of the existing transactional and relational machinery—but still gives you object views of the application-building process."

Tibbetts isn't shy about his views on object orientation. As he sees it, object orientation represents the best way to create cooperative systems that span multiple platforms and meet the needs of both the enterprise and the end users. He is anything but shy about predicting the future.

"Presently, you have terrific object-oriented capabilities on the front end. On the back end, you want to keep it relational and representational. And in the middle, you have a mixed bag. As we move along in the decade, the object-oriented paradigms will eventually extend throughout. As we go more and more into distributed and parallel systems toward the end of the decade, we are absolutely going to require the object-oriented paradigm throughout."

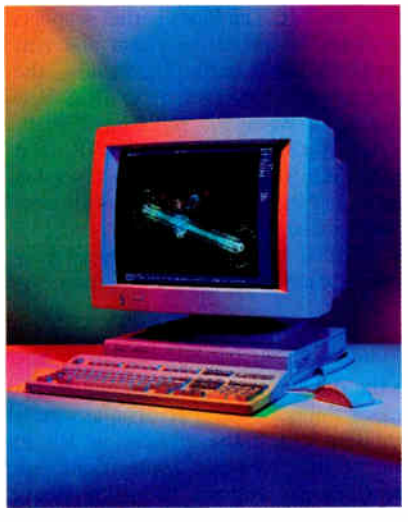
World Radio History

"The DECpc 433 mixes top PC performance with networking and blazingly fast video performance."

PC Magazine
October 15, 1991

Pretty hot stuff, huh? And that's not all *PC Magazine* felt fit to print about our DECpc™ 433 Workstation. Just get a load of this: "The DECpc 433 adds value to the existing standard without sacrificing compatibility. What's more, this machine shows strength in an area where DEC knows a thing or two: the graphics workstation market."

And how about this: "At $5,999*.. [this] machine is a PC designer's dream."



Of course, far be it from us to censor one of the best PC sources in the business. Especially when it comes to this quote (our favorite): "If graphics speed is important to you, give the DECpc 433 a long hard look."

Naturally, we encourage you to take them up on this suggestion.

For more information on the DECpc 433, or any PC in Digital's line, call 1-800-DIGITAL, ext. 417. Or talk to your local Digital Authorized Distributor.

DIGITAL. THE OPEN ADVANTAGE.

© Digital Equipment Corporation, 1992.The DIGITAL Logo and DECpc are trademarks of Digital Equipment Corporation.486 and Intel Inside are trademarks of Intel Corp. * U.S. Pricing

World Radio History

The Third Wave

Jon Udell

New processor architectures and operating systems burst out of the starting gate each year. Time was, software developers who bet on a horse that zigged when the market zagged were ruined. That can still happen today, but, increasingly, developers are finding ways to hedge their bets.

The widespread adoption of ANSI C helped enormously. Finally, you could count on the ability to abstract programs away from the details of Intel, Motorola, SPARC, VAX, and other architectures.

Then the next challenge arose. Each platform evolved its own GUI—or several of them. ANSI C alone could not help you move programs from one GUI to the next.

Homegrown and commercial toolkits that spanned the differences between GUIs sprang up. As a result, developers now successfully field versions of their applications for two or more GUIs. Some favor C or C++ libraries and prototyping tools, and others rely on pure object-oriented programming environments. But nearly everyone sees the need to abstract away from the raw minutiae of GUI programming.

What's next? The coming challenge will be to create distributed applications that cross operating-system *and* network boundaries.

Few applications exemplify this third wave, although businesses now commonly deploy a mixture of computing resources. PCs, Macs, and workstations stand side by side and may even share common network cabling. Thanks to an emerging class of interoperability products (see "The Perfect Pitch," December 1991 BYTE), these different cultures can sometimes even emulate on another's file- and printer-sharing services. Programs that support the same file formats across different platforms (e.g., Wingz, PageMaker, and dBase) benefit accordingly.

More sophisticated and less widespread are client-server applications that depend on networked interprocess communication. Even though database vendors (e.g., Oracle) offer tools that shield developers from a certain platform's operating system, GUI, and network transports, the leverage they confer extends only to applications in the database realm.

Integrators looking for ways to deliver networked software on multiple platforms really need a general-purpose solution. Just as ANSI C adapts to 68000, 80x86, and SPARC architectures, and GUI toolkits can work with the Mac, Windows, and Motif, what's needed is a communications layer that handles IPX, NetBIOS, TCP/IP, AppleTalk, LU6.2, and other protocols.

Pipe Dream?

PeerLogic claims that its Pipes platform fills the bill. The Pipes kernel supports a range of operating-system and network-transport pairs. Up to now, the list has included DOS-IPX, DOS-NetBIOS, NetWare-IPX, NetWare-TCP/IP, OS/2-NetBIOS, SunOS-TCP/IP, and AIX-TCP/IP. An MVS-LU6.2 version is all but complete, and AppleTalk now waits in the wings.

Written in C, the Pipes kernel augments each host's native interprocess-communication services with a message-oriented peer-networking subsystem. The Pipes application programming interface (API)—just a dozen well-chosen verbs—is, as you'd expect, common to all supported Pipes platforms.

Pipes irons out the differences among transport protocols and abstracts away from the details of network programming. That means you can build a distributed application for a NetWare LAN without any references to IPX (a neat trick) and then port it immediately to a TCP/IP or NetBIOS LAN with equal disdain for the nuts and bolts of these other transports.

What's more, the same distributed application can run in a mixed environment in which DOS-IPX and Unix-TCP/IP nodes work as peers. Communicating nodes need not share a common transport protocol—and that's a major boon. Most DOS-to-Unix network scenarios, for example, rely on protocol multiplexing at each DOS node to accommodate NetWare and Unix at the same time. This side-by-side approach not only burdens DOS with extra protocol processing, but, more significantly, it does little to facilitate communication among the parallel networks.

DOS stations can have peer-to-peer or client-server relationships with Unix nodes, but only on the terms dictated by Unix—either TCP/IP sockets or remote procedure calls. Contrast this with the Pipes approach, in which a DOS node running IPX can reach a Unix node running TCP/IP through a *context bridge*. The bridge, which can be any node in a Pipes network, runs dual protocols, so the rest of the nodes don't have to.

engines in one form or another. So, it can act as a glue between front-end applications and back-end databases.

The most talked-about cooperative-processing scheme today is the client-server architecture. With this architecture, a number of different applications running on several different platforms can all access a common data repository by sending SQL queries over a network to the database engine. The engine processes the query and returns any resultant data back to the application. By separating the front-end applications from the database engine, the client-server scheme allows you to use any application to access the database—even a spreadsheet or a word processor—as long as the application can generate standard SQL queries.

Because it's a standard across all types of computer platforms (e.g., desktop machines, minicomputers, and mainframes alike), SQL has the potential to provide access to large corporate databases from PC-based applications. It is also one of the driving forces behind the downsizing movement, where core corporate applications that formerly ran exclusively on mainframes migrate to PC LAN envi-

World Radio History

A particularly strategic place to locate a Pipes kernel would be in a NetWare 3.11 server. Although Novell now offers a robust TCP/IP (with NetWare NFS), a NetWare 3.11 server isn't a context bridge in the Pipes sense. DOS clients must still run TCP/IP in order to communicate with the Unix side of a mixed Unix/NetWare LAN.

That is why Novell released LAN Workplace for DOS—the company's own protocol multiplexer and DOS TCP/IP stack—at the same time as NetWare 3.11. With a Pipes NetWare loadable module in place, however, the DOS TCP/IP stack could become superfluous. A DOS-IPX node can converse with a Unix-TCP/IP node through the context bridge; each speaks its native dialect and is unaware that its partner is foreign.

The virtual network that is the set of connected Pipes nodes offers other benefits as well—notably, fault tolerance. You can have several context bridges active in a network. If one fails, message traffic automatically seeks an alternate route. Routing information is distributed everywhere, and at each of the levels of the deeply hierarchical logical network there is a privileged manager node that runs the show.

The Programmer's View

To the developer, the Pipes API looks alarmingly thin. There are verbs to register an application with the kernel, advertise a service (or "resource"), find resources advertised elsewhere, establish sessions, send messages—and that's just about it. PeerLogic points out that, simplicity notwithstanding, writing applications for a symmetrical network of peers requires a major conceptual shift analogous to the entry to GUI programming. It took us a while to get used to the idea of applications as collections of overlapping windows. It'll be a while longer before we learn to think of them as sets of communicating processes.

While conceptually small, the Pipes kernel consumes a fair bit of RAM. The current version of the DOS kernel uses 200 KB of extended memory and another 40 KB of conventional memory. That will be partly offset if Pipes saves you from loading one or more foreign transports.

Still, it is a lot for DOS to digest, particularly because Pipes' asynchronous messaging thrives best when supported by real—preferably threaded—multitasking. Even though it supports DOS and Windows, PeerLogic wisely recommends Unix and OS/2 to developers who are serious about building mission-critical distributed applications.

The AppleTalk version of Pipes has been delayed—for an interesting reason. American Express asked PeerLogic to port Pipes to IBM's MVS operating system and LU6.2 transport protocol.

Perhaps this shouldn't be surprising at all. Without a doubt, the most prevalent sort of cross-platform application today uses the personal computer as a mainframe terminal. While preserving its investment in this venerable but lopsided architecture, American Express hopes to usher in an era of more equal distribution of computational work, relying on Pipes' superior portability as a hedge against the volatility of the personal computer market.

In the meantime, despite endless talk about client-server computing, today's heterogeneous LANs often fail to add up to more than the sum of their parts. That will change when developers can routinely target their applications for the diverse networks that now wreath our desktops. Technologies like Pipes will play a key role in the transformation.

Jon Udell is a BYTE senior technical editor at large. He can be reached on BIX as "judell."

ronments.

If the client-server architecture sounds too good to be true, that's because it is. Marvelous in theory, it is less easily implemented in practice. For one thing, not all database engines speak the same dialect of SQL—and some databases only process queries from front ends developed by the same company. In addition, you must overcome the problem of universal network connectivity before your organization can implement universal database access. Finally, there are basic security problems that must be dealt with when you try to integrate networks of PCs with a corporate data repository (see the text box "The Vertical View" on page 164).

Despite the obstacles, the client-server architecture is catching on—although more slowly than its boosters envisioned. Products such as Microsoft Excel and Lotus 1-2-3 are being built with the ability to generate SQL queries, and many companies are providing back-end relational databases that run PC-based LANs. One of the more aggressive companies in the client-server field is Gupta Technologies (Menlo Park, CA). Gupta markets query tools, applications builders, connectivity solutions, and database engines. By offering a series of gateway products, Gupta gives you all the tools you need to access an IBM DB2 database from a Windows desktop.

Sharing the Load

SQL connectivity solutions from Gupta, Oracle, and other companies make it possible to share a common database engine, but they are not capable of the more general task of sharing processing among all the computers on a network. In other words, it takes something other than SQL to create network-aware applications.

Sharing machine cycles, whether in a peer-to-peer environment or a client-server arrangement, can greatly increase the power and efficiency of a computing environment. An application can take advantage of the computing power of an entire network and access subroutines that reside on any machine. Computational servers that specialize in floating-point math or vector processing could provide services to any number of other computers. Once you step over the line into shared computational resources, you enter the domain of distributed processing.

One of the better-known tools for producing distributed applications is the remote procedure call. RPCs are conceptually simple. All programs make procedure calls; in the vast majority of cases, these procedures are contained within the calling program or are at least located on the same machine. RPCs are procedures located on different machines. They still take parameters and return results; they simply execute on some other machine that is on the network.

For RPCs to work, you need a common format for the calling application and the called procedure, and a naming service that lets the application find the proper remote procedure. Less sophisticated RPCs use early binding, where you have to explicitly state the location of the remote procedure when you compile the application. More sophisticated systems use late binding, where a naming service matches calling applications and called

World Radio History

Object Request Brokers

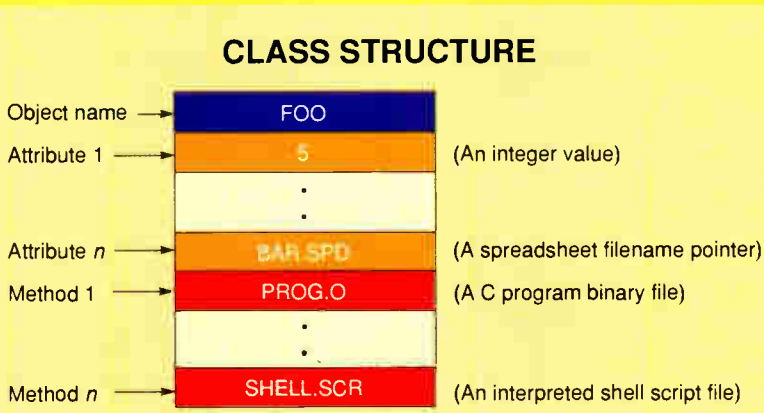
Herbert M. Osher

During the last few years, the computer industry has reverberated with news of the coming revolution in object-oriented software. The commotion has reached a crescendo over the last few months as the Object Management Group (OMG) has attempted to create a new platform standard called an Object Request Broker (ORB). What's all the fuss about, anyway?

First, you should understand what the OMG is and why its members are interested in creating object-oriented standards. Today, the OMG consists of 150 companies, mostly hardware and software vendors, as well as a small number of end users. The OMG's major objective is to work with computer industry vendors and end users to create object-oriented standards and avoid a multiplicity of incompatible systems.

One of the OMG's first forays into the standards arena was its call for submissions for an ORB. From the original 10 submissions, two became finalists. HyperDesk and DEC submitted one proposal, and Hewlett-Packard and Sun submitted the other.

The ORB has attracted so much attention because it promises to revolutionize software and the way it is created, integrated, and deployed. This technology will deliver the benefits of object-oriented development as well as those of client-server computing. Its marriage of network-based systems and object orientation will let developers create applications that are truly independent of the system and the network architecture—in effect, software without walls.



Objects of class FOO contain a number of attributes and methods. The attributes correspond to the data, and the methods are the code that acts on the data. You access and manipulate an object's data by invoking the methods.

Objects and Their Uses

Put simply, an *object* is the specific instance of a generalized software template. This template is a flexible and open-ended mechanism that describes certain data and the procedures that work on that data. The template layout (see the figure) is called a *class*. It is only when the fields in that template are filled in with specific information that you create an instantiation of the class template: the object. Therefore, a class is a description of the set of specific implementations or instances called objects.

A class template consists of a set of attributes and a set of methods. Attributes can be simple data items (e.g., integers or character strings) or more complex data (e.g., files, bit maps, or digitized voice—in these cases, the attributes are pointers to the complex data items). The methods can range from compiled subroutines written in conventional languages, such as C, to code written in interpretive languages, such as BASIC, REXX, or even shell scripts. Objects permit you to take a component approach to building large software systems. Using relatively simple and reusable objects makes it considerably easier to produce and maintain complex applications.

Distributed Object Management

The ORB represents the core of a new area of object-oriented technology called Distributed Object Management. Basically, the ORB acts like a network operating system that sits on top of any conventional operating system, such as Unix, OS/2, or DOS. It implements one basic command: EXECUTE. The format of this command looks like this:

```
EXECUTE [object_name, method,
parameter1, parameter2...
parameterN].
```

It's the job of the ORB to locate the named template (i.e., the object), start the specified operation (i.e., the method), and pass it the parameters. Because objects can exist anywhere on a network, you need a name service or a unique identifier—a handle—to locate them. If this handle is known, the object can be directly accessed.

In addition to this basic invocation function, the ORB must provide other capabilities associated with object-oriented systems. These capabilities are what make software development in an object-oriented environment as productive, maintainable, and extensible as the evangelists have proclaimed. Although these concepts have fancy computer science names (e.g., subclassing, inheritance, and polymorphism), they are simple to understand when put in the context of the software-class templates described above.

Subclassing allows you to create new

World Radio History

classes from existing ones. You can revise the behavior of any of the existing (inherited) methods and add new methods and attributes of your own (specialization). By doing this, you've created a new version of the class that is similar, but not identical, to the original. Subclassing lets you take advantage of an existing template—perhaps one developed for an application unrelated to your own—and modify it to suit your needs. It provides the reusability benefits of object orientation and promotes cost-effective software systems that are easier to develop, maintain, and enhance.

A slight variation on subclassing is the substitution of a different method (with the same name) for one in the original template. Because methods are invoked by name, this lets you leave an application unchanged yet still benefit from the modified behavior—be it a bug fix, an enhancement, or whatever. This process is referred to as *overloading*.

For instance, say you have a text-based template called "document" that contains a "print" method. If you copied the template for use in a graphics-based class (graphics document), you could replace the original print method with one (still called print) that knows how to output bit maps. You would invoke this new template just as you did the old one, but the behavior would change. This capability, called *polymorphism*, lets you maintain a consistent interface and hide differences in implementation. Any object-based system needs to support these capabilities.

The ORB supports these capabilities by including some primitive, or root, templates (also called *base classes*) as part of the basic ORB. Built into these base classes are methods that provide the functionality of subclassing, inheritance, and polymorphism.

The presence of base classes lets you use the EXECUTE command, which provides the basic object-oriented functions by letting you invoke a subclass or substitute method. In fact, adding more of these intrinsic operations to the base classes enhances the system's capabilities and makes them available through the same simple interface mechanism. What's more, you can now define your own functionality by adding and changing methods. Because these methods can be inherited by newly defined classes, you can create and specialize more functionality as the system evolves.

So, the ORB is essentially a control module with a simple interface for manipulating objects and a small number of operations defined by a set of base classes and their built-in methods. This is the starting point for building more complex and extensible software. One interesting point is that even these built-in objects are predefined classes (templates), manipulated by the same basic interface. Because these classes can be changed or replaced, even the system's basic capabilities can be modified and extended. This raises a couple of interesting points.

First, you need a bootstrap process that loads the initial set of classes. This capability is provided by the Genclass compiler. Second, because basic functionality can be redefined, you must establish a standard for these basic functions and classes. This is exactly the role that the OMG is expected to play. In this arena, the base classes and their object life-cycle methods are known as a *type repository*. To provide true interoperability and compatibility between different implementations of an ORB, a standard for these classes and methods is essential.

Software Without Walls

With an ORB, you have a method of accessing objects located anywhere on a network using a name service. This permits you to build complex client-server applications using objects located on network servers that you access by invoking their methods through the ORB. Building applications in this manner lets you move pieces around easily, change services without affecting the clients, create prototypes quickly, and generally attain great flexibility in building network applications.

In addition, HyperDesk envisions an ORB with the following attributes:

- A developer of the class template should be able to modify or add new code without bringing the system down or affecting applications that are already running. This is known as *dynamism*.
- A developer should be able to provide several methods (with the same name). The system would determine the proper method at run time based on user preferences, such as the machine the user is running, the language that is being used, or other cultural or system preferences.
- The user (or client application) should be able to ask the object to describe itself (i.e., its methods, parameter requirements, and attributes) so that, by exploration, you can discover new capabilities and services that can be used at run time. This is also a capability of dynamism.
- All this software should be portable across different hardware, operating systems, and networks.

The functionality provided by Distributed Object Management and the ORB reduces cost and creates more maintainable software for client-server and LAN applications, and it enables true applications interoperability across diverse computing environments. Additionally, the dynamic application-integration aspects of the software provide the developer and the user with greater efficiency and productivity.

Through the standards leadership of the OMG, the capability to develop applications that are truly independent of system and network architecture is now a reality.

Herbert M. Osher is president of HyperDesk Corp. (Westborough, MA), which develops distributed-computing software based on object management technology. You can reach him on BIX c/o "editors."

World Radio History

procedures at run time.

RPC toolkits are available from many sources. Netwise (Boulder, CO) offers interoperable RPC implementations for dozens of different platforms. The Distributed Computing Environment from the Open Systems Foundation (Cambridge, MA) is built on RPCs. With its sophisticated naming, time, and remote file services, DCE lets you create globe-spanning distributed applications.

Although they are extremely powerful, RPCs don't deal with the lower-level protocol issues that you must face to create network-aware applications. One innovative solution to building applications over multiple-protocol networks is Pipes. It gives you everything that you need to create LAN-spanning applications (see the text box "The Third Wave" on page 168).

Networks of Objects

Software development is hard and getting even harder. Throw in multiplatform networked environments, and it becomes almost impossible. In increasing numbers, developers are turning to object-oriented technologies to help them create and maintain usable software.

The point of object orientation is to shield developers from the incredible complexity of software systems. Using objects whose functions are well understood—but whose internal workings may be a mystery—developers can create and maintain sophisticated systems much more easily than they can with standard procedural code. This way, you need only understand *what* an object does, not *how* it does it.

Objects are showing up in many places in cross-platform environments. For example, the ParcPlace and Digitalk implementations of Smalltalk discussed earlier are object-oriented environments. In fact, one company even offers an object-oriented interface builder for ParcPlace's Smalltalk that further abstracts the problems of building a GUI for your Smalltalk applications. The Tigre Programming Environment from Tigre Object Systems (Santa Cruz, CA) enables you to create Smalltalk GUIs for many different platforms with a minimum of coding.

Given the advantages of object orientation and of distributed computing, you shouldn't be surprised that people are trying to put the two together. The Object Management Group (Framingham, MA), a consortium devoted to setting practical standards for object technology, has recently announced its choice for an Object Request Broker, which will let applications access objects anywhere on a network just as an RPC lets a program access a procedure anywhere on a network. The ORB is the first step toward the definition of a truly transparent cross-development environment (see the text box "Object Request Brokers" on page 172).

Are objects the be-all and end-all of cross-platform development? Given the enormous complications of cross-platform development and the powerful abstraction capability of objects, the answer is undoubtedly yes. The question now becomes whether it is cost-effective to move hundreds of billions of dollars' worth of software into the object-oriented realm. That answer is just as obvious—not yet. ■

Bob Ryan is a BYTE technical editor. You can reach him on BIX as "b.ryan."

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

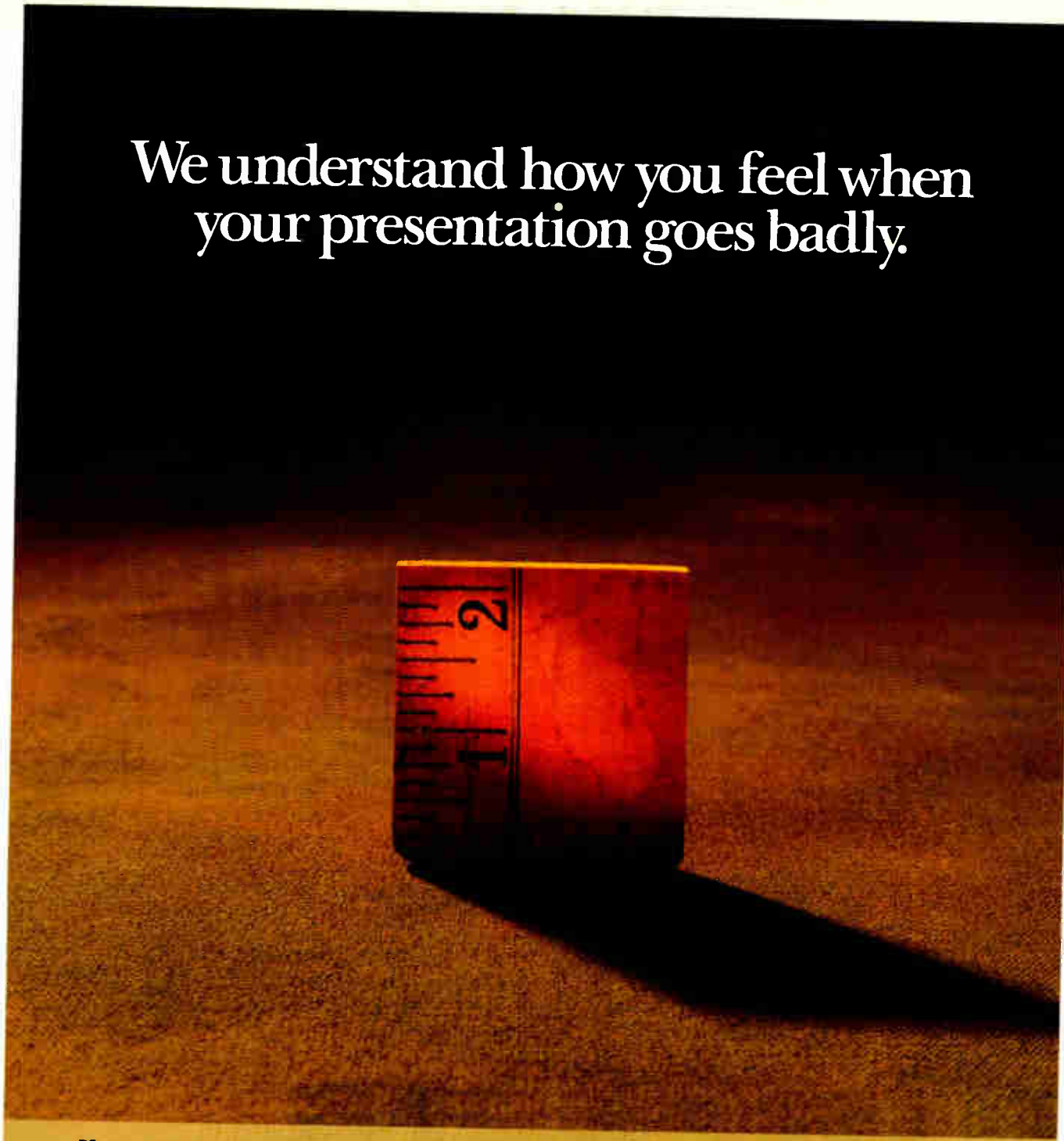
PKWARE® INC.
THE DATA COMPRESSION EXPERTS®

9025 N. Deerwood Dr.
Brown Deer, WI 53223
(414) 354-8699
Fax (414) 354-8559

Circle 129 on Inquiry Card.

World Radio History

We understand how you feel when your presentation goes badly.



If your LCD projection panel doesn't perform as well as you do, you're the one that ends up looking foolish. That's why we gave the MagnaByte® 6001 true color saturation and outstanding image clarity. And we made it so easy to set up and use, virtually anyone can give a professional, glitch-free presentation. Anywhere.

With the lightweight MagnaByte 6001, whatever appears on the computer screen is projected in thousands of crisp, rich colors through an overhead projector. And you can still use your mouse or key commands to manipulate graphics, call up different screens or type in new text. All in brilliant 640 x 480 resolution.

Seeing is believing. Ask your AV dealer for a comparative demonstration. For the Telex dealer nearest you, call 1-800-828-6107.

Because if you can't show it as well as you know it, your presentation isn't the only thing that will suffer.

©1991 Telex Communications, Inc.

The MagnaByte® 6001.

Compatibility: IBM and IBM-compatibles with VGA output; Macintosh II and LC.

TELEX.

Circle 167 on Inquiry Card.

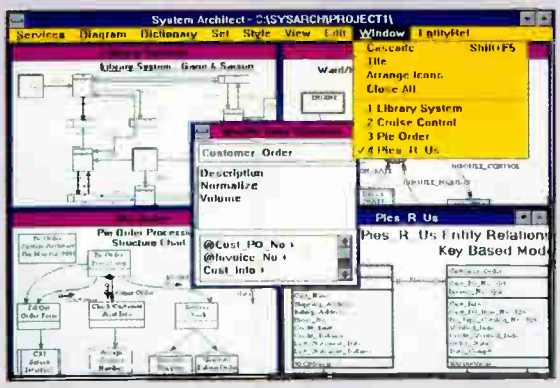
World Radio History

THE CONCEPT BEHIND OUR CASE PRODUCT.

System Architect has the power to handle your most complex applications. And it's so easy to use, even beginners will be productive in no time.

Use such methodologies as DeMarco/Yourdon, Gane & Sarson, Ward & Mellor (real-time), Entity Relation diagrams, Decomposition diagrams, Object Oriented Design (optional), State Transition diagrams, & Flow Charts.

Create an integrated data dictionary/encyclopedia, and get multi-user support both with and without a network.



Take advantage of such advanced features as:

- Normalization
- Requirements Traceability
- Import/Export Capability
- Extendable Data Dictionary
- Rules & Balancing
- Network Version
- Custom Reporting
- Auto Leveling

Rely on a proven CASE product. System Architect has received rave reviews from the press and users. IEEE Software Magazine called System Architect "a useful, well-planned, affordable CASE tool." CASE Trends found System Architect "to be extremely easy to use. . . . with many features that are completely lacking in higher priced competitors." Toshiba found that "System Architect stood out from many other prospects because it had the best core technology." System Builder called System Architect "truly a price/performance leader."

Work in the Windows 3.0 environment, or OS/2 Presentation Manager (call for availability), and count on context-sensitive help.

Stay within your budget. At **$1,395,** System Architect is quite affordable -- and it runs on almost any PC.

Call **(212) 571-3434** today for **introductory 35% off** optional **Database Schema Generator.** Supports DB2, Oracle, INGRES, OS2, Sybase, SQL Srvr, RDB, Progress, Paradox, SQL Base, AS400(SQL), XDB, and Informix.

POPKIN
Software & Systems Inc.
11 Park Place, NY, NY 10007
Tel: (212) 571-3434
Fax: (212) 571-3436

MICROSOFT WINDOWS
Version 3.0 Compatible Product

SystemArchitect™

Supporting IBM's AD/Cycle

System Architect logo is a trademark of Popkin Software & Systems Incorporated. Other product names used herein are for identification purposes only and may be trademarks of their respective companies. Price shown valid only for USA & Canada. Price and specifications subject to change without notice at the sole discretion of the company. Product delivery subject to availability. Please call for the name of the nearest international distributor.

Circle 130 on Inquiry Card.

World Radio History

TRIBUTARIES AND DELTAS

Tracking software change in multiplatform environments

RANDALL D. CRONK

Despite the best efforts of the computer industry's many standard-setters (official and unofficial), the world is still a dangerous place in which to write software. It is bad enough that there are still Hewlett-Packard, IBM, DEC, Sun Microsystems, Silicon Graphics, Mips, and about a hundred or so other variations of Unix to contend with—there remain all the proprietary platforms, too. Several represent huge markets, and woe to the vendor who introduces exciting new features for the Macintosh now and asks its Unix and DOS customers to wait a year.

The challenges of cross-platform development, however, do not affect just vendors, nor are they limited strictly to compatibility issues. By far, the biggest problem is code management. Anyone who has ever written more than one version of the same program knows the frustration of trying to make sure that bug fixes and updates are applied appropriately to all versions. Changes to the X Window System version of a Unix program may work in the DECwindows version of a VMS program, but not in the command-line version. The addition of TCP/IP to an E-mail application may affect different software modules for different users, depending on whether they have Chipcom, Proteon, or some other hardware.

For large development efforts, managing code for applications that run on different platforms can become very complex indeed. The definition of a platform can include not just the operating system and CPU hardware but also such things as database managers, communications servers, and math coprocessors. And

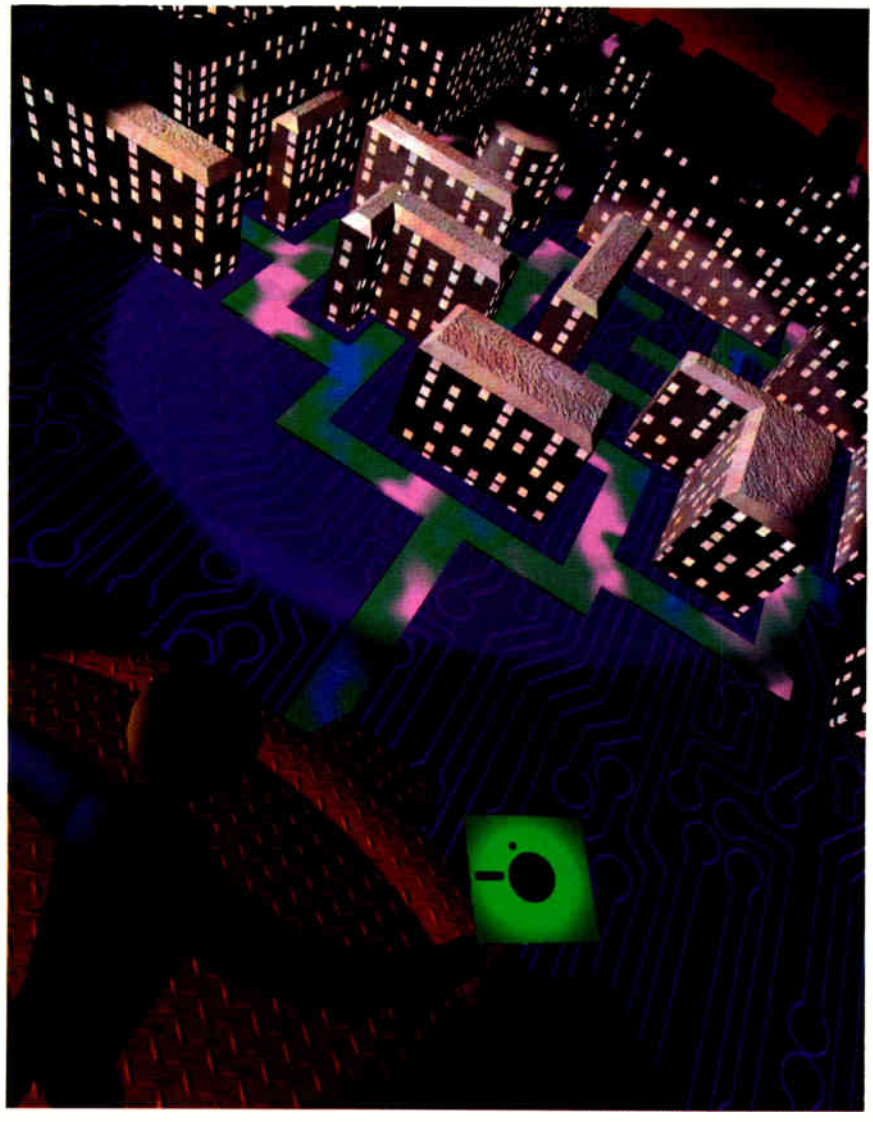


ILLUSTRATION. JIM LUDTKE © 1992

World Radio History

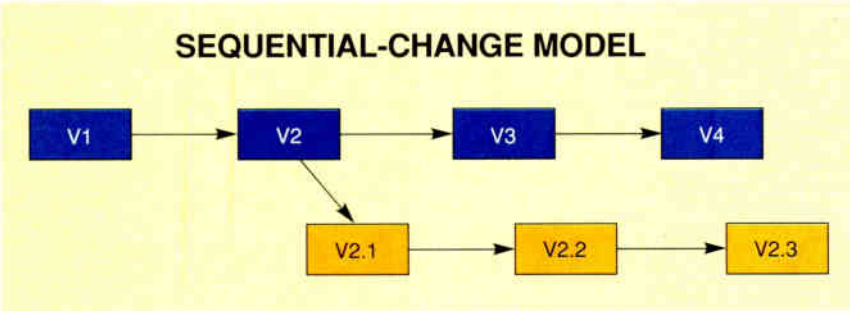


Figure 1: *The boxes indicate versions of the file. Each version is the immediate successor of the previous version. One or more logical changes are made between versions, and every version in the tree has a linear sequential history.*

these are only the technology factors. There are also nontechnology factors. These can include accounting rules, demographic preferences, legal requirements, and distribution-channel restrictions. Nontechnology factors often have a lot of influence on what features are implemented on what platforms. For example, a company might want to allow third parties to develop local variations of its DOS product in non-U.S. markets while developing all its Macintosh versions itself.

There can be as many different versions of a program as there are ways to define users. You don't need to have too many versions before the potential for overwhelming complexity becomes clear. Every time a change is made, the following questions must be answered:

- What versions are affected by the change?
- How will the change be migrated to those versions?
- What other code in each of those versions is affected by this change?
- What else is affected (e.g., documentation)?
- How are selected versions created from the software inventory?

The last two questions raise issues that go beyond making certain that the correct changes are successfully implanted in the right release. External dependencies (e.g., documentation) are also part of a software release. For example, if only the DOS version of a product feature is changed (say, to reflect the existence of a brand-new coprocessor chip), all the appropriate references must, obviously, be identified and changed in the documentation.

Finally, there is the issue of version creation itself. This can be more complicated than it might first appear. For example, who's to say that the latest versions will always reflect the most recent changes? At some point, the developer may want to undo some prior changes for some of the platforms supported (e.g., because a function becomes available in hardware that was previously implemented in software).

It is also possible that the vendor will want to institute a "reusable code" policy. The company may adapt code from a previous version as a base for a new platform migration. That might happen if the most recent version supports one windowing system and a new target platform calls for another that is completely different. Rather than use the existing windowing system as a development base, the developer may opt to start with the original command-line version of the product. Finally, the developer might want to create a completely new version of the software from the existing source code inventory. Rather than select an existing version and add changes, the developer might want to simply select code out of the inventory and build a version from that.

BYTE ACTION SUMMARY

Software revisions can turn your multiplatform computing environment into a frustrating tangle of conflicting code versions. The way to avoid the problems caused by revisions is to adopt the right approaches to managing software in these environments.

Wanted: A Good Code Manager

The general practice of keeping track of multiple software versions is known as software-configuration management. A number of automated SCM tools exist, and each one addresses some or all of the cross-platform development issues. All SCM tools share certain features. For example, they all view software development as an incremental process in which any version equals a base version and the changes. All SCM tools also exploit the idea that less storage should be required to hold one release and the changes than to hold entire copies of all releases. Saving storage space during product development, however, is not usually a major concern in multiplatform development efforts.

There are major differences among the various SCM tools. These differences broadly affect the tools' ability to cope with cross-platform development. The key differences center around the following issues:

- whether the tool is file- or object-oriented
- whether the tool represents changes physically or logically
- whether the tool applies changes sequentially or selectively

For all but the most simple design efforts, a system that captures change as an object rather than as a file of source code is better. Source files lack the ability to represent all the things that need to be managed in a complex cross-platform development effort. They can only include the physical code itself and the various name tags (e.g., the name of the file and the name of the version to which the file belongs). Some of the things that cannot be easily represented include platform dependencies, code dependencies, and documentation dependencies.

A better candidate for a change "container" than a file would be an abstract data type called a *change set*. Such an object can be defined to incorporate all the features that are meaningful to the cross-platform development process.

A big advantage of using change sets is the ability to represent software changes as logical change rather than just physical change. A logical change is what the change accomplishes (e.g., converting output to PostScript format). A physical change is the physical evidence that results from the implementation of the logical change (e.g., changes to source files, executables, and documentation). SCM tools based on files are only suited to deal with physical changes, and primar-

World Radio History

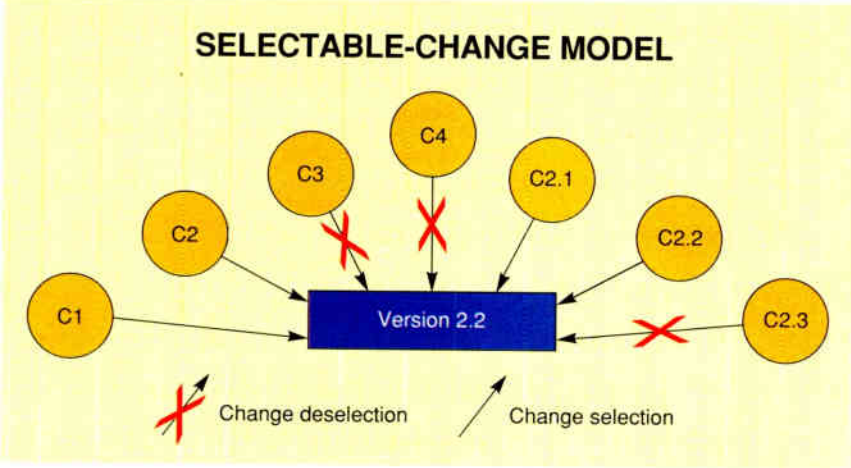


Figure 2: *The circles indicate changes. A version specifies a collection of selected changes. The diagram shows the change selections for V2.2 shown in figure 1 as though a single logical change were made between the versions.*

ily one kind of physical change at that: changes to the source code. A change object can just as easily capture changes to executable code, graphical data, imaging data, or documentation.

Change sets can also have features called *attribute tags*, which allow them to be manipulated on the basis of abstract criteria. As an example, the developer could ask the SCM system to list all change sets that support a specific function on a particular platform and that include references to specific subroutines. Fundamentally, the benefit of expressing change logically rather than physically is that it conforms to how people think. People are more likely to understand a change called "Convert output to PostScript format" than a change worded "version 3.2 of File 123, version 5.1 of File ABC, and version 3.7 of File XYZ."

The third criterion that differentiates SCM tools is the way they select software to be included in a version. There are two basic types of version-selection models: the sequential model (see figure 1) and the selectable-change model (see figure 2). In the sequential model, the SCM tool is, in essence, an archiving mechanism for recording the sequence of file versions as they are generated. The fundamental unit in the sequential model is the file version; changes are just bridges from one version to the next.

In the selectable-change model, the changes are the fundamental unit. A version is, in effect, a collection of changes. Systems that use the selectable-change model are always implemented in a way that permits individual changes to be included or excluded independently of each other.

The Sequential Model

SCM tools that are based on the sequential model are not really management systems; they are archival tools (i.e., they select previously named versions). A previously named version is one that was created by making changes to an older named version. SCM lets you pull together established versions from an inventory of source code files, not create new versions from the source code.

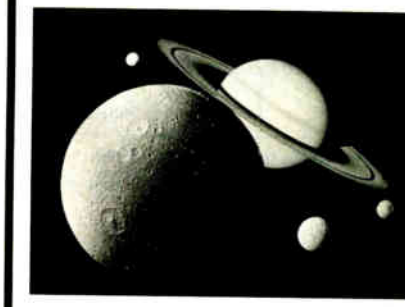
There are a number of variants of the sequential model. They share the following fundamental assumptions:

- The fundamental unit of specification is the version.
- Changes are represented as the differences between an old version and its successor.
- Each version (except the original base) has an immediate ancestral version.
- The only versions recorded in the system are those that are read into it; these are the only ones that can be retrieved from the system.

The simplest model is the linear sequential model. In this model, the system records a sequence of versions, each being the successor of the one immediately preceding it. Prior versions can be retrieved on demand, but only the latest version can be updated. The linear sequential model is fundamental; in most development efforts, it represents the normal sequence of events. Files are usually altered in a cumulative sequence of changes. SCM systems must be able to handle linear sequences of versions in a convenient manner. The fundamental

Circle 59 on Inquiry Card.

Computer Images



800 Toll-Free Credit Card Signup.
Then use same 800 # to Download.

1-800-GO-MODEM

Or use direct dial 64 Line BBS at (503) 697-5100 8/N1

SuperVGA 1024x768x256

ASTRONOMY • NATURE • SCENIC • GRASP • ANIMATOR • 3D STUDIO MOVIES • SOUND • GAMES • TARGA • UTILITIES • IMAGE CONVERTERS

Event Horizons Commercial BBS, thousands of images and movies. Quality Color Super VGA/VGA/ EGA. 1200/ 2400 bps $10/hr., 9600 bps $40/hr., 800# $6/hr. extra. Also Professional Image Scanning from prints or slides to disk.

No Modem? Order our Mail Image Library with samples $9. World-wide shipment. Info voice line 503-697-7700. All credit cards accepted. Same day shipment. MS-DOS systems only.

Event Horizons

311 Ave. B, Ste. 209
Lake Oswego, OR 97034
Voice 503-697-7700,
BBS 800-466-6336,
or BBS 503-697-5100

World Radio History

SCM-MODEL IMPLEMENTATION STRATEGIES

A comparison between the "manual" model of control-divergent sources and the two structured models for SCM.

	Manual	Sequential change	Selectable change
Elements managed	Files	Files	Change-set objects
Information available to developer	Filenames	Filenames File-version names Sequence of deltas that make up a file version	Filenames Software-release names Changes that make up a release Files affected by a change Software changes Documentation Hardware platforms Releases Operating systems Relationships and dependencies among software routines
Software development steps	Select an existing file version	Select existing versions of all needed	Select an existing release of the whole system Create a new release by selecting desired change sets
Product examples	None	SCCS RCS CMS	Aide-de-Camp

problem with the linear sequential model is that it does not provide a good method of dealing with parallel versions.

The branched sequential model is a natural generalization of the linear sequential model. From a given version, you can create branch versions, each with its own linear sequence of versions. The versions recorded in a branched sequential system form a tree of versions. All versions in the tree are retrievable, but only the version at the terminal nodes can be updated. Linear sequential and branched sequential models often use a simple version-numbering system for specifying versions. This is natural, because it corresponds to the sequences that are recorded. DEC's Code Management System is an example of a system that uses the branched sequential model for specifying names.

The basic problem with the branched sequential model is that branches, once established, diverge and are never reunited. This is not satisfactory. There are two major reasons for creating branches. The first is to create a parallel path of development that will later be merged into the main path. This is known as *version merging*. An example of this is when one development group works on a new release of a product while another group maintains the current release. At some point, the old bug fixes must be merged with new functionality.

The second reason for branching is to maintain parallel versions that have some specific difference (e.g., software that runs under two different operating systems). A bug fix often must be moved across all software releases of a product. This is known as *change migration*. In both cases, there must be communication between branches, which the branched sequential model does not inherently provide. There should be, for example, some way to know which changes made in one branch should be applied to another branch.

The Selectable-Change Model

The selectable-change model leads to true management tools rather than simple version-retrieval systems. The developer has the option of selecting new combinations of prior changes to produce previously unnamed versions. Given the additional capabilities of data-type abstraction provided by an object-oriented change definition, the selectable-change model enables true cross-platform software management. Developers can mix and match their source code to correspond to virtually any combination of hardware, software, documentation, marketing, or other criteria.

In this model, changes are created by comparing an old version of the file to an altered version. Each change receives a name. The changes are stored in such a way that each change set can be applied independently of the others. A version is specified by a list of changes to be applied. In principle, if there are N changes in the system, any of 2^N possible combinations of included and excluded changes may be a version. Versions can be defined at any time, but a version name is not automatically created for each change added. The changes are treated as independent, selectable units of change that are not tied to a particular version.

The major assumptions of the selectable-change model include the following:

- The fundamental unit of specification is the change.
- Versions are specified as collections of changes. This can be done implicitly or explicitly.
- In principle, a change need not represent the difference between two versions.
- Any combination of changes can be used to specify a version, even though the version so specified did not previously exist.

These assumptions are not always explicitly implemented in a particular system; however, they are implicit in the model. The only system with a full implementation of the selectable-change model is Aide-de-Camp from Software Maintenance and Development Systems. So-called update systems (e.g., IBM Update, CDC Update, and Historian Plus from Opcode) ordinarily lack a good method for referencing and representing versions. The modern implementation of the Source Code Control System (SCCS), generally packaged with Unix, is an interesting hybrid system; operationally, it behaves like a sequential-change model system, although its underlying technology uses the selectable-change model.

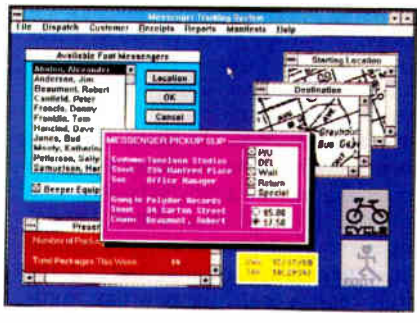
Model Implementations

The table describes the implementation strategies for tools employing the sequential-change and selectable-change models, along with specific product examples. For purposes of comparison, the

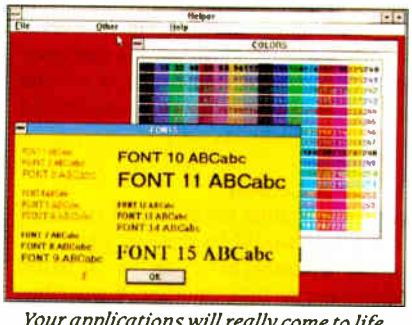
World Radio History

Attention All dBASE Users: Your Windows Have Arrived.

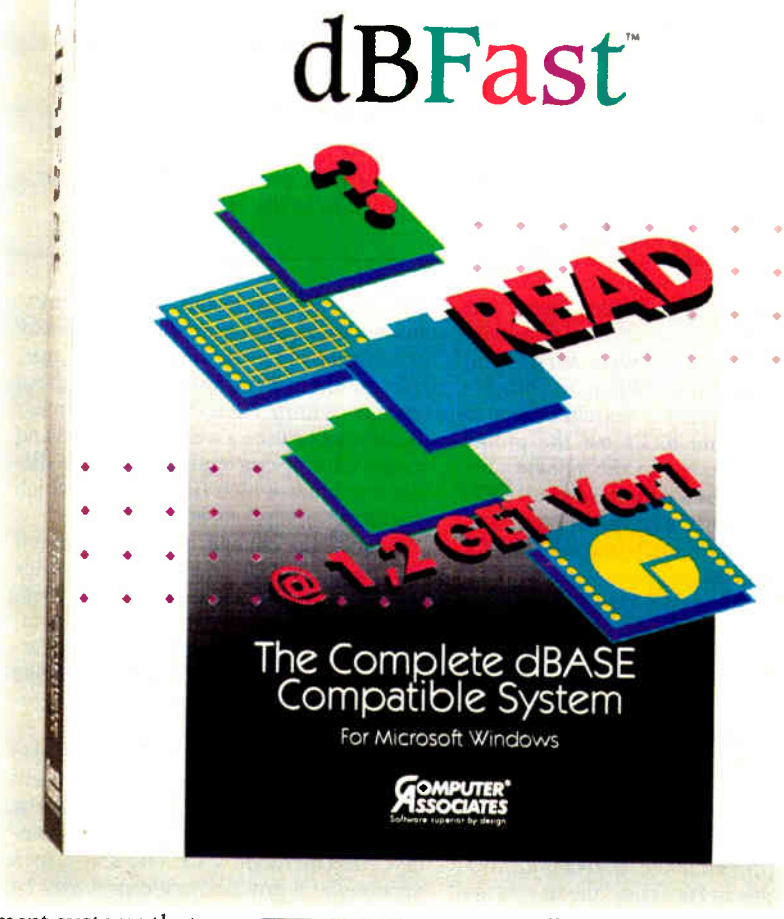
Introducing new dBFast™. The first and only dBASE™ compatible database and dBASE/X-Base language for Windows. It's the fastest, smartest and easiest way for millions of users and developers to join the Windows revolution.



dBFast helps you create powerful, graphical database applications quickly and easily with pull-down menus, check boxes, radio buttons and even bitmap images.



Your applications will really come to life with multiple colors and fonts.



Graphical, colorful dBFast will bring new life to all of your existing dBASE programs.

Liven them up with multiple, movable windows, pull-down menus, check boxes, dialog boxes, radio buttons, push buttons and bitmap pictures.

MICROSOFT WINDOWS

dBFast also helps you create new dBASE programs quickly and easily. Unlike other Windows development systems that force you to learn a new language, dBFast allows dBASE, Fox and Clipper developers to use the language they already know with more than 200 extensions and an interactive editor, compiler and linker.

Free Demo Disk

And full industry standard DDE and DLL protocols allow your programs to communicate with other Windows applications.

So call 1-800-645-3003 and we'll rush you a free Demo Disk.

Call right now.

After all, haven't you waited long enough?

COMPUTER ASSOCIATES
Software superior by design.

dBFast™

© 1991 Computer Associates International, Inc., 711 Stewart Avenue, Garden City, NY 11530-4787. All trade names referenced are trademarks or registered trademarks of their respective companies. dBASE is a registered trademark of Ashton-Tate Corporation.

Circle 38 on Inquiry Card.

World Radio History

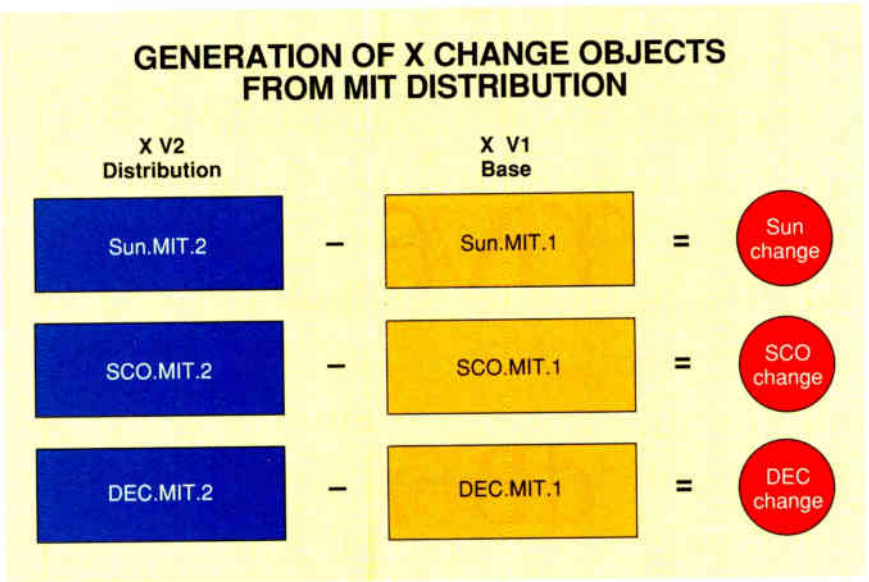


Figure 3: *A change set results from the difference between an existing version of the X files for each platform and the updated files provided in the MIT distribution version for that platform.*

manual model is also listed. This is the familiar scenario where the developer maintains various software versions as files in a directory. When selecting a version, the developer searches through the directory and picks out the proper files to be included in the release. Because it is the manual model that all SCM tools were invented to improve on and replace, no SCM products are listed in the manual category.

Only the selectable-change model has been implemented as an object-oriented system. This makes sense: Files impose a sequential way of looking at data, and objects do not. The next feature on the table is information available to the developer. This relates directly to whether change is represented in logical (i.e., abstract) or physical terms. If the data structures being managed are files, the system is limited to the kinds of information available in files (i.e., the names and contents of files). If the data structures are objects, a change can be associated with whatever information is meaningful to the developer.

Next, the table lists what the developer does to build a release. Only in the object-oriented, selectable-change model does the developer have the option of defining a release as something other than a previously named version. Finally, the table lists product examples.

How versions are built is a function of how versions and changes are represented. The manual approach represents a release as a number of complete program files that the developer selects, links, and builds as a version. There is no way to manage platform-dependent change, because there is no way to isolate these changes within files. Moreover, unless the developer uses a well-disciplined and robust naming convention, it may be difficult to know which files go with which platforms or versions of platforms.

Sequential-change models represent change as files: as complete source files and files of differences to source files. Only by creating an external naming table can developers equate these differences with meaningful units of change (e.g., new functions or platform migrations).

Defining change in terms of files also encourages the developer to represent multiple program versions within the same file. For example, Mips', The Santa Cruz Operation's (SCO), and Ultrix versions of a product would probably be contained in the same file on an SCCS system. To express the appropriate code on the appropriate platform, the developer will probably insert conditional statements in the code.

The purpose of these conditional statements is to check to see on which platform the program will run and to "turn on" the parts of the program relevant to that platform. In essence, the developer implements a code management scheme in the source code. This approach also results in the developer always seeing all existing code variants every time a file is viewed, irrespective of the one version currently of interest.

The object-oriented approach also uses the idea of deltas, except that in this case the deltas are not the objects that are being manipulated by the developer. Deltas, or collections of source code changes to a given file, are defined as features of a change set. Unlike deltas, change sets can include features other than source code (e.g., the author and date of the change, relevant documentation, software relationships and dependencies, and hardware relationships). These features can be used to collect and apply changes that are relevant only to specific platforms or other operating conditions.

In contrast to deltas, change sets are not necessarily defined as the difference between two successive versions. Several change sets, or a single change set, can represent all changes that result in a new version. Several changes can also be tied together by a common attribute (e.g., a work-order number) and treated as a single object. This gives the developer the flexibility to handle change with varying degrees of granularity.

In some instances, the developer may find it convenient to implement all the changes that define a new version with a single identifier. At other times, the developer may find it necessary to examine or manipulate a particular part of the overall change (e.g., the new password-retry restriction). Not only can change objects that implement part or all of a named version be defined, but change objects that implement entirely new versions can also be defined, including versions that merge changes from several development paths. This means that once a feature has been implemented on one platform, it can be selected or deselected for other platforms as well.

An Object Lesson

A good application for an object-oriented SCM system would be if a company had to make updates to its many X-based products every time another X distribution arrived from MIT. Every two or three months, MIT sends out a distribution disk containing a complete directory for each X platform MIT supports. The directory includes a list of bugs fixed or changes made since the last distribution, but with no reference to files changed. A software company receiving the distribution must integrate the changes into its own software releases for the various platforms it supports.

In an object-oriented SCM environment, the company would do this by comparing source files, identifying deltas, and defining change sets containing

World Radio History

THE BEST HOLIDAY BUNDLE OF THE SEASON!

The Cordless Super Mouse is designed and engineered to make your productivity soar! The battery powered **Cordless Super Mouse** uses infrared light to transmit data to your computer. Unlike many cordless devices that restrict your use while recharging, the **Cordless Super Mouse** is carefully designed to provide uninterrupted use.

Norton Utilities® for the Macintosh®
MSRP $274.00

Read My Lips™
MSRP $234.00

3-D Charts Tool™
Microsoft® Windows™
MSRP $319.00

Norton Desktop™ for Windows
Microsoft® Windows™
MSRP $365.00

HP New Wave!
Microsoft® Windows™
MSRP $375.00

* Also Available:

Cordless Super Mouse WindEase™ Microsoft® Windows™
MSRP $164.00

Cordless Super Mouse PFS: WindowWorks™ Microsoft® Windows™
MSRP $355.00

PC Globe®
MSRP $187.00

PC Paint Brush IV
MSRP $164.00

Auto Map™
MSRP $187.00

The Winning Combination
Z-Nix
Cordless Super Mouse
$64.99

Nissan 300ZX Twin Turbo

Z-NIX COMPANY, INC.
Tel: (714) 629-8050

For a limited time when you "test drive" the Cordless Super Mouse at a Z-Nix dealer you can enter for a chance to win a new Nissan 300ZX Twin Turbo worth $40,000. See your computer dealer for details.

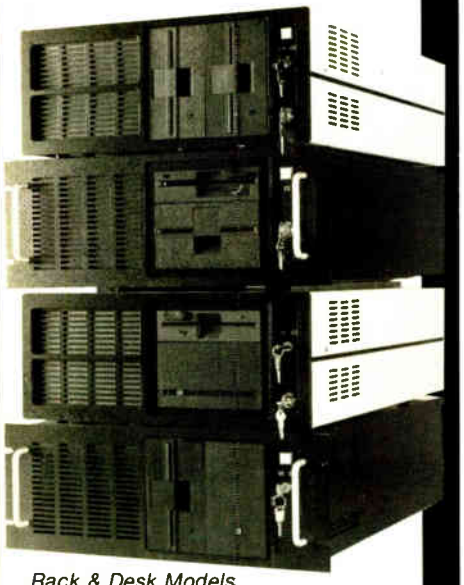
Circle 190 on Inquiry Card (RESELLERS: 191).

World Radio History

Circle 77 on Inquiry Card.

Rack & Desk PC/AT Chassis

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



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

Now Available Passive Backplanes

INTEGRAND RESEARCH CORP.

Call or write for descriptive brochure and prices:
8620 Roosevelt Ave. • Visalia, CA 93291
209/651-1203
TELEX 5106012830 (INTEGRAND UD)
FAX 209/651-1353
We accept Bank Americard/VISA and MasterCard

IBM, PC, XT, AT trademarks of International Business Machines. Drives and computer boards not included.

these deltas. As shown in figure 3, a change set results from the difference between an existing version of X files for each platform and the updated files provided in the MIT distribution for that platform. Although figure 3 shows the difference for each platform as a single change set, in practice there would probably be many change sets, depending on the number of logical changes contained in the distribution for each platform. Each change set is also assigned appropriate attributes (e.g., version number, platform, and feature name).

The sum of all the change sets for all platforms could also be represented as a single change object. This collection of change sets, representing the new X features, can then be migrated to the company's various platforms.

As shown in figure 4, a new version of the software company's products (i.e., ones with the new X features) results from the application of the change sets to the existing version of each of the company's products. For some platforms, no doubt, not only would the new change set have to be selected for a particular platform, but some prior changes, such as those from a previous X distribution, would also have to be deselected.

Because the new code on the X distribution disk comes from outside the path of the company's own sequence of development, it cannot manage these changes using a sequentially oriented SCM system. The only alternatives are to hand-stitch (and later perhaps unstitch) the X code into its product—or else use objects to turn these changes on and off.

continued

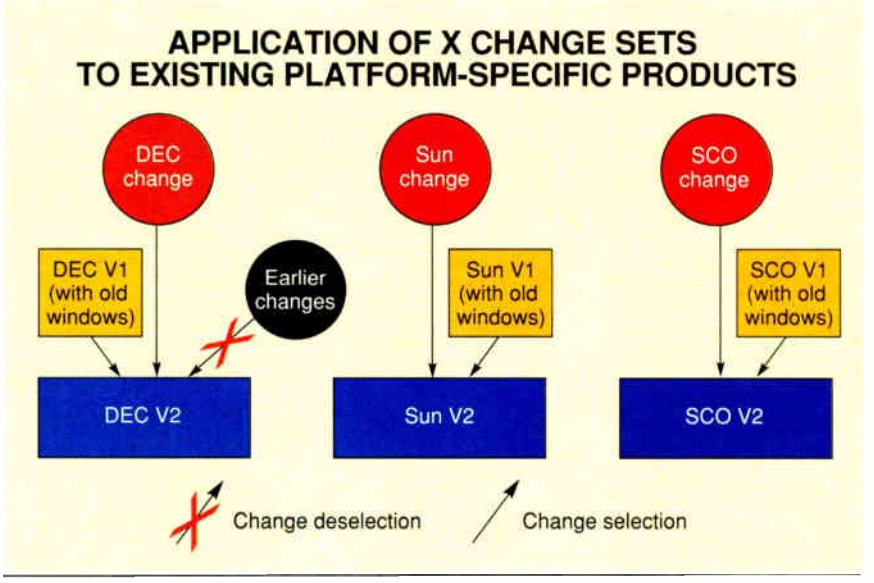


Figure 4: *A new version of the products built using X features results from the application of the change sets to the existing version of each of the products.*

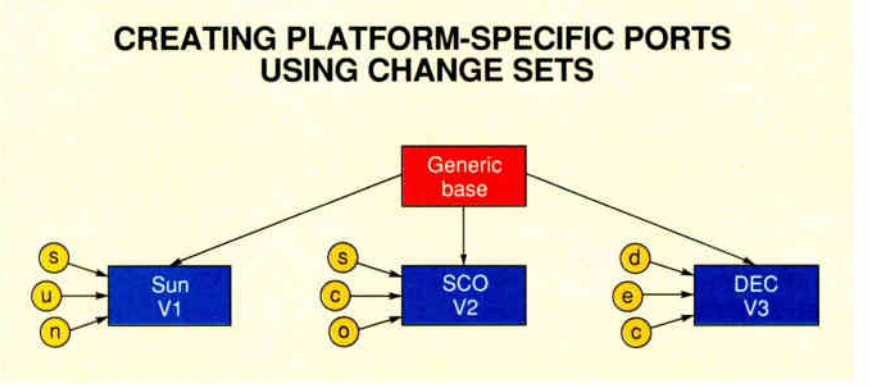


Figure 5: *A simplified model of a product port of generic files to Sun, SCO, and DEC platforms.*

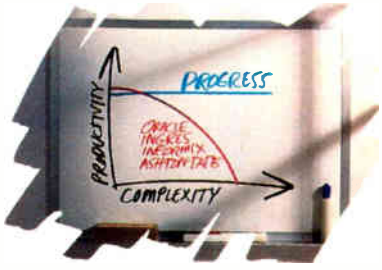
World Radio History

WOULD YOU get on board any SYSTEM THAT only takes you 80% OF THE WAY?

THE WORST TIME to discover that you can't complete a critical application is when you're in the middle of it.

YET IT HAPPENS. Why? Because professional developers have never had a comprehensive, high-level system designed to build even the most complex applications. Never, that is, until PROGRESS.

THE PROGRESS APPLICATION Development Environment is built by developers, for developers. It provides everything you need for the fast, easy creation and execution of strategic applications–from prototype right through to delivery.



The PROGRESS Application Development Environment maintains productivity during complex applications while others cannot.

HOW? PROGRESS GIVES you the most flexible 4GL and relational database system available, including ANSI standard SQL. It's specifically designed to do 100% of the job, enabling you to build industrial-strength applications with a single, high-level language. Without resorting to unproductive third-generation languages.

THE SEAMLESS PROGRESS environment gives your application the flexibility to run on almost every major platform. And to connect to most network protocols and other databases. This ensures portability and interoperability in an ever-changing heterogeneous environment.

THAT'S WHY, IN the last three Datapro Surveys and the latest VAR Business Report Card, developers rated PROGRESS #1 in virtually every category, ranging from ease of use and data management to customer support and documentation.

CALL 1-800-4-PROGRESS for survey results or how you can get a fully functional test drive. Because when you're dealing with serious applications, getting less than 100% from your system won't fly.

PROGRESS SOFTWARE

PROGRESS applications are fully portable across the broadest spectrum of hardware platforms, operating systems, networking protocols and user interfaces. So many, in fact, that we had to list them here in small type: AIX™, A/UX™, BTOS®, OS/2®, UNIX®, ULTRIX™, VMS™, XENIX®, DECNET™, LAN MANAGER™, NETBIOS™, NOVEL® NETWORKS, TCP/IP, MICROSOFT® WINDOWS™, and the X WINDOW SYSTEM™. Also, PROGRESS lets you process information in other databases, including ORACLE, Rdb and RMS.

PROGRESS is a registered trademark of PROGRESS SOFTWARE CORPORATION. All other trademarks and registered trademarks are the property of their respective manufacturers.

BYTADV 01

Circle 131 on Inquiry Card (RESELLERS: 132).

World Radio History

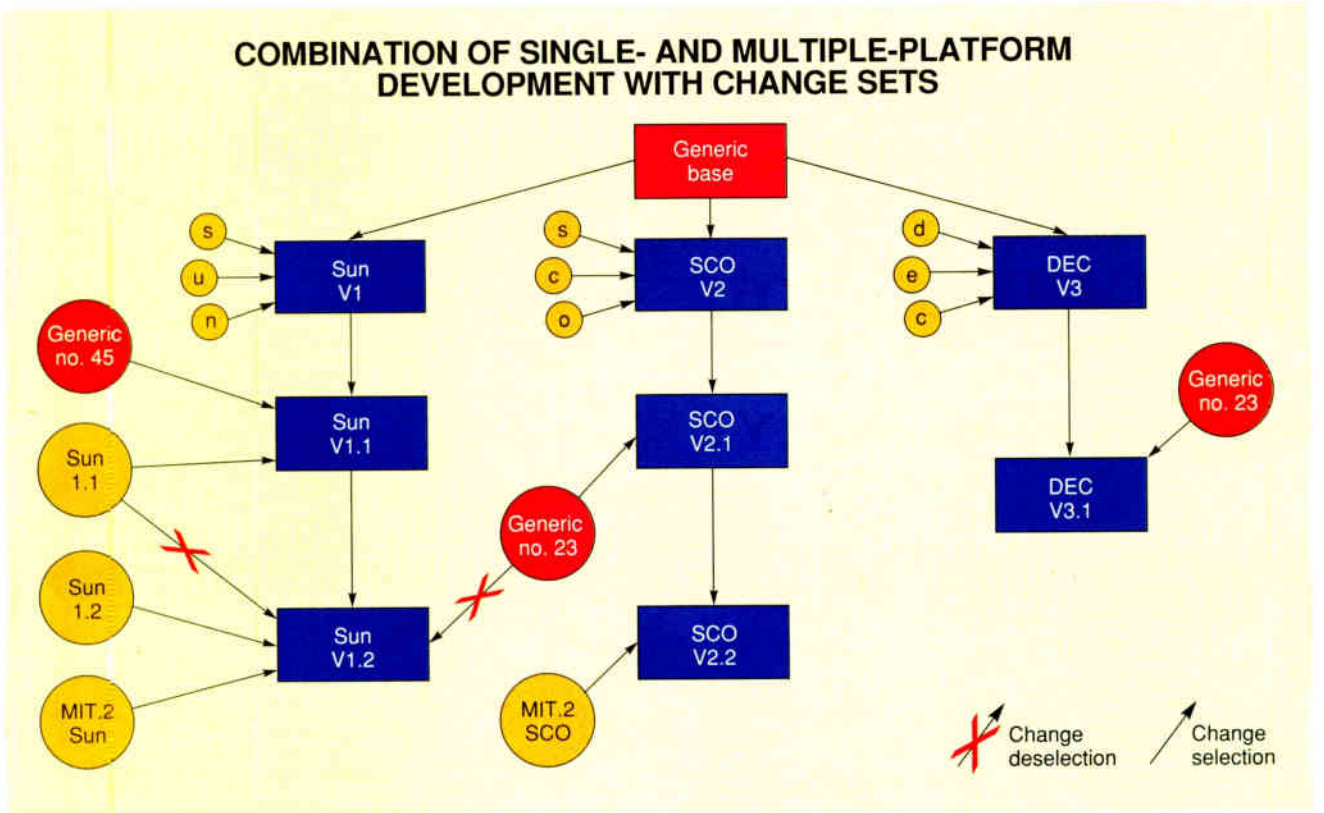


Figure 6: *Simultaneously developing software in two directions means that changes are made to successive versions of a product on each platform, and changes made to a product on one platform are migrated to products on other platforms.*

The benefits of an object-oriented approach become even clearer in the X-update example when one remembers that the X-related changes are not the only kinds of changes likely to be happening to the product at any one time. Among the other types of changes that are also occurring simultaneously are ports to other platforms, as well as general product-feature innovations.

Figure 5 shows a simplified model of a product port of generic files to Sun, SCO, and DEC platforms. For purposes of illustration, the changes needed to turn the generic base into a platform-specific release are represented as just a few change objects for each specific platform.

Again, there might very well be many change sets associated with each logical change required for a platform migration; however, all change sets could be linked to one object—and the number of change objects involved does not alter the basic methodology. For this company, changes have been organized into change objects so that a port is implemented by selecting the change set associated with the desired platform and deselecting any other port's platform-specific changes that may have been present in the code.

Figure 6 illustrates the process of developing software in two directions at once. Changes are made to successive versions of a product on each platform, and changes made to a product on one platform are migrated to products on other platforms. Again, to keep the picture simple, only a few change objects and a few releases are shown. Whether porting the product to other platforms, developing successive versions on the same platform, or importing external code, as with the previously mentioned case with X, changes are managed in a consistent and coherent way. Where software originates—or is used—does not restrict the management process.

The ability to move changes between development paths does introduce one complication not encountered in sequential-change SCM systems—conflict. A conflict might be created when a change on one development path removes a subroutine and a change on another path includes the subroutine. If the two changes are merged into the same path, someone must review the changes to see that the conflict is resolved.

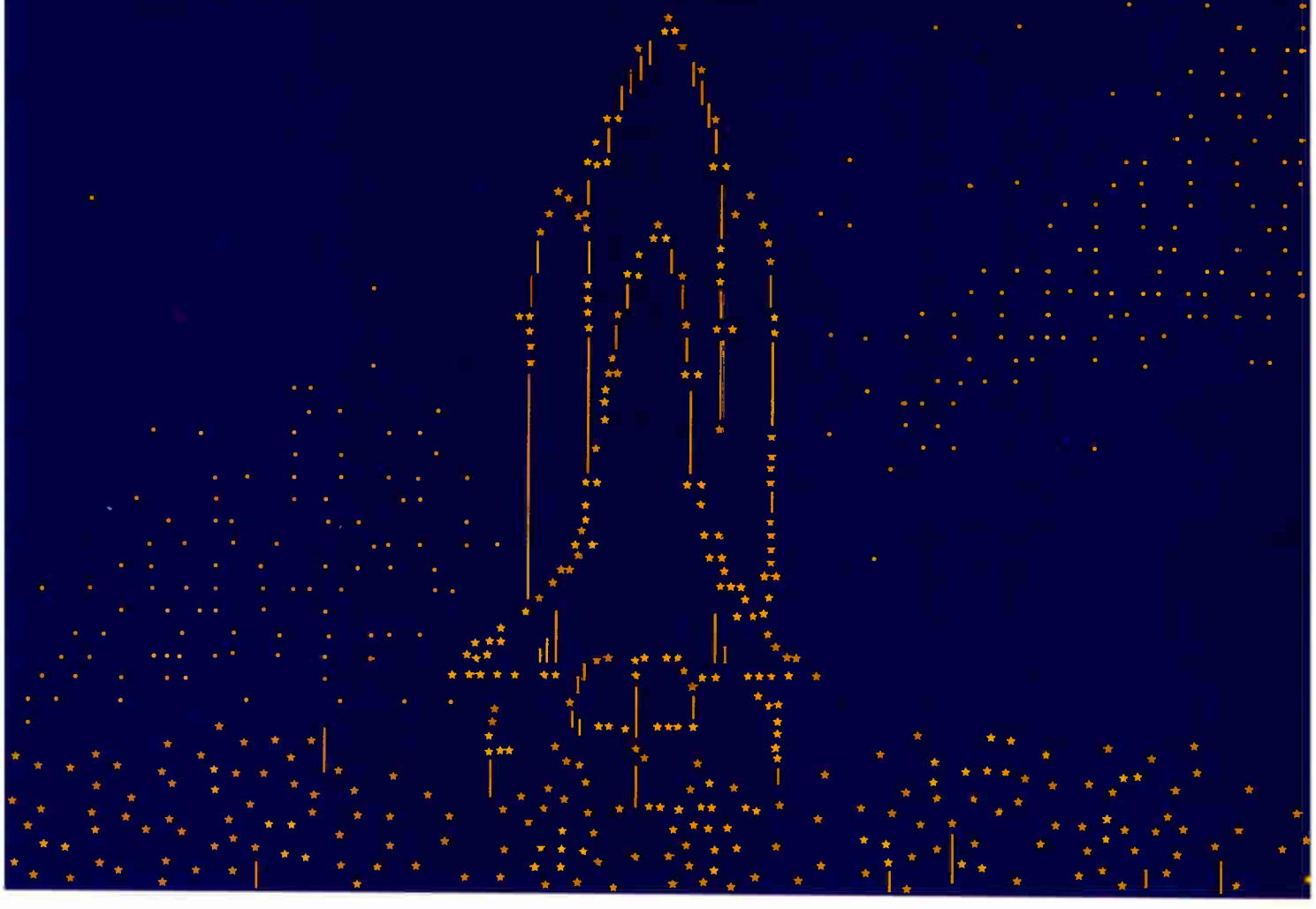
Conflict can occur any time two development paths change the same file. For example, if `file.list.mit` is the list of files changed between MIT V1 and MIT V2, and `file.list.local` is the list of files changed between local version V1 and local version V2, then the intersection of these lists consists of files to be checked for conflict. Even though no system has been invented that resolves logical conflicts automatically, an object-oriented system is ideal for identifying situations where such logical conflicts can exist. That is because it can sort changes by attribute (e.g., all the changes made to a release that reference the same subroutine or hardware device).

Complexity issues such as conflict are more likely to occur in the multiplatform environment, where most software writers work today. These are the kinds of issues that computer technology, especially object-oriented technology, is particularly well suited to address. It is ironic that software developers have waited so long before applying these techniques to their own work. ■

Randall D. Cronk is a Boston-based freelance writer on computer technology and the industry. You can reach him on BIX c/o "editors."

World Radio History

The Right Stuff. For You.



Whether you're working to keep the space shuttle in orbit or analyzing complex census data, SPSS has the right statistical software for you. The same company that helps NASA get off the ground safely through problem-trend analysis, can help make your systems go with in-depth, easy-to-use software. Software that gives you the power to access, manage, analyze and present data. Software supported by the documentation and training that's set the industry standard for over 25 years. Take off with SPSS, suppliers of statistical solutions to over 2 million users worldwide. Call 1(800)543-5835 or FAX (312)329-3668. The sky's no longer the limit.

SPSS *We're Making It Easier To Decide.*

Chicago · Washington, DC · Berlin · Chertsey, UK · Gorinchem, The Netherlands · Munich · New Delhi · Singapore · Stockholm · Sydney · Tokyo · And Distributors Worldwide. **Statistical Software For All Leading Computing Environments.**

Circle 155 on Inquiry Card.

World Radio History

THIRD INTERNATIONAL COMPUTER FORUM (ICF)

COME TO MOSCOW!

- ☐ The ICF brings together people that influence and determine the major trends of information technologies in the USSR and world-wide
- ☐ The ICF lets western companies obtain top-quality, first-hand information about the real and potential computer and software markets in the USSR
- ☐ The ICF provides Soviet computer professionals with better access to products and technologies from the rest of the world

Scheduled Speakers:

- Philippe Kahn (Borland)
- Jerry Kaplan (Go)
- Greg Herrick (Zeos)
- Dick Williams (Digital Research)
- Esther Dyson (EDventure Holdings)
- Stewart Alsop (InfoWorld)
- Ken Wasch (Software Publishers Association)
- Fred Langa
- and others.

Topics:

- Status of the USSR computer market; business opportunities
- Future of PC market
- Workstations market
- Macintosh
- UNIX applications
- LAN policy
- LAN practice
- Windows and OS/2 market
- Pen-based technologies
- etc.

If you're a part of the emerging Soviet and east European computer industry, or if you want to learn more about doing business with that rapidly-growing market, *you need to attend the Third Annual International Computer Forum!*

SAVE MONEY BY PRE-REGISTERING

The registration fee covers access to keynotes, sessions, presentations, exhibitions, cultural programs, 3 lunches and 3 receptions. Register before March 31, 1992 and receive the special discount rate of just US$760. After March 31, 1992 the normal fee of US$840 applies.

RESERVE YOUR EXHIBITION SPACE

Price includes exhibition space itself, labor for building the booth, power supply (220 volt, 50Hz), and furniture (tables, chairs, etc.). The fee is US$3400 for each 9 sq.m. ($2800 for the members of ICC).

FOR MORE INFORMATION

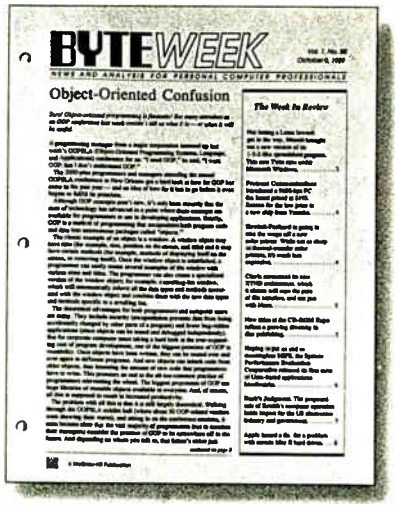
Contact the ICC at:

Mail: 101813 USSR,
Moscow, Proyezd Serova, 4.
Fax/phone: 7-095-921-09-02.
MCI ID: 439-1034.
Internet: levon@staff.icc.msk.su.
San Francisco-Moscow
Teleport: ICC.

JUNE 15-18, 1992
WORLD TRADE CENTER, MOSCOW, USSR

World Radio History

The Cream. The Crop.



There are plenty of places to get information in this industry. Too many. But if you want the best quality information, there's only one that rises to the top: BYTE*WEEK*.

BYTE*WEEK* is a weekly newsletter from the same professionals who produce BYTE Magazine. Each week, the most important news and information from the previous week is presented in a readable and concise manner. BYTE*WEEK* offers you what no other publication can: timely news on the rapidly-evolving computer industry as it happens with the interpretation and evaluation that only BYTE's experienced editorial staff can provide.

Subscribe now and take advantage of a special subscription rate of $395 ($495 outside the U.S. and Canada). Your subscription to BYTE*WEEK* also includes a free subscription to BIX, BYTE's exclusive on-line conferencing system. *Don't miss this opportunity!*

For fastest service, call toll-free **1-800-258-5485** (in N.H., call **603-924-9281**) and charge to a major credit card or we'll bill you.

BYTEWEEK

One Phoenix Mill Lane, Peterborough, NH 03458.

BYTE*WEEK* offers a money-back guarantee if you are not completely satisfied.

Clip Coupon Here

☐ **YES! Sign me up as a subscriber to the Cream of the Crop, BYTE*WEEK* at the special subscription rate of $395 a year for 50 issues ($495 a year outside the U.S. and Canada).**

Name _____
Title _____
Company _____
Mail Address _____
City/State/Zip _____
Business Phone _____

☐ MasterCard ☐ VISA
☐ Check enclosed ☐ Bill me

Card # _____
Exp. _____
Signature _____

BYTEWEEK One Phoenix Mill Lane
Peterborough, NH 03458

World Radio History

You must have heard how SOUND BLASTER took the PC market by storm...

Now the ***HURRICANE****...*

Sound Blaster Consistently **No.1** on **BEST SELLER's** List of major USA distributors for the past year

SOUND BLASTER PRO

Stereo Music/Voice/Speech/MIDI/CD-ROM Interface/Game Port

The Multimedia Sound Standard

"It's the next-generation sound card and it is loaded! The operative word is "twice." It has twice the sound channels (22) of the original Sound Blaster with twice the quality of sound in stereo, as well as stereo DACs for digitized speech and sound effects."
Computer Gaming World
August 1991

"With its associated software, it has quietly (no pun intended, but what the heck) become the standard sound system for advanced PCs."
Jerry Pournelle, BYTE June 1991

COMPUTE August 1991

" ...Creative Labs is now turning up the volume with the Sound Blaster Pro. It's basically two Sound Blasters on a single card with additional multimedia features thrown in. It has twin FM chips capable of creating 22 individual voices, two DACs for stereo voice and sound-effects playback, a stereo microphone jack, and a built-in stereo mixer that can adjust the volume of all your Sound Blaster audio sources (stereo DAC, stereo FM, microphone, stereo line-in, CD-Audio and PC internal speaker).

The built-in mixer makes the Sound Blaster Pro fully compliant with Microsoft's Multimedia Level 1 Extensions to *Windows*. Multimedia software will be able to fade-in, fade-out and pan the various audio sources to create elaborate sound montages.

The Sound Blaster Pro includes a CD-ROM interface for either an internal or external CD-ROM player. There's also an internal connector for CD-Audio. The MIDI interface is compatible with the original Sound Blaster's MIDI interface but adds the MIDI time-stamp that's part of Microsoft's new multimedia standard.

All in all, the Sound Blaster Pro is chock-full of new features, yet it's fully compatible with its younger brother."

Reprinted by permission of COMPUTE ©1991, COMPUTE Publications International Ltd

At a *devastating* price of $299.95 and you get a "chock-full of features":

* Stereo DAC for digitized sound output
* Stereo voice recording from mic, CD or Line-in
* Sampling rate 4KHz to 44KHz
* Stereo 22-voice FM music synthesizer
* Stereo mixer with digital volume controls
* MIDI interface with adaptor and cables
* Built-in CD-ROM interface
* Joystick Port
* Microphone AGC amplifier
* Power amplifier (4W per channel)

and loads of **FREE** bundled software:

* MIDI Sequencer
* Pro-Intelligent Organ
* VEDIT2 - Voice Editor & Utilities
* SBTALKER - text-to-speech synthesizer with DR SBAITSO2
* Talking Parrot - voice in/out application.
* MMPLAY Multimedia Presentation
* CD music player
* Windows 3.0 DLL and sound applications

"The big question is, at a list price of $249.95, is the Sound Blaster worth the investment? Yes, yes, a thousand times yes!!!" **PC HOME JOURNAL**

How many "yes!!!" would you give now that the Sound Blaster list price is reduced to **$169.95**! And you get:

* DAC for digitized voice output
* ADC for voice recording
* 11-voice Ad Lib FM synthesizer
* Full duplex MIDI interface
* Joystick Port
* Microphone amplifier
* Power amplifier (4W per channel)
* Bundled software: • Intelligent Organ • Talking Parrot • Voice Toolkit • SBTALKER • DR SBAITSO • Jukebox for Windows 3.0

Sound Blaster Micro Channel Version is also available.

North America master distributor:
Brown-Wagh Publishing
130D Knowles Drive Los Gatos CA 95030
For your nearest dealer, call **1-800-451 0900**
Tel (408) 378 3838 Fax (408) 378 3577

CREATIVE LABS, INC.

2050 Duane Avenue Santa Clara CA 95054
Tel (408) 986 1461 Fax (408) 986 1777

Outside North America, contact:

CREATIVE TECHNOLOGY PTE. LTD.

75 Ayer Rajah Crescent #02-04 Singapore 0513
Tel (65) 773 0233 Fax (65) 773 0353

Microsoft and Windows are registered trademarks of Microsoft Corp and Ad Lib is a registered trademark of Ad Lib Inc. Sound Blaster is a trademark of Creative Labs, Inc.

THE PC SOUND STANDARD

Largest support of Multimedia, Music, Education, Entertainment & Productivity software under DOS and Windows 3.0.

Circle 208 on Inquiry Card.

World Radio History

LET THE SYSTEM DO THE PORTING

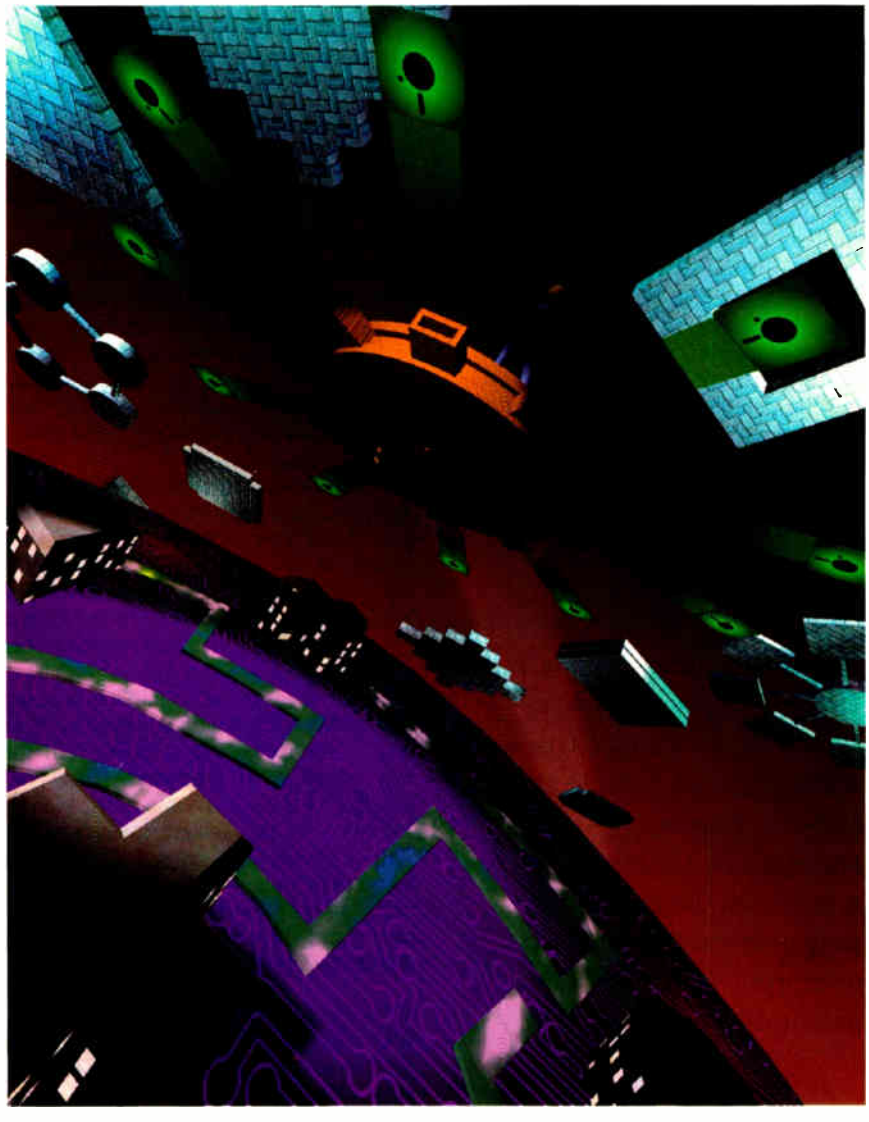
New cross-platform operating systems are coming in the 1990s

ELLEN ULLMAN

The operating system used to be the last place you would look for help in writing applications for multiple platforms. Traditional system software looked down deep into the iron. The operating system was part of the hardware—designed to complement it, fix its limitations, and highlight its good features. The system software was like an iceberg: One-tenth of it was visible above the surface, and nine-tenths had a secret existence deep below.

Suddenly, the operating system is cutting off its longtime relationship with hardware. Microsoft, SunSoft, the Apple/IBM alliance, The Santa Cruz Operation (SCO), and other vendors of system software are falling over each other to offer portable operating systems (see the table). All these companies are promising to deliver systems in the first part of the 1990s that will run on multiple processors using both CISC and RISC architectures.

A number of these new systems will offer full binary compatibility across microprocessors and some source code compatibility. Some will run programs designed for other application programming interfaces (APIs). But whatever the degree of portability, the new operating systems will free the developer from dependence on a single type of hardware. The idea of the portable operating system, which began with Unix, now seems to be everywhere.



Vested Is as Vested Does

Will the new portable operating systems solve the problem of cross-platform development? Not completely. System vendors aren't going to make it easy to port

ILLUSTRATION: JIM LUDTKE © 1992

World Radio History

NEXT-GENERATION PORTABLE OPERATING SYSTEMS

Operating systems that have been announced for the first part of the 1990s include four brands of Unix, one of Windows, and one altogether new breed of object-oriented system. The ideal of the portable, scalable operating system—which started with Unix—will live on into the next decade.

Operating system	Company	Description	Platforms	Supported APIs	Release
Open Desktop	The Santa Cruz Operation	OSF/1-based Unix with X/Motif user interface; ACE operating system	Mips R3000; Mips R4000; Intel 80x86	OSF/1 Unix; Posix; DEC Ultrix; SCO Unix System v/386; SVR4 kernel	Mid-1991 for Mips R3000/R4000 (Open Desktop for Intel shipped January 1990)
PowerOpen	Apple and IBM	IBM AIX with Apple and OSF/Motif user interfaces	PowerPC RISC* on machines from Apple and IBM	AIX; Mac	1993-1994
Solaris 2.0	SunSoft (Sun Microsystems)	SVR4 Unix with Open Look user interface	SPARC; Intel 80x86	SVR4 Unix; on Intel platform only: DOS (emulation), Windows 3.0 (emulation)	First half 1992
Taligent	Taligent (Apple and IBM)	Platform-independent; object-oriented	PowerPC RISC*; Intel 80x86; Motorola 680x0	Mac; OS/2; AIX	Mid-1990s
Windows NT	Microsoft	32-bit, multitasking Windows; ACE operating system	Mips R4000; Intel 80x86	32-bit Windows; 16-bit Windows (emulation); DOS (emulation); Posix; OS/2 1.3 and 2.0	1992
USL SVR4 (ACE version)	Unix Systems Laboratories	The original portable operating system	Mips R3000; Mips R4000; Intel 80x86	Posix; SVR4; OSF/1 AES	Second half 1992

* single-chip version of RS/6000

applications between their own platforms and those of their competitors. Until clear leaders begin to emerge from the new operating-system pack, vendors will continue to have a vested interest in touting the competitive advantages of their own systems. The code for Windows NT is not likely to translate into SCO Desktop code, and Solaris applications probably will not easily migrate to the Taligent object-oriented system.

BYTE ACTION SUMMARY

Operating systems coming in the early 1990s are being designed to run multiple types of programs on multiple processors. Developers writing applications for these new systems may be able to reach an unprecedented number of platforms with little or no porting effort.

However, new portable systems will offer developers a chance to reach an unprecedented number of hardware platforms with a single version of source code. If you can run on every Sparcstation and every Intel 386 and 486 machine, why would you need to develop for any other platform?

With the nascent Apple/IBM system, Taligent, your code could run on Macs, IBM RISC System/6000s, and Intel machines. If you choose SCO Open Desktop, your code will run on every Mips R4000 machine and every Intel 386 and 486. Why would you ever want to port again?

Never have to port again? Just being able to hope for a utopian goal such as this is almost reward enough. Will the new portable systems make that goal possible? I'll discuss some of the technical advances that made possible the advent of portable system software. I will look at the systems about to emerge over the next decade, the companies behind them, and the cross-platform strategies they are adopting.

Why Portable Operating Systems?

Why now? Why is there the sudden competition to offer multiple-processor operating systems? The answer is that portable operating systems had to wait for two long-term developments. First came the need for more powerful desktop microprocessors. Then came the need for the desktop market to agree on the proper role of the personal computer's operating system.

Consider the evolution of the desktop microprocessor. Advances in chip design and integration have given us CISC and RISC chips with processing power unimaginable in the days when CP/M and MS-DOS were born. Add to that factor the advent of cheaper memory and faster I/O channels, and suddenly desktop systems can supply more cycles than you can possibly use when you are running a single program.

Existing operating systems were created during a period of scarce system resources. At that time, traditional system software was based on the idea of limitations—in processor cycles, memory, and I/O channels. Developers of operating systems had to devise a way to dole out resources to hungry programs—the third-world model of needy processes and not enough goods to go around.

Scarcity—The Mother of Invention

During the bad old days of "legacy systems," what differentiated one operating

World Radio History

system from another was its approach to the condition of scarcity. Memory was chopped up into regions or segments, fixed or variable, real or virtual. Processor cycles were scheduled by time slicing and round-robins and so on.

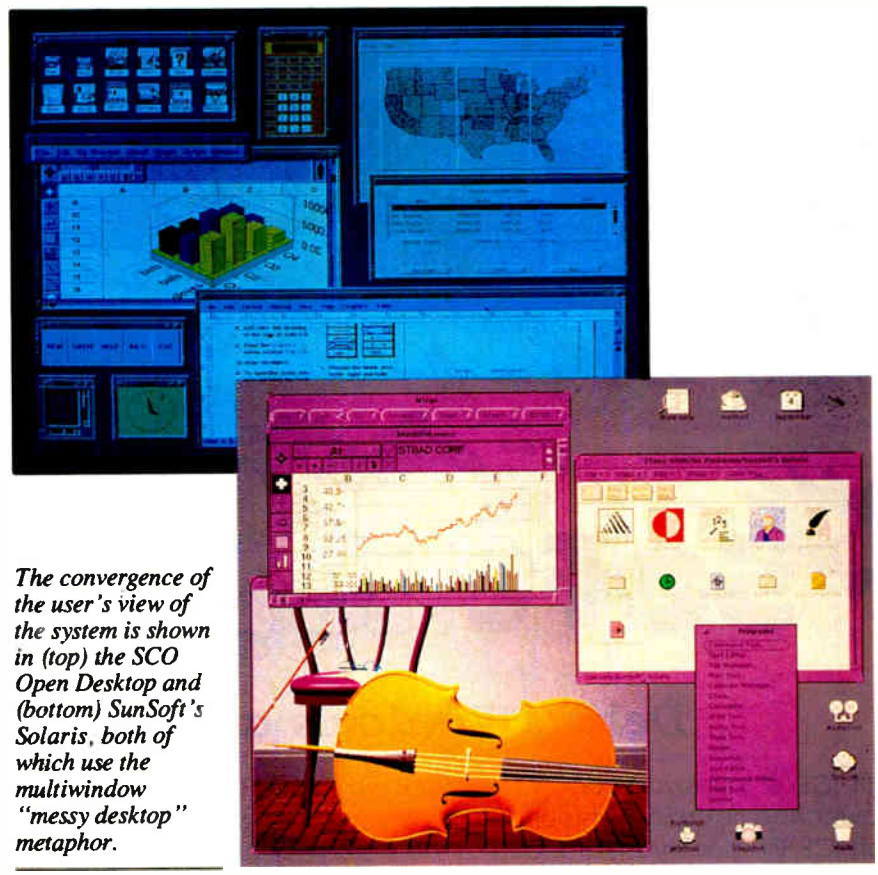
Some systems could handle only one task at a time; some, only a fixed number of tasks; some, a variable number. And applications were not shielded from the particularities of these internal designs. The API was little more than a set of calls that directly reflected the architecture of the underlying operating system.

At that time, a traditional system took its name and flavor from the set of design solutions chosen by its developers. MVS (Multiple Virtual System), VM (Virtual Machine), and VMS (Virtual Memory System) are but a few of the classical operating systems that were named for the type of architecture they used. To see how things have changed, consider the names of forthcoming systems—Open Desktop, Windows, Taligent, and Solaris. None of these monikers even attempts to describe an operating-system design solution, except perhaps to hint at the heady and slightly misleading idea of openness.

Then prevalent resource rationing applied to the operating system as well as to the applications it had to support. Kept busy loading programs, allocating memory, keeping track of registers, and so forth, the operating system had little time left over for extra services. Operating systems and hardware had to work in concert as tightly tuned and tightly related mechanisms.

As hardware became more powerful, the operating system began to offer more services to support applications. Like any other program, system software can take on more than basic housekeeping tasks. User input support, graphics display, interapplication communication, even object linking—all these services are now seen as essential operating-system work.

Now, sitting atop powerful processors, the modern operating system not only can offer more services, it can also afford to abstract those services: The system can present memory, devices, and user inputs as metaphors, not machines. With many more processor cycles available, the system can absorb the overhead of abstraction without significantly degrading its performance. In other words, the operating system can begin to present itself as a truly virtual machine. It can interact with the hardware below the surface, all the while offering an entirely different face to the application program.



The convergence of the user's view of the system is shown in (top) the SCO Open Desktop and (bottom) SunSoft's Solaris, both of which use the multiwindow "messy desktop" metaphor.

The more powerful the hardware, the less the application has to be aware of it. The operating system, freed from squeezing every last drop of performance from the hardware, can pay more attention to the application. The API is no longer a by-product of system design; it is the reason for the system design. It's as if the iceberg has flipped over: The operating system has begun to spend less time looking down and more time looking up at its client programs.

Agreement on the Role of the Operating System

We hear little argument among vendors these days about what an operating system should be—their lists sound almost interchangeable. Just about all system vendors, it seems, will support multitasking, symmetric multiprocessing, 32-bit addressing (at least), a flat memory model, and virtual memory. Every system will have a GUI, and there will be support for networking and distributed processing. Systems will be event driven and will have interprocedure communications mechanisms and some form of object-linking scheme.

Even the look and feel of the new operating systems is beginning to converge. All the new systems present themselves to the user as desktops filled with icons and palettes. Point and click, copy and paste, drop and drag—by now almost everyone knows how to perform these operations.

Generally speaking, this convergence in operating-system features (see the screen) helps users, operating-system designers, and applications developers. Users can carry their experience from one system to another, no longer confronted with that terrible blank screen waiting for input. Operating-system designers, freed from having to reinvent the wheel, can concentrate on applications services and portability strategies. And developers inherit the extra work being performed by the operating system.

Notice that this agreement about operating systems is only occurring on mature platforms. Don't look for portable operating systems yet on palmtops, handheld computers, and pen-based systems. In those arenas, hardware standards are still emerging, and resource scarcity—especially scarcity of power—is still a major factor in system design. For now, where machines are portable, system software is not.

continued

World Radio History

Get Inside WINDOWS!

MICROSOFT WINDOWS
Version 3.0 Compatible Product

Debug Windows at the systems level!

Soft-ICE/W takes you inside Windows! Debug and explore with power and flexibility not found in any other Windows debugger! Soft-ICE/W allows you to debug at the systems or applications level or simply learn the inner workings of Windows.

- Debug VxD's, drivers and interrupt routines at source level
- Debug interactions between DOS T&SR's and Windows Apps
- Debug programs in DOS boxes
- Display valuable system information
  (from the total memory occupied by a Windows application, to the complex internal structures of Windows)

Soft-ICE/W uses the 386/486 architecture to provide break point capabilities that normally require external hardware. Nu-Mega, which pioneered this technology with the introduction of its award winning Soft/ICE for DOS, now gives Windows programmers the same debugging power... *and still at a software price.*

Own the debugger that combines the best "view" of Windows internals with the most powerful break points of any software debugger.

Soft-ICE/W . . . Only $386

ALSO

CodeView for Windows users

See what you're debugging without flash

CV/1 version 2.0 runs CodeView in a graphics window letting you see CodeView and the program screen at the same time. If you're spending more than 10 minutes a day in your debugger you should be using CV/1.

- Runs CodeView on **any** monitor that supports Windows.
- No more "Flip-Swap-Flash". Step through code without the annoying flash.
- Small Window Mode shrinks the debugging window to a few lines of source.

***CV/1* v2.0 . . . $129**

Call: **(603) 889-2386**
FAX: **(603) 889-1135**

P.O. Box 7780
Nashua, NH 03060-7780 U.S.A.

Nu-Mega™ TECHNOLOGIES INC

RISK = NULL
30 DAY
MONEY-BACK GUARANTEE

MICROSOFT WINDOWS IS A REGISTERED TRADEMARK OF MICROSOFT CORP. Soft-ICE/W AND CV/1 ARE TRADEMARKS OF NU-MEGA TECHNOLOGIES, INC.

Circle 115 on Inquiry Card.

World Radio History

Microsoft makes sure you fly realistically. It's up to you to fly responsibly.

So you get an urge to buzz the Golden Gate Bridge. Okay. You can ignore the FAA–but not the crosswinds. Because in the world of Microsoft® Flight Simulator® 4.0, everything that happens is true to life.

Banking, climbing or dodging thunderheads, your plane responds with perfect realism to your every move. Plus, you have 100,000,000 square miles of land to fly over. And four planes to choose from: a Cessna, a Lear Jet, a sailplane, or a dogfighter's dream–the Sopwith Camel.

Ask your Microsoft dealer about PC Flight Simulator. Take it into the air. And find out what they really mean by "the wild blue yonder."

Microsoft

© 1991 Microsoft Corporation. All rights reserved. Printed in the U.S.A. Inside the 50 United States, call (800) 541-1261, Dept. T77; outside the 50 United States, call (206) 936-8661. Customers in Canada, call (416) 568-3503. Microsoft and the Microsoft logo are registered trademarks of Microsoft Corporation. Flight Simulator is a registered trademark of Bruce Artwick

ACE Initiative: Deuce or Joker?

In April 1991, 21 companies affiliated and announced the formation of the Advanced Computing Environment (ACE) initiative. At the onset of this liaison, the computing world was overwhelmed with the idea of unprecedented software portability across two processors and two operating systems, available from multiple hardware and software vendors. Then reality set in.

Once there was time to look more closely at what ACE was offering, it was clear there would be no magic portability pill. The group had chosen to standardize on two operating systems, a Unix system called Open Desktop, from SCO, and a new version of Windows from Microsoft, to be called Windows NT (for New Technology).

Each of these systems would run on two architectures, the Mips R4000 RISC chip and the Intel 386/486. However, although each system would be portable across hardware platforms, ACE would not even address the question of a porting strategy between the two operating systems. In other words, the two operating systems would be competitors, not portability partners.

To further complicate the picture, a dissident group within the initiative was protesting the choice of SCO's OSF/1-based version of Unix. The self-proclaimed Apache Group within ACE was fighting for a System V release 4.0 (SVR4) version of the Unix operating system in place of, or along with, the SCO system.

As of this writing, ACE has agreed to add support for the SVR4 kernel, and Unix Systems Laboratories has joined the ACE group. This ACE support for SVR4 may mean the first step toward a merged Unix API, or it may mean more intense competition within ACE over the future of Unix. USL intends to supply its own "ACE-compliant" operating system, placing itself toe-to-toe with SCO.

ACE, as it turned out, was really a deuce. The group of 21 had chosen two of everything: two "standard" operating systems, two competing versions of Unix, two microprocessors, and, as was later announced, two standard hardware buses. There would be not one applications binary interface, but two—one for RISC architectures and one for CISC architectures. The initiative would not deliver on the tantalizing promise of shrink-wrapped applications able to run on all "ACE-compliant" hardware. According to Richard Treadway, manager of the Western Software Laboratory at DEC and an ACE participant, there might be "incompatibilities" between the hardware platforms, even within operating systems.

Reviewing the ACE portability road map, it was soon clear that developers wishing to write applications for all ACE-compliant hardware would need four compilers and two architecturally incompatible versions of source code. They would need source code for Windows NT and for SCO Desktop, as well as compilers for Windows NT on Intel, Windows NT on Mips, SCO Desktop on Intel, and SCO Desktop on Mips. This is portability? Is ACE a joker?

To be fair to ACE, the portability benefits of the initiative should be looked at one operating system at a time. A certain amount of cynicism is unavoidable when you look only at the hoopla of the overall announcement involving multiple processors, software vendors, and hardware manufacturers.

But, putting aside the political complications, you can see that ACE is offering developers competition in the very area that will benefit them: cross-platform operating systems. Two very different operating systems, SCO and Windows, are competing for precedence across the CISC/RISC divide. This competition can only be good for developers.

What follows is a roundup of the new cross-platform operating systems due in the first part of the 1990s, starting with the two ACE offerings.

SCO Open Desktop

SCO's version of Unix for the Intel 386/486 platform quickly became a popular system environment. As an example of the burgeoning success of SCO Unix, a recent survey of the members of UniForum, a Unix users organization, reported remarkable growth in the use of the SCO system. Between 1990 and 1991, use of SCO Unix went from somewhere in the "other" category to second in overall use among UniForum members, ahead of SunOS and second only to Unix System V.

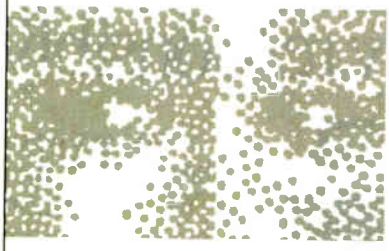
SCO no doubt hopes to find the same response to its version of Unix for the Mips R4000 platform. SCO Open Desktop for Mips will allow developers who have switched to SCO Unix to follow their operating system to the RISC platform. Open Desktop for Mips will offer source code compatibility with Open Desktop for Intel-based applications and with applications written for SCO/Unix System V/386. In addition, SCO Desktop offers binary compatibility with DEC Ultrix systems.

SCO describes the Open Desktop as consisting of three components: operating-system services, networking services, and the GUI. According to reports

World Radio History

Circle 54 on Inquiry Card.

RealTime.



New, affordable video frame grabber for IBM computers. ComputerEyes/RT includes everything you need to capture high-resolution 8- or 24-bit color (or 8-bit gray scale) images from any standard composite or S-video source in real time.

VGA and Super-VGA compatible. All popular file formats are supported.

Call today for more information and free demo disk.

Other versions available for IBM PC and Macintosh from under $250.

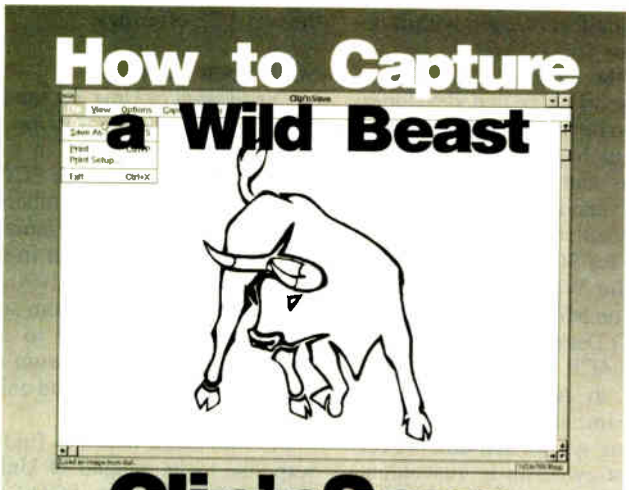
Digital Vision, Inc.
270 Bridge St., Dedham, MA 02026
(617) 329-5400
To order call (800) 346-0090

New 24-Bit Color Video Frame Grabber For Under $ 600.

Digital Vision

COMPUTEREYES™

How to Capture a Wild Beast



Clip'nSave

lets you have your screen in a flash

The simplest and most intuitive screen capture program is now available for Microsoft Windows. Many options available including freehand capture and single-key screen printing. Works in mono, gray, and 16 to 16 million colors. Reads and writes BMP, DIB, TIF, PCX, GIF, and EPS. Also available for OS/2 Presentation Manager.

ORDER NOW! SATISFACTION GUARANTEED!

DYNA LINK TECHNOLOGIES

TO ORDER: 1-800-522-4624
or 1-514-489-3007

Dynalink Technologies Inc. P.O.Box 593, Beaconsfield (QC) Canada H9W 5V3

LET THE SYSTEM DO THE PORTING

from SCO, the kernel of the Open Desktop is based on OSF/1 technology.

The system incorporates technology from USL's System V/386 release 3.2. The operating system is compatible with multiple standards for the Unix system, including the following: X/Open Portability Guide Issue 3, Posix 1003.1; Posix 1003.2; Posix 1003.4 (draft); FIPS 151-1, OSF Application Environment Specification; System V Interface Definition Issue 2; and System V Interface Definition Issue 3.

The networking component, like the core operating system, will support multiple standards. The SCO system will support TCP/IP, Sun's Open Network Computing (ONC), Microsoft's LAN

Windows NT is a 32-bit operating system that uses a flat-memory model.

Manager for Unix Systems Client Support, Simple Network Management Protocol Agent support for network administration, and, as specifications are finalized, Open Software Foundation's Distributed Computing Environment.

The SCO Open Desktop graphical interface uses the OSF/Motif window manager and is based on the X Window System 11 release 4 standard. When you start up the system, you see a desktop showing icons of available programs and services. You can use drop-and-drag operations to execute interactions among applications. For example, you can drag text from a word processor to an E-mail program to send a memo.

The desktop will also include some form of encapsulation of programs and data, a feature known as *object linking*. At the first demonstration of the system, given last October at a Mips event in San Francisco, SCO announced that opening a file could start up the application that had created the file (e.g., opening a text file could start the word processor).

This encapsulation feature hasn't been demonstrated as of this writing, nor has SCO literature described the mechanism. However, given the competition with

Circle 204 on Inquiry Card (RESELLERS: 205).

World Radio History

Microsoft, which has made much of Object Linking and Embedding in its Windows product for Intel, program/data encapsulation is sure to be a must-have feature for SCO.

Windows NT

Windows NT has its history in the tortured relationship between Microsoft and IBM. The two companies jointly began working on a new graphical 32-bit operating system to replace DOS on Intel platforms. That new operating system was supposed to be OS/2 2.0 with Presentation Manager. Then something happened. According to Microsoft, its Windows 3.0 sold about 2.75 million copies in its first seven months on the market.

Microsoft, finding its fortune in the Windows platform, began parting ways with IBM. After months of rumors and confusion, the two companies announced their separate plans. IBM would work on OS/2 2.0, and Microsoft would take on OS/2 3.0. In a short time, though, Microsoft abandoned all pretense of working on any operating system called OS/2. The company began referring to its new system software as *portable Windows*, then as *Windows New Technology*. With the announcements of the ACE initiative and the Mips R4000, the issue was settled once and for all: Microsoft's new operating system would be Windows New Technology, or NT.

Windows NT is a grown-up form of the popular Windows 3.0 environment. The familiar graphical interface is there, but the system is no longer just a pretty task switcher for DOS. Windows NT is a 32-bit operating system with support for preemptive multitasking, multithreading, and symmetric multiprocessing. It uses a flat-memory model with a protected paged-memory design. The specifications include certified security and support for the 16-bit Unicode character set, which will enable the system to support non-Roman alphabets.

But the design of Windows NT had to be more than that of an advanced operating system with a graphical interface. To save its investment in its current user base, Microsoft had to build into NT an upward migration path from the current Windows 3.0 and DOS platforms. The company approached the problem by turning to a microkernel approach, a technology used in the Mach operating system developed at Carnegie Mellon University. A layered system—consisting of a microkernel, privileged processes, protected subsystems, and applications—lets the operating system run on multiple processors and support multiple APIs.

How to land a 747 in an area no bigger than your desk.

What do you need to bring in a 400-ton, five-story jetliner? Nerves. Skill. And the Microsoft® Flight Simulator® Aircraft & Scenery Designer.

Add it to our Flight Simulator 4.0, and you're off on the most realistic flight experience this side of a PC. You get a Boeing 747-400, complete with computerized flight display. You can also try out a Piper Archer, a Beechcraft Starship or a seaplane. Fly them stock, or push the envelope and modify them to your own specs.

See a Microsoft dealer. Because now it's possible to buy excitement. In the jumbo size.

Microsoft

© 1991 Microsoft Corporation. All rights reserved. Printed in the U.S.A. Inside the 50 United States, call (800) 541-1261, Dept. T77; outside the 50 United States, call (206) 936-8661. Customers in Canada, call (416) 568-3503. Microsoft and the Microsoft logo are registered trademarks of Microsoft Corporation. Flight Simulator is a registered trademark of Bruce Artwick.

Windows NT concentrates the core of its system services in a microkernel, or the NT Executive, as Microsoft calls it. This kernel, which consists of 50 KB of compiled code, contains the machine-dependent portion of the operating system, including support for thread dispatching and multiprocessor synchronization. The kernel is rewritten for different processors. It serves as the native portion of the system, isolating machine dependencies from other more machine-independent operating-system services.

Above the NT Executive layer are the privileged-mode extensions—processes such as device drivers, file systems, and LANs, which have direct access to hardware resources and file-system services. For example, Microsoft is implementing LAN Manager, its PC LAN software, as a privileged process.

The protected-subsystems layer is the component that makes NT capable of supporting multiple APIs. Protected subsystems run as separate "fire-walled" tasks (i.e., they cannot cause one another to crash), each supporting a different API.

Microsoft plans to provide three subsystems: Windows, OS/2, and Posix. The Windows subsystem will support 32-bit Windows programs, 16-bit Windows programs (via emulation), and DOS programs (also via emulation). The OS/2 subsystem will run OS/2 1.3 and 2.0 programs. The Posix subsystem will run programs adhering to the Unix standard 1003.1. Because subsystems are implemented as separate tasks and NT is a multitasking operating system, the three protected subsystems can run simultaneously. For the user, this means Windows NT can run multiple types of programs (e.g., Windows, DOS, Posix, and OS/2) at the same time.

The outermost layer of the NT system is the application. Applications are seen as clients of the protected subsystems. Clients issue requests for system services, which are passed to the appropriate subsystem for handling. In this sense, NT uses a remote-procedure-call model between the client application and the server subsystem.

The final shape of Windows NT is not yet clear. The system will run all those applications, but how much interaction will be permitted among them? Will you be able to cut and paste or drop and drag between Posix and Windows programs or between OS/2 and Windows? And what about networking support? NT has provided the structure for networking (in the privileged-mode extensions layer), but company literature describes the extensions as "a very general architecture" that "can be used by vendors of other networking services." It appears that network implementations will provide the

World Radio History

proverbial third-party opportunities, and may therefore come sometime later than the operating system itself.

SunSoft Solaris

Sun Microsystems has been nearly synonymous with SPARC. The company designed the SPARC RISC architecture and led the efforts to manufacture and license the standard. Then, in February 1991, Sun announced it would become the parent company for three subsidiaries, each one chartered to succeed on its own. SunSoft, the new system-software subsidiary, must have looked with great longing at the enormous installed base of Intel machines. In September 1991, the company announced Solaris (see the figure), a Unix operating environment that would run on both Intel 80x86 and SPARC platforms.

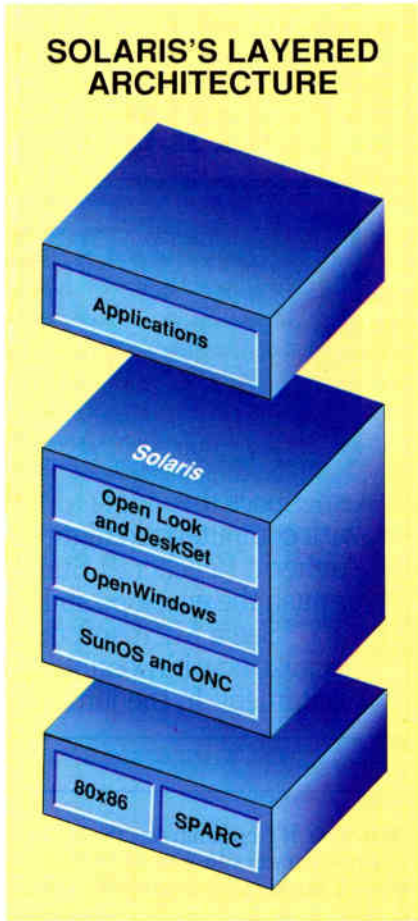
Solaris 2.0, due out in the first half of 1992, will be the cross-platform version of the Solaris 1.0 operating system currently available for SPARC. The entire operating environment will be portable, from developer tools to operating system to user interface to desktop accessories. Solaris 2.0 will offer the developer the advantage of a completely symmetrical development environment across CISC and RISC architectures. The source code is carried to the other platform, and, using the same tools as were used on the original platform, the program is recompiled.

Solaris is based on SunOS 5.0, an SVR4 version of Unix. The system has support for multitasking, multithreading, and symmetric multitasking. Like most Unix systems, Solaris provides extensive networking support, including ONC and the beginnings of Project DOE (for Distributed Objects Everywhere), a network-transparent object-messaging facility under joint development with Hewlett-Packard.

The Solaris user interface will employ a new version of the Open Look X Window manager. You will be able to perform drop-and-drag and cut-and-paste operations among applications running anywhere on the network. And, unlike other Unix systems, Solaris is prepared to run "foreign" programs: Solaris 2.0 on the Intel platform will provide DOS and Windows emulation, and you will be able to cut and paste between DOS/Windows applications and Unix programs.

Apple/IBM PowerOpen

In 1991, just before the Fourth of July, Apple and IBM stunned the computer industry with the announcement of a technology partnership. Among the several facets of this momentous agreement was a relatively prosaic element: a partnership on a new joint version of the Unix operating system, later dubbed the PowerOpen system.



The layered architecture of Solaris 2.0 from SunSoft. Microsoft also describes its Windows NT system as "layered."

The PowerOpen system, due in 1993 or 1994, will combine IBM's AIX version of Unix with Apple's Macintosh user interface. In addition, the system will support the OSF/Motif user interface; you will be able to choose between the GUIs.

PowerOpen will run existing applications for both the Mac and AIX, giving you access to applications that previously required a distinct architectural choice. The combined Apple/IBM system will be Unix with a friendly face, and it will offer access to all those friendly Mac applications. As described by Apple president Michael Spindler, PowerOpen is designed to be a "Unix for the many."

PowerOpen will run on the new PowerPC RISC processor, a single-chip version of IBM's RISC System/6000 chip set, which both Apple and IBM will use in their machines. Designed for one processor, PowerOpen is therefore not technically a cross-platform operating system, as are the others discussed here.

Although PowerOpen will run on only one processor, it will provide the first unified development path that crosses the previously trackless Apple/IBM divide. The system will represent the first joint effort of two companies whose differences have been nearly religious in character. It is in the ecumenical spirit of PowerOpen that I characterize it as a cross-platform system.

Apple/IBM Taligent

The most ambitious piece of the new partnership between Apple and IBM is their joint venture to build a new object-oriented operating system. This operating-system venture is also the most uncertain part of the agreement. Not due until the mid-1990s, the new operating system is still mostly promise and promotion.

What is really known about this most ballyhooed of ventures? Apple and IBM will form a new 350-employee company called Taligent. Taligent will build a "platform-independent" object-oriented operating system. The system will be designed as a cross-platform operating system, running multiple types of programs on multiple processors. As it is now described, Taligent will run Mac, OS/2, and AIX applications on PowerPC RISC, Intel 80x86, and Motorola 680x0 processors.

However, little is known about the details of the Taligent system, and even less about how the two companies will solve their technical and business differences. The final shape of Windows NT is not yet clear. It will be difficult, if not impossible, for Apple and IBM, opposites in corporate culture, to learn to work together. Industry representatives wonder how Taligent will merge the technical contributions of these two competitors.

Taligent had its origins in what appeared to be just one more unpromising IBM technology partnership. The answers to the questions concerning this new effort may lie in the history of the joint venture.

In September 1990, IBM announced the formation of Patriot Partners with Metaphor Computer Systems, a Mountain View, California, software company. Patriot was to build a cross-platform software development environment. At that time, IBM already had two unsuccessful partnerships under its belt. The company had licensed NextStep but

World Radio History

had done nothing with it, and the relationship with Microsoft on PC operating systems had already gone sour. No one expected the alliance with Metaphor to be any different.

Yet Patriot Partners went on to become one part of Taligent. Shortly after the announcement of the Apple/IBM alliance, IBM acquired Metaphor, and with it the work done by Patriot. Patriot, renamed Constellation to avoid association with the now-famous Patriot missile system, would become IBM's contribution to the Apple/IBM joint operating-system venture. Apple would contribute its nascent object-oriented operating system, code-named Pink.

Looking at the two technical contributions to Taligent—Constellation and Pink—you can predict a few things about the new operating system to be offered by Taligent. Although there is no assurance that Taligent will represent a blending of these two technologies, Pink and Constellation should provide clues about the directions Apple and IBM consider important.

Constellation was designed to be a component-software platform. Using the metaphor of machine tools, the component-software model sees applications as assemblies of replaceable parts. Just as the pieces of one machine can be taken and reused in another machine, component software is made up of individually made parts that can potentially be recombined to build a new application.

Developers would write small, highly focused programs—the components. The Constellation platform would provide the mechanisms for assembling the components, protecting some of the assemblies from being disassembled (for program copyright protection), and letting users and vendors freely recombine some assemblies to construct new applications out of existing ones.

The entire Constellation platform was supposed to be portable. As first described in March 1991, Constellation would run on OS/2 2.x, AIX, OSF/Unix, PenPoint, the Mac (depending on the capabilities of System 7.0, which had not been released at that time), and 32-bit Windows.

The Pink operating system has been shrouded in mystery. All we know for sure is that the system is object-oriented. From remarks concerning the design of portable systems made by Edward Birss, senior vice president for object-based systems at Apple, you can assume that cross-platform design was part of the work done on the system. Pink is said to consist of about 1 million lines of code, the result of years of effort at Apple.

If Taligent represents a merging of these two technologies, you can expect an operating system that uses an object-oriented model from top to bottom, from the API to the GUI. Above a small, machine-dependent kernel, user- and system-interface services are likely to be implemented as object classes. Programs will be similarly object-oriented. Code will consist of objects, and the programs themselves will also be objects—coarser-grain objects, or components. The user interface will provide mechanisms for encapsulating the objects, or, in Constellation's parlance, the *assembling components*.

On the other hand, there is no assurance that Apple and IBM will accomplish any significant amount of technology sharing. Reports coming out of the two companies tell of Apple engineers' low regard for Metaphor software and of Apple employees' unwillingness to work directly for the former president of Metaphor, David Liddle. The reported discord bodes ill for Taligent as a business and as an operating system. We will have to wait and see—probably until sometime around 1995.

Will Programming Get Easier?

The operating systems of the next decade will probably consist of four versions of Unix, one of Windows, and one altogether new breed. The new systems will do more work for the developer. They will put cross-platform design where it rightfully belongs: in the system software. The new operating systems will provide an extensive range of user-level services (e.g., interapplication communication, object linking, and distributed computing).

But nothing is free. As system software takes on more work, it also becomes more complex. Although solving many problems for developers, the new systems will also introduce new levels of complexity.

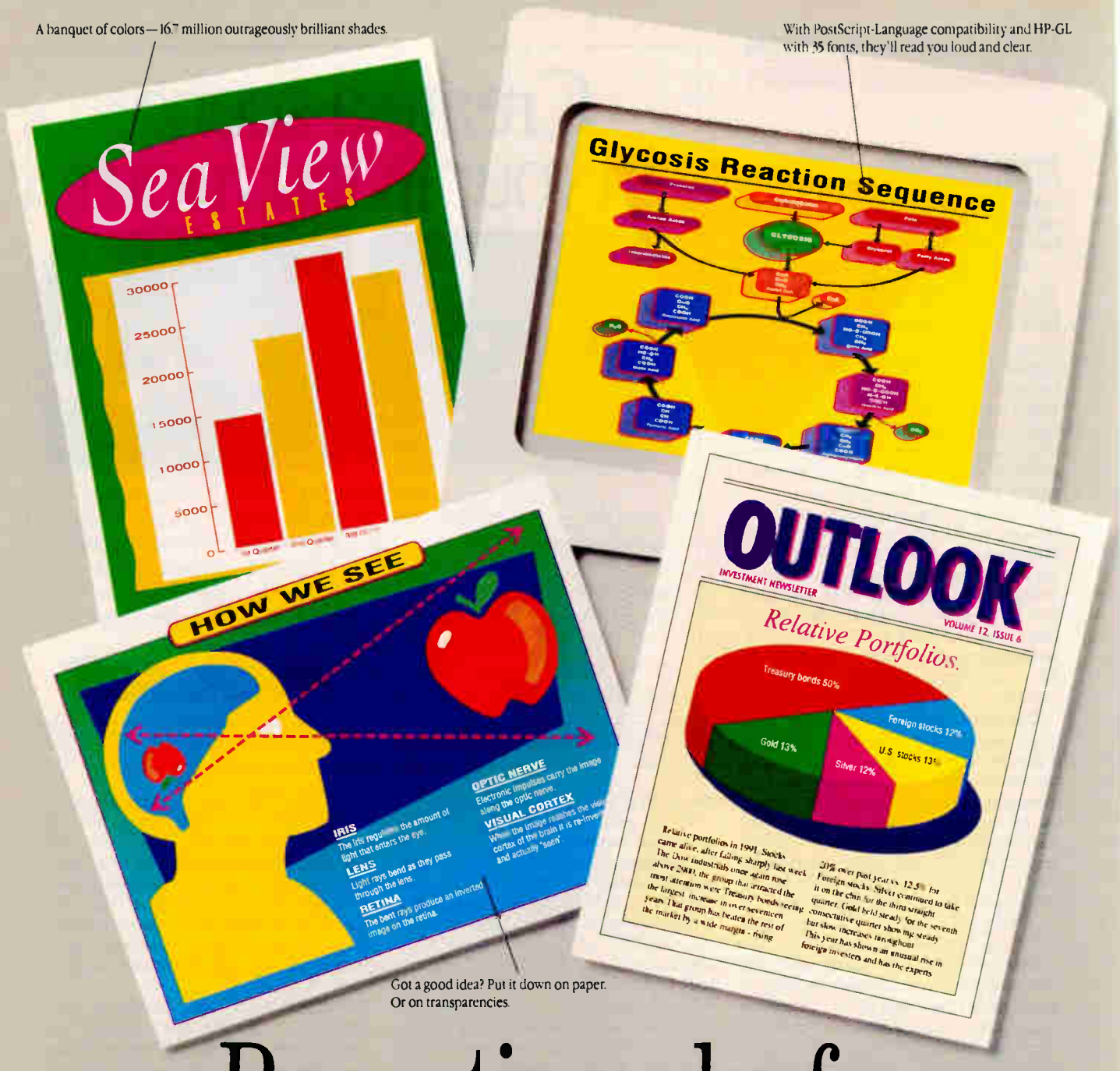
Programming environments are growing ever more complicated. Meanwhile, user expectations grow. The future of software development includes a programming environment with many more layers—software is expected to do more work more quickly. Operating systems will accomplish more, but no one is promising that, as a result, programming will become any easier. For programmers, somehow, the degree of difficulty remains a constant. ■

Ellen Ullman is a software engineer and senior consultant with Ideation in San Francisco, CA. She is a BYTE consulting editor. You can reach her on BIX as "ullman."

World Radio History

A banquet of colors—16.7 million outrageously brilliant shades.

With PostScript-Language compatibility and HP-GL with 35 fonts, they'll read you loud and clear.



Got a good idea? Put it down on paper. Or on transparencies.

Presenting color for big eyes and small budgets.

How do you buy a color printer when your eyes say yes, but your budget's begging for mercy? Easy. Just get a Phaser™ II PX.

It gives you millions of rich, brilliant colors to play with, all at 300 dpi. So you can satisfy your eyes. And it works with Macs, PCs, UNIX workstations, Windows, you name it.

Now to soothe your budget—the Phaser II PX is the lowest-priced, full feature color printers on the market. The one with "the brightest colors and the smoothest blends"* that "stands head and shoulders above the rest."**

So go ahead and let your eyes choose the printer. And tell your accountant not to worry. Call 1-800-835-6100, Dept. 20J for a free output sample.

Tektronix
The best and the brightest.

*Mac User May '91 issue **PC Computing Sept '91 issue. Phaser is a trademark of Tektronix, Inc. for color printers and related products. PostScript is a trademark of Adobe Systems Incorporated which is registered in the USA and other countries. Other marks are trademarks or registered trademarks of the manufacturers or marketers of the products with which the marks are associated. France: (1) 69-86-82-92, U.K.: 0800-521749. Germany: (221) 96969-0, Italy: (2) 84441, Sweden: (8) 29 21 10, Holland: (2503) 13300, European Operations Center: 44 628-899-255.

Circle 166 on Inquiry Card.

World Radio History

Cross-Platform Application Development Tools

Cross-platform application development makes it possible for you to take the outcome of your work on one system and use it in a noncompatible environment. Some companies are in the process of developing "industrial-strength" applications that will include the benefits of both visual programming and object-oriented reusability.

Absoft Corp.
(MacFORTRAN II/Aux)
2781 Bond St.
Rochester Hills, MI 48309
(313) 853-0050
fax: (313) 853-0108
Circle 1166 on Inquiry Card.

Bawamba Software, Inc.
(Multiplatform Compatibility Package)
150 East Olive Ave., Suite 203
Burbank, CA 91502
(818) 843-1627
fax: (818) 843-8364
Circle 1167 on Inquiry Card.

CACI Products Co.
(ModSim II)
3344 North Torrey Pines Court
La Jolla, CA 92037
(619) 457-9681
fax: (619) 457-1184
technical support:
(619) 455-6300
Circle 1168 on Inquiry Card.

CYMA
(Cause 2.0)
1400 East Southern Ave.
Tempe, AZ 85282
(800) 292-2962
(602) 831-2607
fax: (602) 345-5703
Circle 1169 on Inquiry Card.

Dalcon Computer Systems
(U-BASIC)
1222 16th Ave. S
Nashville, TN 37212
(615) 321-9000
fax: (615) 321-5944
Circle 1170 on Inquiry Card.

Digitalk, Inc.
(Look&Feel Kit)
9841 Airport Blvd.
Los Angeles, CA 90045
(800) 922-8255
(213) 645-1082
fax: (213) 645-1306
Circle 1171 on Inquiry Card.

Dimension Software Systems, Inc.
(FreeForm 7.1)
1717 Walnut Hill Lane, Suite 104
Las Colinas, TX 75038
(214) 580-1045
fax: (214) 580-0794
Circle 1172 on Inquiry Card.

Exsys, Inc.
(Exsys Professional 3.0)
1720 Louisiana Blvd. NE,
Suite 312
Albuquerque, NM 87110
(505) 256-8356
fax: (505) 256-8359
Circle 1173 on Inquiry Card.

Falcon Software, Inc.
(cT)
P.O. Box 200
Wentworth, NH 03282
(603) 764-5788
fax: (603) 764-9051
Circle 1174 on Inquiry Card.

Graphic Software Systems, Inc.
(Graphics Development Toolkit)
9590 Southwest Gemini Dr.
Beaverton, OR 97005
(503) 641-2200
fax: (503) 643-8642
Circle 1175 on Inquiry Card.

Gupta Technologies, Inc.
(SQL Windows)
1040 Marsh Rd., Suite 200
Menlo Park, CA 94025
(415) 321-9500
fax: (415) 321-5471
Circle 1176 on Inquiry Card.

ImageSoft, Inc.
(CommonView)
2 Haven Ave.
Port Washington, NY 11050
(800) 245-8840
(516) 767-2233
fax: (516) 767-9067
Circle 1177 on Inquiry Card.

Information Builders, Inc.
(Level5 2)
1250 Broadway
New York, NY 10001
(800) 969-4636
(212) 736-4433
fax: (212) 967-6406
Circle 1178 on Inquiry Card.

Informix Software, Inc.
(Informix-4GL 4.0,
Informix-ESQL/C)
4100 Bohannon Dr.
Menlo Park, CA 94025
(800) 438-7627
(415) 926-6300
fax: (415) 926-6593
Circle 1179 on Inquiry Card.

Interactive Systems Corp.
(Architech Application Series)
2401 Colorado Ave.,
Third Floor
Santa Monica, CA 90404
(800) 346-7111
(213) 453-8649
fax: (213) 828-6453
Circle 1180 on Inquiry Card.

Ithaca Software
(Hoops 2.22)
1001 Marina Village Pkwy.
Alameda, CA 94501
(510) 523-5900
fax: (510) 523-2880
Circle 1181 on Inquiry Card.

Knowledge Systems Corp.
(KSC ChangeManager 1.0)
114 MacKenan Dr., Suite 100
Cary, NC 27511
(919) 481-4000
fax: (919) 460-9044
Circle 1182 on Inquiry Card.

Manx Software Systems, Inc.
(MS-DOS–Macintosh Cross)
P.O. Box 55
Shrewsbury, NJ 07701
(800) 221-0440
(908) 542-2121
fax: (908) 542-8386
Circle 1183 on Inquiry Card.

Meta Software Corp.
(Design/OA 2.6)
150 Cambridge Park Dr.
Cambridge, MA 02140
(617) 576-6920
fax: (617) 576-0519
technical support:
(203) 222-9087
Circle 1184 on Inquiry Card.

Microsoft Corp.
(Visual Basic)
1 Microsoft Way
Redmond, WA 98052
(800) 426-9400
(206) 882-8080
fax: (206) 883-8101
Circle 1185 on Inquiry Card.

Mortice Kern Systems, Inc.
(MKS Make)
35 King St. N
Waterloo, Ontario,
Canada N2J 2W9
(800) 265-2797
(519) 884-8861
fax: (519) 886-8619
Circle 1186 on Inquiry Card.

Neuron Data
(Open Interface)
156 University Ave.
Palo Alto, CA 94301
(415) 321-4488
fax: (415) 321-3728
Circle 1187 on Inquiry Card.

Oracle Corp.
(SQL*Forms 3.0)
500 Oracle Pkwy.
Redwood Shores, CA 94065
(415) 506-7000
fax: (415) 506-7200
Circle 1188 on Inquiry Card.

ParcPlace Systems
(Smalltalk)
1550 Plymouth St.
Mountain View, CA 94043
(800) 822-7880
(415) 691-6700
fax: (415) 691-6715
Circle 1189 on Inquiry Card.

Parsytec, Inc.
(MultiTool)
245 West Roosevelt Rd.,
Building 9, Unit 60&61
West Chicago, IL 60185
(708) 293-9500
fax: (708) 293-9525
Circle 1190 on Inquiry Card.

PeerLogic, Inc.
(Pipes Platform 3.0)
555 De Haro St.
San Francisco, CA 94107
(800) 873-7927
(415) 626-4545
fax: (415) 626-4710
Circle 1191 on Inquiry Card.

Pixar
(Developer's RenderMan Toolkit 3.2)
1001 West Cutting Blvd.
Point Richmond, CA 94804
(800) 937-3179
(510) 236-4000
fax: (510) 236-0388
Circle 1192 on Inquiry Card.

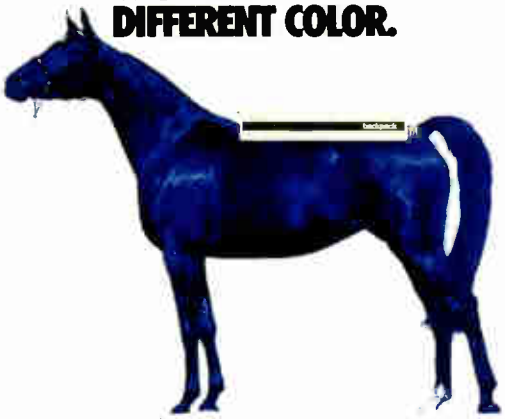
The Progeni Corp.
(Micro-GLE)
3150 Holcomb Bridge Rd. NW,
Suite 220
Norcross, GA 30071
(404) 840-7550
fax: (404) 840-7907
Circle 1193 on Inquiry Card.

continued

World Radio History

Circle 101 on Inquiry Card.

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



Add a diskette drive without horsing around inside your computer — just plug Backpack into your parallel port! Connect your printer to the Backpack drive. No tools. No hassles. No interface cards. Backpack works with IBM and compatibles including PCs, XTs, ATs, PS/2s, PS/1s, and laptops. It's available in 5.25" and 3.5" and comes complete with everything you need. So don't horse around inside your computer, add an external drive the easy way—plug in a Backpack! Hard Disk models and tape backup available soon.

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

Protects while you type!

- **Remains in Place** while you use your computer.
- **Avoids Costly Repairs.** Protects delicate electronics from dust, spills, smoke, ashes, staples.
- **Soft, Flexible,** retains normal keyboard feel.
- **Washable, Durable High-Tech Polymer** lasts years.
- **Hundreds of Models.** SafeSkin is available for most PCs, laptops, workstations and clone keyboards.
- **Office ▪ Home ▪ Factory ▪ Classroom ▪ Laboratory**

List Price $29.95. Please call or write for free color brochure. Dealer inquiries encouraged.

SafeSkin®
KEYBOARD PROTECTOR
Merritt Computer Products, Inc.
5565 Red Bird Center Dr., Suite 150 • Dallas, Texas 75237
(214) 339-0753 • FAX (214) 339-1313

RESOURCE GUIDE

QCAD Systems, Inc.
(QParser+)
1164 Hyde Ave.
San Jose, CA 95129
(408) 727-6884
fax: (408) 727-6105
Circle 1194 on Inquiry Card.

Raima Corp.
(db Query 2.20)
3245 146th Place SE, Suite 230
Bellevue, WA 98007
(800) 327-2462
(206) 747-5570
fax: (206) 747-1991
technical support:
(206) 562-2622
Circle 1195 on Inquiry Card.

Ryan McFarland Corp.
(RM/COBOL-85 6.0)
8911 Capital of Texas Hwy. N
Austin, TX 78759
(800) 762-6265
(512) 343-1010
fax: (512) 343-9487
Circle 1196 on Inquiry Card.

SBT Corp.
(SBT Developer's Platform)
1 Harbor Dr.
Sausalito, CA 94965
(415) 331-9900
fax: (415) 331-1951
Circle 1197 on Inquiry Card.

The Small Computer Co., Inc.
(filePro Plus 4.0)
41 Saw Mill River Rd.
Hawthorne, NY 10532
(800) 847-4740
(914) 769-3160
fax: (914) 769-3653
technical support:
(914) 769-2150
Circle 1198 on Inquiry Card.

Software Translations, Inc.
(B-Tran/B+)
1114 Lost Creek Blvd.,
Suite 350
Austin, TX 78746
(512) 327-6001
fax: (512) 327-6005
Circle 1199 on Inquiry Card.

Sybase, Inc.
(Open Client)
6475 Christie Ave.
Emeryville, CA 94608
(800) 879-2273
(510) 596-3500
fax: (510) 658-9441
technical support:
(510) 596-3555
Circle 1200 on Inquiry Card.

TGV, Inc.
(XView for VMS)
603 Mission St.
Santa Cruz, CA 95060
(800) 848-3440
(408) 427-4366
fax: (408) 427-4365
Circle 1201 on Inquiry Card.

Tigre Object Systems, Inc.
(Tigre Programming Environment 1.6)
3004 Mission St., Suite D
Santa Cruz, CA 95060
(408) 427-4900
fax: (408) 457-1015
Circle 1202 on Inquiry Card.

TPS Publishing, Inc.
(PS Menu, PS Net, PS Lock)
25 South Livingston Ave.,
Suite A
Livingston, NJ 07039
(800) 777-2663
(201) 740-1750
fax: (201) 740-9118
Circle 1203 on Inquiry Card.

Unify Corp.
(Accell/SQL for Oracle RDBMS)
3901 Lennane Dr.
Sacramento, CA 95834
(800) 328-0073
(916) 928-6400
fax: (916) 928-6406
technical support:
(916) 928-6433
Circle 1204 on Inquiry Card.

Via International Corp.
(Via/DRE)
8000 Tower Crescent Dr.,
Suite 290
McLean, VA 22182
(703) 761-4920
Circle 1205 on Inquiry Card.

Windstar Corp.
(WindCode)
475 Cochrane Dr , Suites 2–3
Markham, Ontario,
Canada L3R 9R4
(416) 479-6621
fax: (416) 479-6086
Circle 1206 on Inquiry Card.

The WNDX Corp.
(WNDX GUI Development System)
1550 Eighth St. SW, Suite 305
Calgary, Alberta,
Canada T2R 1K1
(403) 244-0995
fax: (403) 244-1039
Circle 1207 on Inquiry Card.

XVT Software, Inc.
(XVT-Design, XVT Extensible Virtual Toolkit 2.0)
1800 30th St., Suite 204
Boulder, CO 80301
(303) 443-4223
fax: (303) 443-0969
Circle 1208 on Inquiry Card.

Inclusion in the resource guide should not be taken as a BYTE endorsement or recommendation. Likewise, omission from the guide should not be taken negatively. The information here was believed to be accurate at the time of writing, but BYTE cannot be responsible for omissions, errors, or changes that occur after compilation.

Circle 98 on Inquiry Card.

World Radio History

HASP™

The Professional Software Protection System

Aladdin is a world leader in the field of software protection. During the last six years we have helped thousands of software producers in more than 40 countries to protect their software.

The HASP™ system is based on advanced ASIC (Application Specific Integrated Circuit) components and sophisticated encryption algorithms. State-of-the-art engineering ensures full protection of your software with no hassles for your customers.

HASP plugs are designed for the IBM PC & PS-2 families and their compatibles, as well as for Apple-Macintosh computers. Full software support is provided for dozens of languages and compilers under DOS, OS/2, WINDOWS-3, SCO XENIX, SCO UNIX 386, AIX, PHAR-LAP, and AUTOCAD.

NetHASP™, the latest addition to the HASP family of software protection systems, makes it possible to activate a protected program from several stations in a network using only **one** plug.

NetHASP works both on Novell networks and on those based on the NET-BIOS protocol, and it can therefore be used on almost any LAN.

To learn more about why so many professionals have chosen HASP, please contact:

See us at

HANNOVER MESSE CeBIT '92
Welt-Centrum Büro · Information · Telekommunikation
13. - 20. MARCH 1992

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

In North America:

ALADDIN
SOFTWARE SECURITY

306 Weymouth St.,
Dix Hills, NY 11746, USA
Tel: 800-223 4277, 516-586 2845
Fax: 516-586 1602

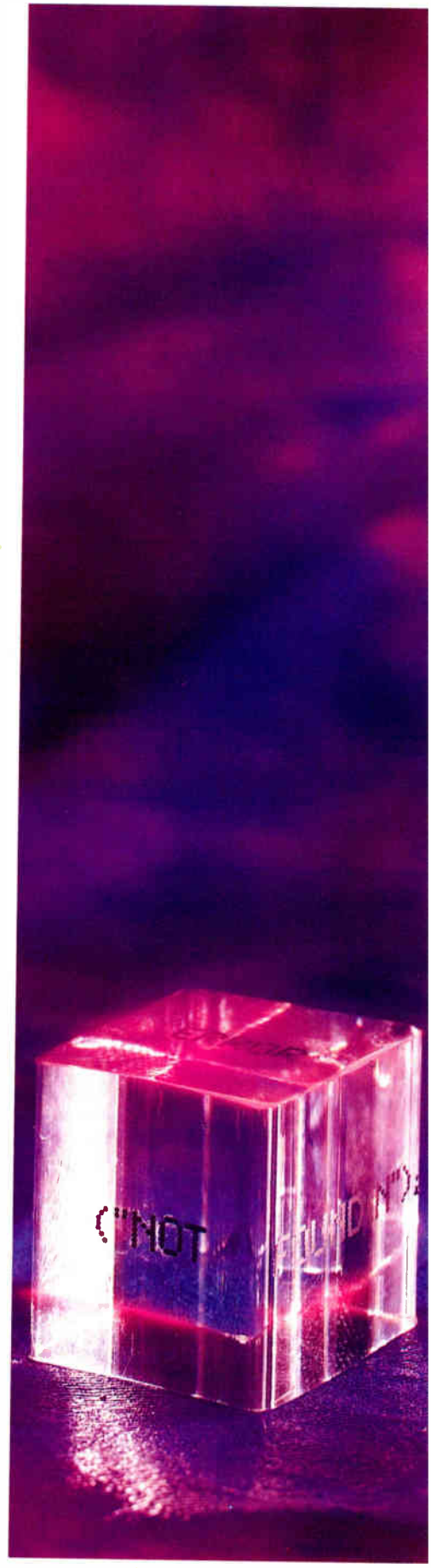
Circle 13 on Inquiry Card.

Australia Conlab Pty. Ltd., Tel: 3 8985685, Fax: 3 8995759
Belgium Akkermans Intl. bvba, Tel: 3 2338826, Fax: 3 2315438
Czechoslovakia ATLAS Ltd., Tel+Fax: 2 821280
Denmark SC Metric a/s, Tel: 42 804200, Fax: 42 804131
France Logidata Intl., Tel: 50707375, Fax: 50753144
Germany CSS GmbH, Tel: 201 74970, Fax: 201 7486-44
Greece Unibrain SA, Tel: 1 6465195, Fax: 1 6423648
Holland Akkermans Automatisering BV, Tel: 45 241444, Fax: 45 245515
Italy Partner Data S.r.l., Tel: 2 33101709, Fax: 2 347564
Korea Hanil System Inc., Tel: 2 5639161-5, Fax: 2 5538079
New Zealand The Training Solutions Co., Tel: 4 666014, Fax: 4 697190
Poland Systherm Tel: 061 45065, Fax: 061 324134
Portugal Futurmatica Lda., Tel: 1 4116269, Fax: 1 4116277
Spain PC Hardware, Tel: 3 2493193, Fax: 3 3337497
Switzerland Opag Informatik AG, Tel: 61 7112245, Fax: 61 7115355

© Aladdin Knowledge Systems Ltd. 1985-1991 Design: Ilan Peeri

World Radio History

DATABASE BUILDING BLOCKS



A database library lets you custom-craft your own database applications, but you must be ready to roll up your sleeves

RICK GREHAN, BEN SMITH, AND JON UDELL

Sometimes prepackaged applications don't cut it. Sometimes you really have to get *inside* a database to forge that program you are not able to buy off the shelf. Or perhaps your department requires an application that demands the kind of control you can get only from a carefully crafted C program. Maybe it is essential for you to be able to display graphics on-screen side by side with data fetched from a database: Just try doing that in dBase.

In-house programming often requires that the programming staff produce on-demand applications with an intricacy not easily achieved with a database applications builder. You also face speed and size considerations. Running a full-blown dBase or FoxPro environment, for example, can place significant memory demands on the workstation. Database development libraries let programmers draw on the flexibility and power of standard programming languages such as C, C++, and Pascal. Essentially, you buy a database engine: a collection of routines for creating and manipulating databases that you'd rather not have to write yourself. Some libraries actually include source code, so intrepid programmers can incorporate only those routines they actually need. If your target application only searches a database, why force it to carry around routines for inserting and deleting?

In this review, we examine seven software database engines. All provide what we call "low-level" access to database files via function calls you make from a C or C++ program. Additionally, all the packages can operate in multiuser environments, either on networks or under Unix. The packages that include libraries for DOS and DOS-based networks are Btrieve 5.10 Developer's Kit from Novell, CodeBase 4.2 and CodeBase++ 1.05 from Sequiter, db_Vista 3.20 from Raima, and Paradox Engine 2.0 from Borland. The two entries for Unix are db_Vista in its Unix incarnation and c-tree Plus 6.0 from FairCom.

PHOTOGRAPHY: RICHARD LAYBOURN © 1992

World Radio History

BYTE ACTION SUMMARY

- **WHAT DATABASE LIBRARIES DO**
  These libraries give programmers low-level access to database files.
- **LIKES**
  For programmers looking to wrap an application around a database, these packages provide the only real alternative to building a database application from scratch.
- **DISLIKES**
  The low-level access that these products provide makes them powerful but difficult to master.
- **RECOMMENDATIONS**
  If you're already using dBase to manage your databases, CodeBase 4.2 or CodeBase++ 1.05 will let you keep your files while integrating specialized database applications into your workplace. Otherwise, db_Vista 3.20 is a powerful package that you can run under DOS, Unix, NetWare, and most PC-based networks.

How Low Is Low?

We should be careful here about the term *low-level*—it's easy to misinterpret it in the multilevel realm of database programming. Some Structured Query Language (SQL) programmers may think that Clipper is a low-level environment, while Clipper programmers may view carefully rolling a database written entirely in C as low-level programming. Using a database library like the ones reviewed here places you somewhere between a Clipper programmer and a poor soul building a database system in C from scratch.

As its name implies, a database library provides you with a collection of functions that you can link into a program. Generally, these functions give your program access to two kinds of files: data files and index files. Data files consist of the information stored in your database. Typically, a data file looks like a series of fixed-length records composed of fields.

Certain fields within a record are unique for that record and specify the route by which the record will be accessed. For example, in a database of student records, the social security number of each student is unique. There will be reports to run that require access to student information via the SSN. Such unique fields are referred to as *keys*, and

World Radio History

Database Glossary

B-tree A data structure that is especially suited for manipulating a large collection of keys on secondary storage devices. The B-tree derives its name from its treelike structure of pointers.

field A member of a row that holds a data value associated with an attribute.

index A collection of keys, usually stored in a disk file. The keys within an index are embedded in some data structure that facilitates rapid searching, inserting, and deleting. Such data structures can include hash tables, binary trees, and B-trees.

ISAM (indexed sequential-access method) An ISAM system lets you access records within a file in either indexed or sequential fashion. *Indexed access* is a form of random access: You specify a value for a field, and the system fetches one or more records that satisfy that specification. *Sequential access* means that you can access records in ascending or descending order based on the value of a field. In both cases, it's understood that the target fields are key fields.

join A merging of records from two or more tables to create a resulting table. The merge is usually guided by a common field.

key A data quantity composed of one or more fields from a record. A key's value is often unique. Keys are kept in an index, and each key usually has an attached data pointer that leads to the associated data record.

rollback The act of returning a database to some previous state, usually on the failure of a transaction.

row Physically, a row is usually a record in a data file. Logically, a row is one horizontal member of a table: a collection of fields.

table Usually, a collection of rows all stored in the same logical file. In some cases, a table also includes any indexes associated with the data.

transaction A collection of operations on a database whose processing is considered to be atomic. That is, if any operation within the transaction fails, all operations fail, and the database is returned to the state it was in prior to the execution of the first operation (see *rollback*).

union The process of combining specified rows from two tables into one table.

keys are typically kept in a separate file called an index file.

Inside an index file, keys are arranged in one of several structures that permit rapid insertion, deletion, and retrieval. Often this data structure is a B-tree, a kind of elaboration on the binary tree. A data-record pointer is associated with each key in the index file. (For more on B-trees, see "Trees 'n Keys," January–March 1989 BYTE.)

Many database libraries provide functions that distinguish between key fields and other fields. Such functions are necessarily aware of the relationship between keys in the index files and data in the data files. You need only call a routine that searches for any record with a particular field matching a particular value. The library routine will search the index for the matching key, fetch the data pointer, and use that to retrieve the associated record from a data file.

Programming with a database library requires not only that you map out key fields but also that you be intimately familiar with the internals of your records. In many cases, you are working at the level of C structures. Some packages help you maneuver through the internals of a record with collections of "field-handling" routines that can manipulate various data types. Once you have specified the layout of a record, the field-handling routines let you extract from or store into the record such things as strings, dates, numbers, and sometimes specialized data types, such as currency.

Elaborate database operations familiar to SQL users (e.g., *joins* and *unions*; see "Database Glossary" at left for definitions of these and other terms) must be constructed manually if you're using a database library. A database library provides record-at-a-time access; hence, any database-wide activity, such as a join, turns into a loop that must examine each record in the member data files. However, there's a universe of database activities for which record-at-a-time access is sufficient. Point-of-sale order entry, reservations tracking, and inventory searching represent three good examples.

To test the database libraries, we developed a simulated inventory system complete with a parts table, a suppliers table, a salesman table, and an orders table. We developed programs to run the same tests on each package (for details about the performance tests, see the text box "Racing the Engines" on page 210).

Besides giving us a handle on the performance of each package, developing our inventory application enabled us to uncover the important similarities and differences among the libraries. We have given a blow-by-blow features list in the table. More subjective analysis follows.

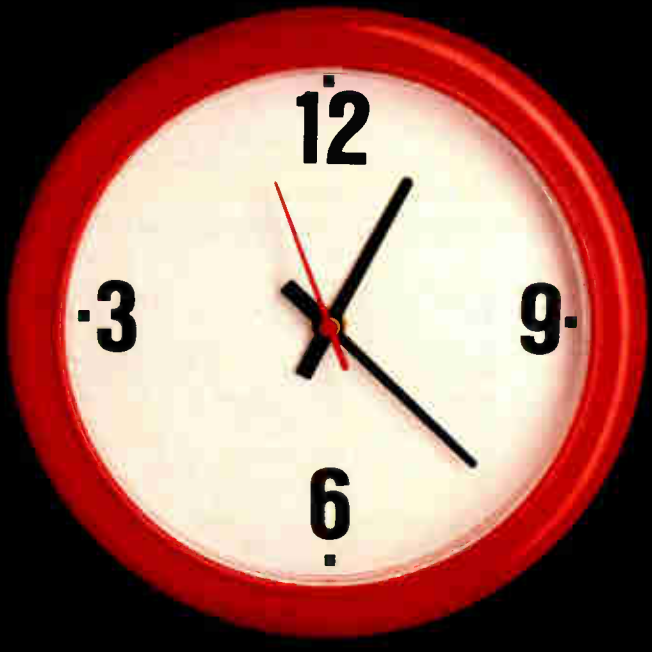
Btrieve 5.10 Developer's Kit

Most of the packages we examine here are strictly libraries of code; Novell's Btrieve is the exception. Btrieve is a record manager that can be either a DOS TSR program (for single-user DOS applications) or a combination of a server-based record manager and workstation-based Btrieve requesters. In the single-user configuration (which we tested), the record manager is a TSR that hooks interrupt vector 7B hexadecimal. In a server-based scenario, each workstation runs a Btrieve requester TSR that redirects calls to the record manager running on the network server. The server-based record manager is implemented as a NetWare loadable module (NLM), which is included with NetWare 386.

The Btrieve Developer's Kit helps you build client applications for the Btrieve record managers. For $595 you get the DOS TSR version of the Btrieve manager; source code files for building interfaces to Btrieve for high-level languages such as C, BASIC, and COBOL; and several utility programs for things like file repairs and crash recovery.

Btrieve's design has two advantages. First, the single-user manager and the server-based managers both look the same to client applications. You can write a Btrieve client application using

World Radio History



YESTERDAY WAS TOMORROW

Are you waiting until tomorrow for a system board that was available yesterday?

There is a better way. **MICRONICS.**

Time is ticking away... OEMs, Systems Integrators, VARs, and end users, it's the same for all.

No Product – No Business!

If you're waiting for your system board vendor to supply you with the latest system boards, go ahead and put your feet up on your desk... you might as well do something while your competition is taking your business away!

Yesterday, Micronics customers were shipped the latest 80486SX, and 80486 EISA system boards. In fact, we ship thousands of advanced technology system boards a month with less than a 1% failure rate.

Our reputation for high quality and superior design has made our customers the price/performance industry leaders in fully compatible system products.

Along with being EISA/ISA standard compatible, our products are designed to be compatible with Novell, UNIX and other platforms.

Micronics' leadership in advanced technology can be seen in our ability to provide new architecture breakthroughs, such as *local bus architecture, and 80486 multiprocessors* in our product lines.

We even have a new program to certify 32-bit EISA peripheral cards to run with our EISA system boards!

You don't find this kind of support anywhere else.

Micronics customers are capturing marketshare now.

So can you.

Call us at 1-800-659-5901.

Micronics EISA Board

MICRONICS

232 E. Warren Avenue
Fremont, California 94539
(510) 651-2300
FAX (510) 651-5612

Circle 100 on Inquiry Card.

World Radio History

DATABASE ENGINE FEATURES

All packages support at least C programming in the DOS environment. Many support a variety of languages and environments, from VMS to Microsoft Windows. (● = yes; ○ = no.)

	Btrieve 5.10 Developer's Kit	CodeBase 4.2	Code-Base++ 1.05	c-tree Plus 6.0	db_Vista 3.20	Paradox Engine 2.0
Company	Novell	Sequiter	Sequiter	FairCom	Raima	Borland
Price	$595	DOS: $295 Unix: $495	$295[1]	$595	Single-user DOS: $895 Multiuser DOS, $1295 SCO Unix: $1895	$495
Languages supported	C, Pascal, BASIC, COBOL, others	C, C++	C++	C	C, C++	C, C++, Pascal[2]
Operating environments	DOS, Windows, OS/2	DOS, Windows, OS/2, Unix	DOS, Windows	DOS, Unix, Macintosh	DOS, Windows, VMS, Unix System V and BSD 4.2	DOS, Windows
Networks supported	NetWare	Any PC-based LAN	Any PC-based LAN	Any PC-based or Mac LAN	NetBIOS, Unix	Any PC-based LAN
Source code	○	●	●	●	●	○
Variable-length records	●	●[3]	●[3]	●	●	○
Key compression	●	○	○	●	●	○
Record locking	●	●	●	●	●	●
File locking	○[4]	●	●	●	●	●
Undelete	○	●	●	○	○	○
Transactions	●	○	○	●	●	○
Data-file encryption	●	○	○	○	○	●
Customizable sort orders	●	●	●	●	●	○
Key length	255 bytes	100 bytes[5]	100 bytes[5]	4 gigabytes	246 bytes	[6]
Data length	4090 bytes[7]	32 KB	32 KB	4 gigabytes	32 KB	1350 bytes[8]
Records per table	No limit	[9]	[9]	Depends on OS	16 million	[10]

[1] Screen management routines are a $95 option.
[2] Supports any language that supports DLLs.
[3] Variable-length records supported with memo fields.
[4] File locking is automatic within transactions.
[5] dBase compatibility; 338 bytes for Clipper compatibility.
[6] Record-length dependent.
[7] Fixed portion. Btrieve allows up to 56 KB for the variable portion of a record.
[8] Keyed tables. Nonkeyed tables can be up to 4000 bytes.
[9] Depends on component fields.
[10] Depends on record length; maximum table size is 256 MB.

the developer's kit, test it using the single-user record manager, and be reasonably confident that it will work on a NetWare network. Second, it is possible to call Btrieve from virtually any language. Novell's documentation provides you with sample source code for C, Pascal, COBOL, assembly, and even interpreted BASIC.

To write a Btrieve program, you have to be willing to get down. You access Btrieve functions by loading up a parameter table, placing the address of that table in a CPU register, and calling an interrupt. The parameter table is a block in memory that carries a set of pointers to the current record buffer, the current key buffer, the position block, and similar information. Fortunately, Novell provides an interface routine that wraps a function call around the interrupt call, so you end up with a standard-looking C function. Btrieve files consist of pages (i.e., fixed-size blocks on the disk). Btrieve will not let fixed-length records cross page boundaries, so any space left on a page after Btrieve has filled it with the records is wasted. You specify the page size when you create a Btrieve file, which lets you minimize wasted space. When you begin designing a Btrieve database, you'll be glad to find an entire chapter in the documentation devoted to calculations of page size.

A Btrieve file is a collection of pages. All data and all data-index information reside in the same file. Each page is either a data page or an index page. An index page holds keys, and a data page holds records. Each Btrieve file can contain the equivalent of one data file and several index files; Btrieve's file organization is often referred to as "super files." If you examine part b of the figure, you'll see that Btrieve's file size appears larger than that of files created by other packages. This is an effect of combining index and data into a single file. (However, the total disk space taken up by each package is roughly the same.)

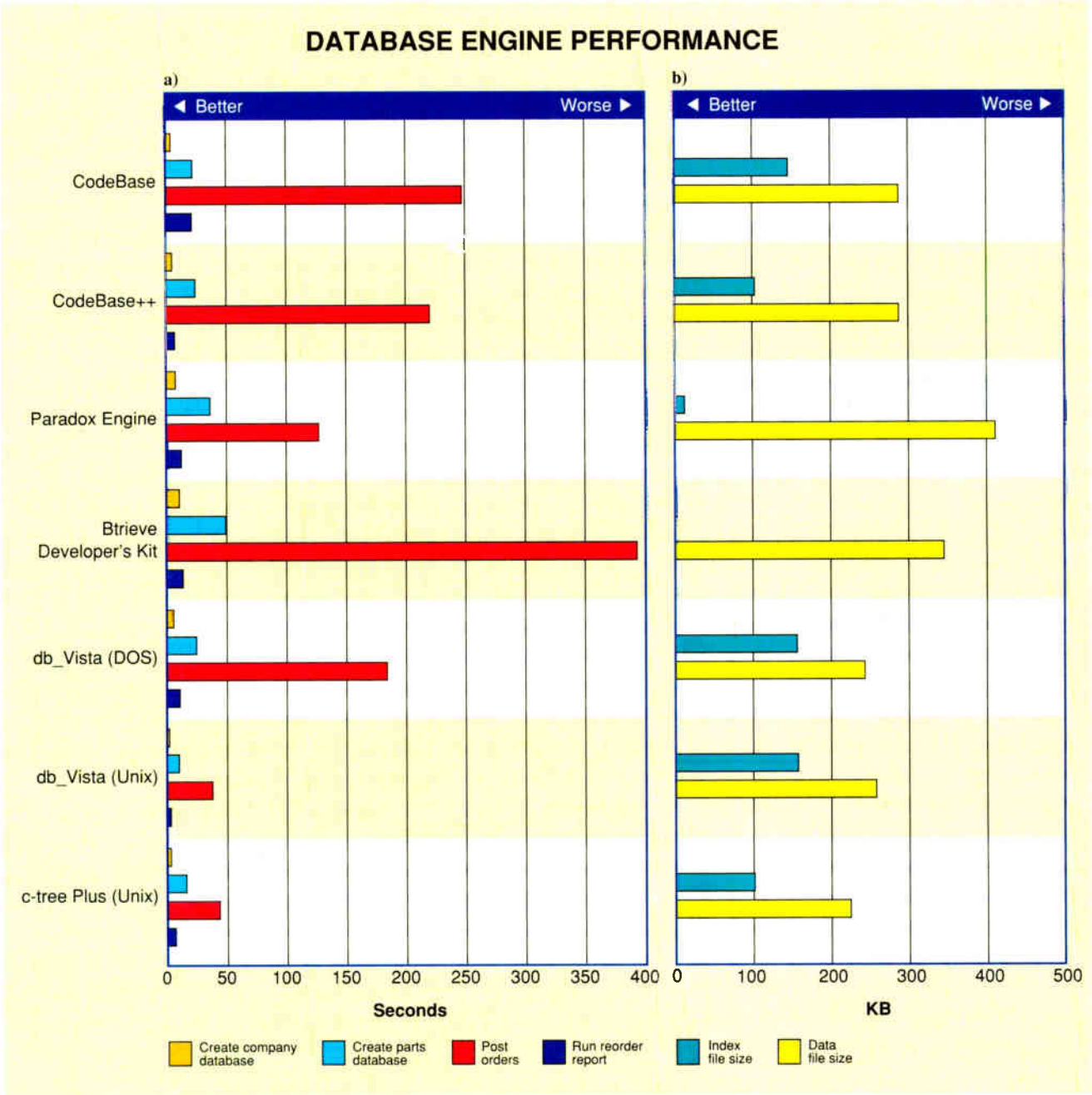
Btrieve's keys can be multisegmented, which means that a single key can be the concatenation of various portions (fields) of the data record. When you create a key, you specify its component field offsets, their types, and their lengths. You can also specify whether each segment is sorted in ascending or descending order. For example, you can build a key constructed of dates in descending order and check numbers in ascending order. This would let you print a report showing most recent checks first.

Btrieve supports alternative collating sequences for all 255 ASCII codes. You can completely respecify how one ASCII code sorts with relation to another, so you can have B sorting before A and Z sorting before B, if you like.

We were impressed with Btrieve's fine-tuning options. As we mentioned above, Btrieve constructs indexes that place keys on fixed-size pages. As your program adds more keys to the file, the pages fill up and their contents must be redistributed to new pages. You can specify whether Btrieve is to be intelligent about this redistribution process. If you choose intelligent redistribution, Btrieve tries to keep key pages packed as densely as possible. Otherwise, it simply distributes the keys so that pages are at least half full. The former produces indexes that are smaller and quicker on read operations but slower on insert operations; indexes produced the latter way are larger, but they are quicker on insert operations.

Btrieve 5.10's most interesting new feature is its support for extended func-

World Radio History



Engines compared for speed and database size: **(a)** *Benchmark results showing the time to create the company information and parts databases, followed by the times to post orders against the parts database and run a reorder report. Shorter bars mean better performance.* **(b)** *File sizes (in KB) for the 4000-record orders database. Notice that Btrieve keeps both index and data in a single file.*

tions. Extended functions permit you to operate on multiple records with a single call; for example, you can insert a set of four records with a single call to the Btrieve insert function.

Btrieve has various levels of file recovery and data-integrity protection. It supports crash recovery with *preimaging*. With preimaging activated, a copy of the page about to be changed is written to a preimage file before the file is modified. Btrieve will discard the preimage file's contents only after the operation is complete. If the system crashes before the operation has finished, Btrieve can use the preimage file to restore the original file to its state prior to the crash.

For even tighter safeguards, you can use Btrieve's transactioning system, which handles rollback. Btrieve can group a set of operations into a single atomic transaction. Once you execute a "begin transaction" command, any subsequent file that you access is automatically locked. This keeps other users from modifying files controlled by your transaction until you have executed an

World Radio History

Racing the Engines

Database developers can appreciate the elegance of object-based field access and the utility of a logical approach to file locking, but these factors mean little to users. Next to questions of data integrity, the most important consideration for users is speed.

Naturally, the engine you choose will make a big contribution to the speed of the application you develop. We chose an inventory application of intermediate size to get a feel for the kind of performance you can expect from the products that we reviewed. The database consisted of four components: a parts table, a suppliers table, a salesman table, and an orders table. We ran a number of tests against this database.

First, we created the suppliers table. The system read an ASCII-format data file and created the table. Each record included an ID number, a company name, an address, and a phone number. Our suppliers table consisted of 1000 entries. Next, we created the parts table. Each record here consisted of an ID number, a description, a supplier, cost each, sale price each, current quantity, reorder level, and back-order quantity. There were 4000 parts in our table.

Once we had created the tables, we ran a daily orders application. The system generated 4000 orders that were posted against the parts table. Additionally, the salesman table was updated to tally each salesman's current sales. If the quantity in inventory dropped below the reorder level, the back-order field was updated accordingly.

Finally, we ran a reorder report. The system simply stepped through the parts table and generated a reorder request for each item that had a nonzero back-order amount.

The idea was for the tests to mimic what might take place in a real-world inventory management system. Orders were posted against the inventory table; salesman records were updated to record year-to-date sales; and reorder reports were run so that depleted inventory items could be replenished.

We performed our DOS tests on a Compaq Deskpro 386/33L running DOS 4.01 with 4 MB of memory and a 120-MB hard drive. For the Unix packages, we used an Everex Step 386/33 with 8 MB of RAM and a 300-MB hard drive. The results are shown in part a of the figure on page 209. As you compare the benchmark figures for DOS packages with those for Unix packages, keep in mind that applications running under Unix enjoy that operating system's built-in disk I/O buffering (which, for an 8-MB system, is substantial).

Part b of the figure shows the size of the data and index files each package created for the parts inventory. In all cases, we used neither data- nor index-file compression. It is interesting to note that the aggregate file size for both data and index files was comparable for all packages.

"end transaction" command. If a failure occurs or your program issues an "abort transaction" before the transaction completes, then changes made to any files since the "begin transaction" command are discarded. Keep in mind, however, that activating transactioning can significantly degrade performance.

The graphs in the figure are for the DOS version of Btrieve without preimaging and without transactions. Btrieve scored at the bottom of our performance tests, although not so far behind the other packages as to be unusable. We should point out that we did not specify index compaction when we started Btrieve. Consequently, insert operations performed well, but search operations were probably less than optimal. We also tested the NLM version of Btrieve on a 486-based Dell server with 16 MB of RAM. As expected, those parts of the benchmark that depended heavily on search operations showed a significant performance improvement, running as much as four times faster than the non-NLM version.

To test the overhead for transactions, we ran the daily orders portion with transactioning activated whenever we added a new order to the orders database. The difference was significant—times rose from an average of 392 seconds to an average of 1200 seconds.

You may find yourself developing applications in various languages that must draw on the same database. In that case—and as long as you don't need to run your application on Unix—we recommend Btrieve. It runs on single-user machines as well as on NetWare networks, you can interface it to just about every language imaginable, and its integrity and crash-recovery features are top-notch.

CodeBase 4.2

If you're already using dBase, you might consider development with a library that can understand dBase files. Sequiter's CodeBase 4.2 easily digests dBase-compatible files, which means that you can rapidly integrate programs written in CodeBase into your existing system. Data and index compatibility is clearly a valuable asset, since a big chunk of the world's PC-resident data is tied up in .DBF files.

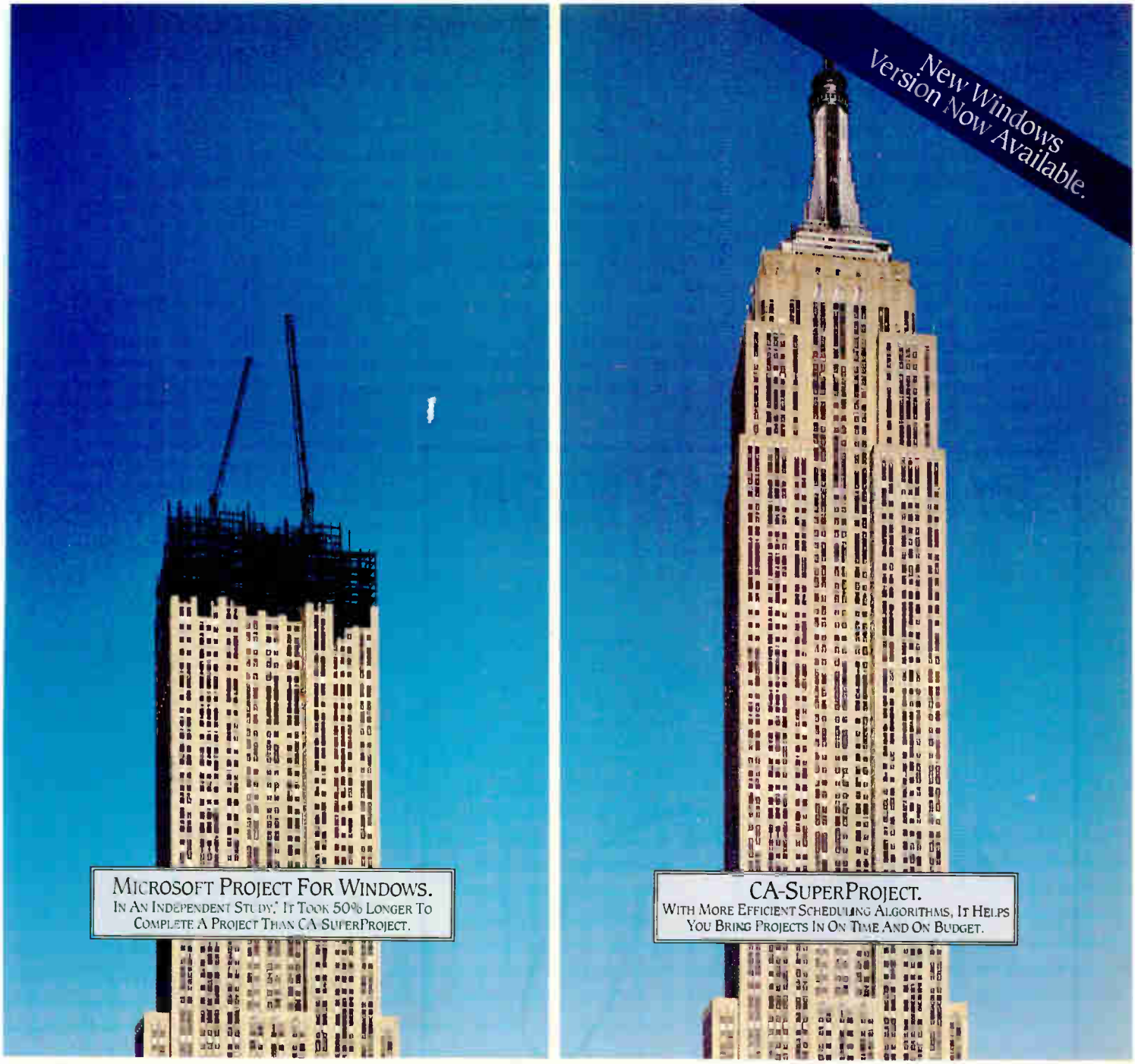
CodeBase's dBase compatibility also means that all fields—numeric or otherwise—are stored as alphanumeric strings. Interestingly, CodeBase boasts special routines that let it parse strings carrying dBase expressions. Usually, you'd use these routines to define the structure of keys within an index file. For example, suppose that you define a dBase-compatible journal-entry file with the fields ENT_DATE and REF_NUM. Assuming that REF_NUM is a string value, you can make the following call:

```
data_ptr=
e4eval("DTOS(ENT_DATE)+REF_NUM")
```

and the static variable `data_ptr` will receive a pointer to an internal field holding the result. You can use this result to construct the key with which your program would search an index that is sorted by date and reference number.

Our biggest complaint with CodeBase is its odd naming convention. For example, `d4go()` means "read the specified record into the record buffer." We assume there is some connection (however tenuous) to the dBase verb GO, but we

World Radio History



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

Efficiency. Accuracy. Dependability.

Required skills for any project manager. But not as common as you'd think. In a recent independent study of the five leading project managers—all scheduling the same project—the completion dates varied by as much as five months.

CA90s
CA's Computing Architecture For The 90s.

CA-SuperProject® finished first in 214 working days. Microsoft® Project finished last in 323 working days.

That's why serious project managers trust CA-SuperProject. It offers more efficient scheduling algorithms, better management of resources and gives you completion dates you can bet your career on. It's also incredibly easy to use. You can create projects in minutes.

And with a few clicks of the mouse, you'll have presentation quality Gantt, PERT, Cost/Resource and Work Breakdown charts.

So call 1-800-645-3003 today to find out the location of your nearest dealer. Because once you've worked with the most-efficient project manager, the difference will be obvious.

COMPUTER® ASSOCIATES
Software superior by design.

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

Circle 39 on Inquiry Card.

World Radio History

never became fully accustomed to the convention.

The CodeBase data-access model assumes one active database at a time. To do anything with a database, you must activate it with a call to `d4select()`. From that point on, all the database functions target that database. You don't have to explicitly tell each function what database you're working on.

You also don't need to explicitly tell CodeBase to write a record once you've modified it. If you use the field-manipulation functions provided, CodeBase recognizes record modifications and makes updates to disk whenever the record buffer is about to be overwritten (or when you close the file).

CodeBase supports variable-length records in the form of memo fields. A memo field is actually a pointer into another file (i.e., the memo file) that holds the variable-length portion of your data records.

We should note that CodeBase provides routines that go beyond database access. For example, CodeBase includes screen management routines that you can use to build windows, pull-down menus, pop-up menus, and even Lotus 1-2-3–style hierarchical menus. CodeBase can also handle data-entry chores.

If you're already using dBase and must preserve your investment, you should check out CodeBase 4.2. It gives good performance, and the input-handling functions provided will take you a long way down the road to developing your final application. Its one great weakness is its lack of any kind of transactioning. Remember, though, that CodeBase 4.2's $295 price tag for DOS ($495 for Unix) gets you the complete source to the library.

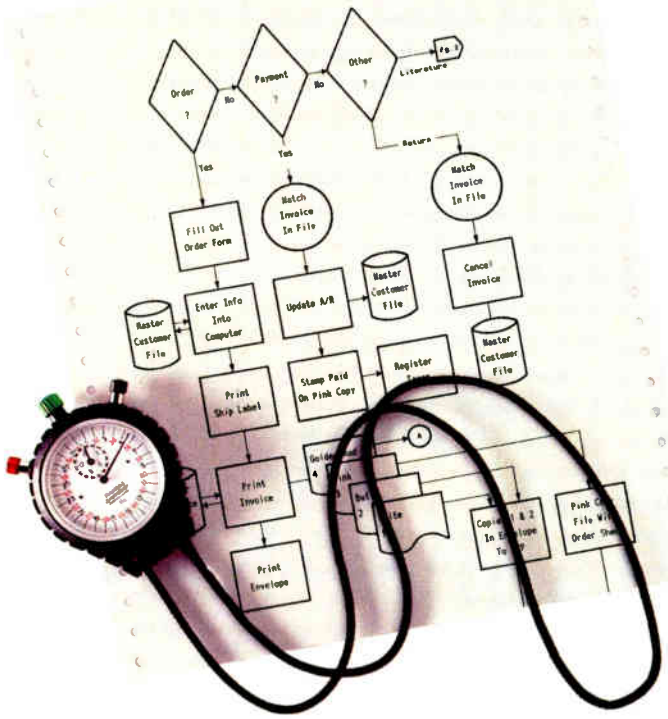
CodeBase++ 1.05

Sequiter's CodeBase++ wraps C++ packaging around the core functionality of CodeBase 4.2. Like its procedural cousin, CodeBase++ reads and writes dBase IV data (.DBF) files and multitag index (.MDX) files and supports standard dBase primitives such as SKIP, GO, RECNO, and ZAP. While retaining the essential dBase verbs might seem strange in a product that takes an object-oriented programming approach to data management, it's actually a fine idea. If you've used any of the so-called xBase family of products (e.g., dBase, FoxPro, or Clipper), you will instinctively know how CodeBase++ deals with filters, index files, and locking. Bringing the leverage of C++ to bear on these familiar mechanisms makes a great deal of sense.

In a CodeBase++ program, you normally declare a single instance of the class named `CodeBase`, which handles errors and stores global settings on behalf of one or more database objects. Next, you declare the database objects. The database classes form a hierarchy. Class `Data` defines the basic .DBF capability, but you're more likely to use its child, `DataIndex`, or its grandchild, `DataMemo`. The idea is that your program need accrue only minimum overhead. If you require index files but will not be needing memo (i.e., variable-length character) fields, use class `DataIndex` and avoid linking in the extra memo-field functions of class `DataMemo`.

You use the separate database class `DataFilter` to restrict the set of available records. With the dBase equivalent (SET FILTER), you supply an expression that defines the filtered record set (e.g., `SALESMAN == "JONES" .AND. ORDERS > 100`). Similarly, in CodeBase++,

BY HAND. OR BY NOON.



Flow Charting™ 3

Now, even complex flowcharts that once took days to perfect can be presentation-perfect—in no time!

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

See your dealer today! Or, for a "live," interactive demo disk, call:
800-525-0082, ext.1113.
International: 408-778-6557, ext.1113.

PATTON & PATTON
Software Corporation

Excellence in charting the flow of ideas!

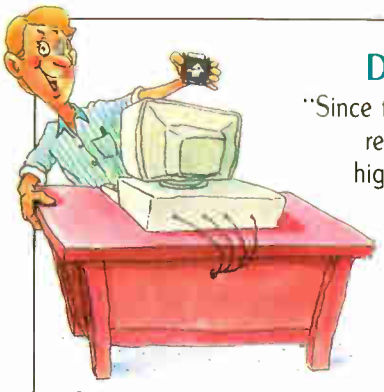
Works on IBM & 100% compatible PC's, supports CGA/EGA/VGA and over 150 dot matrix and laser printers, with multiple print densities and 10 font sizes. **Creates multi-page charts, portrait or landscape, on most standard paper sizes.** Mouse or keyboard controlled.

IBM is a registered trademark of International Business Machines Corporation.

Circle 122 on Inquiry Card.

World Radio History

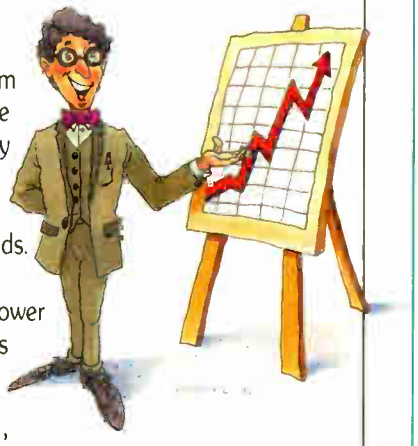
WHY SOFTWARE COMPANIES ARE CHOOSING HARDLOCK™



Developers Say. . .

"Since the Hardlock uses an algorithmic response chip, I am assured of the highest level of protection. Also, the optional programmable memory means I can keep custom configurations in Hardlock rather than in a file. I can protect my .EXE or .COM files directly and/or incorporate Glenco's high level language interface routines into my software. And, I feel confident I'll have Glenco's support if I use other programming languages."

Accountants Say. . .



"Hardlock provides our company with a healthier bottom line. Since our software can't be copied, our revenue has steadily increased. The unique programming board allows us to program the Hardlock in seconds. This ensures optimum delivery schedules from Glenco and a lower inventory cost for us. Hardlock's field programmable feature means a single Hardlock can protect more than one product."

Actual size shown.

Hardlock — programmable, algorithmic response and memory option — all in one

End Users Say. . .

"Hardlock allows me to backup my software investment. I just plugged Hardlock into the printer card, connected the printer cable, and forgot about it. Since Hardlock doesn't require a battery, I am assured of reliability and no down time.

GLENCO ENGINEERING INC.

SERVING THE SOFTWARE INDUSTRY SINCE 1979

270 Lexington Drive
Buffalo Grove, Illinois 60089-6930
(708) 808-0300 FAX 808-0313
1-800-562-2543

HARDLOCK™
The Preferred Protection System!

1-800-562-2543

H A R D L O C K

For a distributor in Europe contact, FAST Electronic GmbH 49-89-539800-20 FAX 49-89-539800-40

For Internotionol informotion circle 66, For End-User informotion circle 67 on Inquiry Cord.

World Radio History

you can declare instances of class Expr that you use to evaluate arbitrary dBase expressions. Expressions can be useful not only for filtering but also for index creation and interactive querying. More general-purpose classes include Date and LinkList.

There's also a set of field classes. These classes naturally derive from the string class Str, because .DBF files represent all kinds of data, including dates, numbers, and Booleans, as characters. Class Field handles character fields. More specialized field classes, such as DField, NField, and MField, derive from Field and handle date, numeric, and memo fields.

Class Str overloads comparison operators, such as == or <, and type-casting operators, such as int and double. The field classes inherit these operators, and that makes field objects extremely easy to use. To compare the contents of a character field called SALESMAN to the contents of another character field called LASTNAME, you can simply write if (LASTNAME == SALESMAN). Or, if ORDERS is a numeric field, you can write (long) ORDERS * 100, casting the field's digits to a long integer on the fly.

The field classes themselves define—and overload—the assignment operator to ease dealing with differing data types. To assign the value 100 to ORDERS, you can write ORDERS = (double) 100 or ORDERS = "100" or ORDERS = QUANTITY (where QUANTITY is another field object).

CodeBase++ makes fields into first-class data types that you can treat just like C integers and strings. That meant that our CodeBase++ version of the test program could use fields directly, without requiring a raft of intermediate variables. Our first cut at the program, however, did use extra variables to help move data from text files into the databases and from the databases back out to the report file.

Then we rewrote the program to exploit the power of C++. From the input and output stream classes in the Borland C++ class library, we derived new classes that added the ability to read and write CodeBase++ fields. By overloading the stream insertion and extraction operators, we eliminated the need to explicitly manage a buffer for field input and output. To perform field input, for example, we could simply write code like this:

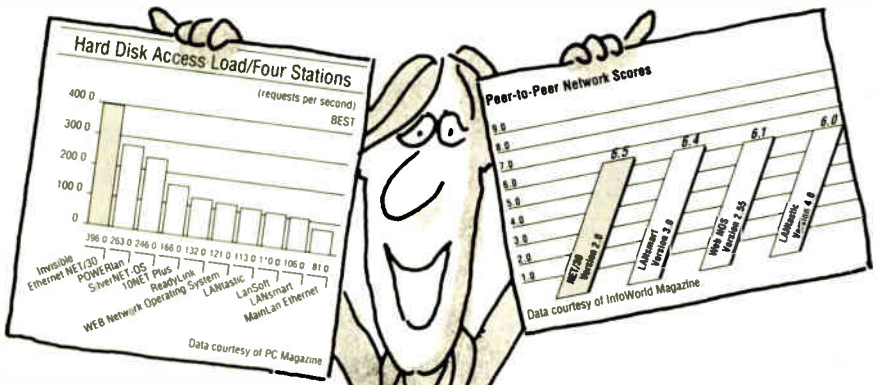
```
f >> Cost >> Description >>
  SalePrice >> CurrentQuantity
 >> BackOrders;
```

where f is a C++ file stream and Cost, Description, and the rest are CodeBase++ fields.

The end result was a program that was shorter, more readable, and more maintainable than any of the other solutions. Whatever the other merits of CodeBase++—and they are considerable—its C++ orientation makes it a compelling choice. It was quite straightforward, for example, to build a windowed database browser by blending the text scroller developed in one of the TurboVision sample programs with CodeBase++ database and field objects. Also, because CodeBase++ provides a dynamic link library, we could have done a Windows version of the browser in terms of Borland's Object Windows Library.

Like dBase, CodeBase++ handles basic record and file locking automatically. When you seek to a record or append a new one, it locks the record; when

Out of Sight
LAN Performance.



The Fastest.

The Best.

Check the latest comparison studies. They're saying what we've said all along.

That Invisible's Net/30 is flat out the fastest DOS based LAN *(PC Magazine)*. And the #1 rated network for all-around, peer-to-peer performance *(InfoWorld)*.

Plus Invisible brings the ease-of-use of Windows to network management. Turning a difficult task into a virtual piece of cake. As to support: for technical savvy, availability, and friendliness, nobody outshines Invisible. Nobody.

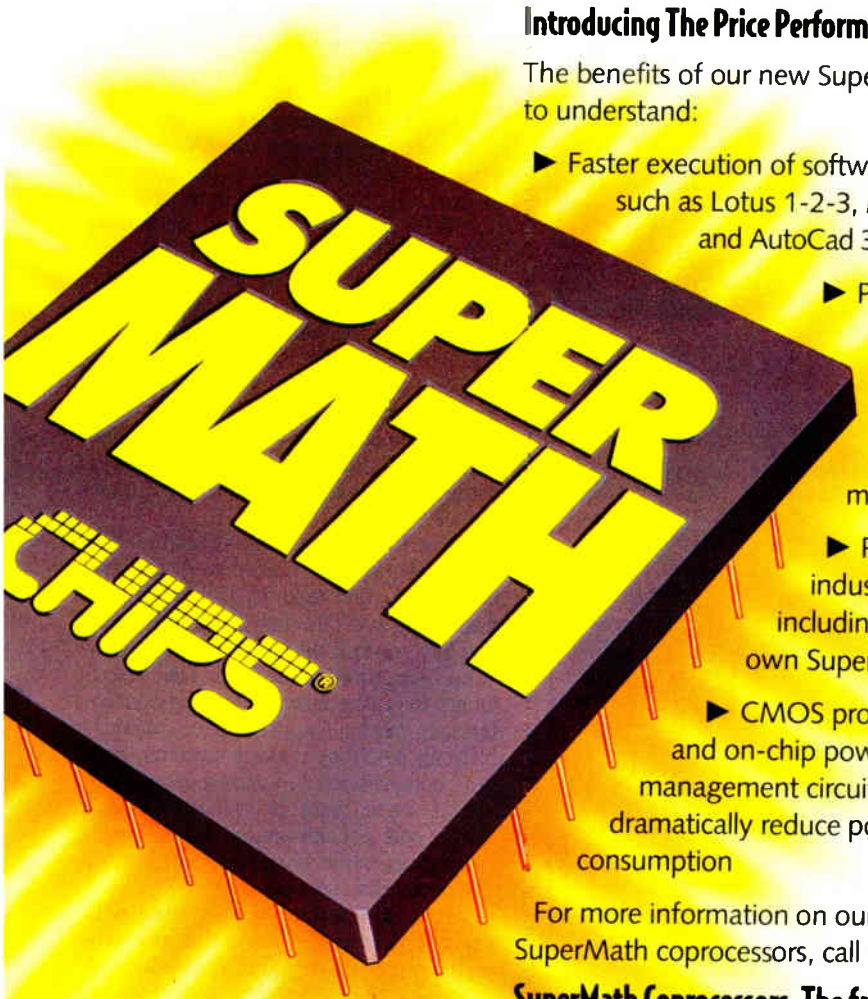
These things are important. Because they help you get faster, easier access to the information you need. For more information call 415/570-5967 (don't be surprised if an engineer answers). Or FAX 415/570-6017. Or write 1142 Chess Dr., Foster City, CA 94404.

Invisible. Out of sight.

INVISIBLE SOFTWARE

World Radio History

When You Think 387, Think Faster.



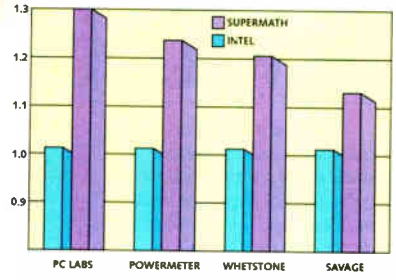
Introducing The Price Performance Leader In Math Coprocessors.

The benefits of our new SuperMath™ coprocessors are very easy to understand:

- ▶ Faster execution of software packages such as Lotus 1-2-3, Microsoft Excel, and AutoCad 386
- ▶ Plug-in compatible and software compatible with industry standard 387DX and 387SX coprocessors
- ▶ Up to 600% better performance at the instruction level
- ▶ Perfect system companion to industry compatible 80386 CPUs – including CHIPS' own Super386™
- ▶ CMOS processing and on-chip power management circuitry dramatically reduce power consumption

SuperMath Coprocessor

PART NO.	PKG.	PIN-OUT
38700SX	68-pin PLCC	Pin-Compatible
38700DX	68-pin CPGA	Pin-Compatible



For more information on our SuperMath coprocessors, call (800) 944-MATH.

SuperMath Coprocessors. The fastest way to improve your system.

CHIPS®

Opening The Future Of Microprocessing.

©1991 Chips and Technologies, Inc., 3050 Zanker Road, San Jose, CA 95134. SuperMath and Super386 are registered trademarks of Chips and Technologies. Lotus, Lotus 1-2-3, Microsoft, Micro-oft Excel, AutoCad 386, Intel, 387DX and 387SX are registered trademarks of their respective holders.

Circle 35 on Inquiry Card.

World Radio History

you reindex or zap a database, it locks the database and associated index file. If you're using only one of many tags in an index file, CodeBase++ will lock the entire index file when it updates that tag—which could cause a lot of contention in certain situations.

However, there is no equivalent to the dBase SETRETRY command, which specifies how long to wait for a locked file. CodeBase++ defaults to infinite retry with a 1-second wait; if you disable waiting, it returns immediately with an error. To get reasonable throughput in the multiuser order-entry test, therefore, we disabled waiting and explicitly polled for locks on the orders file.

CodeBase++ supports Turbo C++, Borland C++, and Zortech C++. Commendably, Sequiter provides full source code so that, with some fiddling, you should be able to use the class library with any compiler that supports AT&T C++ 2.0. CodeBase++ costs $295 without the screen-handling routines that you will find in CodeBase 4.2. If all you need is a database engine, you're set; but if you want to incorporate 4.2's screen handling in your CodeBase++ programs, you can have them for an additional $95.

c-tree Plus 6.0

As with CodeBase++, the c-tree Plus libraries are distributed as source code. We tested c-tree Plus under SCO Unix, but the code is portable enough to make it useful for most Unix implementations. The library we tested sells for $595. FairCom also markets a version for building DOS applications.

To get under way, you run a script program to compile the library modules and utilities. In this way, you can be sure that the library object files are compatible with your development system. You can use c-tree Plus to generate stand-alone programs or to build client applications for FairCom Server, a database server that FairCom markets for Unix systems.

There are three distinct levels of database programing with c-tree Plus: what we've been calling low-level, ISAM, and SQL. We built our sample application using both low-level and ISAM techniques.

c-tree Plus is remarkably flexible. You can program with fixed-length or variable-length data records. If you are programming with the low-level functions, you have several options for how the key values are stored in the index file: fixed-length keys (the fastest), leading-character compression (less file space, particularly for keys that are very similar), padding compression (a variable-length key useful when there is variation in key data), and a combination leading/padding compression when file space is more important than speed.

At the low level, programming with compound keys (i.e., keys that are composed of several key fields) requires additional code for building and breaking down the compound keys. At the ISAM level, however, you can define compound keys from the start, and the ISAM routines know how to handle them. One of the most valuable skills in database design is knowing when to use compound key files, which keys should be combined, and which should have their own index files.

Programming with the low-level functions requires a great deal of planning and care—and lots of lines of code. For each step in a database operation, you must program the relationship between the index files and the data files. Even

PERISCOPE

JUST RELEASED
Model IV for 386SXs
OS/2 Driver Support
32-Bit Toolkit
Rent Model IV
Windows 3 Driver Support Soon!

Professional Software and Hardware-Assisted Debuggers for 80386 & 80486 Systems

If you need a debugger but have no room left in the lower 640K of your 386™ or 486™ system, Periscope now has a new SOFTWARE-ONLY solution for you—Periscope/EM.
- Periscope/EM takes advantage of the extended memory you already have, rather than using any memory in the lower 640K.
- No runaway program can corrupt Periscope/EM because it's write-protected.
- You don't have to use a slot since there's no board to install.
- You can add an optional break-out switch to recover from crashes.
- Periscope/EM costs only $295, half the cost of Periscope Model I, with most of the same functionality.

Periscope/EM requires 386MAX® or BlueMAX™, version 5.11 or later; a 386 or 486 system with about 300K of extended memory; 32K of memory between 640K and one megabyte; DOS 3.0 or later.

New Debugging Tools

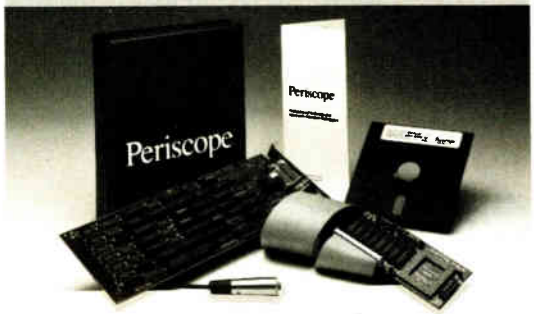
"I needed a means to debug interrupt handlers where I could really see what was going on. The hardware trace buffer is great. I was able to debug code in 3 days that I have been trying to debug for months!"

...writes Peg Sestrich with Prime Computer, on why she chose Periscope Model IV.

If you need more than your current software-based debugger gives you, Periscope Model IV, with these advanced NEW features, may be just what you're looking for:
- Supports 386 and **486** systems running up to **33MHz** with its ICE-like capabilities.
- Real-time hardware trace buffer holds up to **16K** CPU events.
- Enhanced analysis and display of trace buffer makes you more productive.
- Periscope/EM functionality, built-in at no extra cost, saves you money.

Just call toll-free 800/722-7006 for details or to order.

The Periscope Company, Inc.
1197 PEACHTREE ST.
PLAZA LEVEL
ATLANTA, GA 30361
404-875-8080
FAX 404-872-1973

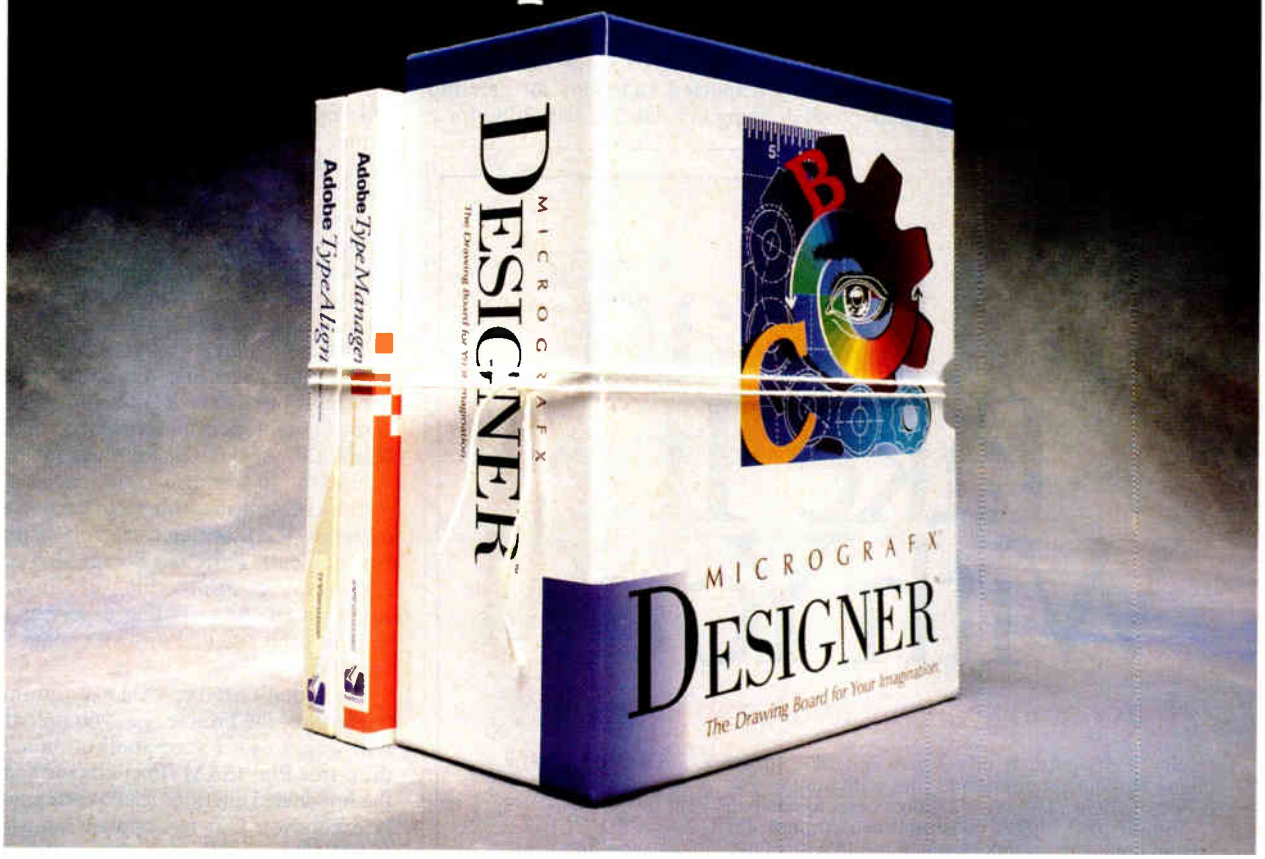


Real-time Periscope Model IV, shown with new 33MHz board and 486 pod.

Circle 125 on Inquiry Card (RESELLERS: 126).

World Radio History

The World's Top-Rated Illustration Software Is Getting Some Impressive Letters.

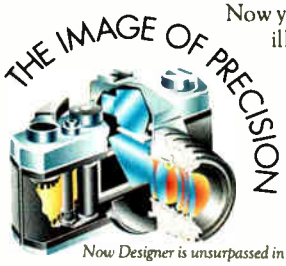


Now Adobe type-handling software and 180 Type 1 fonts are integrated *free* into Micrografx Designer!

What do you get when you cross the world's most powerful PC illustration software with the ultimate type-handling software?

You get lots of attention.

That's because there's never been anything *like* the new Micrografx Designer.™ We've seamlessly integrated Adobe Type Manager, *plus* Adobe TypeAlign, *plus* 180 Type 1 fonts into Designer. ***That's a value of over $5,000 – free!***



Now Designer is unsurpassed in both illustration and type handling.

Now you can bring professional-looking illustration *and* type to everything you do. From technical drawings to transparencies, layouts to logos. As well as to PageMaker, Word for Windows, Excel and other Windows programs.

Besides choosing from a huge selection of fonts in any size, you'll be able to add special effects like perspective, shadows and rotation. Do your own kerning and leading. Or use Designer's powerful drawing tools to alter your type at will.

Here's what people were saying about Designer even *before* our Adobe upgrade:

"Designer is perhaps the most sophisticated of all the illustration packages."
PC Magazine, Editor's Choice (3 consecutive years)

"State-of-the-art features, good performance and unmatched ease of learning and use in a sophisticated package." *Software Digest, ★★★★★ (highest rating)*

So why just get by when you can get *noticed* with Designer?

Call to order today! Registered Designer 3.X users call for your $99.95 upgrade ($149.95 for earlier versions).

60-day money-back guarantee! **1-800-733-2113**

MICROGRAFX®

Micrografx, Inc. 1303 Arapaho, Richardson, TX 75081 (214) 234-1769. Micrografx has offices in Los Angeles, Paris, London, Munich, Sydney and Copenhagen. Copyright © 1991, Micrografx, Inc. All rights reserved. Micrografx is a registered trademark and Micrografx Designer is a trademark of Micrografx, Inc. All other products are trademarks of their respective owners.

Designer system requirements: 286 (386 recommended) IBM PC or compatible, or PS/2. 1 MB RAM (2 MB RAM recommended). 20 MB (or larger) hard disk. Windows 3.0. DOS 3.1 (or higher). Mouse or digitizing pad. Windows-compatible monitor.

Circle 99 on Inquiry Card.

World Radio History

after you create the files, opening each requires a file ID, a filename, and an access mode. And all this is independent of the structure that you intend to stash in each record.

Nonetheless, the 39 functions that constitute the low-level library provide all that you need. (There are an additional five functions for variable-length records.) These data-record-manipulation functions handle basic record functions such as create, lock, unlock, read, and write; they also let you count and release records.

As records are released, they continue to consume space in the file. There is no function available that lets you rebuild the file and thereby return this unused space to the operating system.

The c-tree Plus low-level libraries also include an impressive collection of functions for working on index files. There are the expected functions for creating and deleting key entries; searching for a specific value, the first value, and the last value; and stepping forward and backward through the index file. But there are also functions for searching for key values greater than, greater than or equal to, less than, and less than or equal to a target.

There is a nasty twist to all this flexibility with keys and indexes, and that is that the data in the key-field space is typeless. It's merely a string of bytes. This means that when you create a key string, you cannot simply terminate the string with a null character; all characters are considered significant up to the length of the key. You must pad the entire string space with nulls (or some other character).

Low-level programming gives you some access to FairCom Server. In spite of the necessary reduction in data throughput, accessing the data through the server buys you a lot of comfort. This comfort includes transaction accounting, which allows you to tie multiple database operations to a single transaction. The operations within a transaction are committed to the associated files in a single function call. FairCom Server also adds *resources*, customizable information stored in file headers that describes the state of each file and provides some file specifics.

If you don't need or want to program at the level of the bronze age, you probably will want to start your application using the c-tree Plus ISAM functions instead of the low-level functions (the two are nearly exclusive). Our test application using ISAM took 30 percent less code than the low-level version.

The biggest saving in code and effort comes about because the relationship between indexes and data files is defined outside the source code. The catch is that the file that defines these relationships (i.e., the parameter file) consists of a Byzantine organization of data-file and index-file parameters and descriptors (see listing 1). Fortunately, once you have got past writing the parameter file for your database, you're on easy street. All you need to do to find a record in your data file is to issue a `GetRecord` from an associated index file. Likewise, adding new records with their associated keys in the index files is a simple single step.

You can avoid the parameter file by hard-coding definitions for all the parameters and relationships using IFIL, IIDX, and ISEG, the internal `typedef` structures for incremental ISAM file operations. These structures contain essentially the same information as the

You Can Take It With You.

Introducing Simplicity Portable Drives

Simplicity portable drives give you the confidence and convenience of taking all your programs and files with you, wherever you go-- home, office or client. Use any PC, anywhere, as easily as your own!

Simplicity's rugged construction and small size -- 7.5" X 4.5" X 1.2"-- lets you put it in your pocket and run to a meeting. No juggling floppies and leaving the information you need most back on your desktop.

Simplicity drives are easy to use, too. They attach instantly to any IBM PC compatible or laptop parallel printer port. No card is needed. There's no easier way to add extra storage!

Simplicity drives also come with an exclusive one-year warranty with 48-hour express replacement, toll-free technical support and a 30-day money back guarantee.

INTRODUCTORY SAVINGS!
NOW SHIPPING!
40MB $499, 80MB $699, 120MB $899
Optional five-hour battery $79

ORDER NOW! 1-800-275-6525

Simplicity Computing, Inc. 126 W. 23rd St., NYC 10011 (212) 229-1625 Fax: (212) 229-2938

simplicity computing

Smart Solutions For People On The Move.™

Circle 206 on Inquiry Card (RESELLERS: 207).

World Radio History

BIG NEWS

Announcing The World's First DBMS With An Object-Oriented 4GL

Professional developers agree, DataFlex 3.0 is the ideal application development environment for simple and complex commercial applications. By combining a flexible, full-featured object-oriented 4GL, WYSIWYG application generator, and a powerful database management system, in a single, integrated package, DataFlex represents a radical improvement in the process of application development. ***"Its comprehensive set of built-in productivity tools and utilities make creating large, complex applications much easier, much faster, and much more economical than with any other development system available today."*** *Jerry Busick, President, DataModes, U.S. Software Development Company.* ***"I design the forms in the WYSIWYG screen painter and DataFlex automatically generates and compiles the code. I can run the finished application in minutes!"*** *Tony Figueiredo, Systems Analyst, Laurentian General Insurance Company of Canada.* ***"Reusable procedural and object-oriented command modules including forms, tables, editors, prompts, pull-down menus, action bars, and scrollable selection lists from the built-in library save substantial development time."*** *Paul Wu, M.I.S. Director, Associated Press.* ***"DataFlex 2.3b was already a powerful and stable product. DataFlex 3.0 has reduced our development time by more than 25%!"*** *Craig Bilodeau, Systems Programmer, Raytheon Company.* See how you can eliminate time-consuming drudgery and port to all the most popular supported environments,* by calling us now for more information on DataFlex 3.0.

DATAFLEX 3.0

For more information in the U.S., call us at 800/451-FLEX or contact one of the following International distributors:

Switzerland ABACUS RESEARCH AG 41-71-259-325	***Singapore*** BIZPOINT SYSTEM PTE LTD 65-775-5588	***Canada*** CANVEON SYSTEMS 416-226-2181	***Germany & BeNeLux*** DATA ACCESS EUROPE GmbH 49-6172-75014	***United Kingdom*** DATAFLEX SERVICES LTD 44-71-729-4460
Scandinavia EURODFT AB 46-300-195-30	***Mexico*** INFO MED 525-545-6327	***Brazil*** INTERCOMP LTDA. 55-11-872-9266	***Italy*** LAN SYSTEMS SRL 39-51-437-025	***Spain*** S E I 341-402-2298

* Currently multi-user DOS, and soon to be ported to a variety of other environments including OS/2 and UNIX

® DataFlex is a registered trademark of Data Access Corporation

DATA ACCESS CORPORATION

14000 SW 119 Avenue
Miami, Florida 33186
305/238-0012

For information via CompuServe: GO DAC

Circle 43 on Inquiry Card (RESELLERS: 44).

World Radio History

Listing 1: *The parameter description file for c-tree Plus ISAM programming. The information in this file is scanned whenever the database is opened. The indentation reflects the hierarchy of data structures used internally by ISAM functions to describe the relationship of indexes and data records. Compare this description method to the DDL file used by db_Vista (see listing 2).*

```
12 4 4 4
  0 parts.dat 54 0 1 1 pt_del pt_last
    1 parts.idx 9 0 0 0 0 1 0 0 1 pt_key
      0 9 0
  2 company.dat 70 0 1 1 co_del co_last
    3 company.idx 9 0 0 0 0 1 0 0 1 co_key
      0 9 0
  4 orders.dat 31 0 1 1 or_del or_last
    5 orders.idx 9 0 0 0 0 1 0 0 1 or_key
      0 9 0
  6 salesman.dat 19 0 1 1 sm_del sm_last
    7 salesman.idx 4 0 0 0 0 1 0 0 1 sm_key
      0 4 1
```

parameter file but give you the flexibility of working with the database either as a complete entity or as a collection of data and index files. This means that you can trim the number of buffers for open files down to the minimum needed for the operations at hand. Be warned, however, that working with these structures is almost as complicated and confusing as groping your way through the parameter file.

Unfortunately, the low-level complications of building the key fields for index files also apply to ISAM records. You will want to use the special function `TransformKey` for building anything more complex than the simplest character-string keys. There is no performance cost associated with using the ISAM functions. In fact, since the error handling is simplified, you may find that your ISAM code is faster than your low-level code.

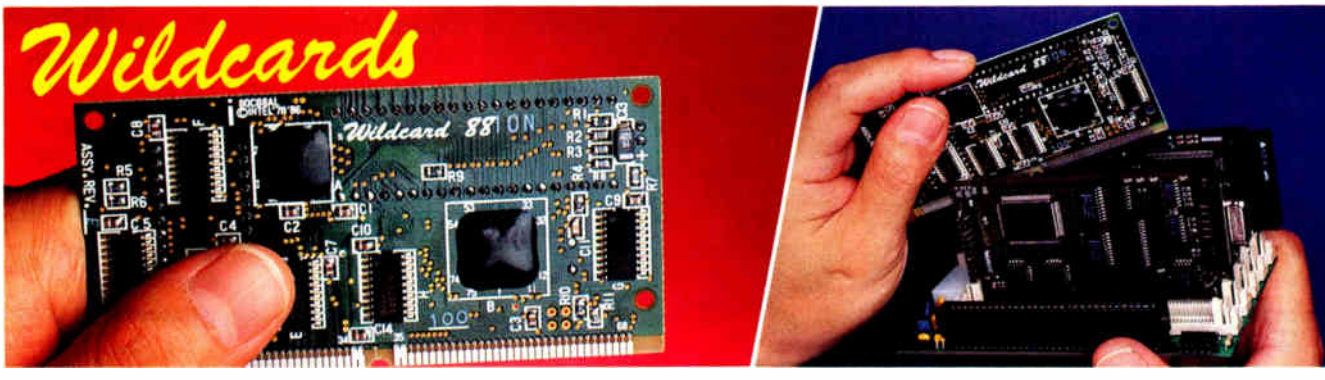
c-tree Plus gives you a library of flexible database functions for developing a wide variety of applications. Performance is good, and the design is outstanding.

db_Vista 3.20

If you prefer not to feel the earth of database development between your toes and would rather travel by coach, you may prefer the db_Vista libraries and utilities from Raima. What db_Vista may lack in low-level flexibility it makes up for in sophistication.

db_Vista is not based on the simple data-file and index-file design that is typical of relational database systems (although you can use it that way). Rather, db_Vista provides access to your data through the simple sequential method,

2" × 4" EMBEDDED PC



Microcontroller. Microcomputer.

"Megatel Wildcards provide PC functionality in a flexible, small format."

Wildcard 88™
- CPU clock to 10 MHz
- Replaces full PC motherboard
- Co-processor and BIOS socket
- DMA, Bus, DRAM, Keyboard controllers

Multi/10
- On-board SCSI Host Adapter (supports up to 7 devices)
- Floppy Controller (1.44M, 1.2M)
- 2 RS-232, 1 Parallel, 1 RS-485 multi-protocol serial port

Vid/Mem:
- 640Kb User memory
- Video/Colour LCD controls CGA, Hercules®, IBM® Mono; (runs LCD Panels)

All Wildcards are low power single +5 volt operation.

For information on our representatives please contact our head office at the number below.

125 Wendell Ave., Weston, Ont. M9N 3K9 Fax: (416) 245-6505

(416) 245-3324

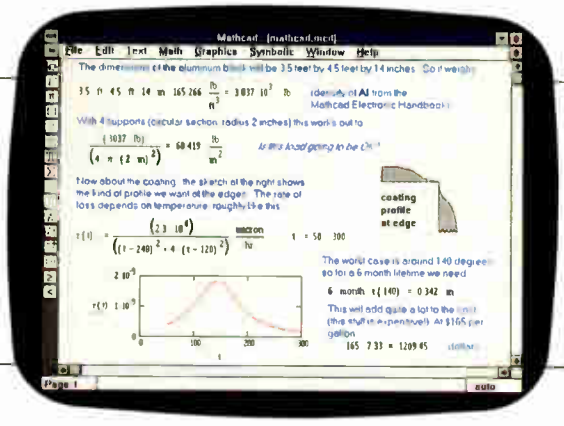
Wildcard 88 and Megatel are trademarks of Megatel Computer Corp. Hercules is a trademark of Hercules Corp. IBM is a trademark of IBM Corp.

megatel®

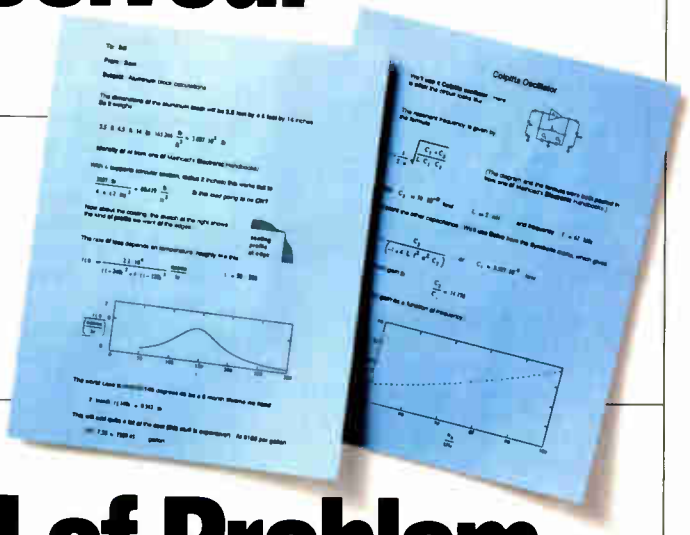
Circle 97 on Inquiry Card.

World Radio History

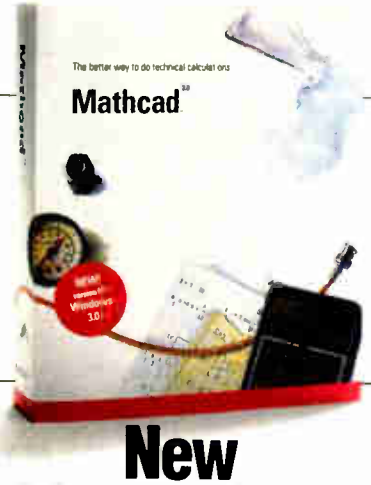
Calculations.



Solved.



Easy.



End of Problem.

New Mathcad 3.0.

When number-crunching time comes, does work grind to a screeching halt?

Want a better way to do technical calculations than a spreadsheet or calculator—an obstacle *clearer* instead of an obstacle *creator?*

You need new Mathcad 3.0, the crunch-those-numbers, and deliver-results-in-a-second calculation software.

As in-depth as you want, as routine as you need. Mathcad 3.0 does everything from averages to FFTs, from percentages to matrices. Almost every function you'll ever need is built in for rapid, effortless calculations.

New Electronic Handbooks make it easy to click-n-paste hundreds of standard formulas, useful data, even entire calculations into your documents. And a full range of add-on Applications Packs help you solve problems specific to your profession.

Mathcad's new easy to learn and use Windows 3.0 interface has you up and running in hours—not days. Best of all, Mathcad is just plain fast.

Simply plug in data and you're done—Mathcad does all the work for you. It does the calculations. Automatically updates results when you change a variable in the live document. It graphs in 2-D or 3-D. And prints results in presentation-quality documents, complete with equations in real math notation. In the blink of an eye—numbers crunched—and you're back to work.

Meet the Mathcad 3.0 power list:

- New easy to learn and use Microsoft Windows 3.0 interface
- New Electronic Handbooks and Applications Packs provide solutions for Electrical, Mechanical, Civil and Chemical Engineering, Statistics, Advanced Math, and Numerical Methods
- New symbolic calculations performed more easily than with any other product
- Does exponentials, integrals, matrices, and more
- 2-D and 3-D graphics
- Prints high-quality documentation
- PC DOS, Macintosh®, and Unix® versions also available

For a free Mathcad 3.0 demo disk, or upgrade information, call 1-800-MATHCAD (or 617-577-1017, Fax 617-577-8829). Or see your software dealer.

PC MAGAZINE EDITOR'S CHOICE
Mathcad 2.5
3-14-89 issue.
Best of '88
Best of '87

Available for IBM® compatibles, Macintosh computers, and UNIX workstations.

TM and ® signify manufacturer's trademark or registered trademark respectively.

1-800-MATHCAD

The answer is Mathcad®

MathSoft, Inc.
201 Broadway, Cambridge, MA 02139 USA

Australia: Hearne (03) 866 1766; Belgium: SCIA 013/55 17 75; Denmark: Engberg 42 25 17 77; Finland: Zenex 90-692-7677; France: ISE-Cegos (1) 46 09 24 00; Germany: Softline (0 78 02) 4036; Italy: Channel 02-90091773; Japan: CRC 03-3665-9741; Netherlands: Klaasing 01620-81600; Norway: Protech 09-959020; Switzerland: Redacom 032 41 01 11; U.K.: Adept Scientific (0462) 480055. In other locations, contact MathSoft, USA.

B 94

Circle 94 on Inquiry Card.

World Radio History

Listing 2: *The DDL file for the db_Vista test database. The syntax is almost the same as that of C (in contrast to the syntax of the parameter file used by c-tree Plus ISAM). The db_Vista DDL processor utility generates a database dictionary and an include file from the information in the DDL file.*

```
database partlist {
 data file parts_dat =
  "parts.d01" contains parts;
 key file parts_key =
  "parts.k01"
   contains parts.stock_no;

 data file company_dat =
  "company.d01" contains company;
 key file company_key =
  "company.k01"
   contains company.co_id;

 data file orders_dat =
  "orders.d01" contains orders;
 key file orders_key =
  "orders.k01"
   contains orders.ref_no;

 data file salesman_dat =
  "salesman" contains salesman;
 key file salesman_key =
  "salesman.k01"
   contains salesman.id;

 record parts {
    unique key char stock_no[9];
    char description[16];
    char co_id[9];
    long cost;
    long sale;
    long curr_quan;
    long backorder;
    long reorder_level;
  }
  record company {
    unique key char co_id[9];
    char co_name[16];
    char co_address[21];
    char co_state[3];
    char co_zip[10];
    char co_phone[11];
  }
  record orders {
    unique key char ref_no[9];
    char stock_no[9];
    long quan;
    long backorder;
    char status;
    int salesman_id;
  }
  record salesman {
    unique key int id;
    char name[13];
    long sales;
  }
}
```

the familiar indexed method, and the set method.

The set method uses the network database model, a hybrid of relational and hierarchical models, and it allows you to organize your data as a tree of linked lists. The set method will be familiar to most programmers; for example, the model of inheritance in object-oriented programming follows the structure of sets.

Unlike the exclusivity of various levels of database library functions in c-tree Plus (i.e., low-level, ISAM, and SQL functions), the three access methods of db_Vista can be mixed within a single database. You can also develop programs that access more than one database at the same time. However, to do so safely requires you to become familiar with the db_Vista concept of current database state. At any given moment, the current state points to only one database and one record within that database. Any database operations that you specify are applied to that current state. This programming model greatly reduces the number of arguments passed to functions but requires additional functions to change the state from one record (or database) to another.

When you open a db_Vista database, you specify one of three modes in which you want to operate: single-user mode, shared-access mode, or exclusive-access mode. If you are new to db_Vista, we recommend that you prototype a multiuser application using only single-user mode. Once your application opens a database in shared or exclusive mode, it requires an access (lock) server (an external program that comes with db_Vista) to handle database-access requests. Since multiuser database operations require interprocess communications with the access server, the data-processing time can be two or even three times greater than that required for single-user access. For this reason, you should design data-access-intensive applications using exclusive or single-user mode with the database locked (i.e., batch mode). Only interactive operations should use shared file access.

To design a database, you define the records and indexes in a data description language file (see listing 2). Before compiling (or even writing) your application, you run the DDL processor utility, `ddlp`, to generate a header file that describes all the structures and alias `#defines` that pertain to your database description. The `ddlp` utility ensures that each database file has a unique handle and that the structures are appropriate for the application. The `ddlp` utility also generates a database dictionary file that the db_Vista functions use.

Most db_Vista functions perform high-level operations and require only two or three parameters. For example, to find a record, the function is `d_keyfind (field_ID, target, db_ID)`, where `field_ID` and `db_ID` are aliases defined by the database header file.

The step up from single-user access to multiuser access requires only a few more function calls but a significant amount of foresight, because you must be careful that one user doesn't lock another user completely out of the data. The access manager can queue requests with an application-specified time-out, but the application must include appropriate code to handle locking so that other users are not locked out of records and files for unbearably long amounts of time.

The value of db_Vista does not stop with the simplicity of its function calls. Its utilities simplify the business of applications development and database maintenance. db_Vista can take you all the way from a simple, single-user database to a complex, multiuser database with transaction safeguards. db_Vista performed at the top in almost all our benchmark tests. Combine that with its cross-platform support, and you've got one powerful database package. The price is a little steep: $895 for a single-user DOS version, $1295 for a multiuser DOS version, and $1895 for an SCO Unix version. But those prices get you source code and a royalty-free license, so the power may well prove to be worth the price.

Paradox Engine 2.0

Although the Paradox Engine provides database access at a very low level, while using it you always feel that you're working much higher—as though you were performing relational activities rather than simply reading and writing individual records. It's an illusion, of course. Much of the illusion comes from the relational terminology Borland uses in the documentation: A database is a "table"; a record is a "row."

The Paradox Engine places very tight controls on how your program accesses fields. When you build a table, you must first define a pair of arrays that you pass to the `PXTblCreate()` routine. One array specifies the field names within the table, and the other specifies the field data types. You build each record by writing into fields with calls to type-specific routines, such as `PXPutAlpha()`

World Radio History

hile the PC industry continues to talk about performance in terms of CPU and disk speed, we at Quarterdeck think the biggest issue for most users is getting rid of "out of memory" messages.

World Radio History

and PXPutDate(), which write character strings and dates. In order to retrieve the contents of fields, you call the corresponding PXGetAlpha() and PXGetDate() routines.

Such routines allow the Paradox Engine to provide data types beyond those of standard C. They also add a level of protection, since it's unlikely that a programming mistake will overwrite a numeric field with a string. However, the result is code that is bulkier than that of a system that simply relies on C structures to map out the record structure (e.g., Btrieve).

Sometimes the Paradox Engine approach to data typing can get frustrating. Just extracting the contents of a record into a form that you can display requires a slew of function calls. We also wondered why the function for packing alphanumeric values (PXPutAlpha) does not require a length count, while its counterpart for extracting alphanumeric information (PXGetAlpha) does. Apparently, PXPutAlpha can derive length information from the field-definition array, while PXGetAlpha cannot. We suppose that the idea is to allow programmers to selectively unpack only a portion of a string, but that selectivity gets you only the leading bytes of the string. A properly placed memcpy() can achieve the same thing.

The Paradox Engine uses handles everywhere; you access everything through them. You make handles for files, handles for records, and even handles for each field within a record.

This handle concept gives the Paradox Engine added flexibility. Database packages like CodeBase provide only one record buffer per database. The handle orientation of the Paradox Engine allows multiple record buffers for each database. In this way, Paradox permits several different simultaneous views into a single database.

You can use the Paradox Engine in single-user mode or on a network. The library is compatible with a variety of network operating systems. However, you need to decide whether or not an application will run on a network at compile time, since you have to set constants to tell the engine what type of network you're running on, what your application's user name will be, and the directory where the PARADOX.NET file will be found. (PARADOX.NET is a file that the Engine uses to control concurrent access.)

Initially, we speed-tested the Paradox Engine using its defaults and with write-buffering off. This meant that the engine's own internal buffers amounted to only 32 KB and that all writes went immediately to disk. The effect was a painfully slow orders update. The results given in the figure show how the Paradox Engine performs with the write-buffering on and its own internal cache set to the maximum (256 KB).

The ability to turn write-buffering off is an important feature in critical situations where an up-to-date image on the disk is more important than speed. Such situations often occur in networked applications.

We tested the $495 Paradox Engine for Borland C. Borland also offers a Turbo Pascal interface that has two Turbo Pascal units—one compatible with version 5.5, the other with 6.0.

The Paradox Engine's documentation is superb. Borland provides the right number of examples at just the right level of complexity. The reference guide is easy to read and navigate through. Paradox fared very well in our benchmarks, leading the DOS pack in the post-orders test. Just as CodeBase will attract dBase users, so will the Paradox Engine attract users with Paradox databases already in place.

Check Out These Libraries

Although most of the packages are closely clustered in their performance times, db_Vista appears to be the overall winner in speed. We were impressed with the performance results for CodeBase and CodeBase++, especially since these packages use standard dBase index and data files.

However, your choice for a database library will be determined more by what your application requirements are than by a benchmarking horse race. To put it another way, it doesn't matter how fast a database package can run if it can't run on your chosen operating system.

If you want compatibility with existing dBase files, either CodeBase package will serve your needs. We really liked the simplified model of programming database applications in CodeBase C++. Likewise, if you already have a significant amount of data stashed in a Paradox database, Paradox Engine is the logical choice for you. For developing databases on NetWare LANs using almost any programming language, we would recommend Btrieve and the Btrieve Developer's Kit.

Our overall favorite is db_Vista. It scored at or near the top in the performance tests we ran. It's a powerful system loaded with all the features you'll ever need. Most important, db_Vista offers portability to a host of operating systems at a time when developing applications for diverse networks is often a critical requirement. ■

Rick Grehan is technical director of the BYTE Lab. He has a B.S. in physics and applied mathematics and an M.S. in mathematics/computer science. His work with database systems extends back to the late 1970s. Ben Smith is a BYTE technical editor, a former database consultant, and the author of UNIX Step by Step *(Howard W. Sams, 1990). Jon Udell is a senior technical editor at large for BYTE. You can reach them on BIX as "rick_g," "bensmith," and "judell," respectively.*

COMPANY INFORMATION

Borland International, Inc.
(Paradox Engine 2.0)
1800 Green Hills Rd.
P.O. Box 660001
Scotts Valley, CA 95066
(408) 438-8400
fax: (408) 439-9344
Circle 1308 on Inquiry Card.

FairCom Corp.
(c-tree Plus 6.0)
4006 West Broadway
Columbia, MO 65203
(800) 234-8180
(314) 445-6833
fax: (314) 445-9698
Circle 1309 on Inquiry Card.

Novell, Inc.
(Btrieve 5.10 Developer's Kit)
5918 West Courtyard Dr.
Austin, TX 78730
(800) 733-9673
(512) 346-8380
Circle 1310 on Inquiry Card.

Raima Corp.
(db_Vista 3.20)
3245 146th Place SE, Suite 230
Bellevue, WA 98007
(800) 327-2462
(206) 747-5570
fax: (206) 747-1991
Circle 1311 on Inquiry Card.

Sequiter Software, Inc.
(CodeBase 4.2, CodeBase++ 1.05)
9644 54th Ave., Suite 209
Edmonton, Alberta,
Canada T6E 5V1
(403) 437-2410
fax: (403) 436-2999
Circle 1312 on Inquiry Card.

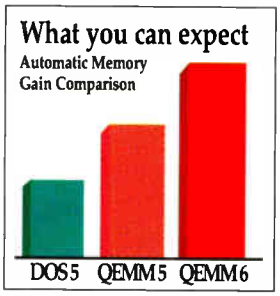
World Radio History

Introducing QEMM 386 v6

Technology, art and magic make the best memory manager better still.

NEW **Stealth: The Ultimate Weapon.** QEMM 6 introduces an amazing new concept: Stealth. This new feature, *the first of its kind*, actually maps ROM into other areas of memory, resulting in a memory gain of up to 211K. Now you can load larger TSRs and device drivers into high-memory (the area above 640K), to give your applications more room. Stealth works on most IBM and IBM compatible computers.

NEW **New Optimize Makes it Easier.** QEMM 6 includes a completely new version of Optimize, the program which automatically configures and optimizes your memory. Now, it includes simple on-screen instructions, the ability to play "what-if" games, and a "view, browse and play" feature.



NEW **Squeeze: Flexible Memory at Start-up.** Often TSRs you wish to load into high-memory require more memory while they are initializing than they do once resident. Squeeze recognizes this, and can temporarily increase a High RAM region during a program's load and initialization.

NEW **Help for Beleaguered Laptop Users.** QEMM 6 now fully supports most battery-operated laptops, with detection of "suspend/resume".

Manifest Changes Destiny. QEMM includes a copy of Manifest free. This amazing memory diagnostic and analysis tool is vital when configuring today's complex PC systems.

Much More Speed. QEMM makes your machine faster, because it can place sluggish ROM into high-speed RAM. (QEMM is also a lightning fast memory manager.)

Even More Memory. QEMM's VIDRAM feature extends *conventional* memory by 96K on EGA or VGA systems. VIDRAM disables graphics, but can easily be turned on or off.

	DOS 3.3			DOS 4.0			DOS 5.0		
Model	DOS Prog Size	Avail High Mem	Avail HMA	DOS Prog Size	Avail High Mem	Avail HMA	DOS Prog Size	Avail High Mem	Avail HMA
IBM PS/2 80	581K	211K	64K	572K	211K	64K	620K	211K	0K
Compaq 20e	581K	211K	64K	572K	211K	64K	620K	211K	0K
ALR VEISA	582K	211K	64K	573K	211K	64K	620K	211K	0K

More Memory by Default. QEMM's Optimize will now, automatically, find up to 211K of high-memory. No other memory manager is able to accomplish this feat.

QEMM Shares Memory. QEMM automatically gives programs any kind of memory they need (i.e. EMS or XMS). Other memory managers require manual *allocation of memory*, which means you have to change your config.sys file and reboot to change memory configurations.

New Feature Highlights

- STEALTH: Maps system ROMs into other areas of memory. Potential memory gain: **211K.**
- NEW OPTIMIZE: Simple menuing interface, "what-if" mode, "view, browse and play" modes, and five new parameters.
- SQUEEZE: Temporarily increases a High-RAM region during a program's loading.
- Support for Suspend-Resume features on laptops.
- Ten new parameters for QEMM386.SYS and LOADHI.COM.
- Support for SCAT shadow RAM.

QEMM Practices Safe Memory Management. Optimize can now automatically detect areas which may present conflicts during operation. Additionally, PS/2 users can sleep well, since QEMM recognizes a wide variety of adapters that may conflict with certain PS/2™ memory areas.

Much More Compatibility. QEMM-386 can run Windows 3.0 in *any* of its three modes.

Chart data is based on the following: Automatic Memory Gain: DOS 5 will automatically gain up to 76K (using the DOS=high and devicehigh commands), QEMM v5 will automatically gain up to 172K (using QEMM's Optimize command and DOS=high), whereas QEMM 6 will gain up to 255K using the new Stealth feature, DOS=high and the new Optimize. As with any utility, these features are dependent on type of machine and application. All trademarks or registered trademarks are property of their respective owners.

© 1991 Quarterdeck Office Systems

Quarterdeck

Quarterdeck Office Systems, 150 Pico Blvd., Santa Monica, CA 90405
(213) 392-9851 Fax: (213) 399-3802

Circle 137 on Inquiry Card.

World Radio History

DOS DATA AT WORK

The first BYTE Lab Product Report takes a look at 10 databases for DOS

RICK GREHAN AND STANFORD DIEHL

If this is indeed the information age—and all the signs point in that direction—then you had best make managing information your top priority. In the absence of a unified storage-and-retrieval method, a pile of important facts and figures usually turns out to be just that: a pile. But when you arrange your information systematically, that same data becomes a powerful tool. Enter database management systems (DBMSes), the filing cabinets for the electronic age.

If you dig into the paperwork of virtually any organization worldwide, you probably will come upon stacks of documents whose contents cry out for a digital home in a database: the customer list for the video-rental parlor, the cassette-tape inventory at a busy music store, or even your own company's employee records. Lots of data already has found its way into dBase, Paradox, and other database files, but still more lies locked up in ink.

In this special product roundup, the BYTE Lab examines 10 database packages that can help convert reams of printed material into a useful electronic data bank. Our selections include such well-known packages as dBase IV (a former Ashton-Tate product now marketed and supported by Borland International), Borland's Paradox, Microrim's R:Base, DataEase from DataEase International, Nantucket Software's Clipper, and FoxPro from Fox Software. Other packages include new or lesser-known products that are no less interesting: WindowBase from Software Products International and Alpha Four from Alpha Software. We also look at Informix Software's durable Informix-SQL and Precision Software's Windows offering, Superbase 4.

All of the products we tested run under MS-DOS or Windows 3.0, but our choices by no means represent an exhaustive survey of database packages for the DOS world. Rather, they provide a cross-sectional sampling of packages equipped with similar capabilities (see the features table). We should point out, however, that what you see in the product descriptions isn't necessarily all you can get. In many instances, you can expand the core capabilities of the databases reviewed here by purchasing upgrades such as multiuser modules, C-language interfaces, and fourth-generation programming language add-ons.

The Gauntlet

The primary focus of our testing was to analyze the ease of use and overall capabilities of each database package: How easily can you get data into the package? Is it difficult to construct a data-entry form? How effective a tool is the program's report generator?

To help answer those questions,

World Radio History

BASES

File Cabinets For The Future

we drew up a specification for an inventory system that enables us to put the programs through their paces in a controlled fashion. The specification required importing start-up data into four tables: an orders table, a parts-inventory table, a supplier's table, and a salesperson table. Next, we built an order-entry screen of the type a mail-order distributor might need for its order-entry clerks. For each package, we also created a reorder report and a batch-mode order-entry program for processing orders and comparing them against a salesperson table and parts table.

Because raw performance also was a consideration, we ran two timing benchmarks (see the benchmark graphs on page 240). The first measured how long it took each package to index a 4000-item parts file and import that file into the parts table. Although most packages let you create an index before or after reading data into a table, to really put the packages to the test we purposely created the parts table index before reading data in. This method often slows down performance, not only during importation but anytime you subsequently access the index. If you create the index after the table is filled with data, the index tends to be more compact, and searches performed on that index are significantly faster than if you had created the index before importing data.

Our batch order-processing benchmark reads an 800-item order table and posts its orders against a 100-item salesperson table and a 4000-item parts table. This benchmark requires the system to perform searches on the salesperson and parts tables, so we indexed those tables on the proper columns whenever possible.

The packages we tested share a rich set of features. All of them, for example, include some form of browser, a querying screen that permits you to search a database for particular information. Many of these browsers include an edit mode for modifying information in the database. All of the packages also let you create forms and reports. However, each package's methods for supporting standard features is unique; benchmarking a specific group of operations enabled us to uncover these idiosyncrasies.

BYTE ACTION SUMMARY

- **WHAT THEY DO**
  Database packages allow you to store information so that it can be retrieved and manipulated rapidly and in some structured form.
- **WHAT YOU'LL LIKE**
  With most packages you can quickly import your data and easily browse and edit your database once its built. Most DBMSes include a form designer for constructing custom data entry screens and some form of report-builder for generating custom reports.
- **WHAT YOU WON'T LIKE**
  A complex database often requires programming in the database package's DML (database management language), which can be as complex as any high-level language.
- **RECOMMENDATIONS**
  The performance and functionality of FoxPro 2.0 can't be beat. We also liked Paradox for its intuitive interface and outstanding documentation.

World Radio History

ALPHA FOUR 1.1

Alpha Four is a database package that wraps a spiffy, menu-driven interface around a dBase-compatible engine. The advertisements touting it as a "relational database for nonprogrammers" are right on target; Alpha Four lacks a real database management language (DML), so there's not much for a programmer to do. In fact, Alpha Four's programming capabilities are so limited that it couldn't perform our batch order-processing benchmark. (A future release of Alpha Four, however, reportedly will include a powerful scripting language that will make the program more versatile.)

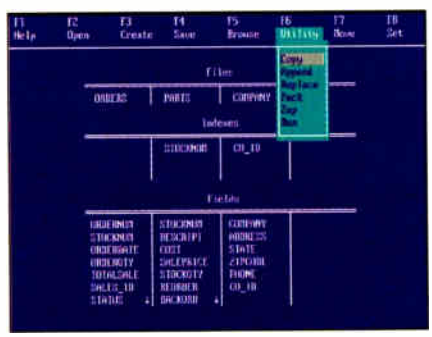
On the bright side, Alpha Four's import capabilities are among the best of any package we tested. If you select the option to import an ASCII file with fixed-length keywords, Alpha Four guides you comfortably through the process of mapping data from the source file to the target database. It even displays the first record of the input file, highlighting sections of the record so you can see instantly what portion of the record you are importing into each field. As you would expect, Alpha Four can read dBase III and dBase III Plus files directly.

You specify relationships among files using the program's set editor (the programs uses *set* to mean *database*). Once in the set editor, you define the primary table (called a *parent database*) and its link fields, its connections to any child databases. The links may be one-to-one or one-to-many, and parent/child relationships may be nested, but you may not create more than 10 databases in each set. The set editor displays links graphically, so you can see a tree diagram of file relationships at a glance.

Alpha Four's forms builder is sufficient for simple data retrieval and querying, but we had trouble using it to do anything complicated. It includes all the basics—multiple file access, verified fields, and calculated fields—but expressions within calculated fields can be only 254 characters long. This restriction quickly limits your ability to set up a form that uses complex decision-making sequences during field updates.

Alpha Four does include some very powerful utilities, though. If you have a search query that you execute frequently, you can save the expression for reuse. If you often use your database to do mailings—creating mailing labels and form letters, for instance—then Alpha Four may be just the ticket. It has functions for just such purposes. Even more useful is Alpha Four's `Post Database` command, which presumes that you keep a database of transactions that you periodically post to a master database. A transaction of this type might be a journal-entries database whose contents you post to your general ledger database on a monthly basis. You tell `Post Database` what the linked field is—the account number, in the previous example—and the command races through the transaction database, tallying its contents into the proper rows of the master database. You can select among four tally functions: add, subtract, replace, or none (although we can't figure out why anyone would conduct a series of null operations on a database).

Alpha Four might be ideal for a small business that uses a database primarily for tracking clients and maintaining an inventory containing several thousand items. The company's claim of providing a package for nonprogrammers is accurate; Alpha Four's ability to easily create mailing labels and churn out form letters attests to that. However, we found the package's simple approach too restrictive overall.



CLIPPER 5.01

Clipper takes the opposite tack from Alpha Four: This database development package is decidedly *for* programmers. Although it lacks some of the nifty code-generation utilities of the other packages, Clipper offers a wealth of tools and capabilities that programmers need.

Two of those tools are a report generator (called RL) and a utility (called DBU) for creating and managing database files, but even these programs come with a twist: They are written in Clipper's own programming language and the source code is included. You can use this code as reference or tweak it and add it to your database applications. You'll especially appreciate the database utility when you're building database structures and objects.

Although Clipper is built for users who understand programming, an interactive working environment still is important, particularly when it comes to doing mundane database management tasks. DBU is helpful here, too. The main DBU screen lists options across the top of the screen, along with the function keys assigned to them. The rest of the screen is devoted to a visual representation of the active database view, which consists of a column split into three sections. The first group displays the names of the active database. If you include an argument when invoking the DBU program, the database or view you specify will appear here. The next section shows the active indexes associated with the active database, and the bottom grouping displays the field names for the active database. The column itself represents a work area. If the column is blank, you simply press the Enter key to see a list of the databases in the current directory. You can select one of them to load into the work area or create a new database by pressing the appropriate function key. This setup lets you quickly and easily load different databases into separate work areas, use or create indexes, and modify the structure of your database. We especially appreciated the ease with which this system let us create different views and set up database relationships.

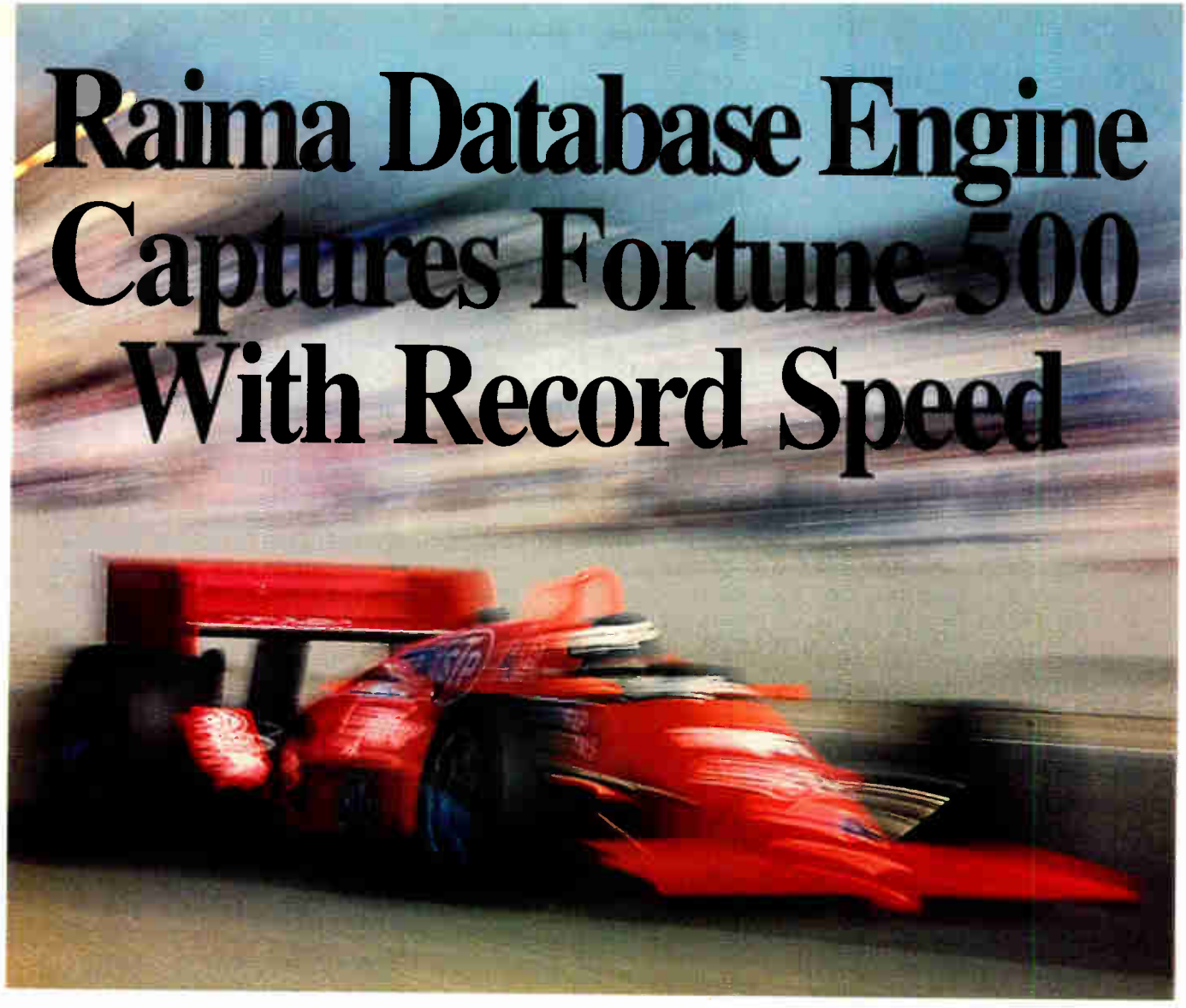
The RL report generator isn't as flexible. It does not support a WYSIWYG outline of the report, nor does it let you see a preview of the output as you work. The program simply prompts you for a column name and definition. You then type in the field name you want to appear in the first column, along with the title for the column. You also can define summary fields from the column-definition screen. That's it. You can add only one column at a time. After you set up your columns, you can specify groups and set up parameters for the entire report. But even though its procedures aren't slick, RL does the job with ease.

Clipper's real power lies in its coding.

continued

World Radio History

Raima Database Engine Captures Fortune 500 With Record Speed



Accelerated Database Performance

Compared to conventional relational databases, retrieval of records can be 10—20—even 50 times faster with db_VISTA III from Raima.

Propelling The Biggest Names In Business

Companies like General Motors, Hewlett-Packard, IBM, Eastman Kodak, Rockwell and others are using db_VISTA III in their competitive environments. Today's most critical, most demanding applications demand the high performance of db_VISTA III.

Powerfully Efficient Leading-Edge Technology

Raima's combined technology merges the flexibility of relational databases with the lightning speed and efficient storage of the network model. It's written entirely in C, so you can "fine-tune" the db_VISTA III engine for optimum performance in any application.

Put Yourself In Fast Company

Give yourself the competitive advantages of db_VISTA III:

- Speed—faster access to data
- Portability—supports most environments
- Royalty-free—increase your profits
- Source Code Available—total programming flexibility
- Full Raima support services—including training

Whether you're writing a stand-alone DOS application, or one for UNIX accessing thousands of records, db_VISTA III will put your application on the fast track. Race to the phone and call for more information!

In the U.S. or Canada, call: 1-800-DB-RAIMA
In Washington state or international, call: **(206) 747-5570**

RAIMA™ CORPORATION

Specifications Relational B-tree indexing. Network data model. Relational SQL query and report writer. Single & multi-user. Automatic recovery. Built-in referential integrity. **Supports:** VMS, QNX, ULTRIX, UNEX System V, Berkeley 4.2, AIX, SunOS, SCO, MS DOS, MS Windows, and OS/2. **Most C Compilers and LANs supported.**

Raima Corporation 3245 146th Place S.E., Bellevue, WA 98007 USA **(206)747-5570** **Fax: (206)747-1991**
International Distributors: Australia: 61 2 419 7177 **Belgium:** 32 2 734 9818 **Finland:** 358 080405350 **France:** 33 1 46 09 27 84 **Germany:** 49 7022 34077; 49 0214 91051 **Italy:** 39 49 829 1285 **Japan:** 81 33 865 2140 **Mexico:** 52 83 49 53 00 **The Netherlands:** 31 215 946814 **Norway:** 472 38 48 88 **Singapore:** 65 334 0061 **Sweden:** 46 13 111 588 **Switzerland:** 41 64 517475 **Taiwan:** 886 2 552 3277 **United Kingdom:** 44 992 500919

Copyright ©1992 Raima Corporation. All rights reserved. Photo: Dale LaFollette

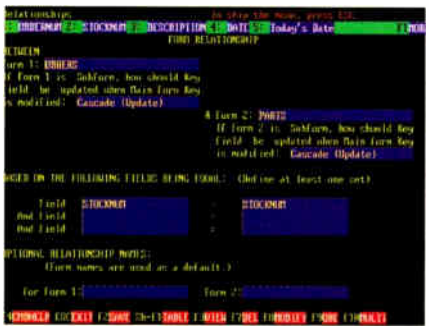
BY112RC

Circle 140 on Inquiry Card.

World Radio History

As the benchmarks indicate, the program's compiler is very fast, but the package also has a number of interesting capabilities. One new feature is its support of so-called code blocks, small chunks of executable code that you can store as variables or pass as arguments to other programs. You use an EVAL() function to execute a code block. Another helpful feature is Clipper's use of make files for tracking which files in a program depend on other files to run properly and keeping them up to date. With this system in place, you can invoke the Make utility to perform only those compiling and linking operations needed to keep all the files in sync. Clipper also supports functions to read from and write to binary DOS files. A file pointer follows the read or write sequence, or you can set the pointer yourself with the SEEK() function.

Programmers also will appreciate Clipper's debugger, which lets you step through your program code, enter commands, and monitor the state of particular variables, field names, or expressions. A status window lists the databases open in all active work areas, as well as the values of all Set commands. The debugger also keeps a history of all routines called as the program code executes. Clipper is not for the database novice, but database programmers will find a lot to like.



DATAEASE 4.2

When you work in DataEase, you get the feeling that the program is taking you by the hand, patiently guiding you along step by step. This can make things easier, but at times you may want to break loose.

If you've worked with databases before, don't expect DataEase to work like anything you're used to. It follows a unique, structured approach. When you start up DataEase, you are greeted with a log-on screen. You must indicate the name of the database you'll work in right off the bat. If you enter the name of a database that isn't listed, DataEase asks if you want to create a new one. The program also prompts you for a user name and password. You can press the Enter key if you don't wish to protect the database from prying eyes.

At the main menu, your choices are listed next to option numbers. You can use cursor keys to highlight an option or press the number of your choice. DataEase does not support a mouse.

Usually, the first thing you do with a new database is create a table (called a *form* in DataEase). DataEase follows this approach but gives you extra mileage. As you create your form, you are creating an entry screen and a table structure. You start with a blank screen on which you can type text (a heading that reads *Company Name:*, for instance). When you press F10 to enter information in a field, a field-entry form containing the text you just typed appears. This sequence is typical of how DataEase works: The interface is made up entirely of menus, function key options, and blanks for you to fill in.

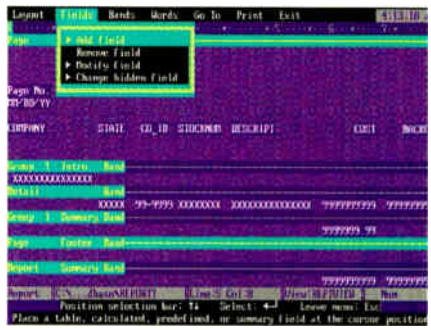
The form used to define your fields exposes some of the powerful features DataEase offers; no programming is required. You can define the field type as you would in any database program, but DataEase also lets you specify numeric formats, such as a phone number or social security number, without using functions or formatting code. You then can designate the field as a required field or a unique field by filling in the blanks the program presents. An entry labeled *derivation formula* lets you enter a formula for the field, such as *quantity*price*; you can use the resulting figure to compute the value in the total sales field.

After you design your forms, you can link them using another menu option. You simply specify the forms you want to link and fill in the fields to link; DataEase makes sure the connection is retained during all subsequent operations. For instance, you can pull up a primary form that tracks company names and press F10 to access a secondary form listing the parts a particular company supplies. DataEase keeps track of the relationship between the two tables.

DataEase's structure made it especially easy to generate our report. We designated a primary table to use and a form came up with the field names. Next, we pressed the space bar to select the fields we wanted to show up on the report. DataEase also let us enter keywords in the field list so that we could group selected fields or accumulate statistical information such as running totals. This enabled us to call up a related table or, easier still, create a lookup field for pulling the associated information into the report. For the company field, for instance, we entered the keywords *group* and *sum* and designated part numbers as the lookup field. This produced a report listing each company name and the part number of the products the parts table indicated that the company supplied. The total replacement cost for all back-ordered parts from each company was listed at the end of each company's parts list, and a grand total was supplied automatically at the end of the report.

The program is easy to work with, but in the end we felt confined by DataEase's environment. You must use the DataEase editor to build code, and it won't let you save a file that contains bad code or nonexistent variables. We also had problems with the batch-entry code because we started out using lookup fields. DataEase's lookup fields are updated only when you enter data in a form; they do not change when the data referenced by the lookup changes. This limits their usefulness for programming purposes.

Restrictions such as this won't help programmers feel comfortable in the DataEase environment, but novice users who need to set up their own applications should do well with the package.

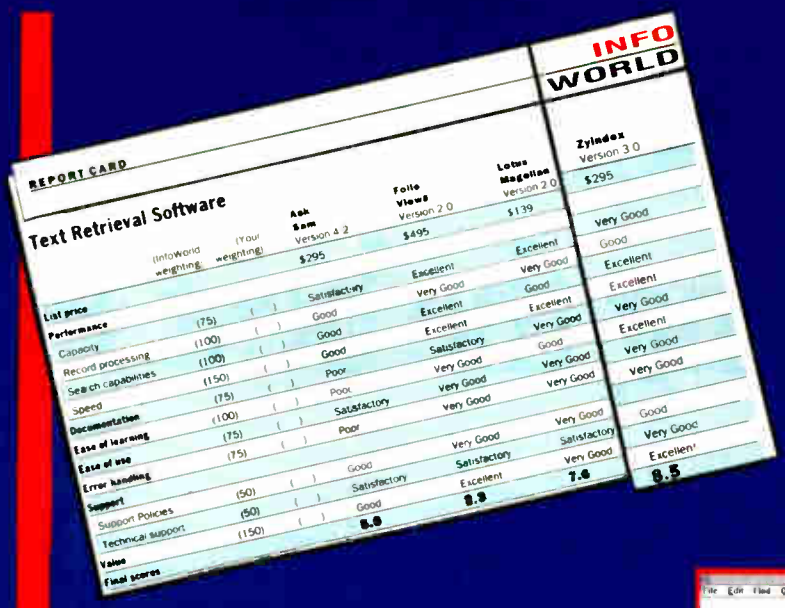


DBASE IV 1.1

Gone are the days when dBase set the standards for DOS-based database management. dBase rose to the top mostly on the strength of its powerful programming language. Delays and buggy releases opened the door for packages that included the same programming prowess hidden beneath simpler interfaces.

dBase is becoming easier to use: In addition to the dot prompt so familiar to old-time dBase hackers, the program now offers a menu-driven interface called the Control Center. Although the Control Center represents an improvement for users intimidated by a single

World Radio History



#1 Text Retrieval Software

"Powerful and flexible search capabilities; extremely easy to learn and use."
–Patrick Marshall
InfoWorld, August 5, 1991

Finds needed information quickly.

ZyINDEX simultaneously searches all files, thousands of pages, entire networks, with results in less than 3 seconds!

Searching is easy. To find a word, just type it. Instructions are clear and readily available.

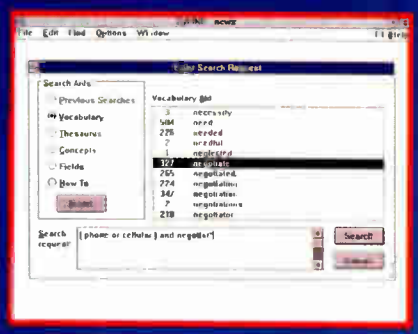
Versatile. Powerful. ZyINDEX provides the widest range of search techniques:

- **Boolean Logic • Thesaurus**
- **Comments • Phrase Searches**
- **Numeric Range • Field Searches**
- **Wildcards • Conceptual Searches**
- **Proximity Searches... and more.**

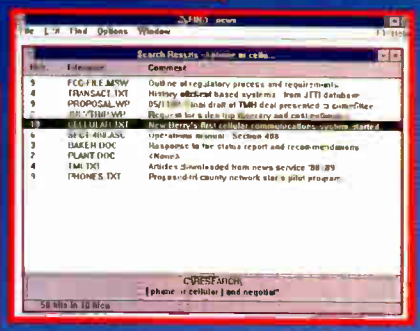
Prepare your entire drive for searching with just one keystroke. Ideally suited for networks and frequently changing text.

ZyINDEX finds every occurrence of your search request.
Select any file for viewing.
Browse or jump from hit to hit.
Copy, paste and print.

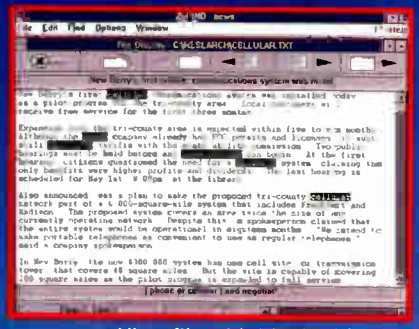
Available for DOS, Windows and UNIX.
Supports WordPerfect, Word and most other word processor formats.



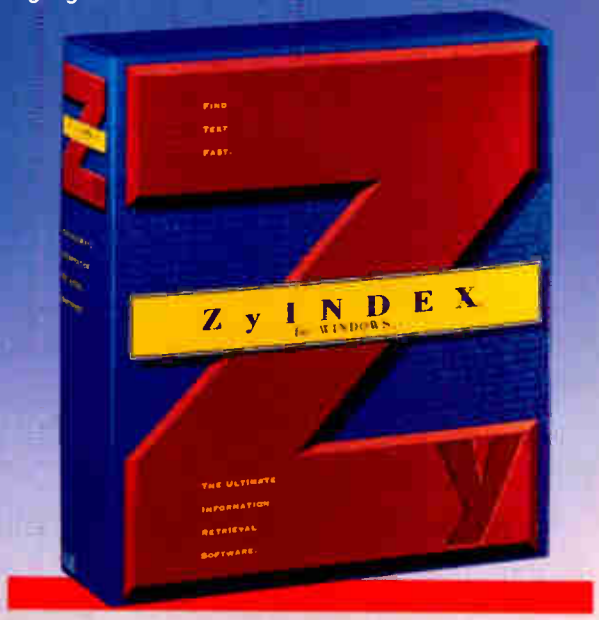
Type a search request.



List of files found.



View file with hits highlighted.



ZyLAB
a Division of *Information Dimensions, Inc.*

100 Lexington Drive
Buffalo Grove, Illinois 60089
(708) 459-8000
FAX (708) 459-8054

Call 1-800-544-6339
Demo disk available

BYTE DEMO DISK Free Demo Download 617-861-9767*

©1991

Circle 193 on Inquiry Card (RESELLERS: 194).

World Radio History

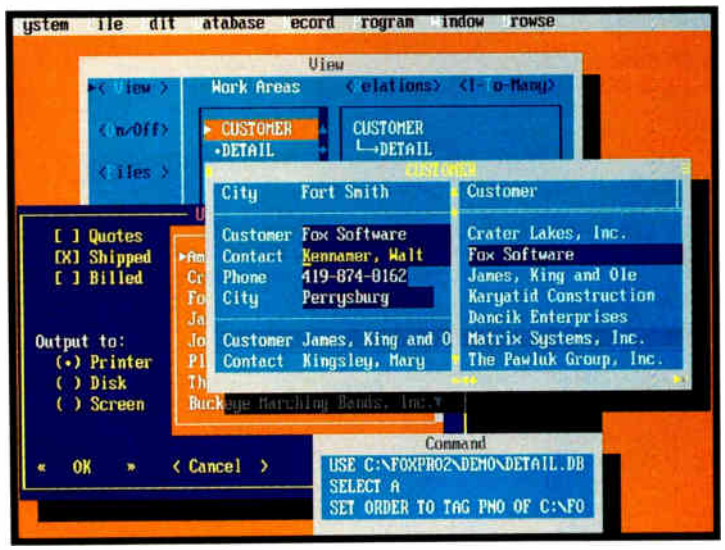
We never dreamed for creating the best PC

Object-oriented, event-driven operation means that you get the benefits of a Graphic User Interface (GUI) on your DOS PCs, and code that's reusable from application to application.

FoxPro 2.0 is the state-of-the-database-art, an object-oriented, event-driven DBMS that runs in DOS to protect your information systems investments.

Rushmore query optimization is unique to FoxPro and gets your answers as much as hundreds of times faster than competitive products.

4GL Tools (Fourth Generation Language) simplify the creation of Mac-like applications on your DOS PCs, using keyboard shortcuts or a mouse.



For users, the View window makes it easy to work with multiple tables of data, RQBE (Relational Query By Example) simplifies the creation of business queries.

Event-driven operation allows you to work with any number of resizable, scrollable windows, get to all of your data all of the time.

FoxPro 2.0 runs your industry-standard dBASE programs today, lets you build on your current systems for your needs tomorrow.

Optional Distribution Kit creates stand-alone .EXE files for distributing your applications.

Application Program Interface (API) links to external libraries written in C or assembler. Third-parties are currently developing communications, client/server access and other packages. (Optional Library Construction Kit available.)

Applications you write in FoxPro 2.0 can exchange data with our FoxBASE+/Mac on a LAN today, will run virtually unchanged under our Windows, Mac and UNIX versions currently in development (no release date yet).

Response to FoxPro 2.0 has been overwhelmingly favorable.

And that's the problem: the response has been overwhelming.

We're hearing of callers being on hold for 20 minutes or longer!

And this in spite of ramping up our support months in advance of the release.

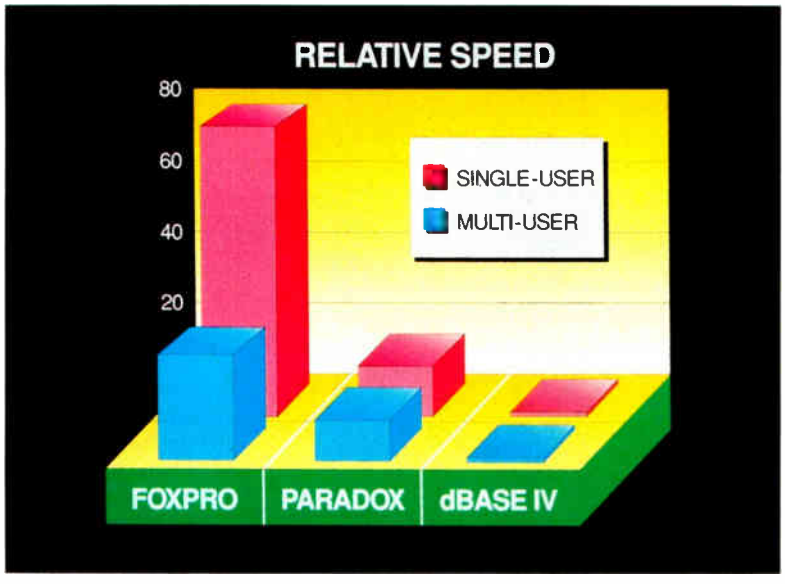
Well, we're adding another 40 phone lines and hiring more people. And if that's not enough, we'll add even more.

In the meantime, we'd like to say

World Radio History

we'd be apologizing database in the world.

Results from an extensive suite of query tests independently performed by Micro Endeavors, Inc. and published in the 8/91 issue of Data Based Advisor.



FoxPro 2.0 is far faster than the other PC database management systems and raw compilers like Clipper, both single-user and on a LAN.

"Thanks" to the tens of thousands of you who put up with the wait, and "Sorry" to those who didn't.

But please try again. We think we've got things under control now.

And FoxPro 2.0 really is worth the wait.

Call 1-800-837-FOX2 or 419-874-0162 again.
(We believe we've fixed it.)

FOX SOFTWARE

Query benchmark tests performed by Micro Endeavors, Inc. (215) 449-4680. FoxPro and FoxBASE+/Mac are trademarks of Fox Holdings Inc.; other products and services are not. © Fox Holdings Inc. 1991.

Circle 62 on Inquiry Card.

World Radio History

dot on a blank screen, the simple addition of pull-down menus doesn't make this a user-friendly product. First of all, the package doesn't offer mouse support. You must rely on Alt-key combinations, cursor keys, and function keys to get around. The Control Center doesn't help the cause much by requiring confirmation whenever you move out of one operation and into another. Even when you've saved the data in the window and you press the Escape key to return to the main menu, the Control Center asks if you really want to do that.

Once you get used to the key sequences, the Control Center offers a few nice features. Among them is the program's query builder. As with many other packages, you start out with a skeleton of the active database structure. You can add multiple databases to the query from the menu and switch among these databases with function keys. By pointing to field names in the skeleton, you can create links between databases, specify fields to include in the query, organize the database using specific fields and sort methods, and set the conditions for the query. A query also can trigger multiple-record updates; you can save the result as a view or as a new database.

We really missed mouse support when building forms and reports. Worse, the interface offers no obvious way to relocate text and fields. You won't find cut-and-paste capability (not even in the editor), and you can't simply select a field and move it. After consulting the menu and the documentation, we finally resorted to deleting fields and replacing them. The forms generator did not support multiple database entry forms without some tweaking of the code. When we first loaded different databases from the menu and placed the fields on the design screen this looked possible, but when we ran the form, it could not find the field designators. We loaded all the databases used in the form into different work spaces and set up relationships for each of them, but the form still didn't understand any references for fields outside of the active work space. Fortunately, the fix was simple. We loaded the generated code (saved with a .FMT extension) into an editor and prefaced the external field names with the databases they belonged to. Not a huge undertaking, but the form generator should have been able to do it.

Usually, the best way to work with multiple databases is to create a query first. This worked well with the report generator but was less effective with the form generator. We couldn't use the dBase form templates for operations that allow updates (browse and edit, for instance). The view created was set to read only. To create our report, we set up a query and used the result to design the report. That worked and didn't require additional tweaking. We added a group designation and placed the company name in the group header so that the company name was listed first, followed by all the part numbers for that company. We then moved to the end of the highlighted band below the group and added a summary variable to compute the back-order replacement cost. This gave us a cost summary at the end of every group listing. The report generator automatically set up report summaries for all our numeric fields. We deleted those we didn't want to use.

Because of the state of the documentation we received, however, the process did not go as smoothly as it sounds. While we were reading about update queries, the discussion suddenly switched to forms. Finally, we discovered that the manual had jumped from page 8-6 to page 9-19. We started looking around for the last part of the chapter on update queries and noticed that chapter 10 also ended abruptly, cut off once more by page 9-19. The rest of the pages then fell in order, but we didn't find the last part of chapter 8 until we rustled up

A Taste of SQL

Two of the database packages we worked with—Informix and WindowBase—used SQL as their database management language. Another, R:Base, retains SQL compatibility while adding a few other capabilities.

To work effectively in any SQL database, you need to start by placing yourself in a "table" frame of mind. That involves adjusting to the idea that you have to manipulate your database as a whole, rather than as a collection of individual records. At times, this approach offers distinct benefits. For example, when we imported the salesperson information into the SALESPERSON table in Informix, we noticed that we had set the ID field incorrectly. It should have ranged from 1000 to 1099 but instead ranged from 0 to 99. In a database not based on SQL, fixing the problem might have required writing a looping structure to read in each entry, changing the ID number, and writing the change back to the database. In SQL, the solution is as simple as adding 1000 to each ID number. The statement to do this is:

```
UPDATE SALESPERSON SET ID =
ID + 1000.
```

But because SQL implementations are far from standardized, not all structures are as predictable across the board. In Informix-SQL, for example, we used the following sequence to move the contents of a field from the parts table into our orders table:

```
UPDATE ORDERS SET PRICE =
    ( SELECT PRICE FROM PARTS
    WHERE ORDER.STOCK_NO =
PARTS.STOCK_NO);
```

WindowBase's SQL, however, does not permit an embedded SELECT command within the SET clause of an UPDATE statement. To combine fields from two tables, you must create a third table and link them along a common field. To complete the operation described above, for instance, you would create a temporary orders table and issue an INSERT command with an embedded SELECT command. The SELECT command would include all the fields from the first orders table, along with the price field from the parts table. The WHERE clause would look similar to the one above and would specify the join field (STOCK_NO, in this case):

```
INSERT TEMPORDS
    SELECT <fields from ORDERS>,
PRICE
    FROM ORDERS, PARTS
    WHERE ORDER.STOCK_NO =
PARTS.STOCK_NO
```


World Radio History

GATEBUSTERS!

$2,899
486-33 ISA*

- 32-Bit Intel 80486/33 MHz CPU
- **Zero-Wait 64KB (Exp. to 256KB) High Speed Cache***
- **Zero-Wait 128KB High Speed Cache****
- 4MB Zero-Wait State 32-bit memory on the World's Best Motherboard made by AMI (Expands to 32MB*/96MB**)
- 8 Expansion Slots 16-bit*/7-EISA and 1-32/8 bit**
- **SONY 1304 HG 14" SVGA Monitor (1024 × 768 Non-interlaced)**
- Orchid ProDesigner II VGA Card with 1MB RAM
- 207MB 15ms Maxtor IDE Hard Drive
- Teac 1.2 AND 1.44 Floppy Drives
- 2 Serial/1 Parallel Ports I/O*
- PC Power & Cooling 300 Watt Power Supply
- Vertical Case: 6 Bays/Security Lock/LED
  (Also shown is our optional deluxe case 450 W PS)
- **Keytronics 101-key Enhanced Keyboard**
- **AMI BIOS/CMOS Set-up/Diagnostics/Clock/Calendar**
- 3-Ring Cloth Binder for Manual and Software
- 10-year Lithium Battery/ TOUCHE Tool
- 800 number for Lifetime Technical Support
- TRW On-Site Service Available to Most Locations
- Federal Express Replacement of Defective Components
- FCC B Certification

$3,499
486-33 EISA**

- Burst Mode Support
- 2 Serial/2 Parallel Ports I/O**

Made in the USA

$1,899 386-33 MHz COMPLETE SYSTEM
Upgradable to 486

386 20SX Starting at $799

TOUCHE
MICRO TECHNOLOGIES
A PC PROS Company
8205 South Cass Avenue Darien, Illinois 60559
708/810-1010 Fax 708/810-9490

COLORADO 120MB Tape Back-Up Option $249
BOCA 2400 Baud Internal Modem Option $69

VISA MasterCard DISCOVER FEDERAL EXPRESS

THE TOUCHE COMMITMENT TO QUALITY AND VALUE KEEPS GROWING!

OUTSTANDING. That is the word PC Magazine used to describe our system! We're very proud of our 486-33 review and we encourage you to read it.

One example: Of 30 systems reviewed, TOUCHE **ranked #1 in the small-record DOS access file test** and #2 in the large DOS access file test for speed! To achieve this feat we relied on Maxtor and Ultrastor, two fantastic product partners.

Maxtor and Ultrastor are just two companies on a long list of companies we obtain high-quality components from to custom-build high-quality systems. AMI–SONY–Intel–Teac–Orchid–Keytronics–Micropolis–CYRIX–SIEMENS–PC Power & Cooling–BOCA are all names you'll easily recognize. You'll never see us offer components from **Fui-Manchui** or other tongue-twisting companies you've never heard of before.

WYSIWYG is a term used in desktop publishing. What You See Is What You Get is also a standard we use in building our systems. That means you get exactly what you expect when you receive your order from us. No hidden surprises or cut corners that many of our competitors try to sneak by with cheap or low quality components.

The use of AMI motherboards **guarantees** full DOS-UNIX-OS2 compatibility. We custom-build every system and offer special prices on enhancement items to upgrade your system like CD ROM's, digitizers, laser printers, scanners, 20" monitors, and hundreds of other products.

Our parent company, PC PROS, was founded in 1982. *Before you buy any system, ask all the hard questions and compare.* Who makes the motherboard? This is one of the most important questions to ask since this is the heart and soul of any computer. We use more AMI motherboards than anyone in the world. **Don't be fooled by claims of an AMI BIOS equaling an AMI motherboard.** Insist you receive a system with the best motherboard money can buy . . . an AMI.

Whether you're government, FORTUNE, major institution or just need a machine or two for your home or office, we offer the absolute best quality and service anywhere!

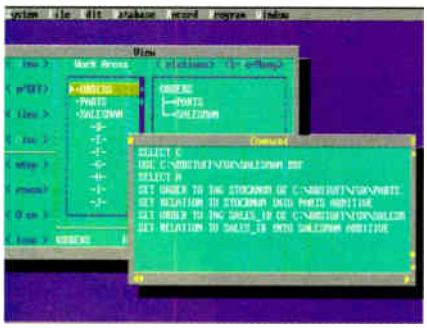
WHO YA GONNA CALL?
708/810-1010

Circle 195 on Inquiry Card.

World Radio History

another dBase package from the BYTE library. Hopefully, quality control will improve under Borland.

The latest release of dBase IV is an improvement over past incarnations. Still, if you like the power and maturity of the dBase language, FoxPro is the better product.



FOXPRO 2.0

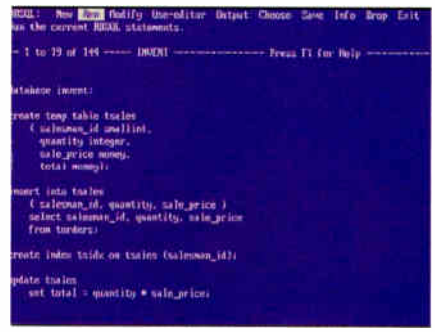
If your primary criterion for a database is performance, you need look no further than FoxPro 2.0. But that's not its only selling point. FoxPro has a lot to offer casual users and developers alike. The interface includes pull-down menus—along with a convenient command window—so you can use menus or type commands without either interface getting in the way of the other. Mouse support is the best of any character-based package we've worked with. The command window keeps a running history of FoxPro instructions. This makes it easy to repeat commands used throughout a session. You also can select portions of the command history and paste them into your applications. If you trigger operations from the menu options, FoxPro places those instructions in the command history—a great tool for building applications. You can perform an operation using FoxPro's menus, capture instructions from the command history, and paste them into a program file.

FoxPro made child's play of our project. To create the data-entry screen, we opened the databases and set up the necessary relationships. FoxPro's View Window assisted these setup chores. The window graphically depicts available work areas; you can select a work area and open a database in it by clicking on a command button. FoxPro provides a list of databases from which to choose. After loading the three databases we needed, we highlighted the orders database and selected the command button to set a relationship between it and the parts database. FoxPro offered a dialog box with a list of key fields. We selected the stock number field to link the two databases. Because we would need to repeat this operation later when writing code for the batch-order test, we called up the command window, copied the commands generated in the operation, and pasted them into a program file.

When we designed the input screen, the screen generator saved environment information. We didn't have to worry about opening databases first and setting up the relationships. The screen builder starts off as a blank screen in which you can enter text and place fields. You also can create command buttons, check boxes, "radio" buttons, and pop-up lists. And you can attach pieces of code to any object, including the fields. From the setup screen, you can designate code to run before and after the screen-entry program. When you generate code for the screen you've designed, you can attach other screens to it, which saves you time once you build a library of generic screens. We simply added a control screen included in the tutorial for navigating through records, adding a command button for processing an entry and attaching code to update the parts database and the salesperson database each time an order is entered.

The easiest way to create the reorder report was to build a query first. To do this, we opened a new query screen and selected the company database and the parts database for our query. A dialog box, which included three blank boxes, prompted us to enter the linking criteria. Clicking on the box on the right brought up a list of fields in the parts database, while the left box offered fields from the company database. The middle box provided a choice of relational operators (like, less than, and so on). With a few clicks of the mouse, we had created a simple query. Next, we selected the fields we wanted to include, grouped the query by company name, and sent the result to a report. When we ran the query, FoxPro generated a report file, which we could call up from the report builder for reformatting. As in the screen builder, we could drag text and fields around with the mouse or group information and then move it. To keep track of running totals, we defined a couple of variables and put them in the group footer and the page footer. A query is saved as a program file and since a formatted report is part of the query, you can generate the final output directly from the command line by invoking the DO command and using the filename as an argument, or you can include the command sequence in an application.

FoxPro was a barn burner on our performance tests, thanks mainly to FoxPro's proprietary Rushmore technology. Our one complaint about the package is its unwieldy documentation. Finding information quickly was a problem, but a strong on-line help facility got us through the rough spots. FoxPro is simply an outstanding product.



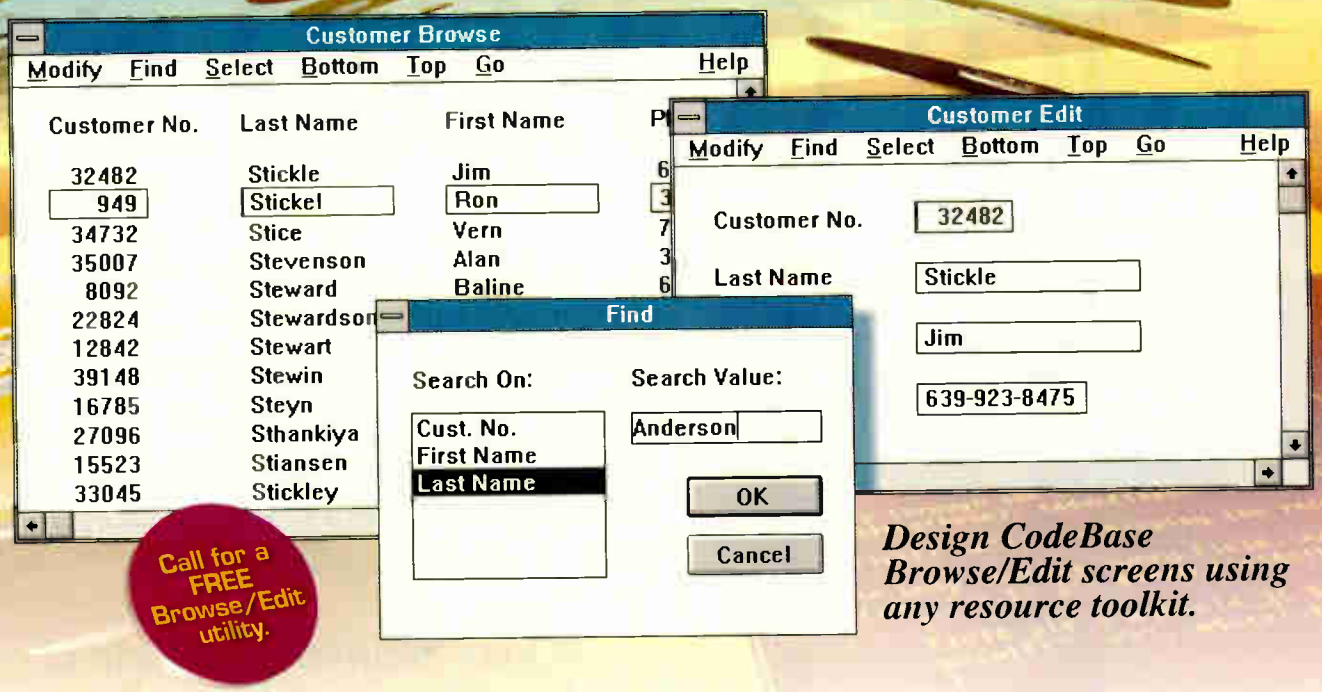
INFORMIX-SQL

Informix-SQL is a structured-query-language (SQL) database through and through. The program's look is more Spartan than that of the other systems we examined; you'll find no multicolored screens with pop-up menus and windows here. The package's Lotus-style, menu-driven screens automate the more significant database operations, such as creating a table, defining and altering fields, and so on. Informix also includes a report generator and a system for executing form-definition files that you design and write in a kind of pseudolanguage. But at its core, Informix is a SQL system.

You build a form in Informix, not by moving a cursor about on the screen with a mouse or arrow keys, but by writing a *form-specification file*, a kind of screen definition coupled with executable instructions. This file comprises five parts: a database section, which identifies the database on which the form will operate; a screen section, which defines the layout of the screen; a tables section, which identifies which tables the form will access; an attributes section, which describes each field displayed by the form; and an optional instructions section, which defines operations to be performed on fields within the form. Simply put, the database and tables sections tell the system what to show, the screen section tells where to show it, the attributes section tells how

World Radio History

Access dBASE IV and FoxPro files from C or C++



Call for a FREE Browse/Edit utility.

Design CodeBase Browse/Edit screens using any resource toolkit.

- **Multi User**
- **Portable (DOS, Unix, ...)**
- **Royalty Free DLL**
- **C++ interface included**

Use CodeBase 4.5 from **Visual Basic** or **Turbo Pascal for Windows**.

Use the super-fast, super-small **FoxPro 2.0** CDX or the Clipper NTX index files.

" Our product was too slow under FoxPro 2.0, so we rewrote it in C using CodeBase. Now it is incredibly fast."

Jeff Reed, DCS Computer Services

CodeBase 4.5

The C Library for DataBase Management

SEQUITER SOFTWARE INC.

TEL. 403•437•2410
FAX 403•436•2999
Europe 33.20.24.20.14

#209,9644-54 AVE., EDMONTON, AB, CANADA T6E-5V1

© 1991 Sequiter Software Inc. Graphics by MicroArts. © 1991

Circle 147 on Inquiry Card.

World Radio History

About the only t can't contain is y

Imagine this.

A Windows™ database that can handle virtually any data type.

It's called Superbase® 4 from Software Publishing Corporation. With it, the development possibilities are, well, thought provoking.

Consider bar coding. The state of the art in inventory control. Start thinking creatively and anything's fair game. A high-security prison, for example, uses Superbase 4 to handle the toughest inventory control problem anywhere. Keeping track of their prisoners.

Or how about video? Through DLL you can store still shots from a full-motion video camera. So you can monitor remote locations in real time. Or grab key images from a previously recorded tape. A petrochemical facility, for example, uses Superbase 4 to store camcorder images in a training file for new engineers.

Imagine, a free demo disk just by calling 1-800-336-8360, Operator 617.

Superbase is a registered trademark and Superbase 4 is a trademark of Software Publishing Corporation. Windows is a trademark of Microsoft Corporation. © 1991 Software Publishing Corporation, 3165 Kifer Road, Santa Clara, CA 95051.

World Radio History

hing Superbase 4 our imagination.

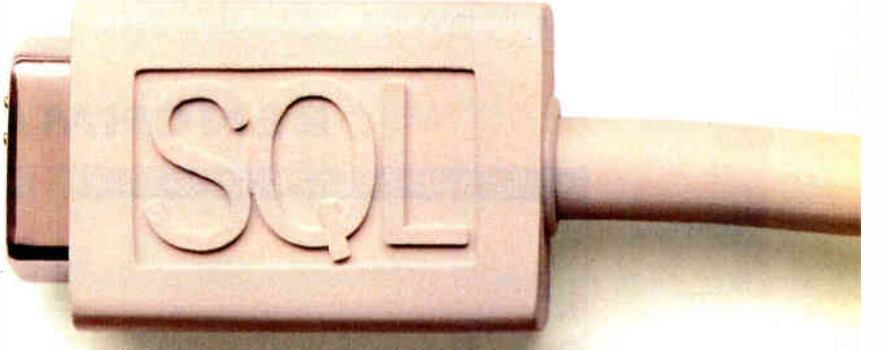
What's more, any photographic or graphic image can be included in any data file. So you can dress up product catalogs. Personnel records. Insurance claims files. Or anything else you can think of.

MICROSOFT WINDOWS
Version 3.0 Compatible Product

And through DDE you can even pull in more familiar business accessories. Like maps, graphs, charts, and spreadsheets.

But don't think for a minute that this versatility comes at the expense of raw power. Superbase 4 is fast. It lets you include an unlimited number of characters in any text field. And supporting SQL, it easily connects with some formidable databases—SQL Server, Oracle, Sybase, dBase, and DB2, among others.

In fact, Superbase 4 already manages a direct mail database containing over one million records. It could handle a lot more.



A stock market ticker. A ticket sales network. You know, big stuff.

And our Data Management Language (DML) gives you unsurpassed ease and flexibility in customizing screens.

So it's no wonder Superbase 4 is the worldwide market leader in Windows databases. Just imagine what it can do for you.

SPC SOFTWARE PUBLISHING CORPORATION

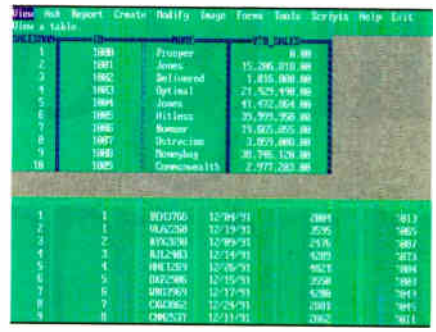
World Radio History

to show it, and the instructions section tells the system what to do before, during, and after showing it.

There's a catch to Informix's form system, though: You can operate only on fields displayed by the form. This ran us aground when we were building our order-entry form. Each order carried a salesperson ID number, which referenced a row in our salesperson table. We naturally wanted the appropriate salesperson's year-to-date sales field updated whenever an order is committed. But we didn't want to let an order-entry clerk see a salesperson's year-to-date sales, so we tried to update that field without displaying it. No chance. Another annoying shortcoming is how fast error messages come and go. In most cases, they appear on the last line of the screen, heralded by a beep. If you don't get your eyes down there quickly enough, the message is gone before you've read it. This happened twice while we were trying to create an index for one of our tables. Ultimately, we did get the index built, but to this day we don't know what the error was.

Included with Informix-SQL are a number of utility packages. BCHECK verifies the integrity of indexes; if it finds a discrepancy between a data file and one of its indexes, it lets you recreate the index. DBLINK and DBLOAD are handy for ferrying data between Informix and the outside world of Lotus 1-2-3, dBase, or ASCII files. With DBSCHEMA, you can produce the SQL statements needed to create a table or database (if you've already built the table in Informix).

The Informix-SQL documentation is well presented, and the software certainly is solidly crafted. Informix-SQL runs on a variety of platforms; if you're interested in portability this is a DBMS to consider. In addition, Informix sells numerous add-ons that extend the capabilities of Informix-SQL. One such package, ESQL, lets you embed SQL in C programs so that you can write code to more efficiently perform operations that SQL is ill equipped to handle.



PARADOX 3.5

One of Paradox's most notable characteristics is its speed. Not only did Paradox perform well in our speed tests, its response time for browsing and editing tables was quick-as-a-blink fast.

You do complex querying and editing using the query by example (QBE) technique. It works like this: Paradox presents you with a grid that mimics the layout of the target database. You enter

BENCHMARKS

*Product proved incapable of running this benchmark.

For the Importing and Indexing benchmark, each program had to create a 4000-record database of parts information from an ASCII file. The Batch Order-Processing benchmark tests the time it took each package to post a batch of 800 orders and update three separate database files. In each case, FoxPro displayed the most impressive performance.

World Radio History

Open new windows with TI microLaser™ printers.

And get powerful fonts and graphics, ease of use and more speed than ever.

By now you've heard how fast and easy Microsoft® Windows™ makes it to tap all that PC power you've got on your desk.

Well now there's an affordable, easy way to put that power on paper — microLaser from Texas Instruments.

Right out of the box, microLaser comes with what you need to print the dazzling pages of text and graphics you've dreamed of.

Just plug it in and go. POSTSCRIPT™

That's because microLaser PS models come with PostScript® software from Adobe® and the memory it takes to use it. Plus you get your choice of either 17 or 35 scalable fonts, starting at just $1,399*.

New model. More speed. Same price.

When it comes to print speed, the new microLaser Plus zips along at 9 ppm. If you need a shared printer solution, turn to the 16 ppm microLaser XL.

If all that isn't enough, just look at what else you get with microLaser. It's the smallest printer in its class. It handles more paper and envelopes in more ways. And it supports more than 4,000 software packages, including your Windows applications.

So when you add it all up, you'll understand why the power of your ideas needs the power, convenience and economy of microLaser. Let microLaser open new windows for you.

For the name of the nearest dealer, call

1-800-527-3500.

TEXAS INSTRUMENTS

*TI suggested retail price. (Dealer prices may vary.) microLaser is a trademark of Texas Instruments Incorporated. Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation. Adobe, PostScript and the PostScript logo are registered trademarks of Adobe Systems, Inc. © 1991 TI 71860

Circle 169 on Inquiry Card.

World Radio History

relational operations and filters within the fields you want Paradox to evaluate. For example, if you want to set all current sales figures to zero, you would type >0, CHANGETO 0 in the appropriate field slot in the template. When you turn Paradox loose, it uses the information in the template to guide its actions.

Paradox supports the most important import and export formats, but we ran into trouble importing information stored in ASCII format. During the portion of our testing involving importation of ASCII data, Paradox demanded that the fields for each record of the import file be arranged in the same order as the fields in the destination table. (In contrast, Alpha Four allowed us to map input fields to target fields in the database.)

With Paradox, you must plan carefully before jumping into building a form. This is particularly true with forms that access multiple tables. Multitable form design involves creating a master form for the master table, then inserting into that master form embedded forms from other tables. So to create the full master form you should design your embedded forms first—unless you don't mind flipping back and forth among forms as you work. Upfront design will eliminate lots of down-the-road headaches.

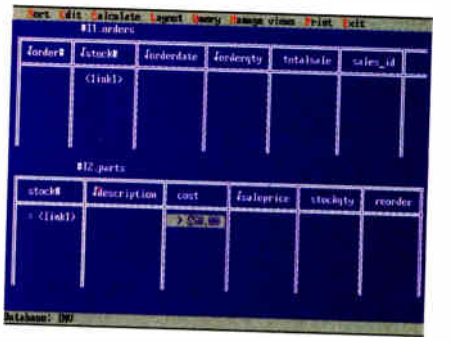
Paradox's database management language is PAL, though to present PAL as simply a DML is a misrepresentation. PAL is not what we expected. Being a procedural language, PAL is not a SQL derivative. Nor does its repertoire include typical database manipulation language statements such as SEEK_KEY and READ_RECORD and DELETE_RECORD. Rather, PAL is a language that automates the Paradox environment. For example, the PAL command for moving to the next record in a file is DOWN, which simulates the effect of pressing the down-arrow key (hence the command's name).

What makes PAL programming difficult is that it resembles sending commands to a robot that's sitting at a keyboard running Paradox. For example, the DOWN command moves to the next record if you are viewing a table. However, if you are in a form (and you can execute forms from within PAL), the DOWN command moves the cursor to the next entry field on the form. A command reacts differently in different states of the Paradox environment, and Paradox has many different states. The key to effective PAL programming, then, is to thoroughly learn Paradox's menus and keyboard and form designer before you try to do any serious work with PAL. The rewards will be well worth the investment in time.

If, however, you simply don't want to have anything to do with PAL, you can install the Personal Programmer. Essentially an application builder, this program guides you through creating an application—complete with menus and forms—outputting PAL code as its final product.

The people who wrote the documentation explaining all of Paradox's ins and outs had better be getting paid well, because they're doing a bang-up job. Borland is fast gaining a reputation for supplying good manuals with its software, and the documentation that accompanies Paradox only bolsters that reputation. Each manual is a supermarket of illustrated examples, each heading on a page is highlighted with a light blue bar, and Borland even put small blue arrows under the page numbers to help you quickly get your bearings as you search for a particular page number. Well done, indeed. The quality of Paradox's documentation alone earns it a high place among this roundup of database packages.

Finally, we should mention the raft of Paradox add-ons that Borland supplies: SQL Link allows you to embed SQL queries in PAL code and talk to SQL servers, the Paradox Engine provides low-level C and Pascal access to Paradox tables (see "Database Building Blocks" on page 204), and Paradox Runtime lets you build applications and distribute them to clients who don't own Paradox.



R:BASE 3.1

When you start up R:Base, a command bar appears across the top of the screen. You can use a mouse or Alt key combinations to make selections that bring up a series of pull-down menus. But because the package's mouse support is a bit uneven, we often resorted to the keyboard. Worse, R:Base does not

COMPANY INFORMATION

Alpha Software
1 North Ave.
Burlington, MA 01803
(617) 229-2924
fax: (617) 272-4876
Circle 1136 on Inquiry Card.

Borland International, Inc.
Database Business Unit
1800 Green Hills Rd.
Scotts Valley, CA 95067
(408) 438-8400
Circle 1137 on Inquiry Card.

DataEase International
7 Cambridge Dr.
Trumbull, CT 06611
(800) 243-5123
(203) 365-2317
Circle 1138 on Inquiry Card.

Fox Software, Inc.
134 West South Boundary
Perrysburg, OH 43551
(419) 874-0162
fax: (419) 874-8678
Circle 1139 on Inquiry Card.

Informix
4100 Bohannon Dr.
Menlo Park, CA 94025
(415) 926-6300
fax: (415) 322-2805
Circle 1140 on Inquiry Card.

Microrim, Inc.
15395 Southeast 30th Place
Bellevue, WA 98007
206-649-9500
fax: 206-146-9350
Circle 1141 on Inquiry Card.

Nantucket Corp.
12555 West Jefferson Blvd.
Los Angeles, CA 90066
(310) 390-7923
fax: (310) 397-5469
Circle 1142 on Inquiry Card.

Software Products International
9920 Pacific Heights Blvd.
San Diego, CA 92121
(800) 937-4774
(619) 450-1921
Circle 1143 on Inquiry Card.

Software Publishing Corp.
8404 Sterling St.
Irving, TX 75063
(800) 562-9909
fax: (214) 929-1655
Circle 1144 on Inquiry Card.

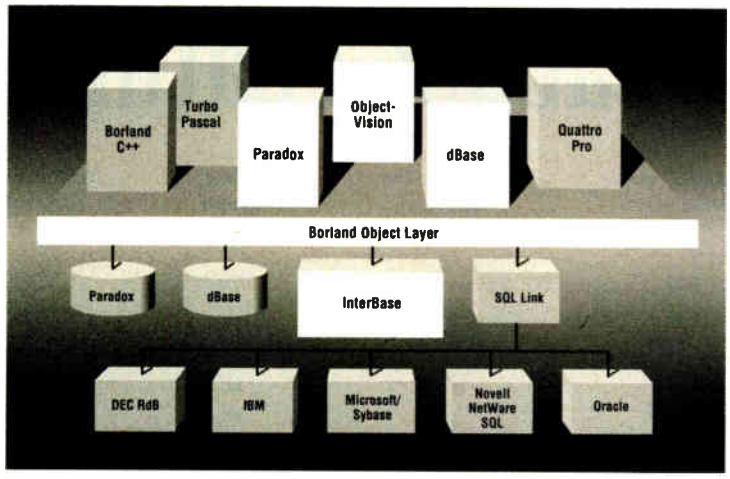
World Radio History

Introducing Borland's Unified Solution for Paradox, dBASE and InterBase

The future of dBASE

Simply stated, we're committed to revitalizing dBASE®: delivering more power, more flexibility and better support to the whole community of dBASE users. We are using our object-oriented development techniques to accelerate releases and add substantial new features. We're adding new SQL server links, event handling and object-oriented extensions to the dBASE language.

Soon, as quickly as 1992, you'll see a new dBASE for Windows and DOS, as well as compilers that generate fast, tight code. All based on Borland's proven technologies, all compatible with the existing dBASE standard. That's the Borland commitment to the dBASE community!



Borland's object-oriented architecture will allow Windows versions of Paradox, dBASE and Quattro® Pro to work together in enterprise-wide information systems, giving you instant access to more types of data.

The future of Paradox

Paradox® is entering the world of objects. We're evolving PAL™ and all the Paradox interactive design tools. Using our leading edge object-oriented technology, you'll be able to visually create sophisticated Windows applications. Instantly. We'll also be introducing revolutionary database-publishing tools as well as powerful new data-modeling capabilities. More than ever, Paradox gives you instant database power on Windows or DOS.

InterBase, the database server of the '90s

InterBase™ is the first relational database server to satisfy the demands of online complex processing. The kind of real-world applications used in finance, banking and manufacturing. Designed for optimal performance in multi-platform networks, InterBase provides features targeted at the needs of highly complex database applications in dynamic, distributed environments. InterBase is the clear technology leader with advances such as true peer-to-peer architecture, highly efficient event alerters, "smart" automatic two-phase commit and rollback, multi-threaded servers and instant recovery from hardware failures. For Paradox and dBASE network users, InterBase will work wonders in helping integrate your data from the desktop to the mainframe. All with unprecedented simplicity.

"By bringing two database platforms under one strong management and support organization, Borland is providing a unified solution to our current database needs."
– Carl Hane, Group Leader Micro Applications Systems MCI International, Inc.

"Now we know that dBASE will have a bright future in Borland's hands."
– Adam Green

Borland, the technology leader

Borland is the pioneer of object-oriented technology. We're now at the forefront of 32-bit computing. What this all means to you: more power, more performance and lower support costs. And that's why IBM and Novell have picked Borland as a strategic partner.

IBM® NOVELL®

Borland, leader in customer satisfaction

J.D. Power and Associates just ranked Borland "Best application software in customer satisfaction in Small to Medium-sized Businesses."* Company for company, technology for technology, Borland is your best choice.

Borland, your database partner for the '90s

There you have it: the best technology and the best support from the one company that guarantees your software investments now and in the future.

J.D. POWER AND ASSOCIATES

APPLICATION SOFTWARE CUSTOMER SATISFACTION INDEX℠

1. BORLAND
2. WORD PERFECT
3. CLARIS
4. ALDUS
5. MICROSOFT
6. LOTUS

Choose Paradox, dBASE and InterBase today and join the thousands of corporations worldwide who have discovered the Borland advantage.

Special offer to database users

Buy either Paradox or dBASE right now, and get your passport to upgrade to the Windows version of the same product for only $139.95!†

And, to inaugurate the new era of dBASE from Borland we're making this special, limited-time offer. Purchase dBASE from any dealer between October 14, 1991, and January 31, 1992, and get a $100 manufacturer's rebate.

See your dealer today or call 1-800-568-9092 for rebate information!

BORLAND

Software Craftsmanship

CODE: MS16

*1991 J.D. Power and Associates' Computer End User Satisfaction Study, Phase I: Office-Based Small to Medium-sized Businesses.℠ Response from Business End Users at 1,784 business sites. Small to medium-sized businesses were based on office sites with between 1 and 499 employees. 1991 J.D. Power and Associates' Computer End User Satisfaction Study Phase II: Office-Based Large Businesses.℠ Responses from Business End Users at 1,094 business sites. Large businesses were based on office sites with 500 or more employees. J.D. Power and Associates is a service mark of J.D. Power and Associates. †Dealer prices may vary. Upgrade pricing good in U.S. and Canada only. Borland is a registered trademark of Borland International, Inc.

Copyright © 1991 Borland International, Inc. All rights reserved. BI 1433-2C

Circle 22 on Inquiry Card (RESELLERS: 23).

World Radio History

Database Features

Company Product Version	Alpha Software Alpha Four 1.1	Borland/Ashton-Tate dBase IV 1.1	Borland Paradox 3.5	DataEase International DataEase 4.2	Fox Software FoxPro 2.0
Platform(s)	DOS	DOS, Unix, Mac, VAX/VMS	DOS	DOS, OS/2	DOS
Price	$549	$795 (DOS version)	$795	$795	$795
Field Types					
Integer	●	○	●	●	●
Floating Point	○	●	●	●	●
Currency	●	○	●	●	●
Date	●	●	●	●	●
Time	○	○	○	●	○
Text	●	●	●	●	●
Variable Length (memo)	●	●	○	○	●
Other	Logical	Numeric	○	Fixed-length memo	Logical
Import Formats					
ASCII	●	●	●	●	●
DIF	●	●	●	●	●
DBF	●	●	●	●	●
SDF	○	●	○	●	●
SYLK	●	●	○	●	●
WK1	●	●	●	●	●
Other	PFS, WordPerfect merge	FWII, RPD	Quattro Pro, Reflex	Custom	Paradox
Query Language					
dBase	●	●	○	○	●
SQL	○	●	○	●	Partial implementation
Proprietary	●	○	● (QBE)	●	○
Recommended Capacity					
RAM	640 KB	640 KB	640 KB	570 KB	640 KB rec., 1.5 MB XMS
Disk	2.0 MB	5 MB	3-4 MB	2.5 MB	6 MB
Limits					
Maximum # of Open Tables	10	10	24	255	99
Maximum # of Indexes per Table	7	57	1 per field	255	unlimited
Maximum Rows per Table	2 billion	1 billion	256 million	255	1 billion
Maximum Fields per Row	254	255	255	255	255
Maximum Record Size	4000 bytes	4000 bytes	4000 bytes, indexed	4096 bytes	4000 bytes
Password Security					
User	○	●	●	●	●
Database	○	●	●	●	●
Table	○	●	●	●	●
Access Levels	r/w	●	●	●	●
Encryption	○	●	●	●	●
Multiuser Support					
File/Table Locking	○	●	●	●	●
Record Locking	○	●	●	●	●
Tools					
Form Generator	●	●	●	●	●
Report Generator	●	●	●	●	●
Database Language	○	●	●	●	●

employ scroll bars, so you'll have a hard time navigating with the mouse, especially when you're building a report that is wider than the screen. You'll also wish you could move fields around by clicking and dragging the mouse while designing forms and reports.

The first pull-down menu lists the databases available to you; you simply select the one you want. If you have dBase files, you can open them from this menu—along with indexes—without importing or converting them. After you select a database, another pull-down menu lists the tables associated with the

World Radio History

Informix Informix-SQL 2.10.06	Microrim R:Base 3.10	Nantucket Clipper 5.01	Software Products WindowBase 1.0	SPC Superbase 4 1.3
DOS, OS/2, Unix $795	DOS, OS/2 $795	DOS $795	Windows 3.0	DOS/Windows $695
●	●	●	●	●
●	●	●	●	●
●	●	○	●	●
●	●	●	●	●
○	●	○	●	●
●	●	●	●	●
○	●	●	●	●
Decmal, serial	Numeric	Logical	Boolean, datetime, image	External text or graphics, logical
●	●	●	●	●
○	●	○	●	●
○	●	●	○	●
○	○	●	○	○
○	●	○	○	○
○	●	○	○	●
○	PFS	●		WKS, XLS, LGS, SOL, SBF
○	○	●	○	○
●	●	○	●	○
	○	○		●
640 KB real/1 MB prot.	640 KB	300 KB	2 MB	2 MB
3 MB	6 MB	3.5 MB	2 MB	1.5 MB
unlimited	80	250	8	unlimited
unlimited	unlimited	15	999	unlimited
unlimited	unlimited	1 billion	2 billion	1 billion
unlimited	400	1000	255	unlimited
32,768 bytes	4096 bytes	65,534 bytes	2 billion bytes	unlimited
●	●	○	●	○
○	●	○	●	○
○	●	○	○	●
●	●	○	n/a	●
○	●	○	●	○
●	●	●	n/a	●
●	○	●	n/a	●
●	●	○	●	●
●	●	●	●	●
●	●	●	●	●
	● = yes	○ = no	n/a = not applicable	

active database. Selecting a table puts you in browse mode, from which you can view or edit your data. Other options within the table menu let you modify the structure of tables and create new tables. All the elements of a database—reports, forms, and views—are available from the main menu.

To build a query, you work from the browse-mode menu. The query screen displays the column names of the selected table; you can select the columns you want to include in the query and set conditions by specifying them below the column name. Another menu selection lets you include up to five other tables in the query and link them by columns. This provides an easy way to build powerful queries, and you can view the results in browse mode or save the result as a separate table or as a view file.

You can create an R:Base command file with any ASCII editor. The code you create is compatible with ANSI SQL, so SQL programmers should be productive right away. The applications generator is especially slick, allowing even nonprogrammers to create menu-based applications without a hitch. Experienced programmers can cut their programming time by generating an application automatically and customizing the resulting code.

We did run into some trouble building input forms, however. Normally, R:Base lets you refer to inactive tables by prefacing the column name with the table name (as in `company_table.company_id`). Unfortunately, the form builder does not support this type of reference. You can include multiple tables in a form, but only one form may be active at a time, and you can't refer to the columns of an inactive table. Fortunately, other features make this an easy limitation to get around. We set up our form with only one active table and used variables to look up related data in the other tables. When you do this, you may attach a command file to any field so that you can validate entries or process input—to exclude parts that cost more than $40, for instance.

The report builder easily handled our sample report. We started with a quick report that automatically displayed selected columns from our parts table on the screen. We then defined lookup variables to pull the name and address of the company supplying each part. By defining the company ID number as a break point, we got R:Base to automatically sort on that number. A variable in the break footer summed the replacement cost of back-ordered parts for each company. We also placed a variable in the report footer to return a grand total for the entire report.

R:Base's biggest drawback is its slow performance. It lacks a facility to automatically link tables together; instead, you must manually set up a pointer (called a *cursor*) and then update tables by matching a key field. For this reason, R:Base does not process batch orders very quickly.

World Radio History

Still, R:Base is a good choice for nonprogrammers. Its interface is intuitive and easy to learn, and its applications generator really works, churning out useful code from simple specifications.

SUPERBASE 4 1.3

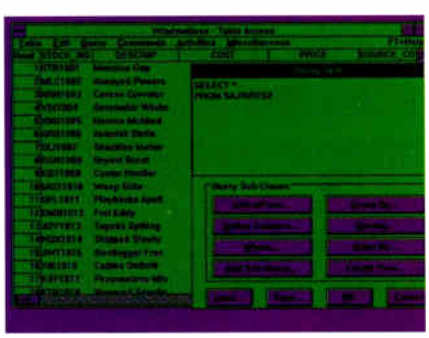
Built to run under Windows 3.0, Superbase 4 is a database package with some quirky but clever features. The quirk you'll notice first is the list of controls at the bottom of the program's main browsing screen. You'll think you're looking at the front panel of a tape deck: There's a rewind button, a fast-forward button, and even a pause button. The tape-deck paradigm fits neatly into database browsing. Once you enter a search criteria and skip to the target record, you can hit Fast-forward to step rapidly through the succeeding records. Hit Pause to stop on a record you're interested in, or rewind if you passed it.

Because it has dynamic data exchange capabilities built in, Superbase 4 can act as a DDE server or a DDE client. This lets you, for example, link Microsoft Excel and Superbase 4 so that data retrieved from a Superbase 4 data file is inserted into the cells of an Excel spreadsheet.

Working with Superbase 4's form designer is almost like using a paint package. When you open a blank form, a toolbox of icons appears across the bottom of the screen. From the toolbox, you select the kinds of objects to place on the form: fields, calculations, boxes, even imported images. The system uses an intelligent hierarchy for displaying objects to govern what happens if you try to place one object on top of the other: Fields are displayed on the top, then text, then images, and so on. Another nice feature is that the designer lets you embed commands within forms. The commands remain invisible, jumping into action only when they detect the right type of input.

Superbase 4's programming language, DML, is based on BASIC. Luckily, it's sufficiently structured—it includes `IF...THEN...ELSE` and `CASE` statements—and uses labels rather than line numbers. Writing programs in DML is straightforward. Superbase 4 supplies a simple editor (it will sustain life, but that's about it). You can load and save ASCII files if you prefer to construct your DML programs in another editor. You also can enter single lines (each line may contain as many as 255 characters) of DML commands from a pull-down menu, which lets you use DML to take shortcuts. For example, if you want to clear out a database named Orders, you can open the command line window and type `REMOVE FROM FILE "ORDERS"`.

In addition, you can use Superbase 4's DML to create start-up programs that execute when you fire up Superbase 4. Other helpful features include macros, a built-in communications package you can use to send files from machine to machine, file viewing of external text or graphics files, and a LAN version with extensions to the DML for multiuser programming. In short, an abundance of features like these and good performance put Superbase 4 near the top of its database class.



WINDOWBASE 1.0

Like Superbase 4, WindowBase is designed to run under Windows 3.0, but although both are graphically oriented they neither look alike nor run alike.

One of WindowBase's many importation selections lets you specify that the field types in the first record are stored in the first record of the import file. WindowBase reads the first record and "guesses" at the format of the remainder of the file based on the contents of the first record's fields. You can help it by specifying the field names and their proper types before WindowBase proceeds with the rest of the file. This technique made it easy to import our sample data. That's good, because the rest of the importation process was slow. Just importing into an index-free table took over 17 minutes for the 4000-item parts file. We watched impatiently as a counter displaying the percentage of completion inched its way upward. When the counter reached 100 percent, we were only halfway to being finished. After telling us it was done, WindowBase pounded the disk for at least 8 or 9 minutes before returning cursor control. Speed is definitely not the hallmark of this package. Once we built the parts table, opening it took nearly a minute and a half. Perhaps WindowBase was reading as much as it could into memory so things would run faster.

As you would expect, WindowBase's form designer is graphical. Object icons appear across the top of the form-design window; tool icons line up across the bottom. You can import graphic images and embed them into your forms.

Designing a form with WindowBase requires some patience and lots of SQL know-how, since SQL is the underpinning for the form designer. Every form has a governing SQL query (typically, a `SELECT` statement) that specifies the tables covered by the form. Fields in which data is entered or displayed are referred to as cells. The cells within a form may be controlled by the governing SQL statement, or have their own "dependent" SQL query (called dependent because it is contingent on a value stored in another cell). The information stored in a cell may be data or the result of a calculation. Furthermore, you can use a calculated cell to update a column within a table. WindowBase provides a function called `external()` that lets you pull data in from a table outside the form and enter that data into the current table.

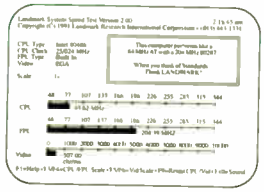
You also may need a bit of patience with the WindowBase documentation. Once, while we were updating the parts table to clear the back-order amounts, we got an "internal error -120" error message. We searched the manual for an error appendix but came back empty handed. A call to the company's technical support line revealed that we had uncovered a bug; the solution was to put an exclusive lock on the table. Unfortunately, this required using a command that was not in the manual, either. The technical representative we spoke with assured us that the next release would include the correction and the new command.

Other deficiencies in the manual caused more problems. For instance, we needed to know whether you can find out if a database already has any indexes defined. The manual offered no help, and we concluded that, unless you keep

World Radio History

PC DIAGNOSTICS MADE EASY

SPEED TEST YOUR PC



You've seen the *Landmark Speed Rating* advertised by many major PC manufacturers, now you can have your own copy of the **Landmark System Speed Test™**. Accurately measure CPU, math, and video speeds to *make an informed purchasing decision*, determine the best PC for the job or maybe just win some bets in the office on whose PC is *really* faster! Includes the Landmark AT CMOS RAM Setup program to update your system configuration *on-the-fly*. ***CALL for current pricing!***

THE 5 MINUTE SOLUTION TO FLOPPY DRIVE FAILURE

With **AlignIt™** you can *clean, diagnose, and align* your floppy drives in minutes *without* a scope. Patented technology requires only a screwdriver to perform ANSI-accurate alignments (.3 mil).

AlignIt is *ideal for corporate users* with 2 or more PCs because it includes a **"GOLD STANDARD"** feature so you can align all your PCs to the same in-house standard, *guaranteeing that all your floppies are perfectly interchangeable* between PCs.

80% of all floppy drive failures can be fixed with AlignIt. So don't replace your drive, save time and money instead.

Includes dual size floppies, (both high and low density) and no-mess pre-lubricated cleaning diskettes (both sizes) good for 180 uses. Replacements and single drive size versions available. For all PCs and compatibles.
CALL for current pricing!

PROFESSIONAL LEVEL PC TROUBLESHOOTING

Landmark **Service Diagnostics™** is ideal for professionals requiring the *most exhaustive diagnostic* test capabilities. Each module is CPU specific, including PC, XT, AT, 386/486, and PS/2. Since 1981 major manufacturers like Wang, Xerox, Prime, Sony, DEC, NEC, and NCR have relied on Service Diagnostics to tackle their toughest operating problems.

Intended for professional service and repair technicians, Service Diagnostics is also *easy to use* for the novice. Clear, concise on-line help and intuitive menus make finding system problems a breeze. Tests all CPUs, math chips, all memory, floppy, fixed and non-standard disk drives, standard/non-standard printers, system board, video, com ports and all keyboards. Utilities include low-level reformat, log bad sectors, edit bad sector table; the partition editor allows you to set up multiple partitions; *back-up program* transfers hard disk image on unformatted floppies and allows for *restore* after reformat.

Ideal for UNIX and other operating systems, the *self-booting version* doesn't require DOS. The manual offers troubleshooting tips to the component level. Also available in a complete Kit including: all CPU specific software, dual size floppy alignment software (see AlignIt), and PC/XT & AT ROM POSTs. ***PC Magazine Editor's Choice 8/90.***

PC WON'T BOOT? THEN JUST KICKSTART IT!

Don't replace your motherboard, use **KickStart 2™**. When serious hardware problems occur, nothing gets you up and running as fast. KickStart 2 *measures power within 2.5%* on all four voltages, *shows Power-On Self-Test* (POST) failure codes, and features *on-board ROM-based diagnostics* allowing you to *determine and remedy the problem quickly, easily, and inexpensively!*

Built-in serial and parallel I/O *allows for testing via modem*, or simply logging results to a remote terminal, printer or laptop. You can configure your own test routines and store them in KickStart 2's battery backed-up CMOS RAM saving valuable setup time. Includes serial and parallel loopback plugs and Landmark JumpStart™ AT ROM BIOS for testing PCs that don't issue POST codes. KickStart 2 *tests your system regardless of O/S (even UNIX).*

On-board switches, LEDs, and digital displays allow complete control over testing in systems lacking video or disk (ideal for motherboard or system burn-in).

KickStart 2 is the *ultimate SECURITY CARD* too! With both supervisor and user levels of password protection, you can prevent unauthorized use of your PC and accidental running of destructive tests. ***CALL for current pricing!***

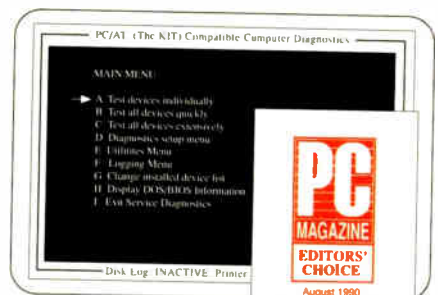
> ***"KickStart 2 system diagnostics board helps users check out virtually every aspect of a PC's hardware system... the board is a worthy investment for computer maintenance." David Claiborne, PC Week***

HOW TO DEBUG A DEAD PC

Need an *inexpensive solution* for dead or problematic PCs and motherboards? Try **KickStart 1™** or **JumpStart ROM POST™**, two quick and easy to use debugging tools.

KickStart 1 test card shows power status on all four voltages and binary PORT 80 Power-On Self-Test codes. The manual translates error codes for easy failed circuit isolation. ***CALL for current pricing!***

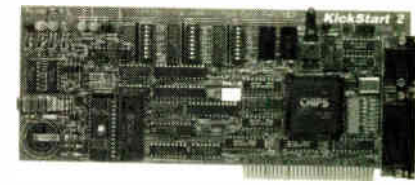
JumpStart ROM POST is a plug-in chip designed to replace your motherboard BIOS for testing purposes. Tests include CPU register and logic, 8087 math coprocessor, 8253 timer, 8237 DMA controller, 8259 interrupt controller, parity error and memory refresh logic, erroneous maskable/non-maskable interrupt detection, display adapter (MDA, CGA, EGA), keyboard, keyboard controller, floppy controller, drive A: read Base memory at normal & slow refresh rates, and POST checksum. Display of motherboard switch configuration. ***CALL for current pricing!***



"Overall, Service Diagnostics: The Kit was the best performer. (You can) locate and identify most of the computer problems you'll ever encounter. If you're running a service department, Service Diagnostics is not an option, it's a necessity." Bill D'Brien, PC Magazine

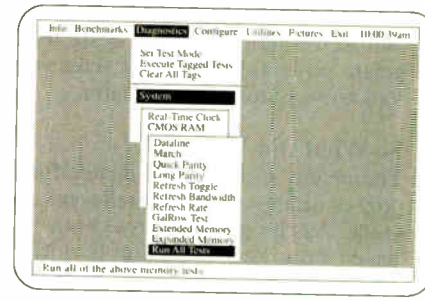
- Service Diagnostics XT/AT Kit...SAVE $$ CALL NOW •
- Service Diagnostics PS/2 Kit...SAVE $$ CALL NOW •
- XT ROM POST...SAVE $$ CALL NOW •
- AT ROM POST...SAVE $$ CALL NOW •

-- Individual pricing available on all kit components, please inquire --



KickStart 2 is ideal for permanent installation. It eliminates the need for an I/O card, provides remote and on-site diagnostic capabilities for quick repair time and offers a solid hardware based solution to unauthorized access with impenetrable password protection.

SLASH DOWNTIME AND OPERATING PROBLEMS



With **PC Probe™** you'll save time and money when your PC starts acting up. In one easy-to-use package you get *Diagnostics, Virus Protection (for over 700+ known viruses), Benchmarks, Performance Enhancement Utilities, and System Information.* Combined, this arsenal of tools will keep your system up and running at peak performance and remove the mystery about what's inside.

PC Probe diagnostic testing quickly isolates the source of hardware problems, even locating bad RAM chips. It tests system board, RAM, video, keyboard, com ports, floppy drive, hard drive, Ethernet card and more. Run PC Probe tests in batch mode or single pass, *remote* or on-site.

PC Probe allows you to *increase your hard drive data transfer rate* by determining optimum interleave and changing it, *prevent catastrophic data loss* by performing data revitalization, *reformat* the hard drive, *run external programs*, display and edit CMOS RAM on-the-fly, *prevent accidental hard drive data destruction* with passwords. *diagnose problems with device drivers installed.*

The 200 page on-line manual has built-in table of contents, *topic/text search*, and troubleshooting tips. PC Probe comes with dual size floppies and 9 & 25 pin serial/parallel port loopback plugs. For PC XT, AT, 386, 486 and compatibles using DOS 2.0 or higher. ***CALL for current pricing!***

- **Toll-Free Lifetime Tech Support**
- **90 Day Money-Back Guarantee**
- **Federal Express Shipping**

CALL (800) 683-6696

Fax (813) 443-6603 • Voice (813) 443-1331
Dealer Inquiries Welcome

LANDMARK
RESEARCH INTERNATIONAL CORPORATION
First in PC Testing... Since 1981

703 Grand Central Street • Clearwater, Florida 34616

Copyright ©1991. PC Probe, AlignIt, KickStart, JumpStart, ROM POST, and Service Diagnostics are trademarks of Landmark Research International Corp. All Rights Reserved. Other names are trademarks of their associated owners.

Circle 161 on Inquiry Card (RESELLERS: 162).

World Radio History

good notes on your databases, the only way to find out what indexes you have defined is to create an index. If you don't get an error message, you haven't defined any indexes. Can you change a column's data type? Again, no clue... you have to try it. Apparently, you can change its name, but to change its type you have to delete the column and re-create it (which involves an additional update step to put back the data that the delete will destroy) or dip into SQL and issue an ALTER COLUMN command.

WindowBase obviously is still rough around the edges and needs a serious performance tune-up. But the package has promising features. It supports DDE and SQL, and the forms designer can create powerful data input screens. We look forward to the next version.

So What Did We Think?

The results of our performance for this crop of database packages tell some of the story. As the graphs show, both SQL-based programs had trouble with our batch-order test. Because we were simply unable to modify our SQL version of the batch-order test to run under WindowBase SQL, no results are posted for that program. Informix could run the test since it permits a SELECT subquery within the SET clause of an UPDATE statement.

FoxPro was the overall performance leader with Clipper and Paradox close behind. Except for the SQL packages, all the products scored very well. In defense of Informix's poor showing, a batch-order processing test doesn't give SQL much of an opportunity to show off its strong points. Those products that could handle items one record at a time naturally fared better.

Our favorite Windows database package was Superbase 4. We were won over partly by its responsiveness, but mainly by its wealth of features. Paradox also is at the top of our list. Its query-by-example format is easily mastered. The documentation is the best you'll find, so you're never far from the solution to any problems that arise with the package. Our only caveat for first-time users is to spend plenty of time toning up their Paradox muscles before tackling PAL.

In the end, though, the laurel wreath went to FoxPro. The interface boasts a convenient mixture of easy-to-use menus and a convenient command window. FoxPro also delivers an outstanding help facility and all the tools for automatic generation of forms, reports, queries, and applications. And its performance is phenomenal. ■

Rick Grehan is technical director and Stanford Diehl is a testing editor/engineer for the BYTE Lab. Rick has a B.S. in physics and applied mathematics and an M.S. in mathematics/computer science. His work with database systems extends back to the late 1970s. Stan wrote the BYTE benchmarks for database applications, notebook computers, monitors, and PCL printers. While in the Air Force, he maintained secure communications equipment for command-and-control operations. In industry, Stan worked at Raytheon as an engineer. Additionally, he developed a database inventory control system for the United Arab Emirates. You can reach Rick and Stan on BIX as "rick_g" and "sdiehl," respectively.

"...ISYS replaces ZyINDEX for DOS as the industry standard for unstructured DOS text retrieval programs."† PC Sources 11/91

	ISYS 2.0	ZyINDEX 3.1 for DOS
SEARCH CAPABILITIES		
• Full range of capabilities: Boolean logic, Proximity, Wildcard and Phrase searches.	YES	YES
EASE OF USE		
• Terminate-and-stay-resident (TSR) option; ability to run search without leaving your document.	YES	NO
• Activate word processing documents from within the search program.	YES	NO
• Cut and Paste to anywhere in your document.	YES	NO
• All functions from main menu. No need to return to DOS to execute functions.	YES	NO
PERFORMANCE		
• Consistently faster indexing and retrieval.*	YES	NO
• Network pricing based on concurrent usage.	YES	NO
TECH SUPPORT		
• Unlimited toll-free technical support.	YES	NO

Text retrieval faster than a speeding bullet...

Usually, the time you want to find information most is when you're in the middle of something. Without exiting your work, pop up ISYS, get what you need, then copy and paste it into whatever you're working on!

Don't take our word for it. PC Week, May 1991, rated ISYS tops in flexibility and functionality, as well as file compatibility and quality of documentation.*

$99 TRADE-IN OFFER: Send us your ZyINDEX disk and receive your ISYS replacement by return mail. $395 value.

Free ISYS Demo Disk:
1-800-992-ISYS
(1-800-992-4797)

od ODYSSEY DEVELOPMENT

17th Floor, 3900 West Alameda Avenue, Burbank, CA 91505, (818) 972-1798 Fax (818) 972-1636

*PC Week comparative review (May 20, 1991) revealed search times between 25% and 53% faster than ZyINDEX, and index creation time 32% faster than ZyINDEX (tests performed by PC Week Labs on identical databases).
†PC Sources, November 1991

Circle 214 on Inquiry Card (RESELLERS: 215).

© 1992

World Radio History

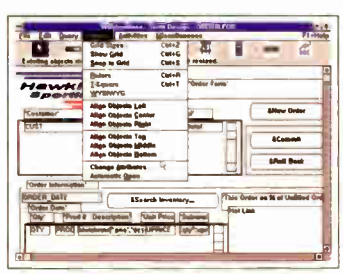
The Windows Database

WindowBase is Easy to Use

Point and click Windows tools assist in defining database tables, in designing forms and reports, and in building simple or complex queries to make retrieving data a snap.

WindowBase is Windows Integration

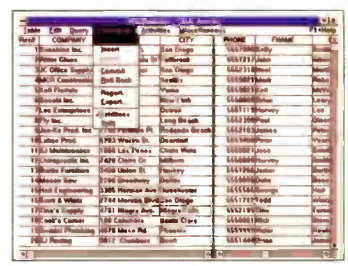
Powerful DDE supports the exchange of data and graphics with other Windows applications such as spreadsheets and word processors. The WindowBase Menuing System enables the user to automate the access of data through forms, reports and SQL queries via customized drop-down menu selections. Or set-up menus to invoke a spreadsheet and automatically open charts and tables, or start-up a word processor and initiate a mail-merge application. WindowBase brings it all together in a simple to use application.



The WindowBase Guarantee

No matter what business you're in, WindowBase is guaranteed to work for you. It gives you the power to easily organize, manage and analyze almost any type of information.

If you don't think WindowBase is the easiest database you've ever used, return it with your receipt within 30 days, and you'll get your money back. It's that simple.



SPI

See your dealer or call now

1-800-937-4774

Software Products International
9920 Pacific Heights Boulevard
San Diego, CA 92121

All product names and trademarks are the property of their respective owners

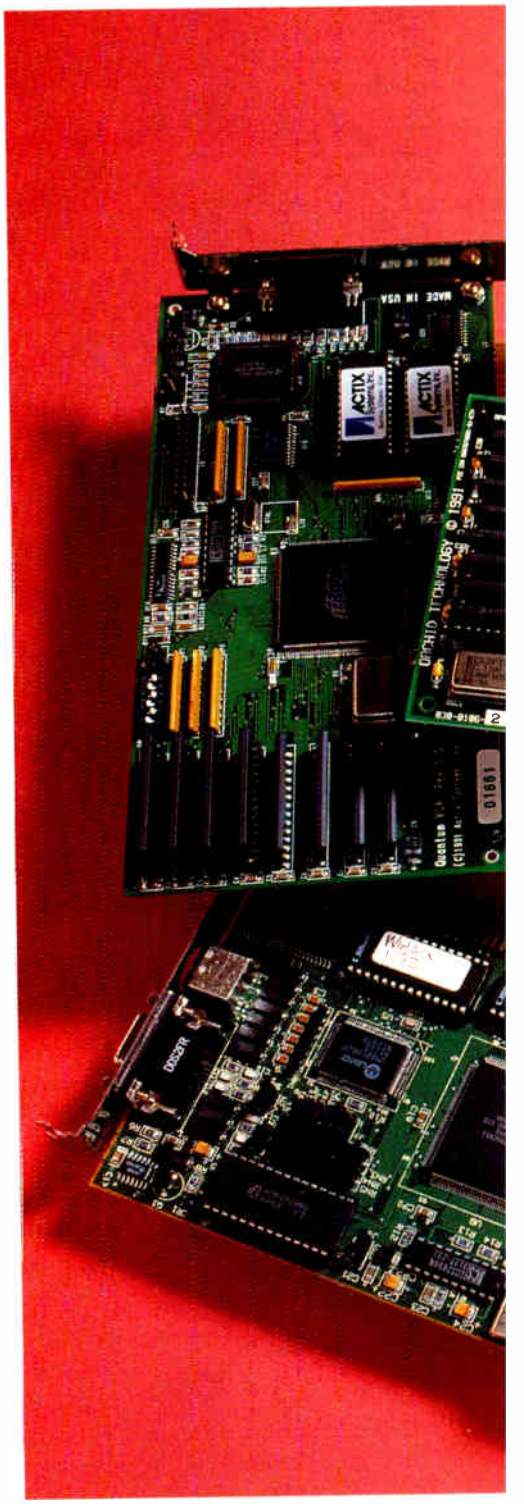
Circle 151 on Inquiry Card (RESELLERS: 152).

World Radio History

HARDWARE

Tweaking Windows:
New Adapters Boost Speed and Clarity

ALAN JOCH



Now that the dust over Windows 3.0 has settled, many businesspeople are finding that this GUI is not without its problems. The performance overhead it levies on standard systems, such as 386s and 386SXs, slows many applications to less than blinding speeds. Consequently, screen redraws, menu displays, text scrolls, and other essential Windows operations can be too slow for some people to work comfortably. For others, these delays are reason enough to avoid Windows.

But in problems lie potential opportunities, and several hardware vendors have recently introduced graphics boards designed specifically to accelerate common Windows functions. I looked at six of these new accelerators: ATI Technologies' Graphics Ultra, Actix Systems' Quantum, STB Systems' Wind/X, Orchid Technology's Fahrenheit 1280, BCC's TIGA-10, and Artist Graphics' WinSpeed 100.

In addition to speeding Windows performance, these boards provide a bridge to another developing trend—the higher-than-standard-VGA resolutions that provide sharper icon and text displays. When teamed with new 15- to 18-inch monitors, which are priced at points that used to define the 14-inch market, the accelerators give businesspeople large, clear, and flicker-free video desktops for the lowest prices ever.

The Playing Field

For this review, I chose boards from vendors that were shipping commercial versions of hardware and drivers in time for testing (more boards will have been introduced by the time you read this). Each adapter includes on-board processors and software drivers optimized to accelerate window scrolls, cursor movement, redraws, and other tasks. All the boards cost less than $900, and some sell for less than $500. All come with 1 MB of video RAM (VRAM).

Similarities aside, this group of six show some fundamental differences in approach to the Windows acceleration problem. The most obvious difference is in coprocessors. For example, the boards from Actix, Orchid, and STB rely on the new 86C911 chip from S3, Inc. This VGA-compatible processor boosts Windows performance by off-loading from the CPU such functions as cursor movement, line drawing, and rectangle fills. The other three boards variously use a proprietary processor or competing products from Chips & Technologies and Texas Instruments.

Conceding the tough competition in this market, some of the board vendors don't stop at speeding up Windows: All promised or were shipping drivers for AutoCAD, Lotus 1-2-3, GEM Desktop, Ventura Publisher, and other applications. A couple of vendors sell accelerators that come with a built-in mouse port and mouse. One even includes its own version of scalable screen fonts.

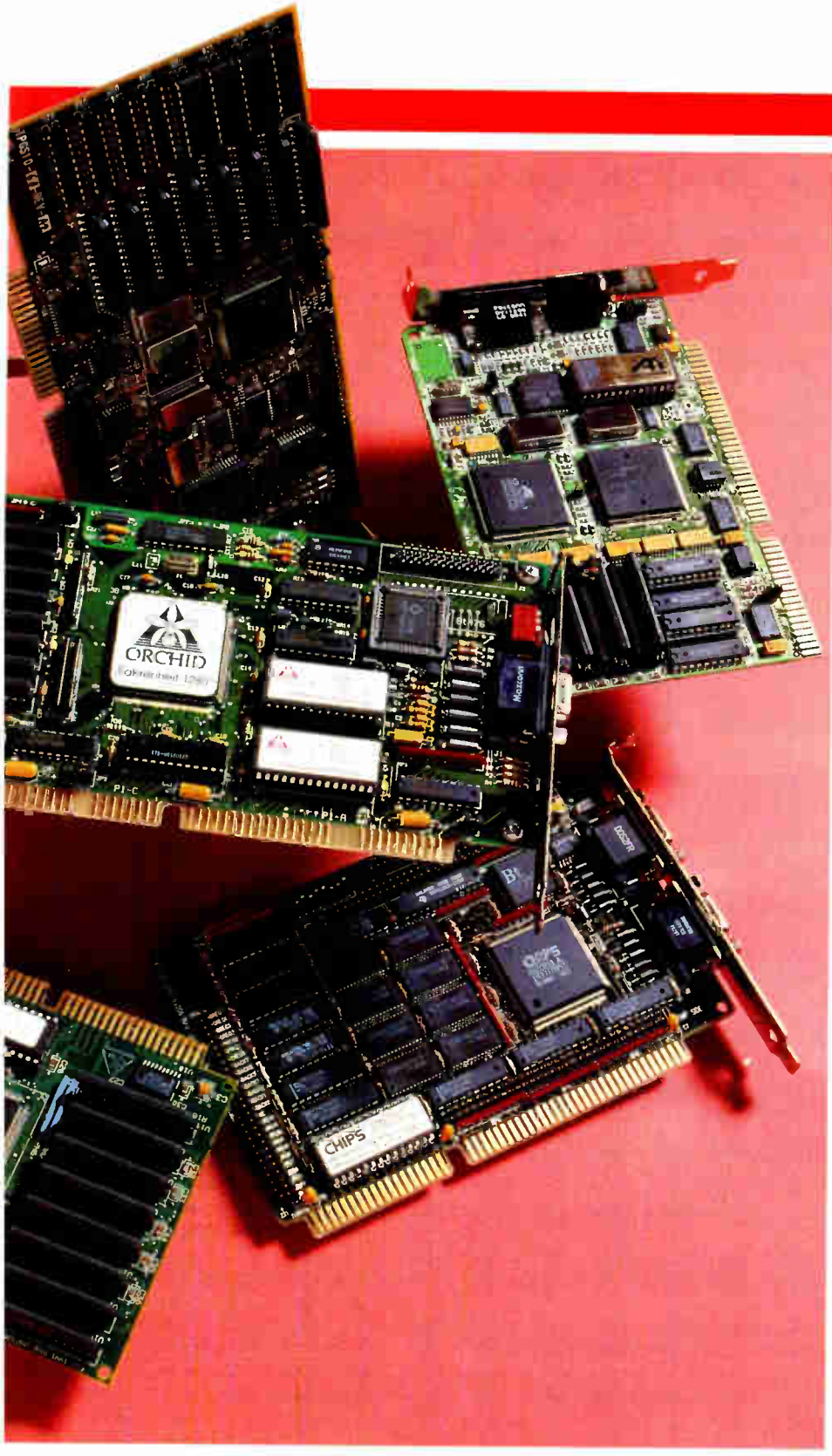
Speed Tests

I tested the boards under Windows 3.0 using NotePad and Windows applications to re-create real-world experiences as much as possible. My test system was a Compaq 386/20 running Compaq DOS 4.01. My monitor was Nanao's FlexScan 9080i, a 16-inch multifrequency display. I tested each board at 1024 by 768 pixels by 256 colors at the highest vertical refresh rate, which for this group of boards was either 70 or 72 Hz.

My objective evaluations consisted of timed tests, including a five-page text scroll within NotePad. I recorded the times of multiple trials scrolling text both forward and backward. Next, I created an Aldus PageMaker file made up of three filled geometric shapes, and I timed horizontal screen scrolls forward

PHOTOGRAPHY: SCOTT PARKER / AVIS STUDIO © 1992

World Radio History



BYTE ACTION SUMMARY

- **WHAT WINDOWS ACCELERATORS DO**
  These graphics adapters provide at least 1024- by 768-pixel resolution and coprocessors that speed standard Windows operations such as screen redraws, text scrolls, and menu displays.
- **LIKES**
  Menu selections unfold instantaneously, repositioned windows redraw with a mouse-click, and you can scroll through pages of text two to four times faster than with Super VGA boards.
- **DISLIKES**
  The lack of clarity in some displays and only incremental performance increases in others.
- **RECOMMENDATIONS**
  The S3-based boards offer the best values in price and performance, and, of these, STB's Wind/X provides the added advantage of a mouse port that can free up an expansion slot.
- **PRICES**
  Fahrenheit 1280, $499
  Graphics Ultra, $899
  Quantum, $499
  TIGA-10, $495 ($100 for optional VGA daughtercard)
  WinSpeed 100, $395
  Wind/X, $499

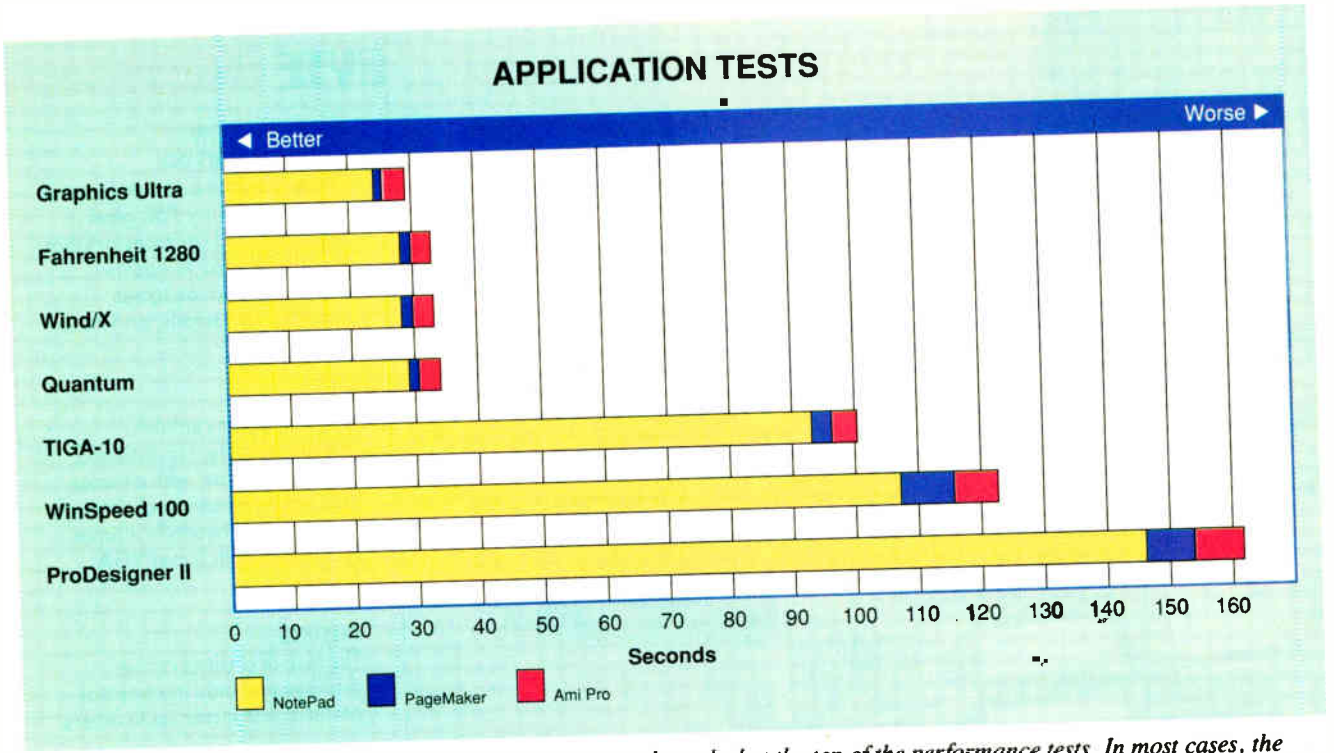
and backward. Finally, I scrolled an Ami Pro text file in 12-point Times Roman in a similar manner. In practice, these tasks can mean the difference between getting your work done efficiently or having enough idle time to ask yourself whether or not the Windows interface is really worth its pokiness.

My baseline comparison was Orchid's ProDesigner II, a 1-MB Super VGA card built around the Tseng Labs ET4000 chip. Although relatively fast, the ProDesigner II isn't optimized for Windows. As the results in the figure show, a natural break appears in the performance rankings. The Graphics Ultra and the S3 contestants were invariably the fastest boards. The 34010-based TIGA-10 and the WinSpeed 100 fell between the leading accelerators and the ProDesigner II. One exception to this came in my PageMaker tests: The WinSpeed 100 actually lagged behind all entrants, including the ProDesigner II.

In the Beholder's Eye

Similarly, I conducted a series of subjective tests to gauge how comfortably I could work in the Windows environment. Because winding through menu trees can be tediously slow on some systems, I

World Radio History



ATI's Graphics Ultra and the three S3-based boards consistently ranked at the top of the performance tests. In most cases, the leading boards ran four to six times faster than the baseline Super VGA adapter, Orchid Technology's ProDesigner II.

judged the speed with which each board displayed pull-down selections and submenus. Timings were impossible because most of the boards sped up response times to a flash.

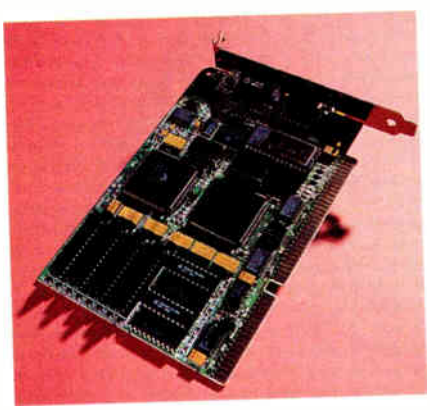
Again my basis for comparison was the ProDesigner II: When I clicked on a main menu selection while running that board, I noted a slight but annoying hitch as I waited for the menu to unfold. Similarly, when I moved open windows around the screen, the redraws were not instantaneous. Only the WinSpeed was unable to eliminate these hitches; the remaining boards boosted redraws enough to achieve an almost immediate response time.

Display quality is also subjective, but I found generally good news in this area. All the boards produced clear displays. Some of them, including the plodding WinSpeed, excelled with crisp icons and text that remained readable even at small sizes.

Overall, each board achieved its stated goal of improving the Windows experience, although differences in effectiveness, degree of acceleration, installation, and price were obvious.

Performance Leader

At $899 for the 1-MB VRAM version, ATI's Graphics Ultra commands the highest price of the tested accelerators.



Graphics Ultra

Based on performance and bundled extras, the Ultra makes a strong case for justifying its price tag.

For example, the Ultra leads the field in two of the three performance tests. It ran six times faster than the ProDesigner II in the NotePad and PageMaker comparisons, and it boosted Ami Pro screen scrolls two times faster than the baseline board.

The Ultra teams a proprietary Mach 8 coprocessor, an 8514/A clone, with an on-board VGA controller for compatibility across the range of low and high resolutions up to 1024 by 768 pixels by 256 colors noninterlaced at 72 Hz. A mouse port and Microsoft-compatible mouse come standard with the board.

Unique among the tested products are the scalable screen fonts that ATI bundles with the accelerator. Like Adobe Type Manager and similar products, these fonts, called Crystal Fonts, produce high-resolution letters to make proofing and reading of small text easier. Apparent resolution increases, thanks to the antialiasing algorithm that adds shades of gray to smooth jagged edges of letters. ATI plans to offer a package of 35 additional Crystal Fonts and support for True Type and Bitstream and Adobe font converters. The package should be available by the time you read this; however, ATI had not established final pricing at press time.

After installing the board, I loaded the software drivers using ATI's installation program, which provides menus for configuring monitor types or adding device drivers and Crystal Fonts. In addition to the Windows drivers I tested, the Ultra also ships with drivers for GEM Desktop, Lotus 1-2-3, AutoCAD, and Ventura Publisher.

As I've already mentioned, the Ultra placed at or near the top in each of the performance tests. In addition, selected menus and repositioned windows appeared instantaneously after my mouse-clicks.

Less impressive, however, was the

World Radio History

The Big Screen

ViewSonic 7 Rated #1 by InfoWorld!

20-Inch

17-Inch

These two new **1280 x 1024** ultra high resolution monitors will soon be in offices all over the world.That's because they're so *powerful!*

Consider this: Our 17" and 20" non-interlaced microprocessor-ennanced monitors will automatically adjust the image the way you want. There are 16 preset modes which can be programmed by the end-user. With built-in memory, these monitors do what you want...and they don't forget. Plus the crystal clarity and sharp focus on the non-glare, anti-static screen are simply unbeatable. NO distortion and low radiation. The ViewSonic 7 even has a flat/square screen.

The ViewSonic 7 (17") and ViewSonic 8 (20") feature a new level of high performance for desktop publishing, CAD/CAM and other graphics-intensive applications. They are designed for PCs, Mac II and Sun systems.

BUYER'S ASSURANCE SEAL
InfoWorld
RECOMMENDED PRODUCT
ViewSonic 7
September 2, 1991

Visit your dealer TODAY and see for yourself why **ViewSonic** monitors, from the 14" to the 20", are becoming a standard in offices throughout the world.

ViewSonic®
12130 Mora Drive
Santa Fe Springs, CA 90670
(213) 946-0711 (800) 888-8583 Fax (213) 946-1618

All products and brand names are trademarks of their respective companies.

INTERNATIONAL DISTRIBUTORS: Australia (02-476-4777, Fax: 02-477-7561); Austria (04252-2700, Fax: 0452-3177); Canada (416-479-5525, Fax: 416-479-1834 and 604-270-8561, Fax: 604-270-1953); Germany (0431-548030, Fax: 0431-5480366 and 05732-101932, Fax:05732-101947) Hong Kong (389-8252, Fax: 343-6479); Italy (02-82442156, Fax: 02-8256993); Korea (02-784-2915, Fax: 02-784-2549); Poland (39-120314, Fax: 39-120314) Spain (93-419-2322, Fax: 93-419-1178); Taiwan (02-248-4072, Fax: 02-240-8238)

Circle 176 on Inquiry Card (RESELLERS: 177).

World Radio History

screen display. The board provided noticeable improvement in display quality over the ProDesigner II, but compared to other contenders in this review, the Ultra's display was lacking. Icons in Ami Pro were recognizable, but the scissors and other toolbox items looked blurry. Also, the boldfaced main menu text looked muddy, while the Roman fonts identifying applications in the Windows Program Manager were fuzzy.

Gang of Three

The S3-based products—the Quantum, the Wind/X, and the Fahrenheit 1280—jockeyed for position at the top of the performance tests. Although the Ultra often prevailed, the lower-priced S3 pack was never far behind. In the three speed tests,

Quantum

the S3-based boards accelerated performance from 2½ to 5 times faster than the ProDesigner II. The base price of each board was $499.

They each offer Windows resolutions of up to 1280 by 960 pixels with 16 colors interlaced at 43 Hz, or 1024 by 768 pixels with 256 colors noninterlaced at 70 or 72 Hz. Upon availability, each vendor planned to offer the Sierra "high-color" RAMDAC and driver for display of 32,768 colors in the 800- by 600-pixel modes. In addition to the Windows 3.0 drivers that I tested, the board vendors also planned to have available by the beginning of the year applications drivers for AutoCAD, Generic CADD, Ventura Publisher, Lotus 1-2-3, GEM Desktop, and other packages.

The Quantum from Actix Systems was easy to install. I needed only to set some DIP switches to configure it for 1024- by 768-pixel operation at 72 Hz. I installed the board's Windows drivers through the standard Windows-installation routine.

Wind/X

Documentation was sparse, but it did not leave me with any unanswered questions. Once installed, the board provided a crisp display. It never led in any of my speed tests, but it ranged in the upper tier. Actix plans to include the Sierra RAMDAC as part of the board's price (the test board had neither the RAMDAC nor the drivers).

The Wind/X performed similarly to the Quantum and differentiated itself with some extras. The board includes a mouse port and Logitech MouseMan. If you already have a mouse installed, you can set a jumper to disable the accelerator-based pointer.

Like other graphics adapters from STB Systems, the Wind/X comes with a D/A converter that accepts the Sierra chip. Pending availability, STB will offer the RAMDAC as a $60 option over the board's base price.

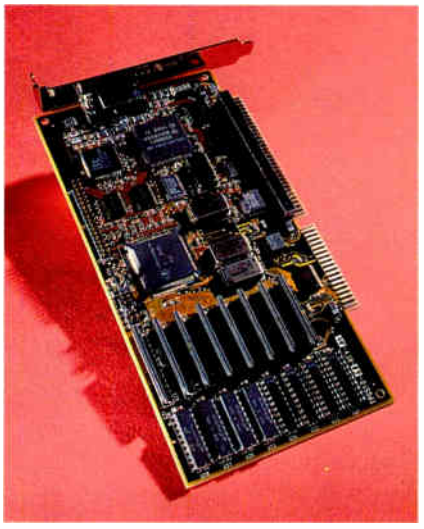
Various jumpers allow you to select 8- or 16-bit BIOS interfaces, depending on whether you'll be running in protected-mode environments. Also, jumpers let you configure system clock speeds for monitor resolutions. I left the default settings in place—except for setting jumpers for 1024 by 768 pixels at 70 Hz, noninterlaced—and plugged in the board. I loaded the drivers from the Windows Setup and quickly had the accelerator up and running.

Installing Orchid's Fahrenheit 1280 requires you to check and perhaps reset various DIP switches for monitor resolutions and refresh rates. Software drivers load using the standard Windows Setup.

Overall, the Fahrenheit 1280 performed as I expected based on the results of the other S3-based boards, except that the driver showed a slight bug when I experimented within PageMaker. I drew some squares and rectangles, and when I selected one of the shapes with the Marquee tool and then deleted the shape, unwanted castoffs in the form of stray lines remained on the screen. These lines disappeared with a screen repaint. The company says that future versions of the software should correct this problem.

Fahrenheit 1280

The three S3 boards all performed similarly. Displays were crisp and clear, and menus appeared instantly. I experienced no compatibility problems when I had Windows set up in standard VGA mode.



TIGA-10

Inexpensive 34010

BCC's TIGA-10 accelerator illustrates how far prices for the TMS34010 coprocessor have fallen recently. Once the domain of higher-end CAD applications, Texas Instruments' 34010 chip is now economical enough to compete in the general business market.

However, taken in this context, the TIGA-10 looks somewhat idiosyncratic compared to its challengers. Lacking

World Radio History

NewWave for Windows. Never has $89 done so much for your organization.

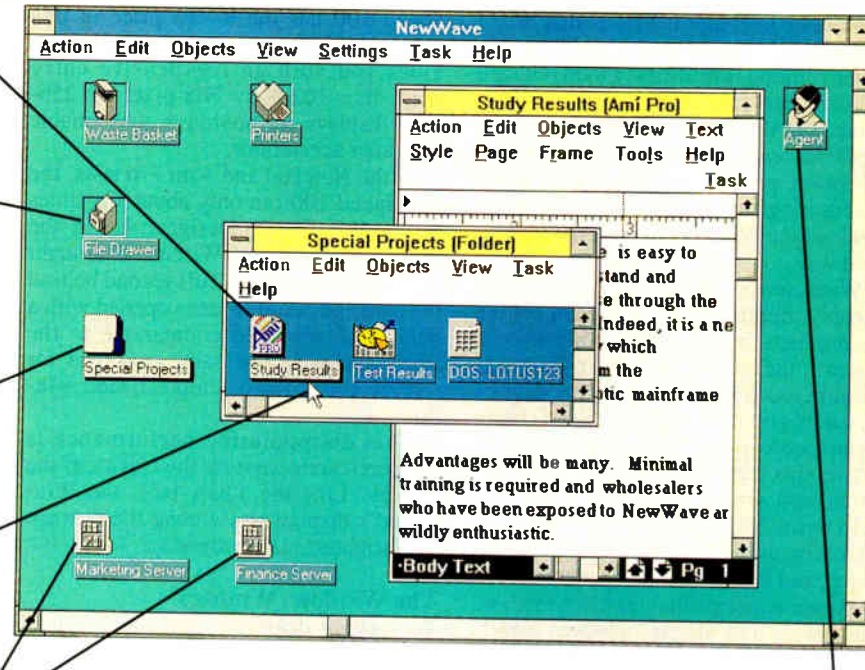
The premier desktop manager for Windows that does a lot more for your organization. Now at a price that's a lot less than what you'd expect. Take a look at all you get:

Icons: NewWave turns all of your existing DOS and Windows programs and files into icons for an easier-to-use desktop. Files can have 32 character names. Easily move files around the desktop by "dragging and dropping."

File Cabinet: On your real desk are documents in folders. Your folders are in a file cabinet. NewWave organizes your PC desktop the same way – by project with folder icons, and with a file cabinet for storing folders.

Folders: Finally, you can file your spreadsheet, word processor and graphics documents together by project, for easy access.

Launch & Load: Just click on an icon – both the file and it's program open simultaneously – NewWave has linked them together automatically. This means you no longer need to understand the Windows program and file managers to get your work done.



The Work Group Library makes it easier for you to share information with co-workers. We've done away with network menus and DOS commands, so you can focus on what you want to do – to share information with colleagues as you work together on the same project. To share text, graphics, and even spreadsheets, simply drag the file icon onto the server icon and your document is immediately available to others on your network. NewWave will track revisions, as well. So an entire group can work on your project and you will know when data has been changed and who has changed it. Welcome to document sharing, the easy way; the NewWave way.

NewWave's Agent brings automation to Windows. Let "The Agent" watch you complete a task just once, like the monthly update of a budget or sales report, and he'll complete the same job for you again and again using your existing software applications. You can even automate "The Agent" to work across applications and networks to gather the information you need. And he's far easier to set up than the Windows' macro-recorder – because he remembers your steps while you execute them and allows you to edit right then or make changes later. By using his calendar, you can schedule work for him days or weeks in advance. Just think of how much extra time you'll save by turning "The Agent" loose on all of your recurring tasks.

Put NewWave to work for your organization and find out how easy it is to get more done. Now it's only $89. At a price like this it pays to be organized.

Call 1-800-848-WAVE ext. 3I and get NewWave for only $89* (suggested retail price $195). But only if you call before 1/30/92.

*Limited time offer. Limit one per customer.

NewWave for Windows. We've made a great idea even better.

HEWLETT PACKARD

Circle 71 on Inquiry Card.

World Radio History

VGA compatibility, the TIGA-10 must connect to a separate compliant graphics adapter for when you're running DOS or applications without TIGA drivers. As an alternative to this two-slot solution, BCC sells a VGA daughtercard for $100.

As part of the standard package, BCC includes drivers for Windows, AutoCAD, AutoShade, 3D Studio, and WordPerfect with the TIGA-10.

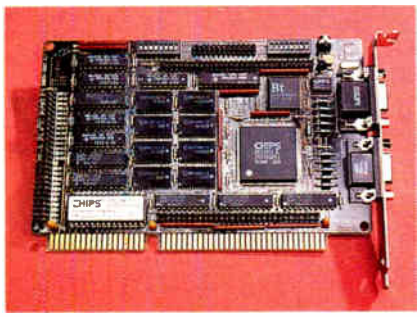
The 60-MHz TIGA-10 displayed a maximum of 1024 by 768 pixels by 256 colors noninterlaced. BCC provides a utility to check for any potential I/O-address or interrupt conflicts that might exist before you install the TIGA-10. After running this utility, I then plugged the card into an expansion slot and connected the VGA pass-through cable to the ProDesigner II in an adjacent slot. An installation program steps you through configuring the board. After rebooting, you load the Windows drivers in the standard way.

Windows performance improved noticeably, but the TIGA-10 lagged behind the products that I've already mentioned. Overall, the board ran the Windows tests roughly twice as fast as the ProDesigner II, yet this represented a clear and slower difference compared to other products. In use, this meant delays in seeing menus unfold and windows redrawn.

In terms of display quality, the TIGA-10 ranks as one of the best. Text was sharp, and icons were easily identifiable. In the scissors icon in Ami Pro's toolbox, each blade and handle hole was clearly defined.

Clear But Slow

Built around the Chips & Technologies 453 processor, Artist Graphics' WinSpeed 100 has the lowest price in this roundup: $395. Although that price provides you with an inexpensive entry point into 1024- by 768-pixel by 256-color displays, the board is a questionable Windows accelerator.



WinSpeed 100

In the NotePad and Ami Pro tests, the WinSpeed 100 ran only about 1¼ times faster than the ProDesigner II. In the PageMaker test, the WinSpeed brought up the rear—almost a full second behind the baseline board. Menus opened with a delay that appeared comparable to the ProDesigner's. The same was true for redraw times when I repositioned windows.

This disappointing performance is tempered somewhat by the clarity of the display. Like the TIGA-10's, the WinSpeed's display was among the clearest and brightest in this roundup.

The Windows Winners

To varying degrees, all these products deliver on the promise of faster, high-resolution Windows applications. And as new and more expansive versions of Windows and OS/2 appear in the coming months, hardware-based acceleration may become even more important. The growth of high-resolution, large-screen monitors could also give impetus to the popularity of these boards, as competition forces their prices down to commodity levels.

Then, as now, the accelerators provide a needed boost for those who have committed their workdays to Windows. Although quite economical, the WinSpeed 100 didn't offer enough of a performance advantage to compete effectively in this category.

The TIGA-10, with its proven 34010 coprocessor, is a solid product, but within the narrow context of Windows accelerators, I found other coprocessors to be more efficient. Likewise, I liked the Graphics Ultra's overall performance and appreciated ATI's attempts at value-added extras. However, the Ultra's list price of $899 is more than I'd be prepared to pay if my primary goal was accelerating Windows. For those who also need to combine a powerful processor with AutoCAD display list drivers for faster redraws, pans, and zooms, the capabilities of the Ultra and the TIGA-10 become more valuable.

In the end, I found the prices, speed, and clarity of the S3-based boards impossible to pass up for Windows work. Within this group, price and performance are equal. So, ultimately, I give the nod to STB Systems' Wind/X. I don't need a mouse, but, like many people, I'd love to free up a slot as I plow through Windows applications with greater speed and clarity. ■

Alan Joch is a technical editor for the BYTE Lab. You can reach him on BIX as "ajoch."

COMPANY INFORMATION

Actix Systems, Inc.
(Quantum)
4633 Old Ironsides Dr.,
Suite 310
Santa Clara, CA 95054
(800) 927-5557
(408) 986-1625
fax: (408) 986-1646
Circle 1233 on Inquiry Card.

Artist Graphics
(WinSpeed 100)
2675 Patton Rd.
St. Paul, MN 55113
(612) 631-7800
fax: (612) 631-7802
Circle 1234 on Inquiry Card.

ATI Technologies, Inc.
(Graphics Ultra)
3761 Victoria Park Ave.
Scarborough, Ontario,
Canada M1W 3S2
(416) 756-0718
fax: (416) 756-0720
Circle 1235 on Inquiry Card.

BCC
(TIGA-10)
174 Component Dr.
San Jose, CA 95131
(408) 944-9000
fax: (408) 944-9001
Circle 1236 on Inquiry Card.

Orchid Technology
(Fahrenheit 1280, ProDesigner II)
45365 Northport Loop W
Fremont, CA 94538
(415) 683-0300
Circle 1237 on Inquiry Card.

STB Systems, Inc.
(Wind/X)
1651 North Glenville,
Suite 210
Richardson, TX 75081
(214) 234-8750
fax: (214) 234-1306
Circle 1238 on Inquiry Card.

World Radio History

WARNING! FAST WINDOWS AHEAD

Fasten your seat belt and snap in the new Hercules Graphics Station GOLD!

Windows *acceleration* plus:

- 32,768 colors
- Graphics processor
- High resolution
- High refresh rates
- VRAM
- DRAM (optional)

$495

Hercules Graphics Station GOLD

High-speed, true color Windows . . .
and much more!

Call 1-800-532-0600 for details.

© Copyright 1991 Hercules Computer Technology, Inc., 921 Parker Street, Berkeley, CA 94710 510-540-6000. Hercules is a registered trademark and Hercules Graphics Station GOLD is a trademark of Hercules Computer Technology, Inc. All other product names are trademarks of their respective owners, who are not associated with Hercules.

Circle 69 on Inquiry Card.

World Class Windows Performance.

Hercules

World Radio History

INTRODUCING DR DOS® 6.0

THE DOS THAT CONQUERS SPACE... AND BEYOND.

More memory for your applications. Twice the hard disk space. Superior productivity.

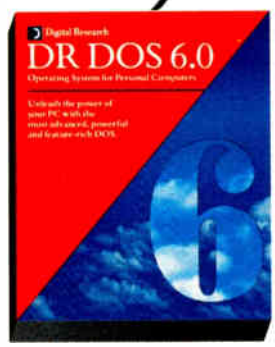
DR DOS® 6.0 is here. A major upgrade to the award-winning DR DOS® 5.0, this is *the* DOS operating system that conquers the limitations of your PC's memory and hard disk space. Fully DOS-compatible, with free product lifetime support, it's the best thing that ever happened to DOS.

Give your applications more room to run.

DR DOS 6.0 lets you run even the biggest DOS and Windows applications. It loads itself into upper and high memory along with buffers, device drivers, TSRs, and network drivers – delivering consistently more memory than the competition on Intel 8088/86, 80286, 386 and i486 PCs and compatibles.

Don't get a new hard drive. Just get a new DOS.

With DR DOS 6.0's optional file compression, *a typical 40MB hard disk can hold up to 80MB of data!* You also get a high performance disk cache for dramatically improved software performance. And a disk defragmentation utility for speedier data access.



Make your PC work for you, not against you.

DR DOS 6.0 gives you the most advanced DOS technology, plus comprehensive password security to protect your system and data, on-line help and documentation, lightning-fast task switching for improved productivity, file recovery commands and much more.

Get the facts by fax:
1-800-955-DOS6
Request Document 602
Or call us at:
1-800-274-4DRI

Expand your PC's universe with DR DOS 6.0. Let us fax you the facts, or call us for details and the name of the DR DOS reseller nearest you.

	MS DOS 3.X	MS 5.0 UPGRADE	DR DOS 6.0
FULLY DOS-COMPATIBLE	■	■	■
MAXIMUM MEMORY ON 386 & 486 PCs	575k	621k	627k
MAXIMUM MEMORY ON 80286 PCs	575k	621k	628k
MAXIMUM MEMORY ON 8086/88 PCs	588k	578k	612k
DOUBLE THE STORAGE CAPACITY OF TYPICAL HARD DISK			■
READ & WRITE HIGH-PERFORMANCE DISK CACHE			■
DISK DEFRAGMENTATION			■
COMPREHENSIVE PASSWORD SECURITY SYSTEM			■
UNDELETE		■	■*
TASK SWITCHING (NO. OF TASKS)		14	20
FAST TASK SWITCHING VIA COMMAND LINE OR GRAPHICAL SHELL USING EXPANDED/EXTENDED MEMORY			■
CUT & PASTE BETWEEN TASKS			■
ON-LINE DOCUMENTATION & HELP			■
PC-TO-PC FILE TRANSFER			■
FREE PRODUCT LIFETIME SUPPORT			■
FULLY BOOTABLE	■		■

* EVEN AFTER INTENSIVE DISK USE

Digital Research®
WE MAKE COMPUTERS WORK

D R D O S 6 . 0

Digital Research and DR DOS are registered trademarks and the Digital Research logo is a trademark of Digital Research Inc. All other brand, product, or company names are trademarks or registered trademarks of their respective owners. Copyright © 1991 Digital Research Inc.

Circle 53 on Inquiry Card.

World Radio History

APPLICATION

Ample Waves of Data: Five Tools to Help You Stay Afloat

PETER WAYNER

One of the curses of the computer age is the tidal wave of data that can wash over us each day. For example, my local supermarket now offers coupon discounts to shoppers who provide their names along with cash-register receipts. Although this ruse raises concerns about privacy, I worry more for the poor clerk who must plow through the terabytes of resulting data to discover possible correlations between ZIP codes and mozzarella sales.

Computers helped cause the problem of data overload, and fortunately they can also help solve it. In this roundup, I review five PC and Macintosh software programs designed to help business people, scientists, and engineers analyze endless streams of quantities, ratios, values, and quotients. For PCs, I evaluated Computing Resource Center's Stata, SAS Institute's SAS PC, and SPSS's SPSS/PC+ 4.0. For Macs, I tested Minitab's Minitab 8.0 and Systat's Systat 5.1. (SPSS also sells a Mac version, while Minitab and Systat also sell PC versions of their products.)

The programs are designed for people who must analyze vast quantities of data and make decisions based on the results. For example, marketing directors might use data-analysis software to track demand for their products and determine sales trends based on geography, seasons, or income groups. As these packages look for patterns, they can also plot the sales data in several different formats to make the results accessible to everyone in the company.

A Range of Capabilities

Each program helps you cope with onslaughts of data, but this class of software doesn't collect information and shouldn't be confused with data acquisition programs. Also, this genre doesn't include related programs such as mathematics software (e.g., Mathematica) or scientific visualization packages (e.g., Spyglass).

All the packages I looked at provide simple ways to read the data into the program, perform calculations, and then display the results graphically or numerically. However, there are many differences among the programs. Some, like SAS PC or SPSS/PC+, come with optional modules that provide an extensive range of analyses and graph formats. Others, like Stata, are simpler and not as loaded with features.

Some of the PC packages, including SAS PC, trace their lineage to old mainframe-based statistical software and have user interfaces that seem arcane on microcomputers. Other packages, such as Systat, were written especially for microcomputers and provide a strong interface that would clog the I/O channels of the old mainframes.

I tested the PC programs with a 486-based system running DOS 4.1 with 4 MB of memory and a 105-MB hard drive. My Mac was a IIci running System 7.0 with 5 MB of memory and a 105-MB hard drive.

I evaluated the packages according to four main criteria: range of data-analysis features, numerical stability, presentation tools, and user interface. I analyzed a set of data I had gathered for one of my research projects. The research involved using computers to match artists and their work. Specifically, the data represented the distribution of pen-stroke lengths across a variety of illustrations.

I also ran a sample set of data through the programs to check for numerical stability; this determined how accurately the packages calculated very small and very large numbers. Finally, I evaluated the user interfaces. Naturally, this is subjective, and users of the original mainframe packages may not care a whit about what they can do with the mouse.

Statistical Options

A range and depth of statistical operations is important if your work involves complicated and rigorous statistical analyses. Because of space constraints, I can't list all the analyses possible for each package, but I will summarize each product's range of capabilities.

Each package handles the basic statistics jobs, such as computing medians, averages, standard deviations, and correlations between different parts of the data set. If you construct an equation that models the data, all five packages will do straightforward regression to determine how closely the model actually fits the data. You can do the regression in one swoop, or you can let the computer do it a step at a time and add more and more variables until the model and data match well. All five packages will also analyze the variation (called ANOVA) and determine how well the model predicts the data.

If you want to check your data for

BYTE ACTION SUMMARY

- **WHAT DATA-ANALYSIS PROGRAMS DO**
  They compute various statistical quantities that let you look for trends and patterns in data.
- **LIKES**
  They provide mathematically sophisticated tests for finding patterns and determining whether the patterns could have been caused by random chance.
- **DISLIKES**
  Many of the user interfaces were rudimentary and not well designed.

RECOMMENDATIONS
For Mac-based statistical analyses and presentations, choose Systat. Although rigorous in its complexity, SAS PC reigned as the most complete package for PCs.

- **PRICE**
  Minitab 8.0 for the Mac, $695 (single-copy price)
  SAS PC 6.04, $595 (one workstation, first-time license, must be renewed annually for $275)
  SPSS/PC+ 4.0, $195
  Stata 2.1, $590
  Systat 5.1 for the Mac, $795
  (Mesosaur time-series statistics module, $395)

World Radio History

consistency, all five programs will compute the basic set of statistics, including the t-test, the Kolmogorov-Smirnov test, and many other nonparametric tests. These tests let you determine whether the data is likely to be from a predictable source. The Kolmogorov-Smirnov test, for instance, is useful for checking whether the variable was produced by a perfectly random source. The t-test is useful for determining whether the difference between the means of two samples could have occurred by chance.

Stata, Systat, SPSS/PC+, and SAS PC also perform cluster analysis for segmenting several sets of data into subsets with similar characteristics. These four can also do factor analysis. The latter is a more complicated version of regression in which different variables are grouped into meta-variables called factors; the influence of these factors is then computed.

SPSS's optional Advanced Statistics package provides sophisticated versions of nonlinear-regression and multivariate-regression variance analysis. Multivariate regression addresses numerous variables that might be related to the data. Both regression analyses are also available in SAS PC's main statistics package and in Systat and Minitab.

Systat, Minitab, SAS PC, and SPSS/PC+ offer packages for analyzing functions that vary with time. The basic purpose of time-series analysis is to look for trends and counteract seasonal variations. Minitab builds these functions into the main module; the other three programs offer theirs as options. Stata provides some of these functions, but not enough for me to consider it a contender in this area.

With the Systat and Minitab versions of time-series analysis, you calculate a Box-Jenkins ARIMA model of the data. This model is helpful for looking for seasonal or periodic variations in a time-dependent variable. Both packages make it easy for you to analyze graphically the auto-correlations between different times and discover any periodic differences. Systat provides many built-in functions for smoothing data.

SPSS and SAS offer more sophisticated time-series systems than either Systat or Minitab. SPSS/PC+ and SAS PC will estimate the various frequencies of seasonal variation with Fourier analysis. This lets you determine whether there may be more than one pattern at work (e.g., vacation passenger loads on airliners are higher on Fridays and in the summer). Both programs also offer the X11 ARIMA package, which was developed by government agencies to do seasonal adjustments of monthly data. SPSS's version comes from Statistics Canada; SAS's version comes from the U.S. Census Bureau.

One important element in handling seasonal data is dates. Although time may be a continuum, the way we represent it is more complex. Systat, SPSS/PC+, and SAS PC offer ways to handle the standard day, month, and year format. SAS, for instance, converts a date into the number of days between it and January 1, 1960. Thus, July 4th, 1776, becomes −67019. If you are using the time of day as well, SAS stores this as the number of seconds from midnight, January 1, 1960. Minitab sees time-series data as simple sequences with data numbered case 1, case 2, and so on. These data-handling features make Systat, SAS, and SPSS much easier to use for large projects than programs that don't address the calendar format.

continued

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.

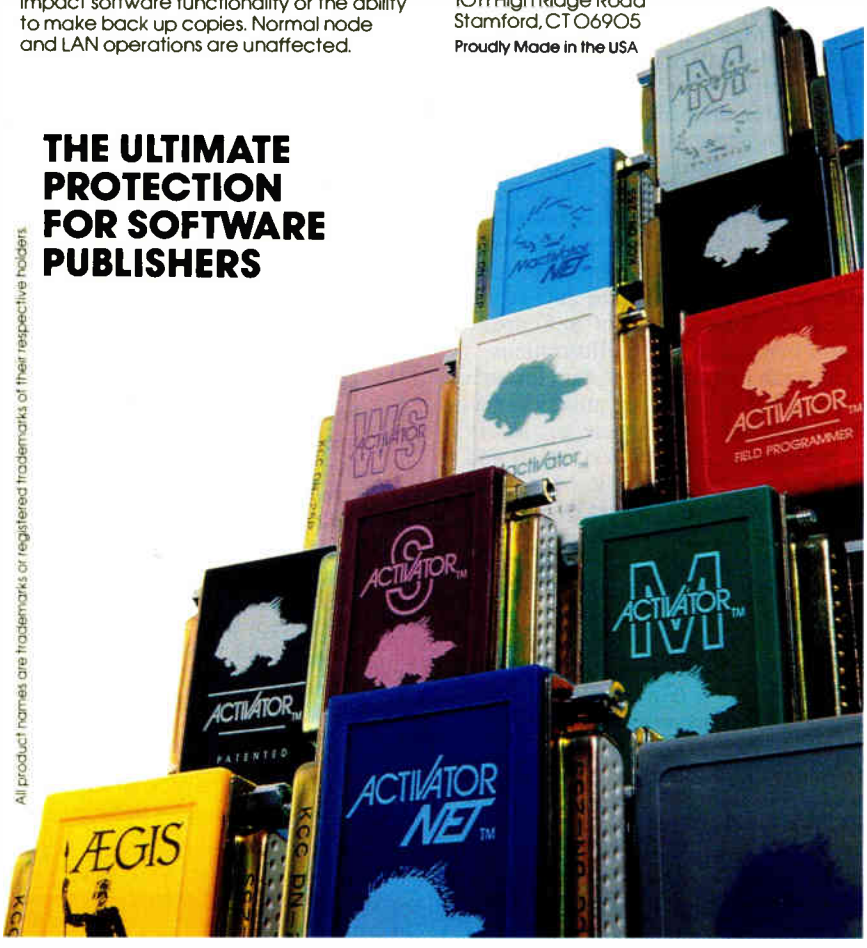
Simple. Unassuming. Ever vigilant. Easy to incorporate into your application package. And quite possibly the most profitable hardware investment a software developer can make.

To find out more, call: **1-800-333-0407**

IN CONNECTICUT CALL: 203-329-8870
FAX 203-329-7428
EUROPE AND UK: +44 784 43 00 60

SOFTWARE SECURITY INC
1011 High Ridge Road
Stamford, CT 06905
Proudly Made in the USA

THE ULTIMATE PROTECTION FOR SOFTWARE PUBLISHERS



All product names are trademarks or registered trademarks of their respective holders.

Circle 153 on Inquiry Card

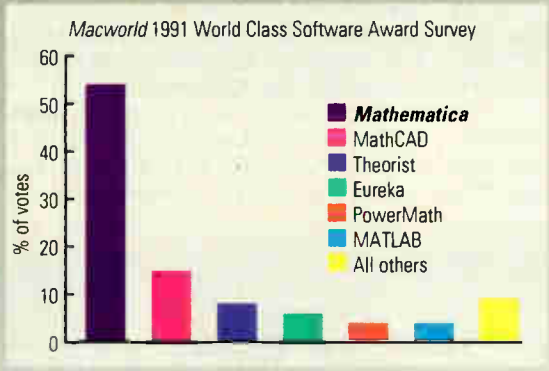
World Radio History

Mathematica 2.0: the standard for technical computing

"The importance of the program cannot be overlooked... it so fundamentally alters the mechanics of mathematics."
New York Times

"*Mathematica* has the potential to change the world of science at least as much as word processing has changed the world of writing."
InfoWorld

"*Mathematica* is a startlingly good tool."
Nature



Mathematica has also received best software/new product awards from:

Macworld, 1990-91
Discover, 1990
BYTE, 1989
MacUser, 1989
Business Week, 1988
InfoWorld, 1988

Available for PC, Macintosh, Unix, and VMS systems, *Mathematica* 2.0 brings a range of new capabilities to *Mathematica*, the proven leader in technical computing software. Interactively handling numerical, graphical, and symbolic computation at all levels, *Mathematica* 2.0 adds 50 percent more functions. These include sound generation, differential equations, external program communication, as well as enhancements to *Mathematica*'s built-in high-level programming language.

Mathematica has rapidly become the standard for technical computing, with more than a dozen textbooks, a quarterly journal, and several newsletters devoted to the system. *Mathematica* is in use at all of the 50 largest U.S. universities, all of the technical Fortune 50 companies, and most of the world's larger engineering firms. In fact, more than 100,000 technical professionals and students around the world are working with *Mathematica* every day.

To find out what *Mathematica* can do for you, call Wolfram Research at 1-800-441-MATH.

Mathematica® 2.0
A System for Doing Mathematics by Computer

For Macintosh information circle 180,
For IBM/Compatible information circle 181,
For UNIX information circle 182 on Inquiry Card.

***Mathematica* is currently available for:**

MS-DOS 386, Microsoft Windows, Macintosh, CONVEX, DG AViiON, DEC VAX (ULTRIX and VMS), DEC RISC, HP 9000, Apollo, IBM RISC System/6000, MIPS, NeXT, Silicon Graphics, Sony, Sun-3, and SPARC.

Prices in U.S. and Canada start at $595. Educational discounts are available.

Wolfram Research, Inc., 100 Trade Center Drive, Champaign, IL 61820-7237, USA
217-398-0700; fax: 217-398-0747; email: info@wri.com

Wolfram Research (UK) Ltd., P.O. Box 114, Abingdon, Oxon OX13 6TG, United Kingdom
+44 (235) 550 440; fax: +44 (235) 550 445; email: info-uk@wri.com

© 1991 Wolfram Research, Inc. *Mathematica* is a registered trademark of Wolfram Research, Inc. *Mathematica* is not associated with Mathematica Inc., Mathematica Policy Research, Inc., or MathTech, Inc. All other product names mentioned are trademarks of their producers. Photo: George Rehrey

World Radio History

SAS PC and SPSS/PC+ have many esoteric options too numerous to name here. SPSS/PC+, for instance, offers a separate package called CHAID, which performs sophisticated cluster analysis based on the chi-squared test and tree analysis. SAS offers a separate package devoted to manufacturers who do quality-control analysis. (At press time, Minitab introduced a similar package.) SAS also sells a package for managing operations such as network flow calculations or linear programming.

It is impossible to say which package is the most sophisticated for data analysis. They all handle the core group of features successfully. For Mac-based analyses, both Minitab and Systat provide an equally solid core of the standard statistical methods. For PCs, SAS PC has the widest range of add-on features, so if you need very complicated procedures, SAS PC is the standout program.

Numerical Stability

One of the most important features of a statistical package is numerical stability. Some software is written by people who are careful to ensure that the mathematical operations are done with high precision. Other programs are looser and sloppier when handling small and large numbers.

The range of acceptable numbers can cause problems. Minitab can only handle numbers between 10^{-13} and 10^{13}. The manual suggests that you can rescale that particular set of data when you get near the boundaries of accuracy. This fix, though, is cumbersome and potentially confusing if you are not expecting it. Every package has some limitation, but most are much better than this. Stata, for instance, can handle numbers between 10^{-99} and 10^{99}.

To test the number-crunching abilities of each program, I created a simple file with five variables and nine cases. In the first variable, I placed the numbers 1 through 9. In the second, I put the numbers 10001 through 10009. The third and fourth columns were filled with the first and second columns divided by 10^8. The fifth column was filled with the first column divided by 1000.

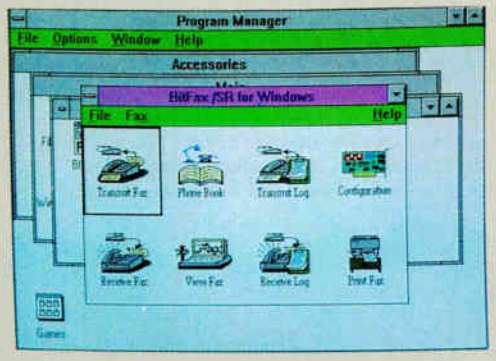
The purpose of the test was to determine how well the programs responded to numbers in a wide range of sizes. The numbers between 10001 and 10009 tested the programs' ability to recognize small variations in size. These numbers were within the range of acceptable values for all five programs.

My test demanded that the programs fit a line to all possible pairs of variables. The numbers should generate perfect lines, but the sizes throw the packages a bit of a curve. The results were quite varied.

Only Stata and SAS PC handled all 10 cases without trouble. Both SPSS/PC+ and Minitab refused to handle the sensitive cases when the numbers 10001 through 10009 were the dependent variables. These packages said that the numbers were too close to a constant. SAS noted this problem, found an answer, and then warned of a potential error with a suggestion of how to fix the problem. Stata plowed through the numbers without a blink and did not warn of any potential instability. I felt more comfortable having SAS's warning message.

Systat, on the other hand, was bothered by the small numbers 10^{-8} through 9×10^{-8}. It refused to draw the line because the small numbers were too

Old-Fashioned Faxing Just Went Out The *Windows* !



Introducing BitFax™ for Windows®, the revolutionary new program that makes faxing a snap. With your PC's fax-modem and Microsoft Windows 3.0, **what you see is what you fax** - any graphic, any font, anything you create in any Windows application can be faxed out directly with no hard copy. Eight user-defined **QuickDial buttons** let you send a fax with a single point and click;other numbers may be stored in the comprehensive PhoneBook, using a **standard dBASE format** that is interchangeable with other applications including BitCom™ for Windows. Because BitFax for Windows takes advantage of the multi-tasking power of Windows, you can send and receive **faxes in background mode** while you keep working. Best of all, the power and flexibility of BitFax for Windows is available now for only **$79.00**; see your software dealer or call BIT Software today!

bit

BIT Software, Inc.
47987 Fremont Blvd.
Fremont, CA 94538
Phone (510) 490-2928
Fax (510) 490-9490

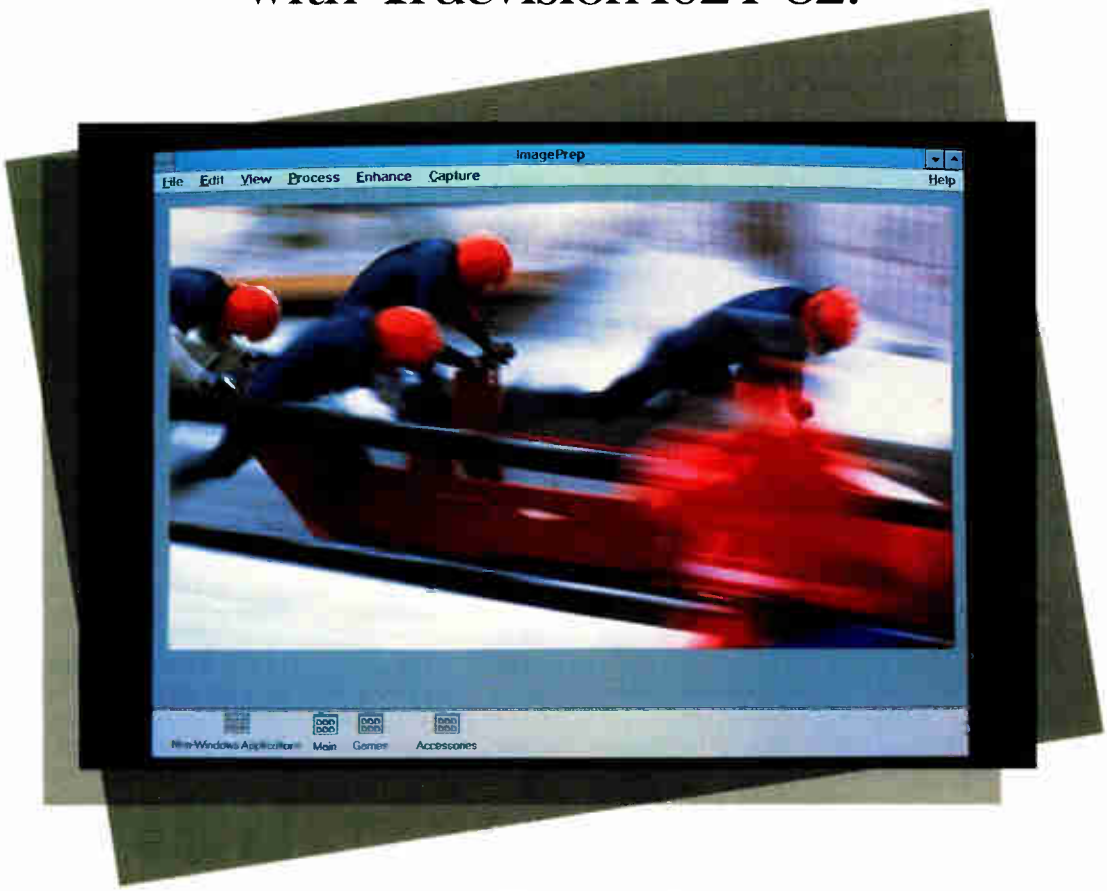
BitFax for Windows is compatible with fax-modems made by AST, Best Data, Cardinal, Digitan, Texas Instruments, Zoltrix, Zoom, and others; call for compatibility check.

Copyright 1991 by BIT Software. All product names used are trademarks or registered trademarks of their respective companies.

Circle 254 on Inquiry Card

World Radio History

Blast into faster color imaging in Windows® with Truevision 1024-32.™



Truevision 1024-32 Graphics Engine provides acceleration for graphics and imaging applications operating under Windows. This single-slot solution features 32 bits per pixel and resolutions up to 1024 x 768.

Truevision 1024-32 dramatically accelerates color imaging under Windows and lets you slide into your next operation without losing a creative stride.

Just pick it up and move it.

With Truevision 1024-32, screen refresh in high-res graphic applications is almost instantaneous. And you can zoom in (up to 8x) and pan around your entire image in real time. Want more? Truevision 1024-32 is also a bootable VGA card.

Are you ready for 32 bit graphics?

Truevision has been for six years. So when your future calls for 32 bits per pixel, you won't need hardware upgrades or a whole new accelerator. You're ready now.

What are you waiting for?

Truevision knows all about high-resolution graphic standards and the need for speed. The Truevision 1024-32 Graphics Engine satisfies both. Anything less, and you're just standing still.

TRUEVISION®

7340 Shadeland Station, Indianapolis, IN 46256
INTERNATIONAL: Canada 416/940-8727 France 33-1-3-952-6253 Italy 39-2-242-4551
U.K. 44-628-77-7800 West Germany 49-89-612-0010 Other international 617/229-6900

Call 800-858-TRUE
For more information

Circle 171 on Inquiry Card (RESELLERS: 172).

Windows is a registered trademark of Microsoft Corp.
ImagePrep is a registered trademark of Computer Presentations, Inc.

© 1991, Truevision, Inc.

World Radio History

close to 0.

When I experimented with exceptionally large numbers (e.g., 10^{129}) SPSS/PC+ crashed completely and I needed to restart the software. This could be a rude awakening if you are in the middle of a calculation that goes awry. SAS PC managed to fit a line to numbers with magnitudes such as 10^{100}, but occasionally it got the *y*-intercept wrong. Stata truncated their values.

The data set I used in this case is not especially complex or sophisticated, but it did reveal several important differences among the programs. Minitab, SPSS, and Systat each refused to do the problem and forced me to rescale the results. Note that I did not test the accuracy of the line fit, because this will vary from machine to machine and more specifically from math coprocessor to math coprocessor.

Mac-based analysts should be wary of using either Minitab or Systat with difficult numbers. Minitab failed to draw some of the lines, and Systat decided that many small numbers were 0. The PC users should be happiest with SAS, because it had no problems; Stata's performance, however, made it a viable alternative.

Presentation Power

The graphical presentation of data can be just as important as equation crunching. In many cases, you can spot important correlations when the data is graphed in the correct way.

Each package offers basic graphs, including scatter plots, that let you look at the relationships between two dimensions of data, bar charts, pie charts, and box charts. These graphs are handy ways to visually describe the mean and standard deviation of a set of data. Histograms and line drawings are also all standard with the reviewed packages. Each of the five packages can handle this basic set of graphs.

All the programs also let you combine these graphs in many different ways. You can overlay or juxtapose the basic graph primitives. Stata, SAS PC, and SPSS/PC+ will place a symbol at each point in a scatter plot and let you scale the symbol in relation to data. For example, Systat's graphics package will let you use several different variables to control the shape of the symbol. Thus, a big blob at the twelve o'clock position of the symbol would signify a big value of one variable, and the size of the protrusion at six o'clock might signify another symbol. Systat will also allow weather vanes to signify direction at a certain place.

Also important for data presentation are 3-D graphics, which show relationships among numerous variables. Neither Stata nor SPSS/PC+ offers this capability. SAS PC does a nice job in 3-D graphics, and it even lets you select the placement of the lighting source.

However, Systat reigns as the best package for 3-D graphics. You can create 3-D surface plots and scatter plots. The fun begins when you start mixing graphs together. One option lets you merge two surfaces. Another option lets you place the graph in a three-sided "box" with scale tick marks. Systat can draw 2-D plots on these walls to bundle even more information into the package.

SAS PC, Systat, and SPSS/PC+ can all create map plots. The packages come with outlines of the U.S. When you provide numerical data, the packages will fill the states with a pattern that corresponds to the values. SAS PC also provides a neat 3-D map option that extrudes the shape of the state based on the data. Thus, if you created a plot of earthquake danger, you would see California towering over the other states.

Overall, Systat is my choice as the best graphics package (see screen 1). Its plots are sophisticated, and the program offers many different format choices. Some of the dialog boxes might be a bit clearer, but even so, the boxes are still better than the rest.

For PCs, SAS PC provided the best graphics among the test programs. It even had some sophisticated options that Systat doesn't provide. Stata offers good 2-D graphics. SPSS/PC+ is the worst among the test packages. If you ask for a plot, you will get one generated by the program's old teletype interface. The mapping software is the only integrated graphics format in the program. For other types of graphics, you must use SPSS/PC+ with Harvard Graphics or Graph-in-the-Box.

User Interfaces

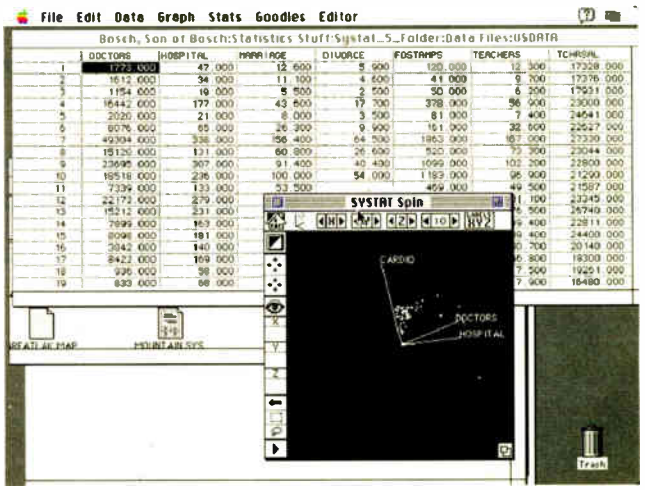
Some of the PC packages were developed before the rise of GUIs, and the remnants of old mainframe interfaces live on. This is good for anyone who doesn't want to learn a new command set. Unfortunately, this also means that some systems are more cumbersome than they need to be.

For example, SPSS/PC+'s GUI is merely OK. The top half of the screen contains a tree-like menu system with every possible command in the SPSS repertoire. At the bottom of the screen is a command window. When you select a command, the program types it for you at the cursor in the command window (see screen 2). Then you must use the function keys to drop into the command window and execute the command. Experienced users will want to avoid the menu system and the added effort of looking for the right command.

The advantage of this technique is that you slowly build up a program to run in the command window. If you need to run it again, the program is already constructed. However, I often needed to refer to the manual to make sure I was doing things correctly, because the menu will allow unparsable commands to be generated.

The SAS PC environment makes even fewer nods to the invention of the GUI (see screen 3). The interface provides three main windows: one for a program, one for commands that run programs, and the third for the data. However, this interface is not just a leftover from the mainframe days, it's a form of torture.

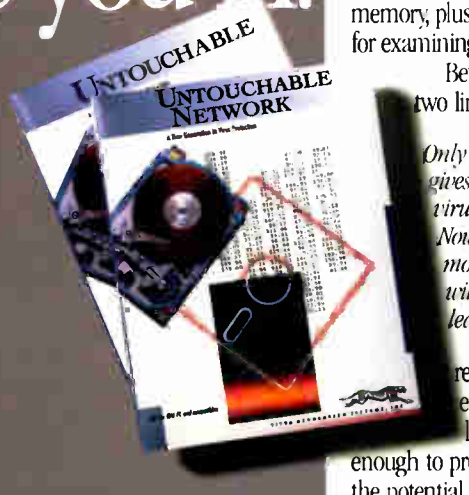
When I first tried to get the simple introductory example working, I failed repeatedly. If I made one mistake, I would get lost in a maze of errors. To make



Screen 1: *Using data contained in an easily edited spreadsheet format (background), Systat builds three-matrix scatter plots (foreground) and other sophisticated presentation formats.*

World Radio History

Paying again and again for virus protection is enough to make you ill.



Frankly, paying anything at all is pretty nauseating.

But that's nothing compared to the feeling you get in your stomach when a drive full of data goes down the drain.

So you pay.

Then you pay again. For upgrades. Or quarterly "updates."

But even that doesn't buy you much peace of mind. Because each new day brings an average of six new viruses into the world.

Which means all anti-virus programs are inherently obsolete.

Except one.

Introducing Untouchable.™ The only software in the world that gives you 100% protection.

Today.

And tomorrow.

Like other anti-virus software, Untouchable is equipped with a TSR monitor for patroling your system memory, plus a scanner/remover for examining the files on your disk.

Between them, these first two lines of defense can

Only Untouchable Network gives you centralized virus protection. Now you can install, monitor and control without having to leave your seat.

recognize and obliterate hundreds of the little buggers—enough to protect you from 95% of the potential carnage.

If you find that statistic reassuring, then you probably like the odds in Russian Roulette.

If you don't, you'll want to know that Untouchable is equipped with a unique *third* line of defense, which has been mathematically proven to be, well, untouchable.

Instead of looking for viruses, this third line of defense looks for *changes in your executable and system files.*

If the change is but a single byte, Untouchable will spot it and, using our patent-pending recovery technique, reconstruct the file to its original state.

The process is known as Generic Differential Detection, and certain other programs claim to perform it, too.

But only Untouchable calculates file signatures using not one, but two proprietary algorithms that can't be reverse-engineered.

Only Untouchable guarantees 100% safe recovery of infected files. (Unlike other programs that proudly generate corrupted files, Untouchable knows when the jig is up and doesn't attempt recovery.)

Only Untouchable can provide centralized network virus protection. In fact, Untouchable Network has enough virus alerts and reporting mechanisms to settle the stomach of even the most nervous Netware® administrator.

And only Untouchable is backed by our vaunted 24-hour toll-free technical support and a one-year money-back guarantee.

If you're worried about viruses—and you should be—don't reach for the Maalox.® Reach for the phone. Dial 1-800-926-4289 Ext. 77.

You'll feel better right away.

FIFTH GENERATION SYSTEMS, INC

Circle 310 on Inquiry Card.

World Radio History

matters worse, SAS PC erased my carefully typed lines, so I would need to retype them to try again. I only discovered that F9 was a magic recovery key after retyping the commands twice. I eventually got the hang of the program, and all these problems were technically my fault, but I think a better-designed interface would fix many of them.

SAS offers two solutions. One is called SAS/AF, which is another programming language that enables you to create menu-driven applications for SAS. It is a product for programmers who need to create easy-to-use interfaces for clerks and data-entry people. A program called SAS/Assist is a menu-driven alternative to running with the standard SAS interface, but it is not as flexible as basic SAS.

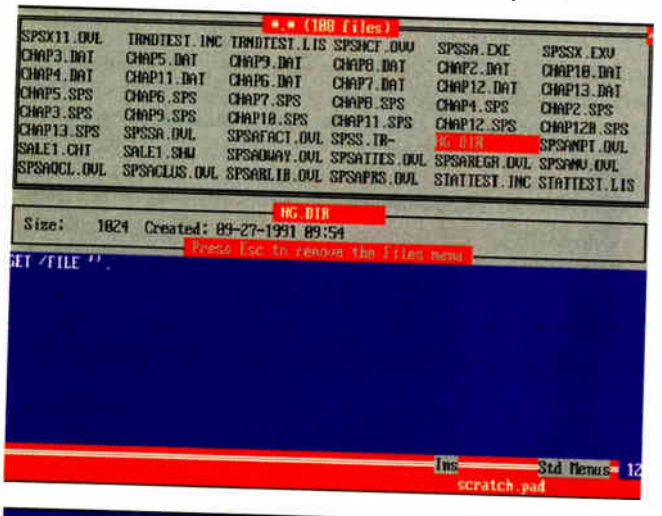
The other solution is the new SAS for Windows, which is scheduled to be released by the time you read this. The mathematical core of SAS is very solid, and Windows may provide it with a more competitive user interface.

Using the main Stata program is like using a teletype. This doesn't mean it is complex, however, and I had no problem using it. The command syntax is a bit unusual, but you'll be able to figure it out. For instance, you need to type `exit, clear` to leave the program instead of simply typing `exit`. The program also has a set of menus and dialog boxes that are similar to the Mac interface. You choose a command and fill out some box selections, and the program does everything immediately. There is no interplay between command window, menu, and program. This was an easier interface to use than SPSS/PC+'s or SAS PC's.

On the Mac side, both Systat and Minitab have menu and command windows that work symbiotically, but they differ greatly from their DOS cousins (see screen 4). Although Minitab and Systat are technically converting your mouse-clicks into typing in the command window, you need never move to the command window to execute an instruction. Often, you can ignore the window entirely if you want. Some of the more complex operations, such as file merging in Systat, can be accomplished only through the command window, but I had no problem doing real tasks without it. Many repetitive and complex tasks are better accomplished by creating a command file and executing it.

In addition, the menu trees have only two levels, so you don't feel like you are digging deeply for a particular command. When you select a graph or statistical operation, both Systat and Minitab open up a dialog box that lets you set the rest of the options. Systat's menus are graphically based, and although this may seem to be a cosmetic distinction, this menu design was easier to use and understand than Minitab's.

PC users who care about user interfaces should consider Stata, which, despite its idiosyncrasies, is much cleaner than SPSS/PC+ or SAS PC (see screen 5). However, if the user interface is one of the selection criteria you care most about, you should buy a Mac or wait for a Windows version. For the Mac, I liked Systat's interface better than Minitab's, but there was not a great difference.



Screen 2: *SPSS/PC+ executes analyses from tree-like menu commands, which are displayed at the bottom of the command window as you select them. Ultimately, this interface proved tedious.*

Screen 3: *Although SAS PC was the most sophisticated package overall, its command window will seem antiquated to many PC users.*

Manual Dexterity

The importance of the manuals varies from package to package. I started up Minitab and Systat on the Mac and generated statistics and plots without even consulting the manuals. The interfaces are good enough to make things easy. Only when I attempted some complicated tasks did I need to turn to the manuals. However, the three PC products are impossible to use for the first time without the manual next to the machine. The companies recognize this, fortunately, and offer nice hand-holding segments, like quick-start guides, at the beginning.

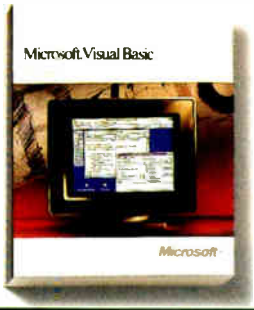
The manuals vary widely in writing style. Parts of the SAS manuals seem aimed at Ph.D.s, while Stata's manual is chatty. Both Systat's and Minitab's are straightforward and simple. SPSS's manuals spell out every detail.

The range of information about statistical analysis also varies among the manuals. Large parts of Minitab's manual cannot be understood by statistics novices. The SPSS and Systat manuals do a better job of providing solid introductions to the subject. SPSS's time-series manual, for instance, offers 13 case studies showing how statistical methods can be applied to analyzing data.

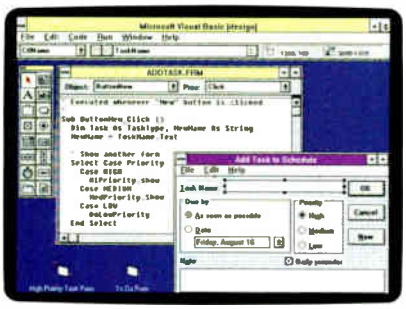
Most of the manuals were good, but I truly enjoyed reading some of SPSS's because of their completeness, including plenty of case histories. So, when using a PC, I would choose SPSS's manuals. For the Mac user, it's a toss-up, but Systat's are generally better than Minitab's.

continued

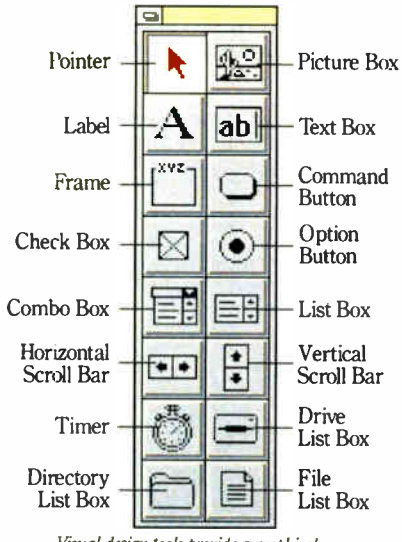
World Radio History



MICROSOFT SOFTWARE DEVELOPMENT TOOLS



Graphical forms and a robust programming language combine to create powerful Windows-based applications.



Visual design tools provide a graphical way to create graphical applications.

A powerful Windows system that lets you develop powerful Windows apps.

With the Microsoft® Visual Basic™ programming system, you can have it both ways.

Start with a robust, structured language, one of the fastest compilers around, and an interactive source-level debugger. All tightly integrated in a programming system that's extensible via direct calls to the Windows™ API or other dynamic-link libraries (DLLs), and even new types of controls.

Of course, all that power can be put to good use.

Namely, remarkably powerful applications. Any app you create can have a graphical interface that includes multiple windows, drag and drop, and all standard Windows controls. Not to mention dynamic data exchange (DDE) for interoperability with other Windows applications.

The result? You can produce any kind of Windows application—each one a compiled, distributable .EXE file.

So call us at (800) 541-1261, Dept. V68. We'll be glad to tell you more about the system that has it all.

© 1991 Microsoft Corporation. All rights reserved. Printed in the U.S.A. For more information inside the 50 United States, call (800) 541-1261, Dept. V68. Customers in Canada, call (800) 563-9048. Outside the U.S. and Canada, call (206) 936-8661. Microsoft and the Microsoft logo are registered trademarks and Windows and Visual Basic are trademarks of Microsoft Corporation.

PROGRAMMER'S CHOICE

Key Features

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

THE INTERACT GROUP BEST SPRING 1991 BYTE

WINNER

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

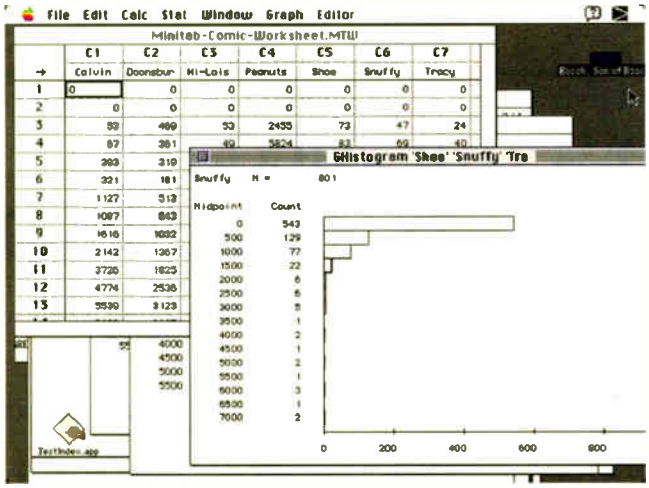
Microsoft

World Radio History

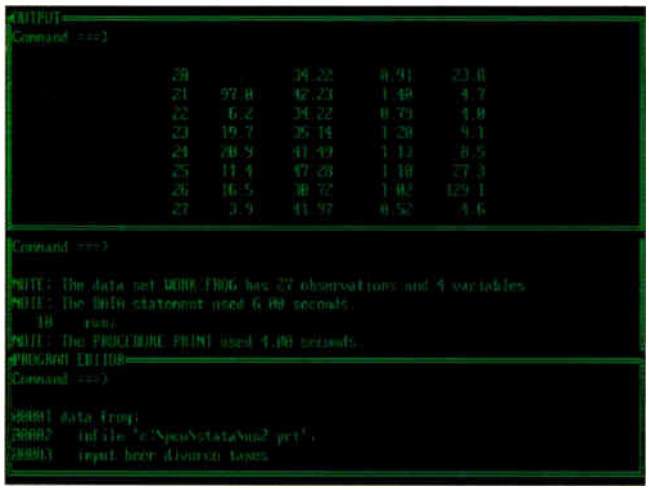
What to Choose

In the end, there are many different reasons for buying data-analysis packages, so any recommendations about which of these five to buy depend on your applications. If you are Mac-based, your work involves moderate-size jobs, and you are mainly concerned with producing graphs and seeing how well a model matches the data, I recommend Systat. The Macintosh version is quite sophisticated and user-friendly. The Minitab software also uses the Macintosh user-interface paradigm well, but the program does not have as large a range of graphics as Systat. Stata is certainly a solid choice: Its user interface is simple, and the statistical core is solid.

continued



Screen 4: *Although Minitab faithfully adheres to the style of the Macintosh environment, the program's graphing abilities fall short of those of other data-analysis packages.*



Screen 5: *To build charts and graphs within Stata, you simply enter commands into input boxes at the bottom of the screen, and then the program does everything immediately.*

Whenever you want to process graphics or texts, "ARTEC" scanner products will help you to reach your goal.

ARTEC

We also support "FAScinator" image processing software & "FAScinator OCR" OCR software. The FAScinator is a highly inclusive image processing software, provides an unlimited mult-window working enviroment. It supports not only a variety of display modes from B/W up to 16.7 million true colors. But also contains a powerful drawing & painting capability including numberless text fonts. Also it provides many file formats compatible with most popular packages such as colorix, pc paintbrush, ventura publisher and so on.

The "FAScinator OCR", a professional OCR software package, makes text files of all image file that you scanned through a scanner. That will be useful without retyping.

For desk top publishing presentation work or Advertisements, you will benefit from using the "ARTEC" A400Z, A256C & A4000C SCANNER.

✱ The "SCAN KIT PPD" option for notebook PC use scanner.

ULTIMA ELECTRONICS CORP.

MAIN OFFICE
9F, NO 18, ALLEY 1, LANE 768, SEC 4, PA TE ROAD, TAIPEI, TAIWAN, R O C
TEL (02) 788-5470 (REP) FAX (886-2) 788-5657 • 788-5655

USA BRANCH
1156 ASTER AVENVE, SUITE A SUNNYVALE CA 94087 U S A
TEL (408) 246-9208 FAX (408) 246-9207

SPAIN:
TWC COMPUTER S A
C/PORTUGALETE, 8 BAJOS 08014 BARCELONA SPAIN
TEL 4312000 FAX 4227849

DENMARK:
UNIPRO SCANDINAVIA BIRKEMOSEVEJ 32, 8361 HASSELAGER, DENMARK
TEL 4586286366 FAX 4586286870

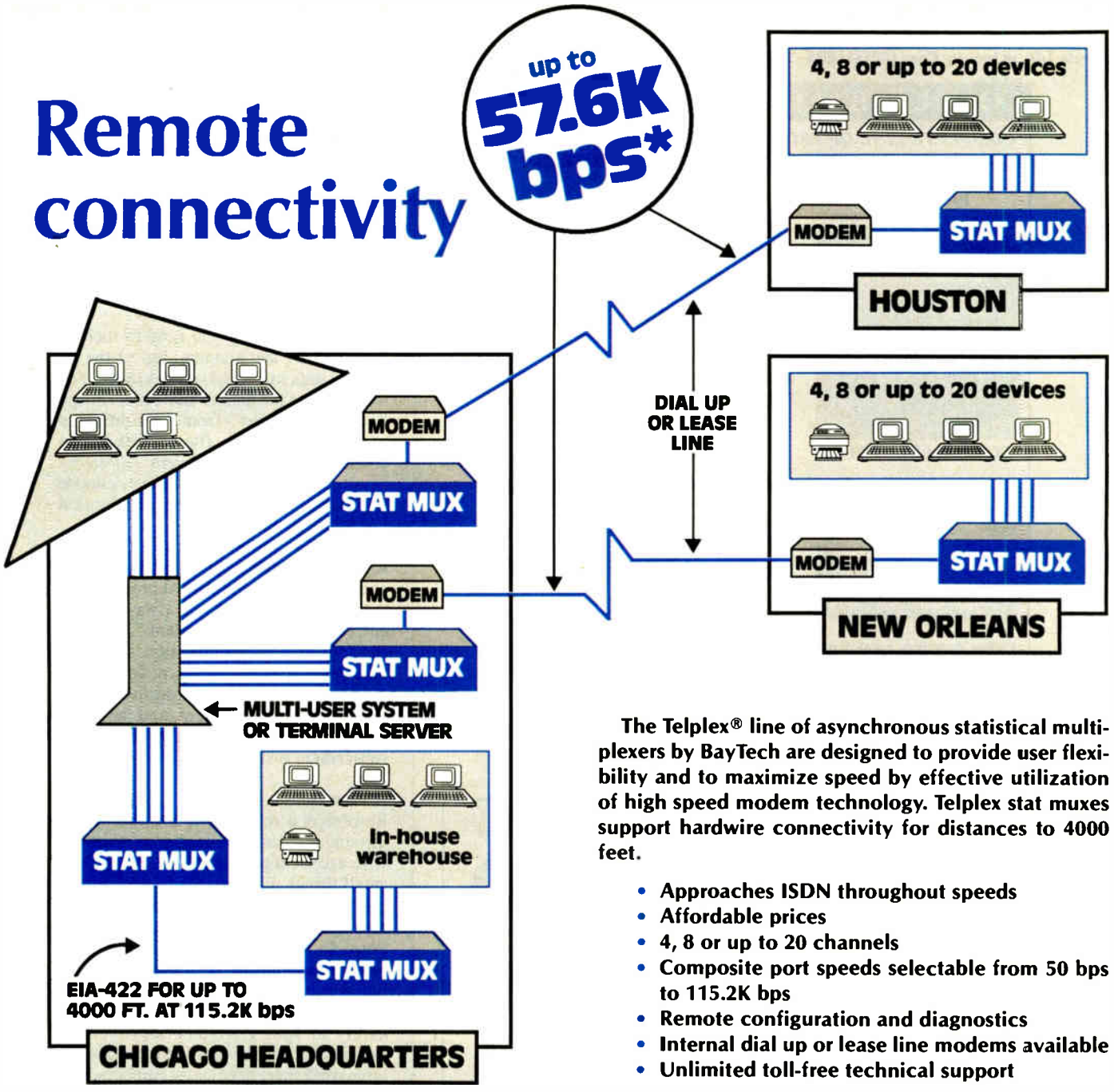
HOLLAND:
SOECOMA COMPUTERS NED BV REKVELDEN 46 5503 NZ
VELDHOVEN THE NETHERLAND TEL 31-40-533515 FAX 31-40-544535

OEM WELCOME!

Circle 174 on Inquiry Card.

World Radio History

Remote connectivity



for multi-user systems.

The Telplex® line of asynchronous statistical multiplexers by BayTech are designed to provide user flexibility and to maximize speed by effective utilization of high speed modem technology. Telplex stat muxes support hardwire connectivity for distances to 4000 feet.

- Approaches ISDN throughout speeds
- Affordable prices
- 4, 8 or up to 20 channels
- Composite port speeds selectable from 50 bps to 115.2K bps
- Remote configuration and diagnostics
- Internal dial up or lease line modems available
- Unlimited toll-free technical support

BayTech gives you 15 years of data communications experience. Call now for affordable, high performance multiplexers, modems, peripheral sharing, and data acquisition/control devices.

Because Resources Should Be Shared

BayTech

Data Communications Products Division
200 N. 2nd St., P.O. Box 387, Bay Saint Louis, MS 39520
Fax: 601-467-4551 Phone: 601-467-8231 or toll-free

800-523-2702

INTERNATIONAL DISTRIBUTORS

Australia
Shuttle Computer Systems
(03) 596 8888

Belgium
Multiway Data Belgium
03-666-3854

Denmark
Trend Communications Ltd.
53 65 23 45

Finland
Genime Oy Impdata
(921) 547200

France
Gradco France
(1) 42 94 99 69

Germany
Munich
AMS Computech GmbH
(089) 126806-0

Düsseldorf
Multiway Data Germany
0211-251875

Italy
Torino
BRM Italiana
(011) 771.00.10

Milano
I.T.D.
(02) 655.9807

Netherlands
Multiway Data Netherlands
079-424 111

Norway
A/S Kjell-Bakke
47-2-830220

Singapore
Mark Systems (FE) Pte., Ltd.
65-2261877

Spain
Vidmar Control
(93) 2454803

Sweden
Solna
Maldata Teknik AB
(08) 7301439

Sollentuna
Beon Data
08-626 92 26

Switzerland
Sengstag Computers AG
0041.1.950.54.44

United Kingdom
Leicester & London
A-Line Dataspeed Devices Ltd.
(0533) 477989

Buckinghamshire
Trend Communications Ltd.
(06285) 30611

All product or company names are trademarks of their respective holders.
*Over dial up line using a V.32bis/V.42bis modem.

Circle 308 on Inquiry Card (RESELLERS: 309).

World Radio History

is accomplished using *editions*, which are documents stored on disk that contain both shared data and lists of subscribers. Changes made in a published document generate changes in its editions; the Edition Manager updates subscribers using Apple events, the high-level IAC architecture built into System 7.0.

For example, say you need to include in your company's annual report the financial data in a Resolve worksheet. You would select the data to share and choose "Create Publisher" from the Edit menu to create an Edition file on disk. Then you'd switch to your System 7.0–savvy word processor, load the report, choose "Subscribe To," and select the Edition file to complete the link.

From then on, any changes in the Resolve worksheet will be transparently communicated to your word processor so that the annual report will always display current data. Using System 7.0's file sharing, this communication can even take place between different Macs on a network. The Publish/Subscribe mechanism is nearly transparent, and the speed with which changes ripple through to the subscribers is surprising.

A Few Rough Edges

Resolve is a robust program, but a few missing interface elements mar an otherwise excellent package. They range from small things, like the lack of auto-scrolling when moving charts and the lack of a progress indicator for lengthy operations, to more serious deficiencies. The most disappointing of these are a one-line formula bar, which makes building complex formulas difficult, and the inability to split a window into multiple panes, which makes adding formulas to a large worksheet needlessly cumbersome. I'd also like to see an auto-sum feature, similar to Excel's, in a future release.

There's little doubt that Resolve has the right stuff to go head-to-head with Excel in the business market. Its few shortcomings are interface issues that can be easily addressed, and its core spreadsheet and scripting technology will set the standard for some time to come. Perhaps most important, Resolve provides System 7.0's IAC capabilities today and demonstrates how powerful—and simple—these features can be. ■

Christopher R. Gibson is president of Cloud Ten, a Macintosh software development firm in San Luis Obispo, California. Chris is a moderator of the BIX Macintosh exchange. He has also taught spreadsheet classes since 1989. You can contact him on BIX as "chris.gibson."

Circle 144 on Inquiry Card (RESELLERS: 145).

COMPUTER SECURITY PRODUCTS

COMPLETE LINE OF PROVEN AND EASY TO INSTALL COMPUTER SECURITY PRODUCTS FOR COMPUTERS.

PREVENT COMPUTER THEFT!

ACCESS SECURITY

Kablit™ Security System

This system allows you to secure all your computer components: CPU, monitor, keyboard, printer. ***Internal component security***: Kablit fasteners secure the rear panel of CPU protecting internal boards and hard drives. Fasteners available for all applications. Prices **$34.95** to **$49.95** depending on system.

Disk Drive Lock™

Prevent anyone from copying your data. Protect your data from harmful viruses. Prevent unauthorized use of your drive. Installs easily and quickly. Models available for 3 1/2" and 5 1/4" drives. List price **$24.95.**

Order your free catalog of these and many other security products.
Purchase orders accepted. Quantity pricing available. Shipping not included. MC/VISA accepted. Dealer inquiries invited.

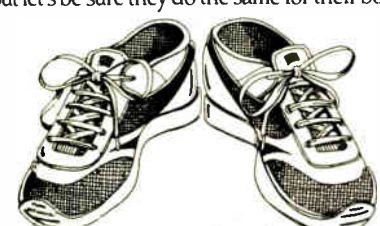
Secure-It, Inc.
18 Maple Court
East Longmeadow, MA 01028
1-800-451-7592

Fitness is Feeling GREAT!

Let's Be Sure Our Children Grow Up Smart And Fit.

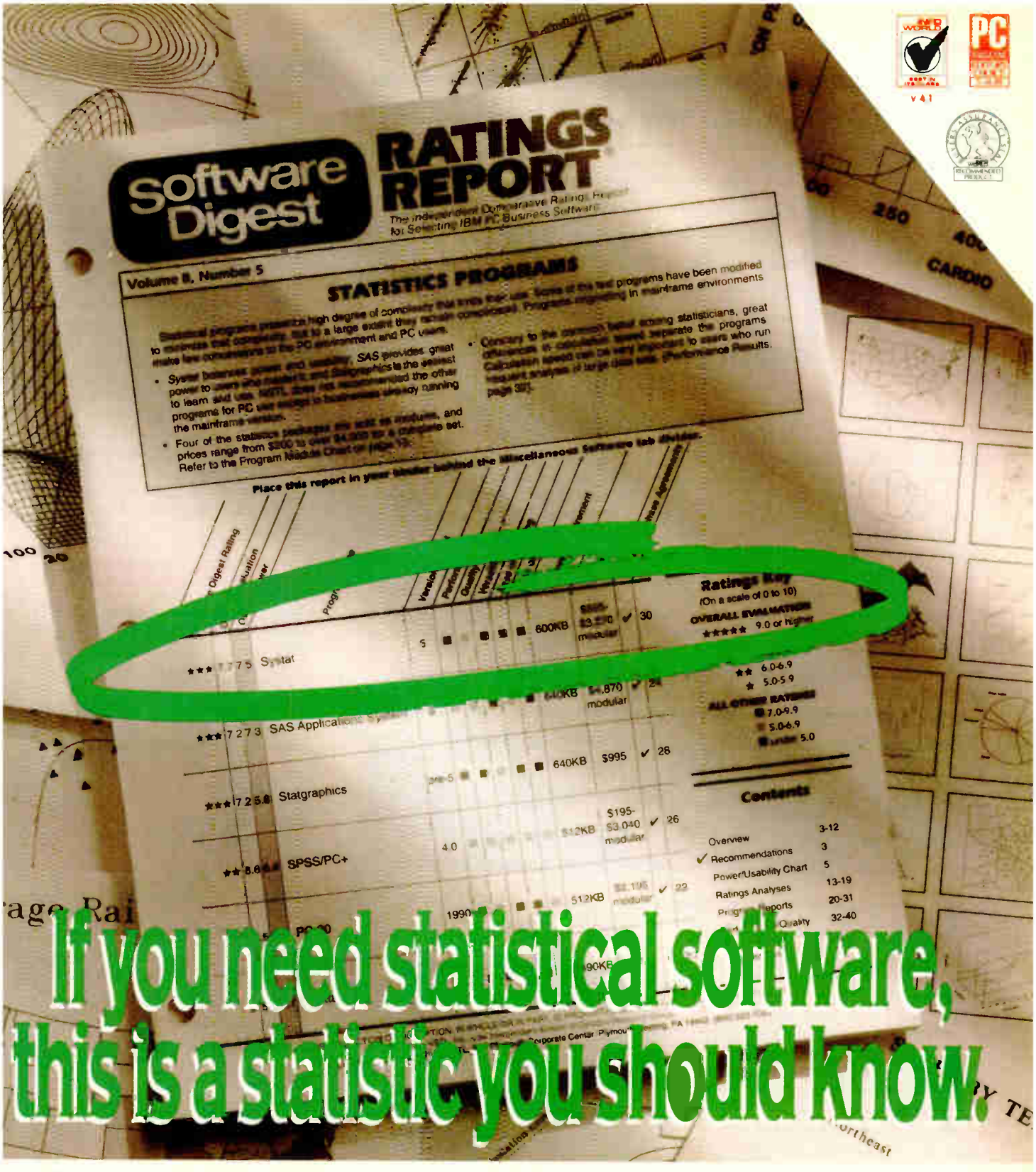
We know our children won't get very far in the world without a good, working knowledge of the "3 R's." That's why school is such an important part of their lives. But there's another part of their education that's just as important to their future — physical education.

The healthy hearts they develop now will go a long way toward helping them grow into healthy adults. And the good fitness habits they learn can stay with them for a lifetime. So let's encourage our children to exercise their minds. But let's be sure they do the same for their bodies.



The President's Council on Physical Fitness and Sports

World Radio History



SYSTAT is rated #1 by Software Digest®. In fact, SYSTAT is the only statistical analysis package to receive top honors from InfoWorld, PC Magazine and PC Week. According to Software Digest: "It is the only program that successfully blends robust features, good usability and performance, and many areas of uncommon strength from analytical graphs to powerful programming."

SYSTAT. The statistics speak for themselves.

For more information call or write: SYSTAT, Inc. 1800 Sherman Avenue, Evanston, IL 60201-3793 Tel. 708.864.5670 Fax: 708.492.3567

SYSTAT®

For international representatives call: Australia 61.3.8661766, Canada 416.424.1700, Denmark 45.64.406575, Finland 358.0.6923800. France 33.1.40935000, Germany 49.61.265950 (DOS), 49.30.310423 (Mac), Italy 39.587.213640, Japan 81.33.5902311, New Zealand 64.71.562675, Norway 47.3.892240, Sweden 46.7.6076207, Switzerland 41.31.416611, The Netherlands 31.340.266336, UK London 44.81.6926636.

©1991 SYSTAT, Inc. Software Digest is a registered trademark of NSTL, Inc.

For IBM/compatible information circle 163; for Macintosh information, circle 164; for Reseller inquiries, circle 165 on Inquiry Card.

World Radio History

Make Your Best Work Look Its Best!

Name	*Definition*
Gamma	$\Gamma(z) = \int_0^\infty t^{z-1}e^{-t}\,dt$
Sine	$\sin(x) = \frac{1}{2i}(e^{ix} - e^{-ix})$
Zeta	$\zeta(s) = \sum_{k=1}^{\infty} k^{-s} \quad (\Re s > 1)$

PCTEX
Typesetting Software

For professional publishing and the power to produce high-quality technical documents, scientific notation, mathematical formulas, and tables, rely on PCTEX to make your work look its best. The next step beyond standard desktop publishing, PCTEX is the difference between average and expert. You'll get professional typesetting at amateur prices. And with our **new PC TEX Systems**, you get everything you need, with no extra costs.

The **PC TEX System for Laser Printers** includes:

- PC TEX and PC TEX/386, Version 3.1
- Our screen previewer and laser printer drivers
- AMS-TEX and LATEX Macro Packages
- Free Technical Support

PERSONAL TEX INC

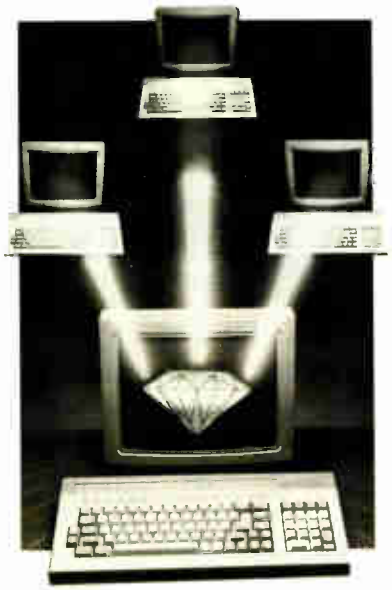
For a free catalog and demo disk, call 415/388-8853. See the best for yourself!
Personal TEX, Inc. • 12 Madrona Ave. • Mill Valley, CA • Fax: 415/388-8865

FacetTerm
UNIX Windowing For Character Terminals & PCs

Increase productivity by giving users simultaneous access to multiple UNIX applications on a character terminal or PC.

FacetTerm™ Features

- Multiple, concurrent UNIX sessions for each user.
- Hot key between word processing, DBMS, office applications, 3270 emulation, and any other UNIX application.
- Screen print.
- Cut & paste between applications.
- Pull down menu interface.
- Full or split screen display.



TRY IT! Full featured evaluation for 30 days. Only $50 + shipping and handling.

Structured Software Solutions, Inc.

214 / 985-9901
4031 W. Plano Parkway Suite 205 Plano, TX 75093 Fax 214/612-2035

Circle 219 on Inquiry Card.

AMPLE WAVES OF DATA

SAS PC and SPSS/PC+ are good choices for people who already know the respective languages or who are considering implementing a large data management system. Both packages offer data-entry front ends that allow statistics novices, such as store clerks, to enter information without regard to what the statistics experts may do with the data later. These packages also offer a wide range of specialized statistics capabilities that you can purchase as options. For its overall sophistication, I give SAS PC the nod for PC-based analyses. ■

Peter Wayner is a consulting editor for BYTE. He is also working toward a Ph.D. in computer science at Cornell University. You can contact him on BIX as "pwayner."

COMPANY INFORMATION

Computing Resource Center
(Stata)
1640 Fifth St.
Santa Monica, CA 90401
(800) 782-8272
(310) 393-9893
fax: (310) 393-7551
Circle 1228 on Inquiry Card.

Minitab, Inc.
(Minitab 8.0)
3081 Enterprise Dr.
State College, PA 16801
(800) 448-3555
fax: (814) 238-4383
Circle 1229 on Inquiry Card.

SAS Institute, Inc.
(SAS PC)
SAS Campus Dr.
Cary, NC 27513
(919) 677-8000
fax: (919) 677-8123
Circle 1230 on Inquiry Card.

SPSS, Inc.
(SPSS/PC+ 4.0)
444 North Michigan Ave.
Chicago, IL 60611
(312) 329-3300
fax: (312) 329-3668
Circle 1231 on Inquiry Card.

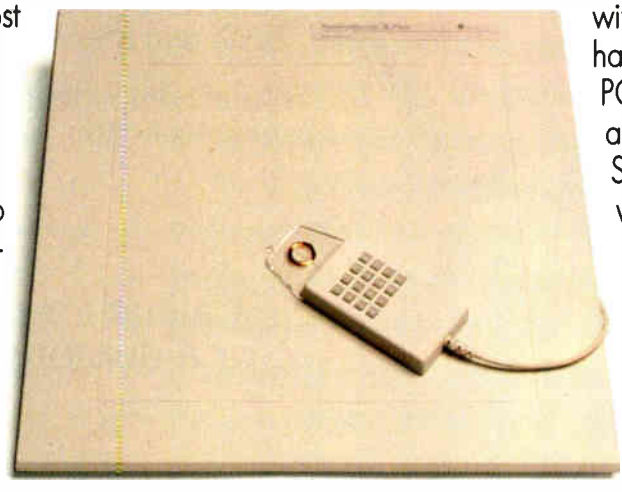
Systat
(Systat 5.1)
1800 Sherman Ave.
Evanston, IL 60201
(708) 864-5670
fax: (708) 492-3567
Circle 1232 on Inquiry Card.

World Radio History

While Our Competitors Are Diligently Trying To Emulate The SummaSketch® II...

We Proudly Announce SummaSketch II Plus.

The world's best selling, most emulated, most acclaimed desktop tablet just got better. We've taken SummaSketch II, the industry standard, and added several new features to create a tablet that is, unquestionably, the world's best.



Unlike some competitors, we put everything in the box—4-button cursor *and* 2-button stylus (or 16-button cursor), interface cables and a utilities diskette with Windows® 3.0 and ADI® drivers. Plus we've added things like 2000 lines per inch resolution and 10 mil accuracy—standard. Plus the fastest, easiest set-up and configuration procedure. Plus an offer for a free AutoCAD® or CADKEY® Master Template (a $245 value). Plus software compatibility with over 400 programs, and hardware compatibility with PCs and Macintosh.® Best of all, it's still 100% pure SummaSketch—the editor's choice, winner of every major editorial accolade for graphics tablets. And the people's choice, with well over one-half million sold to demanding computer graphics professionals.

Every decision should be this easy. In fact, the only tough decision is which Plus to choose: 12" x 12" or 18" x 12" Professional. For literature, or the name of your local dealer, call 1-800-729-7866. For technical information call 203-881-5400.

PC MAGAZINE EDITORS' CHOICE November 26 1989 SummaSketch II

PC WEEK CORPORATE TOP RATED SATISFACTION POLL

CADENCE BEST OF 1990

C 1990

Summagraphics®

Every decision should be this easy.™

© 1991 Summagraphics Corporation. Seymour, CT 06483. All rights reserved.

Circle 160 on Inquiry Card.

World Radio History

Developers:
Lock Up Your Profits

Windows 3.0
Support Available

We have the key for protecting your software profits and your copyright.

Software piracy's a crime! What it can do to a developer's profit margin is shameful. The cost of development and marketing products demands you receive the revenue you are entitled to.
We have the solution.

- Custom hardware and software for each developer
- Encrypted interrogation routines and debug disablers. Over 140 language interfaces available.
- Available active read/write memory and on-board microprocessor provide the ultimate protection
- Keys for PC "compatibles," Macintosh, UNIX and RS-232C standard
- Total compatibility, reliability and end user satisfaction

MEMBER
Software Publishers Association

We have the key.
Call us for more information or a demonstration package.

1-800-843-0413

MICROPHAR

In EUROPE:
MICROPHAR, 122 Ave. Ch. De Gaulle 92200.
Neuilly-Sur-Seine, **FRANCE,** Tel: 33-1-47-38-21-21 Fax: 33-1-46-24-76-91

For Distributors in:
- ***BELGIUM,** E2S (091 21 11 17)
- ***GERMANY, AUSTRIA:** Microphar Gmbh (06223 - 73730)
- ***HUNGARY,** Polyware Kft (76-22-307)
- ***ITALY,** Siosistemi (030 24 21 074)
- ***POLAND,** Microphar Poland (32 586 848)
- ***PORTUGAL,** HCR (1 56 18 65)
- ***SCANDINAVIA,** Microphar Nordic (45 53 51 70 33)
- ***SPAIN,** Microphar España (032 37 31 05)
- ***SWITZERLAND,** SAFE (024 21 53 86)
- ***THE NETHERLANDS,** Infotic (015 15 88 37)
- ***UNITED KINGDOM,** Clearsoft (091 378 91 91)

PROTECH MARKETING, INC

9600-J Southern Pine Blvd.
Charlotte, NC 28217
Tel: 704-523-9500 FAX: 704-523-7651
Hours: Mon-Thurs: 8:30-7:00, Fri: 8:30-5:30 ET
Open late to better serve our west coast clients.
Se Habla Español

For Europe, circle 133 on Inquiry Card.

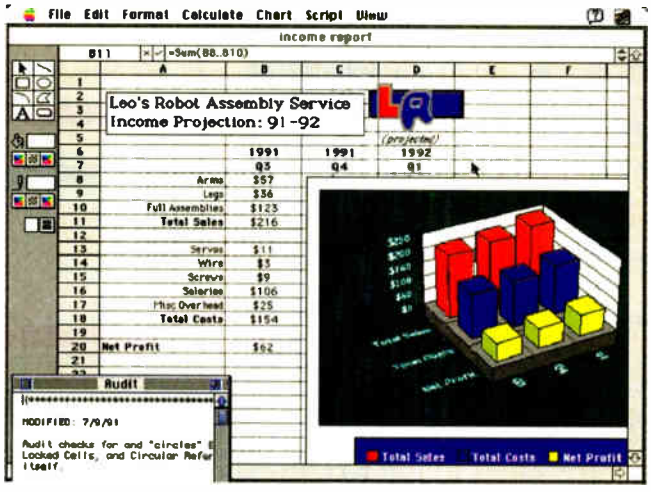
For Americas & Pacific, circle 134 on Inquiry Card.

World Radio History

APPLICATION

Claris Enters the Spreadsheet Wars

CHRISTOPHER R. GIBSON



In Resolve, chart (the 3-D bar graph), text (the title block), and graphics objects (the logo) are independent entities that share the display space with the worksheet grid.

The battle for the hearts and minds of Macintosh business users has heated up again with the release of Resolve 1.0, Claris's System 7.0-savvy spreadsheet. Based on technology from Informix Software (the maker of Wingz), Resolve boasts the same impressive performance, graphics, and scripting that made Wingz such a big hit.

Claris has sweetened the pot by adding a smooth interface and support for the Interapplication Communication (IAC) functions of Apple's System 7.0. Resolve's array of capabilities aims this $399 spreadsheet squarely at both Microsoft Excel—the primary force in the Macintosh spreadsheet market—and the up-and-coming Lotus 1-2-3 for the Mac.

Friendly Front End

The professional Claris design is evident even before you launch Resolve for the first time. The reference materials are thorough and well designed. They include a user's guide, a functions and scripts reference, and a getting-started guide with clear installation instructions and an effective half-hour tutorial.

Installation is made quick and easy by the familiar Installer, the same utility that comes with Apple's system software. Resolve is not small—the application alone weighs in at almost 1 MB, and complete installation requires 5 MB of disk space. Claris has eased the situation by allowing Resolve to share files (e.g., dictionaries) with other Claris products. While Claris claims that only 1 MB of memory is required to run Resolve under System 6.x, plan on 4 MB of RAM to run comfortably under System 7.0.

The distinctive Claris look is obvious with Resolve. Each document window is split into two basic elements: the *palette panel*, which includes drawing-tool palettes similar to Claris's MacDraw II, and the *worksheet grid*, which contains the cells and formula bar common to most spreadsheets. When you're not using Resolve's graphics tools, the palette panel can be hidden with a click of the mouse.

Operating Resolve is intuitive for anyone who is familiar with spreadsheets. In the worksheet grid, you type data and formulas into cells. Virtually everything other than cell data is treated as a resizable, movable "object" that sits over the worksheet grid (see the photo). Objects include graphics figures (e.g., circles and polygons), text objects to hold large blocks of text (including scroll bars if required), and buttons that can be linked to scripts. To create a graphic, you just select the tool you wish to use and start drawing right on the worksheet grid.

Resolve's powerful, if somewhat inflexible, charting abilities are also easily accessible: You select the data to graph, and Resolve creates one of 25 charts as an object on the worksheet. As in Wingz, text, graphics, and chart objects exist on a layer above the worksheet cells, leaving the data underneath untouched.

Behind the Interface

The graphics power of Resolve is so impressive that it's easy to overlook the power of the underlying spreadsheet engine. Resolve's manual lists a full suite of 147 business, statistical, mathematical, and text functions. The package even has functions for matrix math (including solving simultaneous equations)

BYTE ACTION SUMMARY

- **WHAT CLARIS RESOLVE 1.0 IS**
  Claris Resolve is a full-featured spreadsheet for the Macintosh.
- **LIKES**
  Every major spreadsheet feature—graphics, scripting, and fast calculation—are very well implemented. Resolve makes good use of System 7.0's IAC capability. Finally, Resolve caps these features with a clean, intuitive interface.
- **DISLIKES**
  Some convenience features—most notably split windows and a multiple-line formula bar—are missing from the interface.
- **RECOMMENDATIONS**
  Resolve's solid features and excellent performance make it a good choice for those considering a new Macintosh spreadsheet.
- **PRICE**
  $399
- **FOR MORE INFORMATION**
  Claris Corp.
  5201 Patrick Henry Dr.
  P.O. Box 58168
  Santa Clara, CA 95052
  (408) 987-7000
  fax: (408) 987-7440
  Circle 1106 on Inquiry Card.

World Radio History

Circle 311 on Inquiry Card (RESELLERS: 312).

TEMPRA™

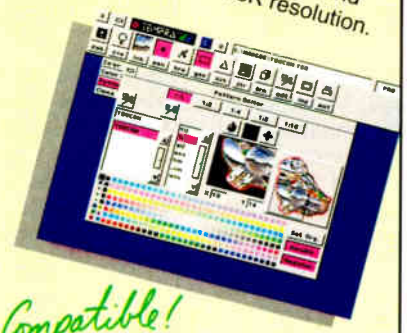
The ultimate personal imaging tool!

Powerful!

Up to 16.7 million colors.

Productive!

Over 275 painting options to create, scan, edit, and print original art and photographs, up to 8Kx8K resolution.



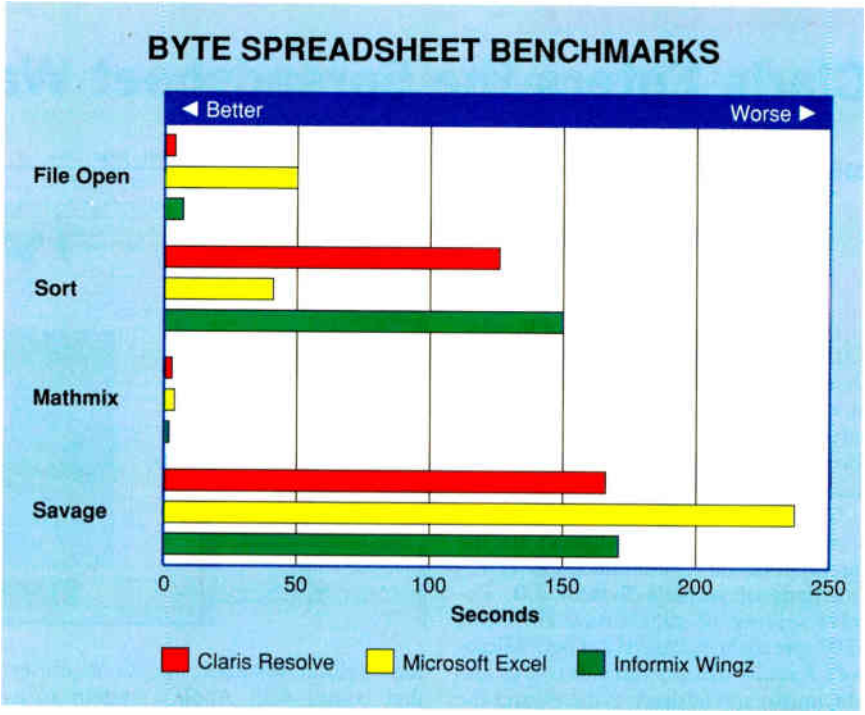
Compatible!

DOS application that runs under Windows, with .GIF, .TIF, .WIN, .TGA, .PCX, and .AVC file formats.

Easy to use!

TEMPRA PRO v1.02 $495
TEMPRA GIF v1.02 $149
TEMPRA Primer Demo $15.95*
*Shipping/Handling included
1-800-852-MATH (6284)

mathematica
INCORPORATED
402 S. Kentucky Ave., Suite 210
Lakeland, FL 33801
Phone: 813-682-1128
Fax: 813-686-5969



Notes: File Open is the time it takes to open a 1.2-MB file. BYTE's Sort benchmark is a timed sort of several thousand records. Mathmix is a test that indicates relative integer performance. The Savage benchmark is a measure of floating-point performance. For a full description of these tests, see "Not Just for Numbers Anymore," February 1990 BYTE.

All benchmarks were run under System 7.0 on a Mac IIsi with no FPU, 5-MB RAM partitions for the application, and the minimum system RAM cache of 16 KB.

and frequency distributions. Resolve also provides database facilities similar to those in Excel, where a portion of the spreadsheet can be defined as a database, and various database functions allow you to search, manipulate, and extract values as you would with any database.

If there's a function you need that Resolve doesn't have, you can roll your own using Resolve's scripting language. But Resolve Script, which resembles HyperCard's HyperTalk, goes far beyond user-defined functions. Resolve Script not only lets you record and store repetitive actions, but it also allows you to manipulate almost every facet of the Resolve interface, including menus and dialog boxes. Scripts can be stored separately, or they can be attached to objects in a worksheet. Scripted event handlers can fire off actions at specific times, such as when a worksheet is opened, closed, or recalculated. With all these features, Resolve Script is powerful and flexible enough to allow you to develop spreadsheet-based applications within Resolve.

The performance of Resolve's spreadsheet engine naturally rivals Wingz's for best in its class. Using the BYTE spreadsheet benchmarks for comparison, Resolve easily bested Excel on most common operations; it showed times similar to those of Wingz (see the figure). Resolve clocked in with recalculations at least 30 percent faster than Excel's on the math-oriented Savage and Mathmix tests, but Resolve's speed isn't limited to number crunching. Opening and saving large spreadsheets in Resolve is refreshingly speedy. Even the largest spreadsheets—which took Excel almost a minute to open—were open and ready to run in less than 5 seconds with Resolve. Unfortunately, Lotus 1-2-3 for the Macintosh wasn't available at this writing, so I was unable to make performance comparisons between Resolve and 1-2-3.

Resolve's one performance weakness is its slow database sorts. On BYTE's Sort benchmark, Excel outdid Resolve by a factor of 3 to 1. Claris says it put most of its effort into optimizing common spreadsheet operations for this first release, and it is working on more performance optimizations for the future.

System 7.0 Savvy

Resolve is fully System 7.0 savvy and makes excellent use of the advanced IAC features available under System 7.0's Edition Manager (commonly known as Publish/Subscribe). The Edition Manager allows a program running under System 7.0 to publish certain areas of a document and then lets other programs subscribe to these published items. This

World Radio History

NEED A NETWORK? HERE ARE 10 REASONS WHY YOU NEED PC-MOS.™

1. PC-MOS is the world's leading DOS-compatible multiuser operating system. Over 150,000 users take advantage of PC-MOS's support of low-cost dumb terminals or graphics workstations attached to a host PC.

2. PC-MOS takes advantage of the latest PC technology to save you big bucks. For a cost less than that of a network of cheap 286 clones, your users can share the benefits of today's 386- and 486-based hardware. Your investment is in current, not obsolete, technology.

3. PC-MOS works with networks. The Software Link offers the PC-MOS Gateway to Novell's NetWare for easy integration of shared processing work-groups into NetWare LANs. Or you may choose to use our LAN, LANLink 5X, to connect your PC-MOS systems.

4. PC-MOS gives users the advanced operating system features they need. Multitasking, print spooling, memory management, disk caching, security and enhanced batch file language capabilities are just a few of the advanced features of PC-MOS.

5. PC-MOS reduces your hardware maintenance costs. PC-MOS typically requires less administration than a LAN or Unix system. And because it connects dumb terminals or workstations rather than fully-configured PC's, maintenance costs are minimized.

6. PC-MOS protects your investment in DOS. Because PC-MOS is DOS-compatible, most of your current DOS-based applications can be used in the PC-MOS environment, eliminating costs of new software and training.

7. PC-MOS flexibility lets your system grow with you. As your needs change, you can add remote or local users or workgroups, integrate local area networking, and add minicomputers and mainframe computers.

8. PC-MOS is ideal for shared database applications. Because the computer's bus provides faster communication than LAN connections, activities that require heavy disk access perform better with PC-MOS.

9. PC-MOS is easy to use for application development. Programmers familiar with DOS can easily learn how to make the most of PC-MOS's intertask communication, data sharing and other features.

10. The Software Link is a company you can depend on. The creator of PC-MOS has been a leader in the development of award-winning systems-level software since 1983.

The Software Link

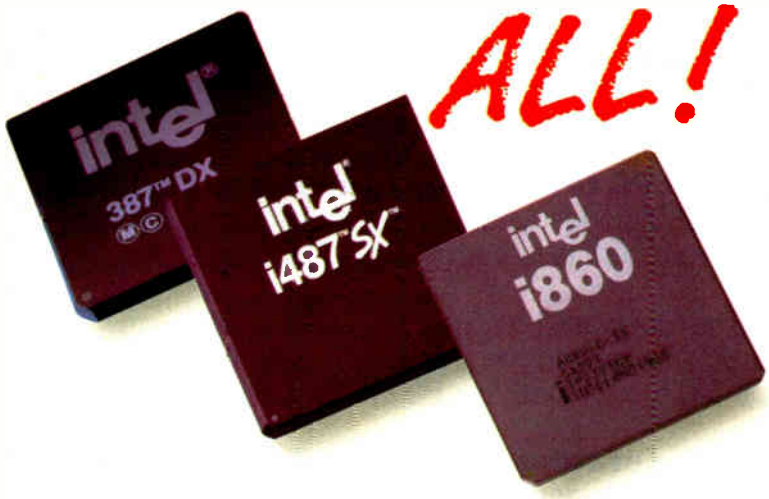
3577 Parkway Lane Norcross, Georgia 30092 **1-800-766-LINK** (404) 448-5465 FAX (404) 263-6474

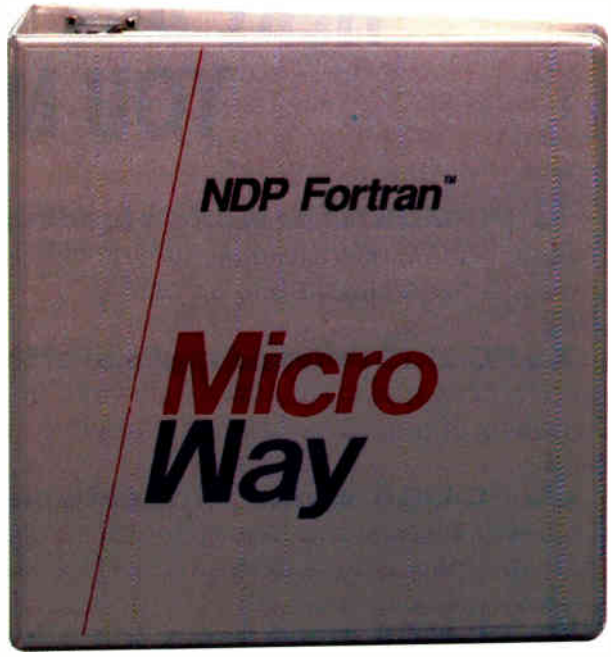
Products referenced are trademarks of their respective companies.
Prices, policies and specifications are subject to change without notice.

Circle 149 on Inquiry Card (RESELLERS: 150).

World Radio History

Only ONE Fortran Drives Them ALL!



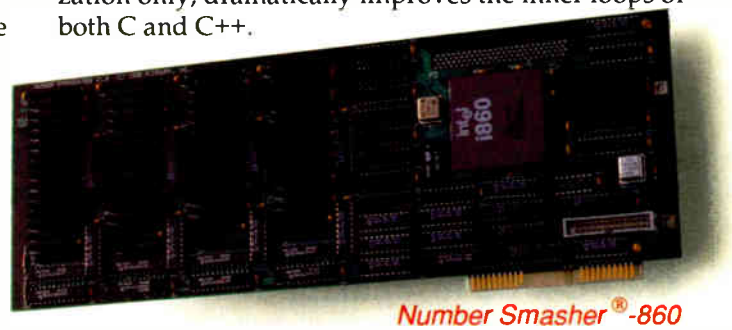


NDP Fortran delivers mainframe performance driving the Intel 387™, 487™SX or i860™.

Since 1982, Microway has provided numeric coprocessor support for scientists and engineers. This support has reached a pinnacle with NDP Fortran, the only PC Fortran available which efficiently drives all Intel advanced coprocessors, plus the i860 RISC, single chip Super Computer.

Whether you are running DOS, UNIX, DESQview, Windows, XENIX, or SunOS, there is a version of NDP Fortran which will give you globally optimized access to the four gigabyte address space of the 386, 486 or i860. Code produced for their 32-bit flat model accesses large data structures and arrays a factor of four faster than 16-bit products which depend on the huge model or EMS memory.

Because Microway's NDP compilers use a common back end for Fortran, Pascal, C and C++, you can access code generation features from NDP Fortran that until recently were thought to benefit C users only. For example, the inlining of small procedures, which is the hottest optimization in both C and C++, was not considered to benefit Fortran users. However, inlining works for all modular code. When inlining was applied to the Whetstone running on our Number Smasher-860, the benchmark jumped from 28.6 to 68.5 MegaWhetstones! Similarly, loop unrolling, which has the reputation for being a mainframe Fortran optimization only, dramatically improves the inner loops of both C and C++.



Number Smasher®-860

NDP Fortran is a full ANSI 77 that is 99% compatible with VMS Fortran and has extensions from BSD, DOD and Microsoft. The DOS version includes the GREX™ library of 88 graphics primitives and I/O functions that give it a BASIC-like flavor.

Finally, every Microway product comes with the best technical support in the industry. Call 508-746-7341 for your free copy of the *Journal of Numeric Data Processing* to see how we used inlining to speed up the Whetstone, and loop unrolling to speed up Livermore Loops.

i860, 387, 487SX and Intel are trademarks of Intel Corp.
Microway and Number Smasher are registered trademarks of Microway, Inc.

Microway®

The World Leader in PC Numerics

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

World Radio History

SOFTWARE

DOS Extenders: Raising the Ceiling

MIKE BLASZCZAK

DOS developers have long struggled with the limitations of the PC environment. Strapped in by the backward compatibility of DOS, developers could only look longingly at the advanced features of the 286, 386, and 486 processors. DOS, running in real mode, demotes all these to the rough equivalent of the 8086. How can you develop memory-intensive programs without sacrificing DOS or relying on workarounds such as overlays?

The solution is DOS extenders. Simply stated, these allow you to create DOS programs that run in the protected mode of Intel's more advanced processors. Many vendors offer DOS-extender packages, which vary in their scope and features. The BYTE Lab staff selected four packages for comparison: Rational's DOS/16M and DOS/4G packages, Intel's 386/486 C Code Builder Kit, Symantec's Zortech C++, and Phar Lap's 286|DOS- and 386|DOS-Extender Software Development Kits (SDKs).

Protected Mode

The 286, 386, and 486 processors all support a protected mode of operation. However, the Intel 286 chips are somewhat limited compared to the 386 and 486 chips. For example, the 286 can access only 16 MB of memory, while the 386 and 486 can virtualize their address space to manage 4 gigabytes of memory.

As a result, extenders for the 286 are significantly different from those for the 386. Some vendors, such as Phar Lap and Rational, offer separate packages for each processor type. And while Symantec's Zortech C++ compiler supports 286 and 386 systems, Intel's C Code Builder Kit generates only DOS-extended 386 and 486 code. While it is possible to run 286 DOS-extended applications on 386 and 486 processors, the converse is not true; the 286 can't support the expanded functionality of its more powerful counterparts.

Compilers and Assemblers

Two of the packages in this group aren't merely DOS extenders but complete development systems, compiler and all. Symantec's Zortech C++ is the most elaborate, since it implements version 2.0 of AT&T's specification for C++. It is capable of generating code that is compatible with Microsoft Windows (without requiring the Windows SDK) as well as with OS/2 and DOS. The Symantec package includes royalty-free 286 and 386 extenders but is also kind enough to support code generation for 286 extenders from Phar Lap and Rational.

Intel's compiler accepts only C, but it is designed to be somewhat compatible with the Microsoft C Compiler. Since many incompatibilities exist between the Intel and Microsoft compilers, the Intel manuals contain sections that explain the differences between the compilers. Most notably, the Intel compiler does not support mixed-language programming keywords.

Unfortunately, the Intel compiler does not support the `_asm` keyword for in-line assembly language. While some simpler assembly language operations can be emulated by special functions provided in the C Code Builder Kit run-time library, many users of in-line assembly language will have to invest in a compatible assembler. Zortech C++ and the Rational development kit both lack assemblers.

Phar Lap's 286|DOS- and 386|DOS-Extenders include assemblers capable of producing protected-mode code. These packages are roughly compatible with the Microsoft Macro Assembler and should present no problem for programmers with MASM experience.

The 386 extenders from Phar Lap and Rational are compatible only with 32-bit compilers (e.g., those from Watcom and MetaWare). Rational's DOS/16M package is compatible with a broader range of compilers but is very difficult to install. Installation instructions are spread throughout the manual, and you must manually copy the files to the hard drive. Phar Lap's 286|DOS-Extender supports an equally impressive list of compilers and includes an installation program that makes it easier to install.

Virtual Memory Management

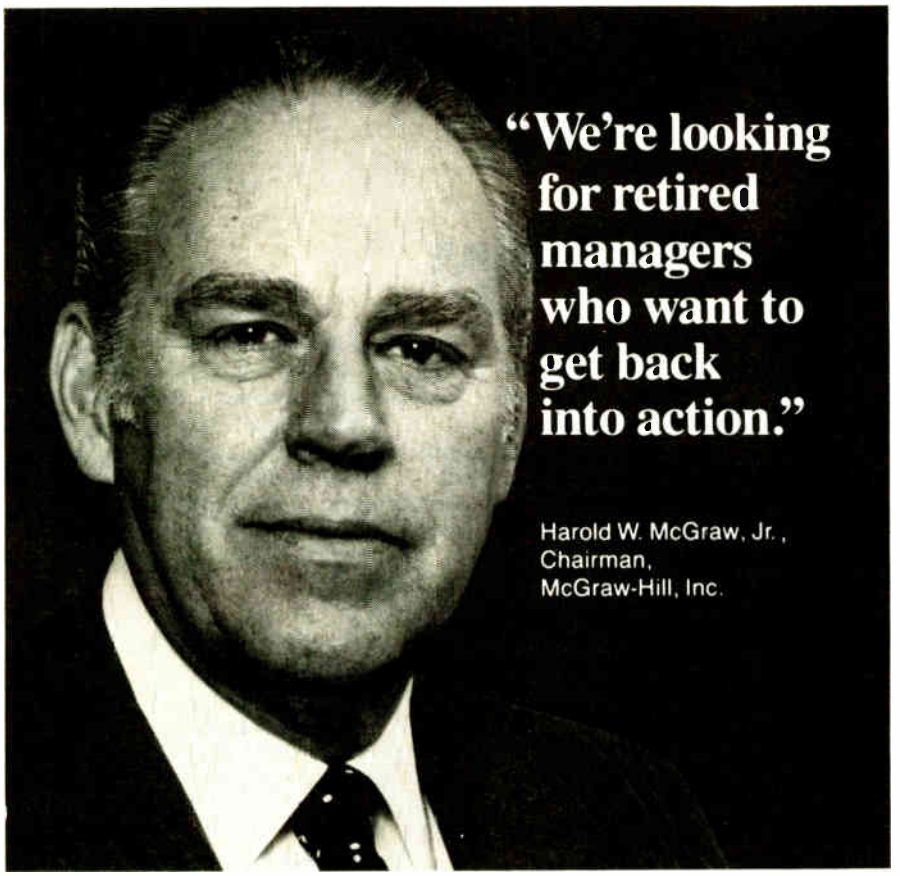
Intel's C Code Builder Kit and Rational's DOS/4G package provide virtual memory managers that use disk space to simulate a larger address space than might be physically available. DOS/4G has a stronger VMM that you can configure at run time. Intel's VMM can only be configured at compile time. Neither vendor gives many hints or rules for optimizing the performance of their VMMs.

The Zortech compiler's 386 extender and Phar Lap's 386|DOS-Extender SDK do not support virtual memory. As a result, programs developed with these tools are limited to the physical memory

BYTE ACTION SUMMARY

- **WHAT DOS EXTENDERS ARE**
  Tools for developing DOS applications that run in the protected mode of advanced Intel processors.
- **LIKES**
  Intel and Symantec offer complete development environments, compiler and all; Rational's documentation and tools for both 286 and 386 development are excellent; Phar Lap's 286|DOS-Extender includes an assembler and can create DLLs.
- **DISLIKES**
  Symantec's DOS-extender documentation is weak; Rational and Phar Lap both charge royalties; Intel's compiler documentation assumes familiarity with Microsoft C.
- **RECOMMENDATIONS**
  For developers who need to create DOS, extended DOS, Windows, and OS/2 programs, Symantec's package is the most versatile; Phar Lap's 286|DOS-Extender excels, while Rational's 386 product is the best choice in its class.
- **PRICE**
  Zortech C++, $699.95
  Phar Lap 286|DOS- and 386|DOS-Extender SDKs, $495 each
  Intel 386/486 C Code Builder Kit, $695
  Rational DOS/16M and DOS/4G, $5000 each

World Radio History



I'm a volunteer supporter of the International Executive Service Corps, a not-for-profit organization with a vital mission:

We send retired U.S. managers overseas to help businesses in developing countries, which often respond by increasing their imports of U.S. goods. In fact, developing countries consume about 40 percent of U.S. exports.

As an IESC volunteer, you would not get a salary. But you would get expenses for you and your spouse, plus a world of personal satisfaction.

IESC leads the field in this kind of work. We've done over 9,000 projects in 81 countries. We could have a project that's just right for you. To find out, send this coupon to: Harold W. McGraw, Chairman, McGraw-Hill, Inc., P.O. Box 10005, Stamford, CT 06904-2005.

International Executive Service Corps

It's not just doing good. It's doing good business.

Ad Council
A Public Service of This Publication

Dear Mr. McGraw: Tell me more about becoming an IESC volunteer. I am a recently retired manager or technician—or am about to retire—from a U.S. company. I'm free to accept an overseas assignment. I understand that volunteers receive expenses for themselves and their spouses, but no salary.

Name _____

Address _____

City _____ State _____ Zip _____

M2

I felt at home with the debugger included in the Intel C Code Builder Kit.

available at run time. Phar Lap, however, offers virtual memory management for its 386|DOS package as an extra-cost option.

Linking, Binding, and Royalties

Any executable file generated by these packages is dependent on the functionality of the extender's run-time software. To make running the application convenient, most of the packages let you bind the extender run-time software into the executable file. This results in a much larger executable file but also lets you launch the application more easily. The Symantec, Intel, and Rational products all include bind utilities (although Rational calls it *splicing*), while Phar Lap's utility must be purchased separately.

Rational's Instant-D debugger and Phar Lap's debuggers support the debugging of executable files that are not yet bound, saving the step of binding an executable file before testing it. Intel's debugger accepts only bound executable files.

Phar Lap's 286|DOS-Extender supports the creation of dynamic link libraries, which are executable files that also provide information about the code and data names stored in the EXE file. This lets other executable images make references to functions or data structures in the module without knowing the address of the reference until run time. Rational's extender supports DLLs with an optional segmented executable toolkit, while Intel and Symantec do not offer DLL support for protected-mode DOS programs.

Since the run-time software is most of the DOS extender, vendors traditionally charge royalties for the inclusion of their extenders in your applications. Symantec and Intel, however, let you distribute unlimited copies of your DOS-extended application without additional royalties or fees. Both Phar Lap and Rational require the payment of royalties, and they have

World Radio History

How the world sees you in Pseudo-Color

How the world sees you in Real-Color

Now you can afford to project a better image.

The portrait on the left reflects a pseudo-color LCD projection.

The portrait on the right reflects a real-color In Focus 1600LC LCD projection.

The difference in color is startling. The difference in price is just a few hundred dollars.

Which is almost nothing when you consider the impact the In Focus 1600LC creates in presentations.

Featuring the 16 most commonly used colors, the new In-Focus 1600LC gives your audience a dazzling view of real color charts, graphs, rainbows and sunsets. With a resolution of 640 x 480.

In seconds, the 1600LC can be set on top of any ordinary overhead projector and connected to any color Macintosh or IBM compatible. It's that easy.

And the 1600LC is just one of a complete line of In Focus LCD projection panels ranging from monochrome to 5000 colors with nearly photographic quality.

For more information or to arrange for a free demonstration, call 1-800-327-7231 or in Oregon, 503-692-4968.

And get the image you deserve.

The new In Focus 1600LC LCD projection panel.

InFocus SYSTEMS

© 1991 IN FOCUS SYSTEMS INC. 7770 SW Mohawk Street, Tualatin, Oregon 97062. 1-800-327-7231. In Oregon, 503-692-4968. Fax: 503-692-4476. In Focus, the In Focus logo and the In Focus 1600LC are registered trademarks of In Focus Systems, Inc. All other trademarks or registered trademarks are the property of their respective holders

In Europe: Planetenweg 91, 2132HL Hoofddorp, The Netherlands Fax: 31-(0)-2503-24388

Circle 73 on Inquiry Card.

World Radio History

several payment plans based on the number of copies distributed and the selling price of the application.

Debuggers

With the exception of Phar Lap's 286|DOS-Extender, all the products tested here include debuggers. Zortech C++ includes debuggers for Windows, DOS, and OS/2, but it does not let you debug programs generated for its 286 extender. Strangely enough, 386 protected-mode debugging *is* supported.

The 286|DOS-Extender relies on Microsoft's protected-mode CodeView debugger, which is included with the Microsoft C Compiler package. If you have chosen to use the 286|DOS-Extender with a compiler other than Microsoft's, you are left to your own resources to locate an appropriate debugger, although you can purchase the 286|Debug package separately.

The 386|Debug tools in the 386|DOS package have rich features for protected-mode debugging. Among these are several system-level debugging aids, such as commands to show information about the interrupt handler, the status of extended memory, and the local descriptor table and global descriptor table blocks in the processor, and commands to manipulate the DOS Protected Mode Interface. The major flaw of the product is that it does not support source-level debugging. For an additional cost, 286|SRCbug and 386|SRCbug are available to provide source-level debugging.

Being an experienced CodeView user, I felt most at home with the debugger included in the Intel 386/486 C Code Builder Kit. While not as robust as CodeView or the debuggers of any of the other packages reviewed here, it did allow source-level debugging.

I found Instant-D, the debugger included with the Rational products, to be the most powerful of the packages reviewed. It includes an optimization profiler that you can use for performance tuning. The screen shows a display of the current stack frame, which is extremely handy, and it also lets you conveniently step up and down the call chain. To aid system-level debugging, Instant-D includes many commands for checking up on the state of the machine, just as Phar Lap's 386|Debug tool does.

Documentation

Documentation for the Rational products was the most convenient to use; it is housed in three-ring loose-leaf binders and is well written and easy to understand. While the documentation for the Phar Lap tools is split into several volumes, each is littered with useful code fragments.

Intel's package has sparse documentation. The volumes comprehensively detail the differences between the Intel and Microsoft compilers but don't provide good overviews of the compiler or the run-time library for users who aren't accustomed to Microsoft's product. While many rich examples are included on disk, not much documentation accompanies them; you're largely on your own in figuring out how the examples work.

The 286 and 386 extenders in Zortech C++ receive only minimal treatment. A chapter in the reference manuals briefly outlines the functionality and limitations of each extender. Absolutely no treatment is given to the special problems that using an extender creates (e.g., accessing memory-mapped system I/O areas or handling interrupts with protected-mode code).

Overall

Developers who don't already have a compiler and need a general-purpose development environment would probably be best off with Zortech C++. Since this package includes a feature-rich compiler, it can offer something to fit almost every conceivable need, from DOS programming (with or without an extender) to Windows and OS/2 development. Because it supports C++, programmers who prefer an object-oriented environment will also favor it, and C programmers can grow into the object-oriented extensions over time. However, if you're just looking for an extender, you'll be poorly served by this package. 386 developers won't miss the lack of a 286 protected-mode debugger, but the lack of extensive documentation for the extenders thwarts serious efforts.

Intel's package is set back because it doesn't include an assembler, but it was the easiest to install and set up. The compiler readily accepted much of my existing Microsoft C code with only a few changes; it would therefore appeal to those who already have a big investment in Microsoft C code.

Since Phar Lap's 286|DOS-Extender also supports Microsoft C, users who need an assembler might want to pick it over Intel's package. Its more complete documentation is a strong asset, and support for DLLs is a big plus for projects that are code-intensive. Remember, however, that you will have to spend extra for the source-level debugger.

Phar Lap's 386|DOS-Extender SDK is comparable to the DOS/16M extender from Rational. However, because of its support for both Microsoft C and the popular Borland C++, the Phar Lap 286|DOS-Extender SDK is an ideal choice for those who already use these compilers. Its bigger 386-compatible brother, on the other hand, is only usable with one compiler and could call for a great deal of porting work. Assembly language coders will appreciate Phar Lap's assemblers, but Phar Lap's debugger pales in comparison to Rational's elaborate Instant-D.

I thought that Rational's DOS/16M extender had the best documentation of all the packages reviewed here. Documentation provided with the company's DOS/4G package suffered a little, probably because the package is new. The DOS/16M extender supports an impressive list of compilers, but, like Phar Lap's products, the 386 extender supports only two 32-bit compilers. ■

Mike Blaszczak is a senior systems engineer at Linc Systems, a consulting and education firm in Bloomfield, Connecticut. You can contact him on BIX as "blaszczak."

COMPANY INFORMATION

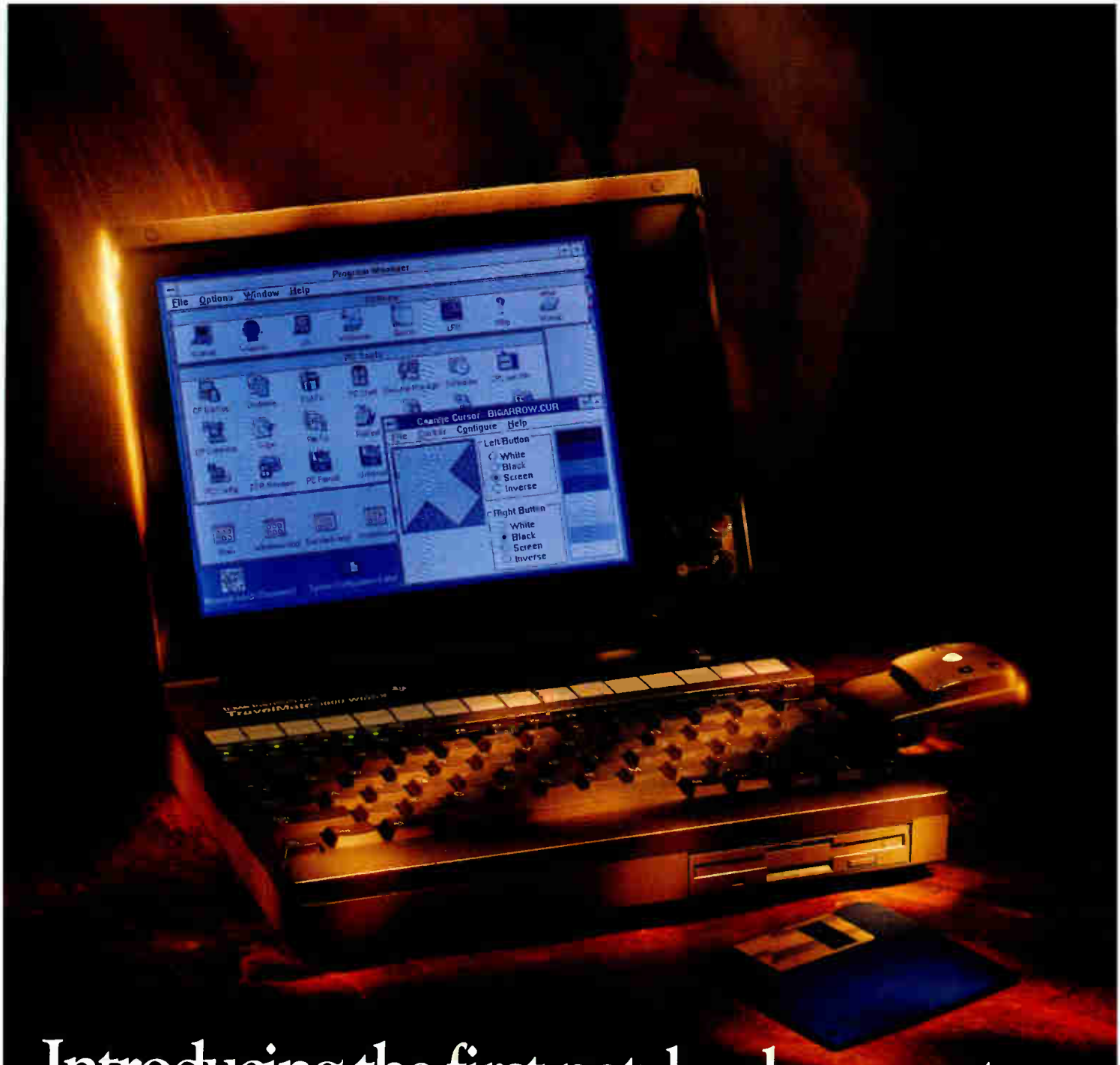
Intel Corp.
(386/486 C Code Builder Kit)
5200 Northeast Elam Young Pkwy.
Hillsborough, OR 97124
(800) 548-4725
Circle 976 on Inquiry Card.

Phar Lap Software, Inc.
(286|DOS- and 386|DOS-Extender SDKs)
60 Aberdeen Ave.
Cambridge, MA 02138
(617) 661-1510
fax: (617) 876-2972
Circle 977 on Inquiry Card.

Rational Systems, Inc.
(DOS/16M, DOS/4G)
220 North Main St.
Natick, MA 01760
(508) 653-6006
fax: (508) 655-2753
Circle 978 on Inquiry Card.

Symantec Corp.
(Zortech C++)
10201 Torre Ave.
Cupertino, CA 95014
(408) 253-9600
fax: (408) 253-4092
Circle 979 on Inquiry Card.

World Radio History



Introducing the first notebook computer designed to make Windows™ a breeze.

Just turn it on and go. It's that simple. The new TI TravelMate™ 3000 WinSX™ package is engineered to meet the challenges of running Windows on a notebook computer. That's why it comes with MS-Windows® 3.0 and MS-DOS® 5.0 already installed on the 60MB hard drive. So within seconds, you're into Windows and ready to load your application software.

But the TM3000 WinSX offers so much more. Like clicking in and out of applications with a specially designed pointing device. An extra-large, easy-to-see cursor that keeps your place as you move from screen to screen.

And Battery Pro™. Designed to extend battery life when working in Windows, it suspends functions you're not using while keeping calendars and other background programs current. So you can pick up where you left off.

Best of all, these Windows features, and more yet, come in the industry's smallest, thinnest and lightest 386SX™ 20 MHz notebook computer.

Finding out more is a breeze, too. For the name of a dealer near you, call 1-800-527-3500.

TEXAS INSTRUMENTS

MS-Windows and MS-DOS are registered trademarks and Windows is a trademark of Microsoft Corporation. TravelMate, WinSX and Battery Pro are trademarks of Texas Instruments Incorporated. 386SX is a trademark of the Intel Corporation.

© 1991 TI 71853

Circle 168 on Inquiry Card.

World Radio History

The Notepad 386SX

THE ULTIMATE BUSINESS TOOL

The Notepad 386SX is the first notebook computer in a notebook. It is a leather computer that is rigidly affixed to a custom leather notebook/portfolio and can be removed in seconds. The Notepad comes standard with a built-in send and receive Fax/Modem, 20 Mhz 386SX, 2Mb Ram, Page White VGA Display, Internal 3 1/2" Floppy and 40 MB Hard Drives all in a 1.5" thick computer.

The Notepad 386SX combines leading edge technology with genuine leather for an aesthetically appealing and elegantly functional business tool. The Notepad 386SX's open face style, coupled with its sleek design, represents a uniquely different alternative to almost all other notebook computers available today.

Call for Further Information
or your Nearest Dealer

1-800-443-3446

Lighthorse Technologies, Inc. 4105 Tolowa St. San Diego, CA 92117

1-800-443-3446
Fax 619-483-1196

Circle 217 on Inquiry Card (RESELLERS: 218).

World Radio History

HARDWARE

The Phaser III Fires Dazzling Colors

TOM THOMPSON

Tektronix's new Phaser III PXi is a standout color printer for a number of reasons. First, the machine uses an advanced ink-jet technology, called *phase change*, that lets you print on plain paper or other media in a wide variety of sizes and thicknesses. Second, print samples from the Phaser III's 300-dot-per-inch output will really catch your eye: The colors almost crackle and glow (thanks in part to the printer's support for Adobe's PostScript Level 2). Finally, the Phaser III's price of $9995 nearly sparkles, too, considering the unit's versatility and output quality.

The new Phaser III color printer from Tektronix. **Inset:** *A close-up view of the color reservoir and its keyed slots that accept the shaped solid ink blocks.*

Meet the Phaser

The printer weighs a hefty 90 pounds and measures 25 inches wide by 27 inches deep by 13½ inches high. Plan on giving it its own table.

Inside, the Phaser III runs an AMD 29000 RISC processor clocked at 24 MHz. The processor powers the PostScript Level 2 interpreter and the Pantone-certified color simulations, and it implements a Hewlett-Packard Graphics Language (HPGL) emulation mode. The Phaser III comes with 10 MB of RAM, upgradable to 18 MB. Its ROMs contain 39 typefaces, including Courier, Helvetica, Times, New Century Schoolbook, and ITC Bookman.

The source of this printer's brilliant color graphics, however, is the phase-change ink-jet technology used to deposit the colors on a variety of paper types that can range from thin tissue to heavy paper stock. This technology uses special, nontoxic, solid inks. These wax-based inks come as sticks that resemble large crayons. Their shapes are keyed, so you can't, for example, accidentally install magenta ink into the yellow color reservoir (see the photo).

Inside the reservoir, heaters liquefy the ink at a temperature of 140 °C. When the Phaser III begins printing, the print head travels back and forth, spraying colored ink droplets onto the paper at 300 dpi. At room temperature, these droplets instantly solidify. Two rollers then cold-pressure-fuse the inks over the paper's surface. (For more information on this process, see "Ink Jet Takes Off," October 1991 BYTE.)

Connections and Other Features

On the outside, the Phaser III sports the usual bevy of I/O ports and indicators. There's a mini-DIN-8 LocalTalk port (whose driver, unfortunately, supports only AppleTalk Phase 1), a DB-25 serial port, a Centronics-style parallel port, and a 50-pin Centronics-style SCSI port. This latter port handles SCSI hard drives for font caching. The Phaser III's firmware automatically detects and spools data from the LocalTalk, serial, and parallel ports so that different computers can share the printer. However, the Phaser III doesn't automatically toggle back and forth between PostScript and HPGL modes; you have to do that manually from the front panel.

The front panel includes a small LCD screen that serves several functions. During a print job, it informs you about the printer's activity (e.g., warming up, imaging page, or initializing). The panel notifies you of a print jam and where it occurred. Finally, it provides a rough indicator of each ink level in the reservoir. By using two front-panel buttons, you can change the language used by the display from English to French, German, Japanese, Italian, or Spanish.

To set up the printer, you power up the unit, drop the four ink sticks (cyan, magenta, yellow, and black) into the keyed openings, throw a lever to drop the inks into the reservoir, and wait for the printer to warm up. The warm-up time is about 15 to 20 minutes, so you definitely want to leave the Phaser III switched on. To conserve power, the printer goes into a standby mode if it sits idle for 2 hours.

continued

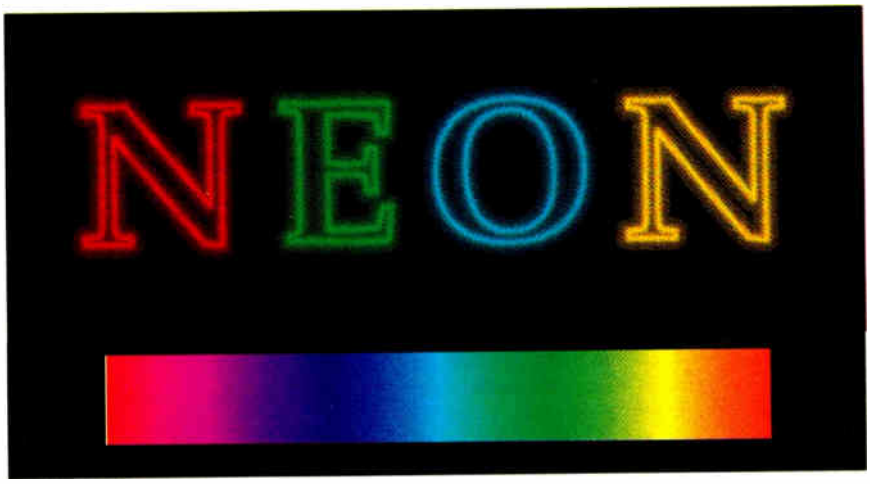
World Radio History

BYTE ACTION SUMMARY

- **WHAT THE PHASER III PXI IS**
  A PostScript Level 2 color ink-jet printer with a 300-dpi resolution that prints solid inks on plain paper and other media.
- **LIKES**
  Solid ink technology is easy to use and works with standard paper; the printer can handle a variety of paper stocks and sizes. The superb color output is a standout among color printing technologies.
- **DISLIKES**
  The printer is big, heavy, and slow.
- **RECOMMENDATIONS**
  This is a winner for those who need bright colors, work with different-size output, and want to keep printing costs low.
- **PRICE**
  $9995 for a standard 10-MB configuration; memory is expandable to 14 or 18 MB for $995 per 4-MB increment.
- **FOR MORE INFORMATION**

Tektronix
P.O. Box 1000
26600 Southwest Parkway
Wilsonville, OR 97070
(800) 835-6100
fax: (503) 682-3408

Circle 1105 on Inquiry Card.



Sample output from the Tektronix Phaser III PXi printer. Notice the rich, saturated blacks in the NEON *output. The rainbow bar shows the wide color range that the Phaser III is capable of producing.*

An incoming job kicks the Phaser III back into operating mode after a delay of about 2½ minutes to warm the ink and clean the print head.

The Phaser III can handle practically any paper stock and a variety of sizes. The printer's standard 10 MB of RAM lets you print on letter-size pages from A-size (8½- by 11-inch) up to B-size (American tabloid, 11- by 17-inch) sheets. With a 4-MB expansion added, you can print on A3-size (Metric tabloid, 297- by 420-mm) sheets.

The standard paper tray handles American type A (8½- by 11-inch) or Metric type A4 (210- by 297-mm) sheets, while an optional universal tray handles A-, legal- (8½- by 14-inch), B-, A4-, and A3-size paper. By manually feeding the paper into a slot on the printer's top, you can print from postcard-size (4- by 6-inch) to Tabloid-extra (12- by 18-inch) sheets. You can also print on a variety of papers, including gummed labels and stickers.

Trial Run

The printer comes with software drivers for both Macs and PCs. On the Mac, a Chooser-selectable, System 7.0–compatible driver is provided, along with support files for background printing. On the PC, there are PostScript drivers for Windows 3.0, Lotus 1-2-3, and Lotus Freelance.

I used a Mac IIfx with 8 MB of RAM and equipped with an 8•24 GC display board and an 80-MB hard drive for the printing tests. I printed a mixture of PostScript graphics and 24-bit scanned images, the latter of which can point out dithering problems. I used Adobe's Illustrator 3.0 and Photoshop 2.0 for my application tests and CE Software's Widgets to download PostScript code.

The bad news is that the Phaser III is slow. There are two reasons for this. First, the LocalTalk network connection that I used is slow. At 230,000 bps, multimegabyte 24-bit images take time to trickle to the printer.

The other delay is due to the print head, which takes time to traverse the paper. The traveling print head sounds like a car's windshield wiper on a rainy day, and the printer is quite energetic about moving it: Occasionally, the lab bench vibrated in time with the head's shuttling. In standard mode, a letter-size sheet of paper took 2½ minutes to print. At higher-quality modes, the print job took longer, using about 4 minutes in enhanced mode and nearly 7 minutes in premium mode to print a page.

Despite the delay, the results were gorgeous: Colors were rich, which made the output glow (see the figure). Using the Phaser III driver, the blacks were crisp and opaque, with a minimum of color-dithering artifacts. Because of the dithering process, blue tones can appear purple on PostScript graphics, but a blue correction option in the printer driver fixes this. I even got brave and printed some logos on some laser printer labels without problems, although I had to use the premium mode to get enough ink onto the labels.

Who Needs It?

Some folks like the translucent glow of thermal wax output, but such printers require specially coated paper. This drives the cost of thermal wax prints up to 45 to 50 cents per page. Personally, I liked the Phaser III's bright, snappy colors. For printing on 30 percent of a letter page's surface, the Phaser III's operating costs are 25 cents per page. Naturally, covering more of the sheet with ink or printing on larger pages ups the costs.

Who needs this printer? Anyone who wants to print on plain paper, thin sheets, thick stock, cards, or labels should consider the Phaser III PXi. The added bonus, of course, is that the Phaser III's bold colors will make your artwork stand out from the crowd. ■

Tom Thompson is a BYTE senior technical editor at large. He has a B.S.E.E. degree from Memphis State University. He can be contacted on BIX as "tom_thompson."

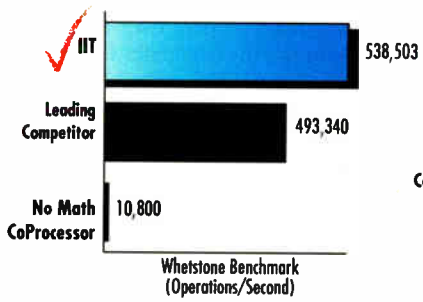
World Radio History

WHEN IT COMES TO MATH COPROCESSORS

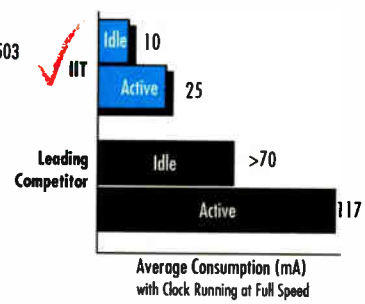
THE CHOICE IS SIMPLE!

✓IIT

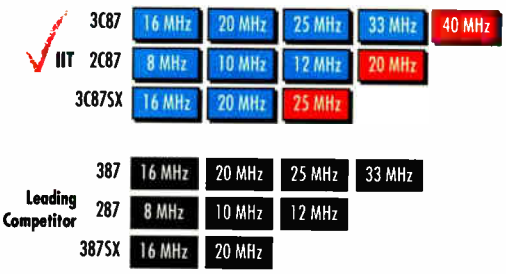
HIGH PERFORMANCE



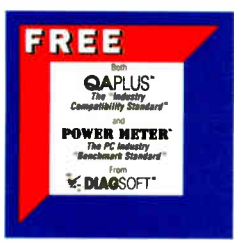
LOW POWER CONSUMPTION



HIGHEST SPEED GRADES



VALUE



- ✓ **Guaranteed 100% Compatibility with all 286, 386 and 386SX systems**
- ✓ **Warranteed For the Lifetime of Your System**
- ✓ **Free QAPlus and POWERMETER Software**

Call now for more information
800-832-0770
408-727-1885

Test results obtained on a 20 MHz 386SX system.

The IIT logo is a trademark of Integrated Information Technology, Inc. (IIT). QAPlus and POWERMETER are trademarks of DiagSoft, Inc.
All other trademarks are of their respective companies. ©1991 IIT. All rights reserved.

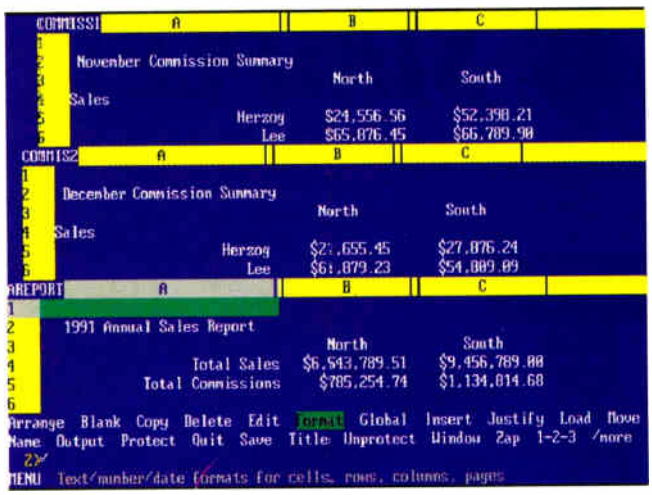
INTEGRATED INFORMATION TECHNOLOGY • INC.

Circle 75 on Inquiry Card (RESELLERS: 76).

World Radio History

REVIEWER'S NOTEBOOK

SuperCalc Gets Supercharged



Screen 1: *CA-SuperCalc 5.1 retains the stacked worksheet view of SuperCalc 5 but is faster and offers better 3-D support.*

Computer Associates International has sharpened up its popular SuperCalc 5 spreadsheet in preparation for further jousting with Lotus 1-2-3 for DOS spreadsheet dominance. CA-SuperCalc 5.1, the latest release, addresses many weaknesses of SuperCalc 5, and at $149 it offers an attractive alternative for users interested in an inexpensive DOS spreadsheet.

SuperCalc 5 gained some success, but it was hampered by slow performance, inefficient memory usage, and less sophisticated three-dimensional manipulation than some of its competitors (see "Not Just for Numbers Anymore," February 1990 BYTE). CA-SuperCalc 5.1 includes enhancements in all these areas, and it makes for a considerably stronger package.

CA-SuperCalc 5.1 is a text-based DOS spreadsheet in the mold of Lotus 1-2-3. You can enter data, text, and formulas into the worksheet area and use a slash command to get to a hierarchical menu. The hierarchical structure is very different from that of 1-2-3, but once you get used to the organization, the menus are easy enough to follow. If you are a die-hard 1-2-3 user, you can enter commands using 1-2-3 syntax. CA-SuperCalc 5.1 reads 1-2-3 macros as well as data files.

Like Lotus 1-2-3 release 3.1, CA-SuperCalc supports a 3-D spreadsheet model. Spreadsheets can be single worksheets, or they can include a collection of stacked sheets or pages (see screen 1). With a multipage spreadsheet, you can work with 3-D ranges—that is, you not only specify ranges with horizontal and vertical borders, but you also specify which pages of the stack of spreadsheets are to be included. Three-dimensional capability is most useful for collecting data across similar sheets. For example, you could set up a collection of monthly reports in a single multipage spreadsheet and use 3-D ranges to create an annual summary. Besides multiple pages, CA-SuperCalc also supports links to other spreadsheets in memory or on disk.

The most significant enhancements to CA-SuperCalc 5.1 are better performance and a more natural 3-D model. BYTE's spreadsheet benchmarks demonstrate the marked improvement between SuperCalc 5 and the newer release (see the table). Most striking is the improvement in simple calculation speed, as demonstrated by the Mathmix benchmark. CA-SuperCalc 5.1 not only beat SuperCalc 5 by a wide margin but also slightly outdid Lotus 1-2-3 release 2.3.

Floating-point calculation speed, measured by the Savage benchmark, and database sorts also show improvement. On these tests, however, CA-SuperCalc 5.1 still falls short of overcoming 1-2-3.

There is less differentiation between 2-D and 3-D ranges in version 5.1 than there was in previous versions. This leads to a more natural extension of formulas and ranges into the "depth" dimension. For example, you can now copy relative page references, whereas page references were always absolute in SuperCalc 5.

CA-SuperCalc 5.1 retains the same strong graphics and reporting capability of its predecessor; you can generate and annotate 3-D graphs and control fonts and shading on reports. However, you still can't embed graphics in reports or see WYSIWIG previews.

This updated version of SuperCalc is a genuine improvement over its predecessor and a worthy contender for those considering a new DOS spreadsheet.

BYTE SPREADSHEET BENCHMARKS

Computer Associates' updated CA-SuperCalc 5.1 shows vast performance improvement compared to the older SuperCalc 5, but it falls short of Lotus 1-2-3 release 2.3. All times are in seconds.

	Savage	Mathmix	Sort
CA-SuperCalc 5.1	52	1	77
SuperCalc 5	64	22	108
Lotus 1-2-3 release 2.3	26	2	34

A New Weapon to Fight Jaggies

Screen 2: *Although JAG does a good job of antialiasing jagged curves, such as those on the* B, *it also smoothes the ascenders and descenders of large sans serif type. Consequently, the base of the* Y *tapered at the corners and looked worse than before we ran JAG.*

JAG, from Ray Dream, gives Macintosh-based graphics professionals an easy way to antialias gray-scale and color PICT or PICS images. An acronym for "jaggies are gone," JAG adds gray tones or colors to image and text edges. As a result, the eye sees smoother lines instead of the rough stair steps in images created in paint packages, rendered 3-D

World Radio History

WHY PAY MORE FOR ADVANCED TECHNOLOGY?

ATronics offers you more for your hard-earned dollar. Highest quality components; customer service and technical support second to no other! Systems designed to avert obsolesence and protect your investment dollar. Motherboards designed with upgradeability in mind.

We've been first since 1985. The very first AT-compatible; the first 486/50 on the market. Dollar for dollar and feature for feature, no competitive system available today can match the ATronics line for technology, quality and value. You owe it to yourself to check our prices. Call us today!

Available as a kit for your existing 3.5" IDE hard disk for just $69.00.

120MB Removable IDE Hard Disk

$425

If you've been looking at Bernoulli or SyQuest for removable media, ATronics can provide a better solution, one that offers the ultimate in unlimited data storage, security, backup and transportability.

- 80MB, 200MB & 300MB IDE drives available
- No special drivers required
- Keylock security
- Completely DOS compatible
- Free padded carrying case

Superior performance from a truly portable and affordable system!

386SX-20MHz Notebook

$1,595

- 20MHz 386SX CPU
- 2MB DRAM, 4MB optional
- 640 X 480 LCD VGA screen, 32 shades of gray
- Dimensions: 8.6"x11"x2", Weight: 6.7 lbs.
- 20MB hard disk standard; 40 & 60MB optional
- 1.44MB floppy disk drive
- Free carrying case
- Other options available at additional cost

Systems Proudly Made in the USA!

ATI-386/33

$1,595

- 33MHz 80386
- 64K cache
- 1MB DRAM
- 120MB IDE hard drive
- 1.44MB or 1.2MB drive
- 1024 X 768 SVGA card
- SVGA monitor (1024 X 768)
- 2 serial and 1 parallel port
- 101 enhanced keyboard
- Baby AT case

ATI-486/33

$2,095

- 33MHz 80486
- 64K cache
- 4MB DRAM
- 120MB IDE hard disk
- 1.44 MB or 1.2MB drive
- 1024 X 768 SVGA card
- SVGA monitor (1024 X 768)
- 2 serial and 1 parallel port
- 101 enhanced keyboard
- Baby AT case

50MHz-486

CALL For Price

- 50MHz 80486
- 256K cache
- 4MB DRAM
- 120MB IDE hard disk
- 1.44 MB or 1.2MB drive
- 1024 X 768 SVGA card
- SVGA monitor (1024 X 768)
- 2 serial and 1 parallel port
- 101 enhanced keyboard
- Baby AT case

Quality: *U.S. designed and made since 1985.* ***On-Site Service:*** *Available; Unlimited technical phone support included.*

intel inside

ATI

ATronics International, Inc.

45635 Northport Loop East
Fremont, CA 94538-6415

Phone: 510-656-8400
Fax: 510-656-8560
Hours: 7 am to 5 pm PST

(OUTSIDE CALIFORNIA ONLY)

1-800-488-7776

Circle 21 on Inquiry Card (RESELLERS: 22).

World Radio History

objects, or animations.

Among JAG's more appealing features is its simplicity. Once you transfer the program to the System Folder, you open a suitable file and choose the antialias selection from the menu, and JAG performs its duty. Alternatively, a menu selection lets you choose whether or not to antialias single-pixel-thick lines. This choice is important, we found when we tested images with small text. Antialiased small type looked bleary and less readable than before it received JAG's treatment. You can also choose to let JAG ignore single-pixel points of color. Otherwise, intended design elements or dots above an *i* would disappear into an antialiased background.

In our tests using a Mac IIfx and a Mac II, JAG performed at a snappy pace. For example, JAG antialiased a 72-KB PICT file in approximately 37 seconds on the IIfx. Using the program's batch queue option, we easily antialiased a presentation consisting of 10 frames, which we created in More 3.0. Similarly, we used JAG to "clean up" a short PICS file consisting of animated text. JAG allowed us to antialias the individual frames as a batch in the background.

In the end, we found ourselves ambivalent about JAG's results, primarily because JAG didn't know when to leave well enough alone. It did a fine job of smoothing the jagged edges around curves in text and images. Unfortunately, the program also decided to smooth the right angles on the ascenders and descenders of large sans serif type. Consequently, the base of a capital *Y* tapered at the corners and looked worse than before we ran JAG (see screen 2). Ray Dream says a future version of JAG, which should ship late in the first quarter, will include a lasso that will let you select only the areas that need sprucing up.

JAG's quickness can make it a handy utility, especially if your 3-D graphics package takes forever to simultaneously render and antialias an image. Just keep in mind that questionable quality can be the trade-off for expediency.

A SideBar for Windows

When we have files to rename or directories to create, we'd rather switch to a DOS shell than fight the Windows file manager. But shelling to DOS is a time-consuming process that makes simple file operations more tedious than they need to be. SideBar, a $99.99 organization tool for the Windows desktop, has made the Windows environment a much more pleasant place to spend the day.

Screen 3: *SideBar combines file management and program management tools behind a slick interface.*

SideBar is a narrow window that sits on one edge of the Windows desktop. It combines file and application management tools in one accessible box (see screen 3). SideBar has many functions, but there are two primary components: a command line and a collection of drive and applications icons. The SideBar command line is a small window near the top of the tool bar. You type in commands such as `dir c:\*.com` or `copy foo.txt bar.txt`, and SideBar responds by bringing up a dialog box with which you can confirm or modify your command. Having a simple command line inside Windows is incredibly useful; it's difficult to imagine how much trouble this saves until you've tried it.

The second component is the icon bar, which contains icons for applications and icons representing disk drives. Applications icons can represent currently active tasks (SideBar replaces the collection of minimized task icons that Windows would normally display in the lower left corner of a screen) or startable tasks that you select. Clicking on applications icons switches to or launches the selection, as appropriate.

Clicking on drive icons displays file lists for that drive. You can split the bar vertically, or horizontally as it is in the photo, to get access to more than one drive or directory. By clicking, dragging, and dropping selections, you can copy, move, or delete files using the icon bar. SideBar can replace the task manager; however, we found that having SideBar in addition to the standard windows task management tools was most useful. SideBar also lets you select items from program groups by clicking on the desktop.

Many functions of SideBar are much easier to use than to describe textually. Documentation writers at Paper Software acknowledge this in the SideBar manual; the manual consists almost entirely of screen shots with arrows pointing out relevant features. We liked Paper Software's innovative approach to documentation and agree that it's easier to get through than the standard sea of text.

We found SideBar to be a very handy utility that improves life within the Windows environment. If you need a new file management tool but don't need (and can't afford) all the accessories in shell replacements like the Norton Desktop for Windows, give SideBar a try. ■

—The BYTE Lab

Reviewer's Notebook provides new information—including version updates, new test data, long-term usage reports, and reader feedback—on products and product categories.

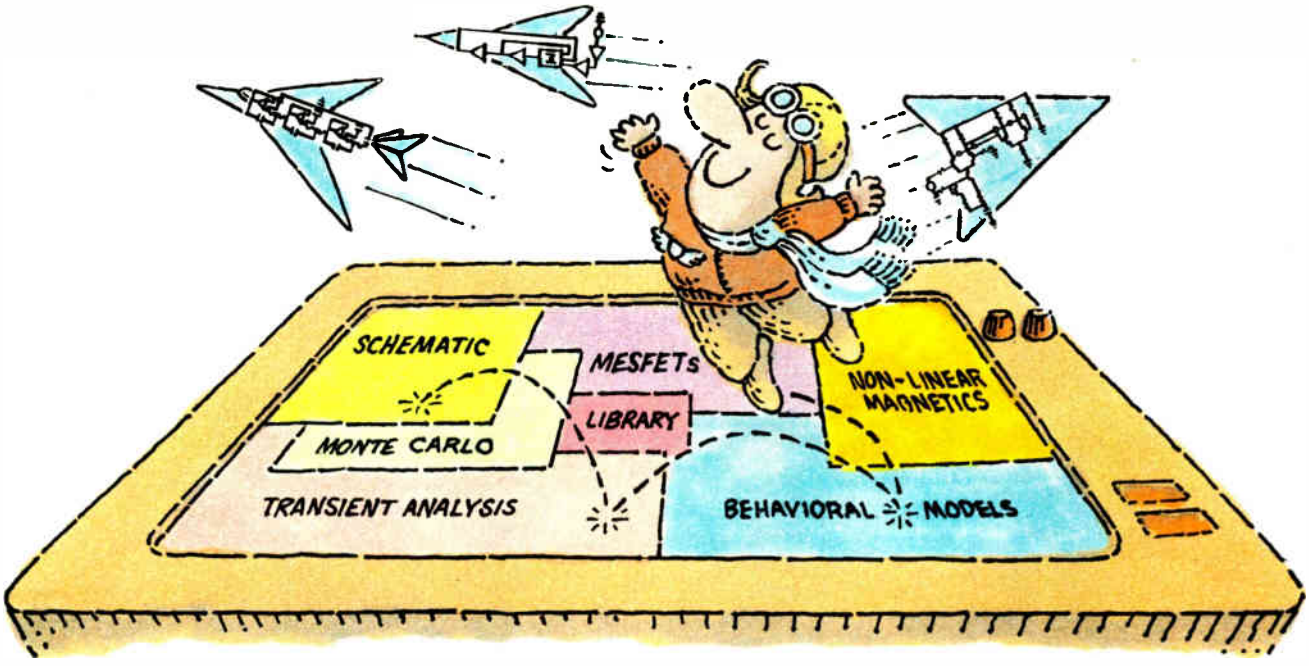
ITEMS DISCUSSED

CA-SuperCalc 5.1 ..... $149
Computer Associates International, Inc.
711 Stewart Ave.
Garden City, NY 11530
(516) 227-3300
fax: (516) 227-3937
Circle 1226 on Inquiry Card.

JAG $99.95
Ray Dream, Inc.
1804 North Shoreline Blvd.
Mountain View, CA 94043
(415) 960-0768
fax: (415) 960-1198
Circle 1224 on Inquiry Card.

SideBar $99.99
Paper Software, Inc.
P.O. Box 567
New Paltz, NY 12561
(914) 255-0056
fax: (914) 255-7572
Circle 1225 on Inquiry Card.

World Radio History



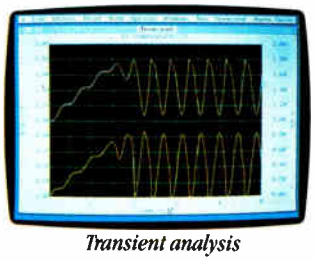
THE NEW MICRO-CAP III.™ SO YOU CAN TEST-FLY EVEN MORE MODELS.

It wasn't easy. But we did it. Made the long-time best-selling IBM® PC-based interactive CAE tool even better.

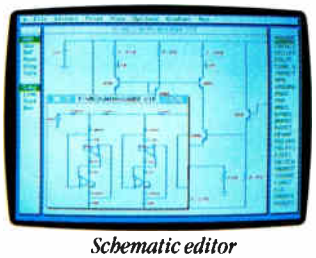
Take modeling power. We've significantly expanded math expression capabilities to permit comprehensive analog behavioral modeling. And, beyond Gummel Poon BJT and Level 3 MOS, you're now ready for nonlinear magnetics modeling. Even MESFET modeling.

Analysis and simulation is faster, too. Because the program's now in "C" and assembly language. That also means more capacity — for simulating even larger circuits.

As always, count on fast circuit creation, thanks to window-based operation and a schematic editor. Rapid, right-from-schematics analysis — AC, DC, fourier and transient — via SPICE-like routines. The ability to combine digital/analog circuit simulations using integrated switch models and parameterized macros. And stepped component values that streamline multiple-plot generation.



Transient analysis



Schematic editor

Monte Carlo analysis

And don't forget MICRO-CAP III's extended routine list — from impedance, Nyquist diagrams and BH plots to Monte Carlo for statistical analysis of production yield. The algebraic formula parsers for plotting virtually any function. The support for Hercules, CGA, MCGA, EGA and VGA displays. Output for plotters and laser printers.

Cost? Still only $1495. Evaluation versions still only $150. Brochure and demo disk still free for the asking. Call or write for yours today. And see how easily you can get ideas up and flying.

Spectrum

1021 S. Wolfe Road
Sunnyvale, CA 94086
(408) 738-4387

Circle 154 on Inquiry Card.

World Radio History

DTK 486 drives high-performance software in PC Week Labs test.

When *PC Week's* editors asked PC Week Labs to test Autodesk's® Renderman™ software, a DTK i486™ computer was chosen to run the sophisticated, high-level shading software program. (The drawing shown above is representative of the high quality of Renderman™ output.)

It takes a lot of muscle to get the full benefits of Renderman's™ power; we build that muscle into every DTK i486™ system™.

We begin with Intel's® potent i486™ processor (with its built-in cache and floating-point coprocessor circuitry) and add a second-level 64KByte static Ram cache (expandable to 256KBytes) for even more impressive productivity levels.

Add to these your choice of hard drives and controllers, a fast graphics card and a post-VGA high definition monitor, and you have a PC screamer that can handle even the toughest of jobs ... while still affordably-priced.

When power and dependability are important, DTK is the computer of choice of people who know. Perhaps it's time you considered a DTK i486™ for your next computer. Call one of the DTK branch offices below for the name of a reseller near you.

The DTK 486 Family ■ 486-33 ISA ■ 486-33 EISA ■ 486-25 ISA ■ 486SX-20 ISA

DTK Computer Inc. A Reputation for Success.

17700 Castleton Street, Suite 300 / City of Industry (Los Angeles), CA 91748 / (818) 810-8880 / FAX (818) 810-5233

Los Angeles	San Jose	Houston	Chicago	New York	Miami
(818) 810-0098	(408) 436-6363	(713) 568-6688	(708) 593-3080	(908) 562-8800	(305) 597-8888

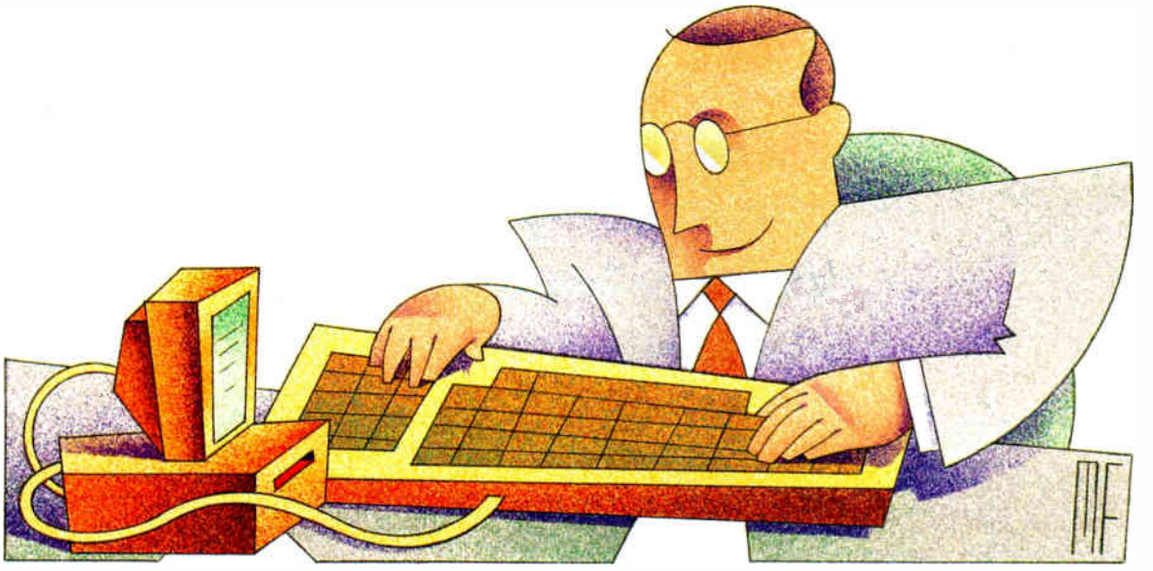
Autodesk is a registered trademark and Renderman is a trademark of Autodesk Inc. The DTK Logo is a registered trademark of DTK Computer Inc. Intel is a registered trademark and the Intel Inside Logo and i486 are trademarks of Intel Corporation. Design and specifications subject to change without notice. ©1991. DTK Computer Inc.

Circle 58 on Inquiry Card.

World Radio History

HOWARD EGLOWSTEIN

FINALLY, A REAL KEYBOARD



If you asked me to name the two most inconvenient things about modern notebook computers, I'd have to say their short battery life and cramped, shrunken keyboards. There's not much we can do about the batteries just yet—that will come in time. In the meantime, however, any time you have your notebook machine near your desk, why not use your desktop computer's keyboard as a substitute? You've probably got everything you need to do the job.

A LapLink cable and your desktop's printer port can take the place of a cramped laptop keyboard

The Versatile Printer Port

Most of the newer notebook machines leave off I/O ports to save space. Few, if any, include an external keyboard connector anymore, and it's simply not possible to use any other port to drive a keyboard, since a standard PC keyboard uses a clocked serial I/O stream to move data to and from the keyboard.

However, the printer port, with 8 bits of data out and 5 bits of data in, is an incredibly versatile beast. When the port is connected to a printer, the 8 output bits are used for the printed characters. Five other control bits take care of handshaking and control functions. The 5 input bits handle handshaking and status. (See the table.) The ROM BIOS has the responsibility of manipulating these bits to make the printer port talk to a parallel printer. But if you write your own software, you can make the port do just about anything you want.

In my case, I was tired of dealing with scrawny little notebook keyboards. Part of developing the notebook battery-life tests (see "Notebook Power Management at Its Zenith," December 1991 BYTE) included sending status information between a host computer and the notebook under test. The machines were linked through the notebook's printer port. With luck and some assembly code, I created a TSR program for the notebook that accepts keystroke information from the desktop machine and posts it in the notebook's keyboard buffer. A companion utility for the desktop machine accepts keystrokes and passes them through the parallel cable.

Let's Talk Keystrokes

The printer port communications is only one part of the project—I'll get to that in a minute. First, here's a brief refresher course on the keyboard.

In a PC, the keyboard is linked through dedicated hardware (in a PC or XT) or a microprocessor (AT). Either way, when a key is pressed, a hardware interrupt occurs. BIOS Int 9 hexadecimal (whose vector is stored at location 0000:0024) fields the interrupt, looks at the incoming scan code, and decides what it means. If it's a Shift/Ctrl/Alt key, the BIOS just stores the key's status. Most likely, though, the keystroke will be a character key. A lookup table in the BIOS ROM contains every

ILLUSTRATION: MARK FISHER © 1992

Two years ago, a lot of people at Texas Instruments found the mainframes difficult to use and inflexible.

So Jim started to look at possible solutions. He wanted to find a system that would utilize their existing equipment, allow MIS to rapidly develop applications, and provide the end users with an easy-to-use interface.

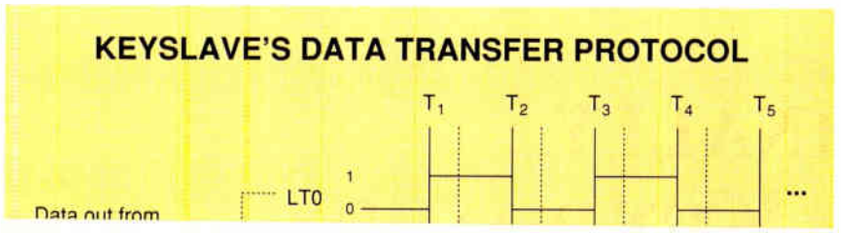
He discovered Microsoft client-server computing was just what Texas Instruments needed.

Texas Instruments' migration to Microsoft's client-server solution, call us at (800) 992-3675, Dept. X32. We'll tell you how you can profit from their experience.

Microsoft®

© 1991 Microsoft Corporation. All rights reserved. Printed in the U.S.A. Offer good only in the 50 United States. In the United States, call (800) 992-3675, Dept. X32. For information only: In Canada, call (800) 563-9048. Outside the United States and Canada, call (206) 936-8661. Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation.

World Radio History



PC PRINTER PORT

Depending on the hardware configuration, the base address of the printer port will be one of three values. On most systems with color monitors, the first printer (LPT1) will have a base address of 378h, and LPT2's

SOME ASSEMBLY REQUIRED

Listing 1: *The desktop computer's data transmission routine. PORTIN transfers a byte of data from the desktop's status port. To acknowledge and respond to a request from the notebook, isolate the three nibble ID bits. Use the ID to determine which of the four nibbles you want, isolate them, and send them out the data port. You'll know the data was received when the notebook asks for another nibble.*

```
sc_1:
; See which nibble they want
   call  PORTIN
; value in bits 3-5
   and   al,00111000b
   shr   al,1
   shr   al,1
   shr   al,1
   mov   ch,al      ; ch holds the nibble ID
      .
      .
      .
   shl   al,1
   shl   al,1
; We're going to rotate the bits 0, 4, 8, or 12 bits to
; the right. Multiply the number in AL by 4 and shift
; the contents of BX that many bits.
   mov   cl,al
   mov   ax,bx
   ror   ax,cl
   and   ax,000fh
; shift it back to the left to make room for the nibble ID
   rol   ax,1
; Now to that, add in the low bit of the nibble ID as
; bit 0.
   mov   ah,ch
   and   ah,1
   or    al,ah
   call  PORTOUT
sc_2:
; Wait for them to ask for a different one
   call  PORTIN
; value in bits 3-5
   mov   ah,al
   and   al,00111000b
   shr   al,1
   shr   al,1
   shr   al,1
   cmp   al,ch
   je    sc_2
; If we sent nibble 3, stop sending
   cmp ch,3
   jne sc_1
sc_out:
```


Award Winning User Interface Classes Now for C++

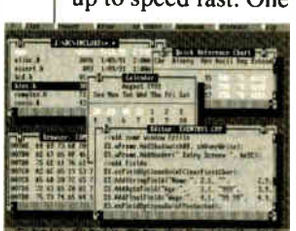
Don't start from scratch with your text-mode user interfaces! Save time with **Object Professional™ for C++**. Over 100 classes provide ready-to-use interfaces for your programs, such as text editors, dialog boxes, pick lists, scrolling data entry screens, help systems, and more. The objects are fully functional as is and built-in calls allow you to change the behavior. Create text-mode Windows look-alikes (SAA/CUA) or your own unique look and feel. All without event-driven programming. And your applications will be responsive even on a 640K 8088 based PC.

Interactive Screen Builders

Object Professional includes utilities to help you build menu systems and data entry screens fast. Design and test interactively, then automatically generate source code.

Hot Demo Programs

Plenty of example programs get you up to speed fast. One is a desktop manager that includes text and file browsers, pick lists, modem dialer, and more. It provides you with classes you can reuse and illustrates how to build an ambitious application using Object Professional.



Source Code and No Royalties

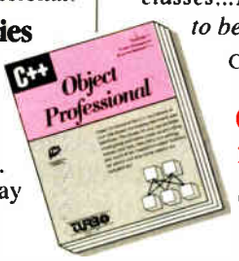
Object Professional includes complete documentation, pop-up help, free technical support direct from the authors by telephone and on CompuServe. You get full source code and pay no royalties.

An Award Winner!

Object Professional for Turbo Pascal was chosen as one of nine development products that "Jolted" the industry during 1990. Object Professional for C++ is the UI objects from that library ported to C++.

"Object Professional...a thoroughly object-oriented, beautifully documented, immaculately designed, comprehensive set of extensible classes...You really can't afford to be without this package."

Computer Language, April 1991



Object Professional for C++, only $249.

Call toll-free to order.
1-800-333-4160

9AM - 5PM MST Monday through Friday, U.S. and Canada.
For more information call (719) 260-6641, fax to (719) 260-7151, or send mail to CompuServe ID 76004,2611
TurboPower Software PO Box 49009 Colorado Springs, CO 80949-9009
© TurboPower Software, 1991

Object Professional for C++ requires Borland C++.
Satisfaction guaranteed or your money back within 30 days.
Includes dual media. Add $10 per order for shipping in US and Canada, add $40 per item for international airmail.
We accept MC, VISA, COD in US, and checks in US dollars.

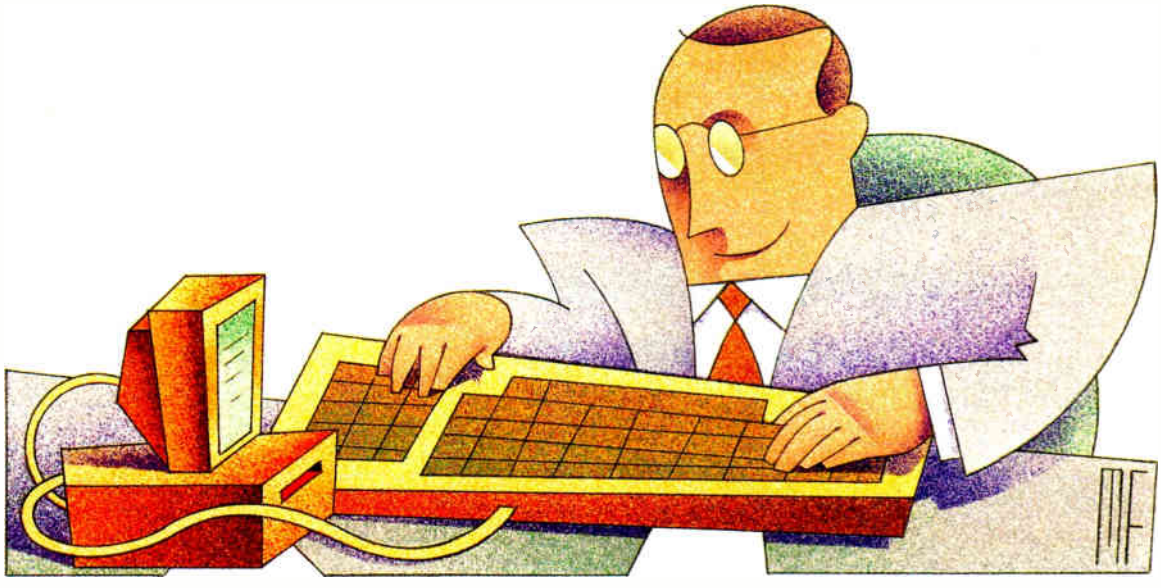
TURBO Power

Circle 173 on Inquiry Card.

World Radio History

HOWARD EGLOWSTEIN

FINALLY, A REAL KEYBOARD



If you asked me to name the two most inconvenient things about modern notebook computers, I'd have to say their short battery life and cramped, shrunken keyboards. There's not much we can do about the batteries just yet—that will come in time. In the meantime, however, any time you have your notebook machine near your desk, why not use your desktop computer's keyboard as a substitute? You've probably got everything you need to do the job.

A LapLink cable and your desktop's printer port can take the place of a cramped laptop keyboard

The Versatile Printer Port

Most of the newer notebook machines leave off I/O ports to save space. Few, if any, include an external keyboard connector anymore, and it's simply not possible to use any other port to drive a keyboard, since a standard PC keyboard uses a clocked serial I/O stream to move data to and from the keyboard.

However, the printer port, with 8 bits of data out and 5 bits of data in, is an incredibly versatile beast. When the port is connected to a printer, the 8 output bits are used for the printed characters. Five other control bits take care of handshaking and control functions. The 5 input bits handle handshaking and status. (See the table.) The ROM BIOS has the responsibility of manipulating these bits to make the printer port talk to a parallel printer. But if you write your own software, you can make the port do just about anything you want.

In my case, I was tired of dealing with scrawny little notebook keyboards. Part of developing the notebook battery-life tests (see "Notebook Power Management at Its Zenith," December 1991 BYTE) included sending status information between a host computer and the notebook under test. The machines were linked through the notebook's printer port. With luck and some assembly code, I created a TSR program for the notebook that accepts keystroke information from the desktop machine and posts it in the notebook's keyboard buffer. A companion utility for the desktop machine accepts keystrokes and passes them through the parallel cable.

Let's Talk Keystrokes

The printer port communications is only one part of the project—I'll get to that in a minute. First, here's a brief refresher course on the keyboard.

In a PC, the keyboard is linked through dedicated hardware (in a PC or XT) or a microprocessor (AT). Either way, when a key is pressed, a hardware interrupt occurs. BIOS Int 9 hexadecimal (whose vector is stored at location 0000:0024) fields the interrupt, looks at the incoming scan code, and decides what it means. If it's a Shift/Ctrl/Alt key, the BIOS just stores the key's status. Most likely, though, the keystroke will be a character key. A lookup table in the BIOS ROM contains every

ILLUSTRATION: MARK FISHER © 1992

World Radio History

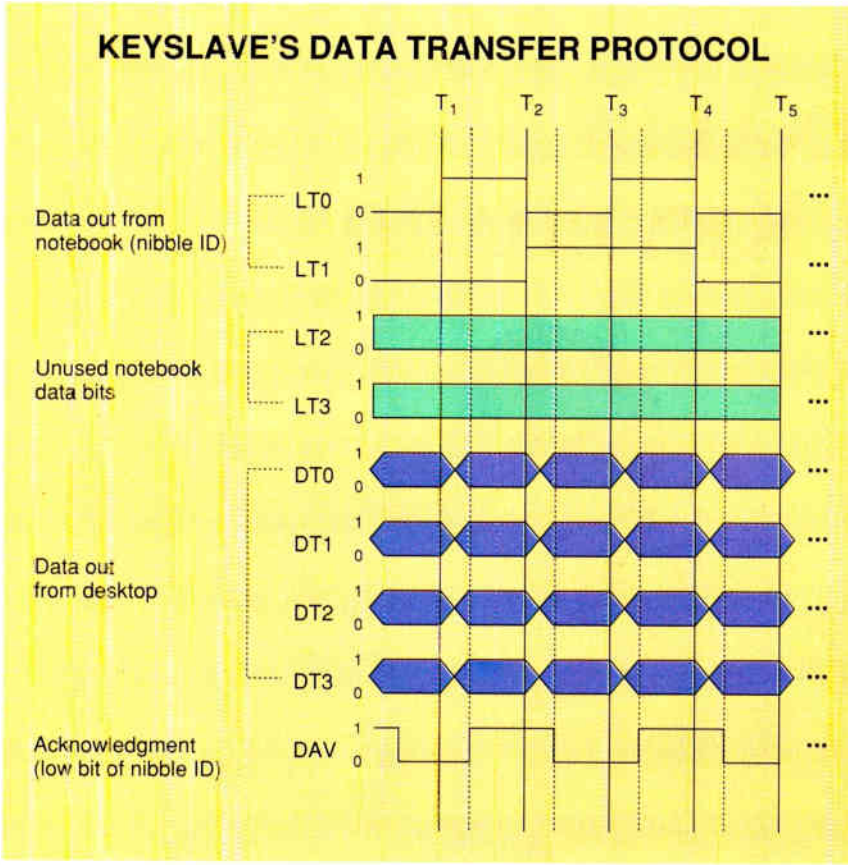


Figure 1: *To begin a transfer, the notebook sets its 2 data bits (LT0 and LT1) to 0 to request the first data nibble (nibble ID value). Some time later, the desktop recognizes a new request and places the data on four of its output lines. Taking a copy of the nibble ID's least-significant bit (in this case, a 0) and placing it on the fifth data line tells the notebook that the data is ready. At the next notebook clock tick (T1), the notebook sees the LSB and gathers up the data bits. After storing the 4 bits of data in memory, the notebook requests nibble 1 and returns to the application. The cycle continues until the notebook takes in the last nibble at time = T4.*

possible keystroke and a corresponding ASCII value. The BIOS searches through the table, finds the appropriate ASCII value, and places the value and key-scan code in the BIOS data area. Later, your application or DOS itself makes a BIOS call (Int 16h) to retrieve the keyboard data.

One approach to extending the notebook's keyboard might have been to send the raw scan codes from the desktop and perform the lookup function on the notebook, but that seemed like a lot of unnecessary work. The desktop's BIOS does the same thing, so I decided to have the desktop send the completed keyboard buffer data and have the notebook simply store the data in its own buffer. The more you mess with hardware interrupts on a PC, the more trouble you're asking for, so I opted to take the safe way out and simply intercept Int 16h.

You Can't Always Get What You Want

The next piece of the puzzle was getting the data from the desktop to the notebook through the printer port. It would have been heaven to have enough bits to move all 16 data bits (8 bits of ASCII and 8 bits of scan code) in one fell swoop, but it wasn't to be. The desktop can send out the 16 bits as two groups of 8, but the notebook can only receive them 5 bits at a time. Besides, there has to be some kind of synchronization between the two machines to ensure that the data made it from one to the other.

Using 4 of the notebook's 5 input bits for data and the fifth bit for control seemed the obvious solution. Traveling Software's LapLink cable is set up to transfer data that way. Inside the parallel cable, bits 0 to 4 of the desktop's data are connected to the notebook's 5 status bits.

PC PRINTER PORT

Depending on the hardware configuration, the base address of the printer port will be one of three values. On most systems with color monitors, the first printer (LPT1) will have a base address of 378h, and LPT2's base address will be 278h. On some color machines and all machines with monochrome ports, LPT1 will reside at 3BCh.

OUTPUT BITS

Address	Bit no.	DB-25 pin	Original function
Base	0	2	LSB data out
	1	3	Data out
	2	4	Data out
	3	5	Data out
	4	6	Data out
	5	7	Data out
	6	8	Data out
	7	9	MSB data out
Base+2	0	1	Data strobe
	1	14	Auto linefeed
	2	16	Initialize printer
	3	17	Activate select
	4		IRQ enable

INPUT BITS

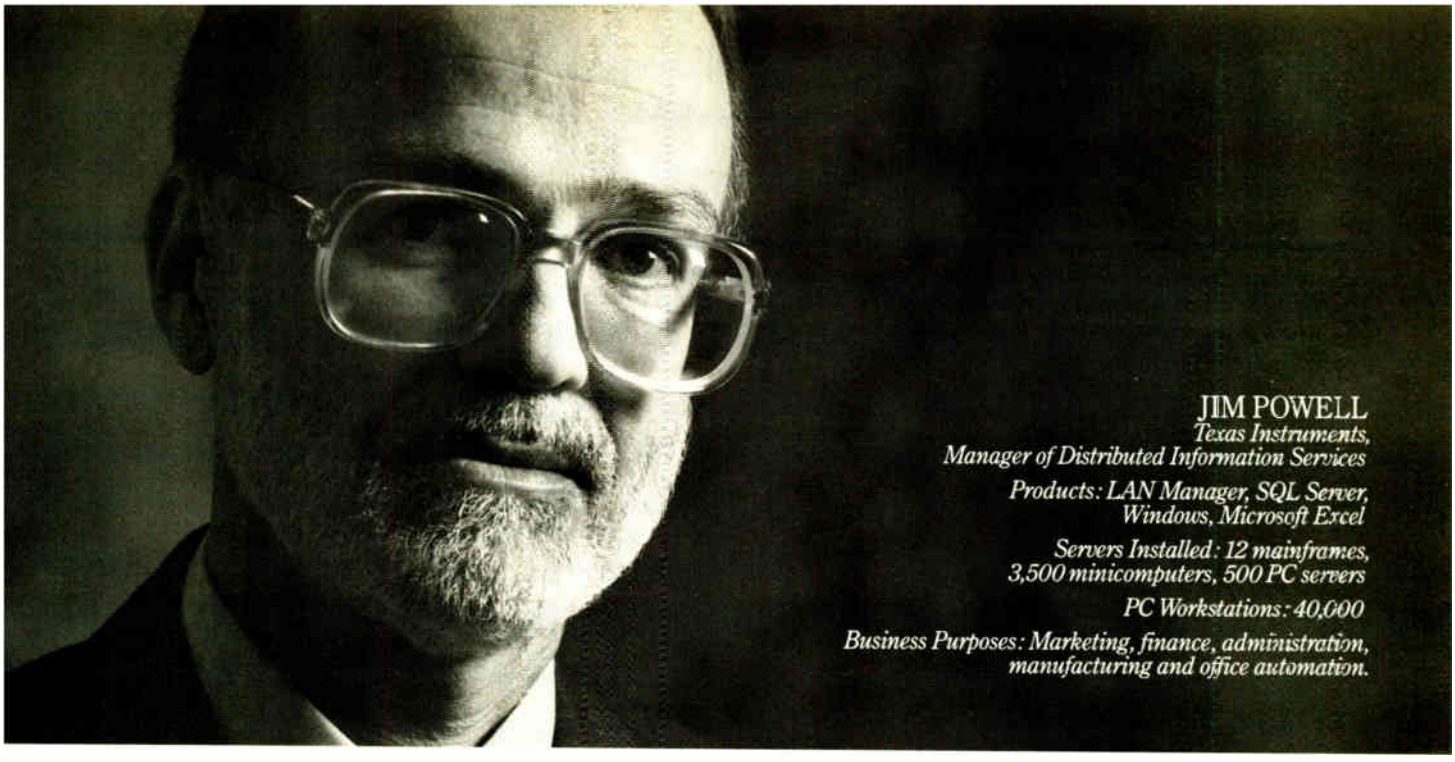
Address	Bit no.	DB-25 pin	Original function
Base+1	3	15	Error status
	4	13	Selected
	5	12	Out of paper
	6	10	Data acknowledged
	7	11	Busy

Bits 0 to 4 from the notebook are connected to the desktop's status bits. Any data output from one machine appears as printer status on the other, shifted to the 5 highest bits on the status port.

Moving 16 bits of data 4 bits at a time requires a bit of protocol. I chose a simple protocol that transfers 1 nibble (4 bits) of data per transfer cycle. Figure 1 shows the timing and data flow between the machines. The notebook is in control of the data flow and refers to the 16-bit value as a sequence of nibbles, numbered 0 to 3.

To begin a transfer, the notebook asks for nibble 0 by putting a 0 on its output port (LT0 or LT1). The desktop machine sees this as a change from the previous

World Radio History



JIM POWELL
Texas Instruments,
Manager of Distributed Information Services

Products: LAN Manager, SQL Server, Windows, Microsoft Excel

Servers Installed: 12 mainframes, 3,500 minicomputers, 500 PC servers

PC Workstations: 40,000

Business Purposes: Marketing, finance, administration, manufacturing and office automation.

Texas Instruments' top executives get to the bottom line instantly with Microsoft client-server computing.

Every business wants to know the bottom line. Thanks to Microsoft's client-server computing solution, Texas Instruments' upper management sees it instantly. Right on their own PCs.

"PEOPLE DON'T JUST WANT ACCESS TO DATA. THEY WANT TO CREATE IT, CHANGE IT AND MAKE IT THEIR OWN."

They can also track inventory, monitor sales, check raw material prices and find other information needed to make decisions.

And that's how Jim Powell likes it. Because as Texas Instruments' Manager of Distributed Information Services, it's his job to provide his coworkers with the computer support they need. And with Microsoft client-server computing, his job is a lot easier.

Two years ago, a lot of people at Texas Instruments found the mainframes difficult to use and inflexible.

So Jim started to look at possible solutions. He wanted to find a system that would utilize their existing equipment, allow MIS to rapidly develop applications, and provide the end users with an easy-to-use interface.

He discovered Microsoft client-server computing was just what Texas Instruments needed.

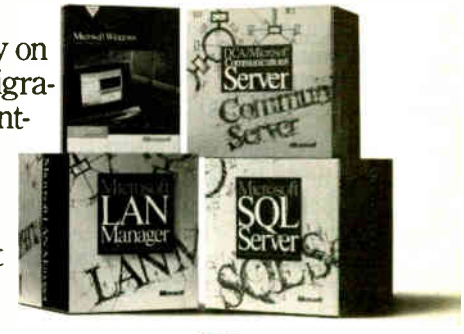
The Windows™ environment was placed on the desktops and Microsoft® LAN Manager and SQL Server were integrated into the system.

There were dividends right away.

Jim's group was able to quickly develop client-server applications, like the executive decision support system. Which means the users didn't have to wait forever to get the computer support they needed. And with Windows, the information on the mainframes was easier to access. In short, Jim was able to get the right information, to the right people, the right way.

"NOW I CAN PUT APPLICATIONS INTO THE HANDS OF PEOPLE THAT WOULDN'T HAVE GOTTEN THEM OTHERWISE."

For a case study on Texas Instruments' migration to Microsoft's client-server solution, call us at (800) 992-3675, Dept. X32. We'll tell you how you can profit from their experience.



Microsoft®

© 1991 Microsoft Corporation. All rights reserved. Printed in the U.S.A. Offer good only in the 50 United States. In the United States, call (800) 992-3675, Dept. X32. For information only: In Canada, call (800) 563-9048. Outside the United States and Canada, call (206) 936-8661. Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation.

World Radio History

Listing 1: *The desktop computer's data transmission routine. PORTIN transfers a byte of data from the desktop's status port. To acknowledge and respond to a request from the notebook, isolate the three nibble ID bits. Use the ID to determine which of the four nibbles you want, isolate them, and send them out the data port. You'll know the data was received when the notebook asks for another nibble.*

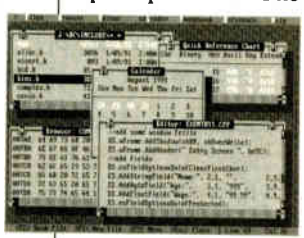
```
sc_1:
; See which nibble they want
   call  PORTIN
; value in bits 3-5
   and   al,00111000b
   shr   al,1
   shr   al,1
   shr   al,1
   mov   ch,al      ; ch holds the nibble ID
      .
      .
      .
   shl   al,1
   shl   al,1
; We're going to rotate the bits 0, 4, 8, or 12 bits to
; the right. Multiply the number in AL by 4 and shift
; the contents of BX that many bits.
   mov   cl,al
   mov   ax,bx
   ror   ax,cl
   and   ax,000fh
; shift it back to the left to make room for the nibble ID
   rol   ax,1
; Now to that, add in the low bit of the nibble ID as
; bit 0.
   mov   ah,ch
   and   ah,1
   or    al,ah
   call  PORTOUT
sc_2:
; Wait for them to ask for a different one
   call  PORTIN
; value in bits 3-5
   mov   ah,al
   and   al,00111000b
   shr   al,1
   shr   al,1
   shr   al,1
   cmp   al,ch
   je    sc_2
; If we sent nibble 3, stop sending
   cmp ch,3
   jne sc_1
sc_out:
```


Award Winning User Interface Classes Now for C++

Don't start from scratch with your text-mode user interfaces! Save time with **Object Professional™ for C++**. Over 100 classes provide ready-to-use interfaces for your programs, such as text editors, dialog boxes, pick lists, scrolling data entry screens, help systems, and more. The objects are fully functional as is and built-in calls allow you to change the behavior. Create text-mode Windows look-alikes (SAA/CUA) or your own unique look and feel. All without event-driven programming. And your applications will be responsive even on a 640K 8088 based PC.

Interactive Screen Builders

Object Professional includes utilities to help you build menu systems and data entry screens fast. Design and test interactively, then automatically generate source code.



Hot Demo Programs

Plenty of example programs get you up to speed fast. One is a desktop manager that includes text and file browsers, pick lists, modem dialer, and more. It provides you with classes you can reuse and illustrates how to build an ambitious application using Object Professional.

Source Code and No Royalties

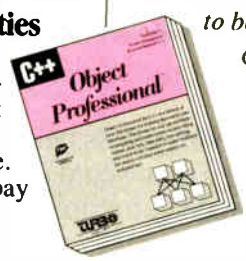
Object Professional includes complete documentation, pop-up help, free technical support direct from the authors by telephone and on CompuServe. You get full source code and pay no royalties.

An Award Winner!

Object Professional for Turbo Pascal was chosen as one of nine development products that "Jolted" the industry during 1990. Object Professional for C++ is the UI objects from that library ported to C++.

"Object Professional...a thoroughly object-oriented, beautifully documented, immaculately designed, comprehensive set of extensible classes...You really can't afford to be without this package."

Computer Language, April 1991



Object Professional for C++, only $249.

Call toll-free to order.
1-800-333-4160

9AM - 5PM MST Monday through Friday, U.S. and Canada.
For more information call (719) 260-6641, fax to (719) 260-7151, or send mail to CompuServe ID 76004,2611
TurboPower Software PO Box 49009 Colorado Springs, CO 80949-9009
© TurboPower Software, 1991

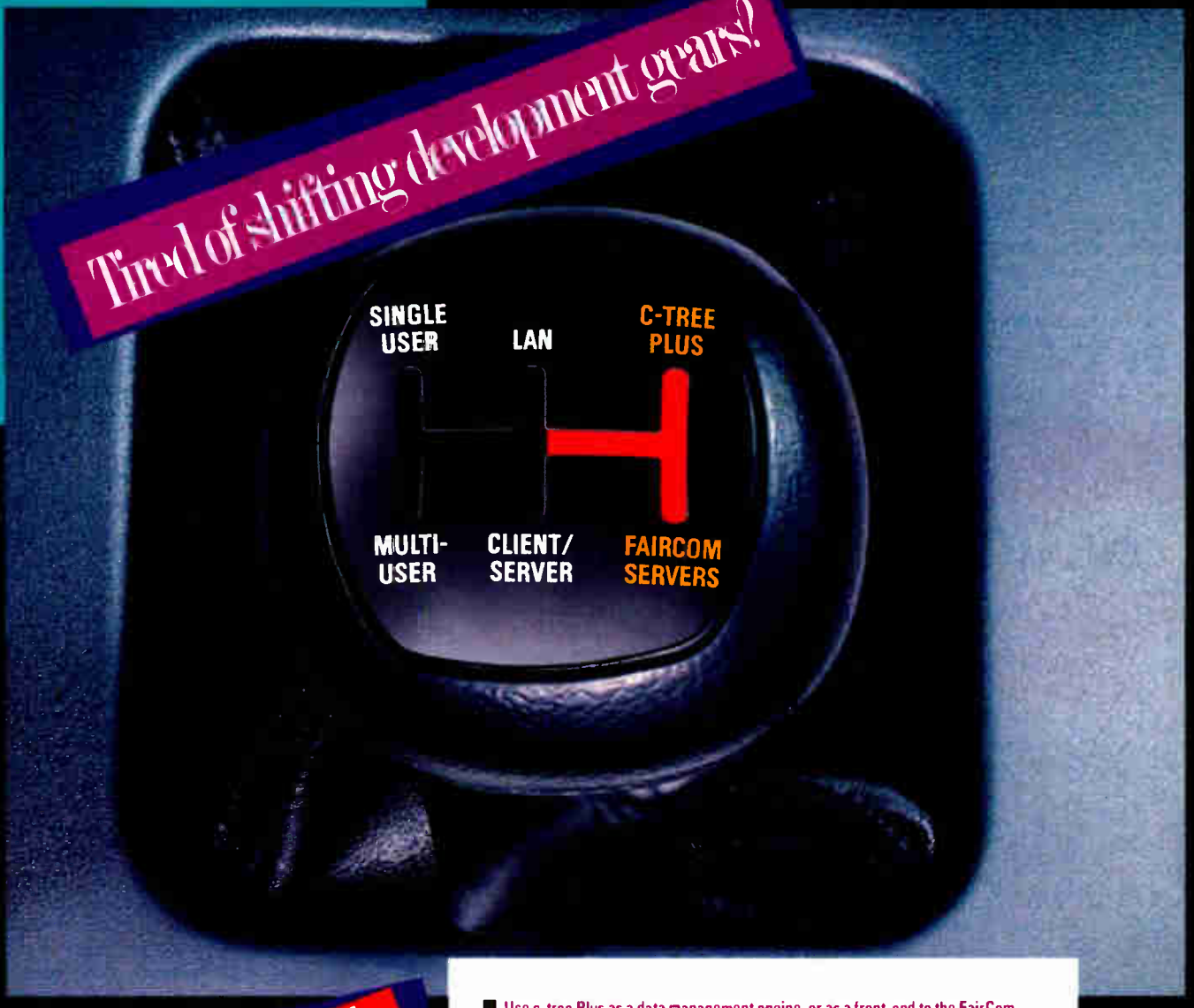
Object Professional for C++ requires Borland C++.
Satisfaction guaranteed or your money back within 30 days.
Includes dual media. Add $10 per order for shipping in US and Canada, add $40 per item for international airmail.
We accept MC, VISA, COD in US, and checks in US dollars.

TURBO Power

Circle 173 on Inquiry Card.

World Radio History

Tired of shifting development gears?



Let c-tree Plus and the FairCom Servers put you into overdrive.

■ **Use c-tree Plus as a data management engine, or as a front-end to the FairCom Server or FairCom SQL Server!**

Now you don't have to choose between different application configurations — c-tree Plus supports them all! You can use c-tree Plus to create single user, multi-user, or LAN applications, and easily adapt them to utilize the advanced client/server technology of FairCom Server or FairCom SQL Server, (which offers full ANSI-standard SQL functionality).

■ **c-tree Plus offers complete scalability!**

No matter what kind of platform you're running on (or moving to), c-tree Plus eliminates the tedious, time-consuming reprogramming normally required to move from one environment to another. With c-tree Plus, you don't change your source code at all — just recompile, link, and you're running on platforms ranging from Cray supercomputers to Zenith laptops!

■ **With the FairCom Servers, c-tree Plus offers powerful (and affordable) transaction processing capabilities!**

Using c-tree Plus as a front-end to the FairCom Servers, you can incorporate powerful transaction processing features directly into your applications, including full commit/rollback, intermediate savepoints and complete logging.

FairCom Servers can be tightly bound to your application.

■ **Order c-tree Plus, and put yourself in the driver's seat!**

Whether you currently need the power of client/server technology, or just need the most powerful data management system around, c-tree Plus is for you — order your copy today!

(800) 234-8180, Ext. 1

Circle 60 on Inquiry Card.

c-tree™ Plus

FairCom Server

FAIRCOM corporation

4006 WEST BROADWAY
COLUMBIA, MO 65203
PHONE 314 445 6833
FAX 314 445 9698

World Radio History

value, isolates nibble 0 from the data, and puts its value on its data port (DT0 through DT3). The notebook needs a signal of some sort, so the desktop uses the low bit of the nibble select as an indicator (data valid, or DAV). On the next clock cycle, the notebook sees that DAV has changed, grabs the data from its status port, and sets LT to the next nibble. After the desktop successfully transfers the third nibble, it waits for another key from the keyboard and repeats the process.

Stay Away from the Clock!

The desktop has nothing else to do during a transfer, so it polls the printer port looking for the data to change. The notebook doesn't have that luxury—after all, the point of this exercise is to let the notebook run normal DOS software from the remote keyboard. Fortunately, when it comes to clocks, the PC is a funhouse.

Every PC has a hardware clock built onto the motherboard. An Intel 8253 timer chip provides three channels of continuous, programmable time clocks. One channel is wired to the memory refresh; playing with that channel is certain death. The second is tied to the PC's speaker, letting the speaker make tones independently of the processor's clock speed. This channel is not only popular with application programs, it's difficult to read—so we'll pass on that one, too.

The last channel is programmed by the BIOS to a steady 18.2 ticks per second and feeds the DOS software time-of-day clock as well as the floppy BIOS. During normal operation, a tick comes in each $\frac{1}{18}$ second. A hardware interrupt (Int 08h) takes over and updates internal counters and the DOS time-of-day clock. It next transfers control to the user clock routine at Int 1Ch and then returns to the foreground program. The BIOS monitors these ticks to provide a stable time source for the floppy disk software. This is an important clock, but you can use it if you're careful. The easiest way is simply to key off the user clock interrupt, 1Ch.

Transferring a keystroke from the desktop requires four clock events. If each one takes $\frac{1}{18}$ second, it will take $\frac{4}{18}$, or $\frac{1}{4}$, second for each keystroke. I don't know about you, but I can type a lot faster than that. I think we can do better than this, but it may help to see how the notebook handles the incoming data first.

Transfer Across State Lines

Unlike the desktop machine, the notebook has to be free to run other applications. The protocol software on the notebook must run as an interrupt-driven process, timed by the PC's hardware clock. On each clock tick, the software takes control, checks to see if there's something to do, and then exits back to the foreground application.

If the notebook decides that the desktop has responded to its previous request, it grabs the nibble into memory. If this was one of the first three nibbles, you ask for the next one in sequence. After grabbing the fourth (and last) nibble, it checks to see if there's room in the keyboard buffer to store it. If there is, it stores the completed keystroke in the buffer and asks for the first nibble of the next keystroke. If there isn't, it simply exits and waits for the next clock tick to check again. The desktop will wait patiently, forever if necessary, for the next request. (See listing 1.)

A simple state machine forms the heart of the notebook software. Listing 2 shows a hacked-up version of the state machine, with the innards removed for clarity. On each clock tick, the appropriate code is executed for the current state.

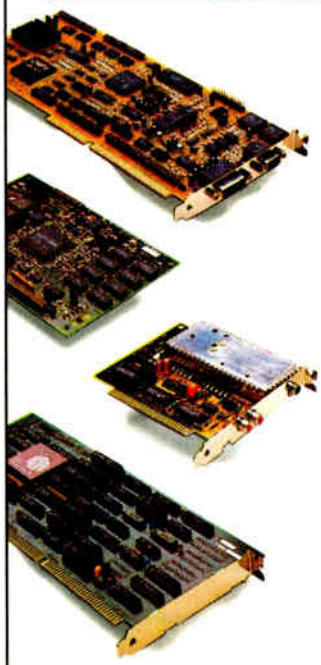
continued

New Low Cost Multimedia Product Family

Add multimedia to your PC

Run under MS Windows 3.0, HP NewWave, or MS DOS

Powerful new silicon offers unbeatable functionality at super, low prices



Super VideoWindows – $895

Display full motion video in a window on VGA monitor. Scale, crop, freeze. Image capture, save and restore. Sound control. Accepts VGA input for graphics/text overlay. Required software sold separately.

Super VGA Daughter – $395

Industry standard VGA (Headland's Video 7) attaches to Super VideoWindows for compact 1-slot solution of graphics/text overlay. IMB buffer.

Super TV Tuner – $395

Computer selectable antenna or 122 channel cable TV input. Combine with Super VideoWindows to watch TV on PC.

Super Still-Frame Compression – $995

JPEG compression up to 75:1 of color or grayscale images. Takes only seconds. All TGA file formats—TARGA 16, 24, and 32.

Celebrating Our 10th Year

NEW MEDIA GRAPHICS

New Media Graphics Corp.
780 Boston Road
Billerica, MA 01821

TEL: 508/663-0666
FAX: 508/663-6678

Order Now: 1-800-288-2207

Circle 111 on Inquiry Card.
VISA, M/C, and AMEX accepted.

World Radio History

Listing 2: *The notebook's state machine. Every time the clock-tick interrupt occurs (72 times per second), control is transferred to the state machine. Depending on where the algorithm left off, deal with one of the four incoming nibbles. If successful, set up for the next one; if not, keep the state the same and try again next time. The maximum transfer rate is 1 nibble every tick, or one complete keystroke every 4 ticks (18 per second).*

```
state_curr db ?
state_table dw ST_0,ST_1,ST_2,ST_3,ST_4
   .
   .
   .
   mov   bl,state_curr  ; grab the current state
   mov   bh,0
   shl   bx,1
   add   bx,offset state_table
   jmp   [bx]
ST_0:
; see if nibble 0 is available
   mov   al,0
   or    al,Keyb_status
   call  PORTOUT
   call  PORTIN
; if the data return bit is the same as the low bit of
; the address (in this case, a 0), then the data is valid
   mov   ah,al          ; make a copy
   and   al,Nibble_ret
   jnz   int_out        ; not yet
ST_0a:
; The data is the high bits of AH, adjusted
   and   ah,Data_mask
   xor   ah,Data_adj
   shr   ah,1
   shr   ah,1
   shr   ah,1
   shr   ah,1
   mov   al,ah
   xor   ah,ah          ; AX is 0, except the low nibble
   mov   Input_data,ax
   inc   state_curr
   mov   al,1
   or    al,Keyb_status
   call  PORTOUT
   jmp   int_out
ST_1:
; see if nibble 1 is available
   mov   al,1
   or    al,Keyb_status
   call  PORTOUT
   call  PORTIN
; if the data return bit is the same as the low bit of
; the address (in this case, a 1), then the data is valid
   mov   ah,al          ; make a copy
   and   al,Nibble_ret
   jz    int_out        ; not yet
ST_1a:
; The data is the high bits of AH, adjusted
   .
   .
   .
   jmp int_out
ST_2:
; see if nibble 2 is available
   mov   al,2
   or    al,Keyb_status
   call  PORTOUT
   call  PORTIN
   .
   .
   .
ST_3:
; see if nibble 3 is available
   .
   .
   .
; That's the last one. Store it.
; The data is the high bits of AH, adjusted
   and   ah,Data_mask
   xor   ah,Data_adj
   mov   bh,ah
   xor   bl,bl
   mov   ax,Input_data
   add   ax,bx
   mov   Input_data,ax
   mov   state_curr,4   ; in case the buffer's full
ST_4:
; output it
   call  store_buffer
; If al=0, no problem. If al=1, then buffer was full.
   cmp   al,0
   jne   int_out        ; couldn't save it
   mov   state_curr,al  ; back to state 0
   or    al,Keyb_status
   call PORTOUT
int_out:
```

The first state clears a 16-bit word and stores the nibble as the lowest-order bits. States 1 and 2 store the data in the correct positions. State 3 stores the final nibble and then tries to place the completed data in the keyboard buffer. If there's room, it resets back to state 0. If not, it goes to state 4, which simply retries the buffer on the next tick. As long as the buffer remains full, the state remains at 4 and the transfer is stopped.

Keyboard Buffers

In listing 2, `store_buffer` is a routine that handles getting the data into the keyboard buffer. On machines with a PS/2-compatible BIOS, that's simply a matter of calling the BIOS keyboard-stuffing function. Int 16h, function 5, takes a 16-bit scan-code/ASCII pair and places it as the last item in the keyboard buffer, as if it were typed.

Using the BIOS function is the preferred method because you don't have to know any machine-specific addresses. On many machines built before 1988, the BIOS doesn't have a clue what function 5 is. To store data in the keyboard buffer on these machines, you have to do it the hard way: You have to duplicate the code that the BIOS uses in its own keyboard hardware handler (Int 9h). If you have trouble getting this to work, you might try disassembling the BIOS handler.

Figure 2 shows the keyboard's buffering scheme. Somewhere in the 0040 segment, there's 16 words of memory reserved for storing keyboard information. Normally, BIOS Int 9h puts its keystrokes there so you can read them back through Int 16h. You're not supposed to access the buffer directly. For one thing, you can't assume that you know where it is—that varies from BIOS to BIOS. Also, programs that expand the keyboard buffer will replace this whole scheme with something else—maybe. If you play with the keyboard buffer and then crash the

World Radio History

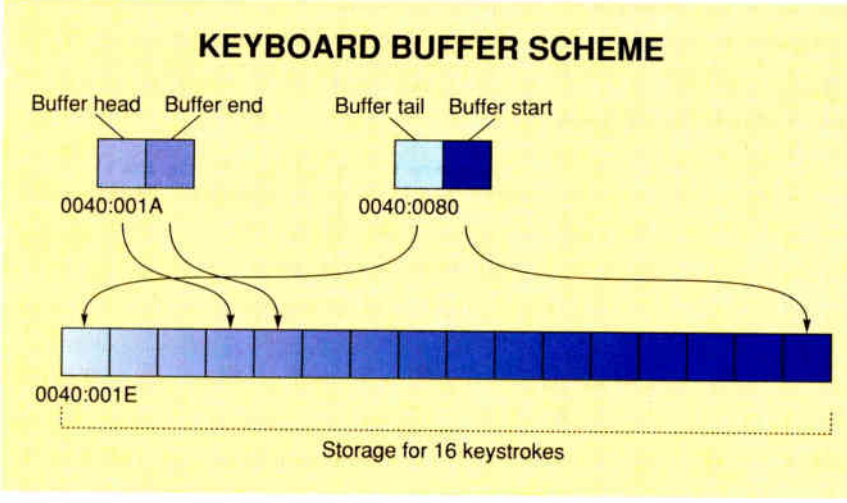


Figure 2: *The keyboard buffer has storage for 16 keystrokes, two pointers to the head and tail of a circular buffer, and two more pointers that determine the physical buffer boundaries. The ROM BIOS normally handles the buffer stuffing as part of the keyboard hardware interrupt, but you need to do it yourself if you're running on an old machine. Newer BIOSes have function calls to place data in the buffer.*

Listing 3: *Stuffing data into the keyboard buffer. First, use* [buffer_tail] *to find the next empty location. Then* [buffer_start] *and* [buffer_end] *tell you where the buffer boundaries are, unless this is a weird machine (assume standard values). Finally, store the data if there's room, and advance* [buffer_tail].

```
; Scan code/ascii char in DX is to be stored in the keyboard buffer
; Returns: AL=0 if OK, AL=1 if buffer full
   mov   ax,40h      ; keyboard data in segment 40
   mov   es,ax
   mov   di,es:[buffer_tail]
   mov   bx,di       ; this is where we'll store to
   add   di,2        ; point to next location
   mov   ax,es:[buffer_end]
; Some machines don't store the buffer start/end in [80],[82h]
   cmp   ax,0
   jne   sb_0
; For example, this one! Is this an old Compaq?
   mov   ax,3eh ; the 'standard' buffer_end
sb_0:
   cmp   di,ax
   jne   sb_nowrap
   mov   di,es:[buffer_start]
   cmp   di,0        ; legit _start?
   jne   sb_nowrap   ; looks like it
   mov   di,1eh      ; the 'standard' buffer_start
sb_nowrap:
   mov   ax,es:[buffer_head]
   cmp   ax,di       ; If =, then no more room
   je    sb_err
   mov   es:[bx],dx
   mov   es:[buffer_tail],di
   mov   al,0
   jmp   short sb_out
sb_err:
   mov   al,1
sb_out:
; Note--this is the equivalent of the following:
   mov   ah,5
   int   16h
```

machine, don't say I didn't warn you.

In addition to the 16-word buffer, 4 other words define where the buffer lives and its current status. Two words starting at 0040:001A are the `buffer head` and the `buffer tail`. The `buffer head` points to the next available word of keyboard data. The `buffer tail` points to the next empty spot. To find out where the buffer physically starts and ends in memory, look in locations 0040:0080 and 0040:0082 for `buffer start` and `buffer end`.

The idea behind buffer stuffing is this: Check to see if the buffer has room for new characters. If so, store the data and advance the tail pointer, using the start and end pointers to handle wraparound. Listing 3 shows the process. Take care to disable interrupts while you're messing with the keyboard buffer; if someone presses a key on the keyboard while you are doing it—well, it won't be pretty.

The next thing to consider is what happens if someone tries to print from within an application while you're slamming on the printer port. You've got data coming in on the printer status bits, and you don't want any applications sending data out or interpreting your incoming data as printer status. The easiest way to avoid this is to install a new printer BIOS routine—one that eats any attempts to print. KEYSLAVE.ASM uses a simple one that flushes any calls to the printer BIOS (Int 17h) and reports the call as successful.

The Funhouse Closes at Midnight

Earlier, I said that the system clock runs at 18.2 ticks per second. That seems an odd number, but it makes sense if you consider how the clock hardware works.

The 8253 timer is fed off a 1.19-MHz crystal, regardless of the CPU speed of the machine. For each of the three timers (remember the speaker and memory refresh), you give the 8253 a divisor. A divisor of 1 divides the clock by 1 and generates a signal at 1.19 MHz. The maximum divisor is 65,536, which generates an 18.2-Hz signal. The BIOS is coded in ROM to expect a signal at that rate. Changing it is easy, but that makes the DOS time-of-day clock go bonkers and freaks out the floppy disk BIOS software. If you're going to change it, you have to take that into account.

If you want to speed up the clock, simply set a different divisor in the 8253's registers and do something about the BIOS. Say you want to speed up the clock by a factor of 4. Instead of using 65,536 as your divisor, use 16,384. That will make the clock run four times as fast and confuse the BIOS beyond belief.

continued

World Radio History

Your interface doesn't have to be a straitjacket.

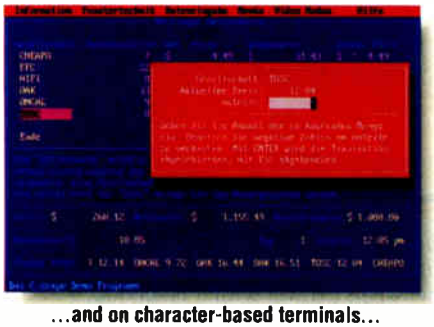
LIANT OPEN SYSTEMS PROGRAMMING TOOLS

C-scape is the most flexible user interface package for text or graphics-based applications.

All too often user interface management systems force you to program with your hands tied. You do things their way or not at all.

C-scape sets you free. It provides powerful features - scrolling windows, mouse support, menus, text editors, help, data entry, etc. - yet lets you tie your own functionality to these objects without touching the underlying code.

What's more, C-scape's object-oriented architecture makes it easy to integrate with any other C library. So you aren't locked into one solution.

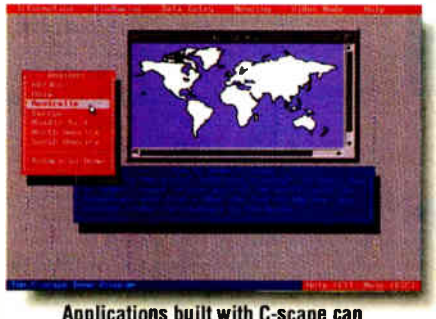


...and on character-based terminals...

Unlike many other screen managers, C-scape is a true windowing environment. Which makes it powerful enough to tackle the most demanding user interface requirements.

C-scape is also so easy to use you can affordably build elegant new interfaces even for simple applications and databases.

Prototyping and code generation are no problem. C-scape's Look & Feel interactive screen designer lets you create full featured screens, test them, and then automatically generate complete C source code or binary screen files.



Applications built with C-scape can run on PC's...

C-scape applications port without modification across DOS, extended DOS, OS/2, UNIX, AIX, the X Window System, QNX and VMS.

And since C-scape supports text and graphics simultaneously, it's a smart choice for users who want to add graphics to existing text applications.

See for yourself why thousands of programmers worldwide use C-scape. Call for a copy today. And escape the interface straitjacket.

...and under the X Window System.

Liant is the world's leading supplier of open systems programming tools, languages, and libraries. Call for your free Liant product catalogue.

30 DAY MONEY BACK GUARANTEE. CALL FOR FREE DEMO 1-800-662-9866.

LIANT

In Europe, call our Berlin office at 030-391-5045. Training and international support available.

Liant logo type, C-scape and Look & Feel are trademarks of Liant Software Corp. Other trademarks belong to their respective companies. Copyright © 1991 by Liant Software Corporation, 959 Concord St., Framingham, MA 01701. 508-872-8700, FAX: 508-626-2221.

Circle 196 on Inquiry Card (RESELLERS: 197).

World Radio History

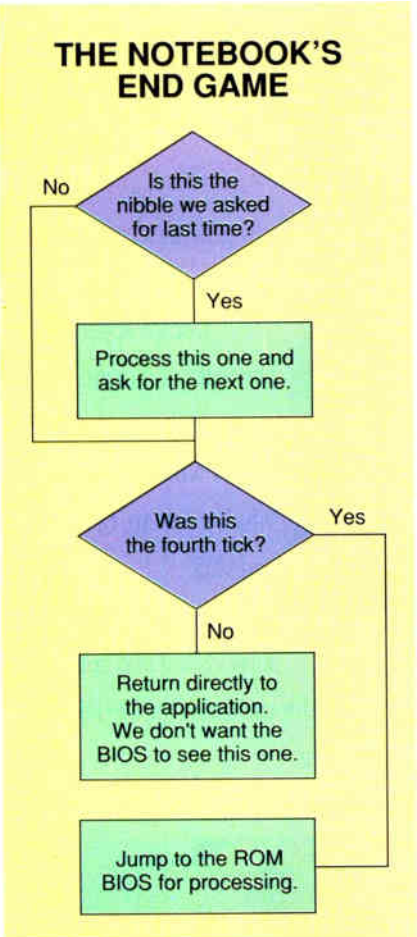


Figure 3: *After retrieving a nibble of data from the printer status port, see if it's the nibble you asked for (by looking at the returned least-significant bit from the desktop). After processing the data, increment a tick counter. If the counter reached 4, reset it to 0 and branch back to the ROM BIOS. If not, exit back to the foreground application so the clock software sees only 18 ticks per second.*

Listing 4: *At the end of the hardware clock interrupt, update a counter and see if it's the fourth tick. If it is, simply jump back to the ROM entry point in effect when you installed your own handler. By daisy chaining, the ROM software will never know you had control. If this isn't the fourth tick, reset the interrupt hardware and exit out of the interrupt routine. You won't call the ROM or any user clock software, but that's OK—they only expect to be called 18 times per second. To speed up the clock hardware, replace the default divisor with a smaller one.*

```
; part of the interrupt 08 handler...
chk_timer:
   inc    clock_div
   mov    al,clock_div
   cmp    al,4
   je     int_out2
; don't call the old one; it's not the fourth tick
   mov    al,EOI
   out    020h,al
int_out:
   .
   .
   .
; during the initialization...
; Speed up the clock by 4. The old divisor was 65535; we want 16384.
   cli
   mov    al,36h          ; mode 3, LSB then MSB
   out    Timer_ctrl,al
   jmp    short $+2       ; brief I/O delay
   jmp    short $+2       ; brief I/O delay
   mov    al,00h          ; LSB of 16384
   out    Timer_data,al
   jmp    short $+2       ; brief I/O delay
   jmp    short $+2
   mov    al,40h          ; MSB of 16384
   out    Timer_data,al
   sti
```

Now say that you intercept the hardware interrupt that normally goes to the BIOS. Maintain a counter for each interrupt that comes in, and on every fourth interrupt, hand control back to the ROM BIOS. On the other three, exit directly back to the foreground application. (See figure 3 and listing 4.) You'll have a 72-Hz clock, and the BIOS will have its 18.2-Hz clock and be none the wiser. The faster clock means a keystroke transfers in $\frac{1}{18}$ second instead of $\frac{1}{4}$ second.

Goodbye, Wimpy Keyboard

The last part is to tell the two computers which printer ports to use, but that's a simple matter of reading the DOS command line. It would also be straightforward to try each of the three possible ports, but this version doesn't bother. Once you get both programs assembled and cable the two machines with your LapLink cable, you're ready to run your notebook from your desktop's keyboard.

Some kinds of programs won't work: Programs that take over the keyboard interrupts and provide their own buffering won't find the data you're stuffing in the default buffer. Windows is a prime offender, as are XyWrite and many third-party keyboard-buffer enhancers. Also, programs that look for raw unprocessed key presses won't see them; your desktop doesn't pass those along.

Lastly, be careful of BASIC. BASIC doesn't know you've reprogrammed the clock, and it speeds it up four times, not knowing that you've already done that. When you exit back to DOS, BASIC puts the clock back to 18.2 Hz. Rerun KEYSLAVE.COM; it recognizes that it's already in memory and simply resets the clock rate. And note that while KEYSLAVE feeds data into the keyboard buffer, it makes no attempt to disable the notebook's keyboard. Both keyboards operate in tandem.

Now when I travel with a notebook, I can use the machine's standard keyboard on the road, and connect a cable and use my MultiMate Business Advantage keyboard when I get back to my desk.

KEYSLAVE could also come in handy in the BYTE Lab. We'll occasionally put a machine in our environmental chamber for low- or high-temperature testing. Prior to KEYSLAVE, there was no way to run the machine while it was under test. Now, if a vendor says its machine can run Lotus 1-2-3 at 120°, we can check it out. This could be the beginning of a new BYTE benchmark.... ■

Editor's note: *KEYSLAVE and KEYBRD are available in electronic format. See page 5 for details.*

Howard Eglowstein is a testing editor for the BYTE Lab. You can reach him on BIX as "heglowstein."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

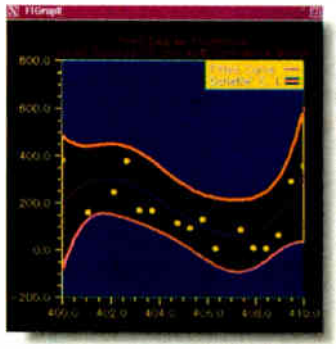
World Radio History

Our graphics toolkits start where X ends.

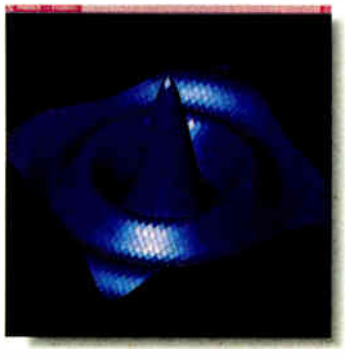
If you're a graphics developer, you know the problems creating advanced graphic applications on X.

Fortunately, our toolkits can add the high level graphics functions your X applications need. Quickly, easily, seamlessly.

Our toolkits also provide your applications computer independence. So you can run on non-X platforms from PCs to supercomputers. Even better, platform independence is not provided at the expense of graphics speed.



FIGraph makes creating any kind of chart or plot easy.



FIGARO+ is the most powerful graphics tool available.

Use our toolkits to upgrade your current X applications without the pains of X programming. Our toolkits actually integrate with X, not merely coexist with it.

Liant graphics toolkits. X is just the start.

FIGARO+™. The enhanced graphics programming toolkit.

FIGARO+ provides what X doesn't — dynamic and interactive modeling, viewing, modification and rendering of 2D and 3D interactive objects.

FIGARO+ also provides a sophisticated application programming interface to X. This support for X and PHIGS extensions to X (PEX), as well as for proprietary graphics accelerators, lets you use FIGARO+ to build truly portable 3D graphics applications.

FIGraph™. The advanced 2D & 3D charting and graphing toolkit.

FIGraph is an advanced 3D charting and graphing toolkit for graphics software developers who require sophisticated visualization capabilities. FIGraph features a wide range of 3D plotting and charting formats and can be integrated with FIGARO+ for complete customization.

C-scape®. The powerful interface management system.

C-scape is an object-oriented user interface package that supports both the X Window System and the curses library. Application source code produced with C-scape is portable between UNIX®, DOS, OS/2, VMS®, and other supported environments without modification.

C-scape makes applications come alive under the X Window System.

C-scape includes the Look & Feel® Screen Designer and simulation tool.

Call 1-800-662-9866 to learn more.

Liant is the world's leading supplier of open systems programming tools, languages, and libraries. Call for your free Liant product catalogue.

LIANT

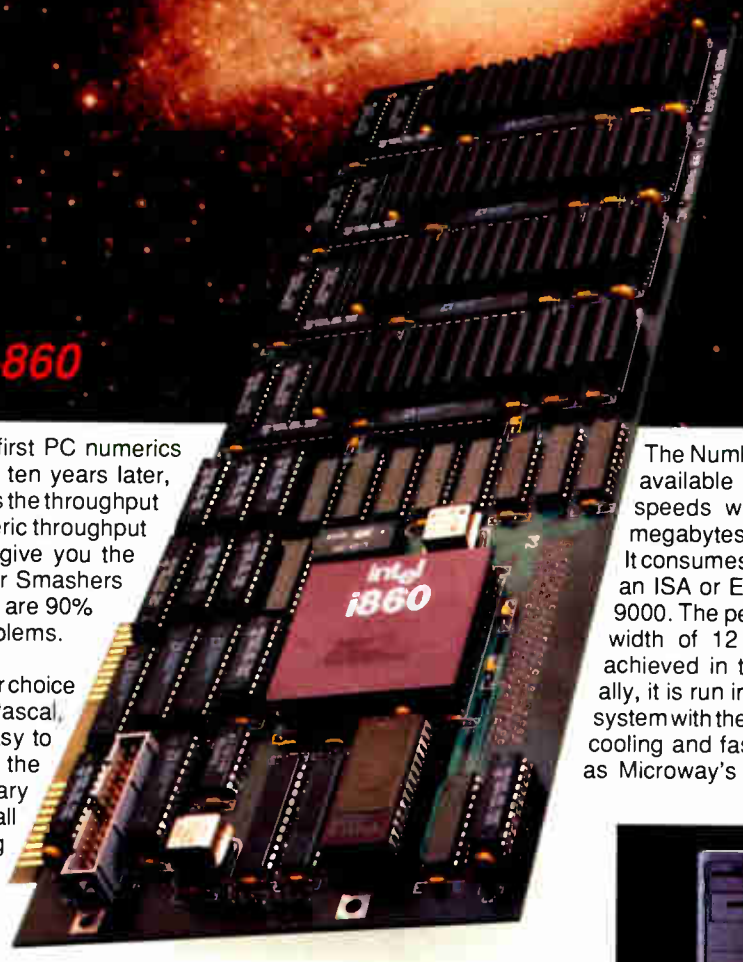
Liant logo type, FIGARO+ and FIGraph are trademarks of Liant Software Corp. C-scape and Look & Feel are registered trademarks of Liant Software Corp. Other trademarks belong to their respective companies. Copyright © 1991 by Liant Software Corporation, 959 Concord St., Framingham, MA 01701. 508-872-8700, FAX: 508-626-2221.

Circle 200 on Inquiry Card (RESELLERS: 201)

World Radio History

LIGHT YEARS AHEAD!

Number Smasher™-860



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

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

The Number Smasher-860 is available in 33 and 40 MHz speeds with either 8 or 32 megabytes of 64-bit memory. It consumes 35 watts running in an ISA or EISA PC or the HP-9000. The peak i860/host bandwidth of 12 megabytes/sec is achieved in the EISA bus. Ideally, it is run in a high quality 486 system with the appropriate power, cooling and fast hard disks, such as Microway's 486-B^3 or 486-B^2T.

486-B^2T

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

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

Microway®

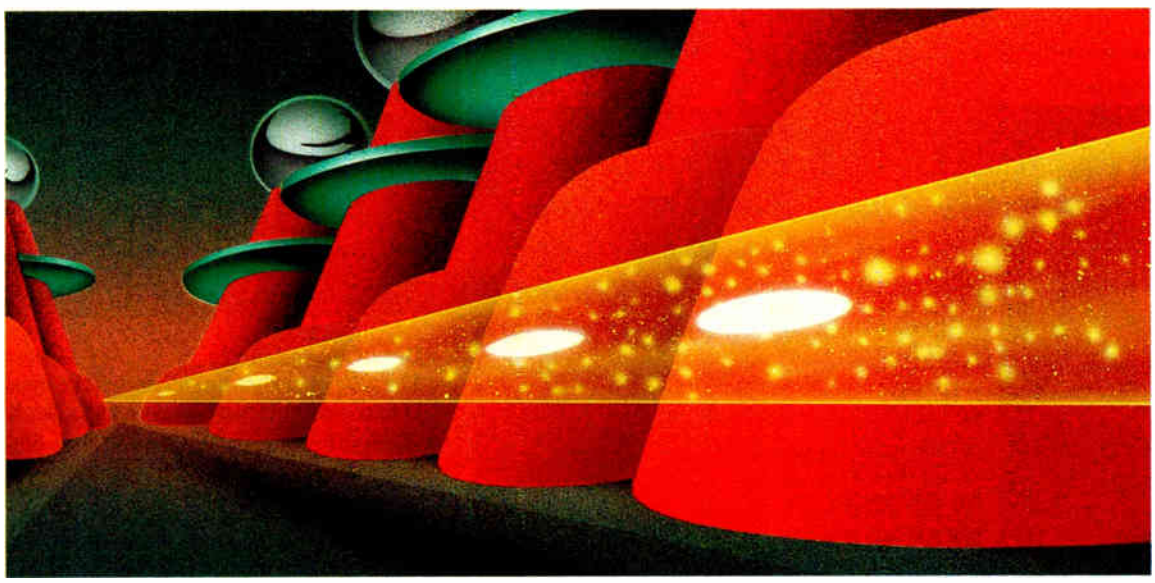
The World Leader in PC Numerics

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

World Radio History

PETER WAYNER

PROCESSOR PIPELINES



Making modern processors live up to their rated speed is no easy task. Although much of performance can be attributed simply to making chips smaller, a good bit comes from careful designs that keep data moving in a smooth and highly optimized path. At the center of modern chip architectures is the pipeline—literally, an assembly line for computation. Pipelines speed up calculations in much the same way that Henry Ford revolutionized car production.

Automotive engineers examine the list of tasks required to build a car and then split the list into jobs to be performed at *n* sequential stations. Each stage does its work and passes the result on to the next stage. If the engineers have done a good job dividing the work into *n* equal pieces, each car gets built in almost the same amount of time it would take without the assembly line—and *n* cars get worked on at the same time.

In the abstract, a computational pipeline works the same way. Computations are divided among *n* functional units. The first unit typically decodes an instruction into internal signals. When it finishes, it passes the instruction on to the next unit, which handles the next part of the computation—typically fetching data. (Meanwhile, the first unit starts decoding the next instruction.) Then the actual arithmetic is performed, and the results are stored in registers or memory.

The pipeline works faster because each small unit completes its task in about $1/n$ the amount of time as a large, single unit that does all *n* tasks. The result is that the processor effectively executes *n* instructions simultaneously. Each instruction still takes the same amount of time to complete, but the chip can go *n* times faster because a new instruction completes every *n* steps.

Henry Ford would have liked the Mips R4000, the IBM RISC System/6000, and the Intel 486

The idea sounds quite simple, but there are problems that make implementing a pipeline difficult. I'll compare the pipelines of some modern chips like the Mips R4000, the IBM RISC System/6000, and the Intel 486 to illuminate some of the details and design constraints facing computer architects today.

Superpipelined, Superscalar, and CISC/RISC Hybrid

A superpipelined processor like the Mips R4000 (see "The Mips R4000," December 1991 BYTE) attacks the throughput problem by pushing compartmentalization to the limit. The R4000's predecessor, the R3000, featured a five-stage pipeline. The R4000 goes further, subdividing instruction fetching and data cache access to create an eight-stage pipeline that advances at double the processor's clock speed. The stages of the R4000 chip's pipeline are Instruction Fetch First Half, Instruction Fetch Second Half, Register Fetch,

ILLUSTRATION: JOE SPENCER © 1992

"Master C eschews flash for elegant competence, and it works!"

Jeff Dunteman - PC Techniques

Master Pack ($59.90) $_____
(includes all of the above plus Master C)
Add Shipping
($5 USA - $10 Canada - $30 Foreign) $_____
Texas Residents add 8.25% Sales Tax $_____
Total amount of your order $_____

Circle 102 on Inquiry Card.

World Radio History

Instruction Execute, Data Cache Access First Half, Data Cache Access Second

of the pipeline running at the same time. The RISC System/6000's pipelines share

sor. RISC chips like the R4000 and the RISC System/6000 feature simple in-

UNDER THE HOOD

stages. The writing back to registers happens right after the execution phase. This means that only one bubble needs to be inserted into the pipeline. Why, then, does the R4000 expose itself to such severe stalls, given that these data dependencies must be quite common? Mips has a solution: code reordering.

What if you had a smart compiler that would recognize when there was going to be a data dependency between two instructions? It might notice that there are four instructions that have nothing to do with register 3. It could move these instructions between I1 and I2, and when I2 got to the register-read step, the result of I1 would be waiting for it. Mips, in fact, has such a compiler that can reorder code so it flows optimally.

Data dependency affects the 486 less critically. The 486 pipeline is short, in part because it is much harder to reorder code for the 486. Chips belonging to the 486's family tree have only eight registers, and when you reorder code, you need extra registers to hold the values between the different instructions. When you spread out the instructions, you need to keep more values "live" at the same time. It's like juggling. The Mips chip can keep 31 balls in the air, but the Intel chip can handle only eight.

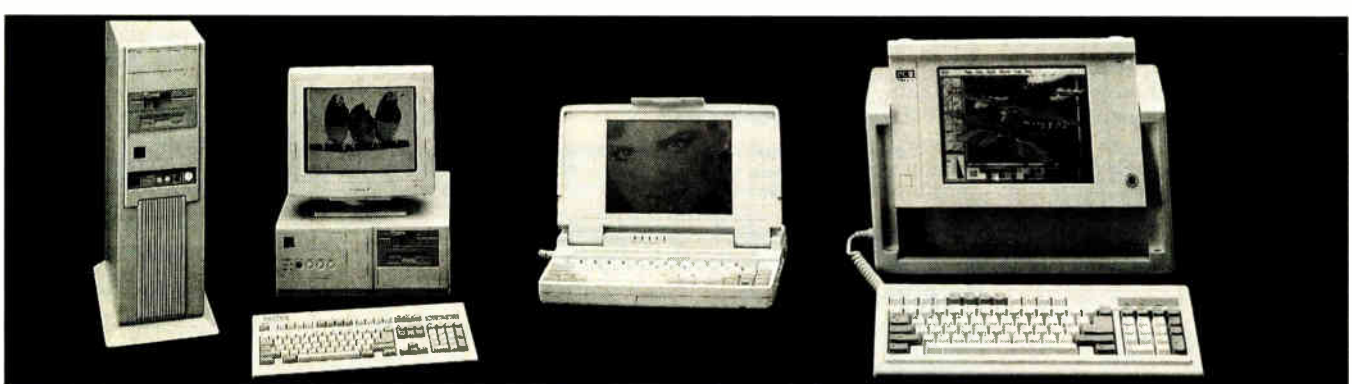
The order of instructions can make a big difference in throughput.

The important lesson is that the order of instructions can make a big difference in throughput. One approach to ordering places the burden on the programmer. For example, *The Intel i486 Programmer's Reference Manual* advocates arranging code to avoid data dependencies. Full-blown RISC chips, however, rely on compilers that automatically produce an optimal ordering. If the compiler doesn't do this, there are lots of pipeline bubbles, and throughput suffers.

Branch Prediction

Data dependencies aren't the only way to stall a pipeline. Imagine that one instruction is a branch on the condition that a register's value is greater than zero. Which instruction should follow this branch instruction in the pipeline—the one that would follow if the branch were taken, or the one that would follow if the branch were not taken?

Engineers have analyzed traces of thousands of programs running through processors. They've found that when branches point backward toward the beginning of a program, they are taken about 90 percent of the time. This pattern corresponds to loops that often execute many times. When branches point forward, however, they are taken only 50 percent of the time. For this reason, the 486 and the R4000 will make a guess and follow the path most taken. If the guess turns out to be wrong, the pipeline must be flushed clean and started again with the correct instruction. The 486 loses



Desktop NI Super VGA Color System

PCI 386SX-20MHz $1,445
PCI 386-25MHz $1,545
• 2MB RAM • 85MB IDE HD (19ms)
• 1.2 & 1.44 MB FD • 16 bit Super VGA Card with 1MB RAM
• 14" Super VGA Color Monitor
• 2 Serial, 1 parallel and game ports • 101-key keyboard
• Case & power supply • DOS 5.0
• Windows 3.0 with mouse • 30-day money-back guarantee
PCI 386-33 ..... $1,845
PCI 386-40 ..... $1,945
• same as above configuration • 64K Cache memory
• 4MB RAM • 120MB HD
PCI 486-33 ..... $2,495
PCI 486-33 EISA $3,295
• same as above configuration • 256K Cache memory
• 200 MB IDE HD (14.5MS) • 4MB RAM

Notebook 386SX $1,895

• 2MB RAM • 1.44MB FD
• 40MB HD • Serial and parallel
• Ext. keyboard port
• Ext. monitor port
• Carrying Case
Fortune 1000 companies, Universities and Government purchase orders welcome.
All systems come with 2 years labor + 1 year parts warranty.
Free lifetime toll-free technical support

LCD VGA Portable

386SX-20MHz $1,495
386-25MHz $1,645
386-33MHz $1,795
• 2MB RAM • 1.2MB & 1.44MB FD
• 85MB hard disk
• LCD 640x480 screen
• LCD VGA display
• Serial and parallel
• 86 key detachable keyboard
• 200W power supply
• 9.1" (H) x 7.5" (D) x 16.1" (W)
486-33 MHz.... $2,895
256K Cache Memory
4MB RAM
200 MB IDE HD (14.5MS)

Plasma VGA Portable

386SX-20MHz $1,645
386-25MHz $1,795
386-33MHz $1,945
• 2MB RAM • 1.2MB & 1.44MB FD
• 85MB hard disk
• Plasma VGA 640x480 screen
• Plasma VGA card
• Serial and Parallel
• 86 key detachable keyboard
• 200W power supply
• 9.1" (H) x 7.5" (D) x 16.1" (W)
486-33 MHz.... $3,095
• 256K Cache Memory
• 4MB RAM
• 200 MB IDE HD (14.5MS)

OFFICE HOURS: MON-SAT 8:30AM-5:30PM PST
Price Subject To Change Without Notice

PACIFIC COMPUTERS

9945 LOWER AZUSA, TEMPLE CITY, CA. 91780
TOLL FREE 800/346-7207 • FAX: 818/442-9112

Circle 118 on Inquiry Card

World Radio History

Are you too wrapped up in your work?

Today's business has a problem. It's overflowing filing cabinets. It's waiting for someone to type it into our systems. Or to find out where it's been filed. Quite literally, it's burying our best ideas alive. ● The problem is paper. Or, more precisely, how to cope with all the information that comes to us on paper. ■ We are pleased to report, however, that there is a solution. Calera's OCR (Optical Character Recognition) technology lets you convert any paper or electronic fax document to word processing, spreadsheet, desktop publishing or database applications (with Windows). Ready in moments for revisions, retrieval or networking and E-mail. Among our powerful range of OCR systems and software: WordScan™ and WordScan Plus. The former, offering a broad set of features at a price anyone can afford. The latter, with productivity tools not found anywhere else. Which is why Calera consistently wins first place awards from *PC Magazine*, *PC Week*, *Infoworld*, *Byte Magazine* and others worldwide. ■ So call Calera today for information about our OCR productivity tools. And let us take the wraps off new ways to handle all that paperwork.

CALERA
RECOGNITION SYSTEMS

475 Potrero Ave., Sunnyvale, CA 94086 USA
(800) 544-7051 Outside USA (408) 720-0999 FAX (408) 720-1330

*Call (800) 544-7051 For The Name Of The Dealer Nearest You And For A Free Full-Working Evaluation Copy Of WordScan Plus.**

©1991 Calera Recognition Systems. Calera® is a registered trademark and WordScan™ is a trademark of Calera Recognition Systems, Inc.
All other products and brands are the property of their respective trademark holders. *Offer valid in USA only.

Circle 32 on Inquiry Card.

World Radio History

three cycles when this happens, because there are three stages between the execution unit that decides the branch and the beginning of the pipeline. The R4000 only loses two, because it does not have the extra address-generation step. This is one place where the clean RISC instruction set pays off.

One standard solution to this problem is a delayed branch. In this case, a pipeline is not cleared, and the instructions that are in it are allowed to finish. To a programmer, this means that a branch may come into effect one or two instructions *after* it is executed. This can be quite useful if it is possible to move an instruction with no data dependencies later in the instruction stream. For instance, consider the case where one instruction (I1) is R1 + R2 −> R3 and the next instruction (I2) is IF R4>0 THEN Branch. It's possible for I2 to go down the pipeline before I1 does. Then, if the branch is taken, I1 can execute, and the program is not required to insert bubbles. The compiler must be aware of this problem and be able to shuffle the code around without destroying dependencies.

The RISC System/6000's approach to the branch dilemma differs from that of the 486 and the R4000. Its instruction set has an additional compare instruction that will set a 1-bit condition-code register based on the values in some data register. The branch instruction simply tests the value of this condition register.

Just splitting the branch instruction in two doesn't solve the problem of delays when an unexpected branch is taken. The compiler must still position this condition-code instruction at least three instructions before the branch to ensure no lost time. In this respect, it's just like the Mips delayed branch—the register values being tested must still be ready three instructions before the branch.

The difference is that the RISC System/6000's instruction dispatch stage, which comes second in the pipeline, decides branches. The R4000's branch instruction is computed by the execution stage. The branch instruction must travel the length of the pipeline, and if the branch isn't taken, it ends up as a bubble. The RISC System/6000 doesn't prejudge a branch. It fetches and starts decoding the computational instructions from both sides of the branch. When the condition code is set and read by the second stage, it then sends the correct instructions down the pipeline to be executed. There is no branch instruction traveling like a bubble down the pipe.

Of course, this won't work every time. There will be many situations in which the IBM compiler will not be able to move the condition test three instructions before the branch. The chip designers, though, analyzed the instruction streams of many programs and decided that the strategy would pay off on average.

The Resistance of Memory

Although silicon memory has gotten relatively inexpensive, it has not become correspondingly fast. Several very fast cycles of modern CPUs will be wasted before the memory answers with the right value. For this reason, RISC instruction sets are designed to decouple the loading and storing of information from the computation on that information. That way, a compiler can schedule the load of a value several instructions before the computation takes place with the value. The RISC System/6000 and the Mips R4000 both take this approach. It's one reason that RISC chips have many registers: They need places to store

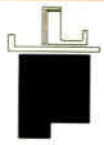
Computer Friends, Inc.

Celebrating Ten Years in Business
1982 - 1992

Super compact computing power and portability via the 2001 Data Dream

✦ Weighs only 2.9 lbs. ✦ Full-sized screen and keyboard. ✦ Solid-state storage up to 1 MEG with two 512k disks. ✦ Up to 30 hours of battery life with standard or rechargeable four AA batteries. ✦ Built-in DR-DOS and LotusWorks™, Word Processor, Spellchecker, Thesaurus, Database, Spreadsheet and Communications package. ✦ Parallel, serial, mouse, CGA monitor ports, built-in. Optional 2400 baud Micro-modem or 9600 baud Pocket fax/modem. Ask for brochure.

2001 Data Dream ONLY $799.00



Recharge Ink-Jet Cartridges

Save hundreds of dollars with Jet Master

Extremely simple and cost-effective way to recharge ink-jet cartridges—single color & multicolor: deep black, green, bright red, blue, brown, orange. Cyan, magenta and yellow for multicolor printers.

Jet inks & kits available in black, color, and waterproof.

Kit for PaintJet, ColorQuick	JM1	$49.95
Kit for DeskJet, DeskWriter, Tek 4696	JM2	$24.95
Kit for ThinkJet, QuietJet, Diconix	JM3	$29.95
Kit for Tektronix Color Quick	JM4	$49.95
Kit for Bubble Jet, Stylewriter, ExecJet	BJ1	$37.95

Shipping $5.50

Universal Cartridge MacInker shown with Epson cartridge

Re-ink ANY Printer Ribbon for less than 5¢ with MacInker

Over 24,000 printers supported. Better than new print quality. Extended printhead life thanks to lubricated ink. Average cartridge can be re-inked 60-100 times. Multicolor adapters re-ink multiband cartridges. Documented customer savings of up to $30,000/year. Detailed free catalog.

Universal Cartridge (includes one adapter)		$ 79.45
Multicolor Adapter (specify printer)		40.00
Epson only MacInker™ model 271EP		48.00
Imagewriter only MacInker model 2341M		48.00
Universal Spool MacInker		79.45
Heat Transfer Adapter		25.00
Extra Ink Bottle, Black $3.00	**Pint**	$ 18.50
Multicolor Ink Set (4-color)		$20.00

All units come with bottle of ink, meter, reservoir, reservoir cover. Single & multi-color, standard and heat transfer cartridges available: red, green, blue, brown, purple, yellow, orange.

OCR Scanner

Don't type it, scan it with Character!

Full page scanner with an automatic sheet feeder at no extra charge. 100-400 dpi selectable resolution. Complete with PC interface, cable & image software. *Perceive* OCR software $99 if purchased with Character! Ask for detailed brochure. **Character 400P** $ 499.00

Diskette Doubler

Increase 3.5" disk capacity to 1.44 Megs with this ingenious & handy device. **Diskette Doubler is only $29.95!**

New electric ribbon bonding device—**MacBond II**, splices & welds ribbons in seconds. We have ribbon in bulk in any width, color & type

MacBond II (to 7/8"width) $299.00

Computer Friends has a complete line of modems, buffers, & cables, and other re-inking options. Call 503-626-2291 for more information.

Computer Friends, Inc.
14250 NW Science Park Dr.
Portland OR 97229

Satisfaction or 30 day refund - Prompt shipment - Major credit cards and COD. PO's from nat'l accounts - Shipping charges $5.50 or actual cost + $2.00 handling

Order Toll Free 1-800-547-3303
In Oregon (503) 626-2291
Fax (503) 643-5379 Telex 4949559 CF

Circle 40 on Inquiry Card

World Radio History

GREAT PERFORMANCE GETS YOUR ATTENTION GREAT TECHNOLOGY KEEPS IT

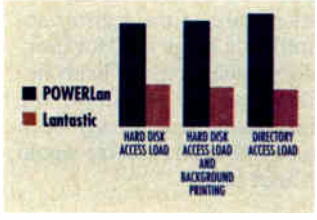
POWERLan

DOS Networking

"POWERLan swept all of the performance categories on our benchmark tests."

"If you need to link DOS, OS/2, Unix, and other platforms in an interoperable network ... POWERLan is the product to choose"

"you can't ignore this powerhouse, POWERLan's features speak for themselves; its speed convinces"



PC MAGAZINE EDITORS' CHOICE

June 25, 1991
POWERLan, Version 2.10

Circle 127 on Inquiry Card.

POWERsave

Network Backup

"This is the fastest single-file restore we found in any of the systems, including server-based units. We didn't believe it either until we ran the test three times."

"simple to use"

"Performance Technology may have the fastest workstation-based drive in Netwaredom."

"offers excellent progress tracking"

"operates ... at warp speed"

LAN Times, June 17, 1991

LAN TIMES RECOMMENDED FOR NETWORKING 1991

POWERfusion

DOS - UNIX Connection

"In our benchmark tests, Performance Technology lived up to its name."

"... the POWERfusion family can support large networks of busy users and still deliver"

"If you're looking for a way to connect your Unix box to a network of DOS-based PCs, look no further."

PC MAGAZINE EDITORS' CHOICE

May 28, 1991
POWERfusion, Version 1.3

"Performance Technology is selling glue technology that can help solve a variety of local- and wide-area networking problems. Lord knows, that's something we all need."

BYTE, March 1991

POWERbridge

LAN to LAN Connection

"Usually I wonder about a product that has "power" associated with it, but POWERbridge ... deserves the honor."

"POWERbridge supports nine operating systems ... links all the networks you'll ever have."

LAN Times, February 4, 1991

"... well, you haven't lived until ... (you) ... hop through a NetWare LAN to an SMB server running under Unix" (with POWERbridge)

BYTE, March 1991

Sure, we like to make products that go fast. But, performance is just one quality we take seriously. Operating in multi-vendor environments is high on our list too. And there's lots more. Call us to get the rest of the story.

PERFORMANCE TECHNOLOGY

800-FAST-LAN
800-PC-2-UNIX
512-349-2000

World Radio History

values as loads and stores occur.

In the R4000, execution comes third in the pipeline, and memory access comes afterward. This is a great compromise, because it means the chip has only a two-cycle latency when a branch is not taken. The memory-access stages cannot cause the pipeline to be flushed, so it doesn't matter if they come later in the pipeline. Mips is betting that the compiler will be able to move the load and store instructions far enough apart to ensure that there are no data dependencies.

The 486's CISC instruction set includes instructions that load, compute, and store in a single operation. The loads and stores are, therefore, bound to the execution stage. Intel's engineers would probably like to have made the 486's execution stage come third instead of fourth so that a bad branch would result in a shorter pause, but they needed the address-generation step. In the end, the engineers did a careful analysis and decided that the benefit of the address-generation step outweighed the cost of lost cycles at branches.

What if the Pipeline Stalls?

At this point, you should realize that there is plenty of code being reorganized to keep the R4000 and RISC System/6000 pipelines from stalling. The RISC philosophy has always assumed that compilers will be able to make the right decisions and reorganize everything. In the worst case, this can be a pretty difficult problem. A compiler might need to consider an exponentially growing number of possible solutions before coming up with an answer. In most cases, however, a compiler is able to find a good solution and make it work.

Even if optimization fails to avert a stall, however, there's still merit in the pipelined approach. Consider this short section of code:

```
Load R1,Address #1
Load R2,Address #2
R1 + R2 -> R3
Store R3, Address #3
```

The third operation—an addition—cannot finish until the two loads do. The addition operation stalls at the register-access stage until this happens. However, when the information from the loads becomes available in the registers, the arithmetic instruction has already been decoded. A nonpipelined machine would not have this head start.

Rearranging the Code

Although RISC chip users have always known they would need smart compilers, many PC users are not used to the notion of pipeline optimization. The order and arrangement of instructions can affect the running speed of the 486 in a substantially different way than it affected earlier chips. Although the 486 will still run 8088 programs, some combinations of instructions exploit the pipeline much better than others do.

One example is indexed addressing. The 486 works faster if you use simple instructions that do not require it to add an index register to a base register to determine an operand's address. Here is an example from *The Intel i486 Programmer's Reference Manual*. The instruction

MOV EAX, [ESI]

uses ESI as a base register and loads from the location it points to. The instruction

MOV EAX, [ESI*]

Circle 17 on Inquiry Card

World Radio History

INTRODUCING GENERIC CADD 6.0

FULL-TIME CADD AVAILABLE FOR PART-TIME WORK.

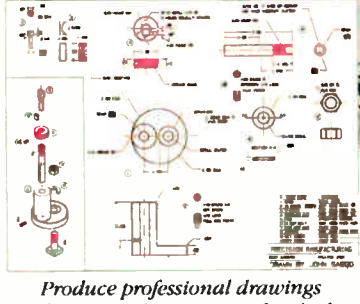
eneric CADD® 6.0 is a feature-rich
mputer-aided design and drafting
ol for those who want high-end
rformance at a reasonable price. It's
eal for the busy engineer or designer
no may require CADD just part of the
ne. Today, Generic CADD offers more
wer than ever.

MPORT AUTOCAD ILES DIRECTLY

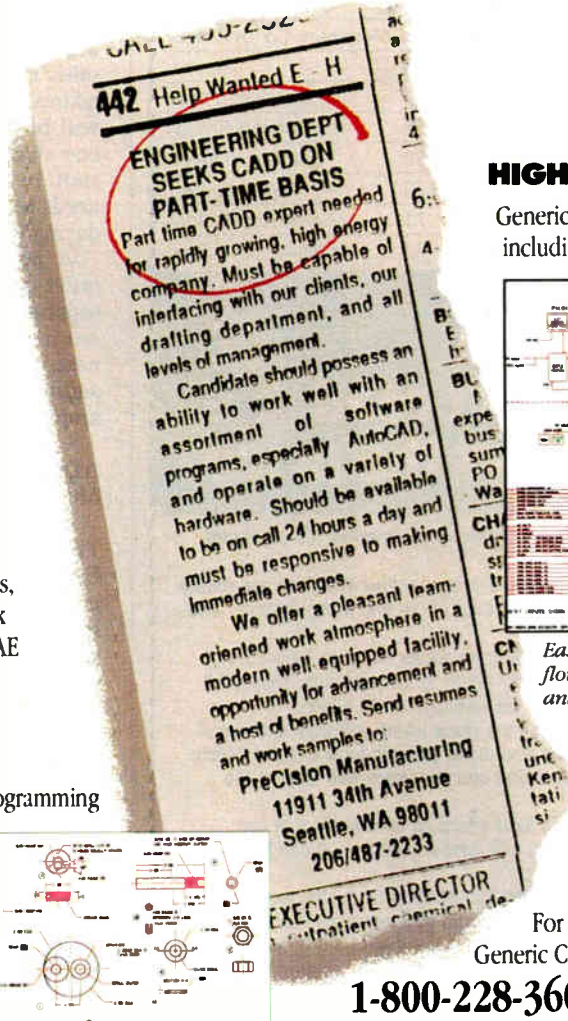
ith Generic CADD 6.0 you can easily
port 2D files from AutoCAD®-based
signers and drafting departments. Plus,
fast DXF In/Out feature lets you work
ith a myriad of popular CAD, CAM, CAE
d GIS software.

EW FEATURES ND EASE OF USE

eneric CADD 6.0 has a new macro programming
nguage to help you elim-
ate repetitive commands.
r even create new fea-
res. A multi-view option
ts you split the screen
to windows, each having
different zoom factor. Its
ll-of-material generator
uilds parts lists and
ports. And thanks to
tensive online help and
l-new tutorial, you'll be
roductive in just hours.

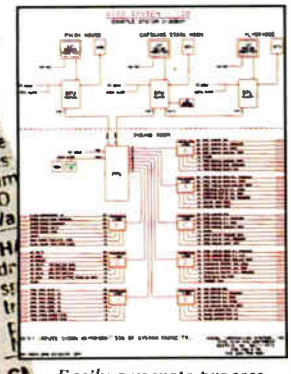


Produce professional drawings from initial concepts to finished production blueprints.



HIGHLY COMPATIBLE

Generic CADD 6.0 runs on standard desktop PCs, including XTs, ATs, 386s and even laptops. Plus, it works with leading word processors, desktop publishers and draw and paint programs. Such as WordPerfect, PageMaker and CorelDraw.



Easily generate process flow, system diagrams and schematics.

PRICED RIGHT— EVEN FOR PART-TIME WORK

At $495, you can easily justify the cost of Generic CADD 6.0, even if you use it only part of the time. It's so affordable every engineer can have a copy.

For more information or the name of a Generic CADD retailer near you, call us at

1-800-228-3601, Ext. 803.

PC MAGAZINE EDITORS' CHOICE
December 17 1991
Generic CADD 5.0

"For pure ease of use, power, and speed at a reasonable price, Generic CADD (5.0) is hard to beat."
PC Magazine 12/17/91

AUTODESK

opyright 1991 Autodesk Retail Products. All rights reserved. Generic CADD is a registered trademark of Autodesk
tail Products. AutoCAD is registered in the U.S. Patent and Trademark Office by Autodesk, Inc. WordPerfect
d PageMaker are trademarks of WordPerfect Corp. and Aldus Corp. respectively. Autodesk Retail Products,
911 North Creek Parkway South, Bothell, WA 98011, FAX 206-483-6969.

Circle 63 on Inquiry Card.

World Radio History

1	Exxon	25	Standard Oil (Ohio)	49	Consolidated Foods
2	General Motors	26	AT&T Technologies	50	Lockheed
3	Mobil	27	Boeing	51	Georgia-Pacific
4	Ford Motor	28	Dow Chemical	52	Monsanto
5	IBM	29	Allied	53	W.R. Grace
6	Texaco	30	Eastman Kodak	54	Signal Companies
7	E.I. du Pont	31	Unocal	55	Anheuser-Busch
8	Standard Oil (Ind.)	32	Goodyear	56	Nabisco Brands
9	Standard Oil of Cal.	33	Dart & Kraft	57	Johnson & Johnson
10	General Electric	34	Westinghouse Elec.	58	Coastal
11	Gulf Oil	35	Philip Morris	59	Raytheon
12	Atlantic Richfield	36	Beatrice Foods	60	Honeywell
13	Shell Oil	37	Union Carbide	61	Charter
14	Occidental Petroleum	38	Xerox	62	General Mills
15	U.S. Steel	39	Amerada Hess	63	TRW
16	Phillips Petroleum	40	Union Pacific	64	Caterpillar Tractor
17	Sun	41	General Foods	65	Aluminum Co. of Amer.
18	United Technologies	42	McDonnell Douglas	66	Sperry
19	Tenneco	43	Rockwell Int.	67	Gulf & Western Ind.
20	ITT	44	PepsiCo	68	Continental Group
21	Chrysler	45	Ashland Oil	69	Bethlehem Steel
22	Procter & Gamble	46	General Dynamics	70	Weyerhaeuser
23	R.J. Reynolds Ind.	47	3M	71	Ralston Purina
24	Getty Oil	48	Coca-Cola	72	Colgate-Palmolive

27 million Americans can't read. And guess who pays the price.

While American business is trying to stay competitive with foreign companies, it's paying an added penalty. The penalty of double-digit illiteracy.

Believe it or not, 27 million American adults can't read and write. Another 47 million are literate on only the most minimal level. That adds up to almost one third of our entire population. . .and probably a disturbing number of *your* employees.

What does illiteracy cost you? Get out your calculator. Illiterate adults make up 50%–75% of our unemployed. Every year they cost us an estimated $237 billion in lost earnings. They swell our welfare costs by $6 billion annually and diminish our tax revenues by $8 billion.

Illiteracy costs you through your community, too. It robs the place where you work and live of its resources. It undermines the potential of the people who make your products and the people who buy them. No dollar figure can be assigned to this. But over the years, this may be the costliest loss of all.

What can your company do about this? It can join in local efforts to fight illiteracy. It can volunteer company dollars and facilities for better school and tutorial programs. It can invest in a more literate community.

The first step is to call the Coalition for Literacy at **1-800-228-8813** or fill out the coupon below. Do it today. You may find it's the greatest cost-saving measure your company has ever taken.

A literate America is a good investment.

Ad Council

Coalition for Literacy

☐ I want my company to join the fight against illiteracy
Please send brochure with additional information

☐ We want to discuss funding the Coalition for Literacy
Please have a representative contact me

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Phone _____

Please return to: Coalition for Literacy
Business Division
PO Box 81826
Lincoln, NE 68501-1826

UNDER THE HOOD

Execution and write-back are separate stages.

uses ESI as an index that is relative to another base register. In the first case, the address-generation step in the pipeline will be able to find the right address in one clock cycle, and the pipeline won't stall. In the second case, extra arithmetic needs to be done in the execution stage, during which the pipeline will stall.

A programmer should also bear in mind that execution and write-back are separate stages. The pipeline will stall if one instruction computes a value and the next instruction needs that value for an address computation. Here's another example from the Intel manual:

```
ADD ESI,EAX
MOV EAX, [ESI]
```

The first instruction puts the sum of the EAX and ESI registers into ESI. The next instruction needs that result. The problem is that the value from the ADD instruction isn't written back until the last stage in the pipeline, so the MOV instruction must stall one cycle until the result becomes available. Assembly language programmers or smart compilers can actually schedule a third instruction between these two to get more work done. The ADD instruction won't take any longer to execute, assuming the intervening instruction introduces no new pipeline conflicts. As it turns out, although Intel's own 386/486 Code Builder has a "486 switch," that compiler doesn't yet attempt such reorderings. Watcom has tried some experimental pipeline optimizations with its 386/486 C compiler and reports that although speedups are possible, it is tricky to achieve gains without spilling scarce registers. Still, given the intensely competitive nature of the PC compiler market, you can be sure you'll be seeing advertisements touting 486 pipeline optimizations before too long. ■

Peter Wayner is a BYTE consulting editor and is working toward a Ph.D. in computer science at Cornell University. You can reach him on BIX as "pwayner."

World Radio History

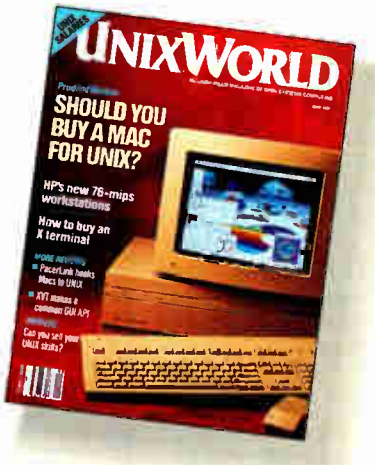
UNIX is changing the world of computers, the world of business – quite simply, changing the world. It's revolutionizing office automation. It's required for U.S. government computer contracts. It's the backbone of information strategies worldwide.

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 recieve the next 12 issues of ***UnixWorld*** for just $18.00 – half the regular newsstand price. Save even more by ordering for two or three years. You can't lose– every subscription to ***UnixWorld*** comes with a no-risk guarantee*.

Subscribe now! Call toll-free: 1-800-257-9402 ext. 29



If you're into UNIX, you need UNIXWORLD

McGraw-Hill's Magazine of **OPEN SYSTEMS COMPUTING**

**UnixWorld's no-risk guarantee: If not satisfied, cancel and receive a full refund for the balance of your subscription.*

UNIX is a registered trademark of UNIX System Laboratories, Inc.

DH1AUW9

World Radio History

The World Standard

First Edition ★★★★★ Everything you've been missing

HIDDEN PLOTS DISCOVERED

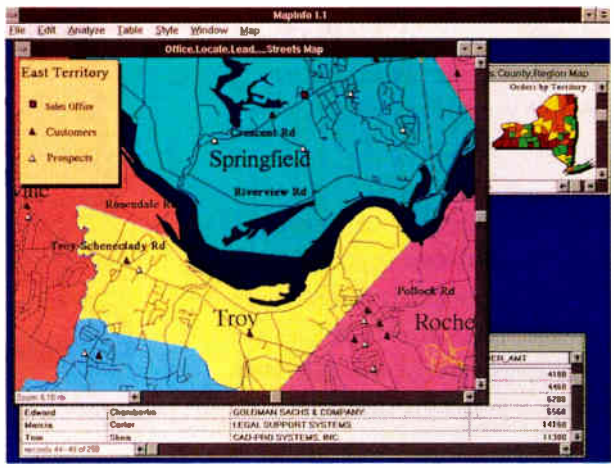
Desktop Mapping Held Responsible

For years organizations have had to rely on spreadsheets and other data analysis techniques to interpret information. But apparently, they've been missing a lot. The new technology of desktop mapping is revealing just how much.

As spokesmen at MapInfo,® the leader in desktop mapping, put it: "By advancing relational database technology to incorporate data with maps, MapInfo has produced a breakthrough in analysis capabilities. It is literally 'showing' its users patterns, relationships and trends that they never knew existed.

"In the process, it's allowing them to understand and present information more quickly, clearly and thoroughly. It's helping them deploy their resources more realistically and profitably. It's showing them how to target customers, service territories and optimize sales. It's helping them plan land use, select site locations, and efficiently manage facilities and operations.

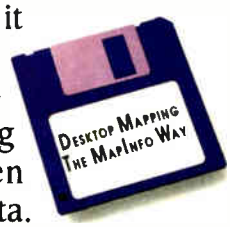
"In a word, it's allowing them to visualize and take advantage of options and opportunities that other data analysis techniques simply can't show."



With MapInfo, you can overlay data from dBASE (DBF), Lotus 1-2-3, Excel, delimited ASCII, plus many other formats, and relate it to thousands of maps, down to street level on Windows, DOS, Macintosh, Sun and HP.

Free Demo Disk Tells Inside Story

It's called *Desktop Mapping The MapInfo Way*. Our reviewers call it the premier guide to discovering what's hidden inside your data.



Call 800-358-7676 x100, or Fax 518-274-0510 for your copy. Then stay tuned for more good news from The Standard On The Streets.

MapInfo®

The Standard On The Streets

France (33) 1 48060648, Germany, Austria, Switzerland (49) 2102 497 1000, Italy (39) 6 3455334, Scandinavia (46) 8 6440950, Spain (34) 3 4143265, U.K. (44) 81 5074601, Remaining European Countries (31) 3443 3004, Australia 02 437 6255, Israel 03 561 0946.

All trademarks are the property of their respective owners. MapInfo is a registered trademark of MapInfo Corporation.

Circle 93 on Inquiry Card.

World Radio History

BARRY NANCE

MEMORY MAPPING, EDIT II, AND AN ALARM CLOCK

Using memory control blocks to track memory use, a Mac editor, and a Unix alarm clock

This one has been done before. Quarterdeck's Manifest, Norton's SI, and Kim Kohkonen's Mapmem all show what's in DOS memory. Programmers have found dozens of ways to tell you why you don't have a full 640 KB in which to run your applications. But the interesting part of these utilities is not so much the results (OS/2 2.0 solves that problem by giving me multiple DOS sessions), but the way in which DOS sets up and manages its memory control blocks (MCBs).

This month, I'll examine how these programs work and offer a program that lets you find out how big the resident portion of DOS is and what TSR programs you have loaded. The C source code for MAPRAM is only about 8 KB, yet it tells you how to gauge DOS and TSR RAM use. MAPRAM detects the presence of expanded memory (the MAPRAM source code shows one of the two techniques you can use to find out if an expanded memory manager is present) and shows the total amount of expanded memory and the amount currently free. If you follow MAPRAM with any argument on the command line, it lists the device drivers you've loaded as well. You can compile MAPRAM.C with either Turbo C or Microsoft C, or just run MAPRAM.EXE.

Programming Techniques

Here's the lowdown. MAPRAM uses DOS function call 52 hexadecimal to locate the start of both the device-driver chain and the first MCB. After the call, the ES:BX register pair points to a special data table within DOS itself, sometimes called the DOS INVAR area. At 22 hexadecimal bytes into the table, you'll find the offset (near pointer) of the first device driver; each device-driver header thereafter points to the next device driver in the chain. MAPRAM.C contains a definition for the device-driver header structure, as well as for MCBs and for the Program Segment Prefix (PSP).

Two hexadecimal bytes before the special data area is a near pointer to the segment address of the first MCB. Each MCB consists of a flag byte ("M" for all MCBs except the last one, which is "Z"), 2 bytes that indicate the owner of the MCB (the PSP segment address for the process that is using the MCB), and 2 bytes that express the size, in 16-byte paragraphs, of the MCB's memory area.

Once you have a far-pointer address to the first MCB, you step through the chain of MCBs by simply adding the size field plus 1 to the current MCB's segment address.

MAPRAM.C also shows how to discover the name of the program that owns the MCB. Beginning with version 3.0 of DOS, the fully qualified name of the program's executable file follows the environment area for each program.

Many programs show what's in memory. MAPRAM.C shows how to get inside DOS and its MCBs, so you can use the information in your applications. ■

UNIX/Ben Smith

A Calendar Alternative

If you're a Unix user who doesn't use the X Window System and thus can't take advantage of the `xcalendar` program mentioned in the November 1991 Software Corner, don't despair. There is an excellent text-based equivalent, `remind`, which was written by David Skoll, an electrical engineer working at Carleton University in Ottawa, Ontario, Canada. Because `remind` was originally written for DOS, the current version (2.3) can be compiled for either operating system.

The `remind` calendar and reminder utility uses sophisticated parsing and date/time algorithms to generate messages (and spawn processes) that are tied to specific dates or very complex date and time specifications that can include offsets, repetitions, and relations. For example, you can generate a reminder for every three days prior to a meeting on the last Friday of every month by specifying the key `Friday 31 +3`. You can use `remind` as an alarm clock or even as an alternative to the Unix `at` and `crontab` utilities.

MAC/Tom Thompson

A Slick but Cheap Mac Text Editor

One of the problems that plagues the new Mac user is writing something. There's no built-in utility, like EDIT.EXE on PCs, where you can at least cobble together a simple text file. Mac word processors cost plenty: $100 and up. (Remember when MacWrite 1.0 was bundled with the Mac?) What's a person who wants to create simple text files to do?

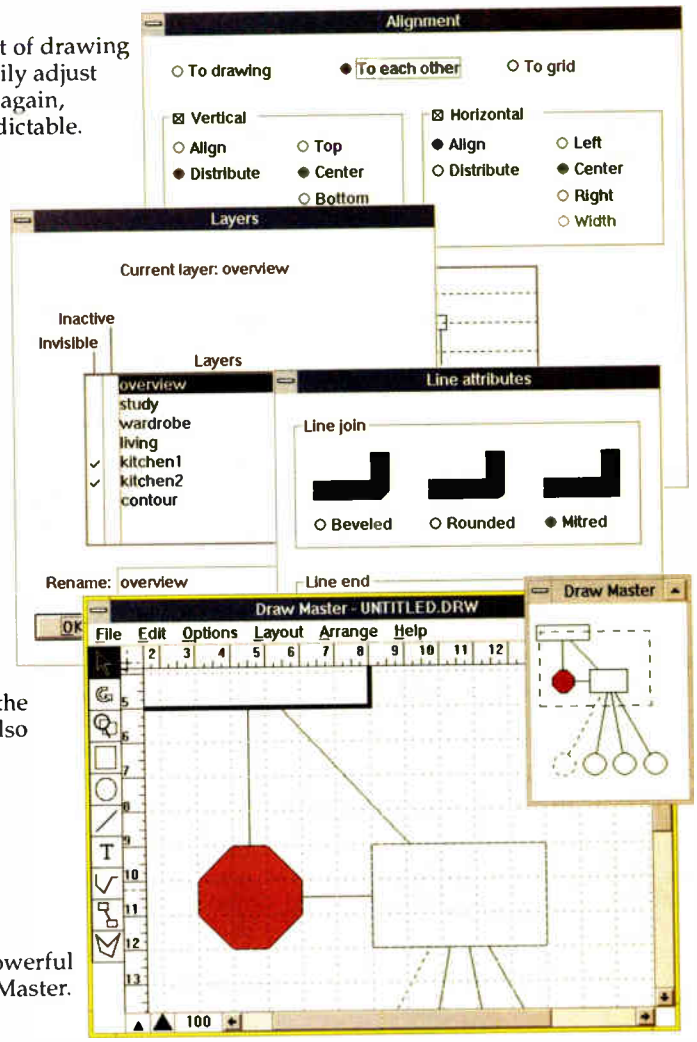
The answer is Kenneth Seah's Edit II, which is modeled after Consulair's old Edit text editor. However, Edit II sports many improvements over its predecessor: It's compatible with the latest Mac OS, and it uses the keyboard cursor keys for pointer positioning. Also, the standard command-key sequences let you save and print files. But wait, there's more. Edit II can deal with text files that contain only linefeeds (you get such files when you download text from Unix systems like BIX), the text search has a built-in grep capability, and you can search for a text sequence on multiple files. All this for a modest $25. Captain Video says check it out.

Editor's note: *Software Corner highlights freeware and shareware programs. The programs are available in a variety of formats. See "Program Listings" on page 5 for details. We solicit your contributions for this column. We'll pay $50 for any program we use. Write to: Software Corner, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.*

World Radio History

Will DRAW_Master save you a lot of time and money too?

DRAW_Master is a construction kit for the easy development of drawing tools. If you need to build a drawing application you can easily adjust DRAW_Master to your exact needs and use it over and over again, making the development of drawing tools easy, fast and predictable.



Product of the _Master Series

DRAW_Master was built as an extension to our GUI_Master object-oriented development environment for OS/2 PM and Microsoft Windows. GUI_Master itself consists of an Interface Builder, a Class Browser and a class tree with 85 user interface classes.

High Functionality

DRAW_Master consists of a class tree of more than 120 classes. Together they form a drawing application which offers a lot of standard functionality such as undo/redo, copy/paste, zoom in/zoom out, alignment, patterns, drawing size. In addition it has features like layer control, overview window and resizing. You can use DRAW_Master as the starting point for your application. By subclassing you can adjust and expand your new application. With DRAW_Master you can build a new drawing tool in a few weeks.

Source code included

To give you the best benefit of DRAW_Master we included the source code. A cookbook and a class reference manual are also included.

Prerequisites

- C++ 2.x compiler
- SDK (for OS/2or MS Windows)
- GUI_Master (source license advised).

Free drawing tool included

If you order now you will receive our OS2DRAW tool. A powerful drawing tool in the OS/2 environment made with DRAW_Master.

Prices

DRAW_Master source code license	$15,000.=
GUI_Master source code license	$50,000.=

There are no runtime licenses

Request for Information

VSR Holland
P.O. Box 2584
3500 GN Utrecht
The Netherlands

Fax: Intl. +31 30 31 04 26
Phone: Intl. +31 30 32 49 44

Name _____

Company name _____

Department _____

Street _____

City _____ State ____ Zip ____

Country _____ DRAW_A4_0991_C

All product names are registered trademarks of their respective manufacturers

FEATURES

- Patterns
- Object selection
- Printing
- Multiple undo/ redo
- Changeable palette
- Rotation
- Zoom in/ Zoom out
- Polygon
- Connections
- Scrolling
- Auto scrolling
- Rulers
- Grid
- Reshaping
- Fonts
- Background/ foreground
- Grouping/ ungrouping
- Automatic Page numbering
- Page breaks
- Polylines
- Layering
- Colouring
- Keyboard shortcuts
- Resizing
- Copy/paste
- Duplication
- Dashed Lines
- Line width
- Line joins
- Line ends
- Grid snapping
- Overview
- Alignment
- 135 changeable classes
- Reuse of code
- Adding new classes
- Class reference
- Cookbook

Circle 179 on Inquiry Card.

World Radio History

DON CRABB

PROGRAMMING UNDER SYSTEM 7.0

What tools do you need to do crackerjack programming on a System 7.0 Mac? The answer to that question depends almost entirely on the type of programming that you expect to do. At different times and for different purposes, I have been happy with HyperCard, ParcPlace Systems' Smalltalk, Manx Software Systems' Aztec C, Apple's MPW and all its languages, Symantec's Think Pascal, TGS Systems' Prograph, and a few others.

I have noticed a phenomenon taking place on Windows, though, that I wish we'd see on the Mac: the introduction of competitors to the standard development kit. In the case of Windows, the standard development kit is Microsoft's Software Development Kit. It functions like Apple's MPW and MacApp, although the SDK doesn't come with any compilers. Other vendors, and even Microsoft itself, are now producing competing development products for Windows. Microsoft's own Visual Basic and Within Technologies' Realizer are good examples. With these systems, I can sit down to do Windows software development without having to strap a language onto the SDK and fool with each of those tools.

A Real Need

It's certainly true that MPW and MacApp are light-years ahead of the SDK, so third parties who might provide systems like Visual Basic or Realizer for the Mac might not see a market there. I think they are wrong: The Mac has a large-enough installed base, supporting every stripe of developer (from in-house types, to commercial developers, to weekend hackers), to make competition for MPW and MacApp a market to explore.

Still, the competition hasn't been forthcoming. Instead, most third-party development system vendors tout their compatibility with MPW tools and their source and object compatibility with MPW compilers. With System 7.0 causing problems in non-Apple development environments (either they aren't 32-bit clean, or they can't use virtual memory—a significant limitation for any development system), MPW and MacApp look better than ever. Unfortunately, all of this has stifled development competition in a way that's probably not healthy for the long-term success of the Mac.

This is an issue of concern to the computer science labs at the University of Chicago. While I have no qualms with MPW's completeness and its general robustness, it's a bit much for our introductory programming students. It's also a bit much for some of our lab Macs, which are still Mac Pluses (albeit with 4 MB of RAM, hard drives, and AppleShare server connections). In other development environments, academia especially, most developers don't have Quadra 900s sitting next to their desks.

Some of your friendly old language systems don't yet work with Apple's latest System

Although we use MPW and MacApp for our upper-level classes, we need good development tools for our lower-level classes, preferably ones that are compatible with MPW but won't break our bank.

Think Pascal

The one program that has fit the bill better than any other over the last two years is Symantec's Think Pascal 3.0. Unfortunately, version 3.0 won't run under System 7.0, and the patched version (3.0.2) that's supposed to work when you turn off virtual memory and 32-bit addressing happens to be quite buggy. Fortunately, Symantec was on the ball and revised the product to include full System 7.0 support (32-bit and virtual memory). Think Pascal 4.0 will fill the needs of our lower-level programming classes.

Think Pascal 4.0 works well under System 7.0, although the installation is annoying (it comes on four floppy disks and includes a set of seven Compact Pro self-extraction archives). It includes a hellacious compiler that can crank about 60,000 lines of code per minute on a standard Mac IIci. That's some serious code compilation for a desktop computer.

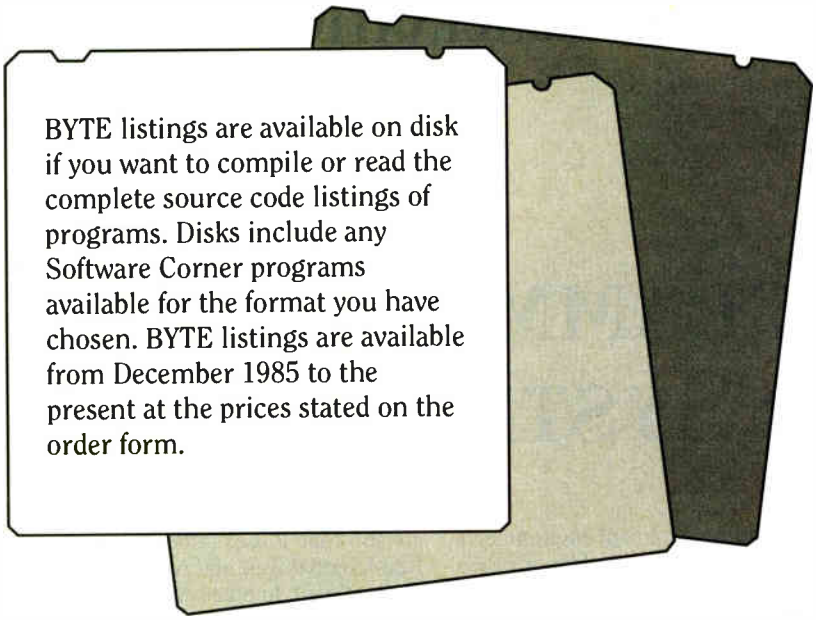
My favorite part of Think Pascal 4.0 is its class browser. Yes, you heard that right. It has an object-oriented programming (OOP) implementation of Pascal, and the class browser helps tie it all together. It works much like a Smalltalk class browser. With the browser, you can edit and examine every class and method and all the bits of allied code you might have for a particular project. It's a handy implementation and one that other language vendors ought to adopt.

Think Pascal 4.0 also supports the Standard Apple Numeric Environment math

ILLUSTRATION: ROGER BOEHM © 1992

World Radio History

Order BYTE Program Listings on Disk!



BYTE listings are available on disk if you want to compile or read the complete source code listings of programs. Disks include any Software Corner programs available for the format you have chosen. BYTE listings are available from December 1985 to the present at the prices stated on the order form.

For direct ordering call TOLL-FREE: 800-258-5485. New Hampshire residents call: 603-924-9281 M–F, 8:30am to 4:30pm, Eastern Time for credit card orders only. Subscription Customer Service: 800-232-BYTE.

ORDER FORM: to place your order, complete the information below, and mail to: BYTE on Disk, One Phoenix Mill Lane, P.O. Box 809 Peterborough, NH 03458-0809. Please complete in full.

Name _____

Address _____ **2/3 Vert Ad** _____

City _____

State _____ Zip _____

County or Parish _____ Country _____

Credit Card # _____ Exp. Date _____

Signature _____ Date _____

Please allow 6–12 weeks for delivery.

JANUARY

5-1/4 Inch: ☐ IBM PC	3-1/2 Inch: ☐ Apple Macintosh ☐ IBM PS/2
IN USA/Single Month	
☐ BYTE listings $13	☐ BYTE Listings $14
IN USA/Annual Subscription	
☐ BYTE Listings $110	☐ BYTE Listings $120
OUTSIDE USA/Single Month	
☐ BYTE Listings $17	☐ BYTE Listings $18
OUTSIDE USA/Annual Subscription	
☐ BYTE Listings $140	☐ BYTE Listings $150

*Please indicate the issue date below. If you are beginning an annual subscription, note the starting issue.

BYTE Program Listings
Month _____
Year _____

☐ Check enclosed
☐ MasterCard
☐ VISA
☐ U.S. funds enclosed. (If ordering from outside the U.S., please remit in U.S. funds drawn on U.S. bank. Thank you.)

BYTE

McGraw Hill

Mac buyers no longer have to pay a premium for hard drives.

package, the full Think class libraries (including those shipped with Think C), MPW object code, and in-line machine code directives that are good for writing device drivers and getting them up to speed. It can generate code for the 68000, 68020, and 68030, and the 68881/2 math coprocessors, although there is as yet no support for the 68040. That will be a problem for Quadra buyers or others who plan to buy the new 68040 accelerators from Radius and DayStar Digital.

Prograph

If you'd like to try something less traditional than a Pascal implementation, another of my favorites, Prograph 2.5 from TGS Systems, just got better. Prograph is a personal programming system for the Mac. It's based on OOP, a GUI, and data flow diagraming techniques (remember those babies from your first structured programming class?). Prograph 2.5 includes an improved compiler and full System 7.0 support, just like Think Pascal 4.0.

You see Prograph's data flow diagrams when you edit or invoke a new method. Instead of writing a method script, as you would do in Smalltalk-80 or C++, you build Prograph methods using data flow diagram components that you select and connect in the programming sequence you need. In other words, you construct your method's algorithm using building blocks, much like the tile-connection method found in Odesta's Double Helix. You build every Prograph 2.5 application using objects, methods, and data flow diagrams.

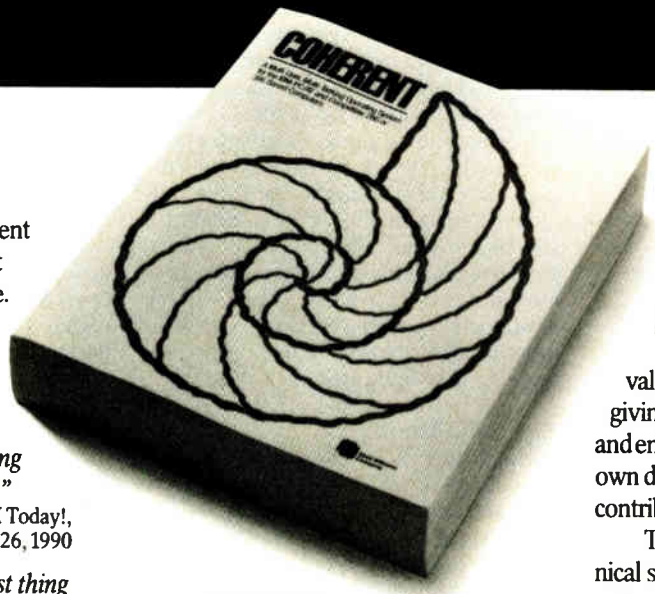
Prograph includes single inheritance, which lets instances of the same class inherit properties or behaviors from all those classes that precede it in your overall object-classification scheme. Inheritance provides great savings in repetitive coding, simplifies overall application design, speeds up compilation, and lets you concentrate on creating your application instead of the development environment.

If you don't really know much about

World Radio History

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

–Sean Fulton, UNIX Today!



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

"Mark Williams Co. seems to have mastered the art of illusion; Coherent comes so fully qualified as a UNIX clone, you find yourself thinking 'I can't believe it's not UNIX.' "
–Sean Fulton, UNIX Today!, November 26, 1990

"...(Coherent) may be the best thing that has happened to UNIX yet."
–William Zachmann, PC Week, November 5, 1990

"If you want to come as close as you can to real UNIX for a low price, COHERENT can't be beat."
–Warren Keuffel, Computer Language Magazine, November 1990

"If you want a UNIX-like development and learning system for less than $100...I don't see how you can go wrong with Coherent."
–David Fiedler, BYTE Magazine, November 1990

OVER 25,000 USERS, AND MORE EVERY DAY!

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

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

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

NEW RELEASE 3.2

$99.95*

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

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

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

WHAT UNIX WAS MEANT TO BE.

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

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

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

HARD TO BELIEVE? IT KEEPS GETTING BETTER.

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

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

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

TAKE 60 DAYS TO CONVINCE YOURSELF.

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

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

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

1-800-MARK WMS

(1-800-627-5967 or 1-708-291-6700)
FAX: 1-708-291-6750
60-DAY MONEY BACK GUARANTEE!

Mark Williams Company
60 Revere Drive
Northbrook, IL 60062

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

World Radio History

traditional programming, check out Prograph. It's a superior environment in which to learn how to create Mac applications, and you don't have to learn all the overhead of the traditional systems.

Despite the usefulness and success of systems like Think Pascal 4.0 and Prograph 2.5, I'd still like to see some full-blown competition to Apple's MPW. I'd also like to see Apple give MPW a complete overhaul (I hope that it takes a close look at NextStep when it does), so Mac developers would have the same kinds of growing choices as Windows programmers are now finding on their PCs.

Tip of the Month

If you follow such things, you know that hard drive prices from Mac vendors have gotten so low they've become commodity items, just like PC hard drives. That's great news for Mac buyers: You no longer have to pay a premium for hard drives. But as prices have dropped, so has quality. And the paper-thin profit margins that such price drops engender are killing some drive manufacturers. Some companies, like Jasmine Technologies, have gone bankrupt twice. That's pretty scary.

Where do you turn for your Mac hard drives, then? Fortunately, I have found several vendors whose products are both reliable and fairly priced. GCC Technologies and Mirror Technologies are two such companies. I've written about GCC's UltraDrive S series before; Mirror Technologies underwent an internal reorganization in the last year and is better for it.

I've been using Mirror hard drives for about six months now. They are solid, well constructed, and still low priced. And they have all the basic features you need. Unlike some cheaper units that preterminate their drives internally, the Mirror drives are unterminated and come with external SCSI terminators. You can easily set the SCSI ID numbers from an external switch.

I just ordered a few dozen of the mirror drives for my labs. The external units come in sizes from 40 MB to 1 gigabyte, and each has a rugged plastic case that's about the same size as an Apple HD80SC external drive.

Mirror also sells removable-medium drives (SyQuest Technology and Sony magneto-optical cartridges), a digital audiotape drive, internal drives, small portable drives (about the size of the Integrated Data Storage Systems' Wip drives I use that work well), and RAM SIMMs. I hope to check out the removable-medium drives as part of a column I'm working on for later this year.

For now, I'd put Mirror Technologies on your short evaluation list when you're thinking about buying hard drives. ■

Don Crabb is the director of laboratories and a senior lecturer for the computer science department at the University of Chicago. Don is also a contributing editor for BYTE. He can be reached on BIX as "decrabb."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

ITEMS DISCUSSED

Hard drives.....$279–$2597
Mirror Technologies
2644 Patton Rd.
Roseville, MN 55113
(800) 654-5294
(612) 633-4450
fax: (612) 633-3136
Circle 1146 on Inquiry Card.

MacApp.....$275
MPW.....$150
MPW C++.....$175
MPW Pascal.....$150
Apple Programmers and Developers Association
20525 Mariani Ave., M/S 33G
Cupertino, CA 95104
(800) 282-2732
(408) 562-3910
fax: (408) 562-3971
Circle 1147 on Inquiry Card.

Prograph 2.5.....$395
TGS Systems
1127 Barrington St., Suite 19
Halifax, Nova Scotia,
Canada B3H 2P8
(902) 429-5642
Circle 1148 on Inquiry Card.

Think Pascal 4.0.....$249
Symantec Corp.
10201 Torre Ave.
Cupertino, CA 95014
(800) 626-8847
(408) 253-9600
fax: (408) 255-3344
Circle 1149 on Inquiry Card.

Global ReLeaf comes in all shapes and sizes.

Planting trees is one of the best and easiest ways to help reduce global warming and other environmental problems. You can make a difference right now by calling our special Action Line — 1-900-420-4545. The $5.00 charge actually pays for planting a tree and we'll also rush you detailed information on Global ReLeaf. Take action now.

1-900-420-4545

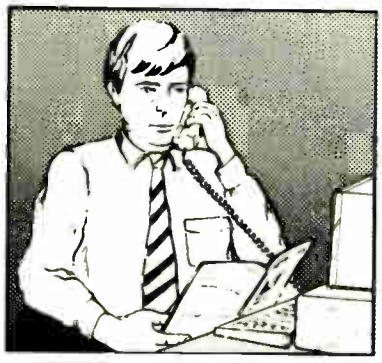
GLOBAL RELEAF

A program of The American Forestry Association
Citizens caring for trees & forests since 1875
P.O. Box 2000, Washington, DC 20013

World Radio History

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

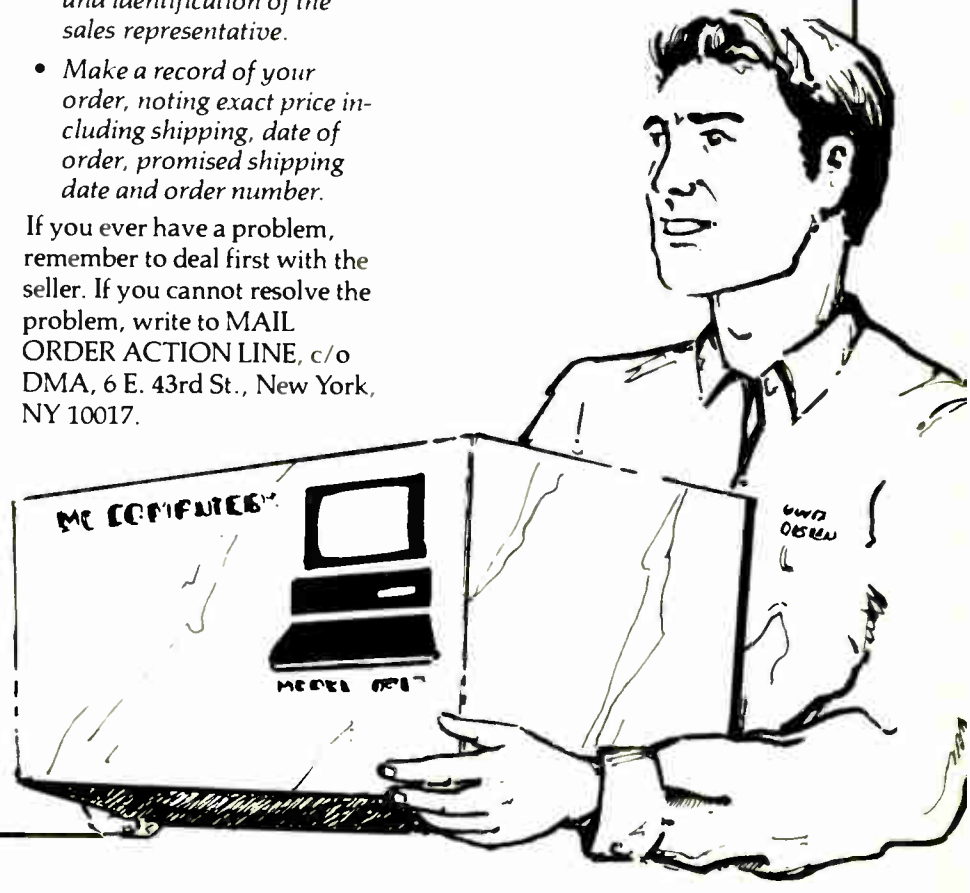
- *State as completely and accurately as you can what merchandise you want including brand name, model number, catalog number.*
- *Establish that the item is in stock and confirm shipping date.*
- *Confirm that the price is as advertised.*
- *Obtain an order number and identification of the sales representative.*
- *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.



© Direct Marketing Association, Inc. 1988

World Radio History

3780Plus for:

Operating Systems

- MS-DOS
- Concurrent DOS
- UNIX System V/386
- XENIX 286/386
- AIX
- 386/ix
- Ultrix
- HP-UX
- NCR UNIX
- DG/UX
- VMS
- FlexOS

Applications

- EDI
- Point-of-Sale
- Mainframe RJE
- Medical Claims Filing
- Check Clearing and Deposits
- Electronic Funds Transfer
- Credit Card Verification
- U.S. Customs Automated Broker Interface
- Electronic Tax Filing
- Stock Market Exchange Data

...and More!

CLEO's 3780Plus® is the preferred 3780/2780 bisynchronous communications solution for applications requiring fast, efficient data transfer.

It provides full IBM 3780/2780 RJE emulation for IBM PCs, PS/2s, and compatibles. It also works with RS/6000, DEC VAX, HP9000, NCR Tower, DG AViiON, Prime, Pyramid, Sequent, Altos, and other systems.

Easy to install, easy to use

With 3780Plus, you get a powerful scripting command language, an integrated application program interface, and a communications line monitor. It supports attended or unattended operations, operating system access, and auto-dial/answer. External modem auto-dialing capabilities include UDS BSC, SADL, AT Command Set, and V.25 bis.

We offer 3780Plus on high-speed modem boards and economical synchronous interface boards. Internal modems supported include 201/212, 208, 208/201/V.22bis, V.32, and others.

3780Plus is also available with our intelligent SYNCcable+, which allows synchronous communications activity through asynchronous ports.

Over 50,000 worldwide installations

To learn more, call us today at 1-800-233-2536. Or write to us at 2652 Eastrock Drive, Rockford, Illinois 61109. Fax: 815/397-6535.

CLEO®

CLEO Communications

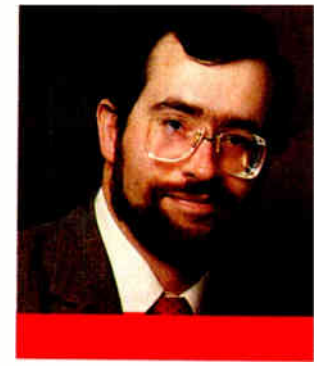
A Division of Interface Systems, Inc.

AVAILABLE WORLDWIDE!

In Europe, call Sintec Peripherals Ltd. in Slough, England, at +44-753-811888 (fax: +44-753-811666).

World Radio History

THE UNIX /bin



DAVID FIEDLER

ACES WILD

It's another new year. Has Unix taken over the world yet? No, but it would be hard to deny that Unix users are in the mainstream. In fact, if you take industry rumors, initiatives, coalitions, and consortia as a bellwether of importance, Unix has figured in most of the important computer announcements of the past year.

MIS executives must be tearing their hair out when asked to determine their hardware and software strategy for the future. Mainframe shops are running on microcomputer networks, notebook Unix systems aren't big news anymore, PC companies are building workstations, and workstation companies are selling their operating-system environments to PC users.

The Real Battleground

The Advanced Computing Environment (ACE) initiative announcement last spring confused many people, because it initially announced support for three main standards that themselves raised questions. Some observers focused on the CPU angle, because that's considered the most important thing by many buyers, but it's only one part of the story.

To summarize, ACE's chief players are Microsoft, Mips Computer Systems, DEC, Compaq Computer, and The Santa Cruz Operation (SCO). The idea behind the ACE consortium is to develop an open standard for RISC computers based on CPU technology from Mips. You might think of ACE as Sun Microsystems' SPARC developed by committee, and in many ways, this is the computer industry's answer to SPARC.

Although SPARC is an open-architecture CPU and is available from a number of sources other than Sun, many people see it as Sun's proprietary product. This impression was not helped by Sun's attempt last year to stop its resellers from selling SPARC compatibles.

Thus, heavy hitters DEC and Compaq (plus many ACE members, including Sony, NEC, Acer America, and Silicon Graphics) are backing Mips and its products instead of SPARC. Sun's share of the market was more than three times as large as Mips' in 1990, but the Mips line of CPUs is still one of the largest in terms of total workstation shipments. ACE is therefore betting on a company with proven performance, and one that's not afraid to loosen its technology grip: Five other manufacturers will be making Mips R4000 chips.

DEC has been in Mips' corner for years and has based its entire RISC line of DECstations around Mips technology. Compaq, by throwing its support to Mips, is openly challenging Sun.

ACE is tacitly backing another company as well. By developing its standard around the IBM PC's ISA, ACE is acknowledging the hold that Intel CPUs have on the market.

The coalition complexities of the ACE standard and Sun's new Solaris 2.0

ILLUSTRATION: ROGER BOEHM © 1992

Hidden Agendas

When ACE was introduced, the two software-related parts of the story were that ACE would have two operating-system platforms: Open Desktop from SCO and OS/2 3.0 from Microsoft. The twin ideas were that OS/2 would run on ACE RISC-based machines (as well as ISA PCs) and that Open Desktop would be ported to ACE RISC-based workstations (as well as ISA PC workstations).

Standards have changed a bit since then. DEC is doing most of the Open Desktop operating-system development and porting, and Microsoft has completely dropped OS/2 in favor of Windows New Technology (NT). And AT&T's Unix Software Laboratories has gotten into the act by coming up with a binary compatibility standard for Unix System V release 4 (SVR4) that is almost, but not quite, completely incompatible with the ACE standard.

These statements require a bit more background. SCO has traditionally played more of a director's role than that of a Unix porting house. It's good at putting pieces together, which is one reason why Open Desktop—based on software from AT&T, Locus Computing, IXI, Ingres, Open Software Foundation, and others—has been so successful. This is not to deny SCO's own internal Unix kernel expertise. In this case, however, it seems as though SCO's role in the new ACE Open Desktop is to make sure that all the pieces come together correctly, and DEC's role is to do the actual kernel work.

As far as Microsoft goes, it's true that OS/2 3.0 will no longer be produced (in deference to the well-publicized Microsoft/IBM rift), but it's also possible

World Radio History

that Windows NT is basically OS/2 3.0 under a new and snazzier name.

Meanwhile, SVR4 for the Mips CPU line uses the "big-endian" byte order, so applications for it will be incompatible with the "little-endian" ACE standard—even though ACE and SVR4 will themselves run just fine on any R4000-based computer.

Is ACE the Place for You?

When all is said and done, several implicit promises shake out of the hype. One is that an ACE workstation could be made simply by plugging an ACE CPU board into an AT clone and rebooting with the ACE operating system. Another promise is that an ACE binary application will run on any ACE-compatible computer unchanged (now, where have we heard this before?). I'd like to see both these things happen before I bet my data-processing budget on ACE.

There are also a few problems. The most-advanced Mips CPU at the time of the announcement was the R3000, which didn't comply with the specifications designed by ACE. The 64-bit R4000 chip, announced last fall, does meet the ACE specifications, but delays caused many systems designers to work with the R3000 instead.

Applications for SVR4 for the Mips CPU will be incompatible with the ACE standard.

If Windows NT dominates the market for high-end PC operating systems as Microsoft hopes it will, it could put the brakes on the acceptance of Unix, just as people are starting to get used to the idea. But to do this, Microsoft will have to duplicate the success of Windows 3.0 and MS-DOS 5.0, which were mature products with a large amount of market acceptance when they were released. Windows NT breaks new technical ground and represents an entirely new direction for Microsoft's marketing skills.

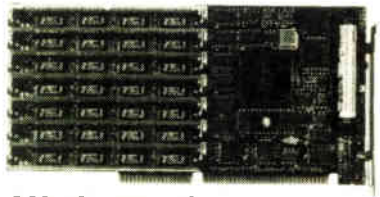
By supporting Windows NT and Open Desktop Unix on the PC and RISC platforms, ACE is hedging its bets. When real products are introduced, Open Desktop will have the advantage of several revisions and years of marketing. It will be an interesting battle, particularly because Microsoft can't lose: It owns a piece of SCO.

What About Sun?

The Sun empire struck back by announcing its Solaris 2.0 product for SPARC and Intel 386/486 architectures. In one bold move, Sun has postulated a world where it might use its name and quality recognition to become the leader in PC Unix software.

Solaris includes not only SunOS 5.0 (based on SVR4), but also OpenWindows (a development system), Open Look (the GUI), DeskSet (some basic applications), and the OPENetwork utility services. It's almost a Sun version of Open Desktop in a box at a competitive price (although, like

ROMDISK™



High Performance Multimegabyte Disk Emulators

NEW MODELS / LOWER PRICES

- Floppy Drive and multimegabyte emulators for ISA bus computers
- 180K to 14 MB capacities
- EPROM, Flash or SRAM technologies
- Autobooting, Single or Dual disk emulation under PC or MS DOS
- List prices from $195

CURTIS, INC.
2837 No. Fairview Ave. • St. Paul, MN 55113
612/631-9512 FAX 612/631-9508
PC DOS is a trademark of IBM; MS DOS is a trademark of Microsoft

A MESSAGE TO OUR SUBSCRIBERS

FROM TIME TO TIME WE MAKE THE BYTE SUBSCRIBER LIST available to other companies who wish to send our subscribers material about their products. We take great care to screen these companies, choosing only those who are reputable, and whose products, services or information we feel would be of interest to you. Direct mail is an efficient medium for presenting the latest personal computer goods and services to our subscribers.

Many BYTE subscribers appreciate this controlled use of our mailing list, and look forward to finding information of interest to them in the mail. Used are our subscribers' names and addresses only (no other information we may have is ever given).

While we believe the distribution of this information is of benefit to our subscribers, we firmly respect the wishes of any subscriber who does not want to receive such promotional literature. Should you wish to restrict the use of your name, simply send your request to the following address.

BYTE Magazine
Attn: Subscriber Service
P.O. Box 555
Hightstown, NJ 08520

 Circle 42 on Inquiry Card

World Radio History

Put more power in your PC

Plug MKS Toolkit into any DOS or OS/2 PC and you'll unleash more power and flexibility than you ever believed your hardware could handle. You'll find that MKS Toolkit is **the** essential piece of DOS or OS/2 software after the operating system itself.

Advanced programming tools once available only on UNIX™ systems are packed into MKS Toolkit for DOS or OS/2 – more than 150 of them, including utilities for: • prototyping • advanced command language • command editing and history • file processing • text manipulation • compression • archiving • editing.

And MKS Toolkit is **easy to use,** with on-line manual pages, lots of examples and quality documentation for both novices and experienced users.

You'll be able to get the job done effortlessly too, wherever you're working. For laptop owners, our installation procedure lets you **load only the utilities you want.** For developers working on a UNIX system and a PC, we've made it **easy to copy files across systems.** And MKS Toolkit **tracks the POSIX.2 standard,** a plus for developers in open systems environments. **Networks** are perfect for MKS Toolkit too.

Plug in MKS Toolkit and soar beyond your hardware.

UniForum
CORPORATE SPONSOR
See us at UniForum
January 22-24, 1992
San Francisco
Booth #3425

MKS Toolkit

Price: DOS $249, OS/2 $349, DOS & OS/2 $399, Upgrade $69 (DOS only). Call for LAN and site license prices.

VISA

To order, call MKS at 1-800-265-2797 (continental U.S. only) or (519) 884-2251; Fax (519) 884-8861

MasterCard

30-day money-back guarantee.

MKS
35 King Street North
Waterloo. Ontario
Canada. N2J 2W9

MKS and MKS Toolkit are trademarks of Mortice Kern Systems Inc.
UNIX is a registered trademark of Unix System Laboratories, Inc.

Circle 103 on Inquiry Card.

World Radio History

Solaris for the SPARC, Solaris for the 386/486 will probably be delivered on CD-ROM, which also saves a heck of a lot of money on documentation).

If this weren't bad enough news for SCO, it's likely (as this column goes to press) that Sun will buy Interactive Systems, SCO's archrival. Sun will thereby get a great deal of PC Unix and networking expertise in one package.

Sun is also hedging its bets, because the creation of its SunSoft subsidiary and an Intel port of SunOS mean that it can at least pay some bills by selling software, even if SPARC sales drop. After all, Sun has been a leader in developing applications software, so what would happen if it was suddenly in a position to sell applications directly to millions of power PC users?

The bottom line for users will be better, faster, and less expensive computers capable of running the new graphical Unix systems. That's good news. The final chapter on ACE will be written when the consortium delivers its hardware and software, and it's a bit early to commit to that platform. If nothing else, ACE and Solaris prove that there's some life in ISA yet.

Some People Really Know Zip

There are several different, and incompatible, standards for compressing and archiving files. These include Pack, Compress, Arc, Zoo, and Zip. Some programs (e.g., the public domain Arc utility I've been using for Unix) are capable of dealing with DOS .ARC files. But in general, folks who use both Unix and DOS keep their files separate.

For those of us who use DOS in conjunction with Unix (e.g., on VP/ix or Open Desktop), it's convenient to use one tool that does the job well. I've been working with Uni-Zip from Precise Electronics for a few months, and it gives 386-based Unix users all the capabilities of PKZip from PKWare, including complete file compatibility.

Uni-Zip keeps PKZip's syntax and file structure, and it gives you a 32-bit cyclic redundancy check missing in many Unix archive and compression programs. If you're not familiar with PKZip, it (and Uni-Zip) lets you work with directory trees, attach comments to files, and update and "freshen" specific files without disturbing the archive as a whole.

My tests showed that Uni-Zip produced a tighter compression than either Compress or Arc, although it was slower than Compress. What I like about Uni-Zip, and archive programs in general over compression programs, is the ability to store lots of files into one but being able to pull them out separately later. ■

David Fiedler has been a consultant and writer on Unix topics for over a decade and has started several Unix publications. His company, InfoPro Systems, produces corporate image and marketing videos for high-tech firms. You can reach him on BIX as "fiedler."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

ITEMS DISCUSSED

Uni-Zip.....$149
Precise Electronics
31 Englewood Ave.
Brookline, MA 02146
(617) 566-6867
Circle 1150 on Inquiry Card.

PROTECT YOURSELF FROM DATA LOSS

PARALLEL STREAM II

PORTABLE

TAPE BACKUP

SYSTEM THAT

NEEDS NO

CONTROLLER

BOARDS

A New Generation of Portable Tape Backup Systems

The Parallel Stream II supports **all** IBM compatible computers that utilize the MS/PC-DOS operating system. The Parallel Stream II has a data backup rate of up to 5MB per minute through the printer port, up to 115.2 K Baud through the serial port and 6MB-12MB through the SCSI Port. The Parallel Stream II was designed with ease of use in mind as well as security by offering such features as a Dataset Library and Password Protection.

A New Direction in Data Protection

The Parallel Stream II is ideal for **all** your backup needs because it requires no controller boards installed in your computer, no jumpers or switch settings to change, no DMA channels to select and no complicated setup procedure. So whether you're backing up a Novell Network or a Notebook PC, Parallel Stream II is the answer. Watch for upcoming versions that will support; Banyan, 3 COM, UNIX/Xenix, MS-Windows 3.0 and Apple Macintosh.

QuanTech International

1-800-950-9327

One Apple Hill • Natick, MA 01760
Telephone: 508-655-8287 • Fax: 508-655-4066

Circle 209 on Inquiry Card

World Radio History

MCGRAW-HILL
PUBLICATIONS ONLINE

Total Recall *instantly . . .*

When you need business information, why not get the total story— any time— instantly. That's the advantage of the McGRAW-HILL PUBLICATIONS ONLINE database.

Now, count on immediate access to every original article, word for word, exactly as it appeared (except for graphics) in the leading McGraw-Hill magazines and newsletters serving the needs of today's business, worldwide.

Only McGraw-Hill, the world's foremost business information publisher, can deliver it all so completely. Companies, people, products, whatever the topic—here's the unequaled connection to the full story in seconds. Call for total recall today. For the 1991 list of our publications online, contact Andrea Broadbent at **(609) 426-5523**. Or Fax to (609) 426-7352. Or send us the coupon.

- BUSINESS WEEK
- AVIATION WEEK & SPACE TECHNOLOGY
- BIOTECHNOLOGY NEWSWATCH
- BYTE
- CHEMICAL ENGINEERING
- DATA COMMUNICATIONS
- ENGINEERING NEWS-RECORD
- LAN TIMES
- NUCLEONICS WEEK
- PLATT'S OILGRAM NEWS
- PHYSICIAN & SPORTSMEDICINE
- POSTGRADUATE MEDICINE

. . . AND DOZENS MORE.

Available through NEXIS® DIALOG,® and DOW JONES NEWS /RETRIEVAL®

MCGRAW-HILL
PUBLICATIONS ONLINE
Princeton-Hightstown Road
Hightstown, NJ 08520-9459 U.S.A.

Please send me the complete 1991 list of your publications online.

Name
Title
Company
Address
City State
Zip/Postal Code Country
Tel.

BY

World Radio History

YOU NEED PEN COMPUTING

(BUT YOU MAY NOT KNOW IT)

You may not even know what pen computing is or what it can do for your organization. Experts* predict that *Fortune 1000* companies collectively will be saving hundreds of millions of dollars in data-entry costs alone through pen computing by 1995, not to mention improvements in customer service, field sales, inventory reporting, medical record keeping, and claims adjusting, to name a few applications.

To better understand how to apply pen computing to the challenges facing your organization, come to the first *Pen Computer Users Conference* for prospective users. Managers who are using pen computing today in organizations like yours will discuss how they gained the acceptance of upper management and end-users, and developed software. The major pen computer systems available today will be demonstrated.

The Pen Computer Users Conference has been guided by The National Advisory Council on Pen Computing, whose members will speak at the conference.

- ▶ Portia Isaacson, Ph.D., Dream Machine
- ▶ Andrew Seybold, Dataquest
- ▶ Bill Lempesis, The Lempesis Report/Pen Vision News
- ▶ Tim Bajarin, Creative Strategies Research International
- ▶ Peter Tiege, Infocorp
- ▶ Bruce Stephen, International Data Corporation

Other industry experts will speak including John Rizzo of Momenta, Pradeep Singh of Microsoft, Chuck Ennis of TelePad, Jeff Hawkins of GRiD, David Fox of Nestor, and Harry Gierhart of OCR Systems.

A total of 16 sessions will be held on key topics including:

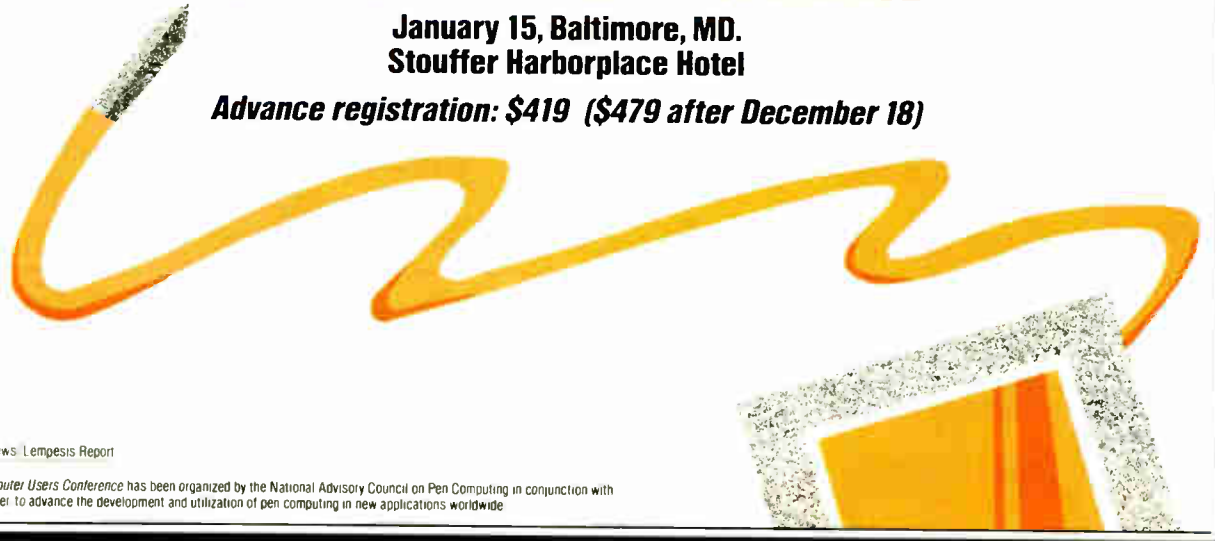
- ▶ Gaining User Acceptance
- ▶ Pen Computing's Return on Investment
- ▶ Demonstrating Advantages to Management
- ▶ Handwriting Recognition Applications
- ▶ Pen-Top Computers
- ▶ Wireless Communication via Handheld Pen Systems
- ▶ Palmtop Computers and Pens

Register now or call for more information on pen computing. Be sure to ask about the conference transcript available on interactive diskette. (800) 729-3660.

PEN COMPUTER USERS CONFERENCE

January 15, Baltimore, MD.
Stouffer Harborplace Hotel

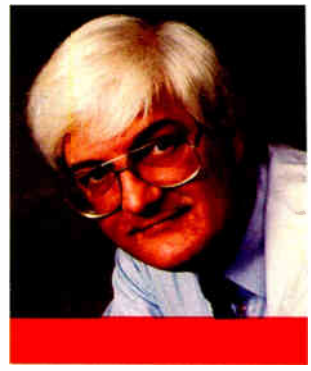
Advance registration: $419 ($479 after December 18)



*Pen Vision News/ Lempesis Report

The Pen Computer Users Conference has been organized by the National Advisory Council on Pen Computing in conjunction with Ogilvy & Mather to advance the development and utilization of pen computing in new applications worldwide.

World Radio History



BARRY NANCE

COMING SOON: FASTER LANS

Networking is so complex and pervasive that it just doesn't make sense to compile a list of significant events that happened in 1991, or to predict the major events that might occur this year. My memory of 1991 is probably different from yours, and my list of 1992 predictions would likely embarrass me at the end of this year.

Instead, here's an in-depth look at two network-related technical innovations currently on drawing boards and in engineering labs that you'll see this year. The first, Novell's *packet-burst* technology, is significant if you're interested in LAN performance. This includes most of us. The second, IBM's 100-Mbps Token Ring, is also performance related, but it will have a significant effect on PC networking in general—especially if it's priced right.

Packet Burst

Novell already had the packet-burst enhancement working fairly well in its labs at press time. In fact, by the time you read this, you may already have seen an announcement of what Novell calls packet burst for NetWare.

Packet burst is a funny name for a technique that was added to the Kermit and XMODEM file transfer protocols a long time ago, and it forms the basis for the ZMODEM protocol. Packet burst involves sending file material to or from the file server in a long stream of packets, without requiring the workstation to issue a request for each small section of a file.

Before packet burst, an application (or COMMAND.COM, if the workstation is in the process of loading the executable file) might issue a request to DOS to read a large part of a file that resides on the file server. As an example, I'll use a request for a 64-KB chunk.

The NetWare shell, NETx.COM, intercepts the file-read operation; DOS never sees it. Assuming that your network uses 512-byte packets (common on NetWare LANs), NETx and the server exchange 128 pairs of message packets to accomplish the 64-KB read.

The workstation requests the first 512-byte packet; the server sends back a response containing the first 512 bytes of the file. At the workstation, NETx puts this first response at the start of the application I/O buffer and then makes another request of the file server for the next part of the file.

When it receives the response, NETx appends this next 512-byte part of the file to the previous material in the application I/O buffer and requests the next portion. This dialogue goes on until NETx on the workstation and the file server satisfy the entire 64-KB file-read operation.

If your LAN uses packets larger than 512 bytes, the network generates fewer than 128 pairs of request/response packets. But it's still quite a lengthy process—especially if one workstation's requests/responses are interleaved on the network with similar traffic to and from several other workstations. The turnaround time for a workstation to issue the next request and get that request onto the LAN is substantial.

Two upcoming products from IBM and Novell could have a big impact in 1992

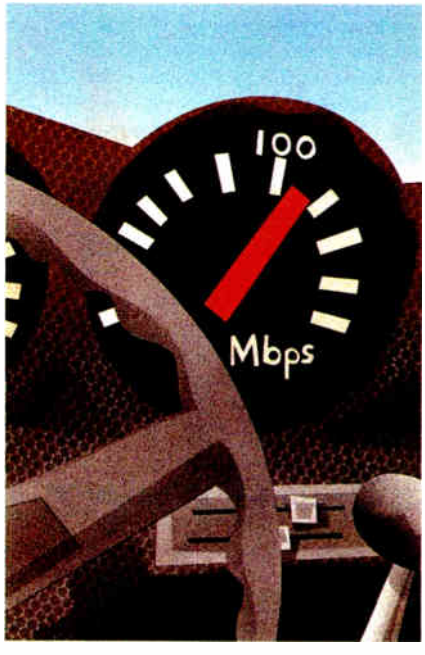


ILLUSTRATION: ROGER BOEHM © 1992

With packet burst, NETx makes a request for the entire 64-KB file as one message packet. The file server sends back a stream, or burst, of packets containing sections of the file material. NETx copies the message contents into the application I/O buffer, one after the other, as they're received. NETx and the server then account for what's been transmitted, and NETx can restart the data stream at any point to handle missed packets.

When packet burst is available, you'll merely have to install and load a new NetWare loadable module on your NetWare 3.11 file server and begin using a new version of NETx.COM. It was still unclear at press time if Novell will charge extra for packet burst.

Another term for packet burst is *sliding windows*. This term suggests several successive windows of activity, where each window consists of a response packet. Instead of acknowledging each packet as it arrives, the workstation acknowledges the entire group of packets with one "thanks, I got all the packets" message. Packet burst gets the same job done with fewer packets flying around on the network.

There's one problem with packet burst, though, and it's the reason why you have not seen this technology before now. Say I have a slow, archaic IBM XT, and you have a powerful, fast PS/2 Model 95. We use the same device drivers, the same IPX.COM, and the same NETx.COM. Your Model 95 initiates a read request for a large file on the file server. My XT reads a 2-KB record from a database file located on the same server. Your request

World Radio History

gets to the file server first. Mine arrives a millisecond later. How should the file server behave to keep us both happy? There are many different answers to this question, and Novell's software engineers are trying to pick an answer that is fair and that imposes the least workload on the file server and the workstation.

It will be interesting to see what the production version of packet burst looks like and how much of a performance improvement you will see from it. I'm vitally interested in LAN performance; I can't wait to try out Novell's packet burst scheme.

Token Ring Turns 100

IBM invests more money in R&D than many companies earn in total revenue. However, IBM announces new products only after it talks to its customers and discovers a "business need" (and, I expect, after thorough testing). There's a business need for 100-Mbps Token Ring LANs, and IBM is getting ready to respond.

In 1985, IBM and Texas Instruments codeveloped and released the 4-Mbps Token Ring. IBM could have endorsed Ethernet, but the IBM/TI network designers determined that Token Ring had certain reliability and speed advantages over Ethernet, especially on large LANs. Ethernet advocates have disputed this design decision for years, yet Token Ring remains the IBM standard for connecting PCs, AS/400s, RISC System/6000s, and mainframes.

There is a business need for 100-Mbps Token Ring LANs, and IBM is getting ready to respond.

IBM recognizes the need to connect its hardware with non-IBM, Ethernet-based LANs. Thus, IBM supports its own flavor of Ethernet, called EtherAND. But it will be a long time before you can use Ethernet to connect PCs, AS/400s, RISC System/6000s, and mainframes.

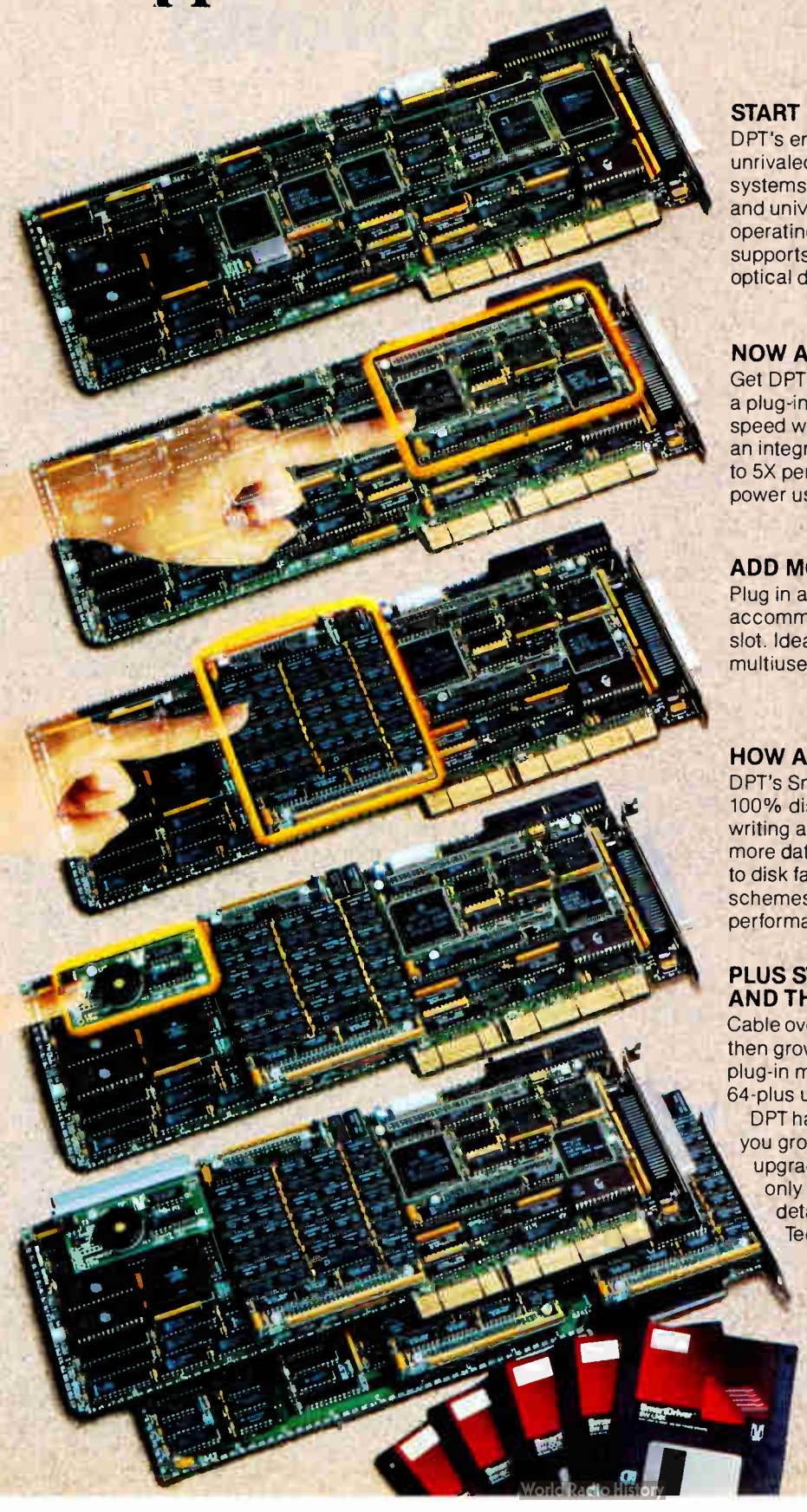
A few years ago, IBM released its 16-Mbps Token Ring product, with the optional Early Token Release feature. ETR reduces latency time by releasing the token before the previous data frame has finished circulating through the LAN (see the text box "ETR Explained" on page 336 for details). ETR becomes a significant factor when packet sizes average 50 to 100 bytes and when network traffic levels are less than 80 percent (most are).

IBM will soon release a 100-Mbps Token Ring product with an enhanced ETR feature. The company will emphasize the use of 100-Mbps Token Ring as a connective backbone between mainframes and PC LANs, but many buyers will use it as their primary LAN medium for applications where performance is critical. IBM will announce faster-processing Token Ring adapter cards, with more on-board RAM and perhaps even an on-board CPU chip, at the same time that it announces

Circle 143 on Inquiry Card

World Radio History

SmartCache™ Plus: the grow-as-you-go approach to SCSI controllers



START WITH THE BEST...
DPT's entry level SmartCache Plus board offers unrivaled price/performance for single-user systems. It features ISA or EISA bus mastering, and universal SCSI disk compatibility for all PC operating systems. SmartDriver software supports SCSI-2 peripherals like tape and optical drives.

NOW ADD CACHING!
Get DPT's award-winning caching technology in a plug-in module! Move up to disk caching speed without investing in a new controller. With an integral 512K cache, the module provides up to 5X performance gains for workstations, power users, and small multiuser systems.

ADD MORE USERS, ADD MORE CACHE!
Plug in a 2 MB or 4 MB memory module and accommodate up to 18 users from a single card slot. Ideal for medium-sized networks or multiuser systems.

HOW ABOUT DISK MIRRORING?
DPT's SmartCache mirroring module provides 100% disk fault tolerance by simultaneously writing all data to a second "mirrored" drive. No more data loss or costly system down-time due to disk failures. And unlike software mirroring schemes, fault tolerance is achieved with no performance penalties.

PLUS STILL MORE CACHE, AND THEN SOME...
Cable over to DPT's 4 MB Cache Expansion Card, then grow your system to 16 MB by adding more plug-in memory modules—enough power for 64-plus users!

DPT has your solution—no matter how you grow. Performance, compatibility and upgradability make SmartCache Plus the only SCSI controller you'll ever need. For details, contact Distributed Processing Technology, 140 Candace Drive, Maitland, FL 32751. Phone (407) 830-5522; FAX (407) 260-5366.

DPT

Circle 55 on Inquiry Card (RESELLERS: 56).

World Radio History

Announcing the

BYTE EURODECK

The First Computer Postcard Deck Targeting the Exploding European Market!!!

By the end of 1992, the European Community will be a $14 trillion market. In fact, behind the US, it's the largest microcomputer market in the world!

If you are a BYTE subscriber in Europe, watch for the new EURODECK coming to you soon! The BYTE EURODECK contains a selection of state-of-the-art products important to you and your business.

Advertisers!
The BYTE EURODECK offers you a unique direct mail approach to increasing sales in this fast-paced computer market.

Circulation of the BYTE Eurodeck is targeted to 50,000 computer buyers in over 20 countries in Western Europe. Take full advantage of the benefits of the upcoming unification of Europe in 1992! For information on the next BYTE EURODECK, call Jim Ball today at

603-924-2533!

Companies outside of North America, please contact your local representative.

ETR Explained

Early Token Release is easily misunderstood; Token Ring LANs are in themselves a fairly complex subject. On a momentarily idle Token Ring LAN, workstations circulate a token. The LAN becomes busy (i.e., carries information) when a workstation gets a token and turns it into a data frame, targeted almost certainly at the file server (or targeted back at a file-needy workstation if originated by a server that is answering a file I/O request). The data frame, after receipt by its target node, continues its circulation of the LAN until it reaches its source node. The source node turns the data frame back into a token that circulates until a downstream node needs it. So far, so good. These are just standard Token Ring concepts.

A workstation needs to send only a few bytes to tell the file server it needs some part of a file. If the signal has to go into and out of many workstations to circulate the ring, and if the data frame is small, latency occurs. This is the unproductive delay that occurs while the source node waits to get its data frame returned to it by its upstream neighbor.

After releasing the data frame, the source node appends idle characters onto the LAN until the data frame has circulated through the entire LAN and arrives back at the source node. The typical latency of a 4-Mbps Token Ring is about 50 to 100 idle characters. On a 16-Mbps ring, latency can reach 400 or more bytes worth of LAN time.

With ETR, the originating workstation transmits a new token immediately after sending its data frame. Downstream nodes pass along the data frame and then receive an opportunity to transmit data themselves—the new token. If you had a Token Ring microscope, you'd see tokens and other data frames chasing the data frame, instead of a long trail of idle characters. And you'd know that your LAN is using ETR to keep itself productively busy.

100-Mbps Token Ring.

What sort of enhancements will IBM make to ETR? One of the original concepts embodied in Token Ring was a preemptive prioritization scheme involving priority bits and reservation bits in each token, or frame. ETR destroyed this scheme. Each new token created during ETR carries the priority and reservation bits of its predecessor token. A workstation that tries to reserve the use of the ring by setting the reservation bits in the current data frame will be too late; the new token will already have been sent out onto the LAN, and it might be claimed by another node before the reserving workstation can grab it.

IBM will use a prioritization scheme in its 100-Mbps Token Ring product that is similar to the one specified in the Fiber Distributed Data Interface. Each device on the ring will be classified as asynchronous (i.e., devices that are not rigid about the time intervals that occur between network accesses) or synchronous (i.e., devices that have stringent timing requirements regarding their accesses to the network).

As you'd expect, a mainframe on a Token Ring will get a higher priority in this scheme. What other nodes will you designate as needing priority access to the LAN? Two come to mind instantly: file servers and database servers.

I'm tempted to speculate about "OS/2 NetWare," "RISC System/6000 NetWare," and the future fate of Microsoft LAN Manager, but I'm out of space. Look for more on those products in the coming months.

Next month, Bruce Shatzman and Jeff Lubeck examine LAN Manager 2.1's ability to coexist with NetWare, and they describe a few tricks for successfully integrating LAN Manager servers in a NetWare environment. ■

Barry Nance is a consulting editor for BYTE. He manages a 70-node NetWare LAN. He is the editor of the IBM Exchange and moderator of the lans conference on BIX, where you can reach him as "barryn."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

World Radio History

To get the most out of C++, get the C++ with the most in it.

LIANT OPEN SYSTEMS PROGRAMMING TOOLS

Now there's a better way to take full advantage of the power of C++. LPI C++ has all the features and tools you need to quickly produce robust and efficient C++ applications.

Most complete implementation

LPI C++, a true 32-bit compiler, is a complete implementation of *The Annotated C++Reference Manual* specs. Which means you get multiple inheritance, nested types, protected derivations, and more — with no "sorry, not implemented" messages.

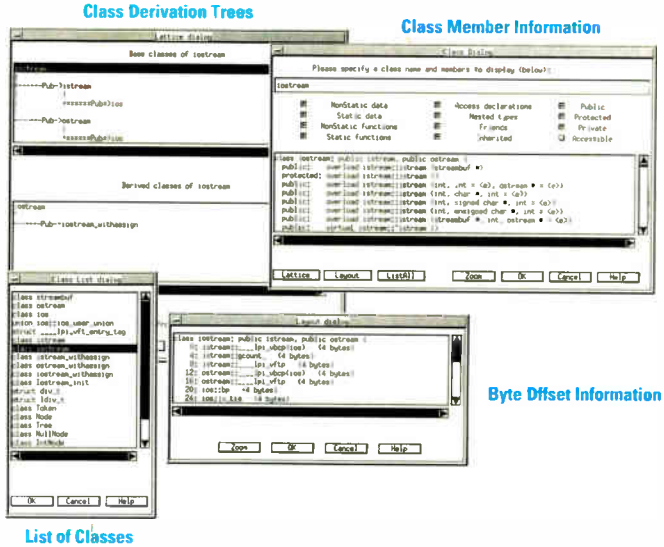
Most compatibility

LPI C++ offers compatibility with cfront 1.2, 2.0, and 2.1, ANSI C, and Classic (K&R) C.

Use existing C code and convert to C++ as your experience grows, or build new applications in C++. Our compiler does it all.

Most efficient native code

Liant's new optimizer and back-end technology produce object code that's among the best in the industry. Optimizations include function inlining, loop induction, temporary object elimination, global subexpression elimination, and much more.



Class browsing using LPI C++ and CodeWatch debugger.

Most powerful source-level debugger

CodeWatch, our source-level debugger, comes bundled with LPI C++ and provides an X/Motif windows interface. CodeWatch helps you find bugs quickly with such sophisticated features as full C++ expression evaluation, class object evaluation, class browsing, and easy handling of overloaded functions.

So get the most out of your C++. Call today to order, or for more information.

1-800-662-9866

Liant is the world's leading supplier of open systems programming tools, languages, and libraries. Call for your free Liant product catalogue.

Supported systems:

i386, i486 SVR3
i386, i486 SVR4
SPARC SunOS

LIANT

Liant logo type, LPI C++ and CodeWatch are trademarks of Liant Software Corp. Other trademarks belong to their respective companies. Copyright © 1991 by Liant Software Corporation, 959 Concord St., Framingham, MA 01701. 508-872-8700, FAX: 508-626-2221.

INTRO. OFFER! $695 THRU 1/31/92. Regularly $1295.

Circle 316 on Inquiry Card (RESELLERS: 317).

World Radio History

The Programmer's Shop

PROVISION WINDOWS

by Sofdesign International

ProVision:Windows is a true virtual-paged, modeless, event-driven windowing environment. The windowing kernel, written in 100% assembler for speed, is complemented by an easy-to-use programming interface. This upper-level interface handles all windowing details, letting developer concentrate on the application.

ProVision:Windows transparently supports overlapping windows, with automatic mouse support, and are movable, scrollable, sizable, and iconizable. All Clipper screen output is automatically directed to the windows and input controls such as radiobuttons, checkboxes, and pushbuttons makes a simple to design user interface.

LIST: $199 **PS** Price: **$195**

FastFaxts 4227-010

PC-lint 5.0

by Gimpel Software

PC-lint 5.0 is the leading C diagnostic facility for finding bugs, glitches and inconsistencies that your C compiler, working on one module at a time, will miss. PC-lint with over 400 messages and 100 options is extraordinarily powerful and fully customizable. New features include a flow-control analysis to catch possibly uninitialized variables and programmer-controllable typedef-based strong type checking. Contains special checks for Windows debugging. Supports full K&R and ANSI C standards, and is the perfect add-on to your Microsoft C compiler.

LIST: $139 **PS** Price: **$115**

FastFaxts 53-009

SVS C3 ANSI C, Pascal, or FORTRAN-77

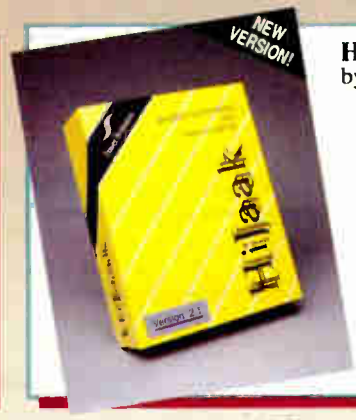
by Silicon Valley Software

Only from the Programmer's Shop!

ANSI compliant, optimizing, 32-bit compilers; DPMI-compliant, royalty-free DOS extender; source level debugger; utilities. Supports "flat model" code. Linker, librarian, make, i387 emulation, W31/4167 support. Interoperable languages!

	LIST	**PS** Price
ANSI C	$1195	$325
Pascal	$1195	$325
FORTRAN	$1495	$395

FastFaxts 1958-048 (C), 1958-049 (FORTRAN), 1958-050 (Pascal)



HiJaak Release 2.1

by Inset Systems Inc.

HiJaak 2.1 is a graphics conversion and screen capture utility that translates more than 43 graphics file formats such as GEM, PICT I&II, CGM, DRW, HPGL, PIC, DSF, PCS, MAC, TIF, and supports more than 25 group 3 fax device formats. 5K pop-up provides capture function of both text and graphics screens, including Windows 3.0 screens.

LIST: $199 **PS** Price: **$149**

FastFaxts 1085-003

386 DEVELOPMENT

	LIST Price	PS Price
286|DOS Extender	$ 495	$459
386|DOS Extender	495	479
F77-EM32 + OS/386	1390	1149
High C 386/486 2.3	995	939
NDP Fortran 386	895	829
SVS C3/ANSI C Comp.	1195	325
WATCOM C8.5 386	795	639
Zortech C++ Dev.	700	629

ASSEMBLY

MS MASM	150	105
Spontaneous Assembly	199	159

C LANGUAGE COMPILERS

Instant C	495	479
QuickC	99	69
Microsoft C 6.0	495	349
TopSpeed C Prof.	297	129
Watcom C 8.5	495	439

CASE & PROTOTYPERS

Demo II V3.0	249	239
EasyCase Plus	495	449
G-Base Professional	799	699
Instant Replay Prof.	595	575
Layout	300	239
Show Partner F/X	395	295

COMMUNICATIONS ADD-ONS

Blast PC Plus	295	245
C Asynch Manager 3.0	189	139
Essential COMM	329	249
Greenleaf Comm Library	359	329
Procomm Plus	119	99
QuickComm	149	129

DBMS

CLARION Prof. Dev.V2.1	845	475
Clipper 5.0	795	570
dBASE IV	795	549
FoxPro 2.0	795	499
Paradox V3.5	795	555
R:BASE 3.1	795	645

DBMS CODE GENERATORS

DataBoss	695	649
Genifer	395	289
Pro-C w/Workbench	795	735
UI2 Developer's Release	595	449

DBMS TOOLS & LIBRARIES

Artful Two	300	289
Accsys for dBASE	395	349
CLEAR + for dBASE	200	179
CodeBase 4	295	269
CodeBase++	295	269
Comet Multiport	169	149
Comm Tools for Clipper	299	269
C Works	698	649
dBX/dBport w/source	1000	895
dGE 4.1	295	279
dSalvage Professional	200	195
Essential B-tree	199	149
Faircom c-tree Plus	595	495
FLIPPER Graphics Lib.	295	279
FUNCky.LIB	249	239
Net Lib	299	269
Novell BTrieve	595	479
Pro Clip	195	185
R&R for dBASE & Comp.	249	229
R&R Code Generator	199	159
Scrimage	149	139

WATCOM C/386

by WATCOM

Develop and debug 32-bit applications for extended DOS and Windows. Includes royalty-free 32-bit DOS extender, true 32-bit Windows GUI Application Kit, our fast, tight, and reliable 32-bit Code Optimizer, licensed Microsoft Windows SDK Components, an interactive Source-Level Debugger, an Execution Profiler and More!

LIST: $995 **PS** Price: **$795**

FastFaxts 1044-020

EZ-Install

by Software Factory

Produces professional, comprehensive installation routines for applications or software products through Installation Aid, a menu-driven facility that quickly steps the developer through installation options, generates the installation configuration, then creates distribution disk(s). Checks/modifies user's CONFIG.SYS, AUTOEXEC.BAT, Windows.INI files, system environment, etc. Also includes compression utility, file splitting utility, and screen builder. Reduces development time, ensures correct installation, reduces support calls. Source included/no royalties. Available for DOS and OS/2.

LIST: $249 **PS** Price: **$229**

FastFaxts 1119-001

THE PROGRAMMER'S SHOP™ 1-800-421-8006

World Radio History

We give developers what they need...

- Tools to automate every aspect of the development cycle – over 4,000 in all
- FREE pre-sales technical support

Add X Windows to Your Microsoft Windows PC with XVision

This X11R4 server, by VisionWare Ltd., lets you simultaneously display X and Microsoft Windows on your PC with copy and paste between X and DOS.

- You can use any X Windows manager, including Motif, OPEN LOOK or Microsoft Windows to manage X clients
- Works with any X Windows system using TCP/IP
- Supports 256 colors

	LIST	PS Price
XVision (Single-user)	$ 449	$ 419
XVision (5-user pack)	$1810	$1759

FastFaxts 168-060

HALO Image File Format Library by Media Cybernetics

Instant file support for your applications

Add image file reading and writing to your applications with the HALO Image File Format Library. Makes your application instantly compatible with hundreds of graphics and imaging products. Offers complete support for TIFF (Tagged Image File Format), PCX (PC Paintbrush), BMP (Windows Bitmap), and CUT (Dr. HALO). Works with Borland C++, Turbo C, Turbo C++, and Microsoft C.

DOS		Windows	
LIST:	$249	LIST:	$349
PS Price:	$199	PS Price:	$279

FastFaxts 86-073

ObjectVision 2.0 by Borland International

ObjectVision enables non-technical professionals and managers to "visually" create applications. Unlike other application development tools, ObjectVision uses declarative programming techniques to quickly create interactive applications and requires no writing of code. All of ObjectVision is visual, not just its user interface. Since no programming is required, ObjectVision is the easiest way to create Windows applications.

LIST: $150 **PS Price: $129**

FastFaxts 777-124

Turbo Pascal for Windows by Borland International

Turbo Pascal for Windows is designed exclusively for Windows programming, and everything you need is included. Turbo Pascal for Windows includes Borland's new ObjectWindows application framework FREE. So now you can develop Windows applications fast because they automatically inherit code for windows, menus, dialogs, controls, and more. You don't need the Microsoft Windows Software Development Kit (SDK).

LIST: $250 **PS Price: $189**

FastFaxts 777-130

DEBUGGERS/ DISASSEMBLERS

Dis/Doc Professional	250	229
Multiscope for DOS	179	99
Periscope/EM	295	259
Periscope I/OK	495	459
Periscope IV	Varies	
Sourcer 486 w/BIOS pre-proc.	170	149
Turbo Debugger & Tools	150	119

DEVELOPMENT TOOLS

AllClear	300	259
ASMFLOW Prof.	200	179
Blinker	249	235
dANALYST Gold Windows & DOS	495	100
C-DOC	189	179
Charge	99	95
CLEAR+ for C	200	179
Codan	395	349
Install	250	219
INSTALIT	149	139
MKS Make	149	129
MKS RCS	249	229
PC-Lint	139	115
PVCS Config. Builder	250	219
PVCS Version Manager	600	530
.RTLINK Plus	495	419
.RTPatch	495	419
Sourcerer's Appr. Prof.	499	459
The Documentor	295	229
TLIB 4	100	89

EDITORS

BBROWSE	89	79
BRIEF	249	Call
BrieFor C++	129	119
Cheetah	145	50
dBrief	129	119
Epsilon	250	229
KEDIT	150	139
PVCS Profes. Editor	300	249
SPF/PC	295	249
SpeedEdit	295	265
Vedit +	185	159

GRAPHICS

Essential Graphics Chart	399	349
GFX Graphics Library	150	139
GraphiC	465	419
graphics-Menu w/ Data Entry	249	229
GSS Graphics Dev't Tlkt.	795	699
GX Effects	199	179
w/ Source	399	369
GX Text	149	129
w/ Source	299	289
HALO Professional	395	319
MetaWINDOW/PLUS	395	349
PCX Programmer's Tlkt.	249	229
QuickPix	495	479

OBJECT-ORIENTED/C++

Borland C++	495	379
C++ 3.0 Dev.	700	629
M++	295	279
Poet/DOS	399	379
Smalltalk/V	200	175
Zinc Interface Library	200	179

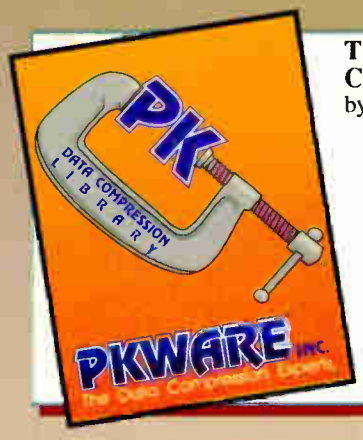
OTHER PRODUCTS

Alpha RPL	595	99
Bootcon	60	Call
Carbon Copy	199	179
CorelDRAW on CD-ROM	795	690
DiskDupe Pro	179	159
EasyFlow	230	199
Fast!	99	89
FastBack Plus	189	159
Flow Charting III	250	199
HEADROOM	130	89
HiJaak	199	149

THE PROGRAMMER'S SHOP™ 1-800-421-8006

World Radio History

And MORE!...

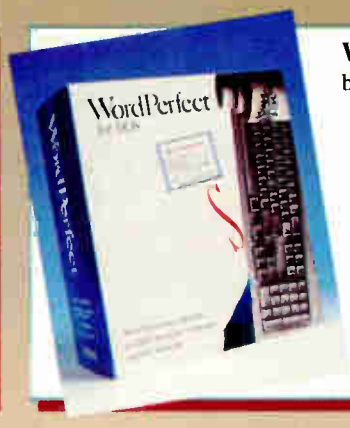


The PKWARE Data Compression Library
by PKWARE

The PKWARE Data Compression Library allows software developers to add data compression technology to applications. The application program controls all data I/O, allowing data to be compressed or extracted to any device or area of memory. Only 35K of memory is needed to compress data, and only 12K is needed to extract data.

Compatible with MSC, BC++, TC, TP 6.0, Clipper, Basic 4.5,7.1, ASM.

LIST: $295 **PS** Price: **$275**
FastFaxts 3043-011



WordPerfect
by WordPerfect

WordPerfect gives you text/graphics integration, tables, pull-down menus, mouse support, equation editor, spreadsheet links, labels, mail merge, context-sensitive help, spell checker/thesaurus, macros, dictionary-based hyphenation – plus toll-free support.

LIST: $495 **PS** Price: **$299**
FastFaxts 1933-014

CorelDRAW on CD-ROM
by Corel Systems Corporation

CorelDRAW is the world's finest graphics program. To date it has won 40 international awards for its incredible type control, superb drawing power, stunning special effects, and ease-of-use. Now you can experience the full features of CorelDRAW 2.01 and much, much more with CorelDRAW on CD-ROM. Over 10,000 clipart images and symbols and 200 fonts are yours on a single disk, at a fraction of the cost. Catch the Corel CD-ROM wave today!

LIST: $795 **PS** Price: **$690**
FastFaxts 2003-008

OS/x86 or EDU-16
by Ergo Computing Inc.

Ergo COMPUTING

Break the 640K DOS barrier and get 4 Gigabytes for code and data by running in Protected Mode. Your programs will now use all of extended memory, both in DOS and in Windows. All popular compilers supported including Microsoft, Borland, Lahey, Watcom, Microway and Metware. Compliant with all memory standards including DPMI, VCPI and XMS. Many graphics libraries supported as well. Implementation is straightforward and quick due to our user-friendly API. Kit pricing and distribution licenses are reasonable and affordable.

LIST: $695 **PS** Price: **$645**
FastFaxts 810-003

LapLink III	150	129
Link & Locate ++ - Ext.	479	399
Mace Utilities	149	99
Norton Anti-Virus	129	119
Norton Utilities 6.0	179	149
pcANYWHERE IV	179	159
PC Tools Deluxe 7.1	179	149
PC-KWIK Power Pak	130	119
Pre Cursor	96	89
Remote2	195	139
SpinRite II	89	89
System Sleuth Pro	149	99
Tame	49	49
Turbo EMS	100	89

PASCAL

MetaWare Prof. Pascal	495	439
Microsoft Pascal	300	199
Quick Pascal	99	69
Pascal ASYNCH Mgr.	175	159
Turbo Pascal 6.0	159	107
Turbo Professional	150	109

TEXT SCREEN ADD-ONS

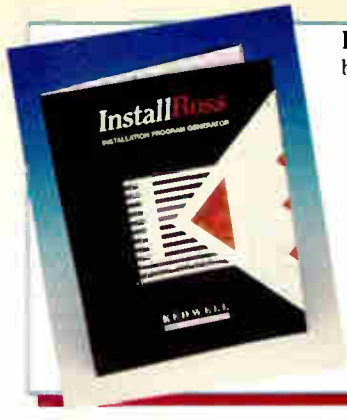
C Worthy w/Forms	449	379
Greenleaf DataWindows	395	339
HI-SCREEN Pro II	395	319
MEWEL Window System	295	279
POWER SCREEN	149	129
Vitamin C	395	369
VC Screen - painter	149	139
Vermont Views w/ source	890	819

UNIX/XENIX

Interactive Systems:		
UNIX Sys. V/386 4.0: Complete	2795	2475
Microport V/4 Complete	3000	2879
Santa Cruz Operations:		
UNIX Operating Sys.	595	559
UNIX Dev't System	995	895
UHC UNIX Sys. V Rel.4	2395	2199

WINDOWS & OS/2

ACTOR 4.0	249	225
ACTOR Professional 4.0	495	449
BRIEF for OS/2	249	Call
Case: PM (for C or C++)	1995	1899
Case: W Corporate Vers.	995	969
Class Manager	399	379
dBFAST/Windows	550	529
GFA BASIC for Windows	495	275
Graphics Server SDK	495	455
Guild	1995	Call
Instant Windows for Win.	495	439
KnowledgePro Windows	549	395
MS Windows V3.0	149	119
MS Windows SDK V3.0	500	365
Multiscope Windows Deb.	379	315
Objectrieve/Windows	395	379
ObjectVision by Borland	Call	
OptLink/Windows	350	345
OS/2 PM Toolkit 1.2	500	369
Poet/Windows	499	469
ProtoView	695	675
QuickC for Windows	199	149
Realizer	395	349
Smalltalk/V	500	399
Time after Time	80	75
ToolBook	395	349
Visual BASIC	199	165
WindowsMaker Prof.	995	895



SPECIAL! $69 (offer expires 2/15/92)

InstallBoss
by Kedwell Software

Installation for program generator for MS-DOS based computers. It generates professional installation programs and procedures for your software application. InstallBoss is menu-driven and uses a compression utility, and checks Config.sys and Autoexec.bat files. Prepares distribution diskettes for easy installation.

LIST: $169 **PS** Price: **$69**
FastFaxts 5277-001

OPUS Make
by Opus Software

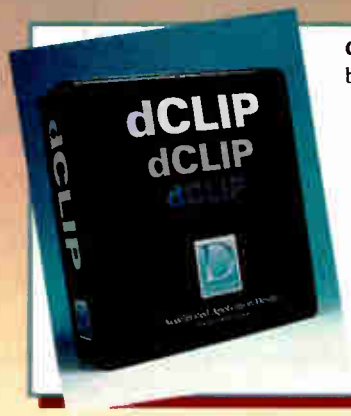
OPUS Make will save you time by efficiently managing your library and program builds. OPUS Make offers multiple directory support, makefile debugging, regular expression macros, and supports all major version control systems and object librarians. Includes a makefile and dependency generator, timestampers for source and object files, and OS/2 version. DOS Memory Miser allows OPUS Make to run in 3K. **"Without a doubt, OPUS Make is the hottest Make Utility on the market"** – Tom Swan, PC World.

LIST: $129 **PS** Price: **$119**
FastFaxts 1675-002

THE PROGRAMMER'S SHOP™ 1-800-421-8006

World Radio History

- DOS, Windows, OS/2 and UNIX tools – for every major language
- FREE, comprehensive buyers guides
- Instant, detailed product literature with *FastFaxts!*



dCLIP 2.50
by DONNAY Software Designs

Winner of DBMS Magazine's 1991 Readers Choice Award for Best Clipper Tool. A complete Turbo-like and Dot-Prompt-style Interactive development environment for Clipper 5.01 and S87. With dCLIP you can develop Clipper applications without linking. Includes complete Database Management System and 700 tutorial programs. A library of functions (with source code) lets you build any dCLIP feature (including dot-prompt) into Clipper applications.

LIST: $349 **PS** Price: $325
FastFaxts 1684-001

Bsupport®
by Information Architects, Inc.

Bsupport is a family of products for Novell's Btrieve record manager. Bedit displays, edits, and manipulates any Btrieve file. Banalyze is a TSR Btrieve application debugger. Brun replaces BUTIL and includes run-time license and C source. Bcreate builds file definitions easily and quickly. Toll-free tech support and BBS.

LIST: $309 **PS** Price: $279
FastFaxts 2100-007

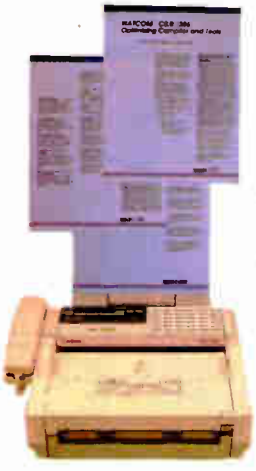
.RTPatch
by Pocket Soft, Inc.

.RTPatch allows you to update files or entire systems by sending only the changes between versions. .RTPatch compares the old version of a file (or set of files) to the new version, and creates a small patch file that contains just the differences. This patch file is then sent to the end user. The patch file is then used to change the end user's old version into the new one.

The advantages of patching are numerous: Patches are typically very small and therefore use less disk media or BBS time. Patches are also very easy to create and apply, thus taking the hassle out of updating. Patches can also be posted on public BBS's without fear of theft since the patch is useless if you do not have an original copy of the program. Finally, patches are very safe. Extensive verification insures that a correct patch is created and applied.

.RTPatch works on any file type in DOS, OS/2, and Windows, and comes with a full 45-day, no-risk, money-back guarantee. There are NO RUN-TIME charges or Royalties of any kind.

LIST: $495 **PS** Price: **$419**
FastFaxts 127-7013



What is FastFaxts?

Access literature on any of our products via FAX machine. ***FREE***!

Call 617-740-0025 from any fax phone!

Follow the voice computer's instructions and enter your product's code number. Then await your instant print out of product literature.

THE PROGRAMMER'S SHOP™

800-421-8006

National Accounts 800-446-1185

90 Industrial Park Road, Hingham, MA 02043 • Canada 800-446-3846 • Mass. 617-740-2510 • FAX: 617-749-2018

Credit card orders processed *only* when product is shipped. All prices subject to change. Int'l. prices will vary. BY192

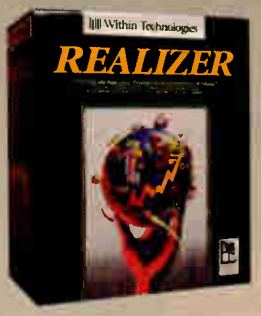
World Radio History

The REALIZER Challenge

1991
– FINALIST –
PC Magazine Award
for Technical Excellence

DEVELOPMENT TOOLS
Realizer
Within Technologies

Within Technologies™



REALIZER™

***REALIZER** was presented with the **BYTE Magazine/Interface Group** "Best Rookie Exhibitor" Award at the Spring 1991 Comdex/Windows World show, prompting **BYTE** editor Jerry Pournelle, in his September 1991 column, to write that "**REALIZER** looked to be a better program ... certainly easier to use ... than Visual Basic."*

The Interface Group
BEST
SPRING
1991
BYTE
WINNER

"... Visual Basic may have legitimized the idea of using BASIC for Windows development, but Within's Realizer has met the competition under combat conditions and demonstrated the versatility and robustness demanded by corporate developers."
- Peter Coffee, **PC Week**
September 9, 1991

"... You've heard of Microsoft's Visual Basic, but a much more powerful environment you should try is Within Technologies' Realizer ..."
- Brian Livingston, **InfoWorld**
October 14, 1991

"... a Windows programming breakthrough ..."
- Kaare Christian, **PC Magazine**
October 15, 1991

"... no other Windows BASIC can match it for power and breadth of features ..."
- Paul Bonner, **PC Computing**
October 1991

"... light years ahead of Visual Basic in terms of compatibility and porting your old BASIC application."
- Don Crabb, **InfoWorld**
October 21, 1991

REALIZER FEATURES

- Structured superset of BASIC.
- Fast, full-featured integrated development environment with sophisticated debugging tools.
- Creates .EXE files with no royalties or runtime charges.
- Automatically creates a Windows installation disk for an application.
- **Programmable Application Tools™** such as spreadsheets, charts, animation, text editors, graphics tablets, schedulers and forms.
- Visual form design with automatic code generation.
- Access functions from languages such as C and Pascal via Dynamic Link Libraries.
- Full support for Dynamic Data Exchange (DDE) and serial communications.
- Powerful features such as custom controls and automatic array processing.
- Interactive tutorial, sample code, and full featured sample applications.
- Many advanced features such as MDI, high level printing, and the ability to read and write a wide range of text and binary file formats such as Lotus 1-2-3 and Excel.
- Extensive context-sensitive online help.

SPECIAL OFFER

*Decide for yourself which is the more powerful Windows development system. For a limited time, buy a copy of **REALIZER** from*
The Programmer's Shop
*and get a copy of **Visual Basic™** **ABSOLUTELY FREE!***

Call 1-800-421-8006

THE PROGRAMMER'S SHOP™

Copyright © 1991 Within Technologies, Inc. All rights reserved. **Realizer**, **Programmable Application Tools**, and **Within Technologies** are trademarks of Within Technologies, Inc. **Microsoft** is a registered trademark and **Windows** and **Visual Basic** are trademarks of Microsoft Corporation. **Lotus** and **1-2-3** are registered trademarks of Lotus Development Corporation. **The Programmer's Shop** is a trademark of The Software Developer's Company, Inc.

World Radio History

MARTIN HELLER

OLE FOR WINDOWS 3.1

Oh, what horrors have I seen in that chamber.—James Joyce

Being a beta tester is both good and bad. You get to suggest things that would be useful to you in the final product, but you have to put up with the inevitable horrors—bugs and synchronization problems. If you use one beta program, fine—you can keep that under control. But I'm currently running test versions of Windows, Word for Windows, and Borland C++. It gets out of hand. Not that any of these is bad—no, I wouldn't go back. But I've been rebooting my computer too often. And I sometimes must go back to previous versions for compatibility with other programs.

The New Windows

You'd think that Windows 3.1 was a minor upgrade from Windows 3.0. Superficially, it is: It's faster and more robust, and it comes with better utilities and better type. Under the surface, though, are some major changes. For instance, Windows 3.1 has Object Linking and Embedding (OLE) built in.

Big deal, you say? It is a big deal when you realize that Write can now automatically launch PC Paintbrush to revise a drawing. And it's a big deal for the programmer who has to do the work of updating an application to support OLE—there are about 100 new OLE functions. Just when you thought you understood Dynamic Data Exchange!

Speaking of which, there is now an easier way to implement DDE, a set of libraries called DDEML. This implements the protocol-using functions and call-backs that insulate you from handling DDE messages directly.

TrueType makes an obvious difference in Windows 3.1. More fonts are available, they can be scaled to any size and rotated to any angle, and they look the same on the screen as on the printed page. TrueType requires a little work from applications developers—half a dozen new calls are needed to completely support TrueType.

Drag-and-drop functionality makes it easier to get programs started with specific data. For the developer, adding drag-and-drop support is nearly free. There's one function call to tell Windows you can handle dropped files and one message to process when the files are dropped. You'll soon see more consistency in the commonly used dialog boxes in Windows 3.1.

Before this, developers had to reinvent everything, even the dialog box for opening a file. Now there are reusable dialog-box functions for color selection (RGB and hue-luminance-saturation models), font selection, filename selection (open and save file dialog boxes), finding and replacing strings of text, and printing (both configuring a printer and controlling a print job). What a concept—and about time, too.

Windows 3.1 APIs, C++ libraries for Windows, and hard drive adventures

Writing shells is easier now, too, with documented functions for pulling icons out of .EXE files, for finding out about the program inside an .EXE file, and for automatically opening or printing a data file using the appropriate program. Alas, the shell side of drag-and-drop is not yet documented.

Writing Windows debugging functions and programming tools is now much easier because of about 100 new "tool help" functions. Developers can use 10 new "stress" functions to test their applications in reduced-resource situations, so the programs you see will be less likely to fail in use. And the Windows kernel itself is much fussier about what it accepts from application programs, so it is less likely to crash because of a badly behaved program. It's a brave new world.

There are other ways for developers to improve their programs before shipment. Testers can run an application named Dr. Watson, which records the conditions that lead to the dreaded unrecoverable applications error. Send your Dr. Watson logs back to the developer, and chances are the problems can be fixed, even if they don't reproduce on the developer's machine. Earlier in the game, developers can use a special "strict" version of WINDOWS.H to double-check their code at compile time.

Developers who want to get ready for Windows NT and Win32 (Microsoft's next-generation Windows environments) can (and should) change the way they handle Windows messages. The new "message cracker" application programming interfaces (APIs) in version 3.1 automatically pick apart Windows messages and call message-handling functions with the correct parameters. This cuts down on the amount of ugly casting programmers have to use now and guarantees portability with

ILLUSTRATION: ROGER BOEHM © 1992

World Radio History

future versions of Windows, which won't be compatible at the raw-message level.

C++ and Class Libraries

Message-handling functions sound a lot like what the object-oriented folks call virtual methods. I don't think that's an accident. Microsoft is working on C++ for version 7.0 of its venerable C compiler, along with base classes for every environment the company supports. I haven't seen it yet (I'm still using version 6.0b for my production programs), but I do have a retail version 3.0 of Zortech C++ and a beta version 3.0 of Borland C++. I also have Watcom C 8.5 and MetaWare High C 2.3; I'll talk more about those in an upcoming column.

The Zortech compiler package is an outstanding value for multiplatform work. It supports DOS, OS/2, Windows, Presentation Manager, 286 DOS extenders, and 386 DOS extenders. It has a dynamic overlay technique for DOS, a handle pointer type for virtual memory management, and a royalty-free 286 DOS extender.

Zortech's compiler—which does global and local optimization—is the first to support the new Numerical C Extensions Group standards for floating-point operations and the first PC compiler to support the revision 2.1 C++ specification.

The scientific and engineering version of the Zortech compiler package also includes the M++ class libraries, which make handling vectors and matrices a snap. If you are still using FORTRAN because of the availability of LINPACK and EISPACK, this may be the time to switch to C++.

On the other hand, Borland C++ is the fastest compiler for developing DOS and Windows programs. Version 3.0 is even faster than version 2.0—there's no longer any perceptible penalty for writing C++, and, miraculously, the compiler now optimizes without a significant cost in compilation speed.

Borland's application frameworks—Turbo Vision for DOS programs and ObjectWindows for Windows—will give any developer a flying start at a working program with a good interface. I was quite surprised at how much Borland included in Turbo Vision—there's enough here that you can make your program look exactly like it was developed at Borland, with no trouble at all.

ObjectWindows is good, but it's not complete. Third-party class libraries like Win++, Tier, Zinc, and C++/Views have additional functionality. Which should you choose as an application framework?

Tough question. A more fundamental question is: Why use C++ and a class library at all? Aren't all the major Windows programs written in C using the Software Development Kit? Well, yes, they are—or were, until recently. Consider: A DOS "hello, world" program in C is five lines long, but the Windows equivalent in C is 80 lines long—and in three separate files, at that. "Hello, world" in C++ without a class library takes about 275 lines of code; with ObjectWindows, it takes 28 lines, and that includes white space. That's a big difference.

The other class libraries show roughly the same kind of dramatic simplification in the "hello, world" application, so that's not a reason to choose one over the other. You'll find the differences when you get deep into your project: differences in coverage of the API, ability to go directly to the API, availability of source code, completeness of documentation, and so on.

If a library doesn't let you go directly to the Windows API and doesn't support what you want to do, you'll have to add a class to the library. This may not be easy

Some of the most enlightening articles in a magazine never make it to the table of contents.

Open to the table of contents in any publication and you can find some insightful stories. You'll also find some missing. Because the advertising isn't there.

Advertising is important. It's informative. It lets you know your options. And helps you to make decisions.

Like which car to buy. Which airline to fly. And what to serve for dinner.

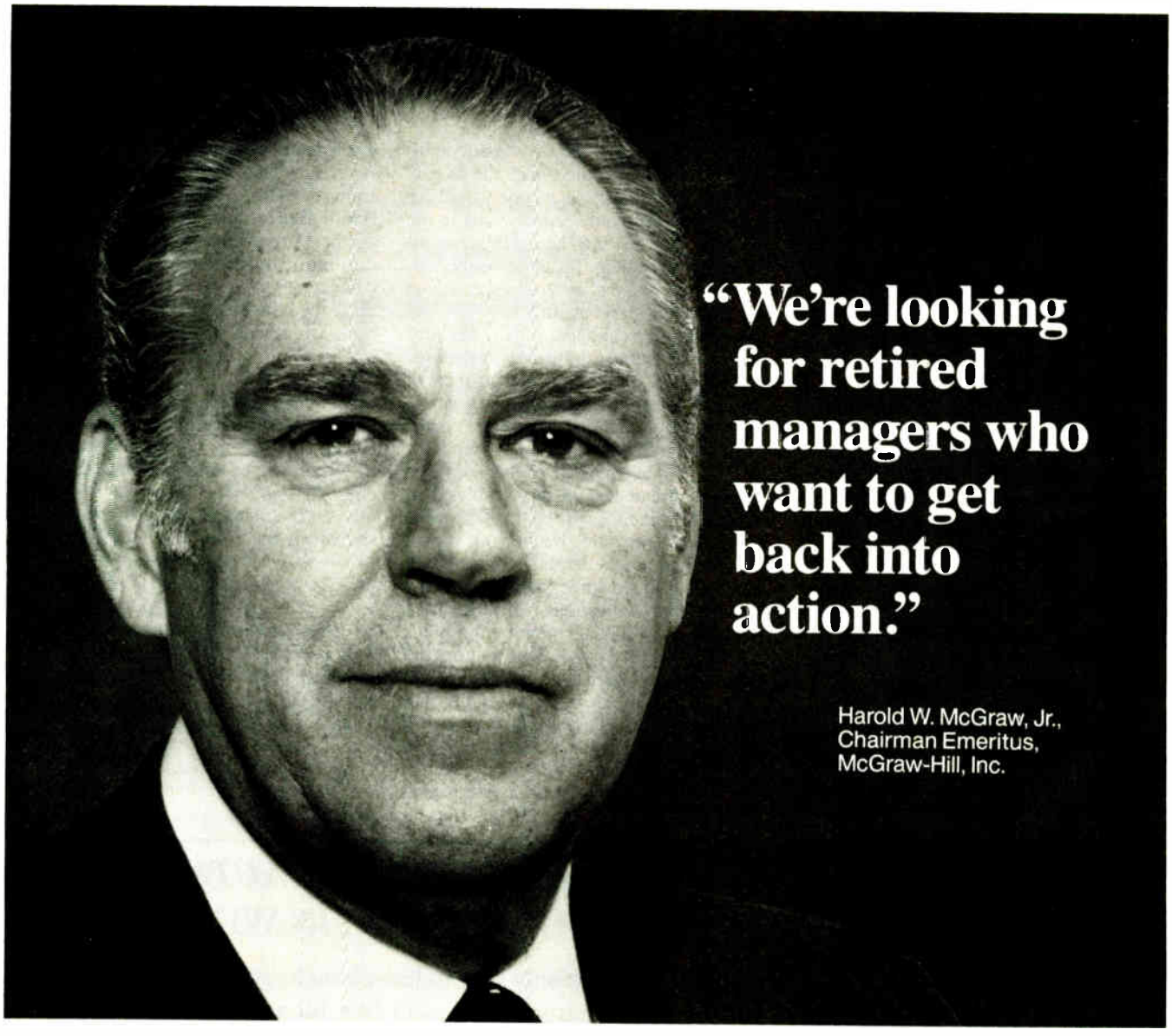
So, next time you open a magazine, read it. From cover to cover.

Because what's on the back cover, may be just as important as what's on the front.

ADVERTISING.
Without it you wouldn't know.

AAF
AMERICAN ADVERTISING FEDERATION

World Radio History



I'm a volunteer supporter of the International Executive Service Corps, a not-for-profit organization with a vital mission:

We send retired U.S. managers overseas to help businesses in developing countries, which often respond by increasing their imports of U.S. goods. In fact, developing countries consume about 40 percent of U.S. exports.

As an IESC volunteer, you would not get a salary. But you would get expenses for you and your spouse, plus a world of personal satisfaction.

IESC leads the field in this kind of work. We've done over 9,000 projects in 81 countries. We could have a project that's just right for you.

For more information, send this coupon to: Harold W. McGraw, Jr., Chairman, McGraw-Hill, Inc., P.O. Box 10005, Stamford, CT 06904-2005.

Dear Mr. McGraw: Tell me more about becoming an IESC volunteer. I am a recently retired manager or technician—or am about to retire—from a U.S. company. I'm free to accept an overseas assignment. I understand that volunteers receive expenses for themselves and their spouses, but no salary.

Name _____

Address _____

City _____ State _____ Zip _____

In what publication did you see this ad? _____ M3

Ad Council

International Executive Service Corps

It's not just doing good. It's doing good business.

World Radio History

unless source code is supplied and the documentation is good. If a library does allow API calls, things are a little simpler. Now you're writing C again. The best case is a library that already has C++ classes built in for everything you want to do.

Another issue is integration of the classes, both within a library and between libraries. For instance, you might want to save a program's current state. If all your classes are streamable, that's easy—almost trivial. If not, well, it isn't impossible, but it's a lot of work.

I'm not going to attempt to list the coverage of each library. Even if I had the space, the list would be obsolete in a few months. I will, however, spotlight individual class libraries in my next few columns. Meanwhile, you may want to contact the class library vendors yourself. Most of these vendors have literature that includes their class hierarchy tree, so you can compare coverage and organization among libraries.

Alarums and Excursions

A few months ago, one of my ESDI hard drives developed the alarming habit of spontaneously spinning down and dumping its heads. Click-thunk, and suddenly DOS wouldn't be able to see the D partition table. Usually, a reboot would fix things. The problem seemed worst in the morning, but leaving the machine on all the time didn't help. I was seriously concerned that one day it would spin down and never power up again.

I got religious about doing my backups and realized that my 60-MB cartridges were not ideal for backing up a gigabyte of material. It took me all day to do a single set of backups, and I wasn't about to make multiple sets. With a little push from folks on BIX, I bought a bottle of Stabilant 22a. I cleaned and treated the drive cables; better, but not fixed. I treated the hard drive controller card's edge connectors and all the socketed ICs; better, but still not fixed. Finally, I dripped some Stabilant into the ribbon cable connections inside the drive case. Eureka! I've had no more trouble.

One down, one to go. I cast out my old tape drive and borrowed a 1.3-gigabyte digital audiotape drive from Palindrome (Naperville, IL), along with its Network Archivist 2.0 software. I've never had so much archival coverage for so little effort. I run Network Archivist at lunchtime, and when I come back it's done. It manages save sets, checkpoints, and migration archives using rule sets and a Tower of Hanoi algorithm—all the storage management procedures you'd find at a well-run mainframe shop. It even tells you which tapes to move off-site and when to bring them back. I don't want to give this back. Oh, my poor budget!

Signing Off

I mentioned earlier that I have a beta version of Word for Windows. It's version 2.0, and it's mostly wonderful. I'm using it to write and produce the camera-ready copy for *Advanced Windows Programming*, which should be on the bookstore shelves by the time you read this. ■

Martin Heller develops software and writes about computers, despite a Ph.D. in physics and having worked, literally, as a rocket scientist. He is the author of Advanced Windows Programming *(Wiley, 1992). You can reach him on BIX as "mheller."*

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

ADVANCED WINDOWS PROGRAMMING

• • •

By Martin Heller
Available February 1992

ISBN: 0-471-54711-5
Price: $32.95 (paper) 400pp.

JOHN WILEY & SONS, INC.
605 Third Ave.
New York, NY 10158-0012

CONSULT WITH THE *AUTHORITY* ON PROGRAMMING IN WINDOWS 3.1

Up to now the only way to learn how to program in the Windows environment was to do it for a couple of years, learning by trial and error. In ***Advanced Windows Programming***, Heller describes the actual development of a large scale, real-world Windows application. Learn how all the new features of Windows 3.1 will impact on you as a programmer. Heller identifies the following unique tips and techniques:

- ✓ Device independent bit maps
- ✓ Programming for color
- ✓ Substanital treatment of debugging techniques
- ✓ Co-ordinated operation between DOS & Windows programs
- ✓ How the new features of Windows 3.1 affects programmers

RESERVE YOUR COPY AT YOUR LOCAL BOOKSTORE OR CALL TOLL-FREE

1-800-CALL-WILEY

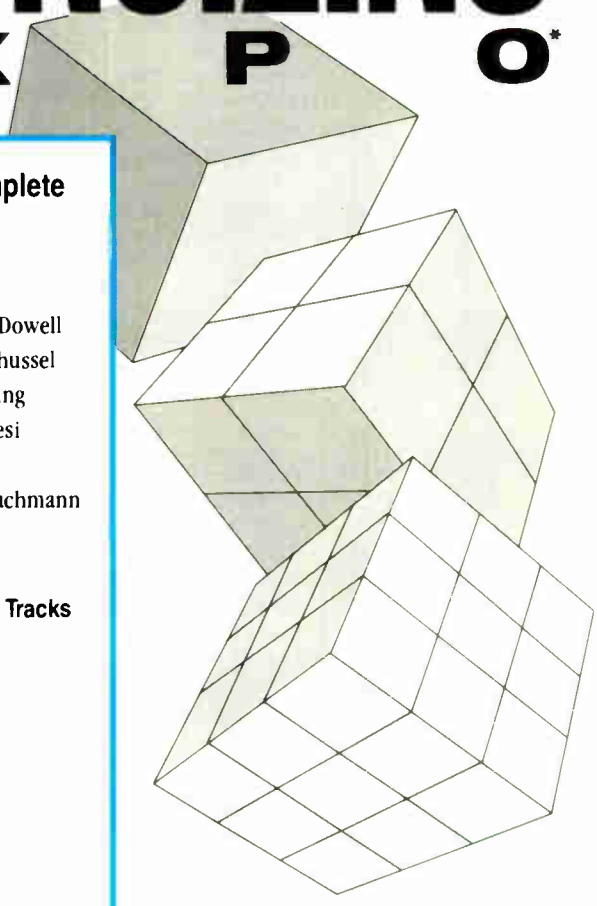
WILEY

World Radio History

THE NATIONAL CONFERENCE & EXPOSITION

DOWNSIZING EXPO®

March 10-12, 1992
Chicago, IL



Co-Sponsors:

ALLY

ANDERSEN CONSULTING

Boston Systems Group, Inc.

BORLAND

COMPAQ

COMPUTER ASSOCIATES
Software superior by design

HEWLETT PACKARD

Information Builders, Inc.

Microsoft

NETWORK WORLD

TEXAS INSTRUMENTS

UNIX SYSTEM LABORATORIES

UNIX Today!

The Original and Most Complete Downsizing Conference

The Leading Industry Experts:

- Ross Cooley
- Paul Cosgrave
- Larry R. DeBoever
- Rob Dickerson
- Ted Klein
- Dominique Laborde
- Robert McDowell
- George Schussel
- John Soyring
- Enzo Torresi
- Amy Wohl
- William Zachmann

— And Many More —

Five New, Expanded Conference Tracks

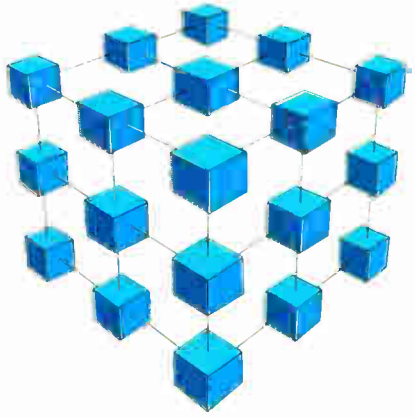
- Client/Server DBMS
- Windows Applications
- Open Systems
- Networks and Their Management
- Downsizing Experiences

Plus . . .

- Today's Hot Topics — Including:
  - — The Development of the ACE Consortium
  - — IBM's Information Warehouse
  - — New Operating Systems, Including: IBM's OS/2v2® & Microsoft Windows NT™
  - — The New World of Windows 4GLs
- 4 Optional In-Depth Seminars
- Product Education Sessions
- FREE Admission To Over 50 Exhibits

Sponsored by:

Digital Consulting, Inc.

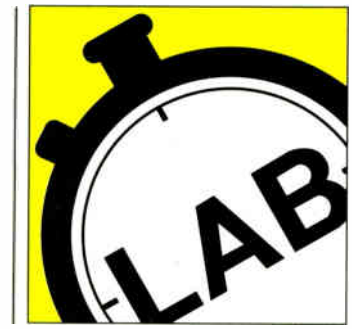


To register or receive a complete brochure, please call Digital Consulting, Inc. at (508) 470-3880

A12YB

World Radio History

ASK BYTE



A Really Big Disk

A serious problem with MS-DOS 5.0 has reared its ugly head. I need a large RAM disk for an application. To this point, I have been using DOS 3.3+ and VDISK.SYS 3.08 to create an 8-MB RAM disk. I now need to run the application in a 32-MB RAM disk.

MS-DOS 5.0 comes with RAMDRIVE.SYS, but it allows a maximum RAM disk size of only 4 MB. My previous VDISK.SYS had a minimum and default, but it had no maximum size restriction. However, when I tried to run VDISK.SYS under MS-DOS 5.0, the operating system imposed a 4-MB limit.

Do you know of a RAM disk creation program that will run under MS-DOS 5.0 and allow for a 32-MB RAM disk?

T. Pappan
Owosso, MI

A 32-MB RAM disk! I shudder at the very thought of it. A momentary power glitch and your data would be history. The Microsoft programmers had a reason for putting a limit on the size of the RAM disk.

You didn't mention the nature of the application program you are running. If you can, invest in a caching hard drive controller and a fast hard drive.

The only software solution I could find is an ADJRAM41.ZIP file in the IBM.UTIL listings section on BIX. The .ZIP file includes the .SYS, .EXE, and .DOC files, plus source code in C and ASM. ADJRAM is an adjustable RAM disk. You can vary the size of the RAM disk on the fly from 15 KB to the maximum available RAM in your system. The program uses only expanded memory.

Good luck.—Stan Wszola

Any Port in a Storm

I just read "Repairing the Cracks in Windows" in the September 1991 BYTE. Version 3.0 does not support the COM3 and COM4 ports. Will Windows 3.1 support them?

Chris Crosby
Plano, TX

Windows 3.0 certainly does *support COM3 and COM4. Your problem may be that you haven't configured Windows to use all your COM ports. First make sure that all your COM ports are configured for the correct I/O address and interrupt:*

Port	*Address*	*IRQ*
COM1	*3F8h*	*4*
COM2	*2F8h*	*3*
COM3	*3E8h*	*4*
COM4	*2E8h*	*3*

You may have four serial ports, but they share two interrupts. You can run into problems if, for example, you are using a serial mouse on COM1 and have an internal modem on COM3. This configuration won't work because the mouse is tying up the interrupt that is shared with COM3. This also occurs if you are using a serial mouse on COM2 and want to use an internal modem on COM4.

COM3 and COM4 may not work reliably under Windows 3.0 (in standard and real modes) unless both COM1 and COM2 are first activated. Don't use a higher serial port (i.e., 2, 3, or 4) unless all lower number ports (i.e., 1, 2, and 3) are first activated or in use.

You should also check the default setting in the 386ENH section of the SYSTEM.INI file for proper functioning of the ports under enhanced-mode Windows 3.0:

COM1BASE=3F8h
COM2BASE=2F8h
COM3BASE=3E8h
COM4BASE=2E8h

The procedure for modifying the SYSTEM.INI file is described in detail in the SYSINI2.TXT file. The discussion appears in the 386ENH section.—Stan Wszola

Yankee Doodle Deadly

After I returned a defective shareware disk to a distributor, I learned that it contained the Yankee Doodle virus. I have not been able to obtain a copy of Richard Levin's *Computer Virus Handbook*, which Hugh Kenner mentioned in the November 1990 Print Queue. Is there somewhere I can find out about this computer virus?

C. J. Jaskowiak
Skokie, IL

The Yankee Doodle virus is a fairly common strain affecting IBM PC compatibles. Infected .COM and .EXE files generally increase in size from 2772 to 2899 bytes. There are many versions of the virus, the most common of which plays "Yankee Doodle Dandy" on the PC's speaker at 5:00 p.m. For this reason, it's also known as the Five O'Clock virus.

Computer Viruses *by David J. Stang (Diane Publishing, 1991, ISBN 0-941375-24-2) lists some in-depth information about this virus, starting on page 315. Stang and Bill Bales head the National Computer Security Association (227 West Main St., Mechanicsburg, PA 17055, (717) 258-1816). The NCSA conducts seminars and provides information about computer security and virus protection.*

The NCSA's booklet Computer Virus Survival Guide *explains how to prevent, detect, identify, and recover from viruses. You can get a copy for $7. The NCSA also has a BBS you can call for more information: (202) 364-1304, 8 bits, 1 stop bit, no parity.*

We recommend a complete program of security and virus prevention if you are concerned about the virus threat. For a review of security and virus-prevention software, see the Solutions Focus in the August 1991 BYTE.—Stanford Diehl

World Radio History

"Software engineering has been defined as the process by which all the fun is removed from computer programming. By this definition, the Software Development conferences are a failure. Sure the classes teach state-of-the-art techniques that you can put into practice tomorrow, but everyone—students and teachers alike—enjoys the conference. I return from each one a more competent and more enthusiastic programmer."

Jon Bentley
Member of the Technical Staff
AT&T Bell Laboratories

Follow the Leaders

The Software Development Conference is where the world's top programmers come for unbiased solutions to complex programming challenges.

The whole idea behind our conference and exhibition is embarassingly simple. Get the world's best software developers and managers together in one place and let the sparks fly.

Our speaker lineup represents the best and brightest—industry leaders such as Steve Mellor, Jon Bentley, Brian Kernighan and Larry Constantine, to name just a few. But these aren't just great speakers, they are great teachers who can provide programming solutions you can take back to the office and put to use immediately.

You'll leave Software Development '92 full of new ideas, re-energized and ready to take on your next big challenge.

Over 150 Classes on Every Important Development Topics.

Of course, we'll lead off with beefed up versions of the best tracks from '91: **C/C++, Analysis, Design & Software Engineering** and **Object-Oriented Programming,** and more.

Then, we're adding brand-new tracks on:

- **Windows Development** - From costing to design, coding and testing Windows applications--learn top to bottom how to develop for Windows.
- **OS/2**- Intro to OS/2 2.0 Kernel and PM APIs, Cross Platform Development with OS/2, Porting to OS/2. and much more.
- **Interoperability and Enterprise-Wide Development** - Insight into distributed databases, downsizing, client-server, developing networkable applications, cooperative processing, X programming, and more.
- **Programming Futures** - Up-to-the-second information from the sources on what's happening with pen-based computing, end-user programming, parallelism, Apple's PINK, and the Patriot Partners.

SOFTWARE DEVELOPMENT '92

Call today (415) 905-2414

YES! Please send me more info on:

❑ ATTENDING ❑ EXHIBITING

Name _____

Title _____

Company _____

Address _____

_____

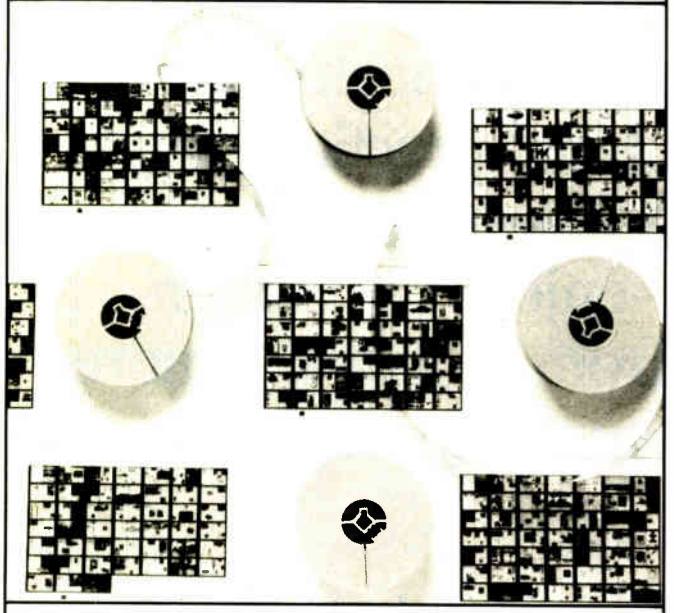
Phone ( ) _____

Fax ( ) _____

Software Development '92
600 Harrison St. San Francisco, CA 94107 BMSDS

World Radio History

This publication is available in microform.



UMI reproduces this publication in microform: microfiche and 16 or 35mm microfilm. For information about this publication or any of the more than 16,000 periodicals and 7,000 newspapers we offer, complete and mail this coupon to UMI, 300 North Zeeb Road, Ann Arbor, MI 48106 USA. Or call us toll-free for an immediate response: 800-521-0600. From Alaska and Michigan call collect 313-761-4700. From Canada call toll-free 800-343-5299.

Please send me information about the titles I've listed below:

_____

_____

Name_____

Title_____

Company/Institution_____

Address_____

City/State/Zip_____

Phone (_____)_____

U·M·I

A Bell & Howell Company
300 North Zeeb Road, Ann Arbor, MI 48106 USA
800-521-0600 toll-free
313-761-4700 collect from Alaska and Michigan
800-343-5299 toll-free from Canada

Ins and Outs

I am looking for information on IBM PC/XT/AT/386 hardware interfacing (i.e., RS-232, Centronics, I/O bus, mouse, and video adapters). Is there a single source? Specifically, I want to use the Centronics parallel printer interface for general I/O.

Gilbert Mackay
Middlesbrough, U.K.

Programmer's PC Sourcebook, *2d ed., by Thomas Hogan (Microsoft Press, 1991, ISBN 1-55615-321-X) should have everything you need. It includes complete hardware specifications for PC components, peripherals, and ports.*

By a grand coincidence, Howard Eglowstein has written about using the Centronics parallel printer port in this month's Some Assembly Required. He has created a TSR program for a notebook computer that accepts keystroke information from a desktop machine and posts it in the notebook's keyboard buffer. A companion program for the desktop machine accepts keystrokes and passes them through the parallel cable. This article should give you some good ideas.—Stanford Diehl

A DISKussion on TSRs

As a computer analyst, I have a lot of experience with computers, mainly IBM PC compatibles. Until now, I've written only "safe" applications using dBase, Pascal, or C. I taught myself assembly language, and then I wrote a small TSR program to see how it works. My TSR redirects INT 17 hexadecimal (i.e., BIOS printer request) to the screen (or a file). I managed to redirect the printer output to the screen, but when I tried to send the output to a file, it stopped working. I tried everything, and I'm stuck. Is it the famous DOS reentrancy problem? Can you suggest a solution or a reference for more information?

Albert Ivanov
Fléron, Belgium

Well, you didn't try quite *everything. You have in fact stumbled into the DOS reentrancy problem, and working around it is one of the trickiest TSR problems in DOSdom. Master that, and you're well on your way to being a DOS wizard.*

The problem is this: DOS is not an operating system as much as it is a collection of utilities. If you think of the file system as a utility for handling disks, it's easy to see why Microsoft didn't build in support for multiple tasks. There simply was no reason to do so. Once DOS starts a task, you have to let it finish before asking it to do something else. The reason your TSR crashes is that it often tries to do disk access during another DOS call. The disk call wipes out the status of the interrupted call, and DOS goes away.

The workaround is conceptually simple. Before you make your DOS call, ask DOS if it's busy. If it is, exit the TSR to let DOS finish what it's doing and try again later. To do that, you need the assistance of a "secret" DOS call that was largely undocumented until version 5.0. During your TSR installation process, call INT 21h, function 34h. DOS will return ES:BX as a pointer to the

World Radio History

InDOS flag. Your TSR can check the contents of this byte to see if DOS is free.

The correct way to have a TSR capture the printer output to a file is along these lines: The TSR has to capture two interrupts. Obviously, you have to capture INT 17h, the printer interrupt. Your new INT 17h will take the characters and start them on their way to the file. Buffer up a bunch of them, and when you're ready to save them, your TSR should check the InDOS flag. If it's zero, it's safe to call DOS. Temporarily take over INT 24h (the critical error handler), so any disk errors don't plop an "Abort, Retry, Ignore?" message on-screen. Open your file, seek to the end, write the data, and close the file. Restore the critical error handler.

If the InDOS flag has a nonzero value, you're stuck. You'll just have to hold the characters in memory and wait until you get control next to try again. I'd suggest that you daisy chain to INT 1Ch (the 18.2-tick-per-second clock). By examining the InDOS flag 18 times each second, you're going to find DOS available more often than by merely using INT 17h.

That's a lot to do, and you're going to crash the machine frequently while you debug it. The new Microsoft MS-DOS Programmers *(Microsoft Press, 1991, ISBN 1-55615-329-5) has a brief discussion of the procedure. You might also see Andrew Schulman's* Undocumented DOS *(Addison-Wesley, 1990, ISBN 0-201-57064-5) for more information on the InDOS flag. If you can still find a copy, check out the* Waite Group's MS-DOS Papers *(ISBN 0-672-22594-8). It's a collection of articles by various authors on the scarier parts of DOS programming. Their discussion of TSR file access is excellent.*

—Howard Eglowstein

EISA or ISA

I am looking for a 33-MHz 386 or 33-MHz 486 EISA motherboard to update my present 286 computer. A vendor that I visited had an EISA board with both EISA and ISA slots. I wondered if the EISA slots on this board really work at full speed.

At another computer store, I was told that its motherboard had two EISA slots, but that these operate at only 12 MHz. At what speed should EISA slots work? If I mount an ISA card in an EISA computer, does the EISA bus still work at full speed?

I have several ISA cards in my computer that I would like to move to my new motherboard. Are there any problems using old 8-bit cards in EISA slots?

Carl Nilsson
Lund, Sweden

One of the purposes of EISA was to provide a high-performance bus standard that maintained compatibility with the great majority of devices designed for the ISA bus. Systems we've seen run the EISA bus at 8 MHz, so using your old 8-bit cards should be fine. Their presence should not affect the performance of other peripherals.

Some motherboards partially implement EISA as a way of saving money or as a stepping-stone design between full-ISA and full-EISA systems. Whether you choose full-EISA or a partial design, you shouldn't have any trouble with cards that work reliably in IBM ATs.

—Steve Apiki ■

Circle 314 on Inquiry Card

486-50MHz ISA
486-33MHz EISA

The cutting edge of technology is now available from Mega Computer Systems.

Since 1978, we have been providing our customers with the most powerful, high quality computers at an affordable price!

For information and pricing on our complete line of 286's, 386's and 486's, please call ***800-338-6628.***

VAR/VAD and OEM Inquiries Welcome.

MCS

Mega Computer Systems • San Diego, CA

Characters Unreadable?
Print Fading? Out of Memory?
Panda has solutions!

Printheads: If your dot-matrix printouts are light, jagged or incomplete, you may need to refurbish or replace the printhead. Save **money** and get your printer running like new. Warranty: refurbishment–6 months; new–3 months.

Model	New Price	Repair	Model	New Price	Repair
Apple Imagewriter II	$94.00	$69.00	Okidata 84/92/93	$138.00	$58.00
Epson LQ800/1000	218.00	129.00	Okidata 182/183/192/193	99.00	58.00
Epson LQ850/1050	210.00	129.00	Panasonic 1080/1090	101.00	82.00
IBM Proprinter X24	407.00	129.00	Star NB 24-10	199.00	122.00
NEC 5200/5300	238.00	114.00	Toshiba 351	424.00	140.00
NEC P6/P7	308.00	117.00	*Over 400 types refurbished & many new in-stock!*		

JetFill 2-pack $16.95

Recharge inkjet or bubble jet cartridges

Remanufactured Laser Cartridges $49.95*

- Highest Quality
- Quick-ready to ship
- Guaranteed

* after trade-in

Call 24 hours a day for more info
(800) 580-3232

Panda Printer Products

Printer Products:
- Cleaning supplies
- Fonts/font cards
- Memory
- Ribbons

VISA MasterCard Prepay

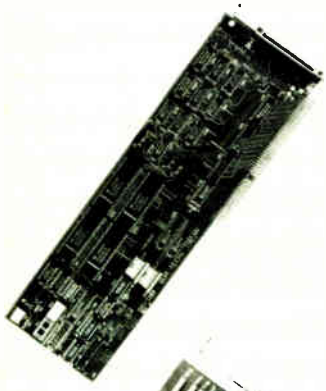
Prices subject to change. Texas residents add 8% sales tax.

2324 Ridgepoint Dr., Suite A • Austin, TX 78754 • (512) 339-9781

World Radio History

QUATECH

"not just another board game"



COMMUNICATION

Quatech produces a full line of communication boards for the PC-XT, AT and MicroChannel systems including:

Asynchronous:

2 port for PC/AT
- DS-100:RS-232
- DS-200:RS-422
- DS-300:RS-485

2 port for PC/XT/AT
- DS-102:RS-232
- DS-202:RS-422
- DS-302:RS-485

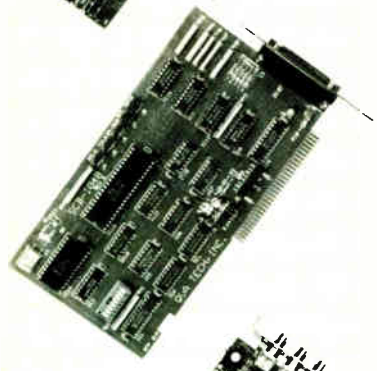
Synchronous

Bisync, SDLC, HDLC
- SCB-1020
  - 1 channel RS-232
- SCB-1040
  - 1 channel RS-422
- SCB-1050
  - 1 channel RS-485

Multiport

8 port RS-232
- ES-100
  - Block addressing
- MS-100
  - Selectable addressing by port

4 port RS-232
- QS-100
  - Flexible addressing

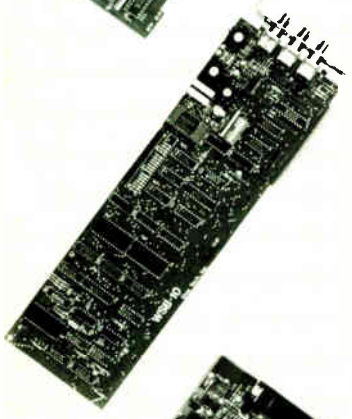


WAVEFORM SYNTHESIZER

The WSB-100 Waveform Synthesizer Board has the best set of numbers in the market. With speeds to 20MHz and 32K memory at $1290, it's making waves in more ways than one.

WSB-10
- •PC/XT/AT, 12 bit arbitrary signal generator
- •Onboard oscillator for independent operation
- •Internal data rates programmable from 200 nS/point to 429 sec/point
- •Output signal defined up to 2048 pts.
- •10 Megahertz maximum output

WSB-100
- •PC/AT, modular arbitrary signal generator
- •DMA support for high speed waveform definition
- •Output signal defined up to 32,000 points
- •20 Megahertz maximum output
- •An analog or digital module is required for operation
  - WSB-A12: 12 bit analog waveform module
  - WSB-D16: 16 channel digital pulse generator module



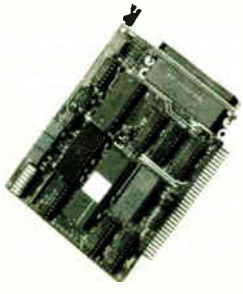
DATA ACQUISITION

Quatech has developed a full line of data acquisition products for the IBM PC-XT, AT, MicroChannel and compatibles. These high performance, low cost boards provide analog-to-digital, digital-to-analog, and digital input/output functions.

PXB-160
- •True 16 bit digital I/O
- •Configurable as two eight-bit ports
- •Handshake signals available for 16 bit I/O transfer
- •List price below $400

SAC-12
- •16 single ended A/D input channels
- •12 bit resolution
- •3 16 bit interval counters/timers
- •3 digital I/O lines
- •Switch selectable address

DAQ-16
- •8 A/D inputs & 2 D/A outputs
- •16 bit/100KHz
- •4 digital I/O lines
- •2 DMA channels for continuous acquisition



1-800-553-1170

Call for a free catalog or fax (216) 434-1409

International distributors call: Australia/Interworld Electronics 03-521-2952, Canada (Western)/Interworld VCR 604-984-4171, England/Diamond Point International 634-722-390, Finland/Lab Hitech OY 0672497, France/Elexo 33-1-69302880, Germany/Jupiter Electronic Systems 06181/75041, Israel/RCM Ltd. 972-03-5447885, Italy/N.C.S. Computer Italia 03311 770-016, Netherlands/ACAL Auriema 040-816565. IBM PC-XT, AT and MicroChannel are registered trademarks of IBM Corporation.

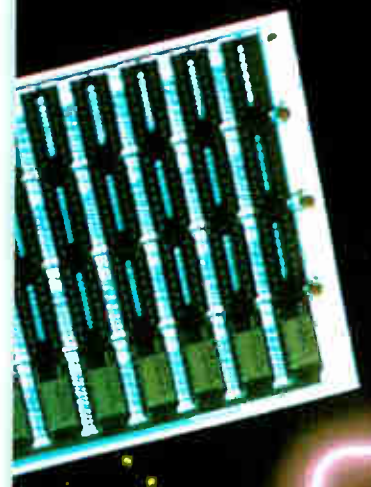
Made in U.S.A.

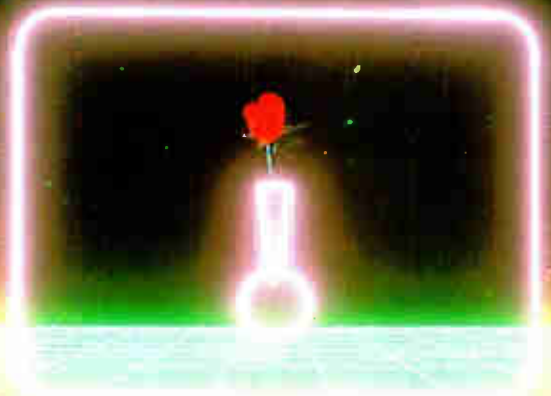
Circle 138 on Inquiry Card.

World Radio History

BYTE BUYER'S GUIDE

Your direct source for buying software, hardware and accessories from knowledgeable and service-oriented dealers.





	Page
Mail Order The latest offerings from vendors supplying products of all leading manufacturers at extremely competitive prices.	354
Hardware/Software Showcase This new, *categorized* four-color display section makes it easy to find Hardware and Software products from a wide variety of manufacturers and suppliers.	381
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.	388

World Radio History

INSTRUMENTATION

New Compression, Conversion and Communications Package

LEAD Technologies' **LEADVIEW**™ combines image compression, file conversion, and communication in an easy-to-use hardware and software package.

- Extended Compression Ratios of up to 255:1
- Supports JPEG compression, JFIF, and JTIFF
- Uses C-Cube CL550B Image Compression Chip
- You can compress, convert, scale, and resize TGA, GIF, TIFF, PCX, BIN, and BMP files

#LTI 255 LEADVIEW 255™ – Compression S/W & Real-Time Processing Board.....$**1995**
(Compr. or Decompr. 1 MB TGA file to 6 KB in 1 Sec)

#LTI 200 LEADVIEW™ – Turbo Software.....$**785**
(1 MB Targa32 file to 6 KB in 8 to 10 Seconds)

#LTI 100 LEADVIEW™ – Software only. .....$**129**
(1 MB Targa32 file to 6 KB in < 30 Seconds)

#LTI 110 LEADVIEW™ – 30-Day Demo Version..$**10**

Digital Products DataCommander

New **DataCommander**™ Serial Port Multiplexers operate independently of your host PC. Achieve high-speed data collection and communications from many sources without taxing your PC's main processor. On-board 250K memory buffer (upgradeable to 4MB) and on-board microprocessor make the DataCommander™ a powerful acquisition tool. **Your PC can be executing other tasks while the unit spools up to 4MB of incoming data.**

Ports on these units use DB 25-pin connectors. **Custom configurations** are available featuring RS-422 (long distance) lines, RJ-11 / RJ-45 connectors, and parallel port options.

#DCOM 600 6-Port RS-232 DataCommander™.....$**995**
#DCOM 1000 10-Port RS-232 DataCommander™...$**1495**
#DCOM 1610 16-Port RS-232 DataCommander™...$**1995**

Arnet Intelligent Serial Boards

Your PC is no longer limited to 2 serial ports! Multi-port serial boards from Arnet let your DOS-based PC support up to 66 serial ports. All Arnet boards come complete with DOS Driver Software and an external 25-pin "D" connector box.

- Intelligent units offer on-board 80186 microprocessor and dual-ported RAM buffer.
- **Free** DOS driver software lets DOS recognize up to 66 COM: ports.
- **SurgeBlock**™ on all ports protects your PC from killer voltage spikes.
- "Rock-Solid" **Lifetime Warranty**.

#COMH 104 4-Port Intelligent Serial Board.....$**595**
#COMH 108 8-Port Intelligent Serial Board.....$**995**
#COMH 116 16-Port Intelligent Serial Board...$**1895**
#COMH 132 32-Port Intelligent Serial Board...$**2995**

CyberResearch

JANUARY PRODUCT SHOWCASE

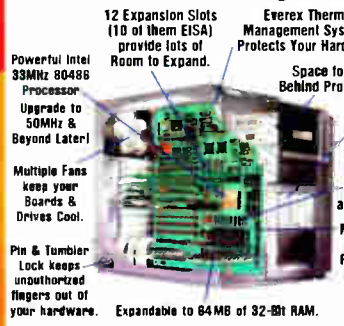
PC Products for Scientists & Engineers

1-800-394-3300

Toll-Free Hotline • Free Application Engineering

PC SYSTEMS

Everex STEP Megacube™



- **486/33 EISA Bus — 20.8 MIPS.**
- **12 Expansion Slots!** (10 EISA, 1 8-Bit, & 1 64-Bit memory board slo.). We also have an 8-Slot ISA Megacube, and 8-Slot EISA and ISA Desktop and Tower configurations.
- **Space for 8 Disk Drives!**
- Front Panel **LED Display.**
- **400 Watt** Power Supply w/Dual Compartment Thermal Management Cooling System.
- **256K Cache Architecture.**

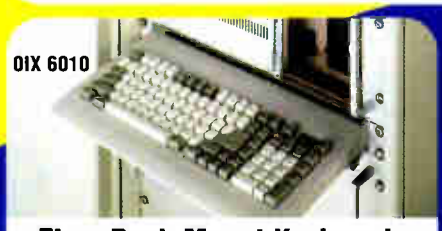
The Ultimate Engineering Workstation

Scientists and engineers need more power than PCs could traditionally provide. Now **Everex** — whose machines have been consistently ranked by *Byte*, *InfoWorld* and others as the fastest available — has developed a line of PC Workstations with everything you've always needed: speed, slots and power. The perfect answer for your file server, multi-user, and graphics workstation requirements.

- **Price includes:**
101-Key Enhanced Keyboard, DOS 5.0, MicroSoft Windows 3.0, a Mouse, and a 1.2 MB Disk Drive.

#EVX 433EC Megacube, 486/33 EISA, 8 MB RAM* .....$**7219**
#EVX 433IC Megacube, 486/33 ISA, 8 MB RAM* .....$**6199**
#EVX 433ET Tower, 486/33 EISA, 8 MB RAM* .....$**5799**
#EVX 433IT Tower, 486/33 ISA, 8 MB RAM* .....$**4799**
#EVX 433EA Large Desktop, 486/33 EISA, 4 MB RAM* .....$**5499**
#EVX 433IA Large Desktop, 486/33 ISA, 4 MB RAM* .....$**4499**
#EVX 433EB Small Desktop, 486/33 ISA, 4 MB RAM* .....$**4399**
#EVX 320SB Small Desktop, 386sx/20 ISA, 1 MB RAM .....$**1599**
#EVX 316SB Small Desktop, 386sx/16 ISA, 1 MB RAM .....$**1499**

* Up to 64 MB of 32-Bit RAM, Hard Drives, Monitors, and Data Acquisition Hardware and Software available on an Optional Basis. No Charge for System Assembly and Test.



Elma Rack-Mount Keyboards

If you use a standard keyboard with your rack-mounted system, you know what a nuisance and a hazard it can be. These new industrial keyboards are designed to fit easily into any EIA 19" rack. Rugged and reliable, these keyboards are made in the U.S.A. by a Swiss company and demonstrate classic Swiss craftsmanship.

- Full 101-key layout.
- Full-travel construction with excellent tactile feel for touch-typing.
- **OIX 3010** keyboard is set in a drawer (not shown).
- **OIX 6010** keyboard slides out w/ a locking door.
- Occupies only 1 rack space (1.75" high).

#OIX 3010 Rack-Mount Keyboard w/Wrist Rest $**295**
#OIX 6010 Rack-Mount Industrial Keyboard ....$**395**

NEW! Rack-Mount PC's with built-in VGA Monitors

CyberResearch carries the broadest line of rack-mount and industrial computers. Now we've added new models with built-in VGA monitors. You get a compact unit with 386 power and a color display.

- Built-In 10" VGA Color Monitor & VGA Card
- 4 Megabytes of RAM (2MB for the VRC 386-16S)
- Enhanced 101-Key Keyboard
- 1.2 MB Floppy Drive (or 1.44/3.5" if preferred)
- 2 Serial RS-232 Ports & 1 Parallel Printer Port
- DOS 3.3 Software (or DOS 5.0, if preferred)

#VRC 386-16S VGA Rack-Mt. PC, 80386sx, 16MHz $**3595**
#VRC 386-33 VGA Rack-Mt. PC, 80386, 33MHz..$**4995**
#VRC 486-33E VGA Rack-Mt. EISA, '486, 33MHz..$**6995**

World Radio History

DATA ACQUISITION

40MHz Data Acquisition for $595

When speed is more important to you than resolution, the new **CompuScope Lite** from Gage Applied Sciences is the perfect solution. Offering 8 bits resolution at 40MHz, it lets you capture even the highest frequency signals without spending a lot of money.

- 16 KByte buffer memory
- Pre, Post, & Mid trigger modes
- ±5V, ±1V, and ±200mV input ranges
- 40MHz sampling on 1 channel or 20MHz simultaneous sampling on two channels
- Trigger Input & Test Output channels
- Perfect for High Speed 8-bit A/D needs
- Multiple units may be used in one PC with our **MultiScope** software.

#DSO 200	Gage CompuScope Lite	$595
#DSO 205	DSO 200 w/Cables for multiple boards	$695
#DSO 121	MultiScope Software	$250

VGA to your VCR

Tape VGA Animation

Redlake TapeCaster VGA to Video Converter

Redlake's **TapeCaster** converts VGA screen output to video for applications such as animation and creating training tapes. The TapeCaster is extremely easy to use: no base addresses, no interrupts, no software — just plug and play.

- True, precise NTSC or PAL video timing.
- Simultaneous VGA and video display.
- Composite Video & Y-C (SuperVHS) output for use with equipment ranging from an inexpensive VCR to broadcast-quality professional video.

#NTSC 200	TapeCaster - NTSC Video Output	$750
#PAL 200	TapeCaster - PAL (Europe) Video Out	$750
#NTSC 100	Spectrum-NTSC Video Digitizer and VGA Overlay Controller with software	$1650

SAVE 30% OR MORE With Metrabyte-Compatibles

Our new series of **CYDAS** Metrabyte-Compatible data acquisition and control boards offer both much lower cost *and* valuable added features, yet they maintain guaranteed 100% Metrabyte-Compatibility.

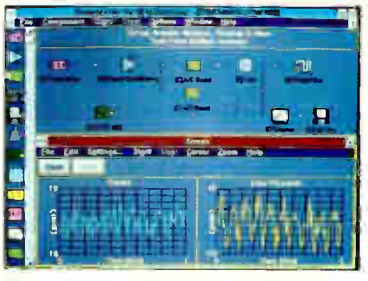
Our Part #		Metrabyte Price	Cyber Price
#CYDAS 16F	100KHz, 16-Ch. A/D Bd.	$1165	$859
#CYDAS 16	50KHz, 16-Ch. A/D Bd.	$999	$799
#CYDAS 8	20KHz, 8-Chan. A/D Bd.	$425	$299
#CYDAS 8PG	20KHz A/D w/Prog. Gain	$599	$349
#CYDAC 02	2-Chan. 12-Bit D/A Board	$299	$159
#CYDDA 06	6-Chan. 12-Bit D/A Board	$650	$349
#CYDIO 24	24-Ch. (PIO-12) TTL I/O	$130	$75
#CYDIO 24H	24-Ch. (PIO-24) Dig. I/O	$185	$95
#CYCTM 05	5-Ch. Counter/Timer Bd.	$325	$149
#CYCTM 10	2 CYCTM 05's on 1 board	$650	$239
#CYMUX 16	16-Ch. Multiplexer Panel	$399	$249
#CYMUX 32	2 CYMUX 16's on 1 board	$798	$349
#CYSSH 04	4-Chan. Simul. Sampling	$450	$399
#CYSSH 16	16-Ch. Simul. Sampling	$1800	$859

SOFTWARE

LabWindows 2.0 Menu-Driven Instrumentation Software

With **LabWindows 2.0** you get the best of both worlds: the ease-of-use of a menu-driven package combined with the flexibility possible only when you write your own code. The menu interface takes you step-by-step through the process of configuring the data acquisition, analysis, and display portions of your system. ***It then compiles your setup into C or QuickBASIC code.*** This is the easiest way to create data acquisition and analysis programs!

#NIS 473	LabWindows 2.0 Software	$695
#NIS 474	LabWindows Advanced Analysis	$895
#NIS 475	LabWin. Acquis. + Analysis (both)	$1395



NEW Snap-Master Software: Data Acquisition for Windows

Discover Snap-Master — the only Windows-based data acquisition and analysis software to achieve high-speed, real-time data acquisition with multiple simultaneous A/D boards.

Snap-Master lets you define your own custom instruments using icons and easy-to-understand flow charts. A pre-defined database of sensors is integrated with the data acquisition system.

#HDS 200	Snap-Master Acquisition Module	$995
#HDS 210	Snap-Master Analysis Module	$495

Use modules as an integrated package or stand-alone

FREE!

Combination Catalog/Tutorial

The CyberResearch *PC Systems Handbook for Scientists and Engineers* describes over 1400 unique and hard to find items for PC-based engineering. Packed with useful technical information & easy-to-read diagrams, this detailed and invaluable reference should be part of every engineer's library. For a complimentary copy of this unusual catalog and reference guide, call (800) 394-3300 or (203) 483-8815 (CT & Overseas).

The *PC Systems Handbook* is available outside the United States for $14.95US, prepaid, including surface delivery (allow 2-4 weeks). Send $19.95US for express airmail delivery.

Circle 240 on Inquiry Card.

MOTION CONTROL

MOTION CONTROL SYSTEM Makes servo-motor control easy

PC-based motion control may seem like science fiction to many people. Here at CyberResearch, it's one of our specialties. Shown here is our **CSVS 872A,** our top-of-the-line Intelligent Servo-Motor Control System, which includes:

- ***Technology 80*** 2-Axis Intelligent Analog Servo-Motor Controller board complete with software.
- ***EG&G Torque Systems*** High-Torque Servo Motors, 140 oz-in, 1300 RPM (Qty 2)
- ***Technology 80*** 2-Axis, 7 Amp Analog Servo Driver
- ***Electrostatics*** Regulated DC Power Supply
- Terminal Blocks and Cabling

#CSVS 872A	High Torque, Dual Motor, PC-Based Analog Servo Motor System	$2995

100% Satisfaction Guarantee

You can order from CyberResearch with confidence. If you are not completely satisfied with your purchase, simply call our toll-free hotline within 30 days of receiving the item. A friendly customer service technician will arrange for a full refund, replacement, exchange, or credit. **No Problem. No Hassle.**

(We reserve the right to refuse returns on items which have been damaged or defaced, and returns of quantity, discounted, dealer, or OEM sales.)

FREE Application Engineering

At CyberResearch we have no salespeople. Our engineers have one priority: to help you find the best technical solution to your problems. Calling our Applications Hotline is like having your own free consultant. So call and let our years of experience work for you.

Wide Selection of Products

When you need PC-compatible equipment for science and engineering, there's only one name to think of: **CyberResearch.** We offer the largest selection of hardware and software for data acquisition, instrumentation, communications, motion control, etc. We stock all your best-known suppliers like those featured on these pages and many more.

It's Easy to Order

We accept Purchase orders from:

- Companies with an established credit account.
- Government Agencies
- Fortune 500 companies
- Universities and hospitals

If you don't fall into one of these categories, you can place orders prepaid (credit card/check) or COD with a company check.

Worldwide
(203) 483-8815
Fax: (203) 483-9024

TOLL-FREE HOTLINE
(800) 394-3300

Mailing Address: P.O. Box [illegible]
New Haven, CT [illegible]

World Radio History

NEVADA COMPUTER

NEVADA'S LARGEST COMPUTER WHOLESALER

SAVE 30-90% OFF RETAIL

WORDSTAR 6.0

OR WORDSTAR 2000 REL. 3.5

This is not a misprint! These are the exact same ones selling for over $300.00 from our competitors. We have thousands in stock. These are current versions.

FOR SALE BELOW DISTRIBUTOR COST! LIST $495.00 ea.

CALL FOR QUANTITY PRICING!

YOUR CHOICE **99.00** ea.

PS/2 50/60 BOARD

AST ADVANTAGE/2

Comes with OK expandable to 8Meg using SIMMS. SuperPak utility software. OK - **49.00**
2MEG - **149.00** 4MEG - **249.00** 8MEG - **449.00**

200 WATT POWER SUPPLY

Direct AT replacement, UL Appr., 110/220V, 4 Drive Connectors.
200 WATT **39.00** 150 WATT for XT **49.00**

101 and/or 84 KEY KEYBOARD

New 1 year Warranty, works on XT, AT & 386's. Low cost, high quality by Mitsumi. 84 KEY **19.00** 101 KEY **39.00**

60 MEG TAPE BACKUP

Mfg. by Wangtec, compatible w/ MS DOS, Novel, SCO Xenix, Pick. Complete w/ controller, cable and manual. **$399.**

SYSTEMS

286-12MHZ		$949.
286-16MHZ		$999.
386-16SX		$1099.
386-20SX		$1149.
386-25MHZ		$1299.
386-33MHZ	W/ 64K CACHE	$1499.
486-33MHZ	W/64K CACHE	$1999.

Systems include: 14" VGA Monitor & Cord w/256K, Desktop or Mini Tower case (200 Watt power supply), 1 Year Warr., DOS 4.1, Parallel, Serial, Clock & Game Port, 1MB Memory, 1.2/5¼ Floppy, 101 Key Keyboard, 40MB Hard Drive.

MODEMS

Fully Hayes compatible, monitor speaker w/ volume control. 2400/300 Baud transmission rate, addressable COM 1,2,3,4, Compatible w/ IBM PC, XT, AT & Compatibles. 2year Warranty. Full Duplex operation, complete with software.
Auto dial, Auto answer. INTERNAL **59.00** EXTERNAL **79.00**

FAX CARD

W/ 2400 BAUD MODEM

Automatic group III digital FAX, background operation, send and receive text, screen images, scan pages,. Hayes compatible, modem built on. FAX 9600/7200/4800/2400. Software, telephone cord.
YOUR COST **99.00** (Without Modem) **59.00**

MONITORS

12" GREEN MONOCHROME Tilt & Swivel Base.....

14" MONO/TTL AMBER FLAT SCREEN		$99.
14" VGA	640X480 (.41 Dot)	$247.
14" VGA	1024X768 (.28 Dot)	$299.
14" VGA	1024X768 (Non Interlace)	$389.
VGA CARD	256K Exp 1MEG	$89.

INTEL COPROCESSOR

5 YEAR WARRANTY!

Quantity

8088 BASED MACHINES:
8087-5MHz **49.00**
8087-2 8MHz **79.00**
8087-1 10MHz **119.00**

80286 BASED MACHINES:
80287-6MHz **49.00**
80287-8 8MHz **59.00**
80287-10 10MHz **89.00**
80287-XL **99.00**

80386 BASED MACHINES:
80387-16 16MHz **185.00**
80387-20 20MHz **199.00**
80387-25 25MHz **209.00**
80387-33 33MHz **219.00**
80387-SX16 **124.00**
80387-SX20 **144.00**

CONTROLLERS

IDE HD/Floppy **39.00**, 16 Bit WD 1:1 **49.00**, 8 Bit HD only **49.00**
FOR FLOPPYS: Super Floppy Controls 1 2, 360K, 720K & 1 44 Drives **49.00**

FLOPPY DRIVES

360K-5¼ - **49.00**, 720-3½ - **49.00**, 1 2 MEG - **58.00**, 1 44MEG-3½ - **58.00**, Tandon TM100-2, the original IBM Drive **99.00**

10 MEG HARD DRIVE

Half height - 80 MSEC - 6 Month Warranty List 149.00
Your Cost **69.00** w/ controller & cable add **$50.00**

20 MEG HARD DRIVE

3½ " - 40MSEC - 6 MONTH WARRANTY. W/ 5¼ " MOUNTS
YOUR COST **99.00** w/ controler & cable add **$50.00**

SEAGATE HARD DRIVES

MODEL	SIZE	ACCESS TIME	INTERFACE	DRIVE	W/CONTROLLER
ST225	21MB	65MSEC	MFM	149.00	199.00
ST157A	44MB	28MSEC	IDE	174.00	204.00
ST251-1	42MB	28MSEC	MFM	229.00	289.00
ST296N	85MB	28MSEC	SCSI	299.00	439.00
ST1096N	84MB	24MSEC	SCSI	349.00	489.00
ST3096A	84MB	16MSEC	IDE	299.00	339.00
ST4096	80MB	28MSEC	MFM	449.00	538.00
ST4144R	122MB	28MSEC	RLL	499.00	599.00
ST3144A	125MB	16MSEC	IDE	349.00	389.00
ST1239A	211MB	15MSEC	IDE	599.00	639.00
ST2383A	338MB	16MSEC	IDE	1279.00	1338.00

MINISCRIBE HARD DRIVE

3180E 5¼ ", 154 MEG, ESDI, 18 MSEC Access Time New Factory Packed! List $1295.00 YOUR COST **$499.**

WE WON'T BE UNDERSOLD ON MEMORY!!

COMPAQ MEMORY

MODEL	MEMORY ADDED	COMPAQ EQUIV. PART#	YOUR COST
DESKPRO 286	512K KIT	113012-001	59.00
DESKPRO	1MB MODULE	118688-001	78.00
286N, 386N	2MB MODULE	118689-001	138.00
	OK BOARD	118700-001	98.00
386SX/20	4MB MODULE	118690-001	298.00
DESKPRO	1MB BOARD	108069-001	238.00
386/16	2MB BOARD	108069W71	348.00
	1MB KIT	108071-001	128.00
	4MB BOARD	108070-001	498.00
	4MB KIT	108072-001	318.00
DESKPRO	1MB BOARD	113633-001	148.00
386S	4MB BOARD	113634-001	328.00
	1MB MODULE	113646-001	98.00
	4MB MODULE	112534-001	268.00
DESKPRO	1MB MODULE	113131-001	88.00
386/20, 25, 386E	4MB MODULE	113132-001	228.00
DESKPRO	1MB BOARD	113644-001	148.00
386/20E/25E	4MB BOARD	113645-001	328.00
DESKPRO	2MB MODULE	115144-001	128.00
386/33, 486/25/33/33L	8MB MODULE	116561-001	639.00
SYSTEMPRO	32MB MODULE	116568-001	3950.00
PORTABLES			
PORTABLE	512K KIT	107331-001	38.00
III	INTFC BD	107808-001	149.00
	EXP BD	107811-001	199.00
	2MB KIT	107332-001	128.00
SLT/286	1MB MODULE	110235-001	148.00
	4MB MODULE	110237-001	458.00
LTE/386S/20	1MB	121125-001	238.00
	4MB	121125-002	598.00
LTE/286	1MB BOARD	117081-001	118.00
	4MB BOARD	117081-003	398.00
PORTABLE	1MB KIT	107651-001	179.00
386/20	INTFC BD	107707-001	88.00
	4MB BOARD	107653-001	698.00
	4MB EXT BRD	107654-001	799.00
SLT/386S	1MB MODULE	108303-001	179.00
	2MB MODULE	108304-001	279.00

RAM CHIPS (DIPS)

DESCRIPTION	150NS	120NS	100NS	80NS	70NS
64X1	1.20	1.45	1.65		
64X4	1.95	2.25	2.45	2.95	
256X1	.95	1.05	1.10	1.15	1.95
256X4		3.95	4.45	4.95	5.45
1MEGX1		3.50	3.85	4.10	4.45

TOSHIBA MEMORY

TOSHIBA MODEL	MEMORY ADDED	TOSHIBA EQUIV. PART #	YOUR COST
PORTABLE 2000SX	1MB BD	PC14-PA8311U	138.00
T1000SE & XE/LE	2MB BD	PC14-PA8312U	248.00
PORTABLE T1200XE	2MB BD	PC13-PA8306U	148.00
PORTABLE T1600	2MB BD	PC8-PA8302U	148.00
PORTABLE T3100E	2MB KIT	1PC9-PA8341U	148.00
PORTABLE T3100SX	2MB BD	PC15-PA8308U	148.00
	4MB BD	PC15-PA8310U	279.00
PORTABLE T3200	3MB BD	PC6-PA7137U	248.00
PORTABLE T3200SX &	2MB KIT	PC12-PA8307U	133.00
T3200SXC	4MB KIT	PC12-PA8309U	278.00
PORTABLE T5100	2MB BD	PC7-PA8301U	148.00
DESKTOP T8500 or	2MB KIT	PC10-PA8304U	148.00
PORTABLE T5200 & T5200C	8MB KIT	PC10-PA8313U	638.00

ZENITH MEMORY

ZENITH MODEL	MEMORY ADDED	ZENITH EQUIV. PART #	YOUR COST
Z386/20/25/33/33E	1MB MOD	ZA3800ME	68.00
	4MB MOD	ZA3800MK	298.00
Z386/25/33	1MB MOD	ZA3600ME	78.00
	2MB MOD	ZA3800MG	138.00
Z248,Z286LP,Z386SX	2MB MOD	Z-605-1	118.00
TURBO SPRT 386,386E	1MB KIT	ZA3034ME	168.00
	4MB KIT	ZA303MK	568.00
SUPER SPORT	2MB KIT	ZA180-64	189.00
SX	2MB KIT	ZA180-86	189.00
	2MB KIT	ZA180-87	278.00
SUPER SPORT 286	1MB KIT	ZA180-66	128.00
SUPER SPORT 286E, SX	2MB KIT	ZA180-64	198.00

BOCA MEMORY BOARDS

8088 XT MACHINES

BOCARAM XT 0-2 MEG BOARD. U.S.ES 256K D-RAM. OK **99.00** 2MEG **219.00**

80286 & 386 AT MACHINES

BOCA AT PLUS (BRAT 80) OK-8MEG BD. 4.0 LIM COMPATIBLE. CONVENTIONAL, EXPANDED & EXTENDED MEMORY. SUPPORTS DOS, OS/2, LIM/EMS & EEMS
OK-112.00 2MEG-189.00 4MEG-259.00 8MEG-399.00

BOCARAM/2 PLUS

FOR PS2 50, 60, 50Z, 65,70,80,90,95. 0-8MB LIM/EMS 4.0, USES 1MB SIMMS
2MB 249.00 4MB 329.00 8MB 489.00

IBM PS/2 MEMORY

FREE MODEM WITH PURCHASE OF PS2 MEMORY*

IBM PS/2 MODEL	MEMORY ADDED	IBM EQUIV. PART#	YOUR COST
PS/1	2MB	N/A	179.00
PS/2 25/286	512K KIT	30F5348	38.00
30-286, 50Z & 55-SX, 65SX	2MB KIT	30F5360	107.00
PS/2 35SX LS & 40SX	8MB	6450129	589.00
PS/2 50Z & 55SX, 65SX	1MB SIMM	6450603	59.00
	2MB SIMM	6450604	94.00
55SX & 65SX	4MB MODULE	34F2933/87F9977	289.00
50, 50Z, 55SX 860, 65SX	2-8MB BOARD	1497259/6450609	349.00
PS/2	1MB SIMM	6450603	59.00
70-E61, 061, 121, P70	2MB SIMM	6450604	94.00
PS/270-A21 A61, B21, B61	2MB SIMM	6450608	98.00
PS/280 041	1MB MODULE	6450375	98.00
PS/280 111, 121, 311, 321	2MB MODULE	6450379	138.00
80-A21, A31, A61	4MB MODULE	6451060	268.00
PS/2	2-8MB BOARD	6450605 OR	328.00
ALL 70s & 80s	2-16MB BOARD	34F3077 OR	358.00
	4-16MB BOARD	34F3011	488.00
90, 95 & P75	2MB	6450902	128.00
Install in pairs	4MB	6450128	308.00
L40SX LAPTOP	2MB		219.00
	4MB		438.00
	8MB		988.00

HEWLETT PACKARD LASER JET MEMORY

MODEL	MEMORY ADDED	H.P. EQUIV. PART#	YOUR COST
HPIII & IID	2MB MODULE	33444B	97.00
	4MB MODULE	33445B	167.00
HP3 & IID	1MB MODULE	33474A/B	97.00
HPIIP	2MB MODULE	33475A/B	99.00
	4MB MODULE	N/A	167.00

SIMM MODULES

DESCRIPTION	120NS	100NS	80NS	70NS	60NS
256X8	5.00	8.00			
256X9	9.00	14.00	17.00	26.00	29.00
1MEG X 9		39.00	42.00	49.00	84.00
4MEG X 9			159.00	169.00	199.00

ORDERS ONLY

800-654-7762

TECHNICAL/CUSTOMER SERVICE/ORDER STATUS:
(702) 294-0204 FAX (702) 294-1168
HOURS: M-F 8:00-6:00 PST, SAT 9:00-3:00 PST

Mfg. part #'s for convenience only. Some memory products 3rd party.
WE ACCEPT INTERNATIONAL ORDERS
WE ALSO PURCHASE EXCESS INVENTORY! FAX OR CALL.
NO SOFTWARE RETURNS
ALL PRICES FINAL.
Trademarks are registered with their respective Co.'s. 386, 387, 287, SX, are trademarks of Intel Corp.

NEVADA COMPUTER

NO SURCHARGE FOR MC/VISA
TERMS:
MC, VISA, AE, COD CASH, NET
Purchase orders from Universities
Fortune 1000 & Government Agencies
Personal Checks, COD add $5.00
20% Restocking Fee on returns within 30 days
No refunds or exchanges after 30 days - WARRANTY ONLY

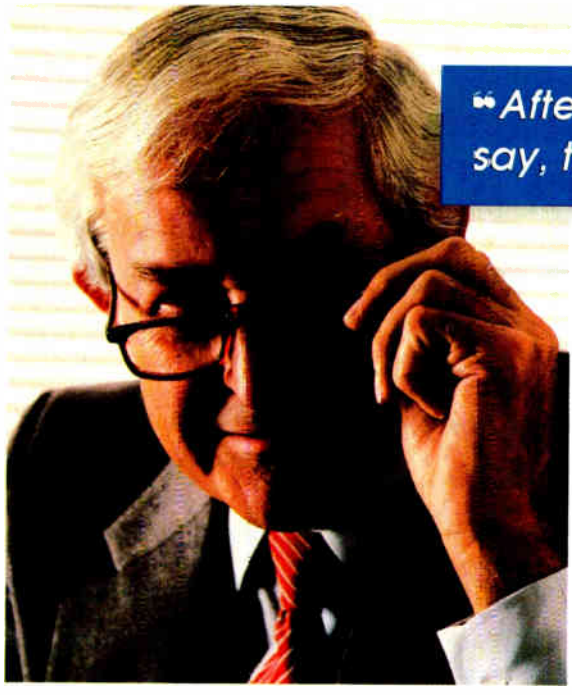
AD # B121B

(*One per customer per month)

PRICES SUBJECT TO CHANGE SHIPPING UPS (Min $8.25)
684 Wells Road, Boulder City, Nevada 89005

Circle 231 on Inquiry Card.

World Radio History



"After reading what all the experts had to say, the choice was obvious . . . Acma."

The Experts Give Acma Rave Reviews For Quality, Performance, Service And Value!

Today's leading experts consistently rank Acma among the best! Simply stated, at Acma, we build quality products that provide top performance and tremendous value. And we stand behind our computers with FREE on-site service, a 45-day money-back guarantee, a full one year warranty, and lifetime Toll-Free technical support. We even load DOS 5.0 and Windows 3.0 for you.

It all adds up! All this and guaranteed satisfaction make Acma an excellent choice -- and the experts agree!

"THE PERFECT WINDOWS 3.0 WORKSTATION." PC MAGAZINE

"...OUR FAVORITE IS THE ACMA 386/25." PC MAGAZINE

"A SOLID VALUE FOR YOUR DOLLAR." PC MAGAZINE

"THE ACMA IS A PRINCE AMONG PEERS." PC MAGAZINE

Acma Gives You All These Features & Services. . .

- 45-Day Money-Back Guarantee*
- One-Year Parts & Labor Warranty (Many Components Covered By Two Year Manufacturer's Warranties)
- **FREE** One Year TRW On-Site Service (Available In Most U.S. Locations)
- **FREE** Lifetime Toll-Free Technical Support
- **NEW!** Tech Support Now Open Mon.-Sat.
- **SPECIAL!** $1.00 Upgrade Program
- **NOW AVAILABLE!** 1.2GB Hard Drives!
- **FREE** Return Shipping, Of Replacement Or Repaired Parts.†
- **NOW AVAILABLE!** Programmable Keyboards!
- Fast Delivery!
- 48 Hour High-Temperature Burn-in
- DOS 5.0 & Windows 3.0** Preloaded
- Custom System Configurations
- Personal & Business Leasing Plans
- Credit Cards *Not* Charged Until Shipment
- Special GSA (& Quantity) Discounts

Standard System Specifications . . .

- 4MB RAM
- 1.2MB & 1.44MB floppy disk drives
- Hard disk drives (see below)
- 16-bit VGA card with 1MB RAM
- 14" Non-interlaced Super VGA monitor (1024x768, .28 dot pitch)
- 101-key enhanced keyboard
- 2 serial, 1 parallel & 1 game port
- Windows 3.0** (loaded) & Mouse
- MS-DOS 5.0 (loaded)
- Call for custom configurations, peripherals, and $1.00 upgrades!

Notebook SX/20MHz: 1MB RAM, 40MB/HDD, VGA Display **$1,795**
386SX/20: 52MB IDE/HD . . . *BEST BUY AWARD!* . . . **$1,595**
386/25: 105MB IDE/HDD . . . **$1,795**
386/33: 105MB IDE/HDD, 64K Cache . . . *BEST BUY AWARD!* . . . **$1,895**
386/40: 105MB IDE/HDD, 64K Cache . . . **$1,995**
486/33: 210MB IDE/HDD, 64K Cache . . . *BEST BUY AWARD!* . . . **$2,595**
486/33 EISA: 210MB IDE/HDD, 256K Cache . . . **$3,395**

© Acma Computers Inc., 48501 Warm Springs Blvd., Fremont, CA 94539 (510) 623-1212, (510) 623-0811 Fax. Purchase orders are subject to approval. No surcharge on Visa or Mastercard. Credit cards are not charged until the order is shipped. All prices and specifications are subject to change without notice. *The 100% satisfaction/45-Day Money-Back guarantee covers Acma brand computers only (software, printers, monitors, and shipping are not included. **Windows and mouse not included with notebook PCs. †Customer pays shipping to Acma for parts replacement or repair, and Acma pays return shipping (call for complete details).

Special $1.00 Upgrades!

800-456-1818

Sales: 6am-7pm M-F & 8am-4pm Sat. (PST)
Tech-Support: 7am-6pm M-F & 8am-4pm Sat. (PST)
International 510-623-1212, 24-Hr. Fax 510-623-0818

COMPUTERS, INC. **Acma** Call For GSA Pricing!

YES! Send me FREE reprints of what the experts are saying about Acma!

Name _____

Address _____

City _____

State/Zip _____

Phone (____) _____

Please send me reprints for:
☐ 386/SX ☐ 486 ISA
☐ 386/DX ☐ 486 EISA

B 192

Circle 222 on Inquiry Card.

World Radio History

Maxtor
340 Mb SCSI
$999

MB	SCSI	IDE
60	N\A	229
120	359	349
213	579	559
340	999	889
535	1599	N\A
760	1649	N\A
1.2G	2299	N\A

Ask about...
our full line of Macintosh and Sun-compatible SCSI hard drives.

Quantum
170Mb SCSI*
$499

52	229	199
105	339	319
170	499	Call
210	629	599
425	1299	N/A

* While Quantities Last

SyQuest
88Mb Removable
$609

MODEL	Bare
SQ-555	399
SQ-5110(88)	609
Dual(ext. 44)	899
Dual(ext. 88)	1449

Micronics
486 33 ISA Motherboard
$999

386SX	ISA 20	259
386DX	ISA 25	419
386DX	ISA/33/Cache	569
486DX	ISA/25/Cache	1149
486DX	ISA/33/Cache	999
486DX	EISA/33/Cache	1549

• **30-Day Money-Back Guarantee** •
All products carry a 30-day money-back guarantee. Your risk in the transaction is the cost of shipping.
• **Disk-for-Disk Replacement Warranty** •
Quantum, Maxtor, Syquest and Archive drives carry a two-year "parts & labor" disk-for-disk replacement warranty. WREN, Teac, WangDAT, Conner, Micronics products and Syquest Cartridges carry a one-year "parts & labor" disk-for-disk (board-for-board) replacement warranty.
• **Mounting Hdwre & Cables Included** •
All Hard Drives include rails, extenders and data cables required for standard operation. Board products are populated but without RAM.
• **Toll-Free Technical Support** •
Toll-Free Technical Support, 9am to 7pm Monday thru Friday, Central Time. As often or for as long as you need.
• Prices and Specifications subject to change without notice.

DAT Tape
1.2 Gb Back-up
$1499

TEAC 155		599
Archive	Python	1499
WangDAT	2600	1999

WREN
600Mb SCSI
$1499

MB	Bare
300	1199
330	1349
600	1499
630	1849
1.2G	2099

Toshiba
CD ROM
$579

3301B	579

SCSI interface drive includes MS extensions

"Bare" Drive includes Drive, Data Cable, Rails & Extenders
- 8-bit SCSI kit (AIC) add $109
- 16-bit SCSI kit (Adaptec 1520) add $149
- 16-bit SCSI Bus Master kit (Adaptec 1540) add $229
- 16-bit MCA SCSI Kit (Adaptec 1640) add $329
- 32-bit EISA SCSI kit (Adaptec 1740) add $599
- 16-bit IDE Kit (Seagate St-07) add $31
- 16-bit IDE Kit (Cumulus 124187) add $79
- Many Models available with Floppy Controller

VISA, MC, Discover -No Surcharge
AMEX Accepted

International Orders
(816) 478-8300

Toll Free Australia: 0014-800-125-875
Toll Free U.K.: 0800-897-545

Ask About our Full Line of Macintosh-Compatible Tapes, Drives and CD ROMS

1-800 235-3707

APS TECHNOLOGIES — Providing Computer Solutions Since 1985

2900 S. 291 Hwy •
Independence, MO 64057

Gov., Univ. & Accepted Corp. PO's, No Surcharge

World Radio History

BLUE STAR SYSTEMS. *Simply the best.*

For over seven years, we've been delivering; delivering service, price, and performance. Together, this means value for you. We start by building the best systems possible — using the best components available. Then each and every system receives a 72-hour burn-in and a comprehensive quality assurance review. The goal is to deliver 100% reliability. But if a problem ever does arise, we fix it — quickly and properly. Each system comes with a full one-year warranty, plus lifetime toll-free phone support, plus all systems have a full 30 day money-back guarantee.

We're here to help you. Our service starts even before you buy. We're going to take the time to learn about your needs and expectations to be sure we deliver a system that is just right for you. And we'll continue to help throughout the life of your system to make sure you're always getting as much from your system as possible. We're here 24-hours a day, 7-days a week, to help you in every way we can. Call us today and see what good service really is.

BLUE STAR 386 SYSTEMS

- 4 MB RAM
- 90 MB hard drive with Cache
- 1.2 and 1.44 MB floppy drives
- 64 K Cache (386-33 and 386-40)
- 16-bit SVGA controller with 1 Meg
- Super-VGA color monitor (1024x768)
- 1 parallel, 2 serial, 1 game port
- Desktop or mini tower case
- 220 Watt power supply
- 101 enhanced tactile keyboard
- Serial mouse
- MS-DOS 5.0 plus data base, spread sheet and word processor

From $1,699

386SX-25	386DX-25	386DX-33	386-40
1,699	1,699	1,949	1,999

BLUE STAR 486 SYSTEM

- 80486-33 MHz processor
- 4 MB RAM
- 130 MB hard drive with Cache
- 1.2 and 1.44 MB floppy drives
- 64 K Cache (expandable to 256K)
- 16-bit SVGA controller with 1 Meg
- Super-VGA color monitor (1024x768)
- 1 parallel, 2 serial, 1 game port
- Desktop or mini tower case
- 220 Watt power supply
- 101 enhanced tactile keyboard
- Serial mouse
- MS-DOS 5.0 plus data base, spread sheet and word processor
- Ask about our free 5-year warranty

$2,449

Tower case add $100

1-800-950-8854

Government and Corporate P.O.'s welcome

BLUE STAR COMPUTER INC.
2312 Central Avenue N.E.
Minneapolis, MN 55418
phone: (612) 788-1092 fax: (612) 788-3442

VISA MasterCard AMERICAN EXPRESS DISCOVER

- [illegible]
- All returns subject to approval
- MN orders add 7% sales tax
- Shipping and handling charges will be assessed from charity or schools
- American Express add 3%
- Blue Star Computer Inc. also distributes Blue Star Marketing Inc. products

BLUE STAR
For Your Computer

1-800-950-8854

"Blue Star's excellent service and support policies are a big plus...for this solid desktop speedster"
PC Magazine,

"Buy a Blue Star . . . a fast PC"
Computer Shopper

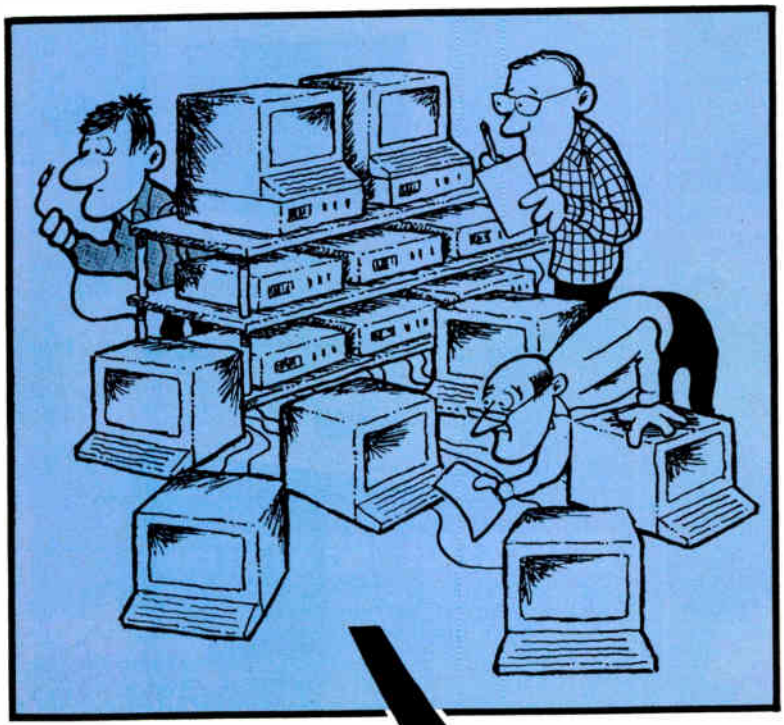
Circle 245 on Inquiry Card (RESELLERS: 246).

World Radio History

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

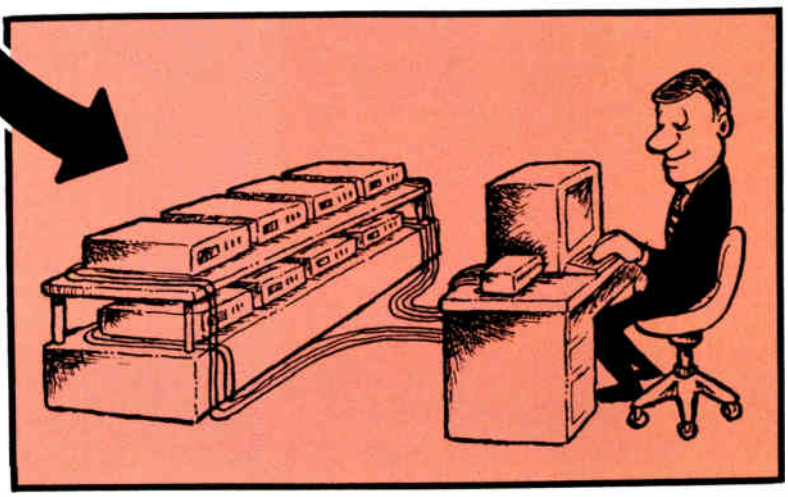
COMMANDER

by cybex



- No external power
- "One-Touch" selection
- Mix PC, PC/XT, PC/AT and PS/2
- "AutoBoot" Feature boots attached computers without operator intervention after power failure
- Shows PC power status
- Mouse support available

- TTL (MDA, CGA, EGA) up to 600 feet away
- VGA up to 400 feet
- Each unit accommodates from 2 to 8 PCs
- Up to 12 units can be cascaded
- Mounting kit available for 19" rack installation



PC, PC/XT, PC/AT and PS/2 are trademarks of International Business Machines Corp.

Dealer Program Available

Cybex Corporation
2800 H Bob Wallace Ave.
Huntsville, Alabama 35805
(205) 534-0011
Fax (205) 534-0010

Circle 227 on Inquiry Card.

World Radio History

CAD ONE

Custom Built Computers .....

386/486 Mini-Tower

386/486 Standard Tower

386/486 Full Tower

Computers built to **your** specifications at competetive prices !

WE FEATURE PRODUCTS MANUFACTURED BY:
IBM/Lexmark - Hewlett Packard - Panasonic - Star Micronics - MicroVitec - CTX - Teac Seagate - Western Digital - Maxtor - Mitsubishi - Toshiba - QVS Cables & Accessories - AOC Gateway - 3COM - Boca Research - Digital Vision - Bondwell - Navstar - Irwin Magnetics BASF - Artisoft - CNET - Micro Solutions - Media Vision - Liteon - Chicony - and many more.

MOTHERBOARDS

486-50 MHz ..... Call
486-33 MHz 256k Cache ..... Call
486-25 MHz 128k Cache ..... Call
386-40 MHz 64k Cache ..... Call
386-33 MHz 256k Cache ..... Call
386-33 MHz 64k Cache ..... Call
386SX-25 MHz Cache Opt..... 249
386SX-16 Mhz 215
286-16 MHz 125

VIDEO

OAK S-VGA 1024x768 512k ... $89
OAK VGA 800x600 256k 69
OAK VGA 640x480 256k 59
TRIDENT S-VGA 512k 98
TRIDENT S-VGA 1MB 139

COMMUNICATIONS

Internal 2400 Baud Modem with MNP level 5 and software $129
External 2400 Baud Modem with MNP level 5 and software 165
Internal 9600 Baud Modem with V.42 BIS and MNP 5 415
External 9600 Baud Modem with V.42 BIS and MNP 5 479
CARDINAL TX/RX Fax Modem with MNP 5 149
ADTEC TX/RX Fax Modem.. 135
ADTEC TX/RX Fax Modem with voice/fax auto detect 189

I/O CONTROLLERS

Super I/O (IDE HDD, FDD, 2S/1P/1G Port ..... $ 29
IDE HDD/FDD..... 18
Adaptec 1522 KIT 187
Adaptec 1542 KIT Bussmaster 290
Adaptech ESDI Controller 165
MFM-AT Controller..... 76
MFM-XT Controller (8 bit) 57

MONITORS

CTX

5468A Super VGA .28DP $330
5468NI SVGA Non-interlaced 399
5432 VGA .29DP 299
5439 VGA .39DP 256
3436 Multiscan .28DP 430

IDENTITY

Super VGA .28DP $335
Super VGA .41DP 275
VGA .31DP 295
VGA .41DP 249

AOC

Super VGA .28DP $348
VGA .31 294
VGA Mono 14" 135

SAMTRON

Super VGA .28DP..... $348
Super VGA .31DP 324

MICROVITEC

17" .28DP Multi-sync $1895
20" Autoscan 1695

NETWORK SUPPLIES

3Com Ether Link II 3C503 ..... Call
3Com EtherLink Plus 3C505 Call
3Com EtherLink 16 3C507 ..... Call
ARCNet 8 port active hub $173
Star 8 bit ARCNet Card 62
Star 16 bit ARCNet Card 108
16 bit Ethernet Card 156
8 bit Ethernet Card 138

WE SELL A COMPLETE LINE OF NETWORKING PRODUCTS & SUPPLIES FOR PRODUCT AND PRICING PLEASE CALL 1-800-524-1005

DATA TRANSFER

ELECTRONIC

4 Position Par. Smart Switch $132
8 Position Par. Smart Switch ... 180
Parallel 2 to 1 Auto Switch 53
Parallel 2 to 2 w/Hot Key 65

MANUAL

AB Switch Box 19
ABC Switch Box 27
ABCD Switch Box 34
ABCDE Switch Box 45

PRINT BUFFERS

64k Parallel Print Buffer 145
256k Parallel Print Buffer 249

KEYBOARDS

LITEON 101 Soft Click $59
LITEON 101 Tactile Click 59
Chicony 101 w/Trackball 99

STORAGE DEVICES

SEAGATE
MAXTOR
WESTERN DIGITAL
(Call for product & price)

FLOPPY DRIVES

TEAC 1.2MB $69
TEAC 1.44MB 69

TAPE BACKUP

IRWIN Accutrak 120MB..... 210
IRWIN Accutrak 250MB 269

MISC. PRODUCTS

SOUND/MUSIC

MediaVision Thunder Board ..$154
ProAudio Spectrum 355

DIGITAL VISION

Computer Eyes Pro 349

PRINTERS

IBM/LEXMARK ..... Call
PANASONIC ..... Call
STAR MICRONICS ..... Call

CAD ONE offers a complete line of cables & accessories , plotters, memory, math co-processors, plotters, power backups and much more. PLEASE call for current prices and products

CAD ONE
COMPUTER DESIGN, Inc.
270 Communication Way # 4D
Hyannis, MA 02601
Phone (508) 778-1895
Fax (508) 778-1887

WE SAY YES TO YOUR CHECK

CAD ONE takes pride in its support and customer relationships. If you can not find what you are looking for, please call our toll free telephone number.
Prices and availability subject to change without notice

Please call 800-524-1005

Business hours: Monday - Friday 9 A.M. to 8 P.M. Saturday 9 A.M. to 5 P.M. Eastern Standard Time

World Radio History

BUY COMPLETE POWER FOR LESS

Sii MICROS 1-800-424-1126

286-12 @ $285 **386-SX16 @ $399** **386-SX25 @ $444** **386-33 @ $599** **486-20SX @ $699**
286-16 @ $299 **386-SX20 @ $439** **386-DX25 @ $549** **386-40 @ $699** **486-33 @ $899**

**All the above systems include: CPU Motherboard, 1MB Ram, great looking Chasis, 200W P/S, 1.2 or 1.44 MB Drive, 1:1 FD/HD Controller*

386-25 SX
- 1MB Ram
- Power Supply, Chasis
- 40 MB Hard Disk
- 1.2 & 1.44 Floppy Disk
- Keyboard
- VGA Card
- 1024 x 768 Monitor

$ 1,099

386-25DX
- 1MB Ram
- Power Supply, Chasis
- 40 MB Hard Disk
- 1.2 &1.44 Floppy Disk
- Keyboard
- VGA Card
- 1024 x 768 Monitor

$ 1,199

386-33
- 1MB Ram
- Power Supply, Chasis
- 40 MB Hard Disk
- 1.2 & 1.44 Floppy Disk
- Keyboard
- VGA card
- 1024 x 768 Monitor

$ 1,299

486-20SX
- 4MB Ram
- 100MB Hard Disk
- Case & power supply
- Keyboard
- VGA Card
- 1024 x 768 monitor
- 1.2 &1.44 Floppy Disk

$ 1,599

486-33
- 4 MB Ram
- 100 MB Hard Disk
- Case & Power Supply
- Keyboard
- VGA Card
- 1024 x 768 Monitor
- 1.2 &1.44 Floppy Disk

$ 1,799

MOTHER BOARDS
XT-12 . . . . . $49
286-12 . . . . . $89
286-16 . . . . . $99
386 SX-16 . . . . . $199
386 SX-25 . . . . . $249
386 DX-25* $159
386 DX-33* $199
386 DX-40* $29
486-33* $299
486 SX-20 . . . . . $499
*CPU not included

TAPE BACK UP
120 MB $259
250 MB $399

MEMORY MODULES
4464 DRAMS $1.75
41256 DRAMS . . . $1.25
44256 DRAMS . . . $4.50
1 x 1 MEG GRAMS . $4.25
1 x 8-80 SIMMS C
1 x 9-80 SIMMS . . . . A
4 x 8-80 SIMMS L
4 x 9-80 SIMMS L

ADD ON CARDS
MGC $29
CGC $29
VGA 250 . . . . . $49
VGA IMB $99
Antivirus Card $99
Sound Blaster Card . $169

MATH CO-PROCESSORS
80287-10 . . . . . $89
80287-12 . . . . . $129
80387-16SX $139
80387-25SX $169
80387-20DX $175
80387-25DX $175
80387-33DX $175
80387-40DX $249

HARD DISKS
40 MB IDE $179
80 MB $299
100 MB $329
120 MB $399
200 MB $599

FLOPPY & HARD DISK CONTROLLER
IDE Controller FD/HD $29
MFM Controller 2:1 . . $69
MFM Controller 1:1 . . $89
1:1 RLL Controller . $109
ESDI HDC/FDC Controller $159
SCSI Controller . . . $149
Ultrastore Controller $179

MODEMS & FAX CARDS
2400 BPS INT $49
2400 BPS EXT $79
9600/2400 Fax Modem $89
9600 BPS Modem . $399

CASES & POWER SUPPLY
Baby AT Case with 200W P/S $79
Full Size Case with 200W P/S $99
Mini Tower Case with 200W P/S $125
Full Size Tower Case W P/S $170

MONITOR & KEYBOARD
Monochrome Monitor $99
VGA 1024x768, .31 dp $299
VGA 1024x768, .28 dp $350
101 Keys Keyboard . $45

TOSHIBA, COMPAQ, AST, ZENITH, MACINTOSH MEMORY AVALIBALE, TOO.

14451 Newport Avenue, Tustin, CA 92680
(714) 731-5489 FAX: (714) 731-1538

MasterCard VISA

ONE-YEAR WARRANTY
Purchase orders welcome

Prices subject to change without notice. Add 4% for Mastercard or Visa orders. Net terms please add 5% to the total. Shipping and handling charges extra. These are COD prices.

Circle 242 on Inquiry Card (RESELLERS: 243).

World Radio History

NEW LOW PRICES!

Prices continue to dive so please call for our most current prices.

MEMORY

For TOSHIBA T1000SE, T1000LE, T1000XE, T2000, T2000SX, T2000SXE, T2200SX, T3300SL, T4400SX

1 Mb	$98
2 Mb	$158
4 Mb	$318
8 Mb	$518

MORE SPECIALS

SHARP PC-6541	IN STOCK!!
SHARP PC-6340	CALL FOR
SHARP PC-8501	PRICES
COMMODORE CLT286/386 2MB UPGRADE	$128
COMPAQ LTE/386S 4MB UPGRADE	$328
CONNER CP-2024 20MB HARD DRIVE	$128
LOGITECH TRACKBALL MOUSE	$128
NEC MULTISPEED 2400B INTERNAL MODEM	$78
POQUET PALMTOP 1MB/2MB UPGRADE	$228/328
SANYO MBC-17NB/18NB 2MB UPGRADE	$128
SHARP PC-6641/TI TM3000 60MB HARD DRIVE	$498
TI MICROLASER/XL (ALL MODELS) 1 MB UPGRADE	$68
TOSHIBA T1200XE/T5100 2MB UPGRADE	$98
TOSHIBA T3200 3MB UPGRADE	$168
TOSHIBA T1200XE 40 MB HARD DRIVE	$468
TOSHIBA T5200 8MB UPGRADE	$488
TOSHIBA T5200 200 MB HARD DRIVE	$748
WORD PERFECT 5.1	$238

UPGRADE TODAY AND SAVE!

APPLE POWERBOOK 4MB/6MB UPGRAOE	$CALL
APPLE QUAORA 16MB UPGRADE	$698
AST PREMIUM EXEC 4MB UPGRAOE	$188
EVEREX TEMPO/LX 2MB UPGRAOE	$128
GRIO 1720/1750 2MB/4MB UPGRADE	$128/248
HP 95LX PALMTOP 512K/1MB UPGRADE	$228/328
IBM PS2 L40SX 2MB UPGRADE	$128
PANASONIC CF170 1MB UPGRAOE	$68
PANASONIC CF270/370 2MB UPGRADE	$128
PANASONIC CF270/370 4MB UPGRAOE	$248
SHARP 6220/TI TM2000 1MB UPGRADE	$98
SHARP PC-6641/TI TM3000 4MB UPGRADE	$178
TANOY 2810HD/3810HO 2MB/4MB UPGRAOE	$128/248
TOSHIBA T3100 & T3100/20 2MB UPGRADE	$268
TOSHIBA T3100SX 4MB UPGRADE (1 SLOT)	$178
ZENITH MASTERSPORT 386SX 2MB UPGRADE	$128

ORIGINAL TOSHIBA MODEMS ON SALE

2400B Internal Modem for T1000, T1100+, T1200, T1600, T3100, T3100e, T3100SX, T3200SX, T3200SXC, T5100, T5200, and T5200C ONLY $78

TOSHIBA SUPER SALE

T5200C	200MB/14MB RAM	$6,538
T5200	200MB/14MB RAM	$5,178
T5200	100MB/14MB RAM	$4,668
T4400SX	GAS PLASMA 85MB	$CALL
T4400SX	LCD 85MB	$CALL
T4400SX	LCD 60MB	$CALL
T3300SL	85MB	$CALL
T3200SXC	120MB/13MB RAM	$6,258
T3200SX	120MB/13MB RAM	$4,128
T3200SX	40MB/13MB RAM	$CALL
T3100SX	80MB/13MB RAM	$CALL
T2200SX	60MB/10MB RAM	$3,838
T2200SX	40MB/10MB RAM	$3,608
T2000SXe	60MB/10MB RAM	$3,378
T2000SXe	40MB/10MB RAM	$3,138
T2000SX	60MB/9MB RAM	$2,948
T2000SX	40MB/9MB RAM	$2,718
T2000SX	20MB/9MB RAM	$CALL
T2000	40MB/9MB RAM	$2,518
T1600	40MB/5MB RAM	$CALL
T1600	20MB/5MB RAM	$CALL
T1200XE	40MB/5MB RAM	$2,038
T1000LE	20MB/9MB RAM	$1,898

LAPTOP/NOTEBOOK SUPER SALE

AST PREMIUM EXEC	386SX/25C	80MB/8MB RAM	$4,788
AST PREMIUM EXEC	386SX/25C	60MB/8MB RAM	$4,508
AST PREMIUM EXEC	386SX/25	80MB/8MB RAM	$3,038
AST PREMIUM EXEC	386SX/25	60MB/8MB RAM	$2,778
AST PREMIUM EXEC	386SX/20	60MB/8MB RAM	$2,698
AST PREMIUM EXEC	386SX/20	40MB/8MB RAM	$2,448
EVEREX TEMPO/LX	386SX/20	60MB/5MB RAM	$2,558
EVEREX TEMPO/LX	386SX/20	40MB/5MB RAM	$2 408
LIBREX	386SX/20	60MB/4MB RAM	$2,608
PANASONIC CF-270	286/16	60MB/5MB RAM	$CALL
PANASONIC CF-370	386SX/20	60MB/5MB RAM	$3,118
SHARP PC-6781/PC6881		80MB/8MB RAM	$CALL
TEXAS INSTRUMENTS	TM2000	20MB/3MB RAM	$1,168
TEXAS INSTRUMENTS	TM2000	40MB/3MB RAM	$1,478
TEXAS INSTRUMENTS	TM3000	WINSX 80MB/6MB RAM	$3,178
TEXAS INSTRUMENTS	TM3000	WINSX 60MB/6MB RAM	$2,958
TEXAS INSTRUMENTS	TM3000	60MB/6MB RAM	$2,668
TEXAS INSTRUMENTS	TM3000	40MB/6MB RAM	$2,518
TEXAS INSTRUMENTS	TM3000	30MB/6MB RAM	$2 488
TEXAS INSTRUMENTS	TM3000	20MB/6MB RAM	$2,258

NEW!
40 Mb Hard Drive Upgrade for Sharp PC6220 TI TravelMate TM2000 CompuAdd Companion
$748

tote-a-lap

"experts in portable intelligence"

1-800-9-LAPTOP (1-800-952-7867)
PHONE: (415) 578–1901 ▪ FAX: (415) 578–1914

550 PILGRIM DRIVE, SUITE F
FOSTER CITY, CA 94404

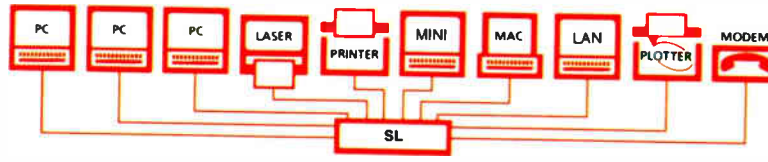
5.25" 1.2 Mb External Drive for *ALL* Toshiba Laptops Just
$168

SE HABLA ESPANOL
Pregunte por Hector

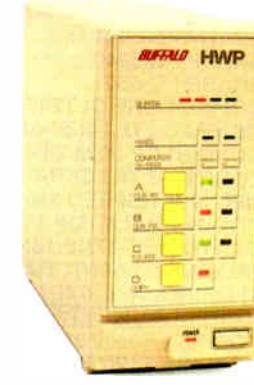
Some prices may reflect cash discounts. Not responsible for printing errors.

World Radio History

Big Business Productivity For Small Workgroups



- Pop-up Menu & Windows Option
- Easy to Install and Use
- Rapid Data Transfer
- User Upgradable Memory
- Reliable Automatic Switching
- No PC RAM Memory Required
- Toll-Free Technical Support
- 45-Day Money-Back Guarantee



Printer Sharing Solutions

Model Name	Total Ports	PCs/ Printers	Memory Available	Printer Selection	Price $ / Buffer
SL	10 6 Ser., 4 Par.	Any Combination	256KB - 4MB	Pop-up Menu	**$495** / 256KB **$595** / 1MB
SLP	10 8 Par., 2 Ser.	Any Combination	256KB - 4MB	Pop-up Menu	**$495** / 256KB **$595** / 1MB
HXM	4 2 Ser., 2 Par.	Any Combination	256KB - 16MB	Pop-up or Buttons	**$295** / 256KB **$395** / 1MB
HXS	4 Serial	Any Combination	256KB - 16MB	Pop-up or Buttons	**$295** / 256KB **$395** / 1MB
HWP	5 Parallel	3/2 4/1	256KB - 16MB	Pop-up or Buttons	**$295** / 256KB **$395** / 1MB
HXP	4 Parallel	2/2 3/1	256KB - 16MB	Pop-up or Buttons	**$245** / 256KB **$345** / 1MB
HCP	2 Parallel	1/1	256KB - 16MB	One Printer	**$225** / 256KB **$325** / 1MB
AS-41	5 Parallel	4/1	None	One Printer	**$195**
AS-31	4 Parallel	3/1	None	One Printer	**$175**

Save Money by Sharing Office Resources:

Printers and other expensive peripherals are idle the vast majority of the time. Buffalo boxes facilitate efficient utilization of these devices, and reduce the need to purchase more of them.

Buffalo boxes further improve productivity by allowing easy user access to all shared peripherals. With a buffer, all users can simultaneously send print data and quickly release their PCs to continue working.

BUFFALO®

US and Canada Toll-Free:

(800) 345-2356

Fax (503) 585-4505

Buffalo Products, Inc.

2805 19th St. SE, Salem, OR 97302-1520

Circle 399 on Inquiry Card.

World Radio History

ABTECH 486/33 64K Cache

made in USA made in USA

- ABTECH 486/33 Mhz Motherboard
- AMI BIOS/ Intel CPU
- 4MB RAM ~to 64MB
- 1.2 MB FD (5.25")
- 1.44 MB FD (3.5")
- IDE Ctrl. w/2serial,1 parallel,1 game
- Desktop Case w/200W P.S.
- 101 Enhanced Keyboard

$1,399

386/33 Mhz	$999
386/25 Mhz	$899
386SX/20 Mhz	$799

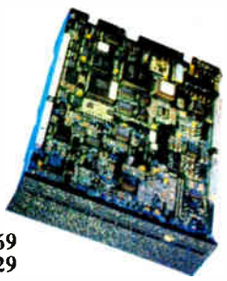
Same standard feature as above

◆OPTIONS◆

Add to above configuration

Hard Drives

40 MB HD $189
80 MB HD $299
120 MB HD $379
200 MB HD $579
345 MB ESDI $1,499
760 MB ESDI $1,799
1.2 GB ESDI $2,899
Internal CD-ROM $399
120MB Tape back up $269
250MB Tape back up $329



Monitors w/video card

12" Amber display monitor $79
14" Amber display monitor $119
14" B&W display monitor $119
14" Mono VGA monitor $169
14" SVGA color monitor (1024x768) $389
14" SVGA non-interlaced monitor $469
Call for 20" Monitors pricing
Med. Tower Case w/ Power supply add $25
Full Size Tower Case w/ Power supply add $45

The sign of excellence in performance and quality

The assurance of quality conponents in each ABTECH system

The assurance of support and service

One year parts & labor warranty

Free for all Corporate Accounts

On-Site Service Option

Our trained technicians can provide solutions

TECH SUPPORT

Solbourne Sparc Station Authorized Dealer

At ABTECH, we are committed to producing **high performance** computers revolving around the latest technology. We provide **quality service and support** with our systems but also keeping the prices down. ABTECH provides **flexibility**, from custom system configuration to networking, leasing, upgrading, and trade-in programs. So give us a call and we'll show you there is a difference with ABTECH.

ABTECH 386SX/16 Notebook

Dual Battery (7 hrs.)◆2MB RAM ~ to 8MB◆40MB HD (60MB option)◆VGA LCD/64 gray scales◆Interchange modules ~Fax/modem, voicemail, scanner etc.. 386/25 & 386/33 available.

'91 Buyer's Guide

Byte Outlook 92
Computer Buying World
Computer Shopper

International Liasions

ABTECH Argentina
Buenos Aires, Argentina
Tel: 783.2266
Fax: 782.6890

ABSTRACT Technology
Burcrest, Romania
Tel: 104273
Fax: 120581

ABTECH Brazil
São Paulo,Brazil
Tel: 212.2559

ABTECH China
Beijing, China

818.575.0007

24 HOURS FAX 818.575.1500

ABTECH INCORPORATED

1431 N. Potrero Ave. Unit B.
S. El Monte, CA 91733
USA

©1991 ABTECH Inc. The brands or names mentioned are trademarks of their repective companies. ABTECH and its logo is a trademark of ABTECH Inc. Shipping, handling and applicable taxes are excluded in prices. Prices are subject to change. The usage of credit cards are subject to surcharge. 30 days money back guarentee.

Circle 220 on Inquiry Card (RESELLERS: 221).

125MB IDE Hard Drive with Cache
Teac 1.2MB 5.25" & 1.44MB 3.5" Drives
1MB SVGA Non-Interlaced Color Card
14" SVGA 1024x768 Non-Interlaced
Flicker-Free Color Monitor
2 Serial, 1 Parallel, & 1 Game Port
MS DOS 5.0 & MS Windows 3.0
Starkey 102 Keyboard
Hi-Res Serial Mouse
Mid-Vertical or Desktop CPU Case
Upgradeable to 50MHz

486 50MHz

$3959

Teac 1.2MB 5.25" & 1.44MB 3.5" Drives
1MB SVGA Non-Interlaced Color Card
14" SVGA 1024x768 Non-Interlaced
Flicker-Free Color Monitor
2 Serial, 1 Parallel, & 1 Game Port
MS DOS 5.0 & MS Windows 3.0
Starkey 102 Keyboard
Hi-Res Serial Mouse
Mid-Vertical or Desktop CPU Case
Upgradeable to 33/50MHz

*Mid & Full Verticals may be additional on some systems.

1.800.875.7568

California, 91784
Tel: 1.818.810 3818
Tech Support:
1.800.875.7569
Fax: 1.818.810.5928

GOVERNMENT, SCHOOLS AND CORPORATE PURCHASE ORDERS WELCOME. All prices and specifications subject to change without notice. 2-Year Parts Warranty applies to Lodestar products only. Money Back Guarantee does not include shipping & handling, and all returns must be shipped pre-paid & in resalable condition. Please call to confirm all warranty details. Photography is for illustration only. No surcharge on VISA, MasterCard, & Discover. 2% cash discount on all Pre-Paid systems. Purchase orders are accepted on approved credit. California orders add 6 1/4% sales tax. All product names, trademarks and registered trademarks are the property of their respective companies. For more written information, please call for our FREE product catalog.

Circle 247 on Inquiry Card.

World Radio History

Get A Lode Of This.

Our Three-Way Guarantee Just Got Better.

There's More To Know About Upgrades Than Just Their Name.

EXPANSION BOARDS

Orchid Technology
Ramquest 16/32
2-8MB for PS/2 50/55/60/70/80
OK $229 2MB $329
Ramquest 8/16 OK $159 2MB $259

BOCA Research
Bocaram At Plus
OK $119 2MB $199 2-8MB LIM 4.0 AT's
Bocaram AT/10 PLus
OK $157 2MB $257 up to 4MB
w/ser & par ports
Bocaram 2 for PS/2's OK $159 2MB $259

AST Research
6pak 286 OK $109 2MB $209
Rampage Plus 286 OK $349 2MB $459
up to 8MB for AT UM 4.0

Intel
Above Board Plus 8 w/2MB $499

VIDEO GRAPHICS CARDS

ATI
8514 Ultra 512K PS/2 or ISA BUS $469
Graphics Ultra 512K & mouse $565
Graphics Vantage w/512K $399
NEW!!! VGA Stereo XL w/1MB $375
VGA Wonder XL 512K w/mouse $239

Orchid Technology
Fahrenheit 1280 w/1MB & Sierra $399
Prodesigner IIS 512K $259 1MB $289
Prodesigner IIMC for PS/2 1MB $399

BOCA Research
BOCA Super VGA 512K $139 1MB $179

PRINTER UPGRADES

Hewlett Packard
Laserjet IIP, IID, IIP
1MB $75 2MB $119 4MB $205
Laserjet II, IID
1MB $95 2MB $149 4MB $249

Panasonic 4420 & 4450I
1MB $109 2MB $149 4MB $249
4450 1MB $179 4455 2MB $269

Epson EPL 6000 & EPL 7000
1MB $129 2MB $151 4MB $255

IBM 4019 & 4019E
1MB $120 2MB $155 3.5MB $219

MEMORY CHIPS & MODULES

DRAM
1X1-70NS $5.25 256X4-80NS $5.15
1X1-80NS $4.95 256X4-100NS $4.95
1X1-100NS $4.75 256X4-120NS $4.75
256X1-80NS $1.99 256X1-120NS $1.75
256X1-100NS $1.85 256X1-150NS $1.50
64X4-80NS $3.00 64X1-100NS $1.75
64X4-100NS $2.75 64X1-120NS $1.60
64X4-120NS $2.50 64X1-150NS $1.35

SIMM/SIPP Modules
4X9-70NS $247 256X9-70NS $21
4X9-80NS $230 256X9-80NS $19
1X9-70NS $53 256X9-100NS $17
1X9-80NS $50 256X9-120NS $15
1X9-100NS $49

MATH CO-PROCESSORS

ULSI
US83C87-16, -25, -20 & -33 $199
US83C87-16SX $115 -20SX $139
New US83C87-40 $279

Intel
80387-16, -20, -25 & -33 $249
80387-16SX $139 -20SX $189
80287-10 $89 80287XL $125

IBM PS/2 UPGRADES

IBM PS/2 Memory
6450604 2MB MOD 50Z, 55SX, 70 $109
6450608 2MB MOD 70A21 $129
34F2933 & 77 4MB PS/2 SIMM $239
30F5360 2MB for 30-286 $109
6451060 4MB MOD 80-A21/A31 $269
6450128 4MB MOD 90 & 95 $359
6450902 2MB MOD 90 & 95 $169
6450609 2-8MB MOD 50, 50Z, 60 $350
6450605 2-8MB MOD 70 & 80 $350
34F3077 2-14MB MOD 70 & 80
w/2MB $365
34F3011 4-16MB MOD 70 & 80
w/4MB $477

Procom PS/2 Hard Drives
Zero Slot 124MB MDL 50 $795
124MB MDL 50Z, 55SX, 70 $740
200MB MDL 50Z 55SX, 70 $1065

PS/2 Accelerators
Model 50, 60 & IBM AT Intel Snap-in 386
386SX-20MHZ $435

Kingston
SX-Now 386SX 20MHZ for 50, 60, 50Z
& 30-286 $399

COMPAQ UPGRADES

Compaq Deskpro
Deskpro 386/20, 25, 20E, 25E & 386S
4MB Module $279 4MB expboard $327
Deskpro 386/33 486/25 Systempro
2MB Module $149 6 socket exp. brd.
w/2MB $395

1/3 height floppy disk drives
1.44MB $129 1.2MB $139

Portable LTE 286
1MB $119 2MB $169 4MB $499

Portable LTE 386S/20
1MB $275 4MB $499

Portable 386/20
1MB Upgrade kit $145 4MB exp/ext
brd $375

SLT 286 1MB $156 4MB $569
SLT 386 1MB $156 2MB $255
4MB $569

LAPTOP UPGRADES

Toshiba
T1200XE/SE, T1600, T3100E, T3100SX,
T3200SX, T5100, T5200, 2MB $139
T3200SXC 2MB $159 4MB $299
T1000SE/XE/LE & T2000SX 1MB $179
2MB $249
T1000LE & T2000SX 4MB $499
T3100SX, T3200SX 4MB $299
T3200 3MB $254

Megahertz Laptop Modems
2400 BD interna. $149 w/MNP5 $210
2400/9600 FAX/Modem w/MNP5 $367

When you want to upgrade your computer, calling a company that just knows brands and order numbers won't get you very far. That's why Universal offers you so much more.

Not only does Universal offer the widest selection of brand names available but we're also knowledgeable about how they work. And how they're installed. So we'll be able to help you figure out what you need. And we'll do it in a way that'll be very understandable.

Universal also offers a variety of ways to purchase and receive your orders. You can use a Purchase Order or C.O.D. Or you could put it on your credit card. With no surcharge added, of course. APO, FPO and orders from around the U.S. and the world are also happily accepted.

As far as shipping goes, same day and overnight is available. So we can send it anyway you like.

Since Universal's prices are so competitive and because we check every product before it's shipped, our return policy is very user friendly.

Everything Universal sells comes with a 5 year warranty, has a 30 day money back guarantee and is guaranteed to be completely compatible with your computer.

100% COMPATIBILITY GUARANTEED

No one else offers you so much.

If you have any questions or if you would like a complete list of what Universal has, give us a call. Or you can receive this information by fax or mail. Whatever's easiest for you.

So, if you want to make some upgrades to your computer, call Universal. No matter what you want to do, we'll tell you how to get it done.

15451 Redhill, Suite E, Tustin, CA 92680

Phone: 714/258-2018 Fax: 714/258-2818

800/678-8648

UNIVERSAL

MEMORY PRODUCTS

Circle 235 on Inquiry Card (RESELLERS: 236).

Our 486/33 has a cache so big, it gets a 99% hit-rate.

PC Sources

COMTRADE 386/33

"The staff is friendly and knowledgeable."

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

NO WONDER SO MANY BUSINESSES ARE PROUD TO WEAR OUR LOGO

• With ComTrade, You're In Good Company •

• Corporations •

Honeywell • General Electric • Bell Atlantic • Jet Propulsion Laboratory • Norland Corporation • Xerox Corporation • Johnson & Johnson • Unisys Corporation • AT&T • Olin Chemicals • Ramada Hotel • Samsung Corporation • NASA • AlphaBeta Super Market • Eaton Corporation • Loral • Allied Signal • Vulcan Materials • Sandia National Laboratories

• Universities •

University of Florida • University of Hawaii • Memphis State University • University of Michigan • University of California Los Angeles • University of Alaska • University of Toronto • University of Southern California • Indiana University • Oregon State University

33 MHz 386 Cache
ONLY $1,795

- 4 MB RAM (70ns)
- *Whopping* 128K Cache Memory
- 1.2 MB & 1.44 MB Drive
- 130 MB 15ms Maxtor IDE Drive with 64K Lookahead Cache
- 16 Bit Super VGA with 1 MB
- 1024 Non-interlaced SVGA Display (VESA standard for flicker-free)
- 2 Serial/1 Parallel/1 Game Ports
- Enhanced 101-key Keyboard
- Hi-Res 400 DPI Serial Mouse
- MS-DOS 5.0 & Windows 3.0

25 MHz 386 VGA
ONLY $1,655

- 4 MB RAM (70ns)
- 1.2 MB & 1.44 MB Drive
- 85 MB 17ms Maxtor IDE Drive with 32K Lookahead Cache
- 16 Bit Super VGA with 1 MB
- 1024 Non-interlaced SVGA Display (VESA standard for flicker-free)
- 2 Serial/1 Parallel/1 Game Ports
- Enhanced 101-key Keyboard
- Hi-Res 400 DPI Serial Mouse
- MS-DOS 5.0 & Windows 3.0

33 MHz 486 Cache
ONLY $2,255

- 4 MB RAM & Built-in 487
- *Whopping* 256K Cache Memory
- 1.2 MB & 1.44 MB Drive
- 130 MB 15ms Maxtor IDE Drive with 64K Lookahead Cache
- 16 Bit Super VGA with 1 MB
- 1024 Non-interlaced SVGA Display (VESA standard for flicker-free)
- 2 Serial/1 Parallel/1 Game Ports
- Enhanced 101-key Keyboard
- Hi-Res 400 DPI Serial Mouse
- MS-DOS 5.0 & Windows 3.0

33 MHz 486 *Plus*
ONLY $2,755

- Same configuration as our popular 486/33 except this machine has 8 MB RAM & a 210 MB 15ms IDE disk.

VIDEO UPGRADES

- 17" SVGA Color Display **$750**
- 20" SVGA Color Display **$1690**
- Orchid® Fahrenheit 1280° S3 Graphics Accelerator **$290**

Quality Is Everything. This philosophy has made us the successful company we are today. There is a difference. From day one, our belief in superior quality and high performance has allowed us to enjoy the success we have today. We are not only technically oriented, but most importantly, people oriented. PC Sources Magazine puts it this way "*Comtrade ... offers an inspired combination of top-notch components, friendly toll-free customer support, and low prices.*" We couldn't have said it better. **At Comtrade, people make the difference.**

Non-interlaced, Flicker-free 1024x768 SVGA. You'll See the Difference. Our 14" non-interlaced Super VGA color monitor, which has a 0.28mm dot pitch, can display absolutely flicker-free 1024 x 768 image. It is VESA standard. Now this top of the line option is standard with our Comtrade systems. **Absolutely the Best Graphics Package.**

1018-B Lawson ST • Industry, CA 9174
• (818) 964-6688 • Fax: 818-964-2492

• Better Graphics • Faster Drives • Bigger Cache •

COMTRADE

"where quality is everything"

800-969-2123

30 DAY MONEY BACK GUARANTEE
ONE YEAR PARTS & LABOR WARRANTY

Circle 238 on Inquiry Card (RESELLERS: 239).

World Radio History

You May Recognize Some of Our Customers...

Intel Corporation U.C. Berkeley
M.I.T. Procter & Gamble
PG & E Digital Equipment Corp.
AT & T Clemsen University
N.A.S.A. U.S. Dept. of Agriculture
S.W. Bell U.S. Dept. of Navy
DuPont U.S. Marine Corps
Exxon U.S. Army Washington Post
U.S. Veterans Hospital Admin. Ctr
Lawrence Livermore Laboratories
Lockheed Missile/Space Eng.
...and the list goes on and on...

Monthly Specials!!

MICRO-L® 486-33 SERVER $6895

- Intel 80486-33MHz CPU Upgradable to 50MHz • 256K Cache
- Fault-Tolerant Operation
- Dual Maxtor 380 MB, 0.5ms Drives w/ Hard Disk Mirroring
- ESDI Disk Caching controller (DPT)
- 16MB 60ns RAM expandable to 32MB onboard
- 1.2MB and 1.44MB Floppy Drives (TEAC)
- SpeedStarPlus, 1MB,16-bit VGA card Hi color, non-interlaced
- 14" SVGA - NI Monitor, 1024 x 768, 0.28dp (Relisys-1422)
- Keytronics 101 Keyboard (USA) • 1 Parallel/2 Serial Ports
- Tower Case w/10 drive bays/digital display 300W P/S
- American 600W Smart UPS • MS.DOS 5.0

Hard Disk Mirroring eliminates the need for back-ups and protects data. The system automatically switches to the second hard drive containing identical data as on the first drive, in the event of hard disk failure.

Free on-site service to most locations

intel inside

* Intel Inside is a trademark of Intel Corporation.

Standard System Features: (*Unless specified differently in Specials)

- Motherboard - Intel CPU
- 4MB 70ns RAM on-board
- Math co-processor socket
- 1.2MB and 1.44MB FDs(Teac)
- Dual HDD/FDD controller
- 2 serial/1 parallel ports
- 101Enhanced keyboard
- Desktop case w/ PS

OPTION: Tower case add - $100

SYSTEMS: (Prices below do not include Hard disk drive, monitor / card)

486-33 EISA	*w/64k cache (Micronics MB)*	**$1,395**
486-33 ISA	*w/64k cache (MCI/Symphony) upgradable to 50MHz*	**$1,195**
486-SX/20	*w/64k cache (Symphony™)*	**$945**
386-33	*w/64k cache (Symphony™)*	**$875**
386-25	*(Symphony™) upgradable to 33MHz/40MHz*	**$745**
386-SX20/16		**$665/635**
386SX-V20	*Vanda NOTEBOOK 2MB RAM, 40HDD, 32-Grey scale mono VGA, 6.2 lbs.*	**$1,750**
386SX-16	*LAPTOP 2MB RAM, 40HDD, Mono VGA, 10.9 lbs.*	**$1,495**

MICRO-L® ISA 486-33 CACHE (Symphony) $2395

- Intel 80486-33MHz Processor - Upgrades to 50MHz; Socket for removable crystal allows for CPU changes
- AMI BIOS, Symphony™ Chipset, Dallas DS1287 real-time clock (w/10-year warranty)
- 64k Cache SRAM exp. to 1MB onboard
- 4MB RAM 70ns exp to 32MB onboard
- 1.2MB and 1.44MB Floppy Drives (TEAC)
- 120MB IDE HDD • IDE HD/FD Controller
- SpeedStarPlus, 1MB,16-bit VGA card, Hi Sierra color
- 14" Super Multi-scan, non-int,1024x768,0.28dp(Relisys-1422)
- 1 Parallel/2 Serial Ports • Keytronics 101 Keyboard (USA)
- Mid Tower case (Heavy duty), P/S and digital display
- MS-DOS 5.0 • MS-Windows 3.0 and MS compatible mouse

MICRO-L® 386-33 CACHE (Symphony) $1795

- Intel 80386-33MHz Processor - Upgrades to 40MHz; Socket for removable crystal allows for CPU changes
- AMI BIOS, Symphony™ Chipset, Dallas DS1287 real-time clock (w/10 year warranty)
- 64k Cache SRAM exp. to 1MB onboard
- 4MB RAM 70ns exp. to 32MB onboard
- 1.2MB and 1.44 Floppy Drives (TEAC)
- 120MB, 15ms IDE HDD/FDD controller
- 16-bit VGA Card w/1MB
- 14" Super Multi-scan, non-int,1024x768, 0.28dp(Relisys-1422)
- 1 Parallel/2 Serial Ports • Keytronics 101 Keyboard (USA)
- Deluxe Baby Case with 200w UL Power Supply/6-bays
- MS-DOS 5.0 • MS-Windows 3.0 and MS compatible mouse
- OPTION: 386-40 SVGA system - add $75

FCC Class B Approved

MICRO-L® 386-SX/16 SVGA $1195

- Intel 80386-SX/16MHz Processor • AMI BIOS
- 2MB RAM expandable to 8MB onboard
- 1.2 MB Floppy Disk Drive (TEAC)
- 1.44MB Floppy Disk Drive (TEAC)
- Hard Disk/Floppy Drive controller
- 52MB 17ms IDE Hard Disk Drive
- 1 Parallel 1 Game/2 Serial Ports
- Keytronics 101 Keyboard (USA)
- 16-bit VGA card w/512K (Flicker Free)
- 14" SVGA Monitor 1024 x768, 0.28dp (Relisys RE-9514)
- Deluxe Baby Case with 200w UL Power Supply/6-bays
- MS-DOS 5.0 & MS Window 3.0 and MS compatible mouse
- OPTION: 386SX-20 SVGA system - add $35
- OPTION: 386SX-25 SVGA system - add $70

FCC Class B Approved

MOTHERBOARDS

486-33 EISA 64K Cache Micronics	$1565
486-33 AT w/64K Cache - Symphony	$775
486-33 AT w/64K Cache -Opti	$695
486-SX/20 w/64K Cache - Symphony	$535
486-SX/20 non Cache - Symphony	$445
386-40 w/64K Cache Symphony	$525
386-33 w/64K Cache Symphony	$475
386-33 non Cache - Symphony	$355
386-25 non Cache - Symphony	$315
386-SX20 w/32k Cache	$245
386-SX20/16	$215/185

HARD DRIVES

Maxtor MXT-7080A 81MB IDE	$285
Maxtor MXT-7120A S 130MB	$360
Maxtor LXT-213A 213MB IDE	$585
Maxtor LXT-340A 340MB IDE	$915
Maxtor XT-8380E/S 380MB	$1025
Maxtor XT-8760E 768MB	$1385
Maxtor XT-8760S 768MB	$1425
Maxtor 1.02 GB SCSI	$1995
Conner CP-3000 40MB	$179
Conner CP-30104 120MB	$350
Conner CP-3204 200MB	$555
Quantum LPS52A 52MB 17ms 1"	$215
Quantum ProDr105AT 105MB 17ms	$330
Quantum ProDr120AT 120MB 15ms	$360
Quantum ProDr210A S 210MB,14ms	$595
Ultrastor 12F ESDI Cntlr w/32K Cache	$160
DTC-3290 SCSI/EISA,512K	$575
Adaptec 1740B-Kit SCSI/EISA	$480
Adaptec 1542B-Kit SCSI Cntlr FD/HD	$260

MONITORS

Relisys VGA Gry Scl RE-9503	$134
Relisys VGA RE 9513 640 x 480	$295
Relisys VGA RE-9514,1024 x 768 0.28dp	$310
Relisys S Multiscan,1024+768 RE-1420	$330
Relisys S Multiscan NI,1024x768 RE-1422	$375
Seiko S Multiscan NI 1024X768 CM-1450	$585
Seiko 20" VGA 1280x1024 CM-2050	$1795
Sony VGA 1024x768 CPD 1304	$610
Nanao 16" VGA 1024x768 908GT	$1165
Nanao 20" VGA 1280x1024 940GT	$2240
NEC Multisync 4-Ds	$ 1040
Genoa VGA Card 512K	$100
SpeedStar+ VGA 1MB, w/Hi Sierra	$195
Orchid ProD IIs 1MB, w/Hi Sierra	$195

MISCELLANEOUS

Intel Math-Coprocessors	Call!
Logitech MouseMan Serial/Bus	$65 77
NEC Silentwriter2 model 90	$1485
QMS Laser Printer PS410, 2MB	$1850
FAX modem 9600/send Recv/sftwr	$115
U.S Robotics 9600 intV.32 PC/V.42 bis	$445
Colorado DJ 10 T Back up 120MB	$245
Colorado DJ 20 T Back up 250MB	$320
LANtastic AE 2 starter kit/Adapter	$489/229
American Smart UPS 600VA	$445
American UPS APC 1250V	$845

HOURS: Mon thru Fri - 8:30am to 6:00pm (PST)
Sat - 10:00am to 4:00pm (PST)

- We offer competitive prices, superior products, customer support, and the best values in the mail order industry. In addition, we offer:
- 30-day money-back guarantee for defective items.
- One-year Warranty (Labor & Parts).
- Prices reflect 3% cash discount.
- Shipping non-refundable on returned items. RMA # is required.
- California residents add 8 ¼% sales tax.
- Allow 10 working days for checks to clear.
- 15% re-stocking fee on non-defective returns.
- Government, University & Fortune 1000 P.O.'s Net 30 add 3%.
- Opened software is not returnable.
- We welcome international accounts, minimum order $250.
- APO's, FPO's, & Overseas orders welcome.
- Prices subject to change without notice
- All trademarks belong to their respective companies.
- We are not responsible for typographical errors.

Government, Corporate & University P.O.'s Welcome!

MICROLINE COMPUTERS INCORPORATED
46757 Fremont Blvd., Fremont, CA 94538

Orders Only **1-800-777-2219**
Info/CA Orders: (510)770-1900 Fax: (510)770-1912

Dealer Inquiries Welcome.

VISA MasterCard
For your protection, we check thoroughly for stolen credit cards.

Microline Computers - Taiwan
Phone: 011-886-7-345-0060
Fax: 011-886-7-345-0025

Circle 244 on Inquiry Card.

World Radio History

It's not only the memory that makes the difference, it's "The Source!"

IBM MEMORY

PS/1		
2MB	IBM PN N/A	$119
PS/2 30/286, 1497259		
2MB Kit	30F5360	$109
PS/2 35SX;LS,40SX,50Z,55SX;LS,65SX;LS,70		
1MB	6450603	$59
2MB	6450604	$119
PS/2 70-A21;A61;B21;B61		
2MB	6450608	$129
PS/2 35SX;LS,40SX,55SX;LS,65SX;LS,34F30XX		
4MB	34F2933	$269
PS/2 35SX; LS, 40SX		
8MB	6450129	$589
PS/2 57SX, 90, 95		
8MB	6450130	$509
PS/2 80-141		
1MB	6450375	$79
PS/2 80-111/311		
2MB	6450379	$139
PS/2 90, 95 and P75 (Install in pairs)		
2MB	6450902	$119
4MB	6450128	$209
Expansion boards for all models 50 and 60		
2 8MB w/2MB	1497259	$319
2 16MB w/2M	6450609	$339
Expansion boards for all models 70 and 80		
2 4MB w/2M	34F3017	$349
4 16MB w/4M	34F3011	$459

NEC MEMORY

Powermate SX		
2MB Brd	APC-H855	$499
4MB Brd	APC-H853	$729
Powermate SX Plus		
1 2MB Brd	APC H850E	$239
4 8MB Brd	APC 852E	$629
Powermate SX/20		
2MB CPU	OP-410 8101	$199
2MB Brd	OP-410-8102	$239
Powermate 386/20		
2MB	APC H655E	$359
Powermate 386/25		
2MB	APC-H655X	$359
Powermate 386/25S		
2MB Kit	OP-410 5201	$199

HP MEMORY

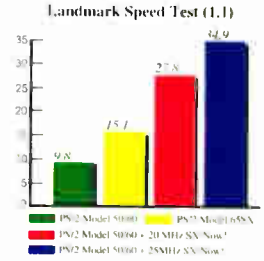
Vectra QS 16S; 20PC, RS/20PC; 25PC, 20C		
1MB Kit	D1540/1640A	$69
4MB Kit	D1542/1642A	$199
Vecta 386/16N, 386/20N		
2MB	D2406A	$159
8MB	D2404A	$609
Vectra 486 PC (Install in Pairs)		
1MB	D2150A	$69
4MB	D2151A	$299
Vectra 386/25, 486/25T, 33T (Install in Pairs)		
2MB	D2183A	$129
Vectra 486PC and 386/25 PC		
8MB	D2152A	$549

Please call for any item not listed.

SX/NOW! PROCESSOR UPGRADE

Kingston Technology Corp.'s SX-Now! is the undisputed performance champ.

-PC Magazine October 29, 1991



Don't replace your system...
Upgrade your 286 to a 386SX with Kingston's SX/Now!

SX/Now! 80386SX Processor features:
- ✔ Available in 20 or 25MHz
- ✔ 16 Kbytes of Cache Memory
- ✔ Onboard High Speed Clock
- ✔ Requires No Expansion Slot
- ✔ 80387SX Co-Processor Socket
- ✔ 5-Year Warranty

Now available for:
- ✔ IBM PS/2 25/286, 30/286, 50, 50Z, 60
- ✔ Origi nal IBM AT
- ✔ AST Premium 286 and Bravo 286
- ✔ Hewlett-Packard ES286/12

Kingston TECHNOLOGY CORPORATION

SX/Now! provides true multitasking and background operation for Windows 3.0, OS/2, and 386 specific software. Improve system performance up to 350%!

SX/Now! 20MHz Accelerator $439
SX/Now! 25MHz Accelerator $539

PRINTER MEMORY

Hewlett-Packard LaserJet IIP, III, IIIP, IIID		
2MB	33475B	$125
4MB	33477B	$199
Hewlett-Packard LaserJet II and IID		
2MB	33444B	$125
4MB	33445B	$195
Hewlett-Packard DeskJet 500 and Plus		
256K	22707B	$99
IBM Laser 4019 and 4019e		
2MB	1039137	$149
3.5MB	1038675	$219
IBM Laser 4029 All Models		
2MB	1183334	$179
4MB	1183335	$359
Canon LBP-4		
2MB	PN N/A	$249
Brother HL-8, 8E		
2MB	MB 820	$199
Panasonic 4450I and 4420		
2MB	KX P441	$149
4MB	PN N/A	$239
Toshiba Page Laser 6		
4MB	LS6-NB3100	$219
OkiLaser 400		
1MB	70014701	$109
2MB	OKI PN N/A	$149
Texas Instruments MicraLaser and XL		
1MB	2565739-0001	$79
Epsan EPL 6000		
2MB	IBS401	$149

SIMM / DRAM

SIMMS AND SIPPS		DRAM CHIPS	
4MX9-80	$169	1X1-80	$4.50
1MX9 80	$48	256X4 80	$5.00
256X9 80	$15	256X1 80	$1.80

COMPAQ MEMORY

DeskPro 386-20, 20E and 25		
1MB	113131-001	$89
4MB	113132-001	$219
DeskPro 386S/16		
1MB	113645-001	$89
4MB	112534-001	$219
DeskPro 286N, 386N and 386SX/20		
1MB	118683-001	$69
2MB	118689-001	$119
4MB	118690-001	$269
DeskPro 386-33, 486-33 and SystemPro		
OK Board	116569-001	$229
2MB	115144-001	$129
8MB	116561-001	$419
DeskPro 386-20e and 25e		
1MB Board	113644-001	$139
4MB Board	113645-001	$309
DeskPro 386S		
1MB Board	113633-001	$139
4MB Board	113634-001	$329

AST MEMORY

Premium 386C, 386-16		
4MB Kit	500510-008	$189
Premium 386, 386-20		
4MB Kit	500510-004	$249
Bravo 386-SX, WS/286, 386		
2MB Kit	500510-002	$99
4MB Kit	500510-008	$189
8MB Kit	500824-001	$389
Premium 386/25;33,Premium II 386SX/16;20		
1MB w/WPB	500780-003	$69
All Premium and Bravo 486 Models		
2MB w/WPB	500718-004	$129
8MB w/WPB	500780-001	$459
Premium II 386SX/20 and 386SX/16		
4MB w/WPB	500780-004	$229

LAPTOP MEMORY

AST		
Executive Notebook	1MB	$79
	4MB	$219
COMPAQ		
Portable LTE386S/20	1MB	$179
	4MB	$379
Portable LTE 286	1MB	$89
	4MB	$219
SLT-286	1MB	$129
	4MB	$449
SLT-386	1MB	$129
	4MB	$399
IBM		
L40SX laptop	2MB	$129
	4MB	$219
	8MB	$449
TOSHIBA		
T1000SE/LE/XE, T2000SX	2MB	$229
T1000LE, T2000SX	4MB	$359
	8MB	$789
T2000SXE	2MB	$229
	4MB	$359
	8MB	$789
T1200XE, T1600, T3100E	2MB	$129
T3100SX T3200SX, SXC	2MB	$129
	4MB	$229
T3200	3MB	$229
T5100	2MB	$129
T5200, T5200C, T8500	2MB	$129
	8MB	$469
NEC		
Powermate Port. SX	2MB	$399
	8MB	$1399
ProSpeed 286, 386SX16	1MB	$129
	4MB	$399
ProSpeed SX20	1MB	$159
	4MB	$449
ZENITH		
MastersPort SL	2MB	$209
MastersPort 386SX	2MB	$209
S.S. SX, 286E, SlimsPort	2MB	$169
SuperSport SX	2MB	$169
SuperSport 286, 286E	1MB Kit	$119
SuperSport 286E, SlimsPort	4MB	$449
TurboSport 386, 386E	1MB	$169

ZENITH MEMORY

Zenith 486/33ET		
4MB Kit	ZA 4200-MZ	$293
16MB Kit	ZA 4200-MB	$1279
Zenith Z-386/20/25,33 and 33E		
1MB	ZA3600MB	$69
4MB	ZA3800MK	$299

EXPANSION BOARDS

BocaRam/AT Plus

Up to 8MB for any AT or 16 bit compatible machines running up to 33MHz. Offers all types of memory, provides a maximum of 8MB LIM EMS 4.0.

2MB with DRAM or SIMM $199

We also stock memory for Acer, ALR, Apple, Arche Technologies, AT&T, Austin, Bondwell, Chinon, Citizen, Commodore, CompuAdd, Data World, Dell, DTK, Everex, Gateway, GRID, Hyundai, Intertec, Leading Edge, Magnavox, Micro Express, Midem, Mips, Mitsubishi, NCR, NeXT, Northgate, Olivetti, Packard Bell, PC Brand, Poquet, Samsung, Silicon Graphics, Smith Corona, Swan, Tandy, Unisys, Wang, Wyse, Zeos and Others.

PRICE, QUALITY, AND SUPPORT

• Same Day Shipping • Free Technical Support • Overnight and Saturday Delivery Available • All Products User Installable • No Surcharge on Visa or Mastercard • APO/FPO International Orders Welcome • Purchase Orders Accepted from Govt. Universities and Qualified Firms •

FIRST SOURCE INTERNATIONAL, INC.
"The Only Source for Computer Memory!"

DELIVERY GUARANTEED

Follow your package every step of the way with 3 day International delivery via Federal Express, UPS or DHL. Fast, inexpensive, dependable delivery anywhere in the world. Information on tracking shipments is available at your request.

Outside the U.S.
1-714-588-9866
BUSINES HOURS: Monday - Friday 8AM - 5PM

1-800-535-5892

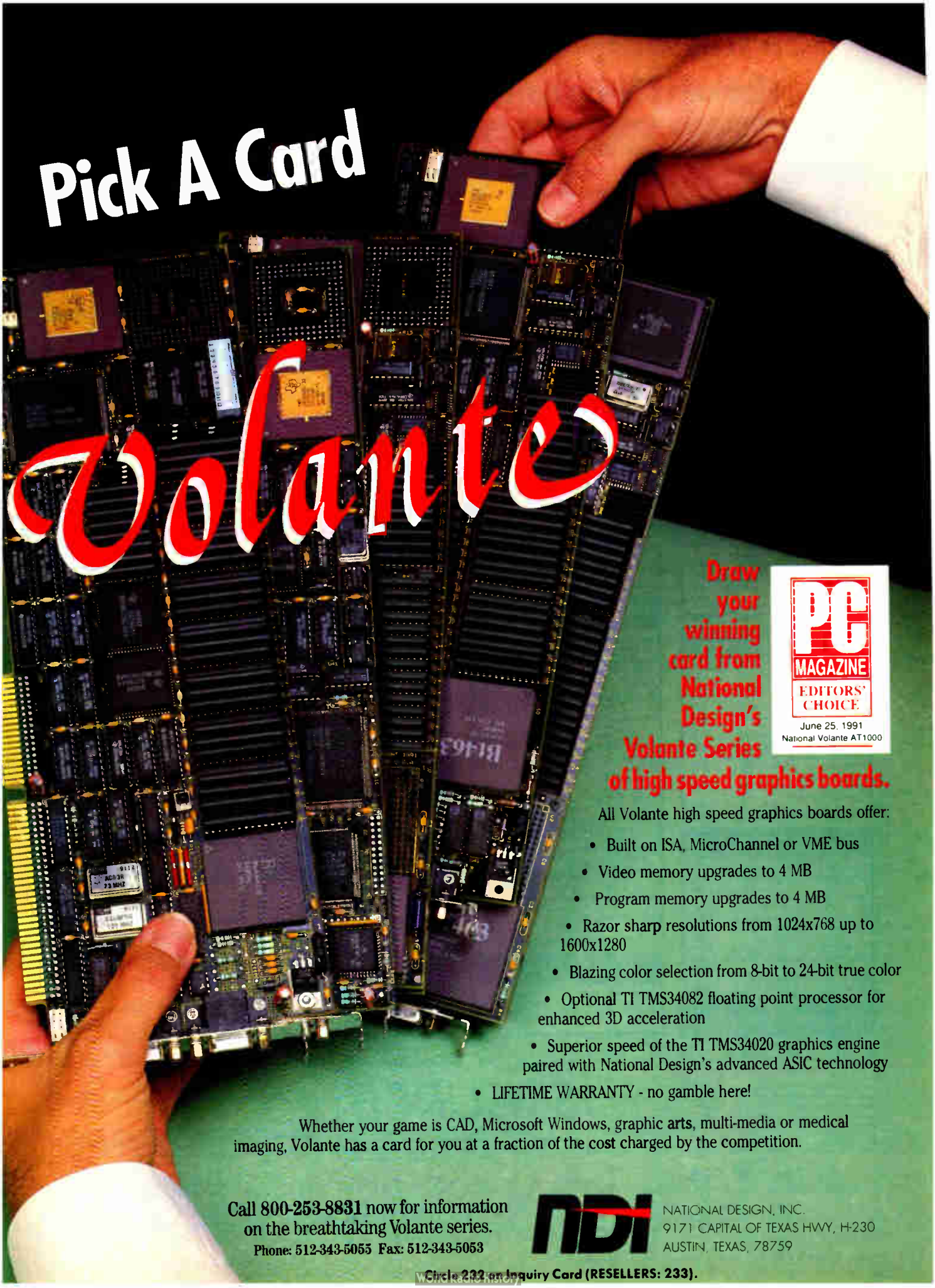
Fax Line
1-714-588-9872
FAX YOUR ORDERS 24 HOURS A DAY!

Mail Orders to: FIRST SOURCE INTERNATIONAL, INC. 36 ARGONAUT, STE. 140 ALISO VIEJO, CA 92656

Terms and Conditions: All products are brand new and carry manufacturer's warranty. Prices subject to change without notice. All sales are subject to availability. All sales are final. Defective merchandise will be replaced or refunded at our discretion. A restocking fee will be charged on all returned merchandise. All returns must have a return authorization number. Shipping and handling charges are not refundable. Prices and availability of products listed may vary from those listed in this ad. We reserve the right to limit quantities. We are not responsible for typographical errors. Prices listed are for cash discount. Credit card prices are 3% higher.

World Radio History

Pick A Card



Draw your winning card from National Design's Volante Series of high speed graphics boards.

PC MAGAZINE EDITORS' CHOICE
June 25, 1991
National Volante AT1000

All Volante high speed graphics boards offer:

- Built on ISA, MicroChannel or VME bus
- Video memory upgrades to 4 MB
- Program memory upgrades to 4 MB
- Razor sharp resolutions from 1024x768 up to 1600x1280
- Blazing color selection from 8-bit to 24-bit true color
- Optional TI TMS34082 floating point processor for enhanced 3D acceleration
- Superior speed of the TI TMS34020 graphics engine paired with National Design's advanced ASIC technology
- LIFETIME WARRANTY - no gamble here!

Whether your game is CAD, Microsoft Windows, graphic arts, multi-media or medical imaging, Volante has a card for you at a fraction of the cost charged by the competition.

Call 800-253-8831 now for information on the breathtaking Volante series.
Phone: 512-343-5055 Fax: 512-343-5053

NDI
NATIONAL DESIGN, INC.
9171 CAPITAL OF TEXAS HWY, H-230
AUSTIN, TEXAS, 78759

Circle 232 on Inquiry Card (RESELLERS: 233).

World Radio History

COMP & SOFT T.M. EXPERTS

30-Day Money Back Guarantee

FREE 5 YEAR SERVICE — ONE YEAR WARRANTY ON PARTS

10th ANNIVERSARY 1981 - 1991
ST. LOUIS'S LARGEST COMPUTER STORE

The Computer Hardware, Communication and Network Experts

1-800-FAST-121 Ext.10
(1-800-327-8121)

VISA MasterCard DISCOVER

CUSTOMIZE YOUR OWN SYSTEM. WE WILL BUILD THE SYSTEM AND TEST IT FOR 72 HOURS.

A. 64K CACHE 486 EISA33=$1799, 33=$1099, 25=$999, SX20=$799, 386/33=$585, 386/25=$465
NO CACHE 386SX 25=$295, 20=$275, 16=$245, 286/16=$139, 286/12=$99
B. CASE WITH P.S. T8=$249, 3S=$199, 1S=$169, 44S=$169, 4A=$169, XT=$99, AT=$129
C. FLOPPY DISK 1.2MB 5.25"=$75, 1.44MB 3.5"=$75, TAPE DRIVE 40-120MD=$299, 80-250=$399
D. HARD DISK IDE WITH 32K CACHE 40MB=$199, 80MB=$299, 130MB=$449, 200MB=$649
E. MONO CARD=$29, VGA CARD 600x800 256K=$59, 512K=$79, SUPER VGA 1024x768 1MB=$119
F. MONITOR MONO 12"=$95, 14"=$119, VGA MONITOR 640x480=$299, 1024x768=$349
G. KEYBOARD=$49, MEMORY 1MB=$49, MS-DOS=$85, WINDOWS=$49, MOUSE=$29 MODEM 2400=$77

PLEASE FAX YOUR ORDER
FAX (314)298-9674
12037 DORSETT ROAD
ST. LOUIS, MO. 63043
PHONE (314)298-1900

Circle 250 on Inquiry Card (RESELLERS: 251).

World Radio History

Circle 223 on Inquiry Card.

AMT INTERNATIONAL

(408) 432-0552 • (408) 432-1790

LOWEST PRICES
SAME DAY SHIPPING
Fax: (408) 944-9801

COMPAQ MEMORY

DeskPro 286-E, 386-20/20E/25
1MB 113131-00* $125.00
4MB 113132-00* $330.00
DeskPro 286N, 386N and 386SX
2MB 118689-001 ..... $200.00
4MB 118690-001 ..... $545.00
DeskPro 386S
1MB 113646-001 ..... $125.00
4MB 112534-001 ..... $315.00
DeskPro 386-33, 486-33 & SystemPro
2MB 115144-001 ..... $200.00

AST MEMORY

Bravo-286, Workstation
512K Kit500510-010 ..... $59.00
2MB Kit 500510-002 ..... $150.00
Premium 386-16/20C
1MB Kit 500510-007 ..... $95.00
4MB Kit 500510-008 ..... $275.00
Premium 386-20
1MB Kit 500510-003 ..... $150.00
4MB Kit 500510-004 ..... $350.00
Bravo-386SX
4MB Kit 500510-008 ..... $369.00
Premium 386-SX/25/33 & 486-25
1MB 500718-002 ..... $80.00

HEWLETT-PACKARD MEMORY

Vectra QS/16S
1MB D1540A $112.00
4MB D1542A $325.00
Vectra QS/20PC, RS/25PC and 20C
1MB D1640A $126.00
4MB D1642A $365.00
Vectra 486PC
1MB D2150A $115.00
4MB 02151A $390.00

IBM PS/2 MEMORY

Models 30-286, Exp. Board 1497259
512 K Kit 30F5348 ..... $54.00
2MB Kit 30F5360 ..... $175.00
Models 70-E61/121, 55SX, 65SX
1MB 6450603 ..... $95.00
Models 70-E81/121, 50Z, 55SX,65SX
2MB 6450604 ..... $179.00
Models 55SX, 65SX, 34F3077 & 34F3011
4MB 34F2933 ..... $370.00
Models 70-A21
2MB 6450608 ..... $150.00
Models 80-141
1MB 6450375 ..... $145.00
Models 80-111/311
2MB 6450379 ..... $220.00
All Models 70 and 80
2-8MB w/2M 6450605 ..... $489.00
2-14MB w/2M 34F3077 ..... $500.00
2-16MB w/4M 34F3077 ..... $925.00
Models 50, 50Z, 55 SX &60
2-8MB 1497259 ..... $599.00

LASER PRINTER MEMORY

Hewlett-Packard Laser Jet IIP, III & IIID
1MB 33474B $110.00
2MB 33475B $150.00
4MB 33477B $215.00
Hewlett-Packard Laser Jet IIP & IID
1MB 33443B $110.00
2MB 33444B $150.00
4MB 33445B $215.00
IBM Laser 4019 and 4019e
2MB 1039137 ..... $369.00
3.5MB 1038675 ..... $469.00
Canon LBP-8II, 8IIR, 8IIT
2MB S63-1880 ..... $225.00
4MB Part #N/A $439.00

LAPTOP AND PORTABLE MEMORY

TOSHIBA MEMORY
1MB Model 1000SE/XE $265.00
2MB Model 1000SE/XE $325.00
2MB Model T1200XE $230.00
2MB Model T1600 ..... $230.00
2MB Model T3100E $175.00
2MB Model T3100SX $175.00
4MB Model T3100SX $395.00
2MB Model T3200SX $175.00
4MB Model T3200SX $395.00
2MB Model 5100 ..... $215.00
2MB Model T5200,T8500 ..... $185.00
8MB Model T5200,T8500 ..... $950.00

ZENITH MEMORY
1MB SuperSport 286 & 286E $199.00
2MB SuperSport 286 & 286E $350.00
2MB SuperSport SX/Alpha ... $350.00
4MB SuperSport SX/Beta $350.00

COMPAQ MEMORY
1MB Portable LTE 286 ..... $175.00
2MB Portable LTE 286 ..... $225.00
1MB SLT-286 ..... $225.00
4MB SLT-286 ..... $775.00

NEC MEMORY
1MB Prospeed 286 ..... $270.00
2MB Prospeed 386 ..... $450.00

ZENITH MEMORY

Zenith Z-386/20/25/33 & 33E
1MB ZA36/3800ME $100.00
4MB ZA3800MK $525.00
Zenith Z-386/20/20/25 & 33
2MB ZA3600MG $199.00
Zenith Z-386 SX
2MB Z-605-1 ..... $225.00

MATH COPROCESSORS

INTEL
8087-5 MHz $70.00
8087-2 8MHz $70.00
8087-1 10MHz $135.00
80287-6 6MHz $79.00
80287-8 8MHz $79.00
80287XL 8/10MHz $89.00
80287XTL 12MHz (Laptop) $99.00
80287-10 10MHz $89.00
80C287-12 12MHz $109.00
80387SX-16 ..... $129.00
80387SX-20 ..... $135.00
80387DX-20 ..... $140.00
80387DX-25 ..... $185.00
80387DX-30 ..... $195.00
80387DX-33 ..... $195.00

WEITEK
3167-20 20MHz $300.00
3167-25 25MHz $450.00
3167-33 33MHz $500.00
4167-25MHz $600.00
4167-33MHz $700.00

CYRIX
8C87-8 ..... $59.00
8C287-10 ..... 75.00
8C287-12 ..... 85.00
8C2877-20 ..... 85.00
8C387-20 ..... $155.00
8C387-25 ..... $158.00
8C387-33 ..... $175.00

IIT
8C87-8 ..... $69.00
8C287-10 ..... $79.00
8C287-12 ..... $89.00
8C287-20 ..... $99.00
8C387-20 ..... $175.00
8C387-25 ..... $175.00
8C387-33 ..... $200.00

AMD
80C287-10 ..... $89.00
80C287-12 ..... $110.00

SIMM MODULES

IBM TYPE
Add $2.00 for SIPPS
4Mx9-80 ..... $145.00
4Mx9-70 ..... 145.00
1Mx9-60 ..... 40.00
1Mx9-10 ..... 40.00
1Mx9-80 ..... 40.00
1Mx9-70 ..... 40.00
256x9-70 ..... 12.00
256x9—10 ..... 10.00
256x9-80 ..... 11.00
256x9-60 ..... 12.00

APPLE-MAC
1Mx8-70 ..... $50.00
1Mx8-10 ..... $40.00
1Mx8-80 ..... $45.00
4x8-80 ..... $190.00

2393 QUME DRIVE,
SAN JOSE, CA 95131

DRAM - DRAM - DRAM

DRAM 1MGXI
1 MGXI-120NS $5.00
1 MGXI-100NX 5.25
1 MGXI-80NX 5.50
1 MGXI-70NX 5.75
1 MGXI-60NX 7.50

DRAM 64XI
4164-150 ..... $2.00
4164-120 ..... 2.50
4164-100 ..... 2.75
4164-80 ..... 3.00

DRAM 64X4
4464-15 ..... $1.50
4464-12 ..... 1.99
4464-10 ..... 2.50

DRAM 256XI
256XI-150NS $1.79
256XI-120NS 1.99
256XI-100NS 2.00
256XI-80NS 2.25
256XI-70NS 2.35
256XI-60NS 3.99

DRAM 256X4
256X4-120NS $5.00
256X4-100NS 5.50
256X4-80NS 5.75

256XI-STATIC COL
51258P-10 ..... $2.99

AAA 2800-08 ..... 3.00
AAA 2800-07 ..... 3.25
AAA 2800-60 ..... 4.50
1X4-80 ZIPP 35.00
1X4-80STT ZIPP 39.00
1X4-70STT ZIPP 39.00

Discover the CPC Advantage!

3 Year Warranty • FREE Federal Express Shipping
1 Year Onsite Pick up • 24-48 Hour Warranty turn around
Overnight Replacement parts • 30 Day Money Back

We Accept
MasterCard VISA C.O.D.

Mother Boards
386-25.....$369
386-33/64K Cache....$485
486-33/64K Cache....$899
486-33/256K Cache..$999
3 Year Parts & Labor Warranty!

CPC Offers More STANDARD Features:
- Intel CPU (AMD on 386-40Mhz System)
- AMI Bios (Award Bios on EISA Systems)
- 4MB RAM Installed
- 64K Cache SRAM on all Systems Except 386-25Mhz
- 1.2 & 1.44 Teac Floppy Drives
- 120MB Conner Hard Drive w/64K Built in Disk Cache
- 1:1 Interleave 2HD/2FD IDE Adapter
- SCSI Interface Available
- 101 Key Enhanced Tactile Keyboard
- 1 Parallel, 2 Serial, Game Port
- Clock- Calendar Built-In
- 16Bit Tseng 4000 SVGA Card w/1MB Installed opt. 700,000 Color Sierra RAM-DAC Avail.
- 14" NON-INTERLACED SVGA 1024x768, .28mm Monitor. opt. Trinitron-NI. Call for 16" & 20" Monitors.
- Desktop Case Standard. opt. Mid Tower or Full Size Tower
- Microsoft MS-DOS v5.0 w/ Microsoft Quick Basic
- MS-Windows 3.0 w/Mouse (add $60)
- Custom Configurations with NO LIMITATIONS!

386-25Mhz $1795.00
386-33Mhz $1965.00
386-40Mhz $1995.00
486-33Mhz $2399.00
486-33Mhz EISA $CALL

CPC Computer Products
278 State St., North Haven CT. 06473

1-800-272-7281
Tel: (203) 281-6705
Fax: (203) 281-7435

TERMS: 3 Year Parts & Lifetime Labor warranty covers all standard components of computer systems except Hard Drives. Hard Drives are covered by a 2 Year parts & Lifetime labor Monitors and Add-ons are warranteed by the manufacturer and honored by CPC. Corporate & University P.O.'s Welcome.

Circle 241 on Inquiry Card.

World Radio History

Accessories/Supplies • Add-In Boards

Pro-tecT Computer Products

Pro-tecT
"The Keyboard Protector"

Pro-tecT,™ "The Keyboard Protector" All computer keyboards are vulnerable, open to attack! Dust, food, liquid, spills, "A DISASTER WAITING TO HAPPEN."

Pro-tecT Computer Products, the leader in Computer Protection, has designed a transparent, flexible, durable custom keyboard cover that remains in place during keyboard use! Highest Quality Keyboard Protector available on the market today, or full refund guaranteed! Available for most popular keyboard makes and models. When ordering always specify keyboard make and model. List $24.95.

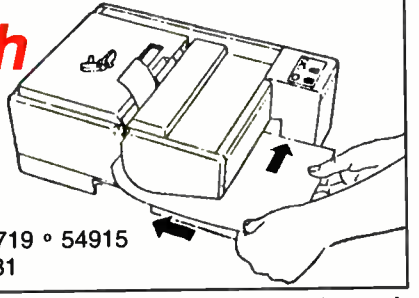
Toll-free 1-800-669-7739
Fax 801-295-7786

Circle 300 on Inquiry Card (RESELLERS: 301).

POS-EQUIPMENT

Printers • Displays • Scanners • Drawers
PC Card which turns your PC into a POS Terminal

dietrich
SINCE 1928



Zaehringerstr. 326
D-7800 Freiburg
Germany

Phone 49-761-552719 ° 54915
FAX 49-761- 5 68 81

Circle 267 on Inquiry Card.

VOICE MASTER KEY® SYSTEM II

VOICE RECOGNITION & SPEECH RESPONSE
FOR IBM PC/XT/AT/386, PS/2, LAPTOPS, COMPATIBLES

FOR PRODUCTIVITY, PRESENTATIONS, SOFTWARE DESIGN, ENTERTAINMENT, LANGUAGE TRAINING, EDUCATION, MORE...

SPEECH/SOUND RECORDING AND PLAYBACK. Desktop Audio sound editing allows you to create custom sound applications. Variable sample rate (to 20 KHz) and compression levels. A four-voice music synthesizer is included also!

VOICE RECOGNITION TSR utility allows you to add voice command keyboard macros to your CAD, desktop publishing, word processing, spread sheet, or entertainment programs. Up to 64 voice commands in RAM at once—more from disk.

HARDWARE SYSTEM contains built-in speaker with separate volume and tone controls, external speaker and headphone jacks. Enclosure made of sturdy vinyl-clad steel. Attaches to parallel printer port without affecting normal printer operation (U.S. Patent 4,812,847). Headset microphone, printer cable, 9 volt AC adapter (110 volt UL/CSA listed), and comprehensive user manual included.

QUALITY THROUGHOUT. MADE IN USA. ONLY $219.95
ORDER HOTLINE: (503) 342-1271 MON-FRI, 8 AM TO 5 PM PST

Visa/MasterCard, company checks, money orders, CODs (with prior approval) accepted. Personal checks subject to 3 week shipping delay. Specify computer type when ordering. Add $5 shipping charge for delivery in USA and Canada. Foreign inquiries contact Covox for C&F/CIF quotes. OEM configurations available.

30 DAY MONEY BACK GUARANTEE IF NOT COMPLETELY SATISFIED.

CALL OR WRITE FOR FREE PRODUCT CATALOG

COVOX INC.
675 Conger Street
Eugene, Oregon 97402

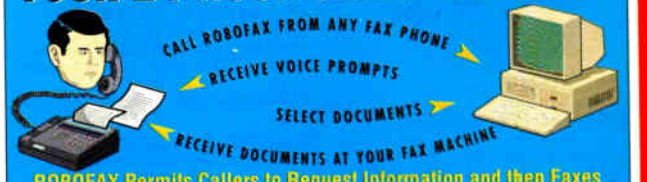
TEL (503) 342-1271
FAX (503) 342-1283
BBS (503) 342-4135

Circle 265 on Inquiry Card (RESELLERS: 266).

Add-In Boards • Communications/Networking

ROBOFAX
• SALES/MARKETING • CUSTOMER SUPPORT
• PUBLIC INFORMATION • 900 NUMBERS

YOUR 24-HOUR SALES ASSISTANT



ROBOFAX Permits Callers to Request Information and then Faxes Requested Documents W/O Operator Intervention

800-292-7771
ROBOFAX DEMO LINE: 800-925-7626

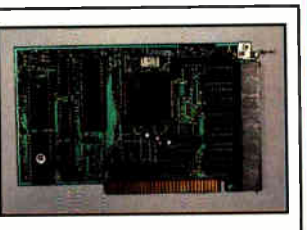
ROBOFAX EZ.....$995
Single-line, one call PC kit
ROBOFAX..... $2,995
Multi-line,two call PC kit

ADD★ON AMERICA
A DIVISION OF PCNH CORPORATION

433 N. MATHILDA AVE. • SUNNYVALE, CA 94086 • (408) 746-1590 • FAX (408) 746-1593

Circle 255 on Inquiry Card.

PCSS-8I
Intelligent
Serial Coprocessor



- On board processor handles serial communication tasks.
- 32K-128K Dynamemory.
- Eight ports per board.
- High performance – low cost!
- DOS, SCO XENIX, SCO UNIX drivers included.

To order call toll-free 1-800-282-GTEK(4835)

GTEK® INC.

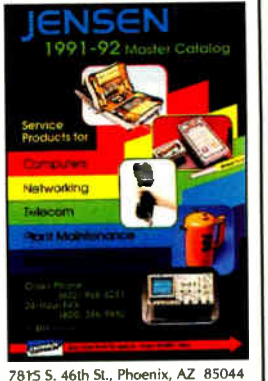
Development Hardware & Software
P.O. Box 2310,
Bay St. Louis, MS 39521-2310 U.S.A.
Mississippi & Technical Support (601) 467-8048 • Fax: (601) 467-0935

Circle 271 on Inquiry Card.

FREE CATALOG

Contains 254 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®



7815 S. 46th St., Phoenix, AZ 85044
(602) 968-6231 • Fax (800) 366-9662

Circle 275 on Inquiry Card.

VOICE MAIL • TELEMARKETING CALL PROCESSING

Let Powerline transform your PC/XT/AT/386 into a multi-line voice processing command center. Have your computer intelligently process your sales, inquiries and messages. Complete package.

Single-line (BigMouth).....$295.00
Multi-line.....$995.00
(Developer/OEM packages available)
VISA • MC • AMEX • COD

(415) 522-3800 • (800) 688-TALK
Fax: (415) 522-5556

TALKING TECHNOLOGY, INC.
1125 Atlantic Ave. Alameda, CA 94501

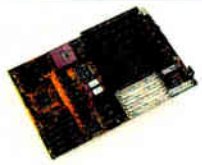
©1990 TALKING TECHNOLOGIES INC.

Circle 288 on Inquiry Card (RESELLERS: 289).

World Radio History

Computer Systems

50 MHz 80486 ISA/EISA 24 MIPS



FEATURES
- 64/256K Write Back Cache
- Burst Mode Design
- Shadow RAM on Video & BIOS
- 64MB 32 Bit Memory Expansion
- Baby-size with Eight Expansion Slots
- UNIX, OS/2 & Novell 100% Compatible
- One Year Full Warranty
- Made in the USA

ISA SYSTEM BOARD

MODEL	CACHE	MIPS	OK	4M
486/50	64K	24.0	CALL	CALL
486/33	64K	15.2	1195	1395
486/25	64K	11.2	1095	1295
486/20SX	64K	9.0	895	1095
386/40	64K	9.8	695	895
386/33	64K	8.3	625	825

*256 Cache Available

Complete Desktop System with 1.2 MB Floppy HD/Floppy Controller, 101 Keyboard and 4MB Memory

MODEL	BASE	MONO	VGA
486/50	CALL	CALL	CALL
486/33	1795	1970	2245
486/25	1695	1870	2145
486/20SX	1495	1670	1945
386/40	1295	1470	1745
386/33	1225	1400	1675

*FCC, UL & CSA Available
*Tower–Add $200 Hard Drive Available

Third Generation Feather Light SONIC 386/20SL NOTEBOOK

- Latest Intel 386/20SL Chip Set
- Intelligent Power Management
- Total Weight 4.8 lbs.
- 2 Mb of RAM (Max 8 Mb)
- 0/16/64 KB Smart Cache Architecture
- Crisp 640X480 VGA Display
- 1.44 Floppy Disk
- Whisper Quiet 40 MB Hard Disk 60/80 Mb Optional
- 1 Serial, 1 Parallel Port
- 80 Key Keyboard with Full 101 Key Emulation
- J-Key Mouse Design
- 3 Hours Battery Pack
- FCC Class B Pending

386SX with IDE/2S/1P

BOARD	
386SX-16	230
386SX-20	269
386SX-25	228

BARE BONE SYSTEM UL/FCC B

386SX-16	370
386SX-20	409
386SX-25	699

HARD DRIVE

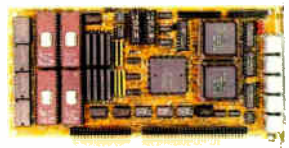
QUANTUM IDE 52MB	215
QUANTUM IDE 105MB	339
QUANTUM IDE 200MB	699

TECHNOLOGY POWER ENT., INC.
47273 Fremont Blvd., Fremont, CA 94538
Tel: 510-623-3818 FAX: 510-623-3840

Circle 290 on Inquiry Card.

ROM Based AT Systems

- Run DOS from ROM
- PC code compatible
- Large memory space
- NEC V53 uP
- Passive backplanes



KS6: NEC V53 uP(286eq). 5 Serial, 2 Par., Clock, Watchdog. Max: 4M Ram, 2M Rom, 512K Sram. $399-ql oem

KS3: V40 uP. 3 Serial, 2 Par., Clock, Flop, Keyboard. Max: 512K Ram, 512K Rom, 384K Sram. $249-ql oem

Easy steps to burn code and DOS in Rom. Development systems & support.

Single Board Computer

303-444-7737
Fax 303-786-9983
655 Hawthorn Ave., Boulder CO 80304

Circle 276 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

RMS286-12	$549	RMS386-33	$1095
RMS386SX-16	$795	RMS486-33	$1695

System Platforms include 7" Rackmount Chassis, 200W Power Supply, Motherboard, 1.0MB Memory, IOE, FOC, 2-Ser, Par, 1.2MB or 1.44MB Floppy Oisk Orive, 1 Year Warranty

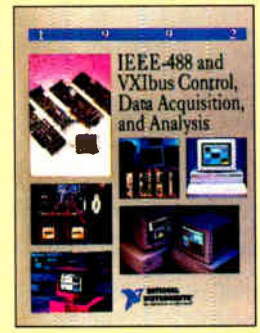
RACKMOUNT CHASSIS – 15 Models up to 20 Board Slots
SLOT CPU BOARDS – 486, 386, 386SX, 286
RACKMOUNT MONITORS – Super VGA and Monochrome
RACKMOUNT CABINET – Modular from 21" to 96" high

VALLEY TECHNOLOGY INC.
2468 Armstrong Street
Livermore CA 94550
(510) 447-2030 FAX: (510) 447-4559

Circle 302 on Inquiry Card.

Data Acquisition

Instrument Control and Data Acquisition



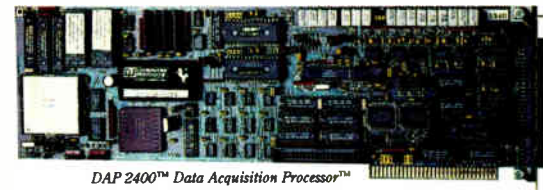
Free 1992 catalog instrumentation products for PCs, workstations, and more. Features IEEE-488.2 interfaces and software, plug-in data acquisition boards, VXIbus controllers, DSP hardware and software, and signal conditioning accessories. Application software for complete acquisition, analysis, and presentation of data, including graphical interfaces. Application tutorials and training classes also detailed.

512-794-0100 FAX: 512-794-8411
1-800-433-3488 (U.S. & Canada)

National Instruments, 6504 Bridge Point Parkway, Austin TX 78730

Circle 283 on Inquiry Card.

The Intelligent Solution For Data Acquisition



DAP 2400™ Data Acquisition Processor™

ANALOG I/O
DIGITAL I/O
- Inputs to 235K samples per second
- Outputs to 250K samples per second

FFT and FIR-filtering
Digital Signal Processing at 10 MIPS
16 MHz CPU with DRAM to 512K

20 MHz DSP with SRAM to 96K
DAPL™ Operating System
- 100+ standard commands
- Custom commands in C

Send for FREE catalog.
Or call us at (206) 453-2345

MICROSTAR LABORATORIES™
2265 116th Avenue NE
Bellevue, WA 98004
FAX (206) 453-3199

Circle 282 on Inquiry Card.

Measurement & Control

Remote monitoring? Unique measurement problem? These are our specialities. Contact Elexor. We'll help you find a solution ...fast!

ELEXOR ... The Solutions Company!

- Stand Alone
- Free Software
- Programmable
- Multi-addressing
- Battery Capability
- Off-site monitoring
- Signal Conditioning
- Intergrated Systems
- Unlimited I/O points
- PC, MAC, DEC, etc

ELEXOR ASSOCIATES
phone (201) 299-1615
fax (201) 299-8513
P.O. Box 246
Morris Plains, N.J. 07950

Circle 269 on Inquiry Card.

Analog Digital NO HYPE

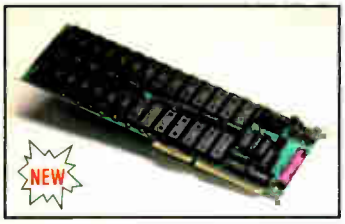
A/D, D/A & SIGNAL CONDITIONING
LAWSON LABS, INC.
Phone 800 321-5355
406 257-5355
FAX 406 257-5572

Circle 279 on Inquiry Card.

World Radio History

Disk & Optical Drives • Misc. • Diskettes/Duplicators

PCDC-3 Hard Disk Caching Accelerator



- Makes hard disks run 10 to 100 times faster.
- Works with any hard disk.
- Half sized card can cache up to 3 Megabytes.
- Non-volatile memory becomes permanent part of hard disk.
- Disk access times of less than 200 microseconds (0.2mS).

To order call toll-free 1-800-282-GTEK(4835)

GTEK INC.

Development Hardware & Software
P.O. Box 2310,
Bay St. Louis, MS 39521-2310 U.S.A.

Mississippi & Technical Support (601) 467-8048 • Fax: (601) 467-0935

Circle 270 on Inquiry Card.

8051 IN-CIRCUIT EMULATOR

NICE-51 from $1195.00

- Up to 12 MHz real time emulation without intruding on any of your device's resources.
- SFR, Code Memory, External Data , Internal Data and Bit Address can all be directly viewed and edited using the full screen editor.
- Down-loads data to external data memory and processes BIN, HEX, and SYMBOL files in code memory.
- Up to 10 conditional software breakpoints and 64K hardware breakpoints.
- 16K deep, 48 bit real time trace buffer records Address Bus, Data Bus, Control Bus, and 18 bit external signal.
- Integrated programmer for EPROMs and 8751 available.
- 1-year warranty, 30-day money-back guarantee.

CALL TODAY FOR MORE INFORMATION.
Distributors are welcome!

Tribal Microsystems Inc.

Circle 293 (RESELLERS: 294) on Inquiry Card.

STAND ALONE DISKETTE DUPLICATOR

OVER 300 DISKS PER HOUR

5.25" and 3.50" Models

SIMPLE AND FAST FROM **$1699**

TEL: (416) 503-3335
FAX: (416) 252-4084

AXIOMATIC

Circle 256 (RESELLERS: 257) on Inquiry Card.

Keyboards • Memory/Chips/Upgrades

Custom Keyboard Products

- Custom Key Imprinting — all brands!
- Custom Colored Keys for IBM®, DEC®, Wyse®, Key Tronic®, Cherry®, many more!
- Full color keyboard templates made to your exact specifications.
- Custom and stock keytop label kits for software support & languages.
- Custom membrane & full-travel keyboards.
- Express turnaround services.
- A total line of keyboard enhancements.

CUSTOM HOTLINE 800 937-1337
from the Leader in Keytop Innovations™

Hooleon CORPORATION

P.O. Box 230 • Dept. BYTE • Cornville, AZ 86325
602 634-7515 • FAX 602 634-4620

Circle 273 on Inquiry Card.

LAPTOP MEMORY

UPGRADES FOR ALL POPULAR MANUFACTURERS, INCLUDING:

▪ Toshiba	▪ Compaq	▪ NEC	▪ Zenith
▪ Epson	▪ Hewlett Packard	▪ Packard Bell	▪ AST
▪ Panasonic	▪ Sanyo	▪ AT&T	▪ Everex
▪ IBM	▪ Leading Edge	▪ Sharp	▪ Bondwell
▪ Texas Instruments			

The MEMORY Depot

"Your stop for memory upgrades"

All Products Covered By Manufacturers's Limited Lifetime Warranty.
Guaranteed 100% Compatibility. We accept VISA, Mastercard, C.O.D. and P.O.'s

Call Now For Current Prices! 800-237-2447

Circle 305 on Inquiry Card.

ICs

PROMPT DELIVERY!!! Same day shipping (usually)
Quantity one prices shown for November 24, 1991

Memory for almost ALL computers

IIT 3C87-25 $180 | 80387-33 CYRIX $197 | 80387DX CYRIX $189

DYNAMIC RAM

4M Board for ph LJ's w/2MB			$125.00
SIMM	4Mx9	80 ns	155.00
SIMM	1Mx9	60 ns	55.00
SIMM	1Mx9	80 ns	45.00
4 Mbit	4Mx1	80 ns	25.00
4 Mbit	1Mx4	80 ns	32.00
1 Mbit	1Mx1	80 ns	4.65
41256	256Kx1	80 ns	1.90
41256	256Kx1	100 ns	1.75
44256	256Kx4	80 ns	5.40
4464	64Kx4	100 ns	1.75

EPROM

27C4001	512Kx8	150 ns	$28.00
D28F010	128Kx8	150 ns	24.00
27C1000	128Kx8	150 ns	10.00
27C512	64Kx8	120 ns	6.95
27128	16Kx8	250 ns	3.40

STATIC RAM

1 Mbit	128Kx8	Pseudo	13.00
62256LP	32Kx8	100 ns	5.90

Sat. del. on Fed-Ex orders received by:
Th: S-2 1-4 lbs $6.25 Fr: P-1 1 lb $17.00
FED-EX COD +$5.00

00287XL INTEL $125 | 80387DX INTEL $195 | 80387-33 INTEL $200

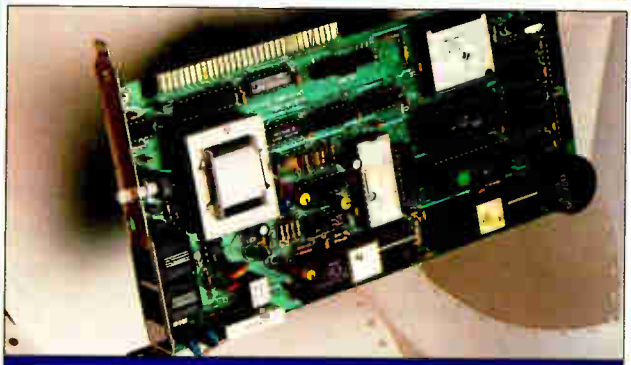
OPEN 6 ½ DAYS, 7:30 AM-8:00PM • SHIP VIA FED-EX ON SAT.

MICROPROCESSORS UNLIMITED, INC.
24,000 S. Peoria Ave., Beggs, OK 74421
MasterCard/VISA or UPS CASH COD • No minimum order.
$1 for packing materials. Shipping and insurance extra.
(918) 267-4961

Circle 281 on Inquiry Card.

World Radio History

Modems/Multiplexors • Multimedia



COMPUCOM

9600 bps MODEM $169

Compucom is one of the few modem manufacturers who develops its own modem technology. 95+% of all modem vendors use third party designs and/or chip sets. They're modem manufacturers...Compucom's the modem innovator. *See for yourself !*

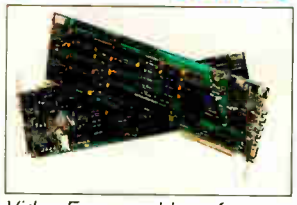
	int. / ext.
• *Speedmodem* Champ, 9600 bps csp	$169 / 199
• Star, 14,400bps v.32/32bis,csp, v.42/42bis	$499 / 539
• Storm, 9600bps v.32,csp, v.42/42bis	$299 / 339
• Remote Pro, remote access software	$59
• Voicemail, fax, caller ID opt.-- 30 day money back trial	

CALL NOW

(800) 748 6840, (415) 499 7600, Fax (415) 499 3366

Circle262 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
316-231-4647 Fax: 231 5816

Circle 264 on Inquiry Card.

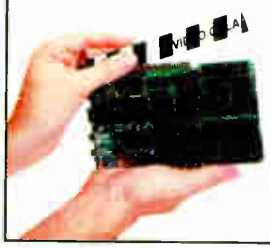
VIDEO FRAME GRABBERS

PCX, TIF, GIF and more file formats.
IBM PC/XT/AT Compatible, NTSC & PAL

VGA VIDEO GALA .....$595.00 Three boards in one: VGA + VCR output + Live video in a window. Captures 640 x 480 true color.

VIDEO GALA .....$499.00 Captures 640 x 480 true color in real time.

GALA GS .....$399.00 Capture 640 x 480 with 256 shades of grey in real time.



HRT 512-8 .....$995.00
Multifeatured high performance industrial model with an Image Processing Library 512 x 512 in 256 shades of grey.

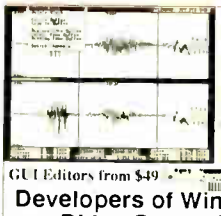
HRT 512-24 .....$1995.00
Same as HRT 512-8 except in 24 bit color.

HIGH RES TECHNOLOGIES INC.

P.O. Box 76, Lewiston, New York 14092 U.S.A.
Tel: 416-497-6493 Fax: 416-497-1636

Circle 272 on Inquiry Card.

Multimedia • Programmable Hardware



SuperSound™

Best Value!
Easy To Use Too!
Digital Audio Authoring Workstations $239 - $640

Having Problems With Big Name Products or Their Tech Support - Try Us And Be Pleased.

GUI Editors from $49

Developers of Windows 3,Toolbook, Visual Basic use our DLLs, Create SuperSound, SoundBlaster, Covox, Disney Sounds; Import sound files from Mac, Amiga

IBM-PC DOS DIGITAL AUDIO from $20 User's Player D/A Module (Plugs Into Printer Port)

USA Made High Quality,30 Day Money-Back Guarantee

- LIKE HAVING A CASSETTE TAPE RECORDER IN A PC.
- Fastest, easiest Editors with the most features for the price
- Simple hardware software installation- NO DMA jumpers
- No Extra Charge for Technical Support on our products.
- DOS Extender Version - Up To 16 MB Working Space.
- Programmer's Libraries for Popular Languages.

Products by Silicon Shack, 4760 Castlewood Drive, San Jose, CA 95129
Ph:408 - 446 - 4521 FAX: 408 - 446 - 5196

Tech. Info./Orders: 800 - 969-4411 Ask for FREE PRODUCT CATALOG.

In Far East: Basware Japan, Inc. Tel:(03)972-5391 FAX: (03)959-1214

Circle 287 on Inquiry Card.

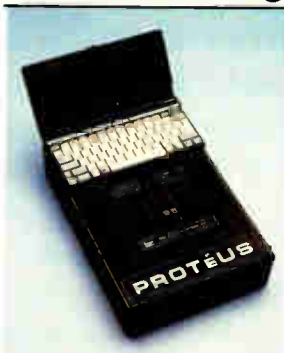
PC/ATbus PRE-PROCESSOR FOR THE HP1650 LOGIC ANALYZER

- Provides a complete interface between the HP 1650 series logic analyzer and the PC/AT bus.
- Quick and easy access to all address, data, and control lines.
- State and timing analysis.
- Logic analyzer configurations supplied on diskette.
- Can be used as an extender card.

TASCO 1950 Corporate Way, Anahelm, CA 92801
TEL (714) 635-0550 • FAX (714) 535-3458

Circle 304 on Inquiry Card.

Universal Programmer *from* $1295



- Memory (up to 8MB), FLASH, SERIAL EPROMs. All Intel MICROs, 87C751/2, Over 1000 PLDs (AMD MACH, PALCE, GALS, BiCMOS 22V10, Lattice 7ns B series, MAPL, QUIET Series)
- PLCC to 84 pin, GANG Memory, Micro, PCMCIA memory cards
- Up to 104 fully protected pins
- Standard parallel printer port
- Optional Palmtop PC for stand-alone operation
- Fully integrated Algorithm Development Language allows users to add/change parts
- True State Machine Testing capability (rise/skew< 10ns)
- True full Selfcalibration & Diagnostics
- Additional Modules for Tester, Data Logger, Controller

Low Cost Programmer $495

- 32 pin E/EPROMs to 4MBytes, Flash EPROMs, Intel Micros
- Gang Module (4 sockets), Motorola Micros Module
- RS232 interface; internal eraser option; Stand-alone capability

Intelligent Rom Emulator $445

- "In-Circuit-Emulator" type features: Address Compare (with HALT output), Address Snapshot, Trigger Input, Reset Output
- Standard parallel Printer Port (64Kbytes in 10 sec)
- Stand-alone operation (rechargable NiCad battery)

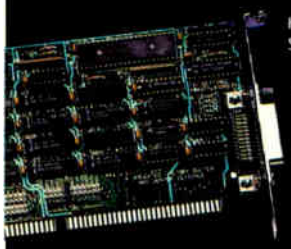
B&C MICROSYSTEMS INC.

750 N. Pastoria Ave. Sunnyvale, CA 94086 USA
Tel: (408) 730-5511 Fax: (408) 730-5521

Circle 258 on Inquiry Card.

World Radio History

IEEE 488.2



Hardware for IBM PC/AT, Micro Channel, Sun, Macintosh, DEC, and NeXT.

Software for DOS, Windows, UNIX, VMS, menu- and icon-driven environments.

IEEE 488 extenders, analyzers, converters, analog I/O, and digital I/O.

Call for your free IEEE catalog

IOtech

IOtech, Inc. • 216.439.4091 • Fax 216.439.4093

Circle 274 on Inquiry Card.

DOS IN ROM!

Always waiting for a prompt? Speed up with MVS ROM Drive!

- Boot 0.1 sec
- 1/2 size card
- Any programs, DOS
- LANs, Control

64K.....$75
360K.....$150
1.44M.....$195

8088 SINGLE BOARD COMPUTER

PC on a card!

1. Debug on PC
2. Test S8C RAM
3. Burn EPROM

- Battery, solor
- 5-yr warranty
- 62 pin PC Bus
- 2PAR, 3SER, ATC
- LCD/K80 ports

MVS8C1.....$95
MVS8C1.....$27/1K
MVBIOS.....$60
PC CABLE.....$50
PC CARD.....$85

MVS (508) 792-9507

Circle 280 on Inquiry Card.

SUPERPRO™

UNIVERSAL PROGRAMMER

- Super easy-to-use menu driven software
- Free & continual updates on BBS
- Universal programming for PAL, GAL, EPLD, EPROM, & Microcontrollers, etc.
- 1 year hardware warranty & telephone support

also ▼ low cost UNIPRO at $399
▼ EPROM programmer at $149

Special offer of this month at **$699** (U.S. only) includes at no charge one of • 4 socket adapter or • PAL compiler or • EPROM eraser (9 chips)

XELTEK

SUNNYVALE, CA **(408) 745-7974**
FAX(408) 745-1401 BBS(408) 745-7256

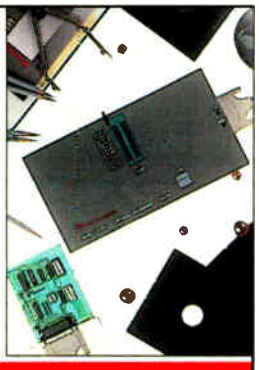
Circle 297 on Inquiry Card.

UNIVERSAL PROGRAMMER, EMULATOR, & TESTER

TUP-400 $745.00 *NEW*

- 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, HD637XXX...).
- Covers DIP, PLCC, QFP, SOP, and PGA with 8 to 84 pins. Gang Progamming adapters available also.
- EPROM EMULATION capability.
- Tests digital ICs and DRAMs (SIMM/SIP adapter available).
- Free software updates and new device added upon request.
- IC Manufacturers' approval.
- 1-year warranty, 30-day money-back guarantee.

CALL TODAY FOR MORE INFORMATION.
Distributors are welcome!



Tribal Microsystems Inc.
44388 S. GRIMMER BLVD., FREMONT, CA 94538 TEL. (510)623-8859 FAX (510)623-9925

Circle 291 (RESELLERS: 292) on Inquiry Card.

Instant Microcontroller + Instant C = Instant New Product

Use our Little Giant™ and Tiny Giant™ miniature microprocessor-based computers to instantly computerize your product. Our miniature controllers feature built-in power supplies, digital I/O, serial I/O (RS232 / RS485), A/D converters (to 20 bits), solenoid drivers, time of day clock, battery backed memory, watchdog, field wiring connectors, and more! Designed to be easily integrated with your hardware and software. Priced from $159. Core modules as low as $59. Low cost, Interactive Dynamic C™ makes serious software development easy.

Z-World Engineering
1724 Picasso Ave., Davis, CA 95616 USA (916) 757-3737
Fax: (916) 753-5141 Automatic Fax: (916) 753-0618
(For automatic fax call from **your fax**, request catalog #18)

Circle 298 on Inquiry Card.

EP-1140 E/EPROM & μcontroller Programmer

- Supports the **NEC 8 Mbit EPROM** and all EEPROMs from 2716 to 16-bit, 4 megabit
- Connects to the standard parallel printer port on an IBM and compatible
- **Qualified** and recommended by **Intel, National Semiconductor, Signetics** and others

- Single EXE file for easy updates
- Lifetime FREE software updates available via BBS (713) 461-4958 or US Mail
- Call **1-800-225-2102** for a complete literature packet and demo disk
- Made in the USA

$895.00

BP MICROSYSTEMS

Houston, TX 77043 • PH: (713) 461-9430 • FAX: (713) 461-7413

© 1991 BP Microsystems, Inc

Circle 259 on Inquiry Card.

9 Track Tape Subsystem for PC/XT/AT/386/PS2

- **Best Quality**
- **Lowest Prices**

800/1600/3200/6250 BPI

CALL 1-800-266-4827

Laguna Data Systems
26941 Cabot Road, Laguna Hills, CA 92653
Tel: 714-367-0497, Fax: 714-367-0508

Circle 278 on Inquiry Card.

Desktop 9-Track Tape Subsystem

#1-selling 9-track system on desktop.

Qualstar's low cost 1/2-inch 9-track Streaming tape systems bring full ANSI data interchange to IBM AT, PS/2 or Macintosh, giving your micro the freedom to exchange data files with nearly any mainframe or minicomputer in the world.

Systems include DOS or Xenix compatible software, coupler card and cables. High reliability 1600 or 6250 BPI capability may be used for disk backup as well as data interchange.

QUALSTAR®

***Call us today!* For details and to order: Fax (818) 882-4081 Phone (818) 882-5822**

9621 Irondale Ave., Chatsworth CA 91311

©1989 Qualstar Corp.
All product and company names and trademarks are the exclusive property of their respective owners.

Circle 286 on Inquiry Card.

World Radio History

Business • CAD/CAM

YOU MAY NEVER CALL THE OPERATOR AGAIN.

(For a Business Phone Number)

Now you can have a complete "directory" of every business in the U.S. right on your PC. Think of it — 9.2 million listings from over 5,000 Yellow Page directories, all on one CD-ROM disc.

With the American Business Phone Book, you will:

- **Save time** - and improve your productivity
- **Save money** - on directory assistance charges
- **Find more businesses** - even if you don't know where they're located, you'll still find the phone number.

You can search two ways:

1. **By Company Name**
2. **By Phone Number**

The American Business Phone Book is complete, lightning-quick, and very easy to use. All you need is an IBM-PC® or compatible and a CD-ROM drive.

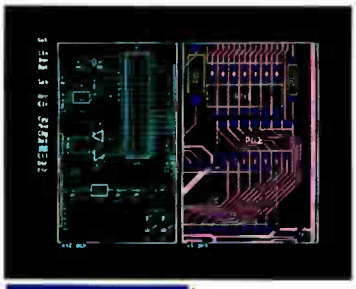
American Business Information, Inc.®

PRICE: $198.00

To order yours, call today at (402) 593-4565
VISA, MasterCard, American Express accepted.
DEALER INQUIRIES WELCOME

Optical Products Division
5711 So. 86th Circle • P.O. Box 27347 • Omaha, Nebraska 68127

Circle 299 on Inquiry Card.



HiWIRE® II Schematic and PCB Software

With support for expanded and extended memory, HiWIRE II can handle your most demanding schematic and PCB designs. The unique HiWIRE II editor allows you to display and edit schematics and PCBs simultaneously, using the same commands for each. HiWIRE II is $995, and is guaranteed.

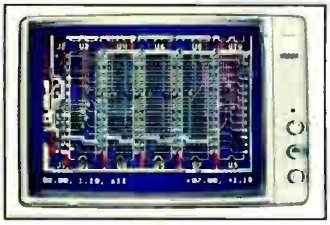
Call (800) 742-6809 or (317) 448-1903

WINTEK

Wintek Corporation
1801 South Street
Lafayette, IN 47904

(800) 742-6809

Circle 295 on Inquiry Card.



smARTWORK® PCB Software

The first printed-circuit-board program for the IBM PC, and still the first choice for designers of 2-sided PCBs, occasional users, and educators. The program's features include unmatched ease of use, continual design-rule checking, automatic pad shaving, trace filleting soldermasks, and silkscreen. smARTWORK with autorouting is $895 ($495 without) and has a 30-day money-back guarantee. Call (800) 742-6809 or (317) 448-1903.

WINTEK

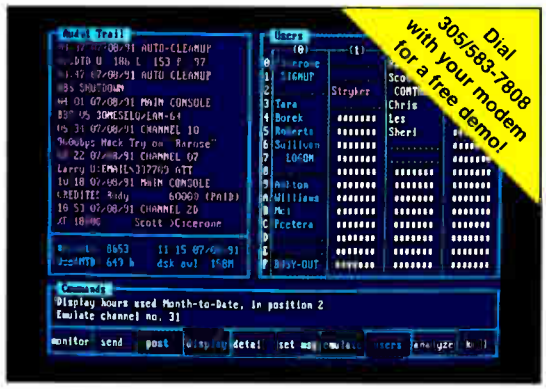
Wintek Corporation
1801 South Street
Lafayette, IN 47904

(800) 742-6809

Circle 296 on Inquiry Card.

Communications/Networking

"Bulletin boards become a major means of communication" -Wall Street Journal



Lots of users (up to 256 at the same time), from all over the world or all around your office, can call into The Major BBS® using modems, your Novell LAN, or X.25 networks such as CompuServe. With a single PC AT, PS/2, 386, 486 or compatible, using DOS 3.1 or later, you can provide:

- E-mail & file transfers
- Public message areas
- Modem server features
- Teleconferencing
- Online order entry
- Multi-user databases
- Polls & questionnaires
- ...24 hrs/day, 7 days/week!

Call 305/583-5990 or fax 305/583-7846

GALACTICOMM

Circle 268 on Inquiry Card.

EM320

DEC VT320 Emulation for Microsoft Windows 3.0

- *132 column display*
- *Cut and paste*
- *Kermit file transfer*
- *Windows style help*
- *Local or ANSI color*
- *Automatic window sizing*
- *Double high/wide characters*
- *LAT or TCP/IP support*
- *Modem dialer/Phone book*
- *Command language*

Diversified Computer Systems, Inc. *(303) 447-9251*
FAX (303) 447-1406 Tektronix 4105/07 Emulation also available

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

World Radio History

Database • Educational • Engineering/Scientific

dBASE Data Entry

The TransTerm 5 is a work station data entry/display terminal for on-line shop floor data collection into PC/AT/PS-2 systems. The unit is one of a family of such terminals which feature LC displays for operator prompting and data entry via sealed touch keys or an optional barcode scanner or badge reader (Code39,UPC+). A multi-terminal network controller (up to 250 stations) and a dBASE IV compatible software package are also available. System costs start below $300 per station. Options include display backlighting, barcode scanning, counter inputs, control output.

COMPUTERWISE®

302 N. Winchester • Olathe, KS 66062

913-829-0600 • FAX 913-829-0810

Circle 263 on Inquiry Card.

EARN YOUR COLLEGE DEGREE AT HOME

B.S. & M.S. In Computer Science

Get the opportunity and earning power a college degree confers—without leaving home and without spending thousands of dollars.

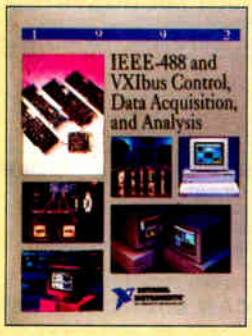
- Approved for tuition reimbursement by leading corporations
- ALL COURSES BY CORRESPONDENCE
- Most courses interactive
- Approved Ada course available
- Qualified instructors available on telephone help lines

AMERICAN INSTITUTE FOR COMPUTER SCIENCES

Phone: 1-205-323-6191 • FAX: 1-205-328-2229

2101 BYX Magnolia Ave. • Suite 200 • B'ham, AL 35205

Instrument Control and Data Acquisition



Free 1992 catalog instrumentation products for PCs, workstations, and more. Features IEEE-488.2 interfaces and software, plug-in data acquisition boards, VXIbus controllers, DSP hardware and software, and signal conditioning accessories. Application software for complete acquisition, analysis, and presentation of data, including graphical interfaces. Application tutorials and training classes also detailed.

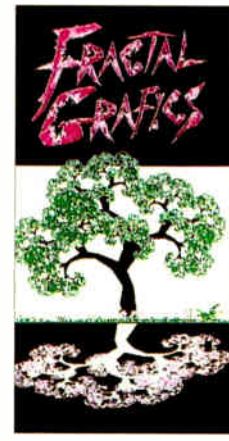
512-794-0100 FAX: 512-794-8411

1-800-433-3488 (U.S. & Canada)

National Instruments, 6504 Bridge Point Parkway, Austin TX 78730

Circle 284 on Inquiry Card.

Graphics • Mail Order • Programming Languages/Tools



Learn to Use Chaos & Fractals

"Highly recommended" – PC Magazine
"lets you explore the creative possibilities of fractals" – Amstrad PC Magazine
"the cleanest short presentation I've seen of what fractals and chaos theory are all about" – H. Kenner, BYTE

Interactive PC software, on-line tutorial, 160pp Guidebook, 200+ example files. Supports DXF and PCX, CGA to SVGA $79 (with C programming tutorial: $109)

Cedar Software: 802-888-5275

Box 5140-R1 Morrisville VT 05661

Circle 260 (RESELLERS: 261) on Inquiry Card.

San Francisco Discount Software

We are committed to providing our customers with the best possible service:

- Latest versions only
- Specialize in hard-to-find items
- Visa/Mastercard – no minimum order
- International and corporate orders
- Low, low prices

Phone: (415) 956-3126 • Fax: (415) 956-0246

369 Pine Street, Suite 216, San Francisco, CA 94104/USA

Circle 303 on Inquiry Card.

HYPERCROSS – asm*

Multi-target Macro Cross Assembler

FEATURES:

Fast One Pass Execution – up to 6000 LOC/Second
Flexible "Library Driven" Architecture
Full-Featured PC-asm Style Directives/Expressions
Popular Vendor Style Instruction Syntax Rules
Six Run Code Formats & Program/X Ref List Options
Host: IBM PC or Compatible (PC-DOS/MS-DOS)

STANDARD SYSTEM: $249.00 US
Macro Cross Assembler – Supports 32 Processors

BASE SYSTEM: $129.00 US
Cross Assembler – Supports 23 Processors

Call for Site Licenses, Custom Systems & Libraries

*Trademark/Product of Hypersys Corporation

PROCESSORS:

8048	6801	Z8
8051	6805	Z80
8085	6809	Z180
8086	6811	Z280
8096	68000	SUPER8
8019		64180
1802	7800	320C1X
6502	70XXX	320C2X
65816	TMP4300	TMS370
COP400	TCP4600	TMS7000
COP800	TMP4700	TMS9900

Hypersys Sales Agent: K & M Associates

P.O. Box 670054, Marietta, GA 30066 Phone (404) 971-2649

Circle 277 on Inquiry Card.

Cross Assemblers, Simulators, Disassemblers

Processor Families:

8051	8096	8048
Z80	64180	6301
6805	6800	1802
6811	6502	68k
8085	6801	Z8

Join Thousands of Satisfied Customers Worldwide.

Call:

PseudoCorp

716 Thimble Shoals Blvd., Newport News, VA 23606
Tel: (804) 873-1947 • Fax: (804) 873-2154

Circle 285 on Inquiry Card.

World Radio History

THE BUYER'S MART

A DIRECTORY OF PRODUCTS AND SERVICES

THE BUYER'S MART is a monthly advertising section which enables readers to easily locate suppliers by product category. As a unique feature, each BUYER'S MART ad includes a Reader Service number to assist interested readers in requesting information from participating advertisers.

Effective January 1, 1992.

RATES: 3 issues—$625 6 issues—$600 12 issues—$525 13 issues—$500
Prepayment must accompany each insertion. VISA/MC Accepted.

AD FORMAT: Each ad will be designed and typeset by BYTE. Advertisers must furnish typewritten copy. Ads can include headline (23 characters maximum), descriptive text (250 characters is recommended, but up to 350 characters can be accommodated), plus company name, address and telephone number. Do not send logos or camera-ready artwork.

DEADLINE: Ad copy is due approximately 2 months prior to issue date. For example: November issue closes on September 8. Send your copy and payment to THE BUYER'S MART, BYTE Magazine, 1 Phoenix Mill Lane, Peterborough, NH 03458. For more information call Joseph Mabe at 603-924-2656. FAX: 603-924-2683.

ACADEMIC COMPUTING

Transputer Education Kit
Get started with Parallel Processing
$396
Kit includes ready-to-use PC add-in board with T400 transputer, 1MB of RAM, and PC interface. Complete with Occam2 and C compilers, assembler, source-level debuggers, example programs, and 1500 pages of documentation (incl. schematics). Expandable!
Computer System Architects
950 N. University Avenue, Provo UT 84604
(800) 753-4CSA (801) 374-2300 FAX (801) 374-2306

Inquiry 701.

ACCESSORIES

RADIOACTIVE?
Plot it on your PC with The RM-60 RADIATION MONITOR
Serial or printer port. Detects: ALPHA • BETA • GAMMA • X-RAY.
MicroR, 1000 times the resolution of standard geiger counters.
Excellent for tracking RADON GAS. Find sources. New: Version 2.7 + 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**

CUT RIBBON COSTS!
Re-ink your printer ribbons quickly and easily. Do all cartridge ribbons with just one inker! For crisp, black professional print since 1982. You can choose from 3 models:
Manual E-Zee Inker — $39.50
Electric E-Zee Inker — $94.50
Ink Master (Electric) — $189.00
1000s of satisfied users. Money-back guarantee.
BORG INDUSTRIES
525 MAIN ST., JANESVILLE, IA 50647
1-800-553-2404 In IA: 319-987-2976

Inquiry 703.

KEYBOARD, VIDEO, MOUSE
Extension with **EXTENDER**
Splitting with **COMPANION**
Switching with **COMMANDER**
Boosts signals up to 600 feet. Control up to 96 PCs with one keyboard and monitor.
CYBEX CORPORATION
2800H Bob Wallace Ave., Huntsville, AL 35805
Phone 205-534-0011 Fax 205-534-0010

Inquiry 704.

ANTI-LOCK-UP PRODUCT!
(SYSTEM WATCH)
The answer for any unattended PCs in use 24 hours a day. SYSOPs—VOICE MAIL, etc. Checks CPU every 30 seconds and reboots upon no signal. Includes board, software & cables. (board does not use PC slot) TWENTY MINUTE INSTALLATION. Requires internal re-set switch. Visa/MC $159. (vol. prices avail.)
STREETWISE SYSTEMS
1600 S. Dixie Hwy., Boca Raton, FL 33432
800-654-0910

Inquiry 705.

ACCESSORIES

HEWLETT PACKARD
Buy — Sell — Trade
Laser Jet II/IID
Laser 2000 2 Meg/4 Meg upgrades
Desk Jet
Rugged Writer
Electrostatic Plotters C1600 (D Size) /C 1601 (E Size)
Color Pro (7440)
HP-7550A
Draft Pro DXL/EXL
Draftmaster I/II
Science Accessories Corporation Sonic Digitizers
36" x 48" (2750) 60" x 72" (3175)
T. E. Dasher & Associates
4117 Second Ave. S., Birmingham, AL 35222
Phone: (205) 591-4747 Fax: (205) 591-1108
(800) 638-4833

Inquiry 706.

ARRAY PROCESSORS

SCIENTIFIC ACCELERATOR
25 MegaFLOP Floating Point Array Processor with 256K+ static memory. Easily programmed by calling 598 routines from your C, FORTRAN, or Pascal PC programs. 512x512 FFT 1.18 secs. Single slot board with software: $2,495.00.
EIGHTEEN EIGHT LABORATORIES
1247 Tamarisk, Boulder City, NV 89005
Tel: 800-888-1119, Fax: 702-294-2611

Inquiry 707.

ARTIFICIAL INTELLIGENCE

LISP like never before. . .
Affordable!
Software Engineer v.2.0 is the most powerful LISP for Windows. It was designed to put the power of LISP into the hands of individuals. It includes a text editor, a dialog box designer and an icon editor. Functionality includes: OOP, stand-alone EXE's, a debugger, OOE, Menus, Windows API calls and on-line help. Sug. Retail $249.95
Raindrop Software Corporation
833 Arapaho Road, Suite 104, Richardson, Texas 75081
(214) 234-2611 Fax: (214) 234-2674

Inquiry 708.

AUDIO

DigPak™
The Standard for PC Digitized Sound!
Use a single API for all PC sound boards with DigPak digitized sound drivers and ACOMP for 6-to-1 compression.
THE Audio Solution, Inc.
P.O. Box 11688, Clayton, MO 63105
314/567-0267

Inquiry 709.

BAR CODE

LABELING SOFTWARE
On EPSON, IBM, OKI dot matrix or LaserJet. Flexible design on one easy screen. Any format/size. Up to 120 fields/label. 18 text sizes to 3"-readable at 100'. AIAG, MIL-STD, 2 of 5, 128, UPC/EAN, Code 39. File Input & Scanned logos/symbols (PCX)—$279. Other programs from $49. 30-day $$ back.
Worthington Data Solutions
417A Ingalls St. Santa Cruz, CA 95060
(408) 458-9938 (800) 345-4220

BAR CODE

BAR CODE READERS
For PC, XT, AT, & PS/2, Macintosh, and any RS-232 terminal. Acts like 2nd keyboard, bar codes read as keyed data. With steel wand—$399. Top rated in independent reviews. Works with DOS, Xenix, Novell, Alloy, -ALL software. Lasers, magstripe, & slot badge readers. 30-day $$ back.
Worthington Data Solutions
417A Ingalls St., Santa Cruz, CA 95060
(408) 458-9938 (800) 345-4220

PORTABLE READER
Battery-operated, handheld reader with 64K static RAM, 2x16 LCD display, 32-key keyboard, Real-Time-Clock. Wand or laser scanner. Program prompts and data checking through its own keyboard. Easy data transfer by RS-232 port or PC, PS/2 keyboard. Doubles as On-Line Reader. 30-day $$ back.
Worthington Data Solutions
417A Ingalls St., Santa Cruz, CA 95060
(408) 458-9938 (800) 345-4220

PRINT BAR CODES/BIG TEXT FROM YOUR PROGRAM
Add bar codes and big graphics characters to your program. Print from ANY MS-DOS language. Bar codes: UPC, EAN, 2 of 5, MSI, Code 39. Epson, Oki, IBM dot matrix text up to ½". LaserJet up to 2". Font cartridges not required. $179–$239. 30-day $$ back.
Worthington Data Solutions
417A Ingalls St., Santa Cruz, CA 95060
(408) 458-9938 (800) 345-4220

BAR CODE READERS
Keyboard emulation for PC/XT/AT & PS/2's, all clones and any RS-232 Terminal. Transparent to your operating system. Available with Steel wands, Lasers, Slot & Magstripe Readers. Same day shipping, 30-day money-back guarantee. One-year warranty. Reseller discounts available.
AMERICAN MICROSYSTEMS
2190 A Regal Parkway, Euless, TX 76040
(800) 648-4452 (817) 571-9015 FAX (817) 685-6232

BAR CODE PRINTING SOFTWARE
- MS/PC DOS SYSTEMS
- 9 & 24 PIN DOT MATRIX
- H-P LASER JET/PLUS/SERIES II
- MENU-DRIVEN or MEMORY RESIDENT
- CODE 39, I 2/5, UPC A/E, EAN 8/13
- BIG TEXT & BAR CODE SOFTFONTS

AMERICAN MICROSYSTEMS
2190 A Regal Parkway, Euless, TX 76040
(800) 648-4452 (817) 571-9015 FAX (817) 685-6232

World Radio History

BAR CODE

PORTABLE BAR CODE READER

Battery operated, handheld reader with 64K RAM, 54 key keyboard, real-time clock, 2X16 LCD display, and built-in calculator. Supports WAND, CCD, and LASER. Built-in program generator supports multiple programs and data files. Interfaces to PC & PS/2 keyboards, RS-232 terminals, and HAYES compatible modems. 30-DAY MONEY-BACK GUARANTEE

AMERICAN MICROSYSTEMS
2190 A Regal Parkway, Euless, TX 76040
(800) 648-4452 (817) 571-9015 FAX (817) 685-6232

BAR CODE READERS
$149.00
Complete with Wand
COMPUTER RESOURCES GROUP
629 Silverdale Drive, Claremont, CA 91711
CALL (714) 624-8734

Inquiry 710.

LASER/WAND/CCD SCANNERS

AGGRESSIVE PRICING!...Reseller discounts. Also bar code slot readers, magnetic stripe. User software-transparent keyboard emulation for PC/XT/AT, clones, PS/2, and Macintosh. RS-232 terminals. Scans all popular bar codes. Label and Bar code printing software. 30-day money back. Visa/MC/AmEx. Same day ship.

DATA HUNTER
6181 Medford, Huntington Beach, CA 92647
(714) 892-5461 Fax 714-892-9768

Inquiry 711.

PC-Wand Bar Code Solutions

Bar codes are easy using our FULL line of readers & printers. They plug & play with your existing CPU/printer/terminals/software systems in your office, store, truck, factory or warehouse. ITS' bar code DOS programs print on matrix or laser printers. 30 day refund, 1 year warranty. OEM/VAR/ Dealer discounts.

International Technologies & Systems Corp.
655-K North Berry St., Brea, CA 92621-Western USA
13 Welwyn Court, Richmond, VA 23229-Eastern USA
(800)228-9487 (714)990-1880 (804)741-6725 (FAX)990-2503

Inquiry 712.

PC BAR CODE SPECIALISTS

Bar code readers designed for fast, reliable, cost-effective data entry. They emulate your keyboard, so scanned data looks just like it was typed in! Choose from stainless steel wand, laser gun, card slot reader, and magnetic stripe scanner. Also, powerful Bar Code and Text printing software. Great warranty. Generous dealer discounts.

Seagull Scientific Systems
15127 N.E. 24th, Suite 333, Redmond, WA 98052
206-451-8966

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 713.

BAR CODE

VARIANT MICROSYSTEMS
8AR CODE READERS DELIVER
WAND/LASER/MAGNETIC CARD CONNECTIVITY
- Keyboard wedges (Internal/External) for IBM PC/XT/AT, PS/2 and portables
- RS232 wedges for WYSE, Link, Kimtron terminals
- Bar code and label printing software
- Full two-year warranty
- **30-Day Money-Back Guarantee**
- **Extensive VAR/Dealer Discounts**

3140 De La Cruz Blvd., Suite 200/Santa Clara, CA 95054/(408) 980-1880
800-666-4BAR FAX: (415) 623-1372

Inquiry 714.

CAD

PCB & SCHEMATIC CAD—$195

"EASY-PC" for single-sided and multilayer boards to 17" x 17" with up to 1500 ICs including surface mount. Phenomenally fast and easy to use. Over 9000 copies sold. Needs PC/XT/286/386 HERC/CGA/EGA/VGA. Output to laserjet/inkjet/dot matrix printer, pen-plotter, photo-plotter and NC Drill. Not copy protected. VISA/MC/AMEX welcome. For full info circle inquiry # or contact us direct.

NUMBER ONE SYSTEMS LTD.
Harding Way, St. Ives, Huntingdon, Cambs, England, PE17 4WR
Tel 011-44-480-61778 Fax 011-44-48-494042

Inquiry 715.

VIEW CAD DRAWINGS

SirlinVIEW Allows non-CAD users to view AutoCAD DWG, DXF & HPGL files on PCs. Print, Plot, attach notes and hyper-link between files. Change views and layers. Accurate! Query databases to locate & highlight objects on the screen.
Also, linkable SirlinVIEW/LIB allows developers to add viewing capabilities to their own applications.

Sirlin Computer Corporation
25 Orchard View Dr., Ste. 14, Londonderry, NH 03053
(603) 437-0727 Fax (603) 437-0737

Inquiry 716.

CAD/CAM

STEPPER MOTOR CONTROL
FROM A PRINTER PORT!

NEW Indexer LPT™ software VERSION 2.1 **$249** VISA/MC

- Controls up to six motors simultaneously
- Linear and Circular Interpolation.
- New features to accommodate machine control.
- Easy-to-use DOS device driver. Super Manual.
- CAD-CAM interface available.

Ability Systems Corporation, 1422 Arnold Ave Roslyn, PA 19001 (215) 657 4338 FAX (215) 657-7815

Inquiry 717.

FREE TECHNICAL REPORT!
Just request info about the:
"CAD/CAM Developer's Kit" Series

C Libraries for CAD/CAM, Engineering and GIS Applications 650+ routines for DXF Input/output, graphical display, line/arc/ellipse/NURB spline construction/editing, and much more than can be described here.

Phone or FAX (617) 899-4350 for more information.

Building Block Software Inc.
371 Moody Street, Waltham, MA 02154

Inquiry 718.

GREAT NEWS AutoCAD USERS

KIS Scaling "The Problem Solver" makes R11 Vport scaling easy. Create R11 Dimstyles "On The Fly" with KIS DIM Module Icons. KIS Scaling, REAL control of text, arrows & LTScale for R10 or R11. AutoDwgLoad lets you load drawings with popdown menu. New EXTEND-TRIM.LSP—Tutorial + AutoSizing + Autosave. Multi-scale dwgs are easy, so is ordering 800-833-4547. Intro ONLY $149 Until 2/1/92.

KIS SOFTWARE, INC.
Box 663, Pearisburg, VA 24134

Inquiry 719.

CD-ROM

NEW CD-ROMs FROM WAYZATA!
The following CD-ROMs are now available:
- ***Night Owl's*** Collection of 10,000 PC Shareware Programs (1/90-10/91) (IBM-PC DOS)—$139
- ***Crossword Cracker*** Word Analysis System and Anagram Answer Program (IBM PC DOS)—$79
- ***Newsbytes*** International Computer Industry News (5/83-8/91) (IBM-PC DOS or Macintosh)—$129
- ***Washington Times & Insight on the News*** (IBM-PC DOS or Macintosh)—$149

Call or write now for more information!

WAYZATA TECHNOLOGY INC.
Post Office Box 807, Grand Rapids, Minnesota 55744
Tel: (800) 735-7321 (218) 326-0597 Fax: (218) 326-0598

Inquiry 720.

CLIP ART

- 12,000 Dover Clip-Art images
- Less than 2.5¢ per image
- Available for IBM and Macintosh
- Specially priced at $299.00
- Sample diskettes available $4.00

Islo Tech Inc. PO Box 431, Excelsior, MN 55331 800/722-9724, 612/934-2024 (Voice) 612/934-2824 (Fax)

Inquiry 721.

COMMUNICATIONS

SDLC, HDLC AND X.25 SUPPORT

Use Sangoma hardware and software to provide cost effective, robust and easy-to-use SDLC, HDLC and X.25 links from MS-DOS, UNIX, PC-MOS, etc.

All real time communication functions performed by Intelligent co-processor card.

Full function SNA emulation packages also available.

Sangoma Technologies Inc.
(416) 474-1990

Inquiry 722.

COMPUTER INSURANCE

INSURES YOUR COMPUTER

SAFEWARE Computerowners coverage provides replacement of hardware, media and purchased software. As little as $49 a year covers accidents, theft, power surges and more. One call does it all. Call 8 am–10 pm ET. (Sat. 9 to 5)

TOLL FREE 1-800-848-3469
(Local 614-262-0559)
SAFEWARE, The Insurance Agency Inc.

Inquiry 723.

CROSS ASSEMBLERS

CROSS ASSEMBLERS
Universal Linker, Librarian
Targets for 42 Microprocessors
Hosts: MS-DOS, UNIX, VAX VMS

ENERTEC, INC.
BOX 1312, 811 W. Fifth St.
Lansdale, PA 19446
Tel: 215-362-0966 Fax: 215-362-2404

Inquiry 724.

CROSS ASSEMBLERS/SIMULATORS

New unique full-function simulators for the 8096 and 80C196 controllers, featuring ALL MODES of interrupts, plus the HSI, HSO, and A/D functions.

We also support the 8048/49, 8080/85, 8051/52, and Z80 controllers with excellent, reasonably priced Cross Assemblers and Simulators.

Lear Com Company
2440 Kipling St., Ste. 206, Lakewood, CO 80215
(303) 232-2226 FAX: (303) 232-8721

Inquiry 725.

World Radio History

THE BUYER'S MART

CROSS COMPILERS

WANTED

BBX-COMPILER WHICH CONVERTS BBX-CODES TO C-LANGUAGE

contact: **VERO**

Ottergemsesteenweg, 441 - 9000 Ghent - Belgium
PHONE INTL +32/91/22/66/98
FAX INTL +32/91/22/62/49

Inquiry 726.

CROSS DISASSEMBLERS

PROFESSIONAL PC/DOS SOFTWARE
CROSS-ASSEMBLERS/DISASSEMBLERS
8051, 8048, 8096, 8080/85, Z80/180, Z8000, SPARC, 6800, 6809, 68HC11, 680X0, 6502/C02, 6301, 9900
COMPLETE, OPTIMIZED DEVELOPMENT TOOL SETS FOR THE ENGINEERING PROFESSIONAL
CALL (408) 773-8465

LOGISOFT PO BOX 61929, SUNNYVALE CA 94086
FAX: (408) 773-8466

Inquiry 727.

DATA ANALYSIS

FORECASTING PATTERN RECOGNITION

- DynaMind™ Neural Network Software
- Developed with Intel • PC Based
- NeuroLink™—link a Neural Net to your C-code
- Menus, manual, full-color graphic interface
- Processes data from spreadsheets

INTRODUCTORY PRICE—One Month Only! **$79** + One year of FREE upgrades

NeuroDynamX, Inc.
PO Box 323
Boulder, CO 80306
FAX 303/442-3539

FREE Brochure: 303/442-3539

Inquiry 728.

DATA RECOVERY

CRASHED?

Your valuable data can be recovered!

- 95% success rate • Fast turn around
- Priority service available • Clean room
- Servicing Novell, DOS, Macintosh, Unix, Xenix, OS/2, Bernoulli, Sun and more!

ONTRACK DATA RECOVERY, INC.
6321 Bury Drive, Eden Prairie, MN 55346
1-800-872-2599 • 612-937-5161

Inquiry 729.

DATA/DISK CONVERSION

Quality Conversions

Tape — Cartridge
Disk — Scan
Lowest Price
Call . . . 1ST Run Computer Services Inc.
(800) 833-2207 (outside NY)
(212) 779-0800 (in NY)

Inquiry 730.

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 731.

DATA/DISK CONVERSION

IBM PC ⬅ TO ➡ HP FILE COPY
FASTER EASIER TO USE
Update version uses windows: Call for free demo! IBM PC <to> HP File Copy allows IBM PCs, PS/2, compatibles to interchange files with Hewlett-Packard Series 70, 80, 200, 300, 1000, 9000s.
Oswego Software
Box 310 **708/554-3567**
Oswego, IL 60543 **FAX 708/554-3573**

Inquiry 732.

CONVERSION SERVICES
Convert any 9-track magnetic tape to or from over 3000 formats including 3½", 5¼", 8" disk formats & word processors. Disk-to-disk conversions also available. Call for more info. Introducing OCR Scanning Services.
Pivar Computing Services, Inc.
165 Arlington Hgts. Rd., Dept. #B
Buffalo Grove, IL 60089 **(800) Convert**

DATABASE

NOTEBOOK II

- Database mgr. for unlimited text • Research Notes • Inventory • Client profiles • Collectables • Full text editor • Concept analysis • 12 pages text per record • Menu-driven interface • Excellent tutorial • 30-day money-back guarantee. From $189.

Pro/Tem Software, Inc.
3790 El Camino Real, Suite 389, Palo Alto CA 94306
Call toll-free 800/533-6922 FAX: 415/323-0611

Inquiry 733.

DATABASE MGMT SYSTEMS

***dBASE file Access from* C, Basic**
CodeBase 4.5 gives database management capabilities and dBASE, FoxPro or Clipper file compatibility from C, C++, Visual Basic or Pascal for Windows.
Full 90 day guarantees. FREE DEMO.
Sequiter Software Inc.
#209, 9644-54 Ave, Edmonton, AB, Canada, T6E 5V1
Call (403) 437-2410 Fax (403) 436-2999
See our ad on page 237.

Inquiry 734.

YOUR SALES MESSAGE
about the special computer product or service that you provide belongs in print.
THE BUYER'S MART
can help you reach computer professionals and produce valuable inquiries for your company!
Call Joseph Mabe for more information
603-924-2656
or
Fax: 603-924-2683

Inquiry 735.

EDUCATION

B.S. & M.S. in COMPUTER SCIENCE
The American Institute for Computer Sciences offers an in-depth correspondence program to earn your Bachelor of Science and Master of Science degrees in Computer Science at home. B.S. subjects covered are: MS/DOS, BASIC, PASCAL, C, Data File Processing, Data Structures & Operating systems. M.S. program includes subjects in 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

Inquiry 736.

ENTERTAINMENT

Go, NEMESIS, Go
Go - a Zen game. So appealing, it has endured 4,000 years. So useful, governments study it.
NEMESIS Go Junior entices novices of any age.
NEMESIS Go Master Deluxe satiates the addicted.
Windows Version
Chaos Manor User's Choice Award (BYTE/1990)
Toyogo, Inc. (800) 869-6469
PO Box 25460-Y, Honolulu, HI 96825-0460
(808) 396-5526 fax: (808) 396-4126

Inquiry 737.

FAULT TOLERANCE

No*stop Network
No*stop Network, the only Level 3 Fault Tolerant software product that allows MIRRORED SERVERS and CONTINUOUS PROCESSING in any PC/LAN. Supports Novell, Microsoft, IBM, Banyan, etc. Any server environment—DOS, OS/2, Unix, Wang, DEC, etc.
Nonstop Networks Limited
20 Waterside, New York, NY 10010
212-481-8488

Inquiry 738.

FILE COMPARISON

A Difference That Must be Seen!
Diff „It™
△ Faster resync algorithms. △ Multiple wildcard filename parsing. △ Mouse support. △ Mixed file difference output. △ Unlimited file sizes △ Scrollable split screen display. △ Configurable compare algorithms. △ Command line interface. △ Pop-up menu interface. △ Line, Word and Hex compare. △ Fast terse modes. △ Batch file drive-able.
Requires IBM PC or 100% compatible, 256KB memory, DOS 2.0 or higher, floppy or hard disk. 30-day money-back guarantee $129.95 (215) 666-6104
Double R Software, Inc.
Rd 1 Fifth Ave., Valley Forge Manor, Phoenixville, PA 19460

Inquiry 739.

FINANCIAL SOFTWARE

BrainMaker:
"The most fascinating computer software I've ever seen. . . learn about this stuff." *John Dvorak, PC Mag.* Predicts stocks, bonds, sales, inventories. Comprehensive manual. Menus. 12,000 sold. PC or Mac.
Still only $195!
Free Flyer: 800/284-8112, 916/477-7481
California Scientific Software

Inquiry 740.

FLOW CHARTS

New Windows 3.0 Diagramming Tool
ADS Diagrammer is a general purpose diagramming tool which can be used to create flow charts, block diagrams, structure charts, DFDs, and more. Customize for your type of diagram by adding your own symbols and line terminators to the existing libraries. Draw symbols within symbols. Link Objects. Manipulate curves directly. Call for free trial disk.
$250 Atlantic Design Systems
Phone: (800) 745-6095 or (603) 524-2943
Fax: (603) 524-3657

Inquiry 741.

FLOW CHARTING 3

FRIENDLY
FAST
FLEXIBLE

- High resolution print outs . . . dot matrix or laser
- Multi-page charts . . . portrait or landscape
- Import/export capabilities
- 35 shapes, 10 fonts, 4 line styles

ONLY $250

Call for free demo disk!
PATTON & PATTON 800-525-0082 ext.1310
Software Corporation 485 Cochrane Cr., Morgan Hill, CA 95037
See our ad on page 212

Inquiry 742.

World Radio History

FLOW CHARTS

WINDOWS FLOWCHARTER $129

RFFlow 2.0 is a professional drawing tool for flowcharts & org charts. Requires Microsoft Windows 3.0. 100 shapes auto adjust in size. Diagonal lines and curves. Auto line routing and re-routing. Click on a shape to bring up a sub-chart. Move charts to other apps. via the Clipboard. Call for free trial disk.

RFF ELECTRONICS
1053 Banyan Court, Loveland, CO 80538
Phone: (303) 663-5767 FAX: (303) 669-4889

FONT

Meet our NEW "FASE" in the crowd

• Fonts on-the-fly for WordPerfect 5.0/5.1 • Scalable • infinite font effects • WYSIWYG previewer • supports most printers/fax board • 150 fonts library • network version available • basic package includes 35 Type 1 fonts • **NewFase** V3.0 introductory offer $79 expires 12/31/91 (Reg. $99)

"[NewFase] does what the best software utilities are supposed to do: save you time and money, and make your work look good." Karl Signell, Capital PC Monitor, 11/90

MicroPress
41 Witherspoon St., Princeton, NJ 08542
TEL 908-821-0255 FAX 908-821-5339

Inquiry 743.

HARD DRIVE REPAIR

HARD DRIVE REPAIR
ALSO
DATA RECOVERY
FAST TURN!! CALL FOR DETAILS
H&W micro labs, inc.
528-C Forest Parkway, Forest Park, GA 30050
404-366-1600 Fax: 404-366-0040

Inquiry 744.

CAPACITY	MFM/RLL	ESDI/SCSI
10-19Mb	$55	N.A.
20-29	75	75
30-39	85	89
40-49	105	125
50-85	140	175
86-120	175	225
121-160	205	255
161-350	259	349
351-700	N/A	395

LOWEST DISK DRIVE REPAIR PRICES

jb TECHNOLOGIES, INC.
5105 Maureen Lane
Moorpark, CA 93021
Phone: (800) 688-0908
FAX: (805) 529-7712

Inquiry 745.

HARDWARE

DOS & WINDOWS PROBLEMS

can be resolved with an Award BIOS ROM Upgrade. Windows 3.0 and DOS 5.0 support. Add IDE drives, 3½" 1.44Mb floppies, more. Call for our FREE Catalog.

KOMPUTERWERK, INC.
851 Parkview Blvd., Pittsburgh, PA 15215
ORDERS 800 423-3400 Tech (412) 782-0384 Fax (412) 782-5017

Inquiry 746.

EVERYTHING YOU NEED. . . .

Low prices on industrial and personal computers, monitors, workstations, peripherals, drives, modems, boards, LAN & network products. I/Cs memory, co-processors, ribbons, software, etc.

EXPORTAMOS!!! ***WE EXPORT!!!***

Limatub Import-Export, Inc.
3590 S. State Rd. 7 Suite 16, Miramar, FL 33023
TEL (305) 963-7722 FAX (305) 963-7733

Inquiry 747.

HARDWARE

PRE-OWNED ELECTRONICS, INC.™
APPLE® II & MACINTOSH®
SYSTEMS • PARTS • EXCHANGE REPAIRS

HOLIDAY SHOP THROUGH OUR CATALOG!

To order a Catalog call **800-274-5343**
Int'l: 617-275-4600 • Fax: 617-275-4848
205 BURLINGTON ROAD • BEDFORD, MA 01730

Inquiry 748.

386SX, 20MHZ, 1MB, 2FL, 80MB - $990

MACINTOSH, IBM, AST, EPSON, ALTIMA, NEC, SHARP, HP, HOUSTON INSTRUMENTS, ROLAND, 3M

Call UCC
213-921-8900 Fax 213-802-0831
13738 Artesia Blvd. 150, Cerritos, CA 90701
INTERNATIONAL ORDERS WELCOME

Inquiry 749.

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" x 3" board uses Hitachi 16-bit H8/532 CMOS μP. Screams 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, I2C peripherals. Interrupts, multi-tasking, watchdog timer, editor. 33 I/O, 2 x RS-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! *Sale-or-return*
Saelig Company ***tel: (716) 425-3753***
European Technology ***fax: (716) 425-3835***

Inquiry 750.

SDK-386™ *

*386 is a trademark of Intel Corporation. Used by permission.

BRAND NEW AND AVAILABLE ONLY FROM URDA, INC. along with the URDA SDK-85 and SDK-86 educational trainers and microprocessor development systems. The URDA SDK-51 will be available next year. Other 8, 16, and 32 bit systems are available.

Phone URDA, Inc.
1-800-338-0517 or 412-683-8732

Inquiry 751.

HARDWARE/CONTROLLERS

S T E P P E R
UP TO 8 MOTOR CONTROL VIA COM PORT OR BUS

Our SA703 is a 2 axis controller. Plug into PC Bus or use externally with our SA800 programmable controller. The SA703's 600 mA/coil can be boosted to 10 amps/coil with the SA603. The SA703C supports co-ordinated motion for up to 3 channels. Software drivers including an HPGL interpreter included free. SA703 $149, SA 703C $299, SA603 $149 SA800 $149

STRADA AUTOTECH INC. TEL: (613) 359-1029
P.O. Box 188, Elgin, Ont. Canada K0G 1E0

Inquiry 752.

JAPAN MARKET

Looking for Suppliers

How about entering the Japanese market? We'd like to help you. The enormous trade surplus encourages Japan to purchase foreign products. Generating great demand for computer hardware and software, the Japan market is attracting worldwide attention. If this market appeals to you, contact us by fax today! We would appreciate catalogs depicting your products well.

Giken Shoji Co., Ltd.
Fax: 81-052-972-6577 Phone: 81-052-972-6544
6F Soar Bldg. 2-3, 1-chome, Izumi, Higashi-ku, Nagoya 461, Japan

Inquiry 753.

LANS

FREELAN
Complete LAN solution at LAN CARD price

► 2 user Ethernet Starter kit for $229, including: • Two 8-bit Ethernet cards (w/drivers) • Two terminators and one 15' cable • Network Operating System for two users. ► 2 user Arcnet Starter Kit for $159. • Additional user: Ethernet $119, Arcnet $84. • LAN cards and NOS separately available.

Crystal Computing Corporation
3140 De La Cruz Blvd. Suite 200, Santa Clara, CA 95054
Tel (408) 748-0125 (800) 726-6209 Fax (408) 748-0879

Inquiry 754.

The $25 Network
Try the 1st truly low-cost LAN

- Connect 2 or 3 PCs, XTs, ATs
- Uses serial ports and 5-wire cable
- Runs at 115K baud
- Runs in background, totally transparent
- Share any device, any file, any time
- Needs only 14K of RAM

Skeptical? We make believers!
Information Modes
P.O. Drawer F, Denton, TX 76202
817-387-3339 Orders 800-628-7992

Inquiry 755.

LANS/SOFTWARE

NetRunner
Remote Control Program for just $19.95

• Control remote computer across WAN or LAN • Running on NetBIOS, Novell, RS-232 and Modem • Keyboard locking • Remote execution • File transfer. $19.95 per user, $24.95 starter kit, $99.95 unlimited. • Network Operating System available for $39.95, with File/Record locking, Printer Spooling, Peer-to-peer.

Crystal Computing Corporation
3140 De La Cruz Blvd. Suite 200, Santa Clara, CA 95054
Tel (408) 748-0125 (800) 726-6209 Fax (408) 748-0879

Inquiry 756.

LAPTOP COMPUTERS

SAVE! **LAPTOPS*NOTEBOOKS** *SAVE!*

TOSHIBA • EVEREX • ZENITH • AT & T • TANDON
AST • SANYO • SHARP • BONDWELL • ALR • LIBREX
PANASONIC • ALTIMA • LEADING EDGE • FORA
PACKARD BELL • SAMSUNG • NEC • TI • COMPAQ

• We *ALSO* carry a full line of accessories •

Computer Options Unlimited
12 Maiden Lane, Bound Brook, NJ 08805
CALL: (800) 424-7678 Need Help?: 908-469-7678
9-9 M-F 9-5 Sat. **6 days** Worldwide Sales

Inquiry 757.

IBM CONVERTIBLE
MEMORY–128K $79 256K $225 384K $295
MODEMS–Standard $75 Enhanced $175
CRT ADAPTER–for monitors $99
SERIAL/PARALLEL ADAPTER–$120
MONITORS–Monochrome $115 Color $249
COMPACT Carrying Case $39
ENHANCED LCD–$79 BATTERY –$89
HARD DRIVES–20 Meg–$495 40 Meg–$695
MORE ACCESSORIES AVAILABLE
COMPUTER RESET
P.O. Box 461782, Garland, TX 75046
Phone (214) 276-8072 BBS & FAX (214) 272-7920

Inquiry 758.

LAPTOP PERIPHERALS

LAPTOP POWER ADAPTERS
AC and DC input
TOSHIBA INTERNAL CARDS
Fax/modems: 9600/2400bps, software, acoustic port Modems, exp: 2400 bps, acoustic or serial port Modem, dedicated: 2400 bps (notebooks, T31&3200SX) Serial IO cards: RS232, RS422, SCSI, HPIL, barcode
Contact us for more information:
PRODUCT R&D Corporation (Calif.)
805/546-9713 Fax 805/546-9716

Inquiry 759.

World Radio History

THE BUYER'S MART

PRODUCT MANAGEMENT

Keep Track of Bug Reports

New tool gives instant access to information about pending bug reports/suggestions on the products you maintain or support. Eases planning of new releases. No more paperwork, lost reports or hunting for customers' example files. Multiple users (development, marketing, QA) can independently categorize, prioritize, and rearrange records. KeyTrack $495

C Street Software
(805) 486-7807 • (800) 350-8649 • Fax (805) 483-7809
3L Ltd (UK) +44 506 41 59 59 Fax +44 506 41 59 44

Inquiry 760.

PROGRAMMERS TOOLS

DON'T DEVELOP NETWORK APPLICATIONS

without NPPC, a powerful library sub-routine package that handles all the details of NetBIOS or IPX programming! **NPPC** supports high-level program communications at the message level for all server/client and peer-to-peer models. If you are using C or Assembler, **NPPC** allows you to write a single application that runs on BOTH IPX AND NetBIOS without any modifications. **NPPC** is compatible with any true NetBIOS emulator, therefore applications written with **NPPC** will work with most LANs in the marketplace. We offer a 30 day money back guarantee.

NPPC for IPX or NetBIOS: $195.00, with source: $395.00

SOFTWAREHOUSE CORPORATION
326 State Street, Los Altos, CA 94022
(415) 949-0203 FAX: (415) 949-0208

Inquiry 761.

YOUR SALES MESSAGE
about the special computer product or service that you provide belongs in print.
THE BUYER'S MART
can help you reach computer professionals and produce valuable inquiries for your company!
Call Joseph Mabe for more information
603-924-2656
or
Fax: 603-924-2683

Inquiry 762.

PUBLIC DOMAIN

$1.00 PER DISK
NO MINIMUM ORDER!
Free Catalog of 700+ Programs
Many Unique, Hard to Find Titles.
(Watch For Our On-Line BBS -Coming Soon!)
Northern Micro Systems
16 Main St. Absarokee, MT 59001
(406) 328-4343

Inquiry 763.

FREE SOFTWARE FOR IBM®/clones
TRY US! GET 15/5.25" or 6/3.5" Disks full of our best selling software—*FREE*. Great games, programmer's utilities, business, educational, and desktop publishing. Pay only $5.00 shipping/handling. Credit cards only. Call Today!
SMC SOFTWARE PUBLISHERS
619-931-8111

Inquiry 764.

FREE CATALOG
FOR IBM PD AND SHAREWARE
SELECTED PROGRAMS
LATEST VERSIONS
Low as $1.50
SOFTSHOPPE, INC.
TEL: 800-829-2378 • 313-761-7638
FAX: 313-761-7639
P.O. Box 3678, ANN ARBOR, MI 48106

Inquiry 765.

ROM BIOS UPGRADES

AMI, PHOENIX & MR BIOS
Upgrade your IBM PC, XT, AT or compatible. Also 386SX & 386 versions. Supports 2 user-defined hard drives, 101/102 KB, 360, 720, 1.2 & 1.44 floppies, setup in ROM, All Video, Windows 3.0 Diagnostic in ROM AMI 286 & 386 versions only. CALL. New version just came in.
Advanced Software
4½ Marlboro Road Suite 2R, Derry NH 03038
800-835-2467 603-432-1532

Inquiry 766.

SECURITY

FIGHT PIRACY!
Since 1986, companies worldwide have been choosing **Az-Tech** security products. If you demand the strongest protection available, why not choose one of these "proven leaders":
- **EVERLOCK** Copy Protection
- **EVERTRAK** Software Security
- **EVERKEY II** "The Lock"

For IBM and Compatibles. 30 day money back guarantee. Free info and demo disk available.
Az-Tech Software, Inc.
201 East Franklin, Richmond, MO 64085
(800) 227-0644 (816) 776-2700 Fax: (816) 776-8398

Inquiry 767.

THE ULTIMATE COPY PROTECTION
- Completely Menu Driven
- Defeats all Hardware/Software Copiers
- No Source Code Changes
- Multiple Layering
- No Damaged Media
- Full Hard Disk & LAN Support
- Unlimited Metering, FREE Demo Disk

Quite Simply The Best Ways To Protect Your Valuable Software Investment

STOPVIEW® STOPCOPY PLUS® (800) 879-2224
BBI COMPUTER SYSTEMS, INC. (301) 871-1094
14105 Heritage Lane, Silver Spring, MD 20906
FAX: (301) 460-7545

Inquiry 768.

H Y P E R - L O C K
If you search for a powerful copy protection system, you also can have privileges of HYPER-LOCK.
- Protects on standard diskettes • Machine And/Or Hard disk install • LAN support • Cannot be copied by any device
- No source code required • And/Or password protection • Cost effective • FREE demo disk and info

GUVEN COMPUTER LTD.
Talimyeri sk. 7/3 Macka/Istanbul TURKEY
(90) 1-136 10 07 Fax: (90) 1-160 36 46

Inquiry 769.

Cop's CopyLock II
The professional software protection with TRUE Machine Install. Option Board safe. Supports OS/2, Windows and Trace.
LINK Computer
Int'l: +45 31232350 Fax +45 31238448
US/CAN: 800-344-2545 Fax 408-923-7061

BIT-LOCK® SECURITY
Piracy SURVIVAL 8 YEARS proves effectiveness of powerful multilayered security. Rapid decryption algorithms. PARALLEL or SERIAL port-transparent security device. Complemented by economical KEY-LOK™ and multifeatured COMPU-LOCK™ including countdown, timeout, data encryption, and multiproduct protection. (Dos/Unix/Mac). Also, access control.
MICROCOMPUTER APPLICATIONS
3167 E. Otero Circle, Littleton, CO 80122
(303) 770-1917

Inquiry 770.

SECURITY

HANDS OFF THE BOARD®
1/2 SIZE SECURITY BOARD
Stop floppy boot — Require password to boot PC
Real-time disk encrypt — prevent boot sector virus
Prevent DOS FORMAT/FDISK and low-level formats
Set hard disk READ ONLY or turn ON/OFF
Turn floppies, printers and COM ports ON/OFF
IBM XT, AT Bus — DOS V3.0+ — $149.95 + $5.00 S/H
SYSTEMS CONSULTING INC.
PO BOX 111209, Pittsburgh, PA 15238
(412) 781-5280

Inquiry 771.

SERVER MIRRORING

No*stop Network
No*stop Network, the only Level 3 Fault Tolerant and Backup software that allows MIRRORED SERVERS and CONTINUOUS PROCESSING in any PC/LAN. Supports Novell, Microsoft, IBM, Banyan, etc. Any server environment—DOS, OS/2, Unix, Wang, DEC, etc.
NONSTOP NETWORKS LIMITED
20 Waterside, New York, NY 10010
212-481-8488

Inquiry 772.

SHAREWARE

ISLO Select Shareware on CD ROM $99.00
- ► Also, Shareware by diskette $4.00
- ► IBM, Macintosh and Amiga files
- ► Programmer fresh quality programs
- ► Great Clip-Art files
- ► Wanted: Shareware Contributors

Islo Tech Inc. PO Box 431, Excelsior, MN 55331 800/722-9724, 612/934-2024 (Voice) 612/934-2824 (Fax)

Inquiry 773.

FREE KIDS SOFTWARE FOR IBM®
TRY US! GET 15/5.25" or 6/3.5" Disks full of our best selling software for kids—*FREE*. Great games, puzzles, tutorials, and educational programming. Pay only $5.00 shipping/handling. Credit cards only. Call Today!
SMC SOFTWARE PUBLISHERS
619-931-8111

Inquiry 774.

SOFTWARE/ACCOUNTING

dBASE BUSINESS TOOLS

• GENERAL LEDGER	• PURCH ORD/INVNTORY
• ORDER ENTRY	• ACCOUNTS RECVABLE
• JOB COSTING	• JOB ESTIMATING
• BILL OF MATLS	• SALES ANALYSIS
• PAYROLL	• ACCOUNTS PAYABLE

$99/$198 ea. + S&H
dATAMAR SYSTEMS Cred. Card-Check-COD
8586 Miramar Place, San Diego, CA 92121
(619) 452-0044 **(800) 223-9963**

Inquiry 775.

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 776.

World Radio History

SOFTWARE/ENGINEERING

Analog Circuit Simulation

- PC and Macintosh CAE
- Schematic Entry
- SPICE Simulator using Extended Memory
- Monte Carlo Analysis
- Parameter Sweeping
- Extensive Model Libraries
- Waveform Analysis
- Report-Quality Plotting
- Full SPICE programs starting at $95. Complete systems from just $890.

P.O. Box 710, San Pedro, CA 90733-0710
(213) 833-0710 FAX (213) 833-9658 **intusoft**
Call for your Free Demo and information kit.

Inquiry 776.

MICROSTRESS CORPORATION

Announcing **MICROSAFE 2D/3D Rel. 3.10**
Easy to learn and use Structural Analysis Program for IBM PCs & compatibles. Number of nodes, elements & loading conditions limited by disk space & model bandwidth (1100 d.o.f.) Color graphics support on various display cards (EGA, VGA, VEGA, HERCULES etc.) $350. **SAFELIBs** (Beam Element Libraries for steel, wood & concrete Incl. complete **AISC** Database) $85. **GRAFPLUS** Print screen utility program $65. **386MAX** Memory manager for 386 & 486 systems $100. Shipping not included.

P.O. BOX 3194, BELLEVUE, WA 98009
TEL/FAX (206) 450-0316

Inquiry 777.

GEOMETRY/TRIGONOMETRY CALCULATOR

Apollonius — Sketch-based geometry/trigonometry solver. State-of-the-art variational geometry system lets you sketch your geometry or trig problem and automatically solves for distances, angles and areas. Integrated equation calculator, graphs and tables plus DDE and clipboard support. Ideal for surveyors, engineers, machine shops, students, architects, or anyone who uses trig. Runs under MS Windows 3.0 $98

Saltire Software 1-800-659-1874

Inquiry 778.

Worstcase Gets Even Better!
ECA-2 Analog Circuit Simulator

Offers the best Monte Carlo and Worst-Case Analyses *TWICE the speed at HALF the cost!*

- Interactive/batch modes • Full Nonlinear Simulator
- On line, Real Time Graphics • Multiple Plots
- AC, DC, Transient, Fourier, Temperature

Tatum Labs, Inc.
P.O. Box 1263, Ann Arbor, MI 48106-1263
(313) 663-8810

Inquiry 779.

SOFTWARE/GEOLOGICAL

FREE SOFTWARE CATALOG

Over 160 earth science programs for the PC & Macintosh!

- CIVIL ENGINEERING
- BASE MAPPING
- EXPLORATION
- SURVEYING
- SURFACE MODELING
- MINING
- OIL & GAS
- HYDROLOGY
- GIS
- GEOPHYSICS

RockWare 4251 Kipling St., Ste. 595 Wheat Ridge, CO 80033
(303) 423-5645 • Fax (303) 423-6171 • RockFAX* (303) 423-7112
*24-hr. automated product information line

SOFTWARE/GRAPHICS

T_EX by Example
A Beginner's Guide
Arvind Borde

Features pages on the right that give examples and explanations of T_EX commands and pages on the left showing the T_EX commands used to produce the examples.

November 1991, 192 pp. $19.95/ISBN: 0-12-117650-9

ACADEMIC PRESS
Book Mktg. Dept #11012, 1250 Sixth Ave., San Diego, CA 92101
CALL TOLL FREE 1-800-321-5068

Inquiry 780.

SOFTWARE/GRAPHICS

NEW VERSION!!

TurboGeometry Library 4.0. Now called TGL Professional
"The Ultimate CAD/CAM/CAE Engine"

TGL Professional, the most complete toolbox of 2D & 3D geometric routines available today! Over 600 routines including NURBS, DXF, Graphics, Surfacing, Hidden Line, Volumes, Areas, Transforms, Perspectives, Polygon (Int/Union/Diff), Clipping, Tangents & more. With full source & 30 day guarantee. A technical white paper on this product is available upon request.

Disk Software Inc.
2116 E. Arapaho Rd., Suite 487, Richardson, TX USA 75081
Phone: 214-423-7288 — 800-635-7760 — FAX: 214-423-7288

Inquiry 781.

RAINDROP™

FAST, compact PrtScrn Utility for end users AND developers. Hardcopy as fast as 10 secs. Average binary size - 6 kbyte. 14 video graphic standards. Scale, rotate, colorize and more. 'CALL' from user-written programs. Complete 9- & 24-pin dot-matrix, InkJet, and laserjet library $44.95+$3 s/h.

ECLECTIC SYSTEMS
8106 St. David Ct., Springfield, VA 22153
(703) 440-0064 Fax (703) 455-8965

Inquiry 782.

PEN PLOTTER EMULATOR

FPLOT turns your printer into an HP pen plotter. Fast hi-res output, no jagged lines. Vary line width, color. Screen preview with zoom and pan. Stand-alone, background, and device driver modes. Works with most CAD and graphics programs. Supports most printers. New version 3. $119+$3 S&H. 30 day money back. VISA/MC/Check/MO.

FPLOT Corporation
24-16 Steinway St., Suite 605, Astoria, NY 11103
718-545-3505

Inquiry 783.

GRAPHICS PRINTER SUPPORT

AT LAST! Use the PrtSc key to make quality scaled B&W or color reproductions of your display on *any* dot matrix, laser, or inkjet printer (incl. Postscript) in up to 64 shades of gray or 256 colors. GRAFPLUS also creates PCX & TIFF files. Supports Windows 3.0 or DOS application graphics - EGA, VGA, Super VGA, Hercules screens. Linkable/OEM versions available.

Jewell Technologies, Inc.
130 Nickerson St., Suite 105, Seattle, WA 98109
1 (800) 284-2574 (206) 285-6860

Inquiry 784.

FORTRAN GRAPHICS

GRAFMATIC - FORTRAN callable graphics Library for creating 2-D and 3-D graphics, contour plots and solid models. PRINTMATIC and PLOTMATIC provide high resolution FORTRAN callable printer and plotter drivers for your graphics. NO ROYALTIES. $249.95 ea.

Supports Microsoft/Lahey/RM FORTRAN compilers

Jewell Technologies, Inc.
130 Nickerson St., Suite 105, Seattle, WA 98109
1 (800) 284-2574

Inquiry 785.

SOFTWARE/LANGUAGES

IntegrAda

Standard Air Force PC Ada Compilers & environments for MS-DOS and UNIX. Integrated programming systems include validated Ada compilers, language sensitive editors, complete libraries and other Ada programming tools. FREE demo.

AETECH, Inc. *From $395*
380 Stevens Ave., Ste. 212 Solana Beach, CA 92075
(619) 755-1277 Fax: (619) 755-7540

Inquiry 786.

SOFTWARE/MATHEMATICS

Mathematical Modeling On Your PC
Science Engineering Business

- Faster, Easier, more Powerful than other methods
- Nonlinear Algebraic and Differential Systems
- Solve For Any Parameter Values • No Programming
- Complex • Vectors • Natural Mathematics Editor
- Simulation • Optimization • Graphics

New Chico Solver 2.3 (916) 342-3279 Only $399
Full refund for 30 days if not satisfied. VISA/MC/PO#

Chico Software Company PO Box 5174, Chico, CA 95927

Inquiry 787.

OPERATIONS RESEARCH @ $149
for your IBM or Compatible

LP88—Linear programs up to 3000 rows by 15000 columns
BLP88—Bounded LPs up to 2500 rows by 12500 columns
MILP88—Mixed integer linear programs up to 800 by 4000
TSA88—Transportation problems up to 1200 sources/sinks
NLP88—Nonlinear programs up to 800 by 4000
TPRO88—Shortest path and travelling salesman problems
Student/Demo Package—Reduced capacity versions for students. Manual on diskette. No site license required.
Turbo Pascal Units—Compiled OR/MS procedures for developers

Eastern Software Products, Inc.
P.O. Box 15328, Alexandria, VA 22309. (703) 360-7600. Fax (703) 360-7654

Inquiry 788.

MATHEMATICIANS—ENGINEERS

Have you ever seen functions of a complex variable? Would you like to really understand differential operators like div, grad and curl? How about a peek into the fourth dimension? Call or write for information on our latest PC and Macintosh software.

Lascaux Graphics
7601 N. Calle Sin Envidia, Tucson, AZ 85718
(602) 544-4229 — 1-800-338-0993

SOFTWARE/PACKAGING

SAVE SAVE SAVE SAVE
LET'S TALK LABELS

We do disk labels (5¼" & 3½")
• Better • Faster • Cheaper •
Because we specialize in disk labels. . . Let's Talk

We also have Tyvek Sleeves
Mailers • Binders • Vinyl Pages
We are a complete software packaging service.
Free Catalog

Hice & Associates
8586 Monticello Dr., West Chester, OH 45069
513-777-8586

Inquiry 789.

SOFTWARE/SCIENTIFIC

Chaos/Nonlinear Dynamics

DYNAMICAL SOFTWARE I and II $250 / $350
Ordinary and Delay Differential Equation Solvers
• Bifurcation Diagrams • Basin Boundaries • 2- and 3-D Plotting • Poincaré Sections • Return Maps • Spectral Analysis, Fractal Dimensions, Lyapunov Exponents
NONLINEAR FORECASTING
enhancement to DS $150.00 • stand alone $200.00

DYNAMICAL SYSTEMS, INC.
P.O. Box 35241, Tucson, AZ 85740, (602) 292-1962
Fax (602) 887-0307

Inquiry 790.

Perform engineering and scientific calculations faster. . . and with fewer errors!

MathCAD combines equations, text, and graphics on your PC, Macintosh, or UNIX workstation. Over 120 built-in functions handle formulas, exponentials, differentials, cubic splines, FFTs and matrices for virtually any application—special offer $395. Call for a free demo disk.

1-800-MATHCAD
FAX 617-577-8829
MathSoft, Inc., 201 Broadway, Cambridge, MA 02139

Inquiry 791.

World Radio History

THE BUYER'S MART

SOFTWARE/SCIENTIFIC

FREE CATALOG

A great selection of scientific software products for plotting, non-linear curve fitting, chemical equilibrium, simulation, statistics, symbolic algebra, and more. Prices from $150. Call:

1-801-943-0290

MicroMath, Salt Lake City, UT 84121-0550

Inquiry 792.

SOFTWARE/SORT

OPT-TECH SORT/MERGE

Extremely fast Sort/Merge/Select utility. Run as an MS-DOS command or CALL as a subroutine. Supports most languages and file types including Btrieve and dBASE. Unlimited file sizes, multiple keys and much more! MS-DOS **$149.** OS/2, XENIX, UNIX **$249.**

(702) 588-3737

Opt-Tech Data Processing

P.O. Box 678 — Zephyr Cove, NV 89448

Inquiry 793.

SOFTWARE/VOICE/FAX

MULTI-VOICE® TOOLS

Multi-Voice Tools is a complete development Toolkit for Pascal or "C" to access all the features for most speech processing boards available today. It helps you write MULTI-LINE VOICE APPLICATION systems in minutes. A number of programming examples are provided. All programs and libraries are delivered with source code.

Dialogic, Rhetorex, Pika, VBX: $599. Watson (Single Line): $99. ALSO AVAILABLE: FAX Programmer's Toolkit ($199). Based on CAS specifications. Visa/MC accepted.

ITI Logiciel

4263 Cristophe-Colomb, Montreal, Quebec, Can. H2J 3G2

TEL (514) 597-1692 **FAX (514) 526-2362**

STATISTICS

VISUALIZE YOUR DATA

MCA+ transforms most marketing and social science data to easily understood perceptual maps. Communicate complex relations with ease using presentation quality charts. Most printers supported. Demos available

Bretton-Clark

89 Headquarters Plaza, Morristown, NJ 07960

(201) 993-3135 **FAX: (201) 993-1757**

Inquiry 794.

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 795.

YOUR SALES MESSAGE

about the special computer product or service that you provide belongs in print.

THE BUYER'S MART

can help you reach computer professionals and produce valuable inquiries for your company!

Call Joseph Mabe for more information

603-924-2656

or

Fax: 603-924-2683

Inquiry 796.

TRANSLATION

Tradoc translates and localizes your technical documentation into the following languages:

+ *French*	+ *Russian*
+ *Spanish*	+ *Arabic*
+ *German*	+ *Italian . . .*

Turnkey service: Desktop Publishing, typesetting and printing of your brochures and manuals.

205 Gibson Rd., Annapolis, MD 21401

(301) 267-8655 **FAX (301) 267-8180**

Inquiry 797.

UNINTERRUPTIBLE POWER

ELIMINATE LAN DOWNTIME AND DATA LOSS

APC protects more LANs than any other brand of UPS. Call for your FREE power protection handbook detailing:

- Smart-UPS high performance protection, PC Magazine's Editors' Choice
- Back-UPS cost-effective protection starting at $169
- PowerChute automatic shutdown software for all major OS
- SurgeArrest network grade surge protection

"Our highest marks go to the Smart-UPS 900" BYTE 5/91

American Power Conversion
132 Fairgrounds Road,
West Kingston, RI 02892
800 541 8896

APC Europe
4 Rue St. Claire DeVille Lognes,
77447 Marne la Vallee Cedex 2,
FRANCE (+33) 160178400
Fax (+33) 160178029

Inquiry 798.

UTILITIES

$29 MATH COPROCESSOR
- 287, 387, X87 emulator

$5 SUPER PASSWORD SYSTEM
- No one can break it • Double lock protection
- Invisible password • Movable password

$35 VIRUS PROTECTION CARD
- Immune to virus after installation

MULTIX, INC.

4203 Beltway Dr., Suite 7, Dallas TX 75244

Tel: (214) 239-4989 **Fax: (214) 239-6826**

We accept MasterCard and VISA

Inquiry 799.

Why You Want BATCOM!

BATCOM is a batch file compiler that transforms your .bat files to .exe files to make them faster. BATCOM extends DOS with many new commands so you can read keyboard input, use subroutines, and much more. In addition, BATCOM protects your source code. No royalties! Only $59.95. Order today!

Wenham Software Company

5 Burley St., Wenham, MA 01984

(508) 774-7036

Inquiry 800.

WINDOWS TOOLS

WINDOWS creating tools

WINDOWScreator-code gener. for WINDOWS 3.0. Icon, cursor, brush and bitmap editor included. Oops, inheritance supported. Other products— Sbase, database under WINDOWS and Call&Put, options analyzing program.

Prices: WINDOWScreator 295 US$, Sbase 250 US$, Call&Put 195 US$

P&P Europe 10 US$ elsewhere 20 US$. Specify prog. lang.: SmalltalkV/286/ Windows or C. VISA accepted

AdamSoft, 66 rue de Bourgogne, L-1272 Luxembourg, Luxembourg • Phone: (+352) 420884

Inquiry 801.

WORD PROCESSING

Replace Proofreading

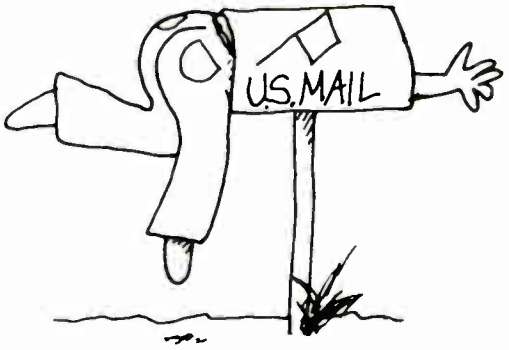
Key, edit, or proof any file on your PC with **WordProofer™**, then import to your application. ***New*** two-pass proofing is faster, more accurate than proofreading or document comparators. Single $295. Multi-copy discounts. Network version.

Computer Keyes **800/356-0203**
21929 Makah Rd. **206/776-6443**
Woodway, WA 98020 Fax: **206/776-7210**

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

Subscriber Service, P.O. Box 555, Hightstown, NJ 08520

World Radio History

BRAND NAMES LOW PRICES

LEADER SINCE 1983

We export to Europe, Asia & the Far East

We Honor Manufacturer's Warranties

Call for details

IBM

PS/2 model 55SX-60 meg	1985
PS/2 model 70-120 meg	3195
IBM model 35-40 meg	1795
PS/2 model 70-A21	4195
PS/2 model 95-320 meg	14950

*** Monitor Extra ***

COMPAQ

DeskPro Models

286E-40/120 meg	1595/1695
386S-20 MHz 120 meg	2375
386/20E-120 meg	2795
386/25E-120 meg	4085
386/33M-120 meg	4995

*Call for other models – Monitor Extra *

NOVELL SPECIALS

Netware Version 2.2

5 users	595
10 users	1395
50 users	CALL
100 users	CALL

Netware 386 V.3.11

20 users	2195
100 users	CALL
250 users	CALL

AST LAPTOPS

EX386SX20 MDL 60	2375
EX386SX20 MDL 80	CALL
EX386SX25 MLD 60	2575
EX386SX25 MDL 80	CALL
EX386SX25C MDL 60	4395
EX386SX25C MDL 80	CALL

LAPTOPS

Compaq LTE/286 40 meg	1895
Compaq LTE/386 60 meg	3295
Toshiba 2000SXE 40 meg	2650
Toshiba 2200SX 60 meg	3395
Toshiba 3200SXC 120 meg	5650

Call for pricing on other brand name models

EVEREX

MEGACUBE ISA BUS

486-33 System
8 meg 128K Cache ESDI
16 meg 128K Cache ESDI ..... CALL

Step 386-20 MHz System

1 meg RAM, 64K Cache, 1.2 &
40 meg Drive, 640x480 VGA Combo ..... CALL

Step 386-25 MHz System

1 meg RAM, 64K Cache, 1.2 &
40 meg Drive, 640x480 VGA Combo ..... CALL

Step 386-33 MHz System

2 meg RAM, 64K Cache, 1.2 &
150 meg Drive 1024x768 VGA Combo ... CALL

AST

AST Bravo 386SX20 MDL 1	1070
AST Bravo 386/25 MDL 1	2295
AST Premium 386SX20 MDL 1	1295
AST Premium 386/33 MDL 1	2225

INTEL COPROCESSORS

80287 XL	$99.00
80387 SX-16	$135.00
80387 SX-20	$149.00
80387 DX25/33	$205.00

WE STOCK TOSHIBA

CITIZEN
OKIDATA
EPSON

HITACHI
TALLGRASS
ARCHIVE

NEC
ALR
WYSE

HOUSTON INSTRUMENTS
MICROSOFT
SUMMAGRAPHIC

INTEL
PC MOUSE
CALCOMP

ACS Computers

All systems include

Made in USA

- Intel CPU (MICRONICS)
- 4 meg RAM memory expandable to 64 meg - Desktop or tower case
- 2 serial, 1 parallel
- 101 keyboard
- 1.2 & 1.44 Teac drive
- Boca SVGA w/1 meg & SVGA monitor
- MS DOS 5.0
- MS Windows & mouse

486/33 with 200 meg HD	2895
386/33 with 120 meg HD	1895
386SX/20 with 40 meg HD	1320

One year limited warranty

NOVELL Authorized Dealer

LAN BOARDS

8 bit Arcnet	110
16 bit Arcnet	220
8 bit Ethernet	190
16 bit Ethernet	275
8 port Active Hub	325
Token Ring Card	399
Tokenhub 4-port	355

Call for other LAN Accessories

LASER PRINTERS

HP Laser IIISI	3595
Hp Laser IIID	CALL
HP Laser III	1525
HP Laser IIIP	CALL
OKI OL 400	665
OKI OL 800	CALL
OKI OL 840 P.S.	1720
Panasonic 4420	835
Panasonic 4450	1295
NEC Silentwriter 2	CALL

PRINTERS

Epson LQ 200	245
Epson LQ 570	295
Epson LQ 870	480
Epson LQ 1170	625
OKIDATA 320	330
OKIDATA 390	465
Citizen HSP-500	335

Modems

Everex	CALL
Hayes	CALL
US Robotics	CALL
NEC 3DS/4DS	CALL
NEC 3FGX	645
Viewsonic 4C SVGA	395
Viewsonic 6A N.I	435

Corporate Accounts Welcome

Call for Discounts on Volume

And Consultant Orders

Exports Available

Computerlane inc.

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 10-6

ALL QUOTED PRICES ARE CASH PRICES ONLY

Visa, MasterCard and American Express are higher

Prices subject to change without notice.

*Quantities are limited

Compaq is a Registered Trademark of Compaq. IBM is a Registered Trademark of International Business Machines.

Circle 226 on Inquiry Card.

World Radio History

ASTRIX 486

It Simply Costs Less

486-33 PLATFORM — $1,291

- 33 MHz Intel 486
- **256K Cache**
- 1 MB RAM
- 1.2 MB 5.25" Drive or 1.44 MB 3.5" Drive
- IDE Hard Disk Controller
- 1 Parallel & 2 Serial Ports
- 101 Key Keyboard
- Desktop Case (small footprint)
- 200W Power Supply

Benchmarks: 14.8 MIPS, 151.9 Landmark

Guaranteed 100% IBM AT and Novell compatible. Lifetime technical support. 1 year parts & labor warranty. 30-day money-back guarantee. Custom configurations available.

486-33 COMPLETE — $2,591

PLATFORM system (left column) with:

- 200 MB, 15ms IDE Hard Drive
- 4 MB RAM
- Second Floppy Drive
- 14" Color SVGA Monitor, 1024 x 768, non-interlaced
- 16-bit, 1MB Super-VGA Card
- MS-DOS 5.00
- **Tower Case with 10 Drive Bays**
- **300W Power Supply**

To get your 486 for $1,291, call ASTRIX, toll free:

(800) 445-5486

In CA: (408) 946-2883
Fax: (408) 946-1610

486-33 SERVER — $8,791

PLATFORM system (left column) with:

- **Fault-tolerant operation**
- Dual 380 MB, 0.5ms Drives with Hard Disk Mirroring[1]
- 16 MB RAM
- ESDI Caching Disk Controller[2]
- 500W UPS[3]
- Super-VGA Display, 1024x768
- MS-DOS 5.00
- Tower Case with 10 Drive Bays

[1]Hard disk mirroring protects data. In the event of hard disk failure, the system automatically switches to a second hard drive containing a mirror image of the first drive. Mirroring eliminates the need to maintain backups.

[2]A caching disk controller reduces drive access time to 0.5ms (from 16ms). It also increases throughput by 400%, eliminating disk bottlenecks.

[3]A UPS (Uninterruptible Power Supply) keeps the server running in the event of a power failure.

intel inside

The Intel Inside logo is a trademark of Intel Corporation.

ASTRIX™
HIGH-SPEED PC WORKSTATIONS™

Circle 237 on Inquiry Card.

ASTRIX Computer Corporation, 1546 Centre Pointe Drive, Milpitas, CA 95035. ASTRIX is a trademark of Four D Corporation. IBM-AT is a trademark of IBM Corporation. 486 is a trademark of Intel Corporation. Other indicated trademarks belong to their respective owners. Prices and specifications are subject to change without notice. ©1991 by ASTRIX Corp. All rights reserved.

World Radio History

Lease: from $192/MO.**

Dell® PowerLine™SE ☆ Series Available with i486 DX 50 MHz or 33 MHz processor, i486SX 25 MHz or 20 MHz processor 128 KB external cache on i486DX systems Processor upgradeable via board Up to 128 MB RAM Integrated non-interlaced 1024 x 768, 256 color VGA Starting at $5,299 for complete systems.

Lease: from $123/MO.**

Dell PowerLine DE ☆ Series Available with i486DX 50 MHz or 33 MHz processor, i486SX 25 or 20 MHz processor 128 KB external cache on i486DX systems processor upgradeable via board Up to 96 MB RAM Integrated non-interlaced 1024 x 768, 256 color VGA 1 MB video RAM Starting at $3,299 for complete systems.

Lease: from $104/MO.**

Dell 486D ☆ Series Available with i486DX 33 MHz processor, i486SX 25 MHz or 20 MHz processor Processor upgradeable via chip Up to 64 MB RAM Integrated non-interlaced 1024 x 768, 16 color VGA Video RAM upgradeable to 1 MB Starting at $2,799 for complete systems.

Lease: from $67/MO.**

Dell 325P ☆ i386 DX 25 MHz processor, 33 MHz also available Upgradeable to i486DX 33 MHz processor RAM expansion to 16 MB Integrated non-interlaced 1024 x 768, 2 color VGA 256 KB video RAM, upgradeable to 512 KB Starting at $1,799 for complete systems.

Lease: from $53/MO.**

Dell 316SX ☆ i386SX 16 MHz processor, 20 MHz also available RAM expansion to 8 MB Integrated 1024 x 768, 2 color VGA 256 KB video RAM, upgradeable to 512 KB 2 Serial, 1 Parallel and 1 Mouse port Starting at $1,399 for complete systems.

Lease: from $93/MO.**

Dell 320N ☆ i386SX 20 MHz processor 2 time award-winner 6.4 lbs 3-4 hour battery life Up to 5 MB RAM 40 MB or 60 MB hard drive Data/Fax modem option Starting at $2,499 for complete systems.

SERVICE AND SUPPORT

On-site desk-side service contract included in the system price the first year★ Toll-free technical support hotline Toll-free TechFax™ line for 24-hour system information On-line Bulletin Board communication with technical staff and other users Self-diagnostic software Free factory installation of selected MS-DOS® software applications Information Service Support Forum on CompuServe

COMPANY AWARDS

Dell has won *PC Week* Corporate Satisfaction Polls an unprecedented 8 times ★ Dell ranked Best Personal Computer in Small to Medium Sized Businesses in the J.D. Power and Associates® Customer Satisfaction Index ★ Dell has won *PC World's* 1991 World Class Award for Best Service and Support/Hardware.

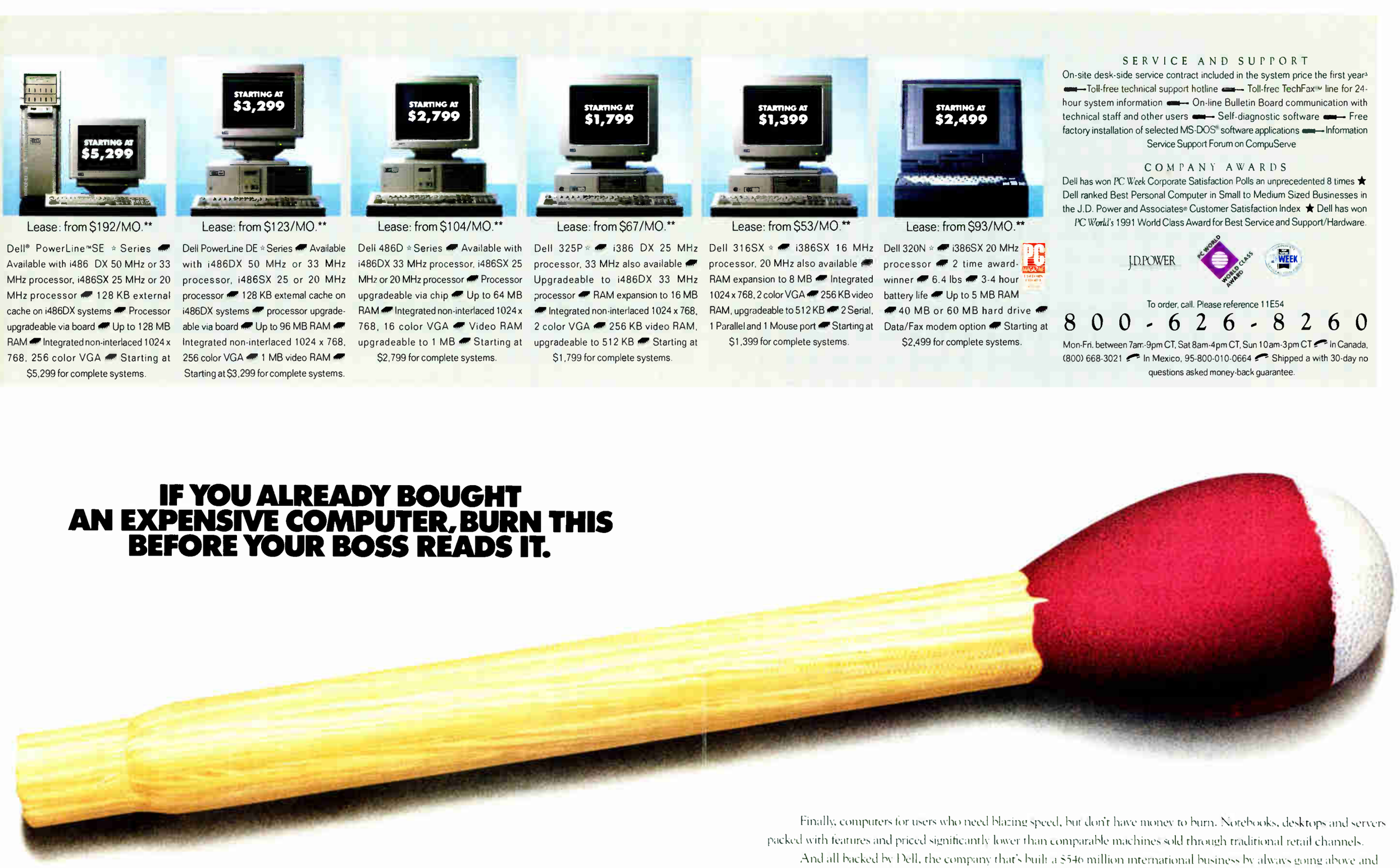
J.D.POWER PC WORLD WORLD CLASS AWARD PC MAGAZINE PC WEEK

To order, call. Please reference 11E54

800-626-8260

Mon-Fri, between 7am-9pm CT, Sat 8am-4pm CT, Sun 10am-3pm CT In Canada, (800) 668-3021 In Mexico, 95-800-010-0664 Shipped a with 30-day no questions asked money-back guarantee.

IF YOU ALREADY BOUGHT AN EXPENSIVE COMPUTER, BURN THIS BEFORE YOUR BOSS READS IT.



Finally, computers for users who need blazing speed, but don't have money to burn. Notebooks, desktops and servers packed with features and priced significantly lower than comparable machines sold through traditional retail channels.

And all backed by Dell, the company that's built a $546 million international business by always going above and beyond the call. By putting them through tests the Marines would be proud of. And backing each one with a service and support package described as "overkill" by the editors of *PC Week*.

So if you need a computer you can fire up without getting fired, call Dell today. We promise you won't get burned.

DELL COMPUTER CORPORATION

intel inside

Circle 47 on Inquiry Card.

Dell Computer Corporation Part Number [illegible]. All rights reserved. [illegible] Dell is not responsible for printing or typographical errors. Dell Computer Corporation reserves the right to change system offers and prices without notice. **Dell has received the highest ranking in proprietary surveys conducted in the United States and Canada. Surveys measure overall satisfaction. Dell is not responsible for third-party offers. Offer may not be available in certain areas. Shipping, handling and applicable sales tax not included in the price. ©1991 Dell Computer Corporation. All rights reserved.

World Radio History

Fasten your seat belts. Because now you can get the speed and power of an i386 system without laying out any serious dollars. Or having to deal with a suspect company.

It's the Dell 325P for only $1,999. This full-blown 25 MHz, i386DX system with an 80 MB hard drive offers maximum performance at the lowest possible price. So it's ideal for any mainstream business application. And it comes from Dell, a company that has built a $546 million international business in just 7 years.

When you buy from Dell, you always deal with us directly. So there's no high dealer margins or erratic support. You'll get a computer we designed, manufactured, and rigorously tested ourselves. And it comes with the service and support that helped us become one of the most awarded PC companies in the world.

So don't wait. Call us today for the Dell 325P.

Because even though the price is stripped down, the computer isn't.

IT'S KIND OF LIKE GETTING A PORSCHE FOR THE PRICE OF A YUGO.

Lease◊: $75/MO.**

TECH STUFF

i386DX 25 MHz processor ▰ Upgradeable to i486™DX 33 MHz processor ▰ 2 MB RAM (expandable to 16 MB) ▰ 80 MB, 15ms IDE Hard Drive ▰ 640 x 480 VGA Color Monitor ▰ 5.25" 1.2 MB or 3.5" 1.44 MB Floppy Drive

SERVICE AND SUPPORT

On-site desk-side service contract included in the system price the first year△ ▬ Toll-free technical support hotline ▬ Toll-free TechFax℠ line for 24-hour system information ▬ On-line Bulletin Board communication with technical staff and other users ▬ Self-diagnostic software ▬ Free factory installation of selected MS-DOS® software applications ▬ Information Service Support Forum on CompuServe

COMPANY AWARDS

Dell has won *PC Week* Corporate Satisfaction Polls an unprecedented 8 times ★ Dell ranked Best Personal Computer in Small to Medium Sized Businesses in the J.D. Power and Associates® Customer Satisfaction Index ★ Dell has won *PC World's* 1991 World Class Award for Best Service and Support/Hardware

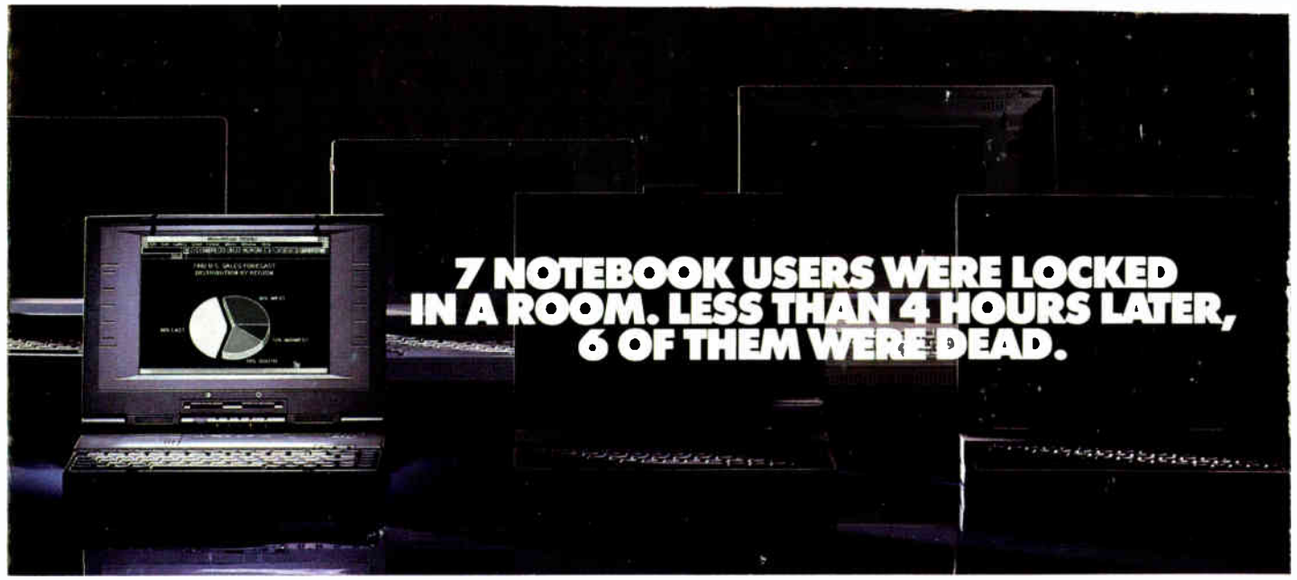
To order, call. Please reference 11E53

800-274-4635

Mon-Fri. between 7am-9pm CT, Sat 8am-4pm CT, Sun 10am-3pm CT ▰ In Canada, (800) 668-3021 ▰ In Mexico, 95-800-010-0664 ▰ Custom-built and shipped with a 30-day no questions asked money-back guarantee

intel inside

DELL COMPUTER CORPORATION



Recently, an independent laboratory ran *PC Magazine's* Battery Rundown Test on 7 leading notebook computers. And we're happy to report that Dell came in dead last.

In fact, Dell's power management system and NiMH battery helped the 320N+ run a full 30 minutes longer than the nearest competitor. More than enough to get you through the next marathon meeting or epic plane flight.

And, Dell has found a way to make your budget last longer too. The 320N+'s $2,999 price is up to a third lower than most of the competition. And still includes Dell's award-winning service and support. Which can get a trained technician right to your home, office or hotel room; usually by the next business day.△

Just what you'd expect from a company that's become a $546 million international business in just 7 years. And one of the most awarded PC manufacturers in the world.

So call us and order a Dell* 320N+ today. You won't have to be afraid of dying any more.

You charge less.

Dell 320N+	***4:00 Hours***
Toshiba T2000SXe	*3:21 Hours*
Compaq LTE 386s/20	*3:05 Hours*
TI Travelmate 3000	*2:32 Hours*
Zenith MastersPort 386SL	*2:26 Hours*
AST Premium Exec	*2:08 Hours*
IBM PS/2 Model L40SX	*1:55 Hours*

Test in accordance with PC Magazine's testing parameters.

We charge less.

Dell 320N+ 4 MB RAM and 60 MB Hard Drive	***$2,999***
Toshiba T2000SXe—4 MB RAM and 60 MB Hard Drive	*$4,178*
Compaq LTE 386s/20—4 MB RAM and 60 MB Hard Drive	*$4,297†*
TI Travelmate 3000—4 MB RAM and 60 MB Hard Drive	*$3,498*
Zenith MastersPort 386SL—4 MB RAM and 60 MB Hard Drive	*$4,798*
AST Premium Exec.—4 MB RAM and 80 MB Hard Drive	*$3,295**
IBM PS/2 Model L40SX—4 MB RAM and 60 MB Hard Drive	*$4,545*

**4 MB and 60 MB Hard Drive retails for $400 more. Go figure.*

Actual dealer prices may vary.

Circle 49 on Inquiry Card.

DELL 320N+ $2,999

TECH STUFF

Dell 320N+ 20 MHz i386™SX System ▰ Lease◊: $112/MO.** ▰ 6.8 lbs ▰ 8 ½ x 11" footprint ▰ Full-travel keyboard ▰ 4 hour battery life on NiMH battery ▰ System includes 60 MB Hard Drive, VGA Edgelit LCD, 4 MB RAM ▰ 80 MB Hard Drive also available

SERVICE AND SUPPORT

Nationwide on-site lapside service contract included in the system price the first year△ ▬ Toll-free technical support hotline ▬ Self-diagnostic software ▬ Free factory installation of selected MS-DOS® software applications

COMPANY AWARDS

Dell has won *PC Week* Corporate Satisfaction Polls an unprecedented 8 times ★ Dell ranked Best Personal Computer in Small to Medium Sized Businesses in the J.D.Power and Associates® Customer Satisfaction Index ★ Dell has won *PC World's* 1991 World Class Award for Best Service and Support/Hardware

To order, call. Please reference 11EA2

800-626-4821

Mon-Fri between 7am-9pm CT, Sat 8am-4pm CT, Sun 10am-3pm CT ▰ In Canada, (800) 668-3021 ▰ In Mexico, 95-800-010-0664 ▰ Shipped with a 30-day no questions asked money-back guarantee

intel inside

DELL COMPUTER CORPORATION

World Radio History