HEAD TO HEAD: NINETEEN 486/33 EISA MACHINES

Zenith's Z-486/25E: 5 Times Faster than VGA
Page 54

HP 95LX: A complete PC, plus Lotus 1-2-3, for under $700

Best Palmtop Ever?

Future Documents: Combining text, graphics, voice, and more
Drowning in Data? See page 150
Borland's ObjectVision
Low-Cost Apple Laser Printer
Mac 3D: Infini-D
Two Portable Printers

PLUS
5 X Terminals
3 LAN UPSes
QEMM vs. 386Max
Mac Image Compression
MultiScope Debuggers
PC Image-Editing Software
Printer Sharing Devices
Color Printers
You even have anytime, any day access to Dell's innovative automated toll-free, 24-hour TechFax line. Just dial-up, and get detailed information from Dell technical library faxed back to you. On the spot.

And if your problem can't be solved over the phone, a trained service technician will come to you with a solution. Usually by the next business day.8

And best of all, you don't have to worry about budgeting for all of this. Because the system price includes on-site service for a year, and phone support forever.

But you don't need to worry too much about that. Those Customer Satisfaction Polls consistently rank Dell tops in reliability as well.

The right hardware for hard times.

A down economy is not the time for Compaq dealer mark-ups.

Which makes Dell computers look even better these days. And, to loosen those tight budgets even more, you can take advantage of a wide variety of credit, lease and lease-to-buy programs.

For instance, you can lease® Dell computers for as little as $56 a month. Or use the lease-to-buy plans and own the computer at the end of the lease term. There's even a Dell Direct Advantage MasterCard with up to a $15,000 credit limit and a way to earn points toward Dell products with everything you buy. Either way, you'll get all the credit you deserve. So if you were planning to buy a Compaq PC, take a deep breath, count to ten and call Dell.

TO ORDER, CALL
800-444-1470
For faster processing please reference #111111
Hours: 7 AM-9 PM CT M-F 8 AM-4 PM CT SAT
In Canada call 800-387-5752

Dell Computer Corporation

3250, 3250P, 3250X, 320N and 320N+; 584 KB (300X, 425E, 425TE and 433TE) of memory is reserved for use by the system to enhance performance. Can be optionally disabled on 433P, 3330, 3250, 3250P, 3250X, 312N, 312SX and 310.

Based on 25-month, open-end lease. *Leasing arranged by Leasing Group, Inc. In Canada, configurations and prices may vary. Dell and Dell System are registered trademarks and SmartFit is a trademark of Dell Computer Corporation. Intel is a trademark of Intel Corporation in the United States and other countries. Xerox is a registered trademark of Xerox Corporation. All other products are the property of their respective owners. Service provided by Xerox Corporation. On-site service may not be available in certain remote locations. Shipping, handling and applicable sales tax not included in the price at Computer Corporation. All rights reserved.
If we've said it once, we've said it ten times. You can get a custom-configured Dell® computer with better service for up to $12,500 less than a similarly configured Compaq system.

Everything from the award-winning 386SX laptop PCs to workgroup-sized i486 network servers. With a virtually limitless number of choices of monitors, hard drives, RAM sizes and peripherals.

But if you're still not convinced, go to a Compaq dealer and compare what's there to what's here.

You make the call, then we make the computer.

And because we actually manufacture the desktop computers we sell, each one is custom configured to your exact specifications when you order.

Then we run a configured systems check, and ship it to you via two-day air standard. With a 30-day money back guarantee and a one-year limited warranty.

Support that wins awards, and you confidence.

The Dell service and support package has won 8 PC Week Corporate Satisfaction Polls for PCs, laptops and servers an unprecedented 8 times. Maybe because the company that supports Dell computers is the same one that designs Dell computers.

Which means you get a technical support staff that can solve 90% of all problems over the phone. Usually in 6 minutes or less. You also get an electronic bulletin board that lets you see other users' questions about Dell systems. And more importantly, Dell's answers.
Compaq has a peculiar proposition for you. They want you to pay up to $12,500 more for a server that's similarly configured to Dell's. That's bad enough in normal times, but with the tight budgets these days it's ridiculous.

The New Dell Drive Array gives performance a boost. With Dell Drive Array, we've overcome the two big problems that plague most servers:

- Slow disk subsystem performance, and the difficulty of ensuring data integrity.

Let's tackle slow performance first: The Dell Drive Array is based on the Intel® 80960 RISC processor. And, depending on the application, can deliver twice the storage I/O performance of a stand-alone ESDI drive.

Allowing more users to access the server more quickly for greater productivity.

As for ensuring data integrity, the Dell Drive Array uses parity checking techniques. So a single disk can guard all the data on up to 4 other disks.

What's more, the Dell Drive Array uses a standard high performance SCSI software interface. Instead of Compaq's proprietary interface. So you get high performance using industry standard device drivers, in just about every operating environment.

TO ORDER, CALL 800-444-1470
FOR FASTER PROCESSING PLEASE REFERENCE #111
HOURS: 7 AM-9 PM M-F, 8 AM-4 PM GT SAT
IN CANADA CALL 800-387-5752

$15,099
LEASE*: $572/MONTH**
THE DELL® 433TE, 33 MHz i486™ SERVER
VGA COLOR PLUS MONITOR, 1 ARRAY OF 5 200 MB HARD DRIVES, 8 MB OF RAM, 128 KB CACHE

THE DELL® 433TE 33 MHz i486 EISA SYSTEM
AND THE DELL 425TE 25 MHz i486 EISA SYSTEM.

STANDARD FEATURES:
- i486 microprocessor running at 33 MHz (433TE) or 25 MHz (425TE) with 8 KB internal cache.
- 128 KB external cache (433TE).
- Standard 4 MB of RAM expandable to 64 MB (eight internal SIMM sockets each accepting a 1 MB, 2 MB, 4 MB or 8 MB SIMM, installable in matched pairs).
- Socket for WEITEK 4167 math coprocessor.
- 11 internal half-height drive bays.
- Eight 32-bit EISA expansion slots (six EISA master slots and two EISA slave slots).
- High-performance IDE (80 MB, 100 MB, 130 MB and 330 MB) ESDI or SCSI (330 MB, 650 MB) hard disk drives.
- SmartAx™ Advanced Systems Diagnostic Display.
- 12-month On-Site Service Contract.

VGA Color Plus System with Array of 5 200 MB hard drives
433TE, 8 MB RAM* 33 MHz: $15,099
425TE, 8 MB RAM* 25 MHz: $13,199
And because Dell is an AT&T UNIX source code licensee and validates compatibility under Novell and Banyan, you can be sure your Dell technician knows quite a bit about networking too.

But on those rare occasions we can't solve it over the phone, a trained service technician will be sent to your office with a solution in hand. Usually by the next business day.

Dell has even pioneered a new 24-hour, toll-free TechFax line which automatically faxes you detailed information about your Dell System from the Dell technical library.

And all this coverage, including a full year of on-site service comes at no additional cost to you. Pretty good for a service and support package that won the PC Week Corporate Satisfaction Poll an unprecedented 8 times.

There's a lot more to know when you buy a server. From the first moment you call Dell, and for as long as you own your system, we'll work with you and answer any questions—from service and technical issues to the wide variety of credit, lease or lease-to-buy plans available.

If you've got the money, Compaq's machine will do just fine. But if you're looking for a server that will soup-up your network without blowing your budget, call Dell.

Unless, of course, you like being overcharged and underserviced.
Introducing The ALR POWERPRO

With the POWERPRO's advanced modular system architecture, the choices you make today won't limit your options tomorrow.

Strapping two traditional PCs together won't give you the dual processing power you need to keep pace with today's growing networks and multiuser environments, but the new ALR® POWERPRO will. It's the affordable, high-performance alternative to the COMPAQ® SYSTEMPRO™.

Whether you need a system for single or multiple users, CAD/CAM, office automation, manufacturing management systems, shared databases or a host of other applications, there's a POWERPRO that delivers. Choose between one or two 33-MHZ i486 processors and up to 1-MB of cache for performance ranging from 14.7 to 40 VAX™ MIPS. Single CPU models can be quickly and easily upgraded to dual processing.

Additionally, all models will be able to accommodate future, faster processors. With 49-MBs of possible RAM, twelve expansion slots, and accommodations for up to 2.5-GB of internal storage (up to 10-GB of total storage utilizing an external ALR expansion chassis), the POWERPRO has the expandability needed to keep pace with your future needs. The POWERPRO also incorporates a 32-bit EISA bus, so you'll have maximum compatibility with cutting-edge enhancement products while enjoying the affordability of today's low-cost "AT" compatible hardware.

SUPERIOR CACHE
The POWERPRO uses ALR's proprietary
Single or Dual Processing Performance with Prices Starting at $7495

PROCACHE scalable cache memory architecture. This mainframe-like read-and-write-back design is more efficient than the standard write-through architecture found on the SYSTEMPRO.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>ALR</th>
<th>ALR</th>
<th>Compaq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model Name</td>
<td>POWERPRO 486/33</td>
<td>POWERPRO 486/33</td>
<td>SYSTEMPRO</td>
</tr>
<tr>
<td>VM</td>
<td>64</td>
<td>512</td>
<td>486/33</td>
</tr>
<tr>
<td>CPU</td>
<td>Single 33-MHz i486</td>
<td>Single 33-MHz i486</td>
<td>Single 33-MHz i486</td>
</tr>
<tr>
<td># of Processors</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Bus Architecture</td>
<td>32-bit EISA</td>
<td>32-bit EISA</td>
<td>32-bit EISA</td>
</tr>
<tr>
<td>Memory Cache</td>
<td>64-KB</td>
<td>512-KB</td>
<td>512-KB</td>
</tr>
<tr>
<td>RAM Std.</td>
<td>5-MB</td>
<td>17-MB</td>
<td>8-MB</td>
</tr>
<tr>
<td>Hard Drive</td>
<td>none</td>
<td>440-MB &lt;18ms</td>
<td>240-MB &lt;19ms</td>
</tr>
<tr>
<td>Expansion Slots</td>
<td>12</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Price</td>
<td>$7,495</td>
<td>$14,495</td>
<td>$20,995</td>
</tr>
</tbody>
</table>

More importantly, this scalable architecture allows you to equip the POWERPRO with up to 1-MB of cache.

ADVANCED DISK PERFORMANCE AND SECURITY

Yet the POWERPRO’s performance edge doesn’t stop there. Selected models use ALR’s SCSI SDA (Software Disk Array) to provide the capabilities of hardware disk arrays — including striping, spanning and mirroring — with greater flexibility and higher performance. ALR’s SDA protects your data while helping to eliminate hard disk bottlenecks.

OFF THE SHELF COMPATIBILITY

The SYSTEMPRO-compatible ALR POWERPRO runs off the shelf dual-processing versions of SCO® UNIX™ with SCO MPX as well as Banyan® Vines™ SMP. And it’s positioned for use with future dual-processing versions of Novell® NetWare™, OS/2™ and LAN Manager 2.0™.

Only ALR can deliver a dual-processing system that’s more powerful than the COMPAQ SYSTEMPRO for a price that’s up to 30% less.

For more information call ALR now;

1-800-BUY-POWR

ALR

Advanced Logic Research, Inc.
9401 Jeronimo Irvine, CA 92718
(714) 581-6770 FAX: (714) 581-9240
Available at these selected resellers: ALR PowerPartner Resellers

Prices based on U.S. Dollars. Prices and configurations subject to change without notice — please verify competitive prices with manufacturer. System shown with optional monitor. ALR is a registered trademark of Advanced Logic Research, Inc. All other listed and product names are trademarks or registered trademarks of their respective owners. ©1990 by Advanced Logic Research, Inc.
FIRST IMPRESSIONS
A PC and 1-2-3 in the Palm of Your Hand
PAGE 44

29 MICROBYTES
Adobe's new font technology will give users more control over text.

48 FIRST IMPRESSIONS
Apple Introduces Low-Cost Laser Quality with Style
A new dual low end for Apple printers.

126 Future Documents
Combine Windows text, graphics, voice, and more.

137 Desktop Prototyping
New technologies make CAD drawings into solid models— from PCs!

145 Data Acquisition: PCs on the Bench
Data acquisition on powerful personal computers and workstations.

150 MANAGING GIGABYTES
Introduction

153 The Data Swamp
Together, hardware and software developments are making it easier to handle massive amounts of data.

157 Browsing Through Terabytes
Wide-area information servers can distill vast archives of data.

169 Prioritizing Information
Grace Hopper speaks out on the value of data and various criteria you can use to help determine that value.

177 Through a Lens Smartly
Information Lens can simplify electronic communications.

191 From Pyramids to Peers
Data management applications strengthen the integrity of network data.

201 Giga-Storage
A variety of storage technologies exist, and conflicting considerations are involved in choosing among them.

213 Resource Guide: Massive Mass Storage
Jukebox manufacturers serve up gigabytes of storage.
216 REVIEWS
PRODUCT FOCUS
486 EISA: Born to Blaze
These 33-MHz 486 EISA systems are the fastest machines we've seen.

238 REVIEWS
X Terminals for Workstation Power at PC Prices
Seamless Unix and X Window networking.

249 REVIEWS
"Smart" UPSes Alert LANs to Power Problems
New LAN-based UPSes prevent damage.

257 REVIEWS
QEMM-386 and 386Max Square Off Under Windows
Contenders for the extended memory of Windows users.

263 REVIEWS
When Less Is More: Making Mac Images More Manageable
Storm Technology debuts an effective image-compression duo.

266 REVIEWS
High-Quality Image Editing Develops on the PC
Image-editing software turns PCs into electronic darkrooms.

271 REVIEWS
The MultiScope Debuggers Make Debugging Easier
The MultiScope Debuggers for DOS provide GUI power.

277 REVIEWS
Extend Your Printer's Reach Without a LAN
A trio of printer sharers that maximize your investment.

287 REVIEWS
Color Printing, Diconix Style: Vibrant but Slow
Kodak's new ink-jet printer graces business documents.

292 REVIEWS
REVIEWER'S NOTEBOOK
Create documents that your workstation application doesn't provide.

HANDS ON

297 HANDS ON
UNDER THE HOOD
All about packet drivers.

309 HANDS ON
SOME ASSEMBLY REQUIRED
Networkwide interprocess communications.

341 HANDS ON
ASK BYTE
External floppy disk drives, phones, and computing for the handicapped.

318 HANDS ON
THE UNIX /bin
Stars of the Show on the Mac
by David Fiedler
A visit to UniForum.

324 NETWORKS
The AIX Alternative
Choosing a Unix-based architecture.

328 NETWORKS
BEYOND DOS:
Windows Tips and Tricks
by Mark J. Minasi
Answers to some frequently asked Windows 3.0 questions.

334 MACINATIONS
Professional 3-D Graphics on the Mac
by Don Crabb
Don finds a graphics oasis.
# 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 374), you can identify articles by type, subject, title, author, or product discussed.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>INSIDE BYTE</td>
<td>286, 68, 111, 201, 249</td>
</tr>
<tr>
<td>MAC</td>
<td>48, 62, 68, 93, 111, 238, 263</td>
</tr>
<tr>
<td>MEMORY MANAGEMENT</td>
<td>68, 257, 328</td>
</tr>
<tr>
<td>NETWORKS/NETWORKING</td>
<td>54, 68, 93, 111, 121, 126, 153, 157, 177, 191, 216, 238, 249, 309, 324, 334, 388</td>
</tr>
<tr>
<td>OBJECT-ORIENTED PROGRAMMING</td>
<td>56, 59, 126</td>
</tr>
<tr>
<td>OS/2</td>
<td>68, 324, 328</td>
</tr>
<tr>
<td>PRINTERS/PRINTING</td>
<td>48, 56, 68, 93, 121, 126, 277, 287, 328</td>
</tr>
<tr>
<td>SPARC</td>
<td>18, 216, 292</td>
</tr>
<tr>
<td>SPREADSHEETS</td>
<td>56, 68, 126, 153, 318</td>
</tr>
<tr>
<td>SYSTEMS</td>
<td>54, 93, 216, 238</td>
</tr>
<tr>
<td>TIGA</td>
<td>54, 266</td>
</tr>
<tr>
<td>UNIX</td>
<td>68, 111, 137, 216, 238, 292, 318, 324</td>
</tr>
<tr>
<td>WINDOWS</td>
<td>18, 68, 126, 177, 238, 257, 318, 328</td>
</tr>
<tr>
<td>WORD PROCESSING</td>
<td>126, 153, 328</td>
</tr>
<tr>
<td>X/X WINDOWS</td>
<td>238, 292</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Authors</th>
<th>Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alford, Roger C.</td>
<td>277</td>
</tr>
<tr>
<td>Andrews, David</td>
<td>44, 54, 68</td>
</tr>
<tr>
<td>Apki, Steve</td>
<td>216</td>
</tr>
<tr>
<td>Baran, Nicholas</td>
<td>145</td>
</tr>
<tr>
<td>Barker, D.</td>
<td>29</td>
</tr>
<tr>
<td>Barron, Janet J.</td>
<td>169</td>
</tr>
<tr>
<td>Cook, Rick</td>
<td>29</td>
</tr>
<tr>
<td>Crab, Don</td>
<td>121, 334</td>
</tr>
<tr>
<td>Diehl, Stanford</td>
<td>216</td>
</tr>
<tr>
<td>Fiedler, David</td>
<td>318</td>
</tr>
<tr>
<td>Fisher, Sharon</td>
<td>297</td>
</tr>
<tr>
<td>Glass, Brent</td>
<td>257</td>
</tr>
<tr>
<td>Grehan, Rick</td>
<td>249</td>
</tr>
<tr>
<td>Heller, Martin</td>
<td>126</td>
</tr>
<tr>
<td>Hopper, Grace</td>
<td>169</td>
</tr>
<tr>
<td>Joch, Alan</td>
<td>287</td>
</tr>
<tr>
<td>Kearns, Steven</td>
<td>271</td>
</tr>
<tr>
<td>Kenner, Hugh</td>
<td>386</td>
</tr>
<tr>
<td>Langa, Fred</td>
<td>10, 121</td>
</tr>
<tr>
<td>Lent, Anne Fischer</td>
<td>54</td>
</tr>
<tr>
<td>Linderholm, Owen</td>
<td>29, 48, 121</td>
</tr>
<tr>
<td>Loeb, Larry</td>
<td>29, 121</td>
</tr>
<tr>
<td>Loveria, Greg</td>
<td>266</td>
</tr>
<tr>
<td>Mallett, Mark</td>
<td>309</td>
</tr>
<tr>
<td>Malloy, Rich</td>
<td>54</td>
</tr>
<tr>
<td>Miastkowski, Stan</td>
<td>54, 121</td>
</tr>
<tr>
<td>Minasi, Mark J.</td>
<td>328</td>
</tr>
<tr>
<td>Nance, Barry</td>
<td>324</td>
</tr>
<tr>
<td>Peters, Richard A.</td>
<td>201</td>
</tr>
<tr>
<td>Pournelle, Jerry</td>
<td>93, 121</td>
</tr>
<tr>
<td>Rash, Wayne Jr.</td>
<td>111, 121</td>
</tr>
<tr>
<td>Reinhardt, Andrew</td>
<td>29, 44</td>
</tr>
<tr>
<td>Robinson, Mike</td>
<td>177</td>
</tr>
<tr>
<td>Romkey, John</td>
<td>297</td>
</tr>
<tr>
<td>Ryan, Bob</td>
<td>153, 213</td>
</tr>
<tr>
<td>Sheldon, Ken</td>
<td>121, 388</td>
</tr>
<tr>
<td>Smith, Ben</td>
<td>121</td>
</tr>
<tr>
<td>Stein, Richard Marion</td>
<td>157</td>
</tr>
<tr>
<td>Swartz, Carol</td>
<td>68</td>
</tr>
<tr>
<td>Tazelaar, Jane Morrill</td>
<td>150</td>
</tr>
<tr>
<td>Thompson, Tom</td>
<td>54, 121</td>
</tr>
<tr>
<td>Toperczer, Tom</td>
<td>191</td>
</tr>
<tr>
<td>Ullman, Ellen</td>
<td>29</td>
</tr>
<tr>
<td>Udell, Jon</td>
<td>121</td>
</tr>
<tr>
<td>Vaughan-Nichols, Steven J.</td>
<td>263</td>
</tr>
<tr>
<td>Wayner, Peter</td>
<td>121</td>
</tr>
<tr>
<td>Wilcox, Grant</td>
<td>205</td>
</tr>
<tr>
<td>Wood, Lamont</td>
<td>137</td>
</tr>
<tr>
<td>Yager, Tom</td>
<td>238, 292</td>
</tr>
</tbody>
</table>
Tri-Star Computer continues to outdistance the pack as America's preferred supplier of high-end 486 Workstations. Read the reviews and you will understand why Tri-Star is the undisputed 486 champ.

"Tri-Star is king of the 33MHz 486 Mountain." PC WEEK Analyst's Choice, February 18, 1991

"Tri-Star's 486/25 rates honorable mention for its thoughtful design touches, two year warranty and excellent service program." PC Magazine Editor's Choice Honorable Mention, September 11, 1990

"Tri-Star's edge is its good documentation and excellent service policy." PC Sources 486/33 Lead Review, February 1991

**Flash Cache 486 Computers**

**Features Include:**
- Intel 80486 Processor
- 8MB RAM (Expandable to 64MB On Board)
- 64K High Speed Static RAM Cache
- 210MB 15ms Hard Disk Drive
- 1.2MB 5.25-inch Floppy Drive
- 1.44MB 3.5-inch Floppy Drive
- 1024 x 768 SVGA Adapter w/ 1MB RAM
- 14" Non-interlaced SVGA Color Display
- Microsoft DOS 4.01 & Windows 3.0
- High Res 400 DPI Three Button Mouse
- Quality 101-Key Tactile Keyboard
- Two Serial Ports and 1 Parallel Port
- Fully DOS, UNIX & Novell Compatible

**Circle 321 on Inquiry Card.**

**FC4251**
$3895

**FC4331**
$4295

**Upgrades:**
- 16" Color Display $695
- 20" Color Display $1695
- Flash Cache 33MHz 386 as above with 4MB RAM & 125MB Hard Drive —Only $2695
Dear Bianca:

I'm pleased to inform you that we've greatly increased the margins on the authentic native idols we are importing from Borneo. This is due to certain cost efficiencies we have been able to bring to the new manufacturing process. A softer, less expensive wood imported from Thailand allows the native carvers to work faster and more effectively. We have obtained colored feathers from a firm in Mexico, as well as glass eyes from a prosthetics company in Philadelphia. We are shipping all the parts to L.A. for final

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>CPU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guatemalan cushions</td>
<td>7.50</td>
</tr>
<tr>
<td>Embroidered cushions</td>
<td>13.50</td>
</tr>
<tr>
<td>Pottery necklaces</td>
<td>2.80</td>
</tr>
<tr>
<td>Gourd bags</td>
<td>18.00</td>
</tr>
<tr>
<td>Fire Irons</td>
<td>250.00</td>
</tr>
<tr>
<td>Retablos</td>
<td>120.00</td>
</tr>
</tbody>
</table>
The Microsoft Windows graphical environment version 3.0 makes it easy for you to do a lot more with your PC. That’s because the Windows environment has friendly icons, menus and dialog boxes that make its powerful features very accessible.

Windows lets you work with a variety of applications on-screen at the same time. Including your character-based programs.

But it’s when you start using Windows applications that you get the most out of your PC. Windows applications are easy. In addition they all work essentially the same way. So once you learn how to use one, you generally know how to use them all.

And they’re so intuitive that experimenting with them is fun. Windows applications let you cut and paste text and graphics. And let you combine them right on your screen. They also let you print out exactly what you see.

You can even establish links between Windows applications. Which means, if you change any numbers in Microsoft Excel for Windows, the chart you cut and pasted into your Microsoft Word for Windows document will be automatically updated.

So call us at (800) 541-1261, Department P31, to find out more about Windows, Windows applications or the big Windows World Convention and Exposition coming up May 20th and 23rd in Atlanta.

Because with Windows, you can start taking the work you do every day a little easier.

And have more to show for it.

Microsoft
Making it all make sense
CeBIT '91

CeBIT at Germany's Hannover Fair is huge, easily the world's largest computer trade show. When CeBIT opened in mid-March, the organizers expected 580,000 attendees. However, war jitters reduced the count to a "mere" 400,000, about four times the size of Fall Comdex, North America's largest computer exhibition. The Fair is virtually a city unto itself: large enough to have its own rail stops, heliport, post office, pharmacy, florist, restaurants, police station... The Fair's logo is the head of Mercury (god of communication), with his mouth wide open. I assume the designers meant him to look as if he was heralding news, but after days of pounding CeBIT's endless aisles, BYTE staffers decided he was screaming because his feet hurt.

Here's a quick summary of some of the most interesting items we saw.

Kyocera's Refalo
Kyocera has been a behind-the-scenes player in portable computing ever since it built the Model 100 for Tandy. Now, Kyocera is rolling out a complete line of PCs under its own nameplate, including a fascinating pen-based notebook computer.

Refalo is an ultraminiaturized PC compatible running DOS 3.2 at 9.5 MHz: the circuitry is built into the covers of a very compact loose-leaf six-ring binder. You can use Refalo as either an electronic notebook or a traditional paper-based notebook.

When you open Refalo, the inside left cover contains a 240- by 320-pixel screen, which is both an input and output device. You can write on the screen, storing your notes either as bit maps or as standard ASCII characters processed via built-in character-recognition software.

The character-recognition software works best on numeric data—phone numbers and the like. Text entry is possible, but it's faster and more reliable to tap it in via a membrane keypad on an electronic "leaf": a rigid touchpad tablet. The leaf is six-hole punched, and it's about as thick as 15 sheets of paper; it clips into the loose-leaf binder rings. The leaf communicates with the CPU using electromagnetic inductance through the metal binder rings—there are no wires.

The notebook can operate for up to 4 hours on either a built-in rechargeable battery or three ordinary, replaceable AAA dry cells.

Refalo comes with the standard megabyte of PC RAM, although the suite of always-available, built-in programs (e.g., schedule, memo, phone list, and telecommunications) eats up some user memory. The off-the-shelf configuration leaves you about 256K bytes to run standard DOS programs, which can be loaded through the serial port or, more conveniently, through two JEIDA-standard IC cards. You can also use the IC card slots to boost memory up to an amazing 16 MB. (EMS 4.0 support is built in.)

Refalo has been selling for several months in Japan. It will be sold this summer in Europe, and although plans for sales in the U.S. are not yet firm, Kyocera is working on it. Stay tuned.

Siemens-Nixdorf
At the other end of the spectrum, Siemens-Nixdorf International (SNI is Germany's largest computer company) announced a 105-million-instruction-per-second, 36-gigabyte multiprocessor Unix box that uses up to seven i486 CPUs: It's as big as a full-size refrigerator.

SNI also showed us a new version of ComfoWare, a complete suite of network-based Windows 3.0 applications that offers an attractive and easy way to get an office up and running on Windows. SNI has opened offices in North America and plans to reach out beyond its home turf. It's a company worth watching.

And More
Amstrad broke its low-end mold with a 20-MHz SX color laptop that will sell for about $8000 and is due out later this summer. NEC and Canon broke their "printers are us" molds, the former with a new line of PCs under its own nameplate, including a fascinating pen-based notebook computer.

East Coast Software, a tiny Irish company, tried to break out of its start-up mold with powerful file transfer software, including a new version of Trax, which is like PC-Anywhere on steroids. CSA Interprint, an Israeli company, broke the antiviral mold with new V-Care software that claims to be the "world's first generic all-virus protection."

Well, you get the idea. We'll be featuring the best of CeBIT products in future issues of BYTE. It was a great show—despite my sore feet.

—Fred Langa
Editor in Chief
(BIX name "flanga")
Make Powerful Connections with Borland’s New Paradox

By any standard, Paradox® is the most powerful database. That’s why it’s been rated #1 by every leading computer publication, and why hundreds of thousands of users worldwide have switched to Paradox.

Now there’s another reason to switch to Paradox—it connects.

Now Ready to Connect with SQL

With Paradox® SQL Link (sold separately), Paradox makes it easy to connect PCs to the networks and SQL servers of your choice. No programming is required. Users don’t need to learn SQL. And since LAN traffic is kept to a minimum, answers to queries are delivered FAST!

All the power and ease-of-use of Paradox now transparently connect with your SQL data, including: Query By Example, multi-table forms and reports, presentation-quality graphics and much more.

Connects with Programmers

Paradox includes a full development language (PAL*) for building complete database applications. And now, with Paradox SQL Link, programmers can integrate SQL statements into PAL programs, use SQL table cursors, trap server error codes, and tap the unique capabilities of different database servers.

Connects with the Full Power of Your PC

Paradox 3.5 incorporates VROOMM™ and Turbo Drive.™ These proprietary Borland technologies let Paradox automatically optimize your computer’s use of available memory, and access up to 16Mb of RAM on 286/386/486* PCs. The result is lightning-fast database performance on any PC.

dBASE Owners!

Step Up for Only $17500

At $795, Paradox is the best database value around. And to introduce its power and speed to dBASE® users, we’re making an outrageous offer: If you own any version of dBASE, we’ll sell you Paradox 3.5 for only $17500. (Does not include Paradox SQL Link, sold separately.) If Paradox will read and write dBASE files for easy integration into your existing environment.

Upgrade to Paradox 3.5 Now.

See your dealer or call 1-800-331-0877

BORLAND

Makers of Paradox®, Quattro® Pro, Turbo C++, Turbo Pascal® and Sidekick®

*Paradox SQL Link ($495 suggested retail) is an add-on product for Paradox 3.5 and is required to make the connection with SQL servers. **Microsoft, 8088, 8086 and DEC RDBMS servers supported now. Offer also good for owners of any version of RBASE or Tandem. Proof of ownership to page from the manual is required. Satisfaction guaranteed or your money back. Upgrade offer expires May 31, 1991. Upgrade pricing valid in U.S. and Canada only. Mail orders to: Borland International, Inc., P.O. Box 660001, Scotts Valley, CA 95067-0001. Add $10.00 for shipping and handling. Residents in CA, CT, IL, MA, OR, WA, NY, NH, PA, TX, VA and WA, please add appropriate sales tax. For orders outside the U.S., call (408) 438-5300. 386 and 486 are trademarks of Intel Corporation. Copyright ©1991 Borland. All rights reserved

Circle 48 on Inquiry Card (RESELLERS: 49).
The IEF™ can help you develop unprecedented quality, productivity.

"The IEF is a superior tool for implementing Information Engineering because it integrates the entire process from planning through code generation. We're deploying the IEF throughout the corporation."
David V. Evans
Vice President
Director, Information Systems
J.C. Penney

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

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

"The strengths of the IEF are clear-cut. One obvious quality advantage is that application changes are made to diagrams, not code. This ensures ongoing integrity—the specification always matches the executing system."
Paul R. Hessinger
Chief Technology Officer
Computer Task Group

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

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

"We are using the IEF to develop a new generation of manufacturing systems replacing over 300 existing systems. We estimate that IEF will increase our productivity by between 2-to-1 and 3-to-1 for new systems development..."
Wal Budzynski
Head of Operations, Systems/Computing
Rolls-Royce

"We used the IEF to rebuild our aging Frequent Flight Bonus system. With DB2 tables of up to 52 million rows, we needed high performance. And we got it...98% of our transactions complete in less than 3 seconds."
Cloene Goldsborough
Director of Data Resource Management
TWA

"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)
develop information systems with activity and maintainability.

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

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

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

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

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

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, including a VHS video demo, call 800-527-3500 or 214-575-4404.

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

© 1990 TI
Information Engineering Facility and IEF are trademarks of Texas Instruments. Other product names listed are the trademarks of the companies indicated.
If you want the ultimate VGA graphics standard, and you’ve resigned yourself to paying a premium of hundreds of dollars to get it, you’ll find our newest monitor pleasant viewing indeed.

The PanaSync C1381 gives you a sharp 1024 x 768 pixels, with 0.28 dot pitch. And virtually infinite color resolution. It’s compatible with the most popular VGA boards, as well as analog RGB, MCGA, SuperVGA, and — of course — 8514/A standards.*

It’s comfortable in virtually any IBM-compatible or Mac II environment.**

And it’s a masterpiece of ergonomics. With front-mounted controls, tilt/swivel stand, plus a non-glare tinted blackmatrix screen.

All this at a suggested retail price comparable to many of the ordinary VGA monitors on the market right now. For more information, simply call toll-free 1-800-742-8086.

Panasonic Office Automation

* VGA, MCGA and 8514/A are trademarks of International Business Machines Corp.
** IBM XT, AT and PS/2 are registered trademarks of International Business Machines Corp. Macintosh is a registered trademark of Apple Computer Inc. An optional cable is required for Macintosh.
The IBM RISC System/
The power you've been seeking

It's a never-ending quest for power seekers. You're always looking for ways to run your favorite applications faster. Well, search no more. The RISC System/6000™ family of POWERstations and POWERservers gives you power that soars as high as 23 MFLOPS.

<table>
<thead>
<tr>
<th></th>
<th>MFLOPS</th>
<th>MIPS</th>
<th>SPECmark™</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWERstation 320</td>
<td>8.5</td>
<td>29.5</td>
<td>24.6</td>
</tr>
<tr>
<td>DECstation 5000-200</td>
<td>3.7</td>
<td>24.2</td>
<td>18.5</td>
</tr>
</tbody>
</table>

When it comes to porting, your ship has come in. Of course, all the speed in the world wouldn't mean much without the applications you need. So the RISC System/6000 family already has more than 2,500 of the most popular technical and commercial applications up, running and running fast. And if you think you know a good thing when you see it, so do software vendors. That's why you'll also be seeing more and more applications coming on board the RISC System/6000 platform all the time. And if you like to build your own solutions, there's a full arsenal of enablers and relational databases from leading vendors, as well as CASE tools and a host of popular programming languages.

A smorgasbord of solutions. Applications already announced include the IBM engineering design packages CADAM™, CAEDS™, CBDS™,
CATIA" and AES. Also available are a broad spectrum of solutions from vendors like Valid Logic, MacNeal Schwendler, Swanson Analysis, SAS Institute, SPSS, Wavefront, Alias, Polygen, Cadence, Fluid Dynamics International, Western Atlas, ECL Petro and create.x. Scientific and technical applications are available in areas like physics, structural analysis, chemistry, securities trading, mathematics, earth resources, operations research, visualization, graphics, technical publishing and more. There's also accounting software like FourGen and support for leading UNIX®-based office automation packages. And there are key industry applications for businesses in medical groups, retail stores, newspapers, pharmacies and many more.

Command enormous processing clout.
The RISC System/6000 family is built to boost the performance of the software power seekers use most. It's got the best floating point processor in the business for numerically intensive applications, plus a new superscalar processor and incredible 3D graphics capabilities.
To find out more, call your IBM marketing representative or IBM Business Partner. For literature, call 1 800 IBM-6676, ext. 990.

For the Power Seeker.

Circle 153 on Inquiry Card.
Power Insurance

Wayne Rash Jr.'s column in January ("The Power Man Cometh") failed to mention the most compelling reason for using an uninterruptible power supply (UPS).

Using high-quality surge suppressors to protect computer equipment is an accepted standard. However, transients, wave-shape disturbances, dips, sags, and brownouts can pass through even the best surge suppressors. In fact, the incidence of these types of disturbances is increasing as more and more utilities tie into ever-larger networks or grids.

In our experience, the use of a high-quality UPS reduces hardware failures by about 50 percent. To us, the ability to ride out power interruptions is merely a side benefit. During a complete outage, power is interrupted (and restored) in the middle of a cycle, again jolting power supplies and potentially weakening the power supply or other components. Some computer and UPS manufacturers design their systems to switch on or off when the alternating current is between states. In this way, no stress is felt by the equipment.

Although we can expect computer equipment to become more reliable and better able to tolerate power disturbances, we can also anticipate that the quality of utility power will continue to degrade. To operate efficiently, utilities will probably become even more interconnected. Furthermore, increasing economic pressures will probably increase the number of power sales, causing more interruptions and disturbances.

The point is that a UPS not only enables a computer to make the "soft landing" described by Wayne Rash, it also protects equipment from any small disturbances that can, over time, weaken components and cause actual failures.

Charles Smith III
Mid-Illinois Data Services, Inc.
Mattoon, IL

386 Comparisons

I thoroughly enjoyed Fred Langa's January editorial, "The End of Intel's Monopoly?" However, I think that some unfair comparisons were made regarding Intel's new i386SL chip.

Langa points out that AMD's Am386 draws only 1 milliamp of current in sleep mode versus 60 mA for Intel's i386SL. What he fails to mention is that the i386SL is far more than just another 386. Intel's new chip contains a clock, a cache, and bus and memory controllers all built around a 386 core. Intel calls it a "microprocessor superset." With the i386SL (and some related support chips), it is possible to implement a complete AT using just 10 components plus memory. AMD's Am386 will certainly require more support chips than the i386SL—quickly nullifying any power consumption advantages it may seem to have. Langa makes another statement I must take issue with. He says that "some 486 instructions execute in fewer clock cycles, but most common instructions run about the same as on a 386." On the contrary, the common instructions have been sped up significantly on the i486 over its 386 counterpart. Overall, in a "typical" instruction mix, the i486 is twice as fast as a 386 when they are operating at identical clock speeds.

Chris A. Kantack
Bellingham, WA

Evolving Networks

I enjoyed "NetWare Troubles" by Barry Nance in January, and I think the article will be very helpful to many NetWare users.

Nance gave the product TXD a very positive review. However, as a TXD developer, I would like to clarify one point. The article implies that TXD provides only IPX/SPX statistics. TXD will provide important adapterspecific information in what is called the "custom variables." For example, some token-ring adapters place...
We're ready right now with a 4 megabyte diskette for your 4 megabyte drive—a new product for the next generation of expanding data storage. We're ready when you are—in any size, capacity or format you need.

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

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

Innovation working for you

4 mb diskettes require compatible drives. ©3M 1991.
For Great Electronics and Computer Product Performance

Jameco's careful orchestration of product selection, quality control, customer support, and competitive pricing will make your next electronics purchase seem effortless. It will be done right, saving you time and money!

Over the past 16 years, Jameco has mastered the distribution of quality electronic components, computer products, and test and measurement equipment. That's why our market intelligence group tracks the very latest technology. Our purchasing groups buy globally for the best quality and value, thoroughly prequalifying each vendor and product against our high standards. And our in-house quality assurance group constantly tests products received into stock.

We offer the widest product selection. For example, choose from a full price/performance spectrum of computer systems, from starter to mid-range, to the most advanced computing tools available. Select from our catalog of over 4000 Jameco products.

Jameco conducts a full program of customer support: beginning with your plan to purchase and continuing
through the life of the product. We maintain telephone customer support; our technically expert staff will answer your questions and discuss your needs, before, during, or after purchase. And you can place an order 24 hours a day!

Consistent quality, wide selection, latest technology, solid customer support, and competitive prices have produced millions of satisfied Jameco customers. Most have requested an encore, joining our large family of repeat customers from big and small businesses, schools and universities, government, and individuals.

If an effortless electronic or system purchase experience sounds good to you, give us the chance to orchestrate it. Call Jameco for a complete product catalog, or visit our catalog-store/headquarters located in Belmont, CA, serving Silicon Valley and the Stanford Technology Park Area.

JAMECO
ELECTRONIC COMPONENTS
COMPUTER PRODUCTS

1355 Shoreway Rd.
Belmont, CA 94002
(415) 592-8097
FAX: (415) 592-2503

Jameco 20MHz 32KB Cache
80386SX Computer Kit
• AMI Motherboard with 32KB cache, 4MB RAM (expandable to 16MB)
• 200 Watt power supply
• 1 key keyboard  • Multi I/O Card
• 1 44MB, 3.5 floppy drive
• DOS 5.0 and QAPlus diagnostic software
$1899.95/JE3820
monitor extra

DB25 Connectors

Jameco Breadboards and
Metex Multimeters

EPROMs

Axial and Radial Capacitors

Circle 177 on Inquiry Card.
I took a personal interest in your December 1990 column "Kicking and Screaming into the Present" by Mark L. Van Name and Bill Catchings. I found it typical of the PC mentality that has surfaced in recent years.

I wholeheartedly agree with the authors' statement that DEC has been "slow." The company has made serious blunders over the past decade. However, I don't think that networking is an area in which it shows weakness. DECnet may be a proprietary networking protocol, but its roots started long before PCs ever existed. DEC has truly been a leader in the networking area. Competition from the PC marketplace has so driven these costs down that up-front hardware costs for networking solutions, PC or larger, are very comparable. And since these costs are only the tip of the iceberg when implementing PC networks, a DEC solution is looking better every day.

DEC (along with IBM, Hewlett-Packard, Sun, and others) is many years ahead of microcomputer networking developers when it comes to security, data integrity, and resource management. All of a sudden, these issues have become important to PC users.

PC networking vendors are reinventing the wheel to a certain extent. Sometimes it appears that PC groups reject any technology proposed by "mainframe" hardware vendors through fear of being forced into proprietary situations. Many people have learned computers from a microcomputer perspective that sometimes serves to limit, for them, the range of possible solutions. I'm not against PCs—they're great tools when used appropriately. Every once in a while, it would be refreshing to hear comments from a broader perspective of the computing world. When this happens, everyone benefits by seeing the "big picture."

Kevin O'Malley
Park Ridge, IL

I was pleased to read "Making the Micro-to-Mainframe Connection" by Sharon Fisher and "Don't Worry, Use HLLAPI" by Mike Fichtelman in the BYTE IBM Special Edition (Fall 1990). Here in Australia, the Australian Gas Light Co. has been investigating these topics for two years, with the following issues in mind.

With the gradual move to distributed processing and databases, personal computers will not be accepted as seriously by the custodians of the mainframe until they can exhibit comparable features in terms of security, backup, and resource monitoring.

Many companies have a large investment in System Network Architecture links back to a centralized mainframe and are reluctant to discard these hard-wired links for the sake of what appears to be a moving target (e.g., 4 megabits per second, 16 Mbps, and Fiber Distributed Data Interface). Assuming that these companies will slowly migrate to distributed LANs centrally connected to a host system, there are no products available that readily allow data transfer from a LAN on one side of the network to a LAN on the other without actively invoking a process on the mainframe. Seamless integration is unavailable.

These and other issues will become of major importance over the coming years as it is realized that the world revolves around neither the mainframe nor the LAN and that, accordingly, concessions must be given on both sides to ensure that users can get on with the job in a way that enhances their business function.

D. C. MacKinnon
AGL Information Systems Pty., Ltd.
North Sydney, Australia

Virus Verification

I just had another virus false alarm, and I thought Jerry Pournelle and his readers might want to know that not everything that goes wrong is due to a virus. Recently, I was downloading some files from a local BBS using Procomm Plus in a Desqview window while doing some editing in another DOS window. After terminating Procomm and Desqview, I couldn't access anything on my E drive. Because I had been getting a lot of files off a BBS, I immediately suspected a virus.

When I looked at the directory of the E drive using The Norton Utilities, the information there looked like some of the stuff that I'd been downloading from the BBS. Then I remembered using my editor to edit the PCPLUS.LOG file in the second window. The trouble was that Procomm was still using that log file. When I re-saved it, Procomm obviously lost the file handle.

I used Norton Disk Doctor to repair the destroyed directory, and Norton Change Directory to rename the directories back to their original names. (NDD didn't know what the root directory names were, so it renamed them DIR0000, etc. But NCD still knew what the names were, so I recorded the old NCD tree structure and used it as a map to the new DIR0000 names.)

To summarize, if you think you've contracted a virus, the first thing to do is sit back and try to remember what you were doing with the system and what you recently did to it. You may be surprised to find that it was you, and not a virus, that scrambled your machine.

Steve Nelson
Mansfield, TX

Thank you for the story, which makes a very important point. I, too, have odd things happen to my machines and can usually trace them back to something I have done. My virus protection is never to move anything from the "test" machine to anything else—a remedy, I fear, that is not available to everyone.—Jerry Pournelle

An Idea Dawns

The feature article "Genetic Algorithms" by Peter Wayner (January) turned on lights and set off bells for me. The subject of genetic algorithms is entirely new to me, but after I read the article, it occurred to me that this just might be the solution to one of my biggest programming headaches.

For a number of years now, I have been working in...
"THE MOST POWERFUL COMPUTERS ARE THE ONES PEOPLE ACTUALLY USE."

—Apple Computer
First off, let's get one thing straight. We totally agree with Apple. A truly powerful computer is measured in how often it's used.

**IF YOU LISTEN TO APPLE, THIS IS THE MOST POWERFUL COMPUTER IN THE WORLD.**

But while Apple has taken great strides in making the personal computer more useful, we've gone substantially farther.

**Introducing the T2000SX notebook computer.**

Quite simply, the T2000 SX is a more useful personal computer because it allows you to work how you want to work. When you want to work. And where you want to work.

Painstakingly engineered with you clearly in mind, the T2000SX will help you work more efficiently than ever before.

Virtually every feature you can find on a desktop computer, you will find on the T2000SX: An 80386SX processor with a math coprocessor socket, VGA compatible display, 1 MB (expandable to 9MB) of 70 nsec RAM, a 40 MB hard disk with 19 msec access time and 1.5 MB/sec data transfer rate.

Our technologically superior battery can be fully recharged in a mere ninety minutes.

The T2000SX has a 40MB hard disk with 19 msec access time.

But more important than the specs themselves, is the way the T2000SX lets you use them. Which is more often.

Our fluorescent side-lit screen provides even distribution of light. (Actual size.)

Welcome to the next generation in personal computing.

Because the T2000SX can fit easily into a briefcase (it weighs a scant 6.9 pounds), you can take it anywhere you go and use it in more ways than you can imagine.

Need to make revisions to a...
Our internal AutoResume backup battery automatically saves your work if your main battery runs out.

business proposal? The T2000SX gives you the freedom to do it from a train. The client wants an estimate on costs? You can give it to him right then and there— wherever there is.

No more wasting time running back to the office. Because the office is always with you.

But just in case there's something back at the office you still need, you can get back to it with our optional built-in modem. Which supports industry standard error correction and data compression (CCITT V.42, V.42bis, MNP* 5 and 10). It even supports cellular data communications via our optional smart cable adapter.

The T2000SX also has a unique feature you won't find on any other computer in the world. It is called AutoResume.

AutoResume: Think of it as a bookmark for your computer.

AutoResume automatically saves whatever you're working on whenever you turn the computer off. And it lets you go directly to the program you were using last when you're ready to start up again. So you don't have to reboot or restart your application and reload your files.

AutoResume also helps save on battery life and it allows you to change batteries without losing an ounce of information.

As for batteries, the T2000SX touts the latest in battery technology—Nickel Hydride. Nickel Hydride delivers 22% more watt-hours per pound than NiCad and it doesn't suffer from memory effect.

In keeping with the Toshiba tradition, the T2000SX also offers superior ergonomics. Like full-size, standard-spaced keys on a keyboard which has a full set of 12 dedicated function and 8 cursor control keys. And a VGA compatible, reversible black on white or white on black high resolution display.

The T2000SX comes complete with Hypertext on-line documentation.

Okay, let's wrap this thing up.

These are just a few of the reasons why we believe the T2000SX is the most useful, and therefore, most powerful computer in the world. And why PC Week Labs said, "the T2000SX offers performance comparable to the LITE 386s/20, plus many of the design features that have made Toshiba a market leader in portable PCs."

If you'd like to learn more about the T2000SX or any of our other portable computers, call us at 1-800-457-7777.

In closing, we'd like to thank you for reading our ad.

We'd also like to thank our friends at Apple for giving us such a wonderful endorsement.

In Touch with Tomorrow.
LETTERS

I am trying to apply statistics of past outcomes to predict the suit of a group of random numbers within a defined subset of integers. I haven’t had much success up to now. I have been trying to apply statistics of past outcomes to predict the future. Wild guessing gives me about the same degree of success. Genetic algorithms seem to have some promise.

I would like to add that I think yours is the best computer magazine on the market.

Fred Hirschfelder
Aubagne, France

Flex Appeal

I just read Ben Smith’s informative feature article “FlexOS’s Muscle” (January). I couldn’t believe what I was reading. Here is an operating system for the PC that is surprisingly similar to the one I use all day long.

I live in the VAX/VMS world and make frequent trips to the PC environment. The similarities between the VMS operating system and FlexOS are heartwarming.

VMS can protect files by allowing or disallowing read, write, execute, and delete privileges to the following user classes: owner, group, world, and system. This is similar to FlexOS. VMS can spawn and create attached processes similar to FlexOS’s spawned concurrent and subroutine processes. Spawned processes that retain their parents’ ID is another feature that VMS and FlexOS have in common. In addition, many of FlexOS’s supervisor class are very similar to VMS’s Digital Command Language commands. VMS makes extensive use of logicals using the Define or Assign statements, as does FlexOS’s Define supervisor call.

For an operating system on a PC to be this similar to a mainframe takes a major step toward blurring the difference between the PC and the mainframe.

Norman G. Coder
Sulphur Springs Valley Electric Cooperative, Inc.
Willcox, AZ

Award Caveat

Your award in January to Digital Research for DR DOS 5.0 is not totally justified. I bought DR DOS 5.0 with the sole purpose of relocating most of my TSR programs in the upper memory of my AT clone, fitted with 2 megabytes of expanded memory. That did not work. A series of faxes to the company resulted in an explanation: My AT is not fitted with a Neat or Leap chip set. That caveat is not mentioned in Digital Research literature and flyers.

About Quattro Pro, you should know that it does not allow the retrieval of read-only files. Lotus does it. Would you call that a bug or just an oversight? Besides that, Quattro Pro is supplied in the U.S. and Europe with Bitstream fonts that are restricted to the first 128 ASCII characters—that is, without any accented letters. That makes them almost useless in Europe.

Emmanuel de Broux
Leignon, Belgium

Mac Connectivity

As an MIS manager, I find all the current hoopla over Windows 3.0 and OS/2 Presentation Manager very puzzling. The experience of my organization has been that the Mac offers far greater connectivity to more environments than any other platform. We work in the Windows, Macintosh, and OS/2 PM environments. I spend half my time with a group of about 25 people now using Windows 3.0 on IBM PS/2 70s with 5 megabytes of RAM who were previously straight DOS users. We also have two PS/2 70s running OS/2 1.2.

The rest of the time, I work with about 35 people using 15 Mac SEs, 15 Mac IIcxs, 2 Mac Iicis, and 3 Mac IIs. The Mac II family machines are equipped with 4 MB of RAM and the SEs with 2.5 MB.

In the DOS-Windows-OS/2 group, we spend a lot of time poring over manuals, trying to kludge together installations and struggling with the underlying DOS. Users still wind up dealing with weird and wonderful filename restrictions and utilities with instructions like “Always exit Windows before running CHKDSK with the /F option, never run CHKDSK from within Windows, loss of data may result.” Or this statement: “Run disk compaction utilities directly from MS-DOS, after exiting Windows; damage to the files on your hard disk might result.” Can you appreciate how counterproductive this all is?

In the Mac group, we simply discuss the work at hand. Rarely do we talk about or worry over computer installations or support. We need our workstations to help us do our work, not to be technical toys for people to tinker with endlessly.

Robert Corley
Mississauga, Ontario, Canada

Recycling Software

Bad Cox missed the mark in “There Is a Silver Bullet” (October 1990). Most software professionals agree with Cox that reuse is the key to software productivity. But object-oriented programming probably isn’t the royal road to software reuse. The oldest practice of software reuse goes back to the 1940s, when the IBM Share library was established primarily to exchange mathematical software. Although the Share collection never got much of a reputation for reliability or efficiency, other libraries have become quite reliable. The tradition in the mathematical software community has long been to reuse software. Mathematical software remains the only discipline in which reusing existing software is the rule rather than the exception.

What has led to this success? It certainly wasn’t a flashy new language or programming discipline: Essentially, all mathematical software is written in FORTRAN. We conjecture that barriers to reuse are not on the producer side, but on the consumer side. If a software engineer, a potential consumer of standardized software components, perceives it to be too expensive to find a component that meets his need, he’ll write one anew. Notice that I said perceives. It doesn’t matter what the true cost of reconstruction is.

Until we have adequate notations, nomenclatures, and, possibly, tools on the consumer side, no amount of
Now, if you want to develop applications for Windows 3.0, there's a fast and easier way to do it with the premiere object-oriented programming language, Smalltalk/V.

With Smalltalk/V Windows, you can explore, prototype, build finished applications and ship them runtime free. You can tap into applications using DDE so effortlessly you don't have to be a Windows expert to do it.

And with one of the world's most comprehensive class libraries, you can choose our objects or easily build your own.

But whatever you develop, it will be portable between the Windows, OS/2 and Mac versions of Smalltalk/V.

With so much at their fingertips, more people are solving more problems with Smalltalk/V than any other object-oriented programming system.

At only $499.95 and no runtime charges, you can solve them, too.

Just call us at (800) 922-8255.

And see why programming Windows has never been easier.

Smalltalk/V Windows

DIGITALK

9841 Airport Blvd., Los Angeles, CA 90045  (800) 922-8255  (213) 645-1082  FAX (213) 645-1306

Smalltalk/V is a registered trademark of Digitalk, Inc. Other product names are trademarks or registered trademarks of their respective holders.
LETTERS

flashy new glitz on the producer side will make software reuse commonplace.

W. Van Snyder
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, CA

Computing Compromises

Robert L. La Fara (Letters, October 1990) wrote, in response to Ben Smith’s May 1990 article “Around the World in Text Displays,” that the answer to collating problems in unusual names (the examples cited were a name with an apostrophe and his own two-word-both-capitalized name, La Fara) is to ease the programmer’s burden by making the name fit a more standard pattern. In the first case, he removes the offending apostrophe; in the second, he makes his name a single word—Lafara.

He misses the boat. It need be axiomatic for everyone working throughout the computer field that computers exist to serve people, and not that people exist to serve computers. Every time people must compromise their desire to see the capability of a computer system that event must be seen as a system design flaw, one that should be reviewed for correction in the next iteration. This attitude is critical to the continued and increasing usefulness and efficiency of computers in every segment and stratum of society, and it is also critical to any hegemony the U.S. yet enjoys in computer technology.

Leland V. Lipman
Republic of Korea

AutoCAD Correction

Your mail bag has probably been full over an error in the May 1990 Computing at Chaos Manor. AutoCAD is written in C, not Lisp, and includes a Lisp interpreter. The AutoLisp interpreter, which is also written in C, is based on XLisp, developed by David Betz of Peterborough, New Hampshire.

AutoCAD release 10 for OS/2 and most versions of release 11 include the AutoCAD Development System. The ADS is a C programming environment that allows advanced users and developers to write more sophisticated programs than AutoLisp can support. The ADS is accessed through the AutoLisp interpreter. It is easy to understand your confusion over this point.

AutoCAD runs under DOS, Extended DOS 386 (Phar Lap), SCO Xenix and Unix 386, Sun Microsystems’ SunOS (Motorola 68000, Intel 386, and SPARC architectures), DEC Ultrix and VMS, Apollo’s Aegis, OS/2, and Mac OS. It would be quite a feat to port a program as complex as AutoCAD to so many environments if it were written in Lisp.

Christopher James DeLucchi
Solana Beach, CA

Legal Breakdown?

I read about the Gilbert Hyatt controversy with fascination and horror (“Micro, Micro: Who Made the Micro?,” January). It is ridiculous that the microprocessor is just now being patented. Our patent system has broken down.

The idea behind the patent is that society gets full disclosure and documentation of a useful device or process in exchange for granting the inventor exclusive marketing rights for a certain time period.

An alternative to the patent is the trade secret, with which there is no disclosure. The peril of the trade secret is that knowledge can be lost forever in any number of ways. The inventor can take the knowledge to his or her grave. The documentation can be destroyed by fire or by simple indifference. And there is a lot of reinventing of the wheel.

Many processes (especially software) in the electronics industry are trade secrets primarily because it is too expensive and time-consuming to get a patent. Our patent system has broken down. It is time to fix it.

Dan Siedelmann
Idaho Falls, ID

Behavioral AI

Our series of articles on AI (State of the Art, January) discussed the cognitive psychologist’s search for the “mind” and a replication of “human intelligence.” This would leave readers with the idea that the issue of human intelligence is the exclusive domain of the cognitive psychologist when it is not. There is a very lively debate within the field of psychology regarding the view that we must understand the mind to understand intelligence versus the view that intelligence is a label for a certain group of behaviors.

From a behavioral perspective, machines already show some of the behaviors we attribute to human intelligence. We will increasingly consider computers intelligent as the range of machine behaviors increases. But to search for some elusive state of “intelligence” will not succeed, because intelligence is a category of behaviors—not a single, unitary attribute.

B. F. Skinner said that if a machine can be made to think, it will be the best evidence yet that thinking follows rules, and following rules is behavior. I suggest that AI’s conception of intelligence is not too shallow; it is too mystical.

Will focusing on behavioral rules, then, make a machine that duplicates human behavior? Only to a limited degree. Human behavior is the behavior of an organism adapting to its environment. Computers, at least in this century, are not organisms, which means they do not respond to natural selection and operant conditioning. Until they do, those who object to creating intelligent machines have nothing to worry about.

David M. Boan
Easton, MD

FIX

- The Mac IIfx from Apple Computer (1990 BYTE Award of Merit, January) uses a 68030 microprocessor.
You find the best values in the most unusual places...

**386SX-16 Price Ranking**
- Gateway 2000, 5th Best Price Out Of 122 Companies

**486-25 Price Ranking**
- Gateway 2000, 2nd Best Price Out Of 92 Companies

*Gateway2000*

"You've got a friend in the business."
Computer buyers who purchased Gateway 2000 systems in January saved an average of $697 per system. This figure comes from a comparison of 132 computer manufacturers' advertised prices in the January 1991 issue of Computer Shopper. That means Gateway customers shared a total savings of $10,747,179 on 15,427 systems in one month alone.

No matter where you look, that's the best value you're going to find in this industry.

Providing The Best Value Starts With Values

"Whenever I'm asked," continued Ted, "why Gateway 2000 is so successful, my answer is: value. When you buy a Gateway 2000 computer, you're getting the best price, best quality and features, best service, all from a very strong, healthy company. That's value. Then I'm asked how we provide value," Ted remarked, "and the answer is almost the same. It's values. The values of the people at Gateway 2000 give our product its value," said Ted. "People who grow up in the Midwest value frugality, quality, resourcefulness, hard work, strength, and most of all, integrity and honesty in all dealings with other people. Providing value in our products starts with these values."

We Value Quality

Only the highest quality components go into a Gateway 2000 computer. Midwestern pride in workmanship and quality is demonstrated by every one of nearly 100 skilled assembly technicians. These technicians build complete system one at a time.

We Value Strength

A company's strength is measured by its balance sheet. As independent sources confirm, Gateway 2000 has an enviable balance sheet coupled with strong growth. The Forbes Magazine listed Gateway as the second fastest-growing private company in America during 1990. Financial strength is good news for you. What good are warranties, guarantees and promises of lifetime technical support if you can't get the value you need from your computer?
Gateway 2000 Customers 9 In One Month.

We Value Integrity

Integrity is the fundamental value without which any organization is doomed. At Gateway 2000, you'll find integrity throughout the company, most visibly in sales and customer support. Gateway salespeople honestly represent the company and its products. Each person you deal with in customer support, during and after the sale, has a personal commitment to make sure you're completely satisfied.

Gateway Customer: Robert C. True, Jr.

"We on the East Coast have become so accustomed to surly, uninformed and disinterested staff that working with your group may have induced an element of Culture Shock. Every person in your organization operates as if there is only one customer in the world — the one they are talking to at the moment. "You've got a friend in the business" is more than a slogan. It's our way of life here at Gateway.

Call-free number for your free copy of our study of computer industry prices.
Gateway 2000 Systems

**12MHZ 286VGA**
- 80286-12 Processor
- 1 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 40 MB 17ms IDE Drive with 32K Cache
- 16 Bit VGA with 512K
- "Gateway Crystal Scan 1024 Color VGA Monitor"
- 1 Parallel/2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.0

$1495.00

**GATEWAY 386SX**
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 40 MB 17ms IDE Drive with 32K Cache
- 16 Bit VGA with 512K
- Gateway Crystal Scan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.0
- MS WINDOWS 3.0

$1895.00

**25MHZ 386™ VGA**
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 80 MB 17ms IDE Drive with 32K Cache
- 16 Bit VGA with 1 MB
- Gateway Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.0
- MS WINDOWS 3.0

$2395.00

**25MHZ 386™ CACHE**
- 64K Cache RAM
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 80 MB 17ms IDE Drive with 32K Cache
- 16 Bit VGA with 1 MB
- Gateway Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.0
- MS WINDOWS 3.0

$2695.00

**33MHZ 386VGA**
- 64K Cache RAM
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 200 MB 17ms IDE Drive with 64K Multi-Segmented Cache
- 16 Bit VGA with 1 MB
- Gateway Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.0
- MS WINDOWS 3.0

$3195.00

**33MHZ 486VGA**
- Same features as the 25 MHZ 486.

$4395.00

**BEST BUY**
- Same features as our 33 MHZ 386 VGA system except this machine has an 80 MB 17ms IDE Drive instead of the 200 MB 15ms IDE Drive.

$2795.00

STANDARD FEATURES & SERVICES
- Microsoft® WINDOWS™ and Mouse with all 386 and 486 systems
- 30-day money-back guarantee
- One-year warranty on parts and labor
- Toll-free technical support for the life of the machine
- Free on-site service to most locations in the nation
- Replacement parts sent via overnight shipping free of charge
- New sales hours: 7am-10pm CST M-F 9am-4pm CST Saturdays

NEW CRYSTAL SCAN 1024NI
- Our new 14" Gateway Crystal Scan 1024NI color VGA monitor comes standard with all 386 DX and 486 systems. This monitor is non-interlaced for a flawless, flicker-free display. 1024 x 768 @ 60 Hz. 800 x 600 @ 72 Hz. 28 D.P.I.

We custom-build each Gateway 2000 computer to your specifications. We'll gladly provide you with a quote on your configuration. 386 and 486 are trademarks of Intel Corporation. Due to the volatility of the DRAM market, all prices are subject to change. Prices do not include shipping.

**Gateways 2000**

800-523-2000
610 Gateway Drive • N. Sioux City, SD 57049 • 605-232-2000 • Fax 605-232-2023
Adobe's New Font Technology Will Give Users More Control Over Type

Adobe Systems (Mountain View, CA) is perfecting new font technology that will give Mac and PC users greater control over computer-generated text. The upcoming Multiple Master typefaces are specially encoded Type 1 PostScript fonts that you will be able to easily manipulate to produce a wide range of type from one core design. You will also be able to control the main design elements of the typeface, including weight (lightness or boldness), width (condensed or expanded), and visual scale (size). As Adobe chairman John Warnock said while demonstrating the technology on a Mac II at the recent Seybold seminars in Boston, Multiple Master font rendering "recaptures the flexibility calligraphers had back in 1400."

A Multiple Master typeface is basically a single spongelike font that can shrink or grow while still retaining its original shape. Working with one scalable font design, Adobe's encoding scheme and related software can generate a character of any size or weight, instead of requiring you to have a whole set of fonts for each typeface (e.g., regular, medium, condensed, expanded, bold, and semibold). With Multiple Master, the one design can generate the whole range. "We design two extremes and get the intermediates synthetically," Warnock said. Adobe intelligently interpolates the points between the extremes to generate all the gradations of weight and width.

Multiple Master fonts will have benefits for "everyone who uses type to communicate information," said analyst Jonathan Seybold. One benefit will be in fitting text in a given space (e.g., trying to squeeze two more lines onto a one-page memo). With Multiple Master typefaces, you could shrink the text so it all fits on one page, without changing the point size, shape, or perspective of the characters.

"One of the biggest advantages to businesses is in font substitution," Warnock said. Say you generate a document using a Bodoni font and then send that document to someone who doesn't have Bodoni on his or her printer. When it comes out, it will be in Courier, the line breaks will be different, and the text won't look like you intended. A system equipped with Multiple Master technology will instead construct a typeface that mimics the one the sender used; it

Think of a Multiple Master typeface as this matrix of character designs, in this case, a sans serif design. The four corner letters each represent the basic, or master, designs: top left is light condensed, and top right is light expanded; bottom left is black condensed, and bottom right is black expanded.
might not look exactly the same, but it will have identical character widths.

Another example that Adobe officials mentioned is a publication that has to include text in different languages—a user’s manual, for instance. French and German versions take up more space than the English version, but Adobe demonstrated how its Multiple Master software shrinks French and German text into columns the same length as the English text. The technology will work equally well with nonroman alphabets, Warnock said.

There’s an economic consideration also, Adobe officials said. “If these fonts are bundled with low-cost laser printers, you can have a wide variety of type just from these Multiple Master fonts,” Warnock said.

Adobe expects to be shipping its Multiple Master designs—initially, a serif and a sans serif face—this summer. (Prices haven’t been set yet.) These fonts will come with a version of Adobe Type Manager and a program called Font Creator that will let you generate the type. Whether companies (e.g., Bitstream) will develop Multiple Master versions of their fonts isn’t clear yet.

—D. Barker

**NEC Says New Design and Process Yields 100-MHz, 200-MFLOPS Processor**

Intel wasn’t the only company that revealed a revamped chip at the recent International Solid State Circuits Conference (see the April Microbytes). Researchers from rival NEC described a new design for a 64-bit vector pipelined processor that they say runs at 100 MHz.

NEC says that a processor using its pipelined design can perform five operations in parallel: addition or shift; multiply; divide, or logical; load; supply; and transfer. Since two of these are potentially floating-point operations, the processor is theoretically capable of 200 MFLOPS. Similar to Intel’s approach with its 100-MHz i486, NEC’s design uses a 0.8-micron triple-level metal process. It’s likely that this type of process will soon become common, resulting in more chip makers capable of producing high-speed ICs.

—Owen Linderholm

**AMD’s 386 Due Soon in 40-MHz Desktops; Battery-Powered Notebooks to Follow**

Cloning the Intel 386 is the easy part. The bigger challenge is designing a chip that offers something that Intel’s doesn’t. Advanced Micro Devices has managed both by producing a pin-compatible processor that’s faster and that consumes less power than any of Intel’s 386s. AMD is now shipping its Am386 chips in volume, and systems using the alternative CPU should start showing up soon. Because of its low-power requirements and special “sleep” mode, the chip could be the basis of full 32-bit notebook computers that will run on batteries for as long as less-powerful systems.

AMD has a standard model called the Am386DX (in speeds of 20, 25, and 33 MHz), but the really significant device is the Am386DXL, which not only needs considerably less current than any of Intel’s chips but also runs at 40 MHz. This model will give you about 20 percent faster performance than Intel’s 33-MHz 386 and twice the speed of the SX, according to AMD officials. AMD’s 0.8-micron CMOS process is designed to produce high-speed, low-power chips and “gives us good yields on the higher-speed parts,” said Mike Webb, director of marketing for AMD’s Personal Computer Products Division. The manufacturing technique could produce CPUs that go faster in the future, he said.

According to Webb, for any given clock speed, an AMD device will need about 30 percent less power than an Intel device; for example, at 33 MHz, the DXL runs on 275 mA, while the Intel 386 needs 550 mA. But, Webb says, in its sleep mode, the Am386DXL essentially stops the clock and the current drain on the battery is 0.08 mA. The DXL also gives off less heat, so computers based on Multiple Master typefaces will work on Macs, PCs, and PostScript printers already out there. They’ll install just like any other Adobe typeface, Warnock said, and you can download them into any PostScript printer. “We have it up and running on a Mac and on a Windows PC,” he said.

Adobe expects to be shipping its Multiple Master designs—initially, a serif and a sans serif face—this summer. (Prices haven’t been set yet.) These fonts will come with a version of Adobe Type Manager and a program called Font Creator that will let you generate the type. Whether companies (e.g., Bitstream) will develop Multiple Master versions of their fonts isn’t clear yet.

—D. Barker

**NEWS**

**MICROBYTES**

There’s 9 million business telephone listings out there, and Dataware Technologies (Cambridge, MA) has put them all on one CD-ROM called Speed Dial. To obtain all that information (the equivalent of 4800 Yellow Pages books), Dataware has developed a slick search mechanism. You can look for any business by its name or by its directory heading (computer dealer, car rental agency, and so on), either by city and state or by area code. If you’ve got a modem, the program will dial the number you select; you can pop into the directory from within your application program. That Chinese restaurant you’re trying to remember the name of—you could probably find it in seconds. Speed Dial ($399) works with IBM-compatible CD-ROM drives.

New twisted-pair cable from Belden Wire and Cable (Richmond, IN) can carry data at speeds of up to 100 Mbps, the company says. The DataTwist cables work with all LAN topologies and come in shielded and unshielded versions.

Hewlett-Packard has licensed AutoCAD display list drivers from Panacea (London, NH). The drivers will speed up AutoCAD drawing when using HP’s IGC-10 and IGC-20 graphics boards. Actix has also licensed drivers from Panacea, for use with its Texas Instruments Graphics Architecture-based graphics boards.

They often call me Speedo: X Window System users will someday have slick, scalable fonts now that Bitstream (Cambridge, MA) has donated its Speedo type-scaling technology to the X Consortium. X Window users will be able to generate smooth bit-map fonts on the fly, in virtually any size. Bitstream’s rasterizer code will be built into the font server of X Window version 11, release 5, which is supposed to be ready later this year.

**NANOBYTES**
New Turbo Pascal for Windows
Don’t Leave DOS Without It!

Go with Borland, the leader in OOP and Windows programming, when you’re heading for the Windows frontier.

With Turbo Pascal* for Windows, your Windows applications will be faster and easier to create.

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.

Create Windows Applications for Less

Turbo Pascal for Windows gives you more and costs you less than other Windows development systems. It’s designed exclusively for Windows programming, and everything you need is included in the one low price. You don’t need to buy the Microsoft® Windows Software Development Kit (SDK).

Turbo Pascal for Windows is the easiest way to make your next program a Windows program.

B O R L A N D

The Leader in Object-Oriented Programming for Windows and DOS

See Your Dealer Today or Call 1-800-331-0877 Now.

Current owners of Turbo Pascal, call Borland for a special offer!*
When you build a better mouse

Microsoft Mouse devotees number over 6 million, and counting.

Just what kind of mouse inspires people this way?

Well, the kind with a patented ergonomic design and high resolution, 400-points-per-inch tracking.

The kind of mouse that wins the PC Magazine Editor's Choice Award and Technical Excellence Award.

Not to mention the Innovation in America Design Award from Business Week, the Industrial
e, you build a bigger following.

Design Award from *Industrie Forum* and others.

And incidentally, no mouse works better with another innovation of ours, Microsoft Windows' graphical environment version 3.0.

To track down America's number one mouse, call (800) 541-1261, Department P98.

We'll be happy to point you in the right direction.

*Microsoft*

Making it all make sense®
PC Makers Sign On to Use PenWindows; Portables Due Later This Year

More than 20 companies have committed publicly to designing hardware that will work with Microsoft's PenWindows operating environment, the extended version of Windows geared to understanding commands from a pen or stylus. Some of the first PCs to use PenWindows will be hybrid portable computers: part typical laptop with a keyboard and part electronic clipboard with a tablet-like screen. The systems will open up like a clamshell, but the keyboard will be detachable; the CPU and storage devices will be housed in the tablet module, so you will be able to work with just the tablet and pen, according to Microsoft.

The PenWindows roster now features some of the biggest electronics companies in the Far East, including the leading laptop makers: Toshiba, NEC, and Seiko-Epson. Other PC manufacturers on the list are Sharp, Mitsubishi, Sanyo, Kyocera, Fujitsu, and Samsung. Canon, Hitachi, and Oki also say that they're planning pen-based systems using PenWindows. NCR, Wang, and Grid had already disclosed their PenWindows support. Momenta, which started up specifically to develop pen computers, is also planning software and development tools based on PenWindows.

In the U.K., the Eden Group already has a prototype tablet-style PC running PenWindows (it will also work with PenPoint, when that's ready). Eden's PaperTalk VFP386, designed around a 16-MHz 386SX CPU, is a 2.4-kg device built in the tablet style. Its top surface holds a backlit, black-on-white LCD that emulates a 640- by 480-pixel VGA display. You can "write" on this coated screen or, with the right overlays, use the metal area framing the screen as a function-key zone. Eden doesn't plan to sell the PaperTalk system under its own name; instead, it will offer it to OEMs.

Conspicuously missing from the PenWindows list are major U.S. computer makers, such as IBM (a PenPoint supporter), Compaq, Tandy, and Hewlett-Packard, as well as leading PC clones such as Dell, AST Research, and ALR. Some observers say that these companies are waiting to see how the pen-computing market shapes up.

Microsoft recently issued copies of a beta PenWindows software development kit. The real product is supposed to be ready later this year, a spokesperson said. PenWindows PCs—which will probably cost about $500 more than their conventional counterparts—will be announced before the end of the year, Microsoft officials say. But when they'll ship is anybody's guess.

—D. Barker

Intel has announced a second generation of EISA support chips. The new 82350DT EISA chip set is a superset of Intel's existing 82350. It allows considerably more integration, reducing total EISA-compatible motherboard space to about one-third of that required with the older 82350 chip set. It is a six-device chip set with DRAM control and peripheral I/O support. The chip set costs $200 in 1000-unit quantities. Intel expects the chip set to be used in modular designs, where the CPU resides on a daughterboard and can be upgraded by adding a faster CPU module.

A survey of managers at sites using Hewlett-Packard computers found some of their top "strategic concerns" to be database technology, application development environments, and getting their HP systems to work with other types of computers. Personal computers were low on the Unix user's list of priorities, while they were high on the list of MPE users. The International Association of Hewlett-Packard Computer Users (Sunnyvale, CA) conducted the study.

Areal Technology (San Jose, CA) says that it has started high-volume production of its 2½-inch 60-MB hard disk drives. Areal uses a different technique than its competitors: Instead of aluminum, it uses a glass disk substrate; this makes a smoother surface so that read/write heads can fly closer to the platter, says the company, and the drive mechanism can deal with denser data at the disk. Areal hopes to have 100-MB hard disk drives available this summer.

The Electronics Industry Association (Washington, DC) has drawn closer to finalizing CEBus, the proposed "home automation standard" for letting appliances and devices talk to each other. The EIA has approved interim standards for sending signals using infrared beams and for connecting communications devices using twisted-pair wires.

—D. Barker
We slash interface development time.
(and we can prove it!)

C-PROGRAMMERS: See for yourself how Vermont Views™ can help you create user interfaces the easy way.

If you want to start saving a tremendous amount of time and effort, call for your free Vermont Views demo kit and put us to the test. Vermont Views is a powerful, menu-driven screen designer that comes with a C library of over 550 functions. Which means you can create user interfaces in just a fraction of the time it takes to write the code yourself!

Why try to reinvent the wheel when Vermont Views lets you interactively create pull-down menus, window-based data-entry forms (with tickertape and memo fields), scrollable form regions, choice lists, context sensitive help, and a host of other interface objects.

Vermont Views combines the convenience of a fourth generation language with the power, flexibility, and blazing execution speed of native C code.

Turn your prototype into the application. Let's face it. With most systems, you have to throw away your prototype when coding begins. Which means you waste precious time and effort. With Vermont Views, things are a lot different. In fact, the prototype actually becomes the application. So menus and data-entry forms are usable in the final application without change. Names of functions for retrieving, processing, and storing data can all be specified as the prototype is created. And that's just for starters.

Here's a truly universal solution. When you create an interface with Vermont Views, you can port it among PC-DOS, OS/2, UNIX, XENIX, and VMS.

Vermont Views can be used with any database that has a C-language interface (most do), and will create interfaces for any roman-based language. Our form-locking version lets you develop quickly and safely on networks and multi-user operating systems, too.

If you need DOS graphics in your applications, we also have the answer. Vermont Views™ GraphEx allows all Vermont Views' windows, menus, and forms to work in CGA, EGA, VGA, and Hercules graphics modes. So you can use your favorite graphics package to create charts, graphs, and other images to enhance text displays.

Call for your FREE demo kit!
800-848-1248
(Please mention "Offer 118")

Don't take our word for it. Put Vermont Views to the test by calling for your personal, free demonstration kit. Or fax us at (802) 848-3502.

WE GUARANTEE YOUR SATISFACTION. FOREVER.

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

Call for your FREE demo kit!
800-848-1248
(Please mention "Offer 118")

Don't take our word for it. Put Vermont Views to the test by calling for your personal, free demonstration kit. Or fax us at (802) 848-3502.

Call for your FREE demo kit!
800-848-1248
(Please mention "Offer 118")

Don't take our word for it. Put Vermont Views to the test by calling for your personal, free demonstration kit. Or fax us at (802) 848-3502.

WE GUARANTEE YOUR SATISFACTION. FOREVER.

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

WE GUARANTEE YOUR SATISFACTION. FOREVER.

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

WE GUARANTEE YOUR SATISFACTION. FOREVER.

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

WE GUARANTEE YOUR SATISFACTION. FOREVER.

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

WE GUARANTEE YOUR SATISFACTION. FOREVER.

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

WE GUARANTEE YOUR SATISFACTION. FOREVER.

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

WE GUARANTEE YOUR SATISFACTION. FOREVER.

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

WE GUARANTEE YOUR SATISFACTION. FOREVER.

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

WE GUARANTEE YOUR SATISFACTION. FOREVER.

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

WE GUARANTEE YOUR SATISFACTION. FOREVER.

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

WE GUARANTEE YOUR SATISFACTION. FOREVER.

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

WE GUARANTEE YOUR SATISFACTION. FOREVER.

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

WE GUARANTEE YOUR SATISFACTION. FOREVER.

We're so sure you'll love Vermont Views that we make this iron-clad, money-back guarantee. If you're ever dissatisfied with Vermont Views, for any reason, return it for a prompt, no-questions-asked refund. (All you have to do is certify that you haven't incorporated our code into any application.)
Beyond ASCII: Group Promoting “Global Code” for Information Exchange

In the increasingly interconnected global village, with computer users trying to send data from one country to another, ASCII, as its name says, is just too American. The American Standard Code for Information Interchange has always lacked the characters to express the written words of most of the world’s peoples. Now a consortium of major computer companies says that it has the solution: a new “global computer code for storage and transmission of text around the world.” The Unicode group says that its proposed standard (currently in final draft form) will make it easier to write multilingual software and simplify international information exchange.

Like ASCII, Unicode basically assigns a number to a character, but Unicode tries to cover every printed character in use today. Unicode’s fixed 16-bit code set will allow 65,000 characters, which supporters say will accommodate “all major living languages,” including ideographs used in Japan, China, Taiwan, and Korea; Cyrillic; Hebrew; Arabic; Greek; Sanskrit; and many others. The character set also has math and technical character sets. Since there is substantial duplication, the total number of characters is much larger. In the ISO method, every character in its basic form requires 32 bits, or 4 bytes, to be represented.

One important thing Unicode has that could help it become a widely accepted format is the backing of major (American) computer companies. Work on the character set began in 1989 at Xerox and Apple, and the group has since been joined by representatives from IBM, Microsoft (which says it will support Unicode in its upcoming “portable” OS/2), Sun Microsystems, Novell, Aldus, Metaphor, GO Corp., and Next. If these companies actually implement Unicode in their systems and software, users of popular personal computers and Unix workstations could soon be downloading Unicode files instead of ASCII.

—D. Barker

Swordfish Could Speed Up Imaging Operations

National Semiconductor (Santa Clara, CA) has developed a new RISC chip that could radically crank up the speed of imaging devices such as laser printers and graphics boards. The company’s new “Swordfish” is a 50-MHz 64-bit RISC chip with a built-in digital signal processor (DSP). The company claims that the device can perform 100 MIPS, putting it ahead of other embedded processors.

Swordfish builds on the architecture of the company’s 32CG16 and 32GX32 embedded processors (and will be delivered with translators to migrate code from the older devices). The new processor uses a superscalar design with two independent integer units, an FPU, on-chip data and instruction caches (1K byte and 4K bytes, respectively), and the DSP. The internal architecture is 64 bits wide, and the external interface can be 8, 16, 32, or 64 bits. Like other high-performance processors, Swordfish is a 0.8-micron CMOS device. It contains about 1.1 million transistors, the designers say.

Operating at 50 MHz, the chip can perform 2 integer instructions per cycle, or 100 MIPS, National Semiconductor says. The company also says that Swordfish executes 115,000 Dhrystones per second, which is about 10 percent faster than Intel’s i860.

Swordfish is aimed at processing-intensive embedded applications such as controlling printers, recognizing patterns, compressing/decompressing data, and processing video. The company says that it has already lined up significant partners, including Adobe, Microsoft, and Canon.

—Andy Reinhardt

Sales forces say that they’ve gained profit, time, and productivity by using laptop computers, according to a new study. After surveying sales managers at 3000 manufacturing companies, researchers at Texas Christian University (Fort Worth) concluded that “the benefits of the laptop appear to be very positive.” Salespeople use laptops mostly for correspondence, E-mail, access to data on mainframes, and presentations. But laptop makers should note: One of the reasons cited for not using laptops was the cost of the machines.

If you’re keeping R&D records and notes on your hard disk drive or on a bunch of floppy disks, you might look at a new pamphlet from the American Chemical Society’s Committee on Patents & Related Matters. “Electronic Record-Keeping for Patent Purposes: Cautions and Pitfalls” discusses using computer equipment to maintain records. To obtain the free pamphlet, contact the ACS at (202) 872-4479.

X Window software developers may have to start paying license fees to AT&T if it turns out that they’re using what AT&T says is patented technology. AT&T has notified some X Window implementers of its patent #4,555,775, issued in 1985, that is entitled “Dynamic Generation and Overlaying of Graphic Windows for Multiple Active Program Storage Areas.” AT&T says this technique, invented by Bell Labs researcher Robert Pike, is used in the X Window System “backing store” function, which is basically a means of redrawing a window on the screen. However, the backing store function is not always implemented in X Window software. At press time, the X Consortium had not yet officially responded to AT&T. Meanwhile, “Those of us who sell X in small volume are keeping our heads down and hoping DEC or somebody big can slug this out with AT&T,” said one X Window developer.
Introducing the Falco Infinity Desktop Computer. 
The Smallest 386SX Desktop.

If you're sizing up desktop computers, you'll immediately see the advantage of the Falco Infinity™ Desktop. It gives you 386™SX power and performance without dominating your deskspace.

Half the size of a standard PC, the Infinity Desktop has everything you need on-board: Peripheral interfaces like disk controllers. Memory expansion. Communication ports. And VGA™ level graphics up to 1024 x 768 resolution. Plus, two AT-compatible, 16-bit expansion slots.

- It runs DOS™ 4.0, UNIX®, OS/2® and Microsoft® Windows 3.0. What's more, you can choose from four configurations, including a diskless network node and a full-featured model with 1.44MB floppy and the option of 40, 100 or 200 MB hard drive.

The only thing we left out is the noise. The Infinity Desktop runs so quietly, you'll hardly know it's on.

Whether you work in close quarters or spacious surroundings, the Falco Infinity Desktop covers all your needs. Without covering your desk. And that's about the size of it. To get one for your desk, call us today.

1-800-FALCO4U

©1990 Falco Data Products, Inc.
440 Potrero Avenue, Sunnyvale, CA 94086-4117

All trademarks are registered to their respective owners.

Circle 116 on Inquiry Card.
This Should Be the Month for System 7.0

The System 7.0 era should begin this month, as Apple is expected to finally release its overhauled Macintosh operating software. Apple sent "near-final" beta versions to most developers in late February, hoping they'd have "System 7.0-ready" programs available by the expected official May 13 launch date. (May 13 is the first day of the Apple WorldWide Developers Conference.) This public release date could be changed to June if unforeseen bugs show up before then.

System 7.0-compatible programs will support core AppleEvents (messages that are passed from application to application and from application to System); Balloon Help (hypertext-like help messages that can be turned on and off); and the Publish/Subscribe mechanism for hot-linking creators and viewers of information. Apple watchers say they expect there could be as many as 200 or so System 7.0 programs at the time of the official rollout. Major Mac software houses will all update their applications to tap into System 7.0.

The company is expected to also release to developers the new QuickTime "media manager." QuickTime is an operating-system extension for dealing with multimedia input and output and with coordinating devices such as videotape machines, video cameras, scanners, CD-ROM drives, and audio gear. Users could see QuickTime by late summer, some Mac insiders say.

-Larry Loeb

Windows Selling Big, But How Many Are Running?

Microsoft says that it has sold more than 2.75 million copies of Windows 3.0, but some people involved in developing Windows applications say that only half of those copies are actually being used. Brian Conte, CEO of hDC, which makes Windows utilities, said at a recent conference that only "one-half to one-third of Windows buyers are actually using it."

Brad Silverberg, Microsoft vice president for DOS and Windows, said that over 2.25 million copies of Windows were sold through retail channels, over half a million were sold bundled with hardware, and more than 40,000 copies were sold to software developers. That makes a total of more than 2.75 million copies sold since the introduction of Windows 3.0. But if Conte is right, there are only about 1.5 million Windows users.

Perhaps part of the reason for the suspected lag is that corporate users are sometimes slow to accept change, and many microcomputer managers say that they've had to provide hard evidence of productivity gains to justify large-scale migration to Windows.

Corporate Software (Canton, MA) and Microsoft conducted a pilot project to study the use of Windows at 14 corporate sites. Despite Microsoft's participation, the project could document only a 10 percent productivity gain during the first year of Windows use. Still, Corporate Software says, Windows 3.0 offers "intangible benefits" such as improving worker morale and encouraging users to "explore" their software environments.

-Allen Ullman

Low-Cost Chip Holds Analog Speech

In a development that could lead to low-cost speech capabilities inside computers, Information Storage Devices (San Jose, CA) has developed a new chip that is able to hold analog samples of speech and sound. ISD's first chip, the ISD 1016, can store up to 16 seconds of recorded voice, and the company says sounds better than what you hear over a telephone.

Direct Analog Storage (DAS), as the technique is called, uses a modification of EEPROM design and puts the sound in what is essentially a 128K-byte cell EEPROM. Although it stores the sound in sampled form, the chip does not store it digitally. The samples are analog.

The heart of DAS is a floating-gate EEPROM. The floating gate turns the EEPROM cell on or off depending on whether it is strongly positive (on) or strongly negative (off). The charge on the gate modifies the conductivity of the underlying transistor. In DAS, the floating gate is charged only moderately, and the conductivity of the transistor takes an
Crunch!

Nothing crunches numbers like the Advanced Math Co-Processors from Integrated Information Technology. They really speed up graphics, CAD/CAE, spreadsheets, and other calculation-intensive applications.

Three models provide a perfect match to your 286, 386, or SX PC, delivering up to twice the performance of other CoProcessors. No wonder hundreds of thousands have been sold. Five-year limited warranty. BYTE-rated. So plug in, and crunch!

Count on iii.™

Available at most local dealers.

©1991 Integrated Information Technology, Inc. All rights reserved.

Circle 161 on Inquiry Card (RESELLERS: 162).
intermediate value. In a DAS chip, the strength of the sound determines the value.

A DAS chip also contains amplifiers, clock filters, and just about everything else needed for a speech system. A designer building a talking device would only have to add batteries, a microphone, a loudspeaker, and a few other parts.

IBM is now reselling Novell NetWare on an equal basis with its own LAN Server. James Cannavino, general manager of IBM’s Personal Systems division, said that IBM and Novell are developing version 3.2 of Novell NetWare for OS/2 2.0, AIX, and the NetWare kernel. The products will be available by mid-1992, claims Novell CEO Ray Noorda.

**Bellcore Uses Laser Beam to Beat the Clock**

Researchers at Bellcore (Livingston, NJ) have prototyped a new device that could help overcome one of high-speed computing’s big bottlenecks: the clock. While CPUs can process data at lightning speeds, they still have to wait for the signal from the clock—they’ll always be bound by the physics of electrical connections.

The scientists are speeding up the timing signal by using laser beams and strands of optical fiber. Inventors Peter Delfyett and Davis Hartman connected a semiconductor laser beam, which generates the master timing pulse, to a strand of optical fiber. A device called a star coupler splits the laser light into 1024 beams, which then shoot down separate strands of fiber to 1024 computer circuit boards (containing receivers). The laser beams’ pulses are more accurate than those generated by electronic components, Delfyett said. When zapping the 1024 circuit boards, the accuracy of the timing signal is “true to within 12 trillionths of a second,” he said. The researchers say their technique could allow a computation rate of one command every 120 trillionths of a second (compared to a current desktop machine’s execution rate of about one command per one-millionth of a second).

Semiconductor lasers have been used as timing devices, but their clock signals were slower because the laser beam had to be turned on and off, researchers said. Bellcore’s “mode-locked” laser works like an oscillator, flipping constantly between on and off. The pulses are so precise that they keep the optical clock essentially free of signal variations, or jitters, Delfyett said.

The Bellcore system now sits on an optical workbench, but it could be squeezed into a case the size of a shoe box.

Bellcore’s technology is geared toward large, high-speed machines, like supercomputers, where signals have to travel to hundreds of boards. One practical application of the work of Delfyett and Hartman will be in high-speed data transmission. “With the advent of optical communications, switches will look very similar to high-speed machines, like supercomputers, where signals have to travel to hundreds of boards,” Delfyett said. Bellcore’s “mode-locked” laser works like an oscillator, flipping constantly between on and off. The pulses are so precise that they keep the optical clock essentially free of signal variations, or jitters, Delfyett said.

The Bellcore system now sits on an optical workbench, but it could be squeezed into a case the size of a shoe box.

Bellcore’s technology is geared toward large, high-speed machines, like supercomputers, where signals have to travel to hundreds of boards. One practical application of the work of Delfyett and Hartman will be in high-speed data transmission. “With the advent of optical communications, switches will look very similar to high-speed machines, like supercomputers, where signals have to travel to hundreds of boards,” Delfyett said. Bellcore’s “mode-locked” laser works like an oscillator, flipping constantly between on and off. The pulses are so precise that they keep the optical clock essentially free of signal variations, or jitters, Delfyett said.

WordTech Systems (Orinda, CA) says that its Quicksilver/Unix dBASE compiler has been certified by the Unix System Laboratories to be compliant with Unix System V release 4. Quicksilver/Unix ($1495) compiles DOS-based dBASE language applications to run without modification under Interactive Unix 386, SCO Unix 386, and other compatible operating systems.

**Modems burn less gas:** The number of workers who telecommute instead of drive to the office two or more days a week will continue to increase, according to a new survey of managers in the San Francisco Bay Area. Of those surveyed, 41 percent said that they think the number of telecommuters will climb 10 percent to 15 percent in two years. Most of those surveyed currently have staffers who telecommute, and the pollsters said “a significant number of the managers supervising telecommuters cited their increased productivity as a key benefit.” The survey was taken by the Northern California Telecommuting Advisory Council, sponsored by the University of San Francisco and the Pilot Group.

**Micro Computer Resources** (Oakland, CA) has compiled a database of more than 6500 quotes, called Wisdom of the Ages. The $79 package, which works with DOS PCs, contains apt phrases from both the Western and Eastern traditions, which you can view side by side for comparison. You can search and filter by author, subject, or keyword.

**IBM** is now reselling Novell NetWare on an equal basis with its own LAN Server. James Cannavino, general manager of IBM’s Personal Systems division, said that IBM and Novell are developing version 3.2 of Novell NetWare for OS/2 2.0, AIX, and the NetWare kernel. The products will be available by mid-1992, claims Novell CEO Ray Noorda.

---

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

Only Zortech Gives You Total Portability to MS-DOS, Windows, OS/2, DOS 386, UNIX 386, and Macintosh. Right Now.

What platform will your application be running on this time next year?

Now that C++ has made significant inroads into mainstream application development, you must choose the C++ compiler that is going to be the performance and portability leader now...and years to come.

Since 1986, we've been testing, refining and perfecting our family of C++ products tirelessly. The results are what you are reading about, a fully portable family of C and C++ products available right now.

We Intend To Keep Up This Pace.

In the past few years, Zortech has quietly become an industry standard earning acclaim from Byte, Computer Language, Dr. Dobbs, and many industry experts for our solid implementation, market-leading performance, and street-level innovation.

Whatever platform you choose, choose Zortech Performance Ice.

With Zortech, no matter what platform you choose to develop on, a substantial performance increase will be realized due to the quality of the original Zortech C++ implementation. For instance, on MS-DOS, your program will compile up to 35% faster with the resultant code running up to 45% faster and 25% smaller than Turbo C++. But we don't stop there. On each platform, Zortech C++ is designed to improve your productivity where it really matters...in the development cycle. For example, using the DOS/MS Windows package, you can edit, compile, link and debug the largest MS Windows applications...and never once leave the Windows environment. All this plus complete plug-and-go to GNU C++/View and CommonView III!

And, of course, these advantages are also available on the OS/2, DOS 386, UNIX, and Macintosh platforms.

Choose, Choose, Choose...

If there is one constant in C++ development, it's change. The Zortech family of products keeps your options exactly how they should be. Open.

To find out more, call today.

Order Hotline:
(800) 848-8408

60 Money-Back Guarantee

Zortech
Industry Standard, Industrial Strength.

Zortech, Inc., 4-D Green Street, Woburn, MA 01801. Tel: (617) 927-0174. Fax: (617) 927-0792
Zortech, Ltd., 58-30 Bankhead Street, London SE1 1EG. Tel: 011-44-71-973-7777. Fax: 011-44-71-973-4138

Supported compilers include Compaq, IBM, and all 100% Compatabile

* Source: MS-DOS, C++ Compilers. A comparison by the Ladd Group, (c) 1990

Circle 349 on Inquiry Card.
Some days you have all the time in the world.

When the pressure is on, pour on the speed. With Hewlett-Packard's new LaserJet IIISi printer. A powerhouse that delivers at a throughput speed of 17 pages per minute.

With the LaserJet IIISi, you're up to speed the moment you give the "print" command. HP's RISC-based formatter and the PCL5 printer language, with vector graphics and on-the-fly typeface scaling, yield fast results. This printer also represents a new standard for I/O performance with optional Network Printer Interface cards for either Ethernet or Token Ring.

The LaserJet IIISi is specifically designed for shared-use environments. Its high-volume paper handling features include two 500-sheet input trays and a monthly duty cycle of 50,000 pages. HP offers software-selectable language switching between PCL5 and optional Adobe* PostScript*. For added versatility, your options include

Adobe and PostScript are registered trademarks of Adobe Systems Inc. in the U.S. and other countries.
And some days you need the new 17ppm LaserJet III Si.

an envelope feeder and two-sided printing.
Beyond speed and efficiency, the LaserJet III Si delivers the sharpest 300 dpi print quality yet. In fact, HP's revolutionary combination of Resolution Enhancement technology and new microfine toner challenges the print quality of many 600 dpi printers.

The price of the new LaserJet III Si, just $5,495, is as impressive as the work load it handles. If you're ready to pick up the pace, call 1-800-752-0900, Ext. 2067 for more information on the fastest LaserJet printer and the name of your nearest authorized HP dealer.

* Suggested U.S. list price. ©1991 Hewlett-Packard Company  PE22101
A PC and 1-2-3 in the Palm of Your Hand

DAVID ANDREWS AND ANDREW REINHARDT

Hewlett-Packard and Lotus make palmtop computing more meaningful

Although notebook computers are becoming commonplace, you can still create quite a stir when you use one on an airplane. But pull out the new Hewlett-Packard 95LX, and you probably won't get any reaction at all. That's because at first glance, the 95LX looks more like an overweight checkbook than a PC. Its diminutive size belies its true nature: The 95LX is a complete DOS computer based on an 8088-class processor.

Like an electronic organizer (e.g., the Sharp Wizard), the 95LX includes a suite of personal productivity applications designed to replace the traditional Day-Timer Planner. It also doubles as an HP financial calculator. But what really sets the 95LX apart is that it comes standard with Lotus 1-2-3 release 2.2 built into its ROM. Including the software, 512K bytes of RAM, DOS 3.22 in ROM, an industry-standard solid-state memory-card slot, and some remarkable communications options, the whole pocket-size package sells for a suggested retail price of less than $700.

When combined with the tiny Touchbase WorldPort modem and the Kodak Diconix printer, which HP will remarket to 95LX customers, this new palmtop may once again alter people's definition of the portable office. The 95LX could become a must-have item for mobile executives or people who crave the latest electronic gadget.

A Micro Micro

HP and Lotus jointly developed the 95LX in close consultation with Intel, Microsoft, and Phoenix Technologies. The tiny, shall we say, "toeprint" of the machine is due to a remarkable feat of miniaturization by Intel: a PC-compatible motherboard measuring only 2 2/3 inches by 3 1/2 inches—not much larger than a credit card—with performance about 2 1/2 times that of an IBM XT, according to HP.

The HP palmtop not only fits in your pocket, it's also small enough to get lost in your briefcase. It weighs a mere 11 ounces and measures 6 1/2 inches wide, 3 3/4 inches deep, and 1 inch high. This is a little more than half the size of the 1-pound Pocket PC.

Along with the small size come some trade-offs. The 95LX has a 16-line by 40-character, nonbacklit supertwist LCD screen, so it shows only a few columns of a typical spreadsheet. However, we found the display highly readable in a variety of lighting conditions. The company says that it achieved this readability by driving the display at 12 volts, instead of the usual 5 V. The other and more serious drawback is the keyboard. Even though it uses a standard QWERTY layout and includes function keys and a numeric keypad, it is too small for serious typing.

The 95LX runs on two AA batteries or an AC adapter. HP says that a pair of batteries will power the machine for two months, but we weren't able to test this claim. To prolong battery life, the system relies on power-saving tricks that are used in HP calculators: The processor rests between keystrokes, and after 5 minutes of nonuse, the system shuts down. When reactivated, the 95LX re-
turns to the state it was in when it left off. A commonly available (CR2025) lithium backup battery on the underside of the 95LX keeps your RAM alive when you change the AA batteries.

Canned Applications
The 95LX comes with seven built-in applications: 1-2-3, an appointment book, a telephone book, a memo pad, a file manager, a communications program, and HP Calc, an advanced financial calculator. On-line help is available with the F1 key. The programs share a similar Lotus-like user interface, including the common use of "soft" function keys and the ability to share keyboard macros. They also support cutting and pasting of data from one program to another, which is especially useful for transferring data between 1-2-3 and the calculator's back-solving HP Solve utility.

One of the most convenient aspects of the 95LX is that all the built-in applications are always open, so you can instantly access them by pressing one of seven buttons labeled with icons near the top of the keyboard. When you switch from one application to another, or when you turn off the 95LX, you always return to exactly where you left off.

DOS applications on solid-state cards or downloaded from another PC can be run from the DOS prompt. The 95LX includes one slot for memory cards that comply with the PC Memory Card International Association standard, and HP has lined up several third-party vendors to deliver software cards for the system.

One of the most convenient aspects of the 95LX is that all the built-in applications are always open.

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

It's called SimpLAN ServerJet.
Simply plug the ServerJet into the 'Optional I/O' slot of your HP LaserJet. Stretch phone cable, up to hundreds of feet, to each computer. Then, 12 people can simultaneously whoooshh documents to the LaserJet at speeds as fast as 115,200 baud.
No more wandering down the hall with floppy in hand.
Or borrowing someone else's LaserJet.
Or wasting time waiting to print.

The ServerJet is available in a variety of models with up to 4MB of buffer memory. And because your office may have printers other than HP LaserJets, ASP Computer Products offers a complete line of printer sharing solutions.
To order your ServerJet or for more information call ASP at:
800-445-6190

SimpLAN & ServerJet are trademarks of ASP Computer Products, Inc. / HP LaserJet is a registered trademark of Hewlett-Packard Co.
These cards include Meca Software's Managing Your Money, Houghton-Mifflin's dictionary and thesaurus, Contact Software International's Act! contact management package, and Globalink's phrase-translation packages.

An open application programming interface will let developers customize their DOS applications for the 95LX by adding support for the desktop manager, clipboard, or soft keys. HP says that even without writing to the API, standard DOS programs won't lose any functionality running on the 95LX, except that their interfaces will shrink to 40 columns.

By putting DOS, 1-2-3, and all the applications in ROM, HP has freed up most of the 95LX's standard 512K bytes of RAM for data files. A setup utility lets you allocate available memory between the C drive RAM disk and space needed by the operating system to run programs that reside in ROM; for our evaluation, HP recommended setting aside about 126K bytes of RAM for the system.

Linking
Because it has no floppy disk drive (and since few applications now exist on memory cards), the primary means to get data in and out of the 95LX is via one of two interfaces available with the system. The most familiar is a small bidirectional serial cable that is supplied, along with software for the host PC, in an optional HP connectivity pack.

The connectivity pack is a complete copy of the organizer applications included with the 95LX. Once loaded on the host PC, the applications can be run just as they are on the palmtop, which means that you can keep the same memos or telephone log on your desktop machine as you do on your 95LX.

Updating the files is easy: you just connect the machines, select the communications application on both, and then transfer or share files—at 57,600 bps—using a split-window interface. For modern users, the 95LX includes built-in terminal emulations and a variety of transmission protocols.

The other interface option is a two-way infrared connection, a technology borrowed from earlier HP calculators. With the infrared link, two properly aligned 95LXes within 8 inches of each other can transfer files at 2400 bps without using cables. The infrared link also works with the HP 48SX calculator.

HP says that it is exploring other uses for infrared technology, such as a print link that would let you beam files to a printer for hard-copy output.

Later this year, HP expects to introduce a third interface option for the 95LX, an RF module being developed by Motorola that uses the company's alphanumerical page technology.

Alas, the Keyboard
It seems there's always a catch, and in the case of the 95LX, it's the keyboard. When we first looked at the palmtop, we joked that nobody would use it to write the Great American novel. Unfortunately, after using the system for a while we have to revise our assessment: Even the Great American short story would be difficult to pull off.

The problem is twofold: First, the keyboard is simply too small for touch typing, and the layout is just strange enough that two-finger typing seems to involve more hunting than pecking. Second, the keys aren't really keys, but rather calculator-type buttons. For entering meetings into a calendar, the buttons are fine, but using them to write more than a few sentences is tedious.

HP readily acknowledges this problem and makes a point to characterize the 95LX not as a replacement for a PC but as an adjunct. The literature suggests that appropriate textual applications would include reading E-mail, proofreading documents, or composing short memos. And if you need to do number crunching, the 95LX, unlike the Psion PC, has the advantage of a numeric keypad.

In a nutshell, if you use a mobile computer for writing long memos, the 95LX may not meet your needs, but if you want a souped-up organizer and calculator, you're in luck.

Impressions
The 95LX invites comparison with the Psion PC and, to some extent, with the Atari Portfolio. The differences are worth exploring. If you're looking for a full-time laptop, the Psion may be a more realistic option than the 95LX, because its display is 80 characters wide and its keyboard is much bigger—large enough for typing text. On the other hand, the Psion requires not only larger pockets but also deeper ones: Even with its price reduced from the original $2345 to the current $1450, it costs twice as much as the 95LX, and it doesn't include Lotus 1-2-3.

The Portfolio costs only $300 and is comparable in size to the 95LX, but it's much less capable. The display shows only eight lines of 40-column text, and the standard RAM configuration is only 128K bytes—not enough to run 1-2-3 or much of anything else these days.

HP's 95LX is an engineering triumph, incorporating amazing advances in miniaturization and connectivity. Coming from HP, the 95LX is unlikely to have the bugs that have afflicted some other palmtops, and even the prototype units felt solid and durable.

Of course, there are weak points. We were a bit disappointed by the built-in organizer applications, which didn't seem very intuitive to use, especially when compared to some of their desktop cousins. Ideally, the 95LX could be a bit flatter, and we might have been willing to accept a slightly larger footprint in exchange for a bigger screen and a less challenging keyboard. But these seem like minor points compared to our overall positive impression.

It's simply amazing to be able to put all your appointments, telephone numbers, and other necessary information into your shirt pocket, inside a machine almost one-hundredth the size of an IBM PC that can run the same software as that PC. If you've ever wanted to unobtrusively run a spreadsheet model while flying on an airplane, your moment has finally arrived.

David Andrews is BYTE's associate news editor for What's New and Andrew Reinhardt is a BYTE news editor in New York. You can reach them on BIX as "dave-news" and "areinhardt," respectively.

THE FACTS

HP 95LX
$699; connectivity pack, $99.95
128K-byte RAM card, $199.95
512K-byte RAM card, $399.95

Hewlett-Packard Co.
1000 Northeast Circle Blvd.
Corvallis, OR 97330
(503) 757-2000
fax: (503) 750-4689
Circle 988 on Inquiry Card.
Once again, editors rave about the Tangent 486.

"...when the full 16 stations included in the test were active. The Tangent Multi-Server 433e was still the fastest..."

PC Magazine, April 16, 1991

Tangent Multi-Server 433e

- Capable of replacing 5 to 10 conventional servers.
- Intel 486-33 MHz EISA
- Up to 64 MB RAM
- SCSI Drive Arrays Up to 12 GB
- Continuous 1-3ms Average Access
- Up to 4 Ethernet Ports or 96 Serial Ports
- UNIX or NOVELL Configurations

Priced from $14,900

Tangent 433e / 425e

- Our high-end, award-winning engineering workstation.
- Intel 486-33 or -25 MHz EISA
- 200 MB to 2.4 GB of Disk Storage
- EISA Caching 32 Bit Disk Controller
- Non-Interfaced SuperVGA Monitor

Priced from $5,995

Tangent 433i / 425i

- A 486 at a 386 price.
- Intel 486-33 or -25 MHz ISA
- 105 MB Up to 2.4 GB of Disk Storage
- Choice of IDE, ESDI or SCSI
- Non-Interfaced SuperVGA Monitor

Priced from $3,695

486 your way. Tell us your applications and operating environment and we'll configure a system to meet your needs 100%. Then we'll build, test and ship your system. Pronto.

We're here when you need us. Our sales and support engineers are as near as your telephone.

Tangent is your first call for affordable high performance.

Call toll free: 1-800-223-6677

When the editors got through writing about Tangent 80486 systems, they didn't leave us a lot to say. Except price. First, compare performance. Then compare price. What you'll see is that Tangent is the price-to-performance leader in 486 systems, with a range of models designed to fit any need.

*All pricing subject to change without notice. ©1991 Tangent Computer. Tangent is a registered trademark of Tangent Computer, Inc. 486 is a registered trademark of Intel Corporation. Other product names may be the trademarks or registered trademarks of their respective companies.

Circle 295 on Inquiry Card.
Apple Introduces Low-Cost Laser Quality with Style

Owen Linderholm

Apple's low-cost printing solutions to complement its new inexpensive systems

When Apple introduced its new systems last year, it immediately increased its sales and answered critics who had been claiming that Apple computers were too expensive. Nevertheless, Apple neglected to provide a solution in one important area: printing. Until now, the Apple printer lineup has consisted of a range of laser printers, from the Personal LaserWriter SC to the LaserWriter IIINTX, as well as the ImageWriter II dot-matrix printer. Third parties have taken the opportunity to fill in the gaps with cheaper laser and ink-jet printers. However, Apple has now come out with two low-cost printing solutions to complement its new inexpensive systems.

The Personal LaserWriter LS is a carefully designed printer that's based on QuickDraw rather than PostScript. It's almost identical to the Personal LaserWriter SC in capability, but it costs considerably less.

The StyleWriter is more unusual. It's an ink-jet printer that's based on the Canon Bubble-Jet, but it's been completely redesigned by Apple. It has a resolution of 360 dots per inch and is also a QuickDraw-based printer.

Both printers work with TrueType, the new font-scaling technology being developed by Microsoft. These two printers are the first ones available that work with TrueType, and Apple is including TrueType system software with the printers, as well as the basic 13 Apple system fonts.

Personal LaserWriter LS

The Personal LaserWriter LS is based on the Canon LBP-LX engine. It has a serial connector and the usual Personal LaserWriter paper handling with a 50-sheet paper feeder. It is 8 inches tall, 15 inches wide, and 18½ inches deep; it weighs 31 pounds. The design is similar to that of the Personal LaserWriter SC, except that it's smaller and has a different paper path.

The printer is controlled by a custom application-specific integrated circuit (ASIC), which decompresses data received from the system. It also includes an additional oscillator that's used to externally clock the Mac's serial port at a higher rate to transfer data to the printer at a higher rate. The serial port usually transfers data at up to 57,000 bps. Apple says that Macs can pass data to the LS at up to 900,000 bps.

This printer uses only 512K bytes of RAM, one of the ways Apple has been able to keep the price down. Nevertheless, it is still able to print a full page of text and graphics, because the data is compressed by the printer driver in the Mac and then decompressed in strips by the custom ASIC in the printer, so that the 512K bytes can hold the compressed form and the uncompressed strip at the same time. In addition, the memory is managed so that the next page can be sent to the printer and stored while the first is still printing as enough memory space is freed. Thus, the Personal LaserWriter LS is faster than the Personal LaserWriter SC.

The Personal LaserWriter LS also comes with a printer driver that spools printing to the hard disk and then prints the document in the background. This lets Mac users get back to work more quickly than they otherwise would.

The one major failing of this printer is that it's a QuickDraw printer. This means that Encapsulated PostScript (EPS) files don't print properly; instead, a coarser bit-map version is printed. However, the addition of TrueType fonts into the system software for this printer means that it is capable of printing high-quality fonts at any point size.

The Personal LaserWriter LS is now Apple's least expensive laser printer. It essentially replaces the Personal LaserWriter SC, with which it compares favorably. It's mostly intended as a single-user laser printer, for someone who needs the...
Amazing special effects
- envelope (warp) text and graphics
- simulate 3D with perspective function
- extrude to give depth to text/graphics
- blend between shapes and/or colors

Incredible type control
- over 150 fully scalable outline fonts
- see exact fonts on-screen
- paragraph and multi-column text
- import ASCII text files
- fit text to a curve
- create your own fonts or symbols

Superb value
- over 4000 symbols and clipart images
- dotted and dashed line styles
- over 80 arrowheads
- dozens of vector and bitmap patterns
- free Pantone® license
- 24 bit color supported
- 31 import/export filters
- CorelTRACE - batch autotrace utility
- MOSAIC - visual file manager
- WFNBOSS - typeface converter

Call customer service: (613) 728-8200 for information and a free demo disk
*Pantone, Inc.'s check-standard trademark for color reproduction and reproduction materials.
**Requires MS-WINDOWS 3.1

Circle 75 on Inquiry Card (RESELLERS: 76).
You don't need a LAN to network your printer! LASERNET's printer sharing family provides all the features you need for any requirement, at the price you want to pay.

FOR BASIC APPLICATIONS

WTI has low-cost, serial or parallel, non-buffered models, for low printer-sharing demand environments. Share from four to six PCs; perfect for the small office or school:

- PSU-4/1A/4P - 4 inputs; single output. $149
- PSU-8/2C/SP - 8 inputs; 2 outputs; printer, parallel models for fast-access, high-volume printer sharing needs. User can select printer of choice directly from PC:
- QwikShare II - 6 inputs; 2 outputs; buffered from 256KB to 2MB. $195
- start at $295

FOR GENERAL APPLICATIONS

WTI has buffered, multiple output, serial/parallel models for fast-access, high-volume printer sharing needs. User can select printer of choice directly from PC:

- QwikShare II - 6 inputs; 2 outputs; buffered from 256KB to 2MB. $195
- start at $295

FOR HIGH-LEVEL APPLICATIONS

For twelve or more users requiring high-speed peripheral sharing and file transfer, WTI has Multi-Link', the ultimate serial/parallel peripheral-sharing device. Expandable through dedicated high-speed link, up to 384 any-to-any usage on selectable ports, over 4,000 feet. Perform printer/plotter sharing, modem pooling, PC-to-PC communication and more:

- Multi-Link - 12 any-to-any ports; baud rates to 115K; buffered from 256K to 4 MB. start at $795

All products made in U.S.A., backed by a 3-year limited warranty with service and technical support.

To order* or for More Information, Call Toll-Free

1-800-854-7226
FAX 714-583-9514

*Vsa, MC Accepted Same Day Shipping

convenience, quality, and speed of a laser printer but hasn't much money.

StyleWriter

The most immediately striking feature of the StyleWriter is the way it looks. On its own, without the accompanying sheet feeder, it looks like an elongated, invertebrate. In this form, it can print manually fed single sheets. The printer also has a clean, straight-through paper path, which makes it ideal for printing envelopes. However, it does come with an automatic sheet feeder that holds 50 sheets. This clips directly to the back of the printer.

Another striking feature of this printer is that it's almost silent in operation. The print quality is incredibly good at 360 dpi. Not surprisingly, the StyleWriter produces output similar to that of the Bubble-Jet. The ink used is formulated to dry quickly. Thus, by the time a page drops into the paper holder, it's dry. The trade-off for fast drying is that the ink is water-soluble and will smear if water is spilled onto a page. Each ink cartridge prints about 500 pages.

The StyleWriter is considerably slower than a laser printer. It prints a page in approximately 2.5 minutes in its letter-quality mode. It has a draft-quality mode of 180 dpi, which lets it print one page per minute. It also receives compressed data from the computer. However, the StyleWriter doesn't have as much built-in intelligence as the Personal LaserWriter LS. Therefore, it receives one strip of data from the computer at a time, decompressing and printing it before receiving the next strip. The printer works faster when attached to faster Macs, because they're able to compress the data and send it faster.

The StyleWriter is also a QuickDraw printer and has trouble printing EPS images. However, the 360-dpi resolution happens to be exactly five times that of a standard 72-dpi screen-based bit map, so these images look somewhat better than on a laser printer. Also, since it prints at 360 dpi, it's able to produce high-quality gray-scale images, in some cases noticeably better than a 300-dpi laser printer.

The StyleWriter comes with TrueType and produces excellent-quality text. I tried it with a wide variety of fonts, including a full kanji TrueType font, and got legible output in sizes from 4 points to over 100 points.

The StyleWriter is a high-quality printer that does, however, operate slowly. It is intended to be a low-cost alternative to a laser printer that is still able to print with good quality. The addition of TrueType fonts makes it an excellent printer for high-quality document printing where single- or low-copy volumes are required. It isn't suitable for printing large batches of documents. Its main importance is that it lets the Apple family have a convenient laser-quality printer for a low price. In some ways, it's intended to replace the ImageWriter II, since it costs the same but has superior quality and somewhat superior speed. However, the ImageWriter II still has some niches left, notably in printing multiple-copy forms.

With these two printers, Apple finally moves into the low-cost arena. Their design shows some of the excellent technical expertise available from Apple at its best. Apple has done a good job of taking these printer designs and pushing their performance as far as possible. The Personal LaserWriter LS is a worthy contender for the crown of best inexpensive laser printer; the StyleWriter sets new standards for ink-jet printing. The street cost of a Mac Classic with a hard disk drive and the StyleWriter will be $1600 to $1700, which makes the combination an extremely competitive one when stacked up against less well integrated solutions based on the IBM PC.

Owen Linderholm is a BYTE senior news editor. You can reach him on BIX as "owenl."

THE FACTS

<table>
<thead>
<tr>
<th>Personal LaserWriter LS</th>
<th>$1299</th>
</tr>
</thead>
<tbody>
<tr>
<td>(includes driver software, TrueType fonts, and System 6.0.7 required to run it)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>StyleWriter</th>
<th>$599</th>
</tr>
</thead>
<tbody>
<tr>
<td>(includes driver software, TrueType fonts, and System 6.0.7)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Apple Computer, Inc.</th>
<th>20525 Mariani Ave.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cupertino, CA 95014</td>
<td>(408) 996-1010</td>
</tr>
<tr>
<td>Circle 1165 on Inquiry Card.</td>
<td></td>
</tr>
</tbody>
</table>
“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 it's 200 MB HD, I still had plenty of room left and it screamed through everything at 11 MIPS!”

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

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

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

“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.
(800)538-7506 US; (800) 233-2077 CA
In Canada call Laptech 1-800-561-4527

Dolch.

ROAD-POWER FOR THE BEST OF US
This new generation PC is remarkable for the performance and practicality it provides. Carry it from the office, to home, to multi-site locations so all your programs and files travel conveniently with you.

Customers and critics alike are praising the Brick for its portability, elegant design, whisper quiet operation and screamingly fast power. This diminutive PC with the unforgettable name is designed for the way you always wanted to do computing.

Here’s a sampling from recent articles on the Brick.

“Every once in a while a PC product comes along in which the performance, design and concept are so uncommon that a little voice inside you says you really want to have one.”

Jon Pepper,
PC Sources, 11/90

“Engineered with the way people actually work in mind. It answers the question of how to transport an entire environment to and from several work sites, something no other product handles elegantly.”

PC/Computing, 12/90

“Overall the Brick represents a clever counter to conventional notebook designs. It solves the fundamental problem of two-location computing. You get to keep your home and away files in sync because they are the same.”

Tracy Licklider
BCS UPDATE, 7/90

“Ergo’s Brick maintains the functionality of a desktop PC within a small form-factor...the Brick is a real performer, consistently outperforming both Compaq’s and IBM’s 16 MHz SXs on PC Labs computer benchmark tests.”

Matt Ross,
PC Magazine, 9/25/90

“The Ergo Brick—that delightfully small, full-featured 386SX™ machine. It’s almost silent, it’s fast...a great personal computer in every other respect too.”

Bill Machrone,
PC Magazine, 1/15/91

“The Brick is the first real innovation in DOS based computers in a long, long time.”

Computer Shopper, 1/91

“The philosophy behind the Brick is so obvious that I’m surprised that no one has thought of it before...you can keep a monitor and a keyboard at each work location, carrying only the computer guts (and your own data) between locations...in a world of boring and utilitarian PCs, the Brick stands out for both its elegance and its technological sophistication.”

Stan Miastkowski,
BYTE, 6/90

THE BRICK
"The Brick is first class all the way. Its appearance and feel suggest even higher quality than that of the Toshiba and Compaq... This system provides an amazing amount of features and support for the price."

Peter Varhol,
Personal Workstation
11/90

"Using the Brick is a pleasure. In fact, several things about the Brick are terrific. By any standard it's a well equipped and competitively priced 386SX desktop; when you add the appeal of its diminutive size, it becomes adorable."

Eric Greustad,
Portable Office, 12/90

"The beauty of this arrangement is that you never have to worry about the consistency of your data files... you just take it all with you."

Henry Ferst-Hus, Weiss,
PC Magazine, 3/91

"Only slightly larger and heavier than a college dictionary, the Brick is a faux-granite-finished portable CPU that explores the middle ground between desktop PCs and portable computers."

Jerry Pournelle,
BYTE, 1/91

"...everyone who sees it falls in love with it... Recommended."

Fred Paul,
PC/Computing, 8/90

One Intercontinental Way
Peabody MA 01960
TEL: (508) 535-7510
FAX: (508) 535-7512

Circle 109 on Inquiry Card.
Zenith 486/TIGA Combo Packs Plentiful Processing Power

With many of today's newest 1446-based computer systems being built and marketed as network file servers, it's easy to feel left out if you're an individual user who needs cutting-edge processing power for heavy-duty number crunching or serious graphics work. With the Z-486/25E from Zenith Data Systems (ZDS) on your desk, you won't feel left out.

The high-end Model 170 that I tested can only be characterized as a serious workstation for serious work indeed. As its name implies, the Z-486/25E is based on a 25-MHz i486. The E stands for EISA, and three open EISA slots are ready and waiting for future expansion.

The Model 170 has a 170-megabyte Intelligent Drive Electronics (IDE) hard disk drive. Matching the speed of the system, the drive sported a fleet 19.7-millisecond access time running the BYTE disk benchmarks. But the speed and power don't stop there; the Model 170 also has a Texas Instruments Graphics Architecture (TIGA) video board that is based on TI's potent 60-MHz 34010 graphics processor. To say that it makes a difference in graphics speed is an understatement. The 34010 takes all the graphics processing away from the system CPU, resulting in BYTE video benchmarks that were 5½ times faster than a comparable VGA-based system.

More and more common applications are supporting the TIGA standard, and TIGA-product manufacturers are also supplying drivers for other applications. ZDS supplies several drivers with the Z-486/25E, including a high-resolution driver for Microsoft Windows 3.0. Couple it with ZDS's new ZCM-1650 16-inch high-resolution monitor, and you end up with a Windows 3.0 desktop with a resolution of 1024 by 768 pixels. And because it's a noninterlaced image, it's rock-steady. Windows 3.0 is an entirely new and eminently useful tool when you couple this resolution with the speed of the graphics board and the CPU power. There's virtually no waiting; things appear to happen instantaneously.

Plunging the humongous ZCM-1650 monitor on top of the system unit results in an interestingly incongruous juxtaposition. The Z-486/25E's case is surprisingly small, with a paltry 14- by 15-inch footprint, and it's just 6 inches high. I expected to find the case packed with equipment and cables, but it wasn't. The system unit has lots of free space on the inside. It's a triumph of careful design and mechanical engineering. The 64-bit memory board (which uses a proprietary slot) can take up to 16 single in-line memory modules without cramping. If you use 4-MB SIMMs, you can have a desktop PC with 64 MB of RAM—a true workstation.

There's even room inside the case to slip in an extra half-height 5 1/4-inch floppy disk drive. The Z-486/25E comes standard with a 3 1/2-inch 1.44-MB floppy disk drive, and you can fill that extra space with a 5 1/4-inch 1.2-MB drive, an additional hard disk drive, or ZDS's pricey ($1299) 150- MB SCSI tape backup unit.

The SCSI controller is already ready and waiting for future expansion. A SCSI bus provides up external SCSI devices (e.g., a CD-ROM drive).

From all its features, it's not difficult to see that the Z-486/25E is a system that's designed to not become quickly obsolete. That's especially true of the unit's EISA expansion capabilities. Neither of the two included boards takes advantage of EISA's bus-mastering capabilities and 33-MHz bandwidth. And you'll pay a hefty premium for having the "EISAbility."

Make no mistake: This is not a low-priced clone. The top-of-the-line Model 170 the I tested, complete with the 16-inch monitor, tips the price scales for $11,998.

For smaller budgets, the Model 80 has 80-MB hard disk drive and a VGA (instead of TIGA) board. At a retail price of $8599, it's still costly, and you'll still need a monitor. (The TIGA board is available by itself for $899.)

ZDS systems are superbly engineered and ruggedly built for full-time work on critical projects. And the finely tuned combination of components in the Model 170 results in a system that delivers every last ounce of performance. Obviously, not everyone needs this type of system. It's overkill for day-to-day, mundane word processing or telecommunications applications. But it's all too easy to become accustomed to this system designed for the ultimate power user. I certainly wish that I had a real reason to keep it.

—Stan Miastkowski
The ELEX Electronic Filing System (EEF) is a hardware/software system designed to reduce the frightening volumes of paperwork that burden businesses on a daily basis. As paper is eliminated, transactions are made in a fraction of the time required by traditional means, costly storage facilities are reduced, data security and integrity is enhanced, and work quality and quantity is increased. These factors all give companies and individuals the competitive advantage they need to excel in the business environment of the 90’s.

**Filing vs. Archiving**

Document image processing is a new technology which has just begun to evolve. The myriad of hardware devices on the market, and the lack of an industry standard protocol for communicating between them, make the integration of an electronic filing system a formidable task. And without intelligent software to control all aspects of the storage, management, and retrieval of documents, the filing system will be nothing more than a micro-fiche machine in disguise.

With these considerations in mind, EEF was designed as a turn-key solution which relieves the clients of all the intricacies involved in integrating a truly functional electronic filing system. Yet its flexible design allows continuous and smooth upgrade as the users needs grow and change.

**Open Architecture**

EEF is designed as a totally open architecture system. Rather than being a closed package, EEF is composed of individual building blocks defined by their area of electronic filing functionality. These blocks are not bound to specific hardware/software limitations. As such, they can be combined in a variety of forms on each of the following operating platforms, to achieve optimal satisfaction of an application’s specific demands:

- A single user workstation under the DOS or the OS/2 operating system.
- A local area network - Novell NetWare 286 and higher or any DOS 3.1 compatible network.
- A host computer under the UNIX, VAX/VMS or IBM AS/400 system with a PC connection.

**EEF Applications**

The EEF system opens a vast new world of opportunities for you. The possible applications are limitless, and to name a few:

**Management Systems**

Any application which requires original documents and forms (e.g. verification of signatures and L/C in the banking area).

**Scientific and Engineering Data**

Any application in these fields that requires maps, charts, logs, sketches, etc.

**Medical Uses**

The kind of visual information which is so essential for medical applications is handled by EEF in a natural, straightforward manner.

**Art Catalogs**

Making multi/media presentations of art works, for example at auctions, can provide an exciting new display method.

**Real Estate / Travel Agency**

EEF can be used to take the customers on an on-site electronic tour without ever leaving the office, thus shortening the process of selection.

**EEF Pilot System**

For prospective clients wishing to enter the field, we have prepared a pilot system, enclosing in one package the full range of functions necessary for electronic filing. The system components are:

**Hardware**

386 base micro-computer at 33MHz with 64K cache, 8 MB RAM, 1.2GB with access time of 0.8MS (disk caching), proprietary scanner and printer interfaces, high resolution (1660 x 1200) CRT display, laser printer 300 dpi at 8 ppm, scanner 300 dpi with 100 page feeder.

**Software**

The EEF software package, including the document manager, the retrieval engine, the hypermedia interface, and 20 hours of customization services.

Total cost for the pilot system is 30,000 US$.

For further details and literature, please contact:

**EUROPE: ELEX INFORMATION SYSTEMS SA**

65, Rue de Lausanne 1202 Geneva Switzerland Tel. + 41 22 738 11 99 Fax. + 41 22 738 11 90

**USA: ELEX INFORMATION SYSTEMS INC.**

125-127 North 4th Street Philadelphia, PA 19106 USA Tel. +1 215 627 7202 Fax. = 1 215 627 2342.

Trademarks: DOS, OS/2, Microsoft Corp; NetWare, Novell, Inc.; UNIX, SCO Corp; AS/400, IBM Corp; VAX/VMS, Digital Equip. Corp.

Circle 107 on Inquiry Card.
Borland Hopes to Make Forms Exciting

One of the most mundane items in any office is a form. And few things are so tiresome as finding the right one, filling it out, and processing it. Software for dealing with forms is a big improvement—especially for forms processing. Now, Borland International has come out with a program that may make designing and filling out forms almost exciting.

The new ObjectVision is a Windows program that goes beyond most forms packages. Being a Windows program, it naturally includes some good graphics capabilities. These let you create a large variety of forms, including a good replica of an IRS 1040 tax form. ObjectVision can also function somewhat like a spreadsheet because each field in a form can contain a spreadsheet-compatible formula. And it includes a Paradox-compatible database manager, which means that you can access ObjectVision data by using Paradox or any of Borland’s Paradox-compatible software.

The most exciting aspect of ObjectVision is its ability to do visual programming. For each field in a form, you can create a graphical decision tree. Such a tree is much easier to design, debug, and maintain than a standard spreadsheet formula.

The best way to illustrate such a decision tree is with an example. Say you are constructing an order form that will automatically determine the credit terms for an order. You can set up a credit terms field that will contain a decision tree. The first branch point will be whether it’s a new customer or not (ascertained by checking a new customer check box on the form). If the customer is new, the next branch point may be the customer’s credit rating (ascertained from the credit rating field). If the credit rating is poor, the end result of that branch may be to set credit terms at 100 percent down (i.e., the customer has to pay in full up front). The other branches may set up different credit terms. One branch may even require the user to fill out an additional form.

The process for creating decision trees takes some time to get used to, but, once mastered, this capability lets you create and modify trees with relative ease. Even an extremely complex tree can be deciphered fairly easily.

This new forms package is interesting, but it may have a slight problem with certain types of forms. For example, an order form, such as that used by a waiter, may have a table of blank fields that can be filled in with any of several item names, quantities, and prices. In ObjectVision, it is awkward to enter data in such a table because the program will lead the user to each of the many blank fields.

ObjectVision has a list price of $495. But if Borland tradition holds, and you already own other Borland products, you will probably receive an offer with a greatly reduced price. The program also includes a run-time module that lets developers distribute runtime versions of their forms for free.

Borland’s forms program is a bold new variation on a mundane theme. Tests performed on an early version of the program suggest it is not only bold but successful. And if you’re developing Windows applications for in-house use, ObjectVision will probably be essential as well.

—Rich Malloy

Portable Printing: From the Practical to the Elegant

With smaller and faster battery-powered systems taking to the road, busy writers and executives have the need for a variety of portable peripherals. I looked at two recently released portable printers and was not surprised to find that you get what you pay for. The laser-compatible Mannesmann Tally MT735 300-dot-per-inch thermal page printer tops the high end, while the 24-pin dot-matrix Seikosha LT-20 is about one-third the price—but one-third the printer, as well.

Mannesmann Tally is calling the MT735 the first portable 300-dpi thermal page printer. But whether it’s first or not, what is most impressive about this little printer is its speed, print quality, and portability—all in one.

The MT735 produces laser-quality text and graphics at up to 6 pages per minute at 300 by 300 dpi. It weighs about 8 pounds and measures 11 1/2 by 8 3/4 by 2 1/2 inches. It comes with a built-in 80-page sheet feeder, a built-in 150-page-capacity rechargeable battery (and charger), and 1 megabyte of memory for full-page graphics. The printer can handle normal copier paper and transparencies. However, for high-quality graphics,
Here’s a chance to buy our $99 Math Coprocessor at no risk whatsoever! It’s fully guaranteed to at least double the math performance of your software.

If you want to unlock the full power of your PC, pick up the phone and order an AMD 80C287 math coprocessor. Without it, your PC just isn’t really complete. You see, our math coprocessor can dramatically increase the performance of 1-2-3®, dBASE®, Excel, and hundreds of your other favorite business applications! It actually runs calculations two to ten times faster than your PC can without a math coprocessor. Which means your graphs will draw incredibly fast and your spreadsheets will recalculate at truly blazing speeds. (And that’s just for starters!)

High speed at a low price.
Don’t think you have to pay over $200 for a math coprocessor. Now you can get ours for just $99 when you order direct from AMO! The AMO 80C287 is fully compatible with your 80286-based PC and the hundreds of commercially available software packages written for it. Our coprocessor is also compatible with the Intel NMOS 80287.

Installation is a snap.
The AMD 80C287 plugs easily into a socket that’s already inside your 80286-based PC. In fact, you can be up and running in just five minutes. Simply plug the chip into the socket and watch the dazzling improvement in performance! The AMD 80C287 comes with easy-to-follow installation instructions, a free utilities disk (which includes diagnostics and test software), and free color computer games.
Mannesmann Tally suggests laser-quality paper.

The four resident fonts include Courier, Helvetica, Times Roman, and Math in various sizes. The printer also accepts downloaded fonts in Hewlett-Packard Series II LaserJet format. The MT735 can print in both portrait and landscape modes, accepts up to legal-size paper, and emulates the HP Series II LaserJet, DeskJet, IBM Proprinter X24, and Epson LQ-850. A copy feature stores the last page printed in memory and lets you make multiple copies.

Seikosha's LT-20 is called a laptop printer because it has been designed to fit under your laptop. It's also a cut-sheet printer and prints 100 pages on a single nickel-cadmium battery charge. It weighs about 5 pounds and measures 14 1/2 by 11 1/2 by 2 inches. It comes with an AC adapter with optional 12- and 24-volt adapters, so you can run it from a cigarette lighter.

The LT-20 has one built-in font (Courier). You can add an optional font ROM with eight other fonts.

In graphics resolution, the LT-20 does 360 by 180 dpi and prints at 10, 12, and 15 characters per inch. Its cut-sheet feeder handles up to letter-size paper. Unlike the MT735's four standard emulations, the LT-20 emulates just the IBM Proprinter X24.

These two printers do an admirable job printing basic text. The MT735 is far superior in printing graphics, both in speed and print quality (compare about 0.6 ppm on the LT-20 to the MT735's 6 ppm). The LT-20 is priced for a system on the go, and it is, after all, essentially a dot-matrix printer housed in a unique package. Its sleek design makes it both attractive and useful, and it prints well enough to compete with the Canon, Kodak, and Toshiba portables in the same price range.

The MT735, on the other hand, would have to earn its keep by running as a full-time office printer as well as a print machine for the road. I found it sophisticated enough to suit my everyday printing needs, and its light weight and battery power only make it that much more appealing.

—Anne Fischer Lent

A new modeling, rendering, and animation program called Infini-D opens the door to a three-dimensional world that, once you enter, you won't want to leave. The program provides a variety of tools for creating wireframe models. It also lets you apply surface textures, light, and reflection to the models with proprietary rendering, and you can animate the images through an intuitive and powerful sequencer.

When you launch Infini-D, you see four view windows—top, front, right, and camera—which together provide a scene through which you view the 3-D world. If you like, you can look at the scene through back, left, or bottom views.

But whatever one you choose, when you change an object in one view, the program provides immediate visual feedback in the others.

Unless you have already created a wireframe model in AutoCAD, the first step is to create a 3-D object. Infini-D provides six building blocks (e.g., cube, cone, and cylinder) called generic primitives. To place a primitive in the 3-D world, you click on its icon in the tool palette and then click once in any open window. Each view window shows the generic primitive from a different point of view.

The primitive tools provide a quick way to build basic models. Three other tools—lathe, extrude, and free-

---

**THE FACTS**

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT735</td>
<td>$1295</td>
</tr>
<tr>
<td>LT-20</td>
<td>$499</td>
</tr>
</tbody>
</table>

Mannesmann Tally Corp.  
8301 South 180th St.  
Kent, WA 98032  
(800) 843-1347  
(206) 251-5500  
fax: (206) 251-5520  
Circle 1168 on Inquiry Card.

Seikosha America, Inc.  
10 Industrial Ave.  
Mahwah, NJ 07430  
(800) 338-2609  
(201) 327-7227  
fax: (201) 818-9075  
Circle 1169 on Inquiry Card.

---

**An Infini-D Example:**

[Image of Infini-D interface and 3D model]
This is what the world's most powerful 486 system looks like.
Cylindrical pin and tumbler locks keep unauthorized fingers out of the hardware. (And your data is equally safe, because we’ve built password protection into the firmware.)

**ETMS** Everex Thermal Management System, makes this the first system to solve the high temperature and related reliability problems of current and future processors. A partition separates the cube into two compartments, independently cooled by SmartFans. One contains the CPU, one the drives. Baffles funnel cool air where it’s most needed. Even the power supply is cool, because at 400 watts, it runs at a fraction of its capacity.

All the full-length expansion slots you’ll ever need—12 altogether, including 10 EISA slots.

AMMA, a 256KB write-back caching architecture, forming “two-tier” caching in combination with the 486 chip’s 8KB internal cache. It improves the cache hit ratio from 50% to as much as 99%.

The 486/33 CPU chip, Intel's hottest. But when hotter chips come around, the cube will be cool enough to handle them. And that includes multiprocessors.

Space for four quick release, half-height drives. They’re front accessible, behind a hydraulically dampened door—which makes sure your drive heads are reading disks and tapes, not dust, smoke and humidity.

Quick release drive bays accommodate up to eight more drives that can be swapped out in less than five minutes.

Removable motherboard for instant upgrades, which we’ll bring you as new technologies emerge.

The entire interior of the cube is accessible in seconds through side panels, using thumbscrews.

Space for four quick release, half-height drives. They’re front accessible, behind a hydraulically dampened door—which makes sure your drive heads are reading disks and tapes, not dust, smoke and humidity.
And this is why.

Conventional system design can't cope anymore. The emerging technology is just too hot for it.

Enter the STEP Megacube. Redesigned from the ground up, the STEP Megacube is a 486™ system unlike any other. It incorporates ideas from the mainframe world, such as its caching architecture and thermal management. And it has performance and features that make it a perfect fileserver. Or a perfect multiuser system. Or a perfect graphics workstation.

A 486/33 CPU combined with Everex's proprietary Advanced Memory Management Architecture (AMMA™) gives it warp speed—21.7 MIPS. Space for twelve drives gives it storage that will remind you of the Library of Congress. And twelve expansion slots give it more expandability than you can shake a peripheral at.

And if it happens to be an Everex™ peripheral, you could get a nice performance bonus. Because Everex graphics, networking and controller boards are designed to take full advantage of our STEP™ architecture for even better performance.

Combine all this with up to 64 MB of RAM—enough for the most demanding applications—and you wind up with a computer that can be configured for anything.

Even the future.

You see, the design breakthroughs of the STEP Megacube eliminate the upgradability problems inherent in other systems. Which means that when the next generation processors arrive—like the 50MHz 486, just down the road—all you have to do is swap out motherboards. No space problems. No overheating problems. No obsolescence.

Performance-wise, this is a machine that will be hot long after others are cold and buried. In fact, as of now, there's no end in sight to the STEP Megacube's upgradability path.

But really, that shouldn't be much of a surprise. After all, at Everex, our mandate is "Always innovate, never compromise." And that's exactly the approach we took when we built the STEP Megacube.

Granted it doesn't look like your typical 486 system. Fortunately, it doesn't perform like one either. To find out more about what it can do, give us a call.

For a free copy of the STEP Megacube Application Guide, call: 1-800-368-STEP

Introducing the STEP Megacube.
Artwork Gets Easier with an Improved FreeHand

Aldus FreeHand is one of two major object-based drawing applications for the Mac. With the release of Illustrator 3.0 from Adobe, Aldus has countered with improvements to FreeHand. If my glimpse of the beta Aldus FreeHand 3.0 is any indication, it will easily hold its own in the drawing arena with its new features and user-interface enhancements, including several types of built-in arrowheads for use with lines, better control of text alignment to lines or curves (especially ellipses), and the ability to import, display, and print 24-bit TIFF images.

FreeHand can create and manipulate composite paths (i.e., objects that have openings or holes in them so that background objects can show through). For example, in an aircraft drawing, the canopy could be drawn as a composite path to allow cockpit details to show. Text that uses either PostScript Type 1 or Type 3 outline fonts can be converted to composite paths, making sophisticated text shading and overlays possible.

A strength of FreeHand is its layers feature, which arranges the order of appearance of a drawing's elements. FreeHand 2.0 was limited to 200 foreground (printing) layers and one background (non-printing) layer; in FreeHand 3.0, the number of layers is limited only by memory.

FreeHand's tool palette sports three new tools: a tracing tool (which can generate
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 ComputerWorks, 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

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

Hauppauge!

Available at your local computer dealer.

Circle 139 on Inquiry Card.
NEWS
F IRST IMPRESSIONS

paths from the edges of a high-contrast scan, a knife tool (to cut lines or curves into two separate paths), and a magnifying tool (to zoom into or out of a point of interest on the drawing).

FreeHand's enhanced interface lets you manage complex drawings easily. Three new palettes—colors, layers, and styles—provide quick access to an element's attributes. Each palette lets you modify the element's attributes on-screen without having to move around in the menu bar.

The colors palette uses small swatches of colors to show an element’s actual fill and line colors. The layers palette shows what layer the element belongs to, and it lets you add and rearrange layers by simply clicking and dragging. The styles palette shows what colors, shading, and patterns are used to fill the element, although you must open a dialog box to view the actual colors. These three palettes conveniently display the fills, colors, and layer of each element as you select it with the mouse.

I used FreeHand 3.0 on a Mac Iici with 8 megabytes of RAM and equipped with an AppleColor 13-inch monitor and a SuperMac Technology 19-inch monitor; I also used it on a Mac Plus with 2 MB of RAM and an HD-20 hard disk drive. Both computers ran System 6.0.5.

On the Iici, color blends displayed superbly at 24-bit screen depths. FreeHand capably handled multiple screens: I could place the palettes on the smaller monitor while expanding the drawing full-size on the larger monitor. I was able to import a 24-bit color TIFF image created by a Sharp JX-100 scanner, add text, and print the result.

As I expected, FreeHand was much slower on the Mac Plus, especially if it had to display colors as dithered patterns. However, these same patterns appear in the colors palette, which allows limited color work on Macs that have black-and-white screens. The Mac Plus's performance was adequate on less complex artwork, but serious drawings require a Mac II-class computer.

I was able to open and edit Illustrator 1.1 and Illustrator 88 files with FreeHand 3.0. Illustrator 3.0 was able to import and display FreeHand drawings saved as encapsulated PostScript files, which augurs well for sharing information between the two applications. FreeHand EPS files include Open Prepress Interface comments, which contain descriptive information that's used by certain high-end prepress systems.

Will FreeHand 3.0 eclipse Illustrator 3.0? Not likely, but neither will FreeHand lurk in its shadow. Illustrator can deal with larger amounts of text and can generate graphs. But FreeHand easily wins over Illustrator as the master of creating color blends, and its layers feature makes complicated artwork practical.

Nor should the enhancement to FreeHand's interface be dismissed casually: It goes a long way toward making a sophisticated drawing application less intimidating and quite usable. Check it out.

—Tom Thompson

---

LUNCH BOX
PLASMA VGA $1,595
CRT 286-12MHz $995
VGA LAPTOP $1,595
286-12MHz CPU
1MB RAM
1.44MB floppy drive
42MB hard disk
LCD VGA 640x480 Paper white LCD
External monitor connector
86-key detachable keyboard
One 16-bit expansion slot
One 2400 baud modem expansion slot
Serial and parallel
Removable, rechargeable battery Run 150 min.
3.5" (H) x 14" (D) x 12.5" (W)
Notebook 286-12 $1,595
Notebook 386SX $1,695

LUNCH BOX
LCD VGA
1MB RAM
1.2MB or 1.44MB FD
42MB hard disk
Plasma VGA 640x480 screen
Plasma VGA card
Serial and parallel
86-key detachable keyboard
200W power supply

Fortune 1000 companies,
Universities and Governments purchase orders welcome

OFFICE HOURS: MON-SAT 8:30AM-5:30PM PST

Price Subject To Change Without Notice

9945 LOWER AZUSA, TEMPLE CITY, CA. 91780
TOLL FREE 800/346-7207 • FAX: 818/442-9112

Circle 236 on Inquiry Card.
TURBO PASCAL
for WINDOWS

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

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

The easiest way to create powerful Windows applications.

List: $250
NOW: $169

BORLAND C++
for DOS & WINDOWS

Designed by professionals, for professionals. Every copy includes all the tools you need to develop Windows and DOS applications:

- Complete support for building Windows applications.
- A 100% ANSI compatible C compiler and a C++ compiler.
- Turbo Drive Compiler & Environment running in protected mode.
- Pre-compiled headers to dramatically increase re-compilation speed.
- Turbo debugger for DOS and Windows.
- Whitewater Resource Toolkit for creating icons, dialogs, bitmaps & menus bars.
- Turbo Profiler and Turbo Assembler.

List: $495
NOW: $325

OBjectvision
for WINDOWS

Visual Application Creation. Quickly. Without any previous programming experience.

- Develop and run applications in the Windows environment.
- No programming language to learn.
- Supports all 100%-Windows-compatible networks and peripherals.
- Direct access to Paradox, Btrieve, and dBASE database files. DDE Links to other Windows applications.
- "What If" analysis: Minimal recalculation speeds up processing.
- WYSIWYG printing.

List: $100
NOW: $95

POLICIES

- Corporate: 800-445-7899
- International: 908-389-9228
- Domestic: 800-445-7899
- Fax: 908-389-9287

Call from your FAX telephone, end follow the instructions to receive more information on Mon-Fri 8:30 AM-7 PM EST. We accept MC, Visa, AMEX. Domestic COD shipments, please add $3 per item for shipping/handling by UPS ground. Rush service available. Mail or FAX/International/POs subject to a $25 processing charge. *All prices subject to change without notice.
Windows MAKER \[PROFESSIONAL\]
The fastest way to create Windows applications. Generates the Windows .EXE with complete source & production files (no royalties). Point & Click to define the user interface. Animate your design to instantly test its look & feel. Make changes on the fly without compiling. Custom code is preserved during code regeneration. A state-of-the-art programming tool. Supports C++. 
List: $995  Ours: $795

WATCOM C8.0/386
Unleash 386 power on your Microsoft C code with WATCOM C8.0/386, a 100% ANSI C optimizing compiler and run-time library generating applications for 32-bit 386 protected mode. With C8.0/386, you can go beyond the 64KB DOS limit. Library and source compatibility with Microsoft C simplifies porting 16-bit applications to the 386. Significant features include: full-screen source-level debugger; protected mode version of the compiler; execution profiler; linker; graphics library. Run-time compatible with WATCOM 777/386.
Standard List: $995  Ours: $719
Professional List: $1295  Ours: $999

LAHEY F77L FORTRAN COMPILER
New version 5.0 includes Fortran 90 features: ALLOCATABLE Arrays, CASE Constructs, CYCLE and EXIT, Construct Names, and many other new features. Package includes Editor, Make Utility, Profiler, Full 77 Standard support, Microsoft and Borland C interfaces, popular main-frame extensions, fast compile, excellent diagnostics and a powerful debugger. 386/486 users have the option of generating 32-bit instructions.
List: $955  Ours: $535

CLEAR FOR C
Automatically creates accurate flowcharts, treestructures and source prints from any code, no matter how old, big or complex. Can save days of reading listings and taking guesses. Also provides instant presentation quality documentation which increases perceived value of your work and impresses clients or managers. Powerful features, 3 preprocessor options, function cross-references, prototype files, detail control. Full support for most C compilers.
List: $200  Ours: $169

---

<table>
<thead>
<tr>
<th>DEVELOPMENT SOFTWARE</th>
<th>LIST</th>
<th>OURLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>386 Development Tools</td>
<td>388 ASMALoc</td>
<td>1295</td>
</tr>
<tr>
<td>386/DOS Extender SDK</td>
<td>395</td>
<td>430</td>
</tr>
<tr>
<td>Intel 386 C Code Builder</td>
<td>695</td>
<td>485</td>
</tr>
<tr>
<td>Lahay F77L-EM/32 (w/ OS/286)</td>
<td>1295</td>
<td>1025</td>
</tr>
<tr>
<td>MetalsWare High C 386</td>
<td>995</td>
<td>515</td>
</tr>
<tr>
<td>OS/286 Developer's Kit</td>
<td>695</td>
<td>625</td>
</tr>
<tr>
<td>WATCOM C 8.0/386 Prof.</td>
<td>1295</td>
<td>909</td>
</tr>
<tr>
<td>w/386/DOS Extender</td>
<td>1795</td>
<td>1395</td>
</tr>
<tr>
<td>WATCOM C 8.0/386 Standard</td>
<td>895</td>
<td>715</td>
</tr>
<tr>
<td>WATCOM FORTRAN 77/386</td>
<td>1095</td>
<td>855</td>
</tr>
<tr>
<td>Zortech C++ Devel. Ed. 386</td>
<td>995</td>
<td>849</td>
</tr>
</tbody>
</table>

| Assembly Language | Advantage Assembler | 295 |
| w/ Pre-Processor | Sourceware | 150 |
| SpontaneousAssembly | Turbo Debugger & Tools | 150 |
| C-Compilers | Instant C | 705 |
| w/Microsoft C 6.0 | 495 |
| w/MS Software Dev. Toolkit | 749 |
| w/Objective-C | 695 |
| MS Quick/C w/QuickAssembler | 199 |
| WATCOM C++ Professional | 495 |
| WATCOM C++ Standard | 355 |
| C++ | Borland C++ w/ a FREE T-shirt! | 495 |
| C++Views | 419 |
| Rogue Wave Tools++ | 200 |
| Turbo C++ | 69 |
| ZinC for DOS | 200 |
| ZinC for DOS & Windows | 200 |
| Zortech C++ | 200 |
| Zortech C++ Database | 200 |
| C++ Bundle | Borland C++ and Tier 1 w/ a FREE T-shirt | 975 |
| C-Communications | Essential Communications | 239 |
| Greenleaf CommLib | 279 |
| SilverComm "C" Asy Library | 249 |
| C-File Management | Codebase IV | 295 |
| c-tree Plus | 219 |
| dBCII Plus | 595 |
| Essential B-Tree w/ source | 409 |
| The Toolbox - Prof. Edition | 1095 |
| The Toolbox - Special | 695 |
| C-General Libraries | C Function Library | 99 |
| C TOOLS PLUS/6.0 | 149 |
| C Utility Library | 149 |
| Greenleaf Functions | 229 |
| Greenleaf SuperFunctions | 229 |
| Turbo C T00LS/2.0 | 149 |
| C-Screens | C-Worthy | 399 |
| Greenleaf DataWindows | 395 |
| Vemont View | 495 |
| Vitamin C | 395 |
| VC Screen | 149 |

| C-Utilities/Other | Bar Code Library | 389 |
| Clear for C | 189 |
| INTERWORK | 189 |
| MKS LEX & YACC | 249 |

| COBOL | COBOL2/32 Compiler & Toolset | 1800 |
| Microsoft COBOL | 900 |
| Realice COBOL | 995 |

| Database Development | Clarion Personal Developer | 79 |
| Clarion Prof. Developer 2.1 | 845 |
| DBASE IV | 795 |
| Dr. Switch-ASE | 180 |
| R&R Code Generator | 150 |
| R&R Report Writer | 249 |
| Say What?! | 50 |
| SilverComm "C" Interface | 39 |
| SilverComm Library 2.0 | 249 |

| Debuggers (DOS) | Paracope Debuggers | CALL |
| Trapper | 300 |

| Editors | BRIFF 3.1 | 249 |
| Microsoft VI | 149 |
| Multi-edit Standard | 99 |
| Multi-edit Professional | 179 |
| Sage Professional Editor | 255 |
| VEDIT PLUS | 185 |

| Embedded Systems | CBarPROM | 149 |
| Link & Locate ++ | 355 |
| Link & Locate ++ Extended | 479 |
| PhatLay 2.0/DOS Ext-SDK | 495 |

| FORTRAN Language | FORTRAN Dev. Tools | 395 |
| FORTRAN 77 | 149 |
| Lahay F77L | 595 |
| Lahay Personal FORTRAN 77 | 99 |
| MS FORTRAN | 450 |
| Salford FTIN 77 | CALL |

| Graphics Libraries | Baby Driver | 250 |
| Essential Graphics | 399 |
| Font-Tools | 156 |
| Graf/Drive Plus Developer's | 299 |
| Graf/Print Developer's | 300 |
| Graf/Print for: Graphoria | 95 |
| Graf/Print Personal | 75 |
| Graf/Print Plus | 159 |
| graphics-MENU | 179 |
| graphics-MENU Data Entry | 99 |
| GX Graphics | 149 |
| HALO | 205 |
| HALO Professional | 595 |
| HALO Window Toolkit | 595 |
| Icon-Tools/Plus | 150 |
| Menuset | 223 |
| PCK Effects | 99 |
| PCK Programmer's Toolkit | 175 |
| PCK Text | 149 |
| Super Pro-Pak | 830 |
| Turbo Geometry Library | 200 |
| Z-PHIGS Lite | 199 |
| Z-PHIGS Professional | 799 |

---

Lahey
Computer Systems Inc.
<table>
<thead>
<tr>
<th>Linkers/Librarians</th>
<th>LIST</th>
<th>OURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blinker</td>
<td>189</td>
<td>175</td>
</tr>
<tr>
<td>Plink88+</td>
<td>395</td>
<td>335</td>
</tr>
<tr>
<td>.RTLink/Plus</td>
<td>495</td>
<td>399</td>
</tr>
<tr>
<td>OS/2 Tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CASE:PM for C or C++</td>
<td>1995</td>
<td>1799</td>
</tr>
<tr>
<td>MS OS/2/Pres. Manager Tkt.</td>
<td>500</td>
<td>349</td>
</tr>
<tr>
<td>Smalltalk/V PM</td>
<td>495</td>
<td>369</td>
</tr>
<tr>
<td>PASCAL Language</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Object Professional</td>
<td>189</td>
<td>149</td>
</tr>
<tr>
<td>Topaz</td>
<td>89</td>
<td>49</td>
</tr>
<tr>
<td>Topaz Multi-user</td>
<td>149</td>
<td>135</td>
</tr>
<tr>
<td>Turbo MAGIC</td>
<td>199</td>
<td>179</td>
</tr>
<tr>
<td>Turbo Pascal 8.0</td>
<td>150</td>
<td>105</td>
</tr>
<tr>
<td>Turbo Pascal 8.0 Professional</td>
<td>300</td>
<td>205</td>
</tr>
<tr>
<td>Turbo Pascal for Windows</td>
<td></td>
<td></td>
</tr>
<tr>
<td>w/ a FREE T-shirt</td>
<td>250</td>
<td>169</td>
</tr>
<tr>
<td>Prototyping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dan Bricklin’s Demo II</td>
<td>249</td>
<td>CALL</td>
</tr>
<tr>
<td>Windows (MS) Tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-In-1</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>3-In-1 C++</td>
<td>159</td>
<td>139</td>
</tr>
<tr>
<td>Actor 3.6</td>
<td>249</td>
<td>199</td>
</tr>
<tr>
<td>Actor Professional</td>
<td>495</td>
<td>399</td>
</tr>
<tr>
<td>Asymetrix ToolBook</td>
<td>395</td>
<td>249</td>
</tr>
<tr>
<td>Batchworks</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>Ericor for Windows</td>
<td>595</td>
<td>489</td>
</tr>
<tr>
<td>Case/V</td>
<td>795</td>
<td>649</td>
</tr>
<tr>
<td>dBFast Windows</td>
<td>495</td>
<td>409</td>
</tr>
<tr>
<td>DBxSHIELD</td>
<td>595</td>
<td>549</td>
</tr>
<tr>
<td>DemoSHIELD</td>
<td>495</td>
<td>459</td>
</tr>
<tr>
<td>DialogCedar</td>
<td>495</td>
<td>479</td>
</tr>
<tr>
<td>Drover’s Toolbox</td>
<td>295</td>
<td>239</td>
</tr>
<tr>
<td>File Organizer</td>
<td>199</td>
<td>179</td>
</tr>
<tr>
<td>InstallSHIELD</td>
<td>395</td>
<td>369</td>
</tr>
<tr>
<td>KnowledgePro</td>
<td>695</td>
<td>635</td>
</tr>
<tr>
<td>LogSHIELD</td>
<td>395</td>
<td>369</td>
</tr>
<tr>
<td>MagicFields</td>
<td>255</td>
<td>235</td>
</tr>
<tr>
<td>MemSHIELD</td>
<td>395</td>
<td>369</td>
</tr>
<tr>
<td>Mewel 3</td>
<td>255</td>
<td>259</td>
</tr>
<tr>
<td>w/ source</td>
<td>595</td>
<td>529</td>
</tr>
<tr>
<td>MS Windows Development Kit</td>
<td>500</td>
<td>349</td>
</tr>
<tr>
<td>w/ Whitewater Resource Tkt</td>
<td>695</td>
<td>469</td>
</tr>
<tr>
<td>ObjectVision for Windows</td>
<td></td>
<td></td>
</tr>
<tr>
<td>w/ a FREE T-shirt</td>
<td>100</td>
<td>95</td>
</tr>
<tr>
<td>Paradox Engine 2.0</td>
<td>495</td>
<td>349</td>
</tr>
<tr>
<td>ProtoView</td>
<td>695</td>
<td>625</td>
</tr>
<tr>
<td>Sage Control Pak</td>
<td>595</td>
<td>536</td>
</tr>
<tr>
<td>Smarttalk V/Windows</td>
<td>500</td>
<td>385</td>
</tr>
<tr>
<td>SpinXaker Plus</td>
<td>415</td>
<td>348</td>
</tr>
<tr>
<td>TbxSHIELD</td>
<td>295</td>
<td>275</td>
</tr>
<tr>
<td>WindowsMAKER</td>
<td>795</td>
<td>635</td>
</tr>
<tr>
<td>Professional</td>
<td>995</td>
<td>795</td>
</tr>
<tr>
<td>WinTrieve</td>
<td>395</td>
<td>339</td>
</tr>
</tbody>
</table>

**APPLICATION SOFTWARE**

<table>
<thead>
<tr>
<th>Communications</th>
<th>LIST</th>
<th>OURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLAST II</td>
<td>250</td>
<td>225</td>
</tr>
<tr>
<td>Crosswalk Communicator</td>
<td>99</td>
<td>CALL</td>
</tr>
<tr>
<td>Crosswalk for Windows</td>
<td>195</td>
<td>145</td>
</tr>
<tr>
<td>Crosswalk MK.4</td>
<td>245</td>
<td>145</td>
</tr>
<tr>
<td>Crosswalk XVI</td>
<td>195</td>
<td>115</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mathematics</th>
<th>LIST</th>
<th>OURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Derive</td>
<td>250</td>
<td>219</td>
</tr>
<tr>
<td>Mathematica 386</td>
<td>695</td>
<td>625</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Op. Sys./Environments</th>
<th>LIST</th>
<th>OURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB DOS 5.0</td>
<td>199</td>
<td>129</td>
</tr>
<tr>
<td>MS DOS 5.0</td>
<td>695</td>
<td>629</td>
</tr>
<tr>
<td>OS/2 Developer’s Kit</td>
<td>695</td>
<td>629</td>
</tr>
<tr>
<td>OS/2 Developer’s Kit</td>
<td>695</td>
<td>629</td>
</tr>
<tr>
<td>VM/386</td>
<td>245</td>
<td>209</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spreadsheets</th>
<th>LIST</th>
<th>OURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lotus 1-2-3 3.1</td>
<td>595</td>
<td>399</td>
</tr>
<tr>
<td>Microsoft Excel</td>
<td>495</td>
<td>349</td>
</tr>
<tr>
<td>Quattro Pro</td>
<td>495</td>
<td>329</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Utilities</th>
<th>LIST</th>
<th>OURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>386MAX5.0</td>
<td>130</td>
<td>114</td>
</tr>
<tr>
<td>BlueMAX</td>
<td>155</td>
<td>135</td>
</tr>
<tr>
<td>Cross Point Backup</td>
<td>99</td>
<td>68</td>
</tr>
<tr>
<td>DIS DCC Professional</td>
<td>249</td>
<td>225</td>
</tr>
<tr>
<td>Grasp 4.0</td>
<td>349</td>
<td>CALL</td>
</tr>
<tr>
<td>HiJack 2.0</td>
<td>199</td>
<td>139</td>
</tr>
<tr>
<td>Hold Everything</td>
<td>199</td>
<td>159</td>
</tr>
<tr>
<td>MICS Toolkit</td>
<td>249</td>
<td>199</td>
</tr>
<tr>
<td>Norton Anti-Virus</td>
<td>129</td>
<td>99</td>
</tr>
<tr>
<td>Norton Commander</td>
<td>149</td>
<td>99</td>
</tr>
<tr>
<td>Norton Utilities 5.0</td>
<td>129</td>
<td>108</td>
</tr>
<tr>
<td>Opt-Tech Sort/Merge</td>
<td>149</td>
<td>199</td>
</tr>
<tr>
<td>PC Tools Deluxe 6.0</td>
<td>149</td>
<td>95</td>
</tr>
<tr>
<td>PreCursor</td>
<td>96</td>
<td>79</td>
</tr>
<tr>
<td>SideKick 2.0</td>
<td>100</td>
<td>69</td>
</tr>
<tr>
<td>SpinFile II</td>
<td>89</td>
<td>74</td>
</tr>
<tr>
<td>SquarePlus</td>
<td>100</td>
<td>75</td>
</tr>
<tr>
<td>SunShow Image Library</td>
<td>CALL</td>
<td></td>
</tr>
<tr>
<td>Switch-It</td>
<td>99</td>
<td>90</td>
</tr>
<tr>
<td>Tree 86</td>
<td>90</td>
<td>59</td>
</tr>
<tr>
<td>UpShot</td>
<td>95</td>
<td>89</td>
</tr>
<tr>
<td>Zeno</td>
<td>269</td>
<td>239</td>
</tr>
</tbody>
</table>

**Word Processing**

| Ami Professional        | 495  | CALL |
| Microsoft Word for Windows | 495  | 349  |

**WordPerfect**

**Thousands more products available! Call or fax today for your FREE catalog.**

---

**FREE Programmer’s Paradise T-Shirt!**

when you buy one of these hot new products from Borland.

- Borland C++ $325<sup>TM</sup>
- Turbo Pascal for Windows $169<sup>TM</sup>
- ObjectVision $95<sup>TM</sup>

Please specify size when ordering (M, L, XL).

*Supplies while lasts*

**THE WHITERETT RESOURCE TOOLKIT**

An easy to use, interactive tool that lets you rapidly design the look and feel of new Windows™ applications, as well as alter existing Windows applications. It is the first product specifically designed to provide a simple and comprehensive way to create, edit and manage Windows resources. Whether you are a C programmer, Actor programmer, systems integrator, or an end-user, you'll find the Resource Toolkit an invaluable tool for creating and modifying the look and feel of Windows applications.

**Bundle Offer: Whitewater Resource Toolkit and Microsoft SDK**

Valued at $695
NOW $469

**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.
- Ask about volume purchase agreements, contracts, and personally assigned inside & outside sales representatives.

CORSOFT is a Division of Voyager Software Corp

---

**POLICIES**

**Phone Orders**

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

**Mail or FAX**

Phone number required with order.

**FAXexem** (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.
DOS and Unix As One

The Voyager, a workstation based on an i486 microprocessor, concurrently runs Unix and DOS applications. Able to take full advantage of both environments, according to Tyan Computer, Voyager includes 8 MB of RAM (expandable to 64 MB) and a 64-bit data bus.

Voyager features integrated I/O ports, a built-in Ethernet interface, and an 8514/A-compatible graphics adapter. Options for the 3½-inch internal hard disk drive range from 210 MB to 500 MB. Preinstalled software includes Unix, X Window System version 11, and Motif.

Price: Starts at $9999.
Contact: Tyan Computer Corp., 612 North Mary Ave., Sunnyvale, CA 94086, (408) 720-1200; fax (408) 720-1584.
Circle 1287 on Inquiry Card.

Gas-Plasma Display and Battery Power

A 16-MHz 386SX PC that runs on 4-hour nickel-cadmium batteries or on conventional power, the Lyte-Byte S300 has 1 MB of RAM (expandable to 4 MB), a 640- by 480-pixel VGA gas-plasma display, a 40-MB hard disk drive, and a 3½-inch floppy disk drive. The unit uses an AMI BIOS and an Intel 80387SX math coprocessor. Hard disk drives with capacities of up to 200 MB are available.

Additional features of the Lyte-Byte S300 include an expansion slot for a 16-bit short card, one parallel and two serial ports, and ports for an external 5½-inch floppy disk drive, a VGA color monitor, and an 101-key keyboard. You can plug the computer into conventional power and use it with or without the battery pack in place.

Price: Starts at $2195.

Contact: Micro Express, 1801 Carnegie Ave., Santa Ana, CA 92705, (800) 642-7621 or (714) 852-1400; fax (714) 852-1225.
Circle 1289 on Inquiry Card.

The Latest Triumphs for Arche

Arche’s latest additions to its Triumph line of PCs are the 386SX-16 and 386SX-20. Both incorporate the company’s integrated motherboards containing Presto, a single 5000 gate application-specific IC. Also on the boards are an Intelligent Drive Electronics/FDC interface and a Tseng Labs ET4000 graphics chip set.

The basic 386SX includes a 16- or 20-bit Intel 386 microprocessor with keyboard-selectable 8-MHz or 16-MHz clock speed, a socket for an 80387SX math coprocessor, and 1 MB of single in-line memory module RAM (expandable to 8 MB on the motherboard). Other features include one parallel and two serial ports, two 8-bit and six 8-/16-bit expansion slots, and a 150-W power supply. The 386SX-20 includes 1 MB of video RAM with a graphics resolution of 1024 by 768 pixels in 256 colors and 2 MB of base RAM (expandable to 16 MB on the motherboard).

Price: Basic Triumph 386SX-16, $1395; with onboard VGA and expandable RAM, $1595. Triumph 386SX-20, $1830.
Contact: Arche Technologies, 48881 Kato Rd., Fremont, CA 94539, (800) 422-4674 or (415) 623-8100; fax (415) 623-8171.
Circle 1290 on Inquiry Card.
A Printer to Consider

In support of the TrueImage page description language, the TrueLaser printer uses the Am29000 32-bit RISC microprocessor. The printer comes with 2 MB of DRAM (expandable to 6 MB).

Compatible with the Mac and any standard PC with a parallel or serial interface, the TrueLaser is bundled with 35 TrueType fonts. It is compatible with PostScript and provides Printer Command Language emulation.

With a print speed of 6 ppm, the TrueLaser prints graphics and text. The printer can automatically switch among its AppleTalk, Centronics, and RS-232 ports.

Price: $2695.
Contact: Microtek Lab, Inc., 680 Knox St., Torrance, CA 90502, (800) 654-4160 or (213) 321-2121; fax (213) 538-1193.

Microtek's RISC-powered TrueLaser printer.

A Cursor Controller for the Road

The Icontroller, a cursor controller that attaches to the side of your laptop, notebook, or PC, is Microsoft and Mouse Systems compatible. In addition to fingertip cursor control with optional speeds, the unit has three function buttons.

Other features of the laptop Icontroller include a signal selector, a 25-pin adapter, and required software. Its protective storage case attaches to the laptop case. For times when you want to use the Icontroller with your desktop PC, an extension cord is packaged with the controller.

Price: $99.95.
Contact: Suncom Technologies, 6400 West Gross Point Rd., Niles, IL 60648, (708) 647-4040; fax (708) 647-7828.

A Hard Disk Drive That Fits in Your Pocket

The PocketDisk, a self-contained, removable hard disk drive for PCs, is available in two models. The PD20-1, for desktop PCs, weighs 13 ounces; the PDH20-1, just over 1 pound, works with desktop PCs and any laptop that accepts a half-card expansion board.

Each disk drive has a 20- MB capacity with a 23-ms access time. Besides using the PocketDisk as your primary drive, you can use it as a secondary or fast backup device.

Price: PD20-1, $895; PDH20-1, $950.
Contact: Tradewinds Peripherals, Inc., 2633 East 28th St., Long Beach, CA 90806, (213) 595-7722; fax (213) 595-6446.

A Cursor Controller for the Road

Use Your Hard Disk Drive While You're Printing

The Export T series of external hard disk drives offers high-speed backup for laptop and desktop computers. Running from the parallel port, the devices let you simultaneously operate your hard disk drive and your printer.

You bring the Export online via a device driver that you add to your CONFIG.SYS file. The capacity of the 3½-inch drives ranges from 20 MB to 207 MB; speeds range from 28 ms to 15 ms. The supplied device driver works with removable cartridge and magneto-optical drives, Bernoulli boxes, and CD-ROMs.

Price: $595 to $1795.
Contact: Systems Peripherals Consultants, 7950 Silverton Ave., Suite 107, San Diego, CA 92126, (619) 693-8611.

Comfort on a Keyboard

Resting on a three-position nested stand, the ergonomically designed K-156-H Klik keyboard creates less stress than other keyboards, according to Hertz Computer. The small-footprint, lightweight keyboard features sculptured, cylindrical keys up by the German firm Cherry. Hidden underneath the board is an AT/XT switch.

PC and Novell ELS NetWare compatible, the Klik includes a separate inverted-T cursor control, 12 function keys, dedicated screen control keys, and a separate numeric keypad. Nonskid rubber grips prevent the keyboard from sliding away while you're typing.

Price: $79 through June; $89 thereafter.
Contact: Hertz Computer Corp., 325 Fifth Ave., New York, NY 10016, (212) 684-4141; fax (212) 684-3658.

The ergonomically designed K-156-H Klik keyboard.
**Speed on a SCSI Solid-State Drive**

The SiliconDisk Plus SCSI solid-state disk drive, with an access time of 0.05 ms, emulates conventional disk drives but without mechanical delays such as seek and rotational latency. By using a Motorola 68020 32-bit processor and a dedicated 25-MHz SCSI processor, the drive achieves a data transfer rate of 5 MBps on your PC or Mac, according to Atto.

Included in the SiliconDisk Plus is Atto's Auto Format feature, which lets you use the device without having to format it or install software drivers. With 32 single in-line memory module sockets, the unit has the capacity to hold up to 128 MB of memory.

**Price:** $2995.

**Contact:** Atto Technology, Inc., Baird Research Park, 1576 Sweet Home Rd., Amherst, NY 14228, (716) 688-4259; fax (716) 636-3630.

Circle 1296 on Inquiry Card.

---

**Learn Multiprocessing from a Kit**

The Transputer Education Kit includes a ready-to-use PC add-on board with a 20-MHz 32-bit transputer, a T400 C cross compiler, a T400 Occam compiler, an assembler, and documentation. The kit is geared toward users who know how to program serial machines and want to learn multiprocessing and parallel computing.

The kit is available with factory-installed options, such as up to 4 MB of local DRAM and a T425 or floating-point T800 transputer. You can link kits within a single PC or between PCs and expansion chassis.

**Price:** Introductory price, $236; 1 MB of DRAM, $110; add-on processor boards, $150.

**Contact:** Computer System Architects, 950 North University Ave., Provo, UT 84604, (800) 753-4272 or (801) 374-2300; fax (801) 374-2306.

Circle 1297 on Inquiry Card.

---

**Grab and Print the Picture**

Two video image-capture systems from IDEC, the Supervision/8 and the Supervision/16, are available to users of AT-compatible computers. The Supervision/8 also works with XT compatibles. Both boards let you capture video images from a camera, videotape, or a live broadcast.

The Supervision/8 has a resolution of 256 pixels by 256 lines by 256 shades of gray. It is compatible with Hercules monochrome, CGA, EGA, and VGA monitors. Printer compatibility is with dot-matrix and laser printers.

The resolution of the Supervision/16 is 512 pixels by 488 lines by 256 shades of gray. You can display the picture on any VGA monitor and many Super VGA monitors. It is laser-printer compatible.

**Price:** Supervision/8, $269.95; Supervision/16, $369.95.

**Contact:** I DEC, Inc., 1195 Doylestown Pike, Quakertown, PA 18951, (215) 538-2600; fax (215) 538-2665.

Circle 1298 on Inquiry Card.

---

**VGA on a Budget**

Two $98 VGA boards that are free of DIP switches and jumpers are available for your PC. Both boards include drivers for Windows, Word, GEM, Ventura Publisher, AutoCAD, WordPerfect, and Lotus 1-2-3.

**Boca's new 800- by 600-pixel version of its Basic VGA by Boca board includes 256K bytes of RAM.** The board supports 16 colors in the 800- by 600-pixel graphics mode and 256 colors in a 320- by 200-pixel mode for VGA, EGA, CGA, and Hercules Graphics.

**Price:** $98.

**Contact:** Boca Research, Inc., 6401 Congress Ave., Boca Raton, FL 33487, (407) 997-6227; fax (407) 997-0918.

Circle 1299 on Inquiry Card.

---

**Everex's Viewpoint Standard VGA card automatically configures itself for an 8-bit or a 16-bit bus and includes 256K bytes of RAM.** Its 800- by 600-pixel resolution supports 16 colors. The board provides extended VGA resolution without using disk-based drivers.

**Price:** $98.

**Contact:** Everex Systems, Inc., 48431 Millmont Dr., Fremont, CA 94538, (800) 628-3837 or (415) 498-1111.

Circle 1300 on Inquiry Card.
Get High Performance Under Microsoft Windows 3.0™ With db_VISTA III DBMS.

Develop Windows applications that are better, faster, and more profitable. db_VISTA III combines speed, flexibility, and productivity into one DBMS tool for C and Windows programmers. Add db_VISTA III’s high-speed SQL retrieval to your application and watch your users enjoy power they’ve never experienced before.

Built For Windows.

db_VISTA III for Windows 3.0 follows all of the Microsoft guidelines for memory use. Dynamic linked libraries (DLL), multi-tasking, and multi-user environments are all supported. For even faster development, use db_VISTA III with products like ToolBook®, Windowcraft®, or Actor®.

No Other DBMS Opens Windows Like db_VISTA III!

- **Speed.** Benchmarks show db_VISTA III significantly outperforms any DBMS under Windows.
- **No Royalties.** Increase your profits; decrease your overhead.
- **C Source Code Available.** For total programming flexibility.
- **Portability.** db_VISTA III supports most environments.


Special $195 Developer’s Edition

For a limited time only, you can get our db_VISTA database engine for Windows for only $195. Call today and ask about our Developer’s Edition and experience how db_VISTA III can open Windows for you. Developer license only; not for distribution.

Call 1-800-db-RAIMA (1-800-327-2462)

In Washington State call: (206) 747-5570 Ask for extension 131.

Full Raima Support Services - Including Training. Develop your applications even faster with Raima Training Classes:

- May 6-8 - Boston, MA
- May 6-10 - Chicago, IL
- May 20-22 - Mexico
- June 10-14 - NYC, SUI, NL
- June 18-20 - San Francisco

Raima Corporation 3245 146th Place S.E., Bellevue, WA 98007 USA (206)747-5570 Fax: (206)747-1991 Telex: 650318237 MCI UW


Copyright ©1991 Raima Corporation. All rights reserved. db_VISTA is registered in the U.S. Patent and Trademark Office. Windows, ToolBook, Windowcraft, and Actor are trademarks of their respective companies.
We've launch solve proble

The new Microsoft BallPoint mouse represents one giant step for you and your laptop computer.

That's because new BallPoint is the first and only mouse specifically developed for laptops. It's compact, yet includes all the features that made the
Microsoft Mouse the industry leader.
Simply attach it to either side of virtually any laptop keyboard, and adjust it to the most comfortable angle. Then thumb your way through Microsoft Windows' graphical environment version 3.0 and all your favorite mouse-driven applications.
And for a limited time, you can get a free BallPoint mouse when you purchase a COMPAQ notebook or laptop PC.
Just call (800) 541-1261, and ask for Dept. P40. They'll send you everything you need to know about the mouse designed to go where no mouse has gone before. Anywhere.

Microsoft
Making it all make sense®

Trademarks and BallPoint, Making it all make sense and Windows are trademarks of Microsoft Corporation. COMPAQ is a registered trademark of Compaq Computer Corporation.
Intelligent Power Backup

During a power failure, the Intelligent Power System on a Card provides 4 minutes of DC battery power to automatically store data onto your PC's hard disk drive. When the power returns, the IPS Card reloads your PC to its state prior to the interruption.

The card requires a PC, DOS 3.0, 512K bytes of RAM, a 5½-inch floppy disk drive, and a 10-MB hard disk drive or access to a file-server network. Compatible software includes Windows 3.0, Lotus 1-2-3, and WordPerfect. The IPS Card supports graphics, a mouse, and expanded and extended memory.

Price: $249.
Contact: Elgar Corp., 9250 Brown Deer Rd., San Diego, CA 92121, (800) 733-5427 or (619) 458-0250; fax (619) 458-0267.
Circle 1301 on Inquiry Card.

Cushioning the Job

Silicon Sports' Wrist Pad combines comfort with utility in a move toward preventing repetitive stress injury caused by long hours at your computer. The Wrist Pad creates a resting surface that maintains your hands in a neutral position while you're typing, alleviating the strain on your arms and wrists, the company says. Composed of two layers of neoprene and one of nylon, the Wrist Pad is three-quarters of an inch high and 1½ inches long, and it fits snugly along the edge of your keyboard.

Price: $19.95.
Contact: Silicon Sports, 1180 Sherman Ave., Menlo Park, CA 94025, (800) 243-2972 or (415) 854-1456.
Circle 1302 on Inquiry Card.

Put Your Laptop in a Hardshell

The Hardshell Laptop Case is the latest addition to Underwater Kinetics' line of cases. As are all Kinetics cases, the new cases are made of injection-molded ABS/polycarbonate and are waterproof to a depth of 30 feet. Guaranteed not to chip, dent, or become discolored, the Kinetics cases include a cushioned, fold-down handle and a full-length hinge. The case interiors are of custom foam.

Price: $29 to $200.
Contact: Underwater Kinetics, 1020 Linda Vista Dr., San Marcos, CA 92069, (619) 744-7560; fax (619) 744-7320.
Circle 1303 on Inquiry Card.

Advanced Technology on a Calculator

A graphing calculator from Casio, the Model FX-7700G, includes 4K bytes of memory capable of storing up to 38 separate programs. The calculator incorporates a 16-character by 8-line display with five zoom modes, trace and scroll, parametric graphing, shading, inequality, and integration. With the FX-7700G you can create matrices, do fractional calculations, and replay function and enhanced statistical abilities. The calculator includes menu keys and a memory-protection system.

Price: $109.95.
Contact: Casio, Inc., 570 Mt. Pleasant Ave., Dover, NJ 07801, (201) 361-5400; fax (201) 361-3819.
Circle 1305 on Inquiry Card.

Print Forms and Labels Quickly

The Facit E7650 forms and label printer automatically adjusts to each form's thickness. Its Form-Finder system senses the top, right, and left edges of the form.

Able to print in near letter quality at 100 cps and QuickPrint at 600 cps, the Facit E7650 advances forms at 16 inches per second. It features automatic paper-parking and paper-loading controls and lets you tear off a form immediately after it is printed; printing resumes at the top of the next page without wasting paper. The wide-carriage impact printer can print text and graphics in as many as seven colors on up to nine-part forms and supports pressure-sensitive labels.

Price: $2549.
Contact: Facit, Inc., 400 Commercial St., Manchester, NH 03108, (800) 733-2248 or (603) 647-2700; fax (603) 647-2724.
Circle 1304 on Inquiry Card.
Take a look at the vast majority of graphical workstations developed over the past decade and you'll see something they all have in common: An integrated UNIX® System environment.

Now take a look at the vast majority of businesses that have put computing power directly onto their office desktops over the past decade, and you'll see something they all have in common: Industry-standard personal computers.

It doesn't take a computer to forecast the platform that's going to put graphical workstations on the vast majority of business and engineering desktops in the next decade: An integrated UNIX System environment for industry-standard personal computers.

And that's what Open Desktop® is all about.

Open Desktop is the complete graphical operating system that's built on the most popular UNIX System platform of all time—SCO®. And it lets you create your own networking, icon-driven workstation environment using the industry-standard 386 or 486 computers and peripherals of your choice.

In a single, easy-to-use, fully supported—and completely integrated—package, Open Desktop delivers:

- the full 32-bit, multitasking computing power of SCO UNIX System V/386, designed to meet C2-level security
- compliance with POSIX™ and X/Open® standards
- an OSF/Motif™-based, Presentation Manager-compatible, graphical user interface
- distributed SQL database management services
- compatibility with existing DOS, XENIX®, and UNIX System applications and data files
- NFS™, TCP/IP, and LAN Manager networking facilities

And all at an unbelievably affordable price.

Discover the complete graphical operating system that leading companies worldwide are choosing as their development platform for the '90s—and using to turn their 386 and 486 PCs into instant workstations today.

Open Desktop from SCO.
Redefining the price-performance ratio in high-resolution color monitors

For the whole sweep of advanced, demanding applications: CAD/CAM, graphic design, desktop publishing, medical and scientific imaging, and Windowing.

Flat square technology and innovative focus system virtually eliminate distortion and flicker and reduce eye strain. Both 17" and 21" monitors offer brilliant color and automatic scanning over wide frequency ranges (30-65KHz). VGA-, 8514A- and Mac II-compatible with resolution up to 1280 pixels x 1024 lines. Smart, compact design with handy controls and easy adjustments.

All this at undeniably realistic prices.
Toshiba FS. Recreating Reality, Affordably.

At $3499 list the 21" is $1000 less than the competition. At $2100 list the 17" delivers far more monitor than anything else in its price range. Seeing is believing. Try a Toshiba at your dealer's. For more information phone or fax today:

1-800-253-5429

In Touch With Tomorrow

TOSHIBA

Circle 308 on Inquiry Card (RESELLERS: 309).
Blazing a Trail for Network Users

Telebit's NetBlazer, a dial-up and leased-line IP router, provides remote users with access to TCP/IP networks and services. A bidirectional network device, NetBlazer enables dial-up users to access multiple hosts during a single session. A network of Unix machines can share the modems connected to the NetBlazer for outgoing connections.

The NetBlazer supports as many as three Ethernet ports, up to 26 connections to modems and other RS-232 devices, and one port for a V.35 connection to a 56K-byte leased line. The unit's 2 MB of memory is expandable to 8 MB. Its software provides three levels of network security. The NetBlazer is available in a number of configurations, letting you customize its functions.

Price: Starts at $2995.
Contact: Telebit Corp., 1315 Chesapeake Terrace, Sunnyvale, CA 94089, (800) 835-3248 or (408) 734-4333; fax (408) 734-3333. Circle 1306 on Inquiry Card.

Making Network Management a Snap

A desktop management and control system for LANs and wide-area networks, SnapNet operates as an application under Windows 3.0. The program helps you build, display, track, and modify the topological layout of your network. You can also create network databases, directories, and graphical displays.

With SnapNet you can view high-resolution topological displays with or without maps. SnapNet lets you move from a national network down through regional displays into a LAN within a single location. At any stage, you can store and print the display, including hardware and software configuration notes, on any printer supported by Windows 3.0. SnapNet automatically creates the database and directory that let you identify and track each node and link by name, type, and location.

The system requires 1 MB of RAM, a hard disk drive, a floppy disk drive, a color monitor, and a mouse.

Price: $995.
Contact: Network Monitoring, Inc., 2365 Paragon Dr., San Jose, CA 95131, (408) 453-6430; fax (408) 453-1210. Circle 1307 on Inquiry Card.

Macintosh to Novell Through Mosaic

Mosaic for Macintosh lets you use your Mac to print documents to a Novell network from any application on Hewlett-Packard LaserJet and DeskJet printers. The program does not require additional hardware or add-on printer adapters.

Mosaic for Macintosh requires 1 MB of memory and System 6.0. The software is compatible with NetWare ELS II, Advanced NetWare, and Advanced NetWare SFF file servers. Included with Mosaic for Macintosh is Novell's NetWare Desk Accessory utility.

Price: $395 for three users; $595 for 10 users.
Contact: Insight Development Corp., 2200 Powell St., Suite 500, Emeryville, CA 94608, (800) 823-4115 or (415) 652-4115; fax (415) 652-9857. Circle 1308 on Inquiry Card.

Token Ring Adapter Card for Mac IIs

Cabletron's Desktop Network Interface (DNI) card for the Mac II NuBus provides built-in network management and diagnostic capabilities. The card lets Mac II users connect to 4- or 16-Mbps Token Ring networks over shielded or unshielded twisted-pair cabling.

The card incorporates Cabletron's Lanview status monitoring and diagnostic system, which lets you quickly determine if you have accessed the network. Lanview also lets you determine your data-distribution speed and whether your computer is transmitting or receiving data.

Price: $1295.
The Carry-I 9000 series comes complete with 80386SX/80286-16/80286-12 microprocessor (Co-Processor optional), 1024x768 VGA/MGA & CGA display interface, 1/2/4 MB RAM, one 3.5'' 1.44 MB FDD or one FDD plus one 40/80 MB HDD, one 8 bit expansion SLOT, one parallel and two serial I/O ports, and one 30W auto range switching power adapter, all in the traditional 240mm x 185mm x 45mm (9.4'' x 7.3'' x 1.8'') casing of Carry-I. Each package includes two mini-tower stands and a carry bag. The 81 key mini keyboard with 101 functions and 9 inch color or monochrome VGA monitor are optional.

Other Carry-I products include the 8000 series XT & AT book-size personal computers and the 6000 series XT and AT book-size LANstations. All Carry-I product lines are bundled with DR DOS 5.0.

FLYTECH GROUP INTERNATIONAL

<table>
<thead>
<tr>
<th>Country</th>
<th>Germany</th>
<th>Hong Kong</th>
<th>Taiwan</th>
<th>U.S.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEL#</td>
<td>69-746081, 748453</td>
<td>305-1268</td>
<td>2-7852556, 7827538</td>
<td>408-7277373, 7277374</td>
</tr>
<tr>
<td>FAX#</td>
<td>69-748375</td>
<td>796-8427</td>
<td>7837970</td>
<td>408-7277375</td>
</tr>
</tbody>
</table>

DISTRIBUTORS

- CANADA: BUDGETRON TEL# 416-564-7800 FAX# 416-564-2670
- FRANCE: MJC TEL# 1-48271976 FAX# 1-42355916
- GERMANY: MACRONIC TEL# 89-4208297 FAX# 89-425745
- GREECE: ALTEC TEL# 1-882-2017 FAX# 1-882-0187
- HONG KONG: PAKI TEL# 305-1268 FAX# 7968427
- INDIA: BEETNUNICORP TEL# 11-6831541 FAX# 11-6845828
- ITALY: PRIMA TEL# 522-519599 FAX# 522-519599
- MALAYSIA: COMTEC TEL# 032-749999 FAX# 03-2749998
- NETHERLAND: KN TEL# 2968-84141 FAX# 2968-97456
- NORWAY: SECUS DATA TEL# 2-722511 FAX# 2-722515
- SINGAPORE: TRANSNIKO TEL# 475-6408 FAX# 471-3806
- SOUTH AFRICA: PC MART TEL# 11-6043355 FAX# 11-6024515
- SWITZERLAND: ESS SOFTWARE TEL# 022-622020 FAX# 022-615690
- UNITED KINGDOM: CENTERPICE TEL# 256-465754 FAX# 256-843174
- BELGIUM: CELEM S.A. TEL# 41-676454 FAX# 41-676515

Circle 123 on Inquiry Card.
The Next Gets a Fax Modem

The InterFax NX fax modem for the Next computer combines 9600-bps fax capabilities with a 2400-bps Hayes-compatible data modem. The unit provides MNP level 5 data compression for data throughput as high as 4800 bps and built-in MNP data correction.

Jointly developed by Abaton and Next, the InterFax NX comprises software built into Next’s newest operating system and Abaton’s hardware. InterFax works by converting your document from Display PostScript to fax format and immediately sending it to the specified destination. You receive visual status of the progress of your fax or data call via the LEDs on the unit. A built-in speaker informs you of additional status information. The machine supports automatic data-to-voice switching.

Price: $595.
Contact: Abaton, 48431 Milmont Dr., Fremont, CA 94538, (800) 444-5321.
Circle 1310 on Inquiry Card.

Fax/Modem for Macintosh Portable

An internal V.42 and V.42bis fax/data modem for the Macintosh Portable, the Comport 5/42 gives you an effective throughput of 9600 bps using a 2400-bps modem. Hayes compatible, the modem works with all Macintosh portables.

The Comport 5/42 wakes the Mac from sleep mode when it detects an incoming call and lets you schedule transmissions to take advantage of nighttime rates. The software includes the QuickFax desk accessory, which lets you send faxes from within any application.

Price: $699.
Contact: PSI Integration, Inc., 851 East Hamilton Ave., Suite 200, Campbell, CA 95008, (800) 622-1722 or (408) 559-8544; fax (408) 559-8548.
Circle 1311 on Inquiry Card.

Poste Your Unix Message

Poste, an E-mail program for Unix users, is designed to let technical and nontechnical users send multipart, multimedia messages across a number of different mail networks. A graphical application, Poste has an OSF/Motif interface that includes multiple windows capable of accepting input simultaneously.

The open architecture of Poste lets you easily integrate new applications as they become available. The program aids message delivery by providing recipient address templates for X.400 and Internet addressing. Message management features include hierarchical file folders, cross-indexing, and message query and sorting on multiple fields.

Price: $395.
Contact: Alfalfa Software, Inc., Suite 4200, 185 Alewife Brook Pkwy., Cambridge, MA 02137, (617) 497-2922; fax (617) 876-2523.
Circle 1313 on Inquiry Card.

Network Flexibility

The FlexiHub, a modular internal 10Base-T hub, features modules called HubSimms. Each HubSimm provides connectivity for two ports, giving you the flexibility of installing a hub with 6, 8, 10, or 12 ports.

The FlexiHub is capable of full repeater signal regeneration, as well as automatic and independent port partitioning and reconnection. A BNC connector provides thin Ethernet connectivity and lets you cascade Flexi-Hubs for larger networks.

Price: $600 for 6 ports; $150 each additional 2 ports; $950 for 12 ports.
Contact: Pivotal Technologies, Inc., 18240 Purdue Dr., Saratoga, CA 95070, (408) 374-7887; fax (408) 374-8074.
Circle 1312 on Inquiry Card.

Network Flexibility

The InterFax NX’s software is built into the latest Next.
You should buy a multi-user BBS for one simple reason:

Return On Investment

How much money do you pay to overnight courier services every month? How much to the U.S. Postal Service? Are you interested in making the most productive possible use of your business resources?

A BBS (Bulletin Board System) can improve your bottom line in several ways:

1. Cut costs by transferring computer files over telephone lines, instead of paying courier charges. With modems, you can send files to or from your home office at speeds up to 38,400 bits per second. A 60-second telephone connection costing less than a dollar can take the place of a diskette via overnight courier costing $11.50 or more.

2. Improve your overall business responsiveness by doing business faster. Why wait for that spreadsheet file overnight, by courier, when you can receive it instantly, by modem? Send and receive software, purchase orders, databases, and word processor files right away, rather than waiting a day. Sometimes an extra day can make the difference between success and failure.

3. Eliminate mailing costs by offering files (updates, newsletters, CAD files, whatever your business may provide) to your customers for download, rather than mailing them diskettes or printed matter all the time. The phone call is on their nickel, and they'll love it because they're getting the information right away, not several days stale.

4. Gain a competitive edge by offering your customers round-the-clock service - but without increasing your staff hours! 24 hours a day, your BBS can provide prices, refer people to your dealers, and act as a Q & A clearinghouse, all unattended. Your own people can log on for a few minutes a day, any time it is convenient for them.

Depending on your particular business, you may be able to harness this technology in even more productive ways. If you have a field sales force, for example, or a dealer network, your BBS can host both public discussion areas and private one-on-one E-Mail. If you're in the software business, you can offer technical support, user-group "forums", application examples, and downloadable "demo disks" to your prospects instantly. If you do market research, you can use online questionnaires to gather vast amounts of data without ever picking up the phone or hiring a single telephone interviewer.

You can get started with all of this for as little as $59. This buys our complete 2-line software package, The Major BBS®, which includes E-Mail, file upload/download, teleconferencing, questionnaires, an Audit Trail, a "user registry", and much more. Initial set-up is quick and easy - 15 minutes on the average - and unlimited technical support (within reason) is just a phone call away. There's even a 30-day money-back satisfaction guarantee.

We're hoping that you'll like the $59 package so much that you'll want to expand it. Our main business is a wide variety of hardware and software add-ons, such as multi-modem cards, multi-port serial cards, the GalactiBox, "extended editions" of The Major BBS, C source code, The Major Database, the X.25 software option, the Ergo OS/286 protected-mode toolkit, the Dial-Out package, Search-and-Retrieve™, and an assortment of multi-user games and amusements.

None of these add-ons approach the cost effectiveness of the $59 package, of course, but they all represent excellent value. Operate your own BBS for a few months, and find out for yourself just how useful a BBS can be.

To order, just call 305-583-5990 and say, "I'd like to place an order!" We accept VISA, Mastercard, and American Express... or, we can ship C.O.D. if you like. We also accept Purchase Orders from major corporations and government.

Galacticomm, Inc.
4101 S.W. 47th Ave. #101
Ft. Lauderdale, FL 33314
TOM: "Well, that's an accurate presentation of unit sales, but what I'd like to know is dollar sales..."

Now, you can answer all those "What if...", "What about..." and "What would happen..." questions from every Tom, Dick and Harriet in the room. Instantaneously. In brilliant, photographic-quality color.

With the new In Focus 5000CX LCD projection panel.

Simply place it on your overhead, connect your Macintosh or IBM compatible computer and you have one of the most powerful and persuasive presentation tools ever seen.

The 5000CX can project nearly 5000 colors at a time. And its 640 x 480 resolution supports all VGA, EGA, CGA and Macintosh video standards.

So you can access all of your computer's software. While you're presenting.

You can project new projections. Revise revisions. And tailor your presentation to accommo-
Dick: "That was certainly quick. Have you got any data on the actual costs of goods?"

Harriet: "That's not a pretty picture for the cosmetics division. By the way, do you think you could help me out on this presentation I'm giving tomorrow?"

Date every member of your audience. On the spot.
What's more, you'll never again have the cost or hassle of preparing slides. Or the boredom of presenting yet another set of dull, black and white overheads.
The 5000CX is just one of a complete line of high-performance, portable In Focus color and monochrome projection panels.
Come see a demonstration of one today. We promise you a show you won't forget.

**FREE OVERHEAD OFFER**
For a limited time, we're giving away a free portable overhead projector with every In Focus color projection panel. It's a $495.00 value. So call 1-800-327-7231 or in Oregon, 503-692-4968 today. And arrange to see a free demonstration.

*IN FOCUS SYSTEMS* INC.

 restricted or prohibited. In Focus, the In Focus logo and the In Focus 5000CX are registered trademarks of In Focus Systems, Inc. All other trademarks or registered trademarks are the property of their respective holders.

Circle 167 on Inquiry Card.
A Mightier Look & Feel

The new version of the C-scape Interface Management System and Look & Feel Screen Designer, a library of C routines for creating user interfaces, now offers support for several DOS extenders, allowing you to write applications that break the 640K-byte barrier. Version 3.2 of the system also supports the X Window System for Unix and VMS.

Supported extenders include the Phar Lap 386 DOS-Extender, Rational Systems' 16/M DOS Extender, and Ergo Computing's OS/286 DOS Extender. The C-scape library of routines lets you add text-entry features such as word wrap, search and replace, and block commands to your applications. You can also add menuing systems, mouse support, data entry, help, graphics compatibility, and other interface elements.

Price: DOS version, $499; Unix version, $1499; QNX version, $599; VMS version, $2499.

Contact: Oakland Group, Inc., 675 Massachusetts Ave., Cambridge, MA 02139, (800) 233-3733 or (617) 491-7311; fax (617) 868-4440. Circle 1272 on Inquiry Card.

C++ Library for dBASE

A new multiuser database management library for C++ lets you work directly with the data, memo, and index files of dBASE IV and build dBASE IV-compatible applications. By using C++ and the class library, you can program applications with code that is faster, more flexible, and more portable than programming in a dBASE language.

Price: $295.

Contact: Sequiter Software, Inc., Suite 209, 9644 54 Ave., Edmonton, Alberta, Canada T6E 5V1, (403) 448-0313; fax (403) 448-0315. Circle 1274 on Inquiry Card.

Unix Development in Motif and Open Desktop

A new programming and desktop publishing environment for Unix takes advantage of Motif, Open Desktop, and Open Look, letting you open multiple windows with files of up to 1 MB each. The new graphical versions of Professional Edit let you cut and paste columns and blocks between windows while providing a workbench environment for linkers, make tools, and C compilers. The editor is WordStar and SideKick compatible; you can remap the keyboard to support your favorite editor interface.

Price: Any platform running X Window System, $550 (includes character-based version for terminals); DOS, $95; Windows, $195; any Unix character-based version, $295; Screen Shooter, $95.

Contact: Buzzwords International, 2879 Hopper Rd., Cape Girardeau, MO 63701, (314) 334-6317; fax (314) 334-0794. Circle 1271 on Inquiry Card.

A New Look to Portable Interfaces

Aspect, a set of graphical user interface creation tools and libraries for writing portable graphics-based applications, includes a C-callable application programming interface and an interactive design tool. You can port applications written to the Aspect API to each supported run-time environment. An OSF/Motif and a Unix-character run-time environment should ship by the end of May. Other versions will follow later this year.

The design tool produces a portable resource file that allows changes to the interface without recompiling the application. Each Aspect run-time environment implements elements such as menues, push buttons, and scroll bars in the underlying native toolbox. An application with an Aspect user interface, when linked to the Aspect Motif run-time, results in a native Motif implementation. Likewise, the same application, when linked to the Mac run-time, results in a native Mac application.

To solve the dilemma of Unix developers who want to offer software in an X Window-based user interface as well as a character interface, Aspect developed a character run-time.

Price: Character-based SCO Unix and Interactive, $995; Motif, $1495; introductory price for Mac and Windows (when they become available), $795.

Contact: Open, Inc., 655 Southpointe Court, Suite 100, Colorado Springs, CO 80906, (719) 576-8967; fax (719) 576-7246. Circle 1273 on Inquiry Card.
PostScript solutions for LaserJet printers haven’t exactly set records for speed.

But times have changed.

In the past, patience has been a necessity when printing PostScript® quality graphics and text on your LaserJet II, III, or IIDD laser printer.

Introducing PacificPage XL™—it will change the way you look at PostScript language emulation products, both in price and performance. That’s because PacificPage XL offers PostScript compatible output in record time for a price lower than competitive products.

Compare it to the Hewlett-Packard PostScript solution. For their cartridge and 2 MB of printer memory you will spend $1085. PacificPage XL provides the newest version of our PacificPage PE cartridge and a high speed accelerator board that installs easily into the LaserJet’s printer memory slot. It includes an Intel i960™ KB RISC microprocessor and 2 MB of memory which produces output 2 to 8 times faster than the HP cartridge solution. All for the low price of $999.

Even without the accelerator board, PacificPage PE now provides an overall 25% increase in speed over the HP cartridge. PacificPage PE and PacificPage XL come with a lifetime warranty and a money back guarantee of satisfaction.

If you're looking for a change of pace in PostScript solutions for the LaserJet printer, call your nearest dealer or contact Pacific Data Products, 9125 Rehco Road, San Diego, California 92121, USA. (619) 597-4644, Fax (619) 552-0889.
Spreadsheets for Motif, Open Look

Access Technology's newest version of its 20/20 spreadsheet supports OSF/Motif and Open Look graphical interfaces. The graphical 20/20 takes full advantage of the X Window System environment, responding automatically to window modification such as resizing, repositioning, and cutting and pasting data between windows.

Developed in tandem with Sun, the Open Look version uses that environment's pushpin facility to make dialog boxes (which normally pop up and disappear) remain on-screen. It also lets you drag and drop icons representing 20/20 files from the Open Look file manager into 20/20 for automatic loading. 20/20 is also available for SunView, as a character-based interface product, and in a real-time version for market traders who need the automatic updating of spreadsheets as information changes.

Add-in products for 20/20 include OpenLink, a bridge to applications written in traditional programming languages, and Database Connection, a DBMS retrieval mechanism that draws information into the spreadsheet for processing. Access says the connection lets you transparently integrate 20/20 with Oracle, Ingres, and Sybase databases without knowing Structured Query Language or requiring an intermediate temporary file.

Currently, 20/20 runs on more than 25 different Unix platforms.

Price: 20/20 prices start at $600 per workstation; 20/20 real-time prices start at $1800; OpenLink and Database Connection prices start at $240 each.

Contact: Access Technology, Two Natick Executive Park, Natick, MA 01760, (508) 655-9191; fax (508) 651-3788.

Circle 1275 on Inquiry Card.

What You See Is What You Get with Quattro

Borland continues to add features to its Quattro Pro (QP) spreadsheet without requiring a hardware upgrade from an 8088-based PC with 512K bytes of RAM. Version 3.0 of the program adds a WYSIWYG display for working with typefaces, styles, colors, and sizes. The WYSIWYG Zoom lets you proportionally reduce or enlarge your screen (between 25 percent and 200 percent) to see more or less of your spreadsheet. A handy print-to-fit feature automatically shrinks or enlarges a print block to fit it into a single page, and the program has built-in banner-printing capability.

Unlike the Impress add-in for Lotus 1-2-3 release 3.1, which has its own menu structure and creates modified versions of the underlying spreadsheet, QP's WYSIWYG is totally integrated into the program. According to Borland, this lets you work with any aspect of the program in WYSIWYG mode without requiring you to learn another command set. QP 3.0's backward compatibility lets you share files among previous versions of the spreadsheet, and it runs on everything from an 8088 to a 486 system.

The ProView Power Pack provides additional clip art, fonts, macros, and other presentation capabilities to augment those already in QP 3.0 (e.g., transitional effects). The pack, which comes with QP 3.0, includes a macro library for streamlining the process of creating graphs and presentations. It also has two headline typefaces, clip art, graph and text chart templates, and a collection of digitized sound effects for use during slide-show transitions. The three effects are fanfare, thank you, and applause. If your company's fortunes have been colored red, you can get a boo and other sound effects from a Borland third-party developer.

QP 3.0 is part of Borland's strategy to provide a continuum of products that provide for an easy upgrade to Windows. The company says it will deliver a full Windows version of Quattro this year.

Price: QP 3.0 with ProView, $495.

Contact: Borland International, Inc., 1800 Green Hills Rd., P.O. Box 660001, Scotts Valley, CA 95067, (408) 438-8400.

Circle 1277 on Inquiry Card.
When you think about it, a one-size-fits-all mouse makes as much sense as a one-size-fits-all shoe. That's why Logitech® created MouseMan™—the first line of mice designed to fit different kinds of hands. All MouseMan products are ergonomically shaped for comfort and ease of use. They're also totally plug compatible with the Microsoft® mouse. Of course, all come with Logitech's legendary quality and lifetime warranty.

MouseMan for the Right Hand

MouseMan for the Left Hand

MouseMan Cordless Radio Mouse

For more information, call:

800-231-7717 ext. 2606

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

Circle 194 on Inquiry Card (RESELLERS: 193).
MouseMan for the Right Hand and MouseMan for the Left Hand are for IBM® PCs and compatible and Macintosh® systems. MouseMan Cordless is for IBM® PCs and compatibles only. TRADMARKS are registered trademarks of their respective holders.
WE FINALLY FOUND A COMPUTER DESIGNER FROM THE GROUND UP AROUND THE TOP OF THE LINE INTEL® 80486 PROCESSOR. TO BUILD A Processor AT A SPEED OF 33 MHZ. AND WE DIDN'T STOP THERE.

WE HAD OUR EXCLUSIVE MULTI-CACHE™, A 64K EXTERNAL CACHE THAT ACCELERATES PROCESSOR READ OPERATIONS EVEN MORE.

AND WE DIDN'T STOP THERE. WE PUT IT INTO HIGH GEAR WITH THE PROPRIETARY TANDON POWERPOSTER™. A UNIQUE WRITE BUFFER THAT SPEEDS UP WRITE OPERATIONS TO RAM.

AND THEN TO MAKE THINGS REALLY FLY, WE COMBINED A 64 BIT BUS (DOUBLE THE WIDTH) WITH THE LATEST EISA TECHNOLOGY TO BOOST PERFORMANCE TO PREVIOUSLY UNHEARD OF LEVELS. AS MUCH AS TWO TIMES FASTER THAN A 386.

OF COURSE, WITH ANY TANDON COMPUTER YOU ALSO GET PROMPT DELIVERY, A ONE YEAR LIMITED WARRANTY, ON-SITE SERVICE, AND 24-HOUR, ON-CALL TECH SUPPORT. WE EVEN OFFER A SPECIAL LEASING PROGRAM. AND IF FOR ANY REASON YOU'RE NOT PLEASED, YOU CAN GET A FULL REFUND WITHIN THE FIRST 30 DAYS.

SO IF YOU'RE INTERESTED IN WHAT HAS TO BE CONSIDERED ONE OF THE FASTEST PERSONAL COMPUTERS IN THE WORLD CALL US TODAY ABOUT OUR TANDON 486/33. OR ASK ABOUT OUR 386/33 FOR $3399 OR 386/25 FOR JUST $3099. AND BE TREATED TO ONE OF THREE TOP PERFORMANCES DAILY.

$7,299 COMPLETE SYSTEM!

• 30-Day Money Back Guarantee
• Toll-Free Technical Support
• 1-Year Limited Warranty
• On-Site Service
• Leasing Program Available
JHN A MACHINE
THE TANDON 486/25.

Tandon 486/33 • Price includes: System unit, 4MB RAM; 200MB IDE hard drive; 1.2MB or 1.44MB diskette drive; VGA monochrome monitor; 16-bit video card; keyboard; power cord; Microsoft® Windows™ 3.0 and serial mouse; operation and installation manual; Tandon MS-DOS software and manual. • Upgrade options: 2MB and 8MB memory upgrade kit (to 64MB); 330MB, 600MB, and 1GB SCSI hard disk drives; 650MB ISO-approved optical drive and cartridge; VGA and Super VGA color monitors; graphics accelerator card; 2400 baud modems; network cards; laser printers. Tandon 386/33 and Tandon 386/25. • Price includes: System unit; 4MB RAM (Tandon 386/33); 2MB RAM (Tandon 386/25); 110MB IDE hard drive; 1.2MB or 1.44MB diskette drive; VGA monochrome monitor; 16-bit video card; keyboard; power cord; Microsoft® Windows™ 3.0 and serial mouse; operation and installation manual; Tandon MS-DOS software and manual. • Upgrade options: 1MB and 4MB memory upgrade kit (to 16MB); 80387 math coprocessor; additional 1.2MB and 1.44MB diskette drives; 200MB IDE, 330MB ESDI hard drives; VGA and Super VGA color monitors; graphics accelerator card; 2400 baud modems; network cards; laser printers. Tower models available. Please call for information.

OPTIONS AND CUSTOM CONFIGURATIONS

• Hard Drives, Diskette and Optical Drives
• Modems
• Memory Expansion
• Coprocessors

• VGA and Super VGA Monitors.
• Additional Options Available On All Systems. Please Call.

To order direct, call now:
800-800-8850
FAX 805-529-8408

Tandem reserves the right to amend specifications and prices without notice. Tandon 486, Tandon 386, ST286, ST486, ST486x, LT286, LT486x, LT586x, LT586x/N, LT686x, LT786x, LT486x/N, Tandon Tower 386, Tandon Tower 486, PowerTower, INTEL and MATH coprocessor are trademarks of Tandon Corporation. Intel is a registered trademark of Intel Corporation. All other products or services are identified by the trademark or service marks of their respective companies. Least term vary by system.

©1991 Tandon Corporation, Moorpark, CA.
FEHT generated this contour plot of temperatures of a nuclear reactor on the Mac. The program lets you assign varying degrees of fine meshing to your problem.

FEHT, a finite element analysis program originally designed to solve heat-transfer problems, is now available for solving problems in electrical engineering and civil engineering. It gives numerical solutions to the governing partial differential equations that describe conduction heat transfer, electromagnetic fields, potential flow, and other phenomena. The program provides a drawing environment for entering the 2-D problem, the finite element calculation procedure, and the ability to graphically display the results.

The program runs on any Mac with 1 MB of RAM. Price: $400.
Contact: F-Chart Software, 4406 Fox Bluff Rd., Middleton, WI 53562, (608) 836-8536.
Circle 1278 on Inquiry Card.

Engineering Notebooks for the Mac, Unix

HiQ is designed to replace all the functions of an engineer's notebook as well as provide all the tools that an engineer would normally use. The program integrates management, design and graphics, programming, engineering analysis, and data reduction.

The HiQ core includes more than 500 math and graphical algorithms and more than 100 problem solvers. Word processing, advanced numeric calculation capabilities, powerful scripting, 2-D and 3-D graphing, and networking facilities are included with the program.

The program is available for the Mac SE/30 or higher and Sun workstations. Versions are planned for the IBM RISC System/6000 and DEC workstations.

Price: Prelease price, $495; $695 thereafter.
Contact: Bimillennium Corp., 101 Albright Way, Los Gatos, CA 95030, (800) 488-8662 or (408) 866-2010; fax (408) 866-2305.
Circle 1279 on Inquiry Card.

Estimate Natural Radiation Effects in Space

Space Radiation lets you model the effects of natural radiation in space on digital electronics and humans. It estimates single-event error rates, radiation dose, and dose equivalent in any orbit, Severn Communications says.

Version 1.1 of the program handles cosmic rays, trapped protons, and solar particles. For satellite and communications design, the program can model the effects of trapped electrons.

Space Radiation runs on DOS-based systems with 640K bytes of RAM. A math coprocessor is recommended.

Price: $2495.
Contact: Severn Communications Corp., 223 Benfield Park Dr., Millersville, MD 21108, (301) 987-5236; fax (301) 987-3113.
Circle 1280 on Inquiry Card.

Mathematica's Multiplied Capabilities

Mathematica 2.0, a new version of the mathematical analysis program for the Mac, Unix workstations, and Windows, adds 283 functions, bringing its total to over 800. The program now solves numerical differential equations and has new programming capabilities, sound, and a faster compiler.

A new set of functions relates to linear programming to solve optimization problems in operations research. Some of the new features work only on certain platforms; for example, the Mac, Sony, Next, and Sun computers, which have built-in sound capabilities, let you render data and functions in audible form; publishing extensions to the Mac and Next let you create on-line books; and Mac, PC, and Windows users can simulate multitasking with Mathematica's concurrent processing feature.

The programming language now includes tracing and debugging features and direct file manipulation. A new compiler can significantly increase execution speed.

Price: $295 to $30,000.
Contact: Wolfram Research, 100 Trade Center Dr., Champaign, IL 61820, (217) 398-0700; fax (217) 398-0747.
Circle 1281 on Inquiry Card.
Everything You Ever Wanted In UNIX.
And Less. $99.95*

OK. We know it's hard to believe. So just consider this.
Coherent™ is a virtual clone of UNIX.
But it was developed independently by Mark Williams Company. Which means we don't pay hundreds of dollars per copy in licensing fees.

What's more, Coherent embodies the original tenet of UNIX: small is beautiful. This simple fact leads to a whole host of both cost and performance advantages for Coherent. So read on, because there's a lot more to Coherent than its price.

SMAILER, FASTER...BETTER.
Everybody appreciates a good deal. But what is it that makes small so great?
For one thing, Coherent gives you UNIX capabilities on a machine you can actually afford. Requiring only 10 megabytes of disk space, Coherent can reside with DOS. So you can keep all your DOS applications and move up to Coherent. You can also have it running faster, learn it faster and get faster overall performance. All because Coherent is small. Sounds beautiful, doesn't it?

But small wouldn't be so great if it didn't do the job it was meant to do.

EVERYTHING UNIX WAS MEANT TO DO.
Like the original UNIX, Coherent is a powerful multi-user, multi-tasking development system. With a complete UNIX-compatible kernel which makes a vast world of UNIX software available including over a gigabyte of public domain software.

Coherent also comes with Lex and Yacc, a complete C compiler and a full set of nearly 200 UNIX commands including text processing, program development, administrative and maintenance commands plus UUCP.

CRITICS AGREE: IT'S AN INCREDIBLE VALUE!
"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."

"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 Fielder, BYTE Magazine, November 1990

EXPERIENCE, SUPPORT AND A 60-DAY MONEY BACK GUARANTEE.
Wondering how something as good as Coherent could come from nowhere? Well it didn't. It came from Mark Williams Company, people who've developed C compilers for DEC, Intel, Wang and thousands of professional programmers.

We make all this experience available to users through complete technical support via telephone. And from the original system developers, too!
Yes, we know $99.95 may still be hard to believe. But we've made it fool-proof to find out for yourself. With a 60-day money-back no-hassles guarantee.

You have to be more than just a little curious about Coherent by now. So why not just do it? Pick up that phone and order today. You'll be on your way to having everything you ever wanted in UNIX. And for a lot less than you ever expected.

1-800-MARK WMS
(1-800-627-5967 or 1-708-291-6700)
FAX: 1-708-291-6750
60-DAY MONEY BACK GUARANTEE!

NEW COHERENT RELEASE 3.1
NOW WITH:
—elvis: vi editor clone
—SCSI (Adaptec AHA 154x series and more on the way.) and ESDI support
—UUCP Bulletin Board System
—RAM disk support
—And much, much more!

OVER 10,000 SATISFIED USERS!

LESS IS MORE!

<table>
<thead>
<tr>
<th>Feature</th>
<th>Coherent Fee</th>
<th>Santa Cruz Operation's</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Manuals</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>No. of Disks</td>
<td>4</td>
<td>21</td>
</tr>
<tr>
<td>Kernel Size</td>
<td>64K</td>
<td>198K</td>
</tr>
<tr>
<td>Install Time</td>
<td>20-30 min.</td>
<td>3-4 hours</td>
</tr>
<tr>
<td>Suggested Disk Space</td>
<td>10 meg</td>
<td>30 meg</td>
</tr>
<tr>
<td>Min. Memory Required</td>
<td>640K</td>
<td>1-2 meg</td>
</tr>
<tr>
<td>Performance*</td>
<td>38.7 sec</td>
<td>100.3 sec</td>
</tr>
<tr>
<td>Price</td>
<td>$99.95</td>
<td>$1495.00</td>
</tr>
</tbody>
</table>

*Byte Exec benchmark, 3000 iterations on 20 Mhz 386.
Hardware requirements: 1.2 meg 516 or 1.4 meg 386 floppy, and hard disk. Does not run on Microchannel machines.
Two Image and Document Databases

Symsoft’s HotShot ImageBase uses a TSR image finder/previewer to eliminate the frustrating and slow task of blindly loading images into Ventura Publisher and most word processors.

The program supports WordPerfect, Microsoft Word for DOS, Harvard Graphics, other applications, and 10 graphics file formats.

Price: $149.
Contact: Symsoft Corp., 924 Incline Way, Call Box 5, Incline Village, NV 89450, (702) 832-4300.
Circle 1282 on Inquiry Card.

The PixSure File Document Imaging System lets you electronically capture, store, manage, and retrieve files, including letters, handwritten notes, forms, and all types of paper documents. You can retrieve documents with user-defined keywords such as names, dates, customer numbers, or other information.

The program is designed for the Novell network environment.

Price: $1495.
Contact: The Norick Companies, 5400 Northwest Grand Blvd., Suite 450, Oklahoma City, OK 73112, (800) 527-5764 or (405) 947-7560; fax (405) 946-7559.
Circle 1283 on Inquiry Card.

Easy Backup for OS/2 PM

Irwin Magnetic Systems’ new OS/2-based backup software for stand-alone and networked PCs takes advantage of Presentation Manager and OS/2’s multitasking capabilities to launch background sessions.

You can select files while the software loads a backup tape. An integrated library gives you on-line access to directory information from all your tapes and backups.

EzTape PM incorporates the Stac Electronics algorithm for increasing the capacity of a tape drive and supports all versions of OS/2, including High Performance File System supporting OS/2.

Other features include automatic unattended backup, multiple hard disk volume backup, and two levels of data protection (password and encryption).

Price: $329.
Contact: Irwin Magnetic Systems, Inc., 2101 Commonwealth Blvd., Ann Arbor, MI 48105, (313) 930-9000; fax (313) 995-8287.
Circle 1284 on Inquiry Card.

Recover from Unix Crashes

With the new Veritas File System (VxFS) and the Veritas Volume Manager (VxVM), Veritas provides a flexible, high-performance commercial file system for Unix. VxVM provides on-line reconfiguration, striping, spanning, and disk mirroring. VxFS provides fast recovery from crashes.

The Veritas system maintains a log of intended changes to the descriptive data that accompanies Unix files, clearing entries from the log as they are written to disk. If, after a system crash, the Veritas software finds leftover entries in the log, it simply writes them to disk. As a result, the maximum time to restore even a disk drive of 1 gigabyte is about 15 seconds.

SPREAD THE WORD

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

The system lets you reorganize file systems into contiguous blocks while the disk is being used. When used together with the logical volume manager, you can expand file systems while they’re still active.

At a lower level, the file system’s behavior can be tuned by applications when a certain type of I/O is expected. This mechanism allows database managers and other disk-intensive applications to avoid the direct-to-disk approach that is commonly taken to work around the file system.

Price: Prices depend on system. VxFS, from $1200 to $18,000; VxVM, from $1000 to $15,000.
Contact: Veritas Software Corp., 4800 Great America Pkwy., Suite 420, Santa Clara, CA 95054, (408) 727-1222; fax (408) 562-4334.
Circle 1285 on Inquiry Card.

DOS Memory at 952K Bytes

Memory Commander, a DOS memory management utility for 386 and 486 computers, lets you free up memory by moving TSR programs and device drivers into high memory between 640K and 1024K bytes. Depending on your system’s video configuration, the utility can provide up to 952K bytes of contiguous memory for use by your application.

The program lets you configure up to five memory models. Once you install Memory Commander, it selects the best model for the application without requiring rebooting.

Price: $99.95.
Contact: V Communications, Inc., 4320 Stevens Creek Blvd., Suite 275, San Jose, CA 95128, (408) 296-4224; fax (408) 296-4444.
Circle 1286 on Inquiry Card.
Here's What We PROMISE

More Quality, Value and Throughput for your dollar.

How?

By assembling our systems with the best components possible. You want names? How about genuine Intel 386® and 468® processors? How about TEAC floppy drives and Trident 8900-based SVGA controllers?

And our hard drives? They're all caching versions from either Maxtor or Imprimis.

The truth is, we really do want to give you the very best system for your money; so we don't just stop at using the best components. We also burn every St. Croix in for at least 48 hours and give you a Full 2 Year Parts and Labor Warranty on the Entire System.

At St. Croix the facts of business life are really quite simple. We figure it's better to spend our time building better PCs, not bigger repair shops.

Here's What We DELIVER

Satisfaction! But please don't take our word for it . . . . listen to some of our customers.

"The 386 you configured for me is addictive! its speed and power are quite out of the ordinary."

"I have multiple communications programs with my main frame, and this (St. Croix) unit has cut the transfer time down tremendously."

"Very few companies extend the level of courtesy, knowledge and service I've received from St. Croix."

"I run acceptance diagnostics on all systems . . . . the St. Croix outperformed a similar 386-SX we purchased from a local outlet. It functioned twice as fast in the math functionality test and in video response time. The motherboard tested faster too."

Our letter file is always open, so you're welcome to read our mail. But nothing's going to happen until you pick up that phone. If you're serious about getting the best performance and value for your money, call us today!

1-800-950-0174
For Technical Support call: 1-800-950-0182

<table>
<thead>
<tr>
<th>MODEL</th>
<th>FEATURES</th>
<th>PRICING</th>
</tr>
</thead>
<tbody>
<tr>
<td>486-33 Cache Tower</td>
<td>125 MB IDE, 4 MB RAM, 1.2 AND 1.44 MB floppy, 14&quot; SVGA 1024 x 768 color, 3.3 or 4.01 DOS, 101 keyboard, 230 Watt power supply, &amp; more!</td>
<td>$4288</td>
</tr>
<tr>
<td>486-25 Cache Tower</td>
<td>Equipped as above, just</td>
<td>$3588</td>
</tr>
<tr>
<td>Caching 386-33</td>
<td>40 MB IDE, 14&quot; high res. monitor, 1MB RAM, 1.2 or 1.44 MB floppy, 200 Watt power supply, 3.3 or 4.01 DOS, 101 keyboard, and more!</td>
<td>$2298</td>
</tr>
<tr>
<td>386-25</td>
<td>Equipped as above, just</td>
<td>$1928</td>
</tr>
<tr>
<td>386-SX-16</td>
<td>40 MB IDE, 720 x 350 mono monitor, 1MB RAM, 1.2 or 1.44 MB floppy, 200 Watt power supply, 3.3 or 4.01 DOS, 101 keyboard, and more!</td>
<td>$1278</td>
</tr>
<tr>
<td>286-12's</td>
<td>AT Compatible, 40 MB IDE, 1.2 or 1.44 MB floppy, 14&quot; high res. mono, 1MB RAM, 3.3 or 4.01 DOS, 101 keyboard, 200 Watt power supply, and much more!</td>
<td>$978</td>
</tr>
</tbody>
</table>

SAINT CROIX COMPUTERS

6640 Shady Oak Road; Eden Prairie, MN 55344; FAX: 612-943-3854; TEL: 612-943-8618

© 1991, St. Croix Computer Corporation

386® and 468® are registered trademarks of another great name in the computer industry, Intel Corporation.
BICC's Wireless LAN Sees Red

One of the advantages of wireless LANs, compared with their cabled cousins, is quick setup and dismantling. BICC takes that a step further with its InfraLAN system, based on infrared technology. It says the advantage of an infrared LAN over a radio alternative is the signal is less prone to fading, distortion, and timing problems. Also, FCC involvement isn’t required.

InfraLAN is transparent to the user and meets the IEEE 802.5 Token Ring standard. The product consists of a base unit that supports up to six terminals and two optical nodes, one for incoming and the other for outgoing data signals. The Token Ring version supports 4-Mbps and 16-Mbps speeds and works with off-the-shelf network interface cards, servers, and bridges, the company says.

If the signal path is blocked, the token ring automatically reverses direction and uses a backup signal path.

Price: One six-port hub and two transceivers, $2995.

Contact: BICC Communications, 103 Millbury St., Auburn, MA 01501, (508) 832-8650; fax (508) 832-8689.

Circle 1000 on Inquiry Card.

RadioLink Hops Down the Trail

California Microwave’s wireless LAN uses spread-spectrum technology, but with a twist: Instead of using the direct sequence spreading, it employs frequency hopping, a technique the company says improves immunity from interference. The RadioLink network, which operates at 250,000 bps, permits eight subnetworks to operate in the same area.

RadioLink transceivers offer up to eight ports for connecting any device with a RS-232, RS-449/422, RS-485, LocalTalk, Ethernet, or V.35 interface. The system can broadcast omnidirectional signals in a 500-foot radius indoors and as much as 5 miles across unobstructed space, the company claims.

Frequency hopping is an alternative technique for modulating signals within the same frequency bands allotted by the FCC for spread-spectrum communications. Unlike direct sequencing, which encodes transmissions by spreading a low signal across the band according to a prescribed code, frequency hopping causes the signal to jump around from one frequency to another.

One version of the product operates in the 902- to 928-MHz band, while the other runs at 2400 MHz to 2483 MHz.

Price: From $3450 for a one-port lower-frequency transceiver to $5280 for an eight-port higher-frequency unit.

Contact: California Microwave, Inc., 985 Almanor Ave., Sunnyvale, CA 94086, (408) 732-4000; fax (408) 732-4244.

Circle 1001 on Inquiry Card.

Terminal Emulation for Windows

OpenConnect Systems (formerly Mitek Systems) and Future Soft Engineering have jointly developed DynaComm/OpenConnect 5250, an IBM 5250 terminal-emulation software package that runs under Windows 3.0. IBM 5250 is the terminal protocol used for AS/400 midrange systems. The package allows full 5250 emulation across TCP/IP and includes full color support, a keyboard mapping facility, font scaling, and an application programming interface and scripting language for developing graphical front ends.

Price: $495.

Contact: OpenConnect Systems, Inc., 2033 Chennault Dr., Carrollton, TX 75006, (214) 490-4090; fax (214) 490-5052.

Circle 1002 on Inquiry Card.

Eicon Technology’s Interactive Terminal Interface lets Windows 3.0 users on a NetWare or NetBIOS LAN access remote ASCII hosts through an X.25 packet assembler/disassembler. ITI works with the EiconCard, an X.25 gateway that is installed in a LAN communications server. ITI is loaded into client computers along with Eicon’s Access X.25 software and the Windows Terminal program or another ASCII terminal-emulation package.

Price: $50 for a stand-alone computer or $200 per network.

Contact: Eicon Technology Corp., 2196 32nd Ave., Montreal, Quebec, Canada, H8T 3H7, (514) 631-2592; fax (514) 631-3092.

Circle 1003 on Inquiry Card.
MYODA LT 5200 CD
$3,495
386-25
32KB Cache
- Expandable memory to 6MB on board
- Gas Plasma VGA Screen
- 40MB Connor IDE hard drive
- Detachable 102 key keyboard
- 25-, 19-, 1 FD, XCVRT Ports
- Free carrying case
FREE: Windows 3.0 and mouse, and DOS

MYODA LT 3500
$1,499 LAPTOP BARGAIN
- Intel 80286 CPU w/o Wait State
- 6/12 MHZ Clock Speed
- EGA Gas Plasma display
- 1 MB installed 4 MB MAX
- 3.5/1.44 MB Internal floppy drive
- 40 MB (28ms) hard drive
- Two serial/1 parallel CRT port
- Free carrying case

MYODA 486-33 $3,199
486-25 $2,899
- 4MB RAM
- 1.2 & 1.44MB drives
- 15MB (18ms) hard drive
- 14" SVGA monitor 0.98 DP
- 16 Bit SVGA card 1MB
- 101 keyboard
FREE: Windows 3.0 and mouse, surge protector, software

MYODA NOTEBOOK
Call for price
- Intel 80386-SX 16MHZ
- Standard 1MB, 4MB max
- 85W FTN LCD screen
- 840 x 640 9 backlight
- 1.44MB 3.5" Disk
- 30MB HD, 40MB optional
- Mouse, CDC, 28, 1P, 16 external ports
- 60 key keyboard
Pansonic Notebooks available (call for price)

MYODA
1053 Shore Road, Naperville, IL 60563
1-800-562-1071
Tech Support: (708) 369-5331
- One year warranty on parts and labor
- Positive technical support
- Custom configuration
- All systems tested and approved
- 100% Compatibility: DOS, CE2. Novell, UNIX, XENIX, & LIM 4.0
- 15 Day money back guarantee
- RMA required
- Price and availability subject to change without notice

Circle 562 on Inquiry Card (RESELLERS: 563).
Executive Information Under Windows

Pilot Executive and Information Builders have combined forces to provide Focus/EIS, a Windows executive-information interface for presenting data collected by IB's PC/Focus application-development delivery environment.

PC/Focus offers user-interface functions, a screen painter, a report painter, file-description generators, utilities, and communications capabilities. With PC/Focus 5.5, you can perform cooperative processing with data stored on DB2, SQL/DS, IMS, and VSAM mainframes. The program can also access dBASE, 1-2-3, word processing, and Symphony files.

On the client side, IB offers several products for running the system on Novell, IBM, 3Com, and Ungermann-Bass networks. You can also run the system on OS/2 and, with the Focus for SQL Server interface, read and write SQL Server data. Focus/EIS requires PC/Focus or PC/Focus Plus, a 386 with 2 MB of RAM, and a VGA monitor.

Price: Focus/EIS, $895; PC/Focus, $1298.

Contact: Information Builders, Inc., 1250 Broadway, New York, NY 10001, (800) 848-8683 or (212) 736-4433; fax (212) 967-6406.

Check Your Attitude

Apian Software's new Survey Pro program helps you manage customer, marketing, membership, and other types of survey projects. You enter the questions you want answered into the program, choosing from a variety of questionnaire styles, answer scales, and layout options; the program generates a professional-looking survey form.

Once you've designed the survey, the program automatically generates a database application for storing the acquired data.

Survey Pro runs on the IBM PC and supports the LaserJet III. It can import TIFF and PCX files for incorporating logos into surveys and reports.

Price: $195.

Contact: Apian Software, Inc., P.O. Box 1224, Menlo Park, CA 94026, (800) 237-4565 or (408) 562-9680; fax (408) 562-9683.

Easy Gen helps you design, administer, and analyze employee-attitude surveys. A database of more than 500 questions covers more than 41 topics, such as benefits, service, and career development. The program requires DOS 3.3 or higher. The program presents reports via graphs, showing trend analyses and breakdowns by demographic categories.

Price: $150.

Contact: E. F. Wonderlic Personnel Test, Inc., 820 Frontage Rd., Northfield, IL 60093, (800) 323-3742 or (708) 446-8900; fax (708) 446-9492.

Statgraphics 5.0 can now display data in contour and surface plots.
486 33MHz Power!

$3295.00

STANDARD FEATURES....

80486 33MHz 32 Bit Intel CPU
4MB RAM-Expandable to 64MB
MICRONICS Motherboard; Phoenix BIOS
64K Cache (expandable to 256K)
Desktop Style Case (Tower Option available)
8 Expansion Slots (ISA 16 bit)
EISA System -- Add $900.00 (486 only)
of 7-32 Bit EISA slots, 1-16 bit ISA
220W Switching Power Supply
19/" Enhanced Keyboard
12/" Hi-Res Monochrome Monitor
Monochrome Graphics Card
12 or 144 MB Floppy Drive
100 MB 18ms Hard Drive
Serial, Parallel & Game Ports
Full 1 Year Limited Warranty
Free Shipping in the Continental U.S.
(UPS Ground)

MS-DOS 3.3 or MS-DOS 4.01 add $50.00

Complete 386 33MHz System

Configured as 486 above except with 128K Cache
386-33MHz ECS Motherboard, AMI BIOS
1MB RAM Expandable to 16MB
7 Expansion Slots, 6-16 bit, 1-8 bit
MICRONICS System add $250.00

Our Best Value!

$1995.00

Quality Service and Support Since 1984
Locations Nationwide

[Image of Lucky Computer Co.]
PC, Mac, and Unix Project Management

Open Plan, the high-end project management program for the IBM PC, has a new graphical interface that lets you examine project data in three views. The Project Executive interface affords you Work Breakdown structure, project-network, and bar-chart and histogram views of the data. You can also cut and paste groups of activities with the interface.

Welcom has also added support for PostScript in version 4.0. WSTView, a new screen painter, is designed to help you create custom entry screens for underlying database products. The program is dBASE- and FoxPro-compatible and runs on the IBM PC.

On the Mac platform, the company’s Open Plan/Mac runs on AppleTalk or EtherTalk, using AppleShare or TOPS, NetWare 2.0 or higher, or any other AppleTalk Filing Protocol compliant networks. Open Plan/Mac stores its data in FoxBase/Mac format. If you have the PC and Mac versions of Open Plan on your network, you can share data files and report files, the company says.

Price: Mac and PC standalone versions, $4200 each; four-user licenses, $14,000 each.

Contact: Welcom Software Technology, 15995 North Barkers Landing, Suite 275, Houston, TX 77079, (713) 558-0514.

Circle 1008 on Inquiry Card.

M
tier, developer of high-end project management programs for the IBM PC and Unix, has released versions of its project management development systems for the Hewlett-Packard 9000/800 and a management planning tool for the IBM PC.

Artemis 7000, a project management system with a fourth-generation-language relational database, a graphics generator, and a report writer, and Artemis Project, a ready-to-use project management application, both support the X Window System interface and Structured Query Language interfaces to Oracle, Ingres, and RDB databases.

Artemis Planner 2.0 for the IBM PC lets you build work and activity plans for export to a larger Artemis system for more detailed planning.

Price: Artemis 7000, $20,000; Artemis Project, $9500; Artemis Planner, $865.

Contact: Metier Management Systems, Inc., 12701 Fair Lakes Cir., Suite 350, Fairfax, VA 22033; (703) 222-1111; fax (703) 222-8203.

Circle 1009 on Inquiry Card.

PC-File Gets 14 Applications and a Browser

ButtWare’s 14 applications for its PC-File flat-file database include accounts payable, address book, business contacts, checkbook, church records, home inventory, and purchase order invoicing.

Other custom applications include books, coins, music inventory, personnel records, photo log, prepay invoicing, and video library.

The company’s db:Crayons utility lets you search and browse PC-File data from other programs, allowing you to cut and paste data or print mailing labels and envelopes. It also lets you dial a telephone number from a PC-File database.

Price: Custom Applications, $19.95 each; db:Crayons, $49.95.

Contact: ButtonWare, P.O. Box 96058, Bellevue, WA 98009; (800) 528-8866 or (206) 454-0479; fax (206) 454-1838.

Circle 1010 on Inquiry Card.

Help for New GUI Users

A
lthough Windows and the Mac’s graphical user interface are designed to be easy to use and intuitive, companies are often surprised to encounter training problems. Some people have never used a computer, while others are comfortable with the command line but have trouble mastering GIs.

Individual Software’s Professor Windows and Professor Mac help people learn at their own pace the intricacies of pull-down and tear-off menus and other aspects of the interfaces.

Price: $49.95 each.


Circle 1011 on Inquiry Card.

Test 1-2-3 Proficiency

T
he Judd Test allows an employer to determine the proficiency of a prospective employee in using and understanding 1-2-3. The program can test in 20 skill groups and is designed to prevent you from passing over a qualified candidate for one that will require extensive training.

The Judd Test runs in the background of the 1-2-3 application. Supported versions of 1-2-3 include 1A up to 2.2.

Price: $495 for one-year license; $295 for each year thereafter.

Contact: Mentrix Corp., 103 Providence Mine Rd., Suite 201, Nevada City, CA 95959; (916) 265-4000; fax (916) 265-0359.

Circle 1012 on Inquiry Card.
<table>
<thead>
<tr>
<th>Model</th>
<th>Configuration</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>286/12-40 PRO</td>
<td>Intel 80286-12 16-bit, 2MB RAM, 40MB Hard Drive, 19ms with 64K Cache, 1.2MB 5 1/4&quot; Drive, 1.44MB 3 1/2&quot; Drive, 2x 86 Max VGA, 2 MB, CTX-1024x, Super VGA Color Monitor, 2 Serial, Parallel, Game Ports, DOS 4.01 &amp; MS Windows 3.0, Microsoft Mouse, 400 ppi, Mid-size Tower Case</td>
<td>$1,595.00</td>
</tr>
<tr>
<td>386/SX-80 PRO</td>
<td>Intel 80386 SX, 2MB RAM, 80MB Hard Drive, 17ms with 64K Cache, 1.2MB 5 1/4&quot; Drive, 1.44MB 3 1/2&quot; Drive, 2x Max VGA, 1 MB, CTX-1024x, Super VGA Color Monitor, 2 Serial, Parallel, Game Ports, DOS 4.01 &amp; MS Windows 3.0, Microsoft Mouse, 400 ppi, Mid-size Tower Case</td>
<td>$1,895.00</td>
</tr>
<tr>
<td>386/SX-100 PRO</td>
<td>Intel 80386 SX, 2MB RAM, 105 MB Hard Drive, 17ms with 64K Cache, 1.2MB 5 1/4&quot; Drive, 1.44MB 3 1/2&quot; Drive, 2x Max VGA, 1 MB, CTX-1024x, Super VGA Color Monitor, 2 Serial, Parallel, Game Ports, DOS 4.01 &amp; MS Windows 3.0, Microsoft Mouse, 400 ppi, Mid-size Tower Case</td>
<td>$1,995.00</td>
</tr>
<tr>
<td>386/25-80 PRO</td>
<td>Intel 80386-25, 32-bit, 4MB RAM, 80 MB Hard Drive, 17ms with 64K Cache, 1.2MB 5 1/4&quot; Drive, 1.44MB 3 1/2&quot; Drive, 2x Max VGA, 1 MB, CTX-1024x, Super VGA Color Monitor, 2 Serial, Parallel, Game Ports, DOS 4.01 &amp; MS Windows 3.0, Microsoft Mouse, 400 ppi, Mid-size Tower Case</td>
<td>$2,495.00</td>
</tr>
<tr>
<td>386/25-100 PRO</td>
<td>Intel 80386-25, 32-bit, 4MB RAM, 105MB Hard Drive, 17ms with 64K Cache, 1.2MB 5 1/4&quot; Drive, 1.44MB 3 1/2&quot; Drive, 2x Max VGA, 1 MB, CTX-1024x, Super VGA Color Monitor, 2 Serial, Parallel, Game Ports, DOS 4.01 &amp; MS Windows 3.0, Microsoft Mouse, 400 ppi, Mid-size Tower Case</td>
<td>$2,595.00</td>
</tr>
<tr>
<td>386/33C-100 PRO</td>
<td>Intel 80386-33, 32-bit, 4MB RAM, 64K Cache, 105MB Hard Drive, 17ms with 64K cache, 1.2MB 5 1/4&quot; Drive, 1.44MB 3 1/2&quot; Drive, 2x Max VGA, 1 MB, CTX-1024x, Super VGA Color Monitor, 2 Serial, Parallel, Game Ports, DOS 4.01 &amp; MS Windows 3.0, Microsoft Mouse, 400 ppi, Mid-size Tower Case</td>
<td>$2,895.00</td>
</tr>
<tr>
<td>386/33C-200 PRO</td>
<td>Intel 80386-33, 32-bit, 4MB RAM, 64K Cache, 210MB Hard Drive, &lt;15ms with 64K Cache, 1.2MB 5 1/4&quot; Drive, 1.44MB 3 1/2&quot; Drive, 2x Max VGA, 1 MB, CTX-1024x, Super VGA Color Monitor, 2 Serial, Parallel, Game Ports, DOS 4.01 &amp; MS Windows 3.0, Microsoft Mouse, 400 ppi, Mid-size Tower Case</td>
<td>$3,195.00</td>
</tr>
<tr>
<td>486/25-200 PRO</td>
<td>Intel 80486-25, 32-bit, 8MB RAM, 64K Cache, 210MB Hard Drive, &lt;15ms with 64K Cache, 1.2MB 5 1/4&quot; Drive, 1.44MB 3 1/2&quot; Drive, 2x Max VGA, 1 MB, CTX-1024x, Super VGA Color Monitor, 2 Serial, Parallel, Game Ports, DOS 4.01 &amp; MS Windows 3.0, Microsoft Mouse, 400 ppi, Mid-size Tower Case</td>
<td>$3,995.00</td>
</tr>
</tbody>
</table>

**Performance:** By using only high performance components such as Intel, Toshiba, Teac, Quantum, Maxtor, 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 2xhe Max VGA (1 Meg Video, 1024x768 resolution with 256 colors).

**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 Toll 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
- Optional On-Site Service
- No Surcharge on Credit Cards
- New sales hours: 9am - 6pm CST M-Sat.

**Contact Derby Tech Computers, Inc.**
1-800-24-DERBY
718 - 15th Avenue / East Moline / Illinois / 61244 / (309) 755-2662
1-800-243-3729

Circle 553 on Inquiry Card (RESELLERS: 554).
DADiSP Now Runs Under X

DADiSP's DADiSP technical spreadsheet for scientists and engineers now supports version 11 of the X Window System.

The program tackles tasks in graphics, signal processing, lab automation, and test and measurement in a menuing environment without requiring programming. DADiSP can directly exchange data with instruments based on the IEEE-488 interfaces and A/D boards. Through the interfaces, you can acquire, analyze, and visualize data from oscilloscopes, waveform records, sensors, gauges, and other devices.

DADiSP runs on the IBM RISC System/6000; Sun-3, Sun-4, Sun386i, and Sparcstation; HP 9000 Series 300 and 800; and the Concurrent Series MC5000 and MC6000. The program also runs on the IBM PC.

Price: $895 to $6995.
Contact: DSP Development Corp., One Kendall Sq., Cambridge, MA 02139, (617) 577-1133; fax (617) 577-8211.
Circle 1013 on Inquiry Card.

Capture and Analyze RS-232 Data

DataScope, designed for IBM PC protocol analysis and data capturing, lets you capture up to 8 MB of data and signal information at rates of up to 115,200 bps. The program can also match trigger strings against incoming data and offers archive-parameter control.

The DADiSP technical spreadsheet now runs under X Window System for digital signal processing and other applications.

Develop 16-MB Programs with LabWindows

The LabWindows 2.0 programming environment for creating PC-based data acquisition and instrument-control systems now uses Rational's DOS extender technology to support the development in the LabWindows environment of programs that use up to 16 MB of memory.

LabWindows 2.0 for DOS also uses the DOS/16M Virtual Memory Manager, allowing programs that require 16 MB to run in only 2 MB of memory. You can either develop in the LabWindows environment or compile the program using a Microsoft C or QuickBasic compiler.

A new user-interface library to LabWindows 2.0 provides tools that make it easier to integrate graphical front ends with your application.

Version 2.0 also supports dynamically loadable libraries. You can use your own external libraries and C code as if they were a standard LabWindows library; the company says dynamic link libraries use much less memory than a standard LabWindows instrument driver. You can also compile LabWindows drivers into object modules and load them dynamically, reducing memory requirements and increasing execution speed of the application.

A new Create Standalone Program utility helps in converting a LabWindows program into a stand-alone executable program.

On the Mac platform, the LabView 2.1 data acquisition program, which doesn't require the programming knowledge of LabWindows, now has a run-time system for distributing applications while protecting your source code from changes.

Price: Lab.Windows 2.0, $695; LabView 2.1, $1995; run-time system, $495.
Contact: National Instruments Corp., 6504 Bridge Point Pkwy., Austin, TX 78730, (800) 433-3488 or (512) 794-0100; fax (512) 794-8411.
Circle 1014 on Inquiry Card.

Acquire Data on the PC for Under $200

PC Data Master combines graphics, data sampling, test data, and math routines in its digital signal processing (DSP) system. The program lets you develop from the command line or with pull-down menus. You can create applications that use multiple windows to display data.

The PC Data Master system provides a complete system for DSP; you can also integrate processing modules written in FORTRAN, C, Pascal, and BASIC with the system, developer Durham Technical Images says.

Other features of the program include a macro recorder and a collection of fundamental DSP routines, such as fast Fourier transform, correlation, and many others.

PC Data Master is a block-oriented DSP system and does not support continuous real-time processing. If sufficient RAM is unavailable, the program creates temporary spill files to buffer excess data.

Price: $185.
Contact: Durham Technical Images, P.O. Box 72, Durham, NH 03824, (603) 868-5774.
Circle 1015 on Inquiry Card.
All the books you need for all the applications you use

- **Build Your Own 80486 PC and Save a Bundle**
  - *by Aubrey Pilgrim*
  - 0-8306-7628-7
  - $16.95 220 pp.

- **Enhanced MS-DOS Batch File Programming**
  - *by Dan Gookin*
  - 0-8306-8641-X

- **80386 Protected Mode Programming in C**
  - *by Len Dorfman*
  - 0-8306-7736-4
  - $24.95 448 pp.

- **Build Your Own PostScript Laser Printer and Save a Bundle**
  - *by Horace W. LaBadie, Jr.*
  - 0-8306-3738-9
  - $16.95 144 pp.

- **Lee Adams' Visualization Graphics in C**
  - *by Lee Adams*
  - 0-8306-3487-8
  - $26.95 512 pp.

---

**Contact Information**

- **Colorado**
  - SOFTWARE CENTRE INTERNATIONAL
    - 9555 E. Arapahoe
    - Englewood, CO 80112
    - 303-799-8833
  - TATTERED COVER
    - 2555 E. 1st Avenue
    - Denver, CO 80206
  - UNITED TECH BOOK COMPANY
    - 249 Main
    - Longmont, CO 80501
    - 303-651-3184
    - 1-800-247-4808
    - 303-651-3405 FAX

- **Minnesota**
  - BAXTER'S BOOKS
    - 608 2nd Avenue South
    - Minneapolis, MN 55402
    - 612-339-4922
  - BOOKSELLERS
    - 21611 Center Ridge Road
    - Rocky River, OH 44116
    - 216-333-7828

- **Ohio**
  - BOOKS & CO.
    - 316 E. Stroop Road
    - Dayton, OH 45429
    - 1-800-777-4881
  - BOOKSELLERS
    - 21611 Center Ridge Road
    - Rocky River, OH 44116
    - 216-333-7828

- **United States**
  - BOOKSELLERS
    - 24031 Chagrin Boulevard
    - Beachwood, OH 44122
    - 216-831-8033
  - INSIDE STORY
    - 8535 Tanglewood Mall
    - Chagrin Falls, OH 44022
    - 216-543-8168
  - MICROCENTER
    - 1555 Wilane Avenue
    - Columbus, OH 43221
    - 614-481-4403
  - WILKIES UNIVERSITY SHOPPES
    - 2614 Colonel Glenn Highway
    - Fairborn, OH 45377
    - 513-429-1677

- **Minnesota**
  - BAXTER'S BOOKS
    - 608 2nd Avenue South
    - Minneapolis, MN 55402
    - 612-339-4922
  - BOOKSELLERS
    - 21611 Center Ridge Road
    - Rocky River, OH 44116
    - 216-333-7828

- **Ohio**
  - BOOKS & CO.
    - 316 E. Stroop Road
    - Dayton, OH 45429
    - 1-800-777-4881
  - BOOKSELLERS
    - 21611 Center Ridge Road
    - Rocky River, OH 44116
    - 216-333-7828

- **United States**
  - BOOKSELLERS
    - 24031 Chagrin Boulevard
    - Beachwood, OH 44122
    - 216-831-8033
  - INSIDE STORY
    - 8535 Tanglewood Mall
    - Chagrin Falls, OH 44022
    - 216-543-8168
  - MICROCENTER
    - 1555 Wilane Avenue
    - Columbus, OH 43221
    - 614-481-4403
  - WILKIES UNIVERSITY SHOPPES
    - 2614 Colonel Glenn Highway
    - Fairborn, OH 45377
    - 513-429-1677

---

Windcrest/McGraw-Hill

Circle 552 on Inquiry Card.
A Companion for Your Word Processor

The Complete Writer's Toolkit comprises six editorial tools, five of which you can directly access as you write.

Writer's Toolkit includes Houghton Mifflin's Correct-Text Grammar, Style, Punctuation, and Spelling Correction System; HM's Abbreviation Program; the American Heritage Electronic Dictionary; Roget's II Electronic Thesaurus; the Concise Columbia Dictionary of Quotations; and the Written Word III—Principles of Grammar & Style. You can hotkey-access all but the grammar checker from within most word processors.

The program runs on DOS systems.
Price: $129.
Contact: Systems Compatibility Corp., 401 North Wabash, Suite 600, Chicago, IL 60611, (800) 333-1395 or (312) 329-0700; fax (312) 670-0820. Circle 1018 on Inquiry Card.

Symantec Ships New Norton Editor

The new version of the Norton Editor features pull-down menus and mouse support to make it easier to search, mark blocks, and lay out text. The Norton Editor 2.0 is a full-screen ASCII text editor.

In the new version, Symantec adds several features to streamline programming efforts, including a Matching Bracket command for finding missing or extra brackets. While searching for a bracket's match, the command recognizes and accounts for nested punctuation, such as a math equation, in a string.

Along with the split-screen editing capabilities, a Window Differences command shows you the first line in which two documents differ. An outline-display feature shows only those lines that begin with a letter or number in the first column—helpful for C and Pascal programmers.

The Norton Editor 2.0 requires 256K bytes of RAM and DOS 2.0 or higher. It includes the Norton Classic Editor, which requires only 50K bytes.
Price: $99.
Contact: Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014, (800) 441-7234 or (408) 252-3570. Circle 1019 on Inquiry Card.

PC Docs Supports Non-WP Files

Unlike the previous version, the PC Docs document management system now supports applications other than WordPerfect. Version 4.0 supports spreadsheets, image files, and other word processors, although without the tight integration available for WP. The program is designed for Novell NetWare LANs.

Running with WP or LetterPerfect, PC Docs intervenes when you save a file and requires you to enter a file profile with the author, job number, keywords, and comments. Under WP, you can retrieve other documents without interrupting your work flow. Integration with WP and LP will remain in PC Docs 4.0.

When used in conjunction with a non-WP file, PC Docs 4.0 has you create a profile first in a template and launch the application along with the document name. PC Docs 4.0 lets you search an infinite number of file servers without requiring you to log into each one. PC Docs also lets you archive documents to an existing on-line volume.

Price: $225 per workstation; $295 per workstation if you buy the full-text search module.
Contact: PC Docs, Inc., Suite 203, 124 Marriott Dr., Tallahassee, FL 32301, (800) 933-3627 or (904) 942-3627; fax (904) 942-1517. Circle 1020 on Inquiry Card.
To The Troops: Thanks for A Job Well Done!

As part of our gratitude, Microcom is offering all military personnel and their families special discounts on all Microcom products. Please inquire by asking your Microcom sales representative.

INTRODUCING MICROCOM'S NEW 386SX/16 VGA NOTEBOOK (W/2 MB RAM)

- Intel 80386SX/16 CPU w/2 MB RAM Standard (Expandable to 6 MB)
- Backlit supertwist LCD Display w/VGA Resolution (640 x 480 in 16 Gray Shades)
- Rugged 20 MB Hard Disk & 3.5" 1.44 MB Floppy Drive
- Parallel, Serial, VGA Display & Keyboard Ports
- NlCad battery & AC power/auto recharging adaptor
- Weighs less than 7 pounds

SPECIAL: Non-Interlaced 1024 x 768 14" Hires Monitor w/1024 x 768-256 Color Graphics Card (1 MB)

- Non-glare etched Screen w/0.28mm dot pitch
- Adv. Drivers Included for Windows 3.0, AutoCad, WordPerfect & many others
- Upgrade from Hires System Packages for $219

Tsong Labs 1024 x 768-256 Color Video Card w/1 MB RAM Features:

- Utilizes Tseng Labs revolutionary ET-4000 Chip & 1 MB of Video RAM
- Up to 1024 x 768 Resolution In 256 Astounding Colors

To Order - Call Toll Free 1-800-248-3398
Open from 9:00 A.M. to 6:00 P.M. PST, Monday-Friday

Prices are subject to change without notice. Not responsible for typographical errors. CA Residents, please add 7.00% sales tax. No surcharge on credit card purchases. Personal and company checks require 14 days to clear. All trademarks acknowledged. Microcom Computers reserves the right to substitute any and all items with equivalent or better parts. Prices do not include shipping & handling.

Circle 561 on Inquiry Card.
Process Satellite Data on the PC

ComStream’s new coprocessor board lets a PC process high-speed data received from satellite links. The CEK101a has four serial I/O ports and uses a 10-MHz 286 backed up with from 512K bytes to 4 MB of RAM, 64 or 128K bytes of EPROM for self-boot operation, battery-backed static RAM, and eight DMA channels. It supports data transfer rates of up to 512,000 bps on all four ports, ComStream says. The four data ports are controlled by a daughtercard. You can configure each port for asynchronous or synchronous protocols; RS-232, RS-422, or RS-423 levels; full or half-duplex; and data terminal equipment or data communications equipment operation.

By handling serial data transfers independently of the CPU, a communications coprocessor such as the CEK101a frees up the main processor for other tasks. The board could be used for any high-speed I/O, not just a satellite feed, ComStream says. It requires a 286-based PC or higher.

Price: In quantity, $1000 each; single unit, $1100.

Contact: ComStream Corp., 10180 Barnes Canyon Rd., San Diego, CA 92121, (619) 458-1800; fax (619) 453-8953.

Circle 1022 on Inquiry Card.

Right Hand Man Remote Communications

Futurus now offers a remote-access program to complement its E-mail system for Novell LANs. With the Right Hand Remote, you can extend your LAN by providing E-mail, appointment scheduling, and simultaneous full-duplex updating for speed and efficiency on-line.

The remote package works with the new Right Hand Man II program, which now supports fax viewing and sending, archiving, keyword searching, and a new Common User Access–compliant interface. Price: Right Hand Man II, from $149 to $5000; Right Hand Man Remote, $295.

Contact: Futurus, 3131 North I-10 Service Rd., Suite 401, Metairie, LA 70002, (800) 327-8296 or (504) 837-1554; fax (504) 837-3429.

Circle 1024 on Inquiry Card.

The Coordinator Goes to the Tailor

Action Technologies’ new Customizer System lets you tailor the company’s Coordinator software (see “Please, Mister Postman,” March BYTE), a communications program that goes beyond traditional E-mail functionality. The Coordinator manages work among many people or groups of people working on Novell LANs.

With the Customizer, you can modify the Coordinator to reflect the way that you work, incorporating company-specific terminology for specific departments. You can use it to translate the system to French, Dutch, Greek, and other languages and create help screens that explain the operations in a certain environment.

The Coordinator provides for the management of projects, the reading of conversation threads in sequence, and the insertion of messages with a request for a reply into your or someone else’s calendar. It also provides for normal E-mail operations.

Price: Coordinator system, $600; 10-pack, $1800; Customizer system, price undetermined at press time.

Contact: Action Technologies, Inc., 1145 Atlantic Ave., Alameda, CA 94501, (415) 521-6190; fax (415) 769-0596.

Circle 1023 on Inquiry Card.

Sight for NetWare, Spooler for LAN Manager

LANSystems has introduced a LAN print spooler for Microsoft LAN Manager and a network monitoring program for Novell NetWare networks. With LANSpool 2.0 for LAN Manager, you can attach as many as five network printers to a designated print server.

LANSight 2.0 provides remote control, diagnostics, and administrative features for monitoring workstations, file servers, and other servers running NetWare 2.x and 3.1x.

Price: LANSpool for LAN Manager, $495; LANSight 2.0, $395.

Contact: LANSystems, Inc., 300 Park Ave. S, New York, NY 10010, (800) 458-5267 or (212) 995-7700; fax (212) 995-8604.

Circle 1025 on Inquiry Card.
Why Do Thousands of Businesses Use P.C. Solutions Systems

We Asked a Data Processing Manager . . .

"P. C. Solutions has satisfied our product and support needs for the last three years. The quality of their products and service are second to none!"

— Gerry Cieminski
D P Manager, Deli Express

486-33 Tower

• Super VGA Color 1024x768, 1 MB RAM
• 125 MB Hard Drive
• 4 MB RAM
• 1.4,1.2 Floppies
• $3,995

386-16/20 SX

• 40 MB Hard Drive
• 2 MB RAM
• Super VGA Color 1024x768
• 1.4,1.2 Floppies
• $1,595

386-33 Tower

• Super VGA Color 1024x768, 1 MB RAM
• 125 MB Hard Drive
• 2 MB RAM
• 1.4,1.2 Floppies
• 64 K Cache
• $2,595

Printers

Epson LQ-510
Epson LQ-1010
Epson EPL-7000 (6 ppm Laser)
Brother HL-8e (8 ppm Laser)

386-33 Tower

• Super VGA Color 1024x768, 1 MB RAM
• 125 MB Hard Drive
• 2 MB RAM
• 1.4,1.2 Floppies
• 64 K Cache
• $2,595

Laptop System

• 386 SX
• 1 MB RAM
• VGA Gas Plasma
• 40 MB Hard Drive
• $2,495

Custom Configurations Available
All systems complete with 1 year warranty and 30 day return policy. Corporate purchase orders welcome.

Call: (800) 279-7070 or (612) 942-7447
Fax: (612) 942-7565

P.C. Solutions

7121 Washington Avenue South, Edina, MN 55439

Circle 566 on Inquiry Card (RESELLERS: 567).
HELP THE AMERICAN FOUNDATION FOR THE BLIND HELP YOU!

The American Foundation for the Blind’s National Technology Center (NTC) maintains a Job Index/User Network which features information from over 1,100 blind and visually impaired people who use adaptive equipment in a variety of jobs.

The NTC is looking for additional participants. Blind and visually impaired individuals of all ages who have hands-on experience with computers, low vision aids, talking products, or other adaptive devices are needed as resource people and/or evaluators.

As a resource person, other users may contact you to share your knowledge and experience. As an evaluator, you may be asked to evaluate both existing and newly developed or adapted devices. Evaluations are published in the “Random Access” section of the Journal of Visual Impairment & Blindness.

If you are interested, please fill out the form below or call our hotline, 1-800-232-5463 (New York residents call 212-620-2147). Tell the operator you wish to be part of the Job Index/User Network.

Your response will be followed by a brief, confidential telephone survey. The information you provide will be used for NTC purposes only and will include the equipment you use, your experience with it, training and employment.

Your assistance will enable the Job Index/User Network to continue as a major information and support system for blind and visually impaired people nationwide.

Mail to: American Foundation for the Blind, National Technology Center, 15 West 16th Street, New York, NY 10011, Attn: A. Hypolite

Name ____________________________________________

Address __________________________________________

City __________________________ State ________ Zip ______

Best time to contact __________________________ Telephone __________________________
From June 25-27, Over 100,000 Eyes Will Peek Into Our Windows At PC EXPO.

In 1990, PC EXPO jumped to the forefront of computing technology with the industry's first Windows-dedicated trade exhibit -- less than one month after Microsoft's breakthrough product announcement. We saw the need--and Windows/PM Pavilion was born.

In '91, industry leaders cried out for more -- and once again we've responded with an even bigger and better Windows/PM Pavilion. More space, more exhibitors, and perhaps the largest display of Windows-based hardware and software solutions you've ever laid your eyes on.

Over 300 exhibitors displaying Windows products. Two independent pavilions and two levels in the Jacob K. Javits Convention Center. Now that's something worth looking into.

And this year's Windows/PM Pavilion promises an even more extensive, in-depth conference track, enabling you to set your sights on those issues most critical to your Windows/PM operating environment.

Windows/PM Pavilion at PC EXPO. It's the perfect opportunity to get an eyeful of the latest, up-to-the-minute information available to successfully implement your corporate computing strategies.

So c'mon, take a peek, and get the clearest view to date on the Windows/PM operating environment. For more information call 800-444-3976.

The Windows/PM Pavilion at PC EXPO


PC EXPO and the Windows/PM Pavilion are produced by Bruno Blenheim Inc.
Windows is a registered trademark of Microsoft Corporation.

Circle 551 on Inquiry Card.
Do the Right Thing with This Hot Box

A tari's Hotz MIDI Translator, or Hotz Box, features a radically different keyboard layout that helps musicians orchestrate, rather than simply play, music. When used with an Atari computer, the Hotz Box lets you compose, edit, sequence, and perform creative projects.

When you link several Hotz systems, one unit can serve as a conductor in a jam session. The Hotz Box can be used to play MIDI sound modules, one person could play bass, another piano, and another trumpet, yet everyone plays in key. With one button, the person running the master unit can configure each unit to produce notes in the same key. This way, musicians in a jam session can play without fear of hitting the wrong note. This lets you focus on creating rather than playing, Atari says. You can program the system to play chords or notes in any key or combination of keys.

The system helps musicians by expanding their musical vocabulary. You can program the system to play complicated chord combinations—not just major and minor chords—and scales flawlessly, Atari says.

The MIDI-compatible system comes with extensive libraries of chords and scales. When used with MIDI sound modules, it can reproduce the sound of any instrument.

Price: $5500.
Contact: Atari Computer, 1196 Borregas Ave., P.O. Box 3427, Sunnyvale, CA 94088, (408) 745-2000; fax (408) 745-2088.
Circle 1026 on Inquiry Card.

A MIDI Maestro for the PC

T he Covox MIDI Maestro consists of a card that fits into a slot on your PC, a score print program, and a 64-track MIDI sequencer that samples at a rate of 600 beats per quarter note. Covox says the sampling rate let's you record a snare drum roll and play it back without it sounding choppy.

The sequencer uses a routine that adds the human factor back to quantized music. This lets your music sound tight, not computerized.

Price: $189.95.
Contact: Covox, Inc., 675 Conger St., Eugene, OR 97402, (503) 342-1271; fax (503) 342-1283.
Circle 1027 on Inquiry Card.

Automated Software Testing with Evaluator

Evaluator is a software test system which automates the hand testing and retesting of software. Software can now be tested unattended, 24 hours a day, seven days a week.

The Evaluator has a powerful, built in test generator that eases the task of test development and execution. The Evaluator Test Control Language and C Test Library allows comprehensive tests to be developed from software specifications. Evaluator can test graphics and text mode applications using keyboard and mouse input. There are few applications Evaluator cannot work with. DOS, OS/2, Unix, Windows and Presentation Manager applications can all be tested. Using a PC in terminal emulation mode, Evaluator can test minicomputer and mainframe software just as well.

Evaluator is a non-intrusive, hardware assisted software test system. No code is loaded with the software being tested, therefore Evaluator will not affect the behavior of the software being tested. You can rest assured that tests carried out using Evaluator are as valid as hand testing.

Testing with Evaluator means higher quality software, it means shorter development times, it means higher profits and greater market share.
Springtime in Atlanta

SPRING '91 is a major new international computing industry event dedicated to information technology solutions.

It's two major shows side-by-side in Atlanta this May 20-23, an expanded COMDEX now reaching resellers and corporate end-user management, and WINDOWS™ WORLD, the first official conference and expo for Windows computing created in cooperation with Microsoft.

Some 1,000 exhibiting companies, plus 60,000 attendees are expected, including computer resellers, software developers, distributors and OEMs, plus corporate buyers, MIS/communications managers, CIO/IS executives, workgroup and departmental managers, and 1,000 trade and business press.

SPRING will feature a combined Conference program of more than 170 sessions -- the largest and most comprehensive forum ever put together for a computer industry event.

COMDEX Continues to Lead the Way

The 11th Spring version of COMDEX will continue to reach every category of reseller, with this year's expanded show featuring a host of reseller-specific educational and training support programs. These will include over 60 conference sessions specifically focused on reseller issues, as well as customized vendor presentations from leading manufacturers and suppliers.

COMDEX '91 at SPRING will also be the first COMDEX event to offer a separate End-User Conference Program with nearly 60 separate sessions. A wide variety of programs and features will also be available to the corporate end-user, from middle managers to senior information system (IS) executives.

Bill Gates, Chairman of Microsoft, will deliver the WINDOWS™ WORLD keynote address, "Windows: Changing the Face of Corporate Computing," an inside look at the contributions of Windows to corporate computing and a preview of future enhancements to Windows technology.

A Multimedia Pavilion

SPRING Multimedia Pavilion will feature an exhibit area for major industry companies, such as IBM, Microsoft Corporation, and others. In addition, SPRING attendees will be able to see a variety of products combining audio, video, animation, graphics and more in a separate Multimedia Presentation Theater. Approximately 20 conference sessions will address the status of this emerging technology.

Highlights of SPRING '91

• 1,000+ COMDEX and WINDOWS™ WORLD exhibitors.
• 170+ conference sessions in the COMDEX and WINDOWS™ WORLD Conferences.
• COMDEX keynote by Novell CEO Ray Noorda addressing critical reseller and user issues.
• WINDOWS™ WORLD keynote address by Microsoft CEO, Bill Gates.
• Special focus on Networked Computing and Multimedia.
• Major new programs including Vendor Presentations, New Product Awareness, User Group Meetings.
• Special focus on Networked Computing and Multimedia.


WINDBUS™ WORLD: The Official Show for Windows Computing

WINDBUS™ WORLD is the official Microsoft-sponsored event supporting Windows, the most influential computing software on the market today.

The show will feature products, support and more than 50 educational conference sessions on Windows computing for corporate users, software developers, system integrators, peripheral designers, value-added resellers (VARs), and other industry professionals.

Raymond J. Noorda, President and CEO of Novell, will deliver the COMDEX keynote address. "The spark that ignites an Industry," an insightful overview of networked computing and its ever-increasing impact on the computer industry.

Bill Gates, Chairman of Microsoft, will deliver the WINDOWS™ WORLD keynote address, "Windows: Changing the Face of Corporate Computing," an inside look at the contributions of Windows to corporate computing and a preview of future enhancements to Windows technology.
Yamaha's Laptop Music Processor

Laptop and palmtop computers are becoming common tools for working away from the office. Now Yamaha has a new machine for the musician who wants to work away from the studio.

The QY10, which is about the size of a standard VHS tape, lets you compose, arrange, and play music using an 8-track/8-song sequencer, 28-note polyphonic tone generator, drum machine, and keyboard pad. Yamaha says uses of the system include writing and listening to arrangements, composing, ear training, sequencing for single or duo live performance, backing for musical practice, and music education.

The QY10 provides options of 29 sampled instruments, including pianos, strings, brass, guitars, basses, synthesizer voices, and drums.

The rhythm section has 76 preset backing patterns with memory for 24 more of your own. Patterns include drum, bass, and chord combinations of 1 to 8 measures, many with strings or brass. You can create your songs and arrangements by mixing and matching patterns, or you can play the notes with the system.

When inputting chords, the QY10 supports added ninths, sixths, suspended fourths; diminished, augmented, eleventh, and thirteenth options; and standard major, minor, and seventh chords.

The sequencer/recording portion of the system supports eight songs and eight tracks. Real-time and step-time recording is available, and you can edit what you record. The QY10 also has MIDI-In and MIDI-Out connections.

The unit measures 4 by 7½ by 1 inches and weighs 11 ounces.

Price: $399.

Contact: Yamaha Corp. of America, Synthesizer, Guitar, and Drum Division, P.O. Box 6600, Buena Park, CA 90622, (714) 522-9011; fax (714) 522-4023.

Circle 1028 on Inquiry Card.

Attention U.S. BYTE Subscribers

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

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

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

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

"Ten years ago we advertised in the very first BYTE Deck—the number of sales leads we received was enormous! The BYTE Deck was so successful for us, that we have continued to use it over the past ten years!"

Lisa Tarpoff, Marketing Manager, Heath Company, Benton Harbor, MI
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

© Direct Marketing Association, Inc. 1988
Three MIDI Programs for the Mac

Passport's latest version of its Master Tracks Pro 4 music sequencer for the Mac supports Apple's MIDI Manager in System 6.0.7 and provides an overdub record mode for recording directly over a track without erasing existing data. Version 4.5's integrated track editor lets you record and play up to 64 tracks of music while providing a graphical user interface that lets you build large works by repeating sections and adding phrases from other sequences, the company reports.

You can view the structure of the song and edit it using cut, copy, paste, and mix commands. You can also step input passages you are unable to play live by playing the piece a note at a time using the mouse or a MIDI instrument. Volume faders let you do live mixing.

AudioTrax, an 8-bit digital audio and MIDI desktop recording studio for the Mac, offers the recording and editing features of Passport's Trax sequencer plus the ability to record and play two tracks of digitally recorded dialogue or sound effects in sync with a MIDI composition. The program can use sounds recorded with Farallon's MacRecorder Digitizer, an internal sound-input device like those provided with the Mac LC and SI, or any digital sampler. You can cut, copy, and paste sequenced and audio data throughout a MIDI sequence and record up to 64 tracks of music in real time. AudioTrax lets you incorporate digital audio and MIDI into desktop presentations, complementing a visual production with a multimedia desktop presentation. Once you load the sequence and audio, you can edit them to synchronize precisely with the visual, Passport says. The program's digital audio functions add any sound, digital or prerecorded, that is not available from MIDI instruments. You can then play the sequence and digital audio in sync with the presentation triggered by MIDI commands, via MIDI Manager or Passport's HyperMusic MIDI player.

The company has also released a new version of Encore, the composing and notation program for the IBM PC and Mac. Encore 2.0 includes an expanded symbol library, improved page-layout control, support for guitar chords, automatic beaming, extensive key commands, and the ability to read ASCII text files from other programs.

The program can also transcribe live MIDI input and standard MIDI files. The program supports 64 staves and lets you work on 16 files simultaneously. Improved guessing routines more accurately transcribe triplets and complex pieces, the company says.

Price: Master Tracks Pro 4 version 4.5, $495; AudioTrax, $199; Encore 2.0, $595.

Contact: Passport Designs, Inc., 625 Miramontes St., Half Moon Bay, CA 94019, (415) 726-0280; fax (415) 726-2254.

Circle 1029 on Inquiry Card.
If You Like Our Prices...
You'll Love Our Guarantee!

BUSINESS/HOME

- Am-Tex 1980 (3690) - Prepare & print your 1980 taxes! 1040 & all schedules A-E.
- Amortization Table 3.5 (1115) - Handles all types.
- Express Check 4.07 (2 disks) (1170) - A great program to manage your checking account! Even prints checks!
- FormGen 4.1/FormFill 15.2 (3 disks) (3240) - A very versatile form generator and form filler. Create and/or fill out any kind of form for home or business on any printer. Includes numerous sample forms to get you started!
- Family (3 disks) (3280) - Helps you keep track of everything you own. Great for insurance.
- Home Legal Advisor 6.1 (3 disks) (3230) - Over 150 legal forms for almost everything including wills and living trusts.
- Names & Dates 4.1 (2 disks) (3140) - Great personal information master! Keeps track of anything and everything.
- Kid's Care of Business (8 disks) (1230) - Easy to use and loaded with features. General Ledger, Accounts Receivable, Payable, invoicing, checking and much more. Professional accounting for non-accountants. (HD)
- PC-Write 3.3 (3 disks) (3260) - Easy to use word processor that is loaded with features including spell checker.

CLIP ART (PCX)

- Note: These disks contain clip art in PCX (PC- Paintbrush) format. They can be used with WordPerfect 5.0/5.1, PageMaker, Ventura Publisher, Windows or programs that read PCX files.
- Accent/Dingbats (217) - Holliday (216)
- Birds (2 disks) (2620)
- Business (2 disks) (2630)
- Butterflies (2695)
- Church (4 disks) (2550)
- Educations (2 disks) (2640)
- Family (3 disks) (2650)
- Food (2 disks) (2660)
- Headlines (2 disks) (2670)

EDUCATION

- Amy's First Primer (1717) - Six different learning programs for children ages 4-8. (CGA)
- The DOS Learning System (1417) - Learn how to use DOS with this great program. Covers all versions of DOS 2.0-4.01.
- Funnels & Buckets (1727) - Teach children basic math skills.
- Lotus Learning System (2 disks) (1420) - Learn Lotus 2.0 easily and quickly.
- Play'n Learn 2.56 (1735) - A collection of six programs for children 18 months to 3 years. (CGA)
- Typing Teacher (1429) - Five great programs designed to improve the speed and accuracy of your typing!
- World 2.99 (1849) - The ultimate global! Learn about cities, countries, with this computerized globe. (CGA)
- Tutor DOS (4 disks) (1430) - The ultimate DOS tutorial. Everything you wanted to know about DOS and more! (HD)

GAMES

- Arcade Games 1 (1811) - Pac-man (3 versions), Hopper, Space Invaders, Fusion (Tetris variation), etc. (CGA)
- Arcade Games 2 (1812) - Double Blocks (another Tetris variation), Q-Bert, Breakout, Beast and others. (CGA)
- Kids Chess 1.99 (2429) - The best chess game available anywhere. (It beats Chessmaster 2000.)
- Kids Games (2377) - Fun for the under-12 set.
- Strategy Games (2461) - Risk, Othello, Chess, Neyt (Tetris clone), and others. (CGA)

MISCELLANEOUS

- Automenu 4.5 (3705) - Latest version of the most popular menu program of all time.
- Banner & Sign Makers (3215) - Makes banners or signs for any occasion. Works with any printer.
- Best DOS Utilities (2 disks) (3562) - Essential utilities for DOS. Screen blankers, file finders, numerous other handy utilities that will save you time. Very easy to use!
- Brother's Keeper 4.5 (3720) - Excellent, full-featured genealogy program that's easy to use!
- MealMaster 6.14 (2 disks) (3140) - A complete recipe file comes with over 450 recipes to start you off.
- Mr. Label 5.0 (3233) - Powerful & versatile label maker.
- Online Bible 5.0 (1416) (CGA) - Complete KV Bible. Includes Greek/Hebrew Lexicon & Cross Reference. (HD)
- PC-Kay-Drew 3.75 (4 disks) (2780) - An exceptionally powerful graphics program comes with a large collection of ready-made graphics. (CGA) (HD)
- Planograms 2.47 (3017) - Create and play music on your PC!
- Vaccines and Virus Killer Wet 7.2 disks) (3560) - Protect your system from viruses! This set will find (and destroy) over 200 viruses and 400+ virus strains.

WORDPERFECT 5.0/5.1

- WordPerfect 5.0/5.1 Art & Graphics Vol. 1 (2 disks) (3770) - Over 100 graphics for WordPerfect 5.0/5.1.
- WordPerfect 5.0/5.1 Art & Graphics Vol. 2 (2 disks) (3770) - Over 100 additional graphics for WordPerfect 5.0/5.1.
- WordPerfect 5.0/5.1 Tools (2 disks) (3750) - Over 150 more graphics for WordPerfect 5.0/5.1.
- WordPerfect 5.1 Learning System (3 disks) (4230) - Learn how to use WordPerfect 5.1 easily and quickly with this great tutorial. (WordPerfect 5.1 is NOT required.)
- WordPerfect 5.1 Macros (2 disks) (4220) - Over 100 helpful macros for WordPerfect 5.1.
- PC-Paint II (2 disks) (3780) - Create clip art & graphics for WordPerfect 5.0/5.1. (CGA) (HD)

Free catalog of over 200 programs with every order or by request.

WINDOWS 3.0

- Note: These disks require Windows 3.0.
- Active Life/ Organize (4538) - Two "Personal Information Managers" that will keep track of important information.
- Almanac (4535) - The ultimate calendar for Windows!
- ATM Fanga for Windows Vol. 1 (4 disks) (4770) - 20+ fonts for Adobe Type Manager. Will work with all Windows applications. (Requires Adobe Type Manager.)
- ATM Fonts for Windows Vol. 2 (4 disks) (4720) - 20+ additional fonts for Adobe Type Manager.
- Checkbook Managers for Windows (4559) - Two great programs to manage your checkbook.
- Chess for Windows (4569) - Play the great game of chess.
- Command Post 7.0M (4537) - Great file manager and menu system that is customizable to your needs & preferences.
- Fractals & Mandelbrotss for Windows (2 disks) (4568) - Fascinating visual effects and startling graphics.
- Games for Windows 1 (4519) - Games including Tic-tac-toe, Connect Four, Space Invaders, Minesweeper, (CGA) (HD)
- Hyperdesk 4.11 (4538) - Makes Windows run 2 to 10 times faster! (Will also help other programs run faster.)
- Icons & Icon Editors (4540) - Over 2500 icons and 3 editors, so you can create your own! Also includes 2 icon viewers and an icon manager.
- PC Project 3.0 for Windows (4625) - A very nice project manager for Windows.
- Quotes for Windows (4599) - Great programs that will give you quotes for the day.
- Screen Savers for Windows (4615) - Five different screen savers for Windows!
- Toolbook Programs Vol. 1 (2 disks) (4670) - Applications and utilities for the Windows Toolbook.
- Toolbook Programs Vol. 2 (2 disks) (4670) - More applications & utilities for the Windows Toolbook.
- Toolbook Games (4670) - A collection of games for the Windows Toolbook.
- Toolbook Tutor (2 disks) (4670) - Learn how to use the Windows Toolbook.
- Utilities for Windows (4 disks) (4510) - 40 utilities that will help you get the most out of Windows, as well as making Windows easier to use.
- Wallpaper for Windows Vol. 1 (4 disks) (4720) - If you want a different background with Windows, this set offers over 75 different backgrounds.
- Wallpaper for Windows Vol. 2 (4 disks) (4620) - 75+ additional backgrounds for Windows.
- Wallpaper for Windows Vol. 3 (4 disks) (4620) - 75+ additional backgrounds for Windows.
- XVI Draw (4539) - Great drawing program.

(CGA) Requires Color Graphics Adapter (CGA) Requires Hard Disk

Unconditional Money-Back Guarantee!

$1.75 per disk
10 disks or more
$2.25 per disk
1-9 disks

Order Toll Free
1-800-876-3475

Information: 503-776-5777
Fax: 503-773-7803

Reasonable Solutions
2101 West Main, Medford, Oregon 97501
Toll free 800-876-3475 or 503-776-5777, Fax 503-773-7803

Circle 570 on Inquiry Card.

Name: ____________________________  Exp. Date: ____________________________  Signature: ____________________________

Disk size: ☐ 5¼ " ☐ 3½ (add $1 per disk if you require 3½")

No. Disks: ____________________________  x $__________  $__________

Shipping: $__________  ☐ Federal Express, Overnight (add $7)

U.S. Only: ☐ Federal 2nd Day (add $5)

City/State/Zip: ____________________________  ☐ COD (add $8)

Phone: ____________________________  ☐ Canada (add $3)

Method of Payment: ☐ Check/Money Order ☐ Visa/MasterCard

All checks must be payable in US funds. We cannot accept Eurocheques.

Card No. ____________________________  Exp. Date: ____________________________  Signature: ____________________________

Total ORDER: $__________
In the fast changing world of Microsoft® Windows®, you need to stay ahead just to keep up. Which is why you need to be at WINDOWS® WORLD '91 this spring in Atlanta.

WINDOWS WORLD '91 at SPRING will open up extraordinary possibilities you've never seen before. For example:

You'll be exposed to every new Windows product, service and support program that currently exists.

You'll see special vendor presentations that will help you decide what's best for your company. You'll find the latest productivity tools, along with tutorials on software applications. You'll have access to all kinds of helpful mini-events, including user orientation, training, and support activities.

And at the conference, Windows-specific topics—ranging from spreadsheets to word and document processing and from multi-media to

MAY 20–23,
network computing—will be covered in-depth and in detail by some of the best minds in the business.

We see large crowds attracted to this event, so plan to be a part of WINDOWS WORLD '91.

FOR MORE INFORMATION, CALL 617-449-8938, TELEX 174273, FAX 617-449-2674, OR MAIL IN THE COUPON.

1991 • ATLANTA
**Music Clips and a Low-Cost MIDI Interface**

Opcode's collection of MIDiclips is a library of professionally composed music stored as MIDI files for use in multimedia presentations on the Mac. The original sound clips, which you can distribute freely through your company, are designed to be played back through a Roland CM32L-compatible MIDI instrument, the company says. However, you can also play them through other MIDI instruments as well. The CM32L is a 32-voice synthesizer tone module featuring linear arithmetic synthesis and sound effects.

Opcode says the sound clips offer to the music and multimedia community what clip art offers to the graphics community. You can incorporate them into multimedia presentations created with Supercard, HyperCard, or MacroMind Director, the company says.

MIDiclips requires a MIDI hardware interface, a MIDI instrument, MIDiplay, and HyperCard 1.2.5 or higher or any MIDI sequencer. MIDiplay lets you play back the sequences of MIDiclips and edit their length and instrument sound while a sequencer lets you record the sounds and graphically edit them. MIDiplay 1.1 now automatically creates programs that are compatible with MacroMind’s products.

Opcode’s MIDI Translator is a hardware interface that plugs into the Mac’s serial port. The Translator doesn’t require a separate power supply.

And for developers who want to create applications that process data in real time, Opcode created Max. You can create complex applications by linking simple modules, the company says. The program is written in C and provides a high-level graphical way for you to create applications that compose and improvise music, provide accompaniment as you play, send commands to a synthesizer, and modify synthesizer patches.

**Price:** MIDiclips, price undetermined at press time; MIDiplay, $59.95; MIDI Translator, $59; Max, $395.


**A Digital Recording Studio for the Mac**

Digidesign’s Studio D integrates MIDI and digital audio on the Mac II, letting you produce, record, mix, and master compact disc-quality music.

The system consists of a Mac II with a hard disk drive, Digidesign’s SampleCell, Deck, and Audiomedia or Sound Tools.

**Price:** Audiomedia, $995; Sound Tools, $3285; Deck, $349; SampleCell, $1995 with no RAM, $2995 with 8 MB of RAM.

Contact: Digidesign, Inc., 1360 Willow Rd., Suite 101, Menlo Park, CA 94025, (800) 333-2137 or (415) 688-0600; fax (415) 327-0777.

Circle 1030 on Inquiry Card.

---

**Finding A Virus Can Be A Hare Raising Experience**

Immunize your computer with Dr. Solomom’s Anti-Virus Toolkit before they multiply, and multiply, and multiply...

- Inoculates, Eradicates, Annihilates
- Checks For Over 350 Viruses - 100 More than the Closest Competitor - in Less Time!
- Includes Network Support
- Detects Duplicate Infections
- FREE Year of Quarterly Upgrades
- V.I.P. Monthly Service Available
- Backed by Ontrack Technical Support

Just $279.95 safeguards you with a collection of anti-virus programs. Call today.

1-800-752-1333

International: 612-937-1107 · Fax: 612-937-5815

6321 Bury Drive, Eden Prairie, MN 55346

Exclusive North American Distributor

See us at Comdex! Booth #4451

Circle 564 on Inquiry Card (RESELLERS: 565).
Well, it's done: Larry Niven and I finished *Fallen Angels* yesterday. It's scheduled for June publication from Baen Books, which means you ought to find it in bookstores in late May.

Tomorrow I catch a plane for Washington, D.C., where the American Association for the Advancement of Science is meeting this year. AAAS is my hands-down favorite conference of the year, even better than the World Science Fiction Convention. Writing takes a lot of output; AAAS is where I get input. This year, I'm also paying my dues by giving a talk on uses of small computers in science, as well as a lecture at George Washington University on technology and society.

Meanwhile, I'm recovering from minor but painful surgery: they had to slice a small skin cancer out of my face. The result is a Heidelberg scar and the world's worst black eye; it's the black eye that's relevant here. Because of it, I wasn't able to get some of the research done that I'd intended for this column. So it goes. As usual, there's still plenty to write about.

Atari TT030

The newest computer at Chaos Manor is the Atari TT030, which, as the name implies, is powered by the Motorola 68030 chip and is a sort of super Atari ST. The 68030 runs at 32 MHz, in tandem with a 68882 floating-point math coprocessor and built-in cache memory. It certainly runs all the old Atari ST software I could find, including stuff written by my Russian friends at ParaGraph. I now have Perestroika, the Game, running on the TT030, and considering how graphics-intensive the game is, that's no bad test. It runs quite smoothly, if too fast.

The TT030 is what the Mega 4 should have been: the case is sensibly designed, although still plastic; the detached keyboard looks professional, with normal function keys instead of the cutie-pie slanted function keys on the 1050ST; and, in general, the machine has a solid, professional look and feel.

Like all Atari machines, it has about a zillion ports, including game, mouse, serial, parallel, and a cartridge port into which you can plug your Spectre Cartridge from Gadgets by Small and have the equivalent of a fast Mac. For reasons not clear to me, the keyboard cable connects to the right side of the keyboard but the left side of the computer.

The TT030 is one of the items I'd intended to do more with until my plans were drastically altered by surgery; alas, I've had little time to work with it.

My first impressions are quite favorable. Getting the machine running was no problem: I took it out of the box and set it on a stand. I looked in the manual and found that the machine was said to work with VGA color monitors, particularly multisync, so I connected it to the Tatung 14-inch monitor that came with the Gateway 2000 computer—the TT030 has a 15-pin VGA connector that the Tatung (or almost any VGA monitor) will plug into—and turned it on. The monitor flashed white. Then nothing happened for a long time—so long that I believed something was broken. I turned off the machine, checked the connections, and tried again. Still nothing.

I figured I had done something wrong, so I unpacked the TTM195 monitor that came with the TT030, an enormous TTM195 VGA monochrome gray-scale 19-inch monitor, and connected it up. I turned on the system. The monitor flashed a couple of times and then settled down to a uniform white. Then nothing happened. I retrieved the box the TT030 had come in from the storage shed, since I figured I'd have to be sending the machine back. Then I had to look for the manual. When I came back, the operating system (TOS) was running and GEM was on the screen, looking nicer than I'd ever seen it, and there was no question the system was working.

One of the programs on the TT030's hard disk was Mandelbrot, so I clicked on that; the result in monochrome was interesting but not very pretty, so I decided to give the Tatung monitor another try. I plugged that into the system and reset, and, lo, up it came; it just takes a while.

In fact, the TT030 doesn't take all that much longer...
 USER'S COLUMN

than a big 486 to power up and do memory tests; the difference is that the Atari TOS shows you nothing on the screen until it's ready to go to work, while DOS systems tell you what they're doing on power-up. Also, the TOS seems to take a lot longer to power up when it's cold than it does when it has been running a while. None of this is any big problem, and once it has been powered up, hitting the hardware reset button gets an instant reboot that takes no more than a few seconds.

The Mandelbrot program runs interestingly, with repeated iterations that smooth out the jagged lines as you watch. It's a good demonstration of the TT030's VGA resolution.

So far, I haven't found any of my older ST software that doesn't work on the TT030, although I do have to change the monitor's resolution. The TT030 has all the ST resolutions plus its own higher screen resolutions: 320 by 480 pixels with 256 colors or 640 by 480 pixels with 16 colors, both from a palette of 4096 colors. The monochrome mode is no slouch either, with 1280 by 960 pixels on the TT195 monitor. When you change resolutions, the TT030 automatically does the equivalent of a reboot.

I am told, though, that there are some compatibility problems with older ST software. This is particularly true with games and other software that have timing loops, since the 68030 is much faster.

I no longer have a lot of Atari software other than games. Alas, I seem to have mislaid my copies of Sundog and Dungeon Master—doubtless they were put in a "safe place," which means they may not surface for years—but it's not fair to restrict the TT030 to games. This is a solid machine, with a GEM interface and a better keyboard than I started with in this business. I have a copy of Aladdin Spectre Cartridge because Mac software for Epson 9- and 24-pin printers, Diablo-compatible...it seems to be a "colour" monitor. In fact, it plugs into the 110-V outlet, but the manual shows its European origins.

It works fine with the TT030, with no discernible difference from the Tatung multisync monitor. It also works with the Premier 9000 in place of the Zenith Flat Technology monitor, but not very well: the vertical lock is way off, and it flickers.

That's all right: when I plugged the 31-kHz Zenith FTM into the TT030, the display was readable, but it flipped. Putting the Atari PTC1424 monitor with the Atari TT030 works fine. Apparently, the PTC1424 and the TT030 really were made for each other.

The TT195 monitor works wonderfully well with the TT030, too.

Tracker/ST

When I knew I was getting the TT030, I looked for software. One of the first programs to arrive was Tracker/ST, which is a combination database, mail-label generator, and mail-merge program.

Tracker/ST is a near-perfect illustration of the pros and cons of using the Atari computer for business. The good points are that the software is cheap and easy to learn. It does the job in a no-frills, unimaginative way. You really can set up and use this for business correspondence and mailing lists. On the other hand, it is unimaginative; the user interface has the flavor of CP/M during the early days of personal computing.

Example: Tracker/ST includes support for Epson 9- and 24-pin printers, NEC 24-pin printers, Diablo-compatible...
Check v It 3.0 saves you time, money, and hassles when you’re troubleshooting PC problems. This easy-to-use software program shows you exactly what’s going on inside your system, without taking off the cover. For example, Check v It’s hardware diagnostics and system information displays will help you quickly:

- Identify DOS Setup Errors
- Determine Exact PC Configuration
- Detect IRQ Assignment Conflicts
- Pinpoint Bad Memory Chips
- Review Current RAM Usage
- Test Hard and Floppy Disk Drives
- Verify Serial/Parallel Port Connections
- Test Printer Operation
- Perform PC Acceptance Tests
- Compare System Performance
- Find over 200 Different Viruses

Whether you are a professional troubleshooter or a professional PC user, you’ll appreciate the fact that Check v It 3.0 finds more types of problems, on more types of PCs, than any other program in the world.

But don’t wait until your next problem to try it. The more you work with PCs the more you need Check v It to avoid trouble before it starts.

Call Touchstone TODAY!
(714) 969-7746 or (800) 531-0450

TouchStone
Software Corporation
2130 Main Street, Suite 250,
Huntington Beach, CA 92648

Check v It is a registered trademark of TouchStone Software Corporation. Copyright ©1991 TouchStone Software Corporation. ALL RIGHTS RESERVED.

Send Literature 314; Call Me, I’m Interested 315
daisy-wheel printers, and the Hewlett-Packard DeskJet and DeskJet Plus. No laser printers. Of course, you can use the Atari SLM804 laser printer, but you must select either the Diablo emulator or the Epson LaserBrain emulator; there's no provision to use the laser printer as itself. They then add, "We feel that the LaserBrain emulator is a better choice, but it currently works only with a monochrome monitor...."

As I said, shades of CP/M days. My original Diablo printer is in the Smithsonian, and while I do bring out an NEC SpinWriter once a month to write the checks, it's only because I have a SpinWriter and a vast supply of pin-feed checks. I wouldn't buy that setup today. On the other hand, there's a lot of older good-enough equipment out there on the used market, and it's nice to know there are still some systems that support it.

More on all this when I get more software and have more time.

Adventures in Musicland

Some of you may remember a wonderful movie called The 5,000 Fingers of Dr. T., with Hans Conried, Mary Healey, and Peter Lind Hayes. Alas, it wasn't a commercial success. It was later chopped mercilessly and released as Crazy Music, which wasn't a success, either. If you can find a videotape of the original, rent it or buy it, and watch it with your friends or a bright child, or both. Whatever your interest in music, I doubt you'll regret the experience.

Clearly Dr. T's Music Software takes its name from that film; and while it's hardly an amusement for adults (which the movie was, or so I think), Adventures in Musicland does try to retain the flavor of having fun with music. The program is a series of musical games, which, although billed for "children of all ages," are most suitable for the younger end of the spectrum: 10 and under at a guess, although I could be off a bit. Adventures in Musicland tries to teach musical principles through repetition, games, and fun, with goofy illustrations taken from the old woodcut illustrations of Alice in Wonderland. You listen to tunes and try to reproduce them, turn over cards to match them, and build musical symbols—that sort of thing.

This is one I'd recommend you look at before buying: some are going to like it a lot, but some will think it's a bit elementary. The version I have is for the Mac, but there's also an Atari version.

Mac Misgivings

Every time I'm ready to conclude that the Mac is a stable and reliable machine, something happens to... with the 8•24 GC video card. Adventures worked fine. I played around with it enough that I could write about it, and capable, built for the rigors of business on the road.

They connect to practically any telephone, public or private, via standard RJ-11 jacks or an optional acoustic coupler. They adhere to Bell and CCITT standards world-wide so you can connect to other modems (or fax machines) almost anywhere. They're powered by a single 9-volt battery or through an AC outlet, whichever is more convenient. And, they're easily shared as external peripherals among co-workers.

The WorldPort family of modems. They're built for travel, whether it's to extreme environments, to exotic locations or just down the hall.

Call us today for the dealer nearest you:
800-541-0345.
(In New York, 516-261-0423.)

Touchbase Systems, Inc.
160 Laurel Avenue
Northport, NY 11768
(516) 261-0423
Fax (516) 754-3491
Pocket Power

The world’s first 3.5 inch, Erasable Optical Drive.

Pinnacle Micro, the leader in 5.25 inch optical storage systems, now brings you the first 3.5 inch erasable optical drive. The new REO-130™ with its small size and quick 30 msec. speed is what the world’s been waiting for in optical storage.

Each 3.5 inch disk holds 128 megabytes of valuable data, safe and secure.

You can hold the disk in the palm of your hand. You can put it in your pocket, or drop it in the mail.

If you need to distribute or archive large amounts of data, the REO-130™ is the perfect choice.

The drive system is available in both internal or external versions. Interface kits available for MAC, SUN, DEC, IBM and compatibles.

Pocket sized. Amazingly fast. Large capacity, is optical storage now.

Another first from Pinnacle Micro, the Optical Storage leader.

Call today for the name of your nearest authorized dealer.

(800) 553-7070
came over and wrote that, and went back to shut down the Mac. Pull down the File menu, click on Quit. Wait. And wait. Eventually it's clear: the machine has hung up, thoroughly and completely. There is no way to get it to respond to anything.

Of course, a Mac II doesn't exactly have a power switch. There is, however, a power cutoff button on the back, and it was either press that or wait for doomsday. Cycling the power did in fact cure the problem: the Mac came up with the Adventures file lying closed on the Desktop, as it would have been had it been able to quit properly when I tried it with software.

This meant I had to take the Adventures program down to Richard's Mac Plus and try it on that; it worked, and I could close the files and shut that down with no trouble. Then I remembered the problems I'd had before with the 8*24 GC video card. I find that the virtual memory expansion program (it swaps from memory to a reserved area of your hard disk) will work with the Mac IIx, but not if the 8*24 GC card is in it, and this isn't virtual memory's fault at all: Apple managed to violate some of their own standards with the 8*24 GC.

The problem is, suppose I'd had some unsaved work somewhere on that Mac? One answer to that, I suppose, is "don't use MultiFinder," but that sure puts the Mac II at a competitive disadvantage. Another answer is "don't use the 8*24 GC video card," and that makes a fair amount of sense given that even Apple finds the card buggy. A final one is "stick to the devil you know," which in my case is PC compatibles. None of these answers is totally satisfactory.

Grrr!
It has been a long day. It included packing for my trip to Washington. I'm looking forward to the trip because I'll get to visit Ezekial, my wonderful old CompuPro CP/M system that's now on display in the Smithsonian. I sure hope he's happy there. Anyway, before I left, I had to pay the bills for the month. Around here what happens is that as bills come in they are sorted into a huge portfolio. I then use my accounting program to record all the bills, whereupon the checkwriter portion of the program makes out checks. I sign them, and John stuffs them in envelopes and mails them.

It all works fairly smoothly. I should, I know, set up to do it all with Quicken, a home and business finance program. Quicken can keep track of my checking and investment accounts. It works much the same as my accounting program. I could then print out the checks myself or send the electronic output from Quicken to the Checkfree system via a modem. Checkfree would then write the checks and mail them out. I can only plead that my system works reasonably well, and although I don't recommend my accounting program to anyone else, I'm very familiar with it.

Another reason to stay with my present system is that it makes me look at every bill. The accounting program remembers what I usually pay to each account, but it won't skip any. Before it will cut a check, it asks me if the amount is right. I designed it that way.

And every month I find at least one bill that should not be there. Typically it works this way: a PR type works on me to look at a product. I plead that it's too much like something else I've already written about, or it's in a product area that I generally have no interest in;
Tektronix introduces the first color printer that's software-based PostScript-compatible for less than $5000. Our new Phaser II SX is great for individuals or small groups. It works with Windows 3.0 or Macintosh QuickDraw using brilliant 300 dpi thermal-wax color.

For bigger businesses, we have the Phaser II PX. It's PostScript-compatible with HP-GL and licensed by Pantone. It works with Macs, PCs, and UNIX workstations. At the same time. And, like all our other printers, it's upgradeable so you'll never outgrow it.

So give us a call at 1-800-835-6100, Dept. 14J for more information. Because no other color printer looks this good on paper.

**Tektronix**

The best and the brightest.

---

PostScript is a registered trademark of Adobe Systems, Inc. Phaser is a trademark of Tektronix, Inc. Copyright © 1991 Tektronix, Inc. All rights reserved.

Circle 297 on Inquiry Card (RESELLERS: 298).
Professional Level Performance

INDUSTRY LEADING PERFORMANCE, PRICE AND RELIABILITY

386™-33 FC Cache System

ORDER YOURS TODAY FOR...

$3,495 complete

(Lease $98/mo., 48 mos.) 386-25FC price $3,195

Non-cache model shown. Tower case available.

• Intel 80386 33MHz CPU
• 4MB 80ns RAM (exp. to 16MB)
• 64K Cache Memory (exp. to 256K)
• 1.2MB High-Density Floppy Drive
• 1.44MB High-Density Floppy Drive
• 130MB Formatted IDE Hard Drive (19 ms)
• 2 High Speed Serial Ports and 1 Par. Port
• 8 Expansion Slots (6 available)
• 102-Key Enhanced Keyboard
• AMI BIOS w/ Setup and Diagnostics in ROM
• Real-Time Clock with 5-Year Battery
• 2U-Watt Power Supply
• Super-VGA Monitor (1024x786 at .28mm d.p.)
• Super-VGA Video Card w/512K (expandable to 1MB)
• Microsoft DOS 4.01 or 3.3 (installed)
• Microsoft Windows 3.0 (installed)
• Microsoft Serial Mouse
• Choice of Tower or Desktop Case
• Free Delivery
• Lifetime Toll-Free Technical Support
• TRW One-Year On-Site Warranty
• Wide Variety of Options Available

ACT's 33MHz mini-tower machine is a class act all the way around. The ACT 386-33FC is a well-made machine with easy drive access, good performance, and impressive attention to construction detail. This computer is easy to recommend.

December 25, 1990

Every A.C.T. System Features

Customized Solutions for 286, 386™ and 486™ Systems • Free TRW One-Year, On-Site Warranty • Lifetime Toll-Free Technical Support • 30-Day Money-Back Guarantee • Guaranteed 48-Hour Burn-in • Plus, Free Shipping

Automated Computer Technology Corporation
2307 Spencer Highway • Pasadena, Texas 77504
Telephone (713) 946-0731 • Fax (713) 946-3117

A.C.T. NOW Toll-Free
1-800-521-9237

Lease Terms, Qualified P.O.s Accepted
Dealer and VAR inquiries Welcomed
Superior Service and Support

386 SX™ - 20 Cache System

COMPLETE SYSTEM FOR...

$2,195

(lease $64/mo., 48 mos.)

• Intel 80386SX-20MHz CPU
• 2MB 80ns RAM (exp. to 32MB)
• 32K Cache Memory
• 1.2MB and 1.44MB High-Density Floppy Drives
• 89MB Formatted IDE Hard Drive (19 ms)
• 2 High Speed Serial Ports and 1 Parallel Port
• 8 Expansion Slots (6 available)
• 102-Key Enhanced Keyboard
• AMI BIOS w/ Setup and Diagnostics in ROM
• Real-Time Clock with 10-Year Battery
• 200-Watt Power Supply
• Super-VGA Monitor (1024 x 786 at .28mm d.p.)
• Super-VGA Video Card w/1MB
• Microsoft DOS 4.01 or 3.3 (installed)
• Choice of Tower or Desktop Case
• Free Delivery
• Lifetime Toll-Free Technical Support
• TRW One-Year On-Site Warranty
• Wide Variety of Options Available

486™ - 33FC Cache System

UPGRADE TODAY FOR...

$5,295

(lease $143/mo., 48 mos.)

• Intel 80486-33MHz CPU
• 4MB 80ns RAM (exp. to 16MB)
• 64K 20ns Cache Memory
• 1.2MB and 1.44MB High-Density Floppy Drives
• 210MB Formatted IDE Hard Drive (15 ms)
• 2 High Speed Serial Ports and 1 Parallel Port
• 8 Expansion Slots (6 available)
• 102-Key Enhanced Keyboard
• AMI BIOS w/ Setup and Diagnostics in ROM
• Real-Time Clock with 10-Year Battery
• 200-Watt Power Supply
• Super-VGA Monitor (1024 x 786 at .28mm d.p.)
• Super-VGA Video Card w/1MB
• Microsoft DOS 4.01 or 3.3 (installed)
• Microsoft Windows 3.0 (installed)
• Microsoft Serial Mouse
• Choice of Tower or Desktop Case
• Free Delivery
• Lifetime Toll-Free Technical Support
• TRW One-Year On-Site Warranty
• Wide Variety of Options Available

All ACT Systems are NOVELL, UNIX, XENIX, and OS/2 COMPATIBLE

MIPS Performance Benchmark

15.23

14.7

14.22

AST

ALR


ADVANTAGES

1-800-521-9237

“The Complete Integration”

Customize your Professional Level System with your choice of hard drives, memory, video, software, printers, accessories and case options. Our Account Executives will assist you in choosing the best components for the ideal Desktop Publishing, Work Processing, AutoCAD, Accounting, Graphics, Networking Systems or any other demanding application.
but that's never good enough. "You've got to look at this, you'll love it, what harm can it do?" Usually I continue to resist, but once in a while they'll wear me down. "All right," I say, "I'll try to look at it, but I probably won't get to it for a while."

"No problem! Thanks!" they say, and in due course a box of software, or a modem or fax card, or some other gadget will arrive at Chaos Manor and be put in the incoming queue. So far, so good: but then, far too often, the next month as I go through the bill box I will find another invoice. From two different outfits. One for some software; the other for a PC card that I reluctantly agreed to look at. The software is clearly marked "For Evaluation Only. Resale Prohibited." The invoice says that as well; but there it is, a bill for the full list price.

Two bins down in the bill box is a dunning letter from a company's lawyers. The first time they sent a letter like that I hung onto it and explaining it was all a mistake. Now they're threatening me with lawsuits.

And yes, I know it's all bureaucratic foul-ups; but I also have to wonder about a company that can't manage their internal affairs any better than that. If they treat me that way, how will they treat their customers?

The truth is that I cannot possibly pay more than 10 percent of the stuff that comes here, and I don't have a big staff to keep track of it all. I don't run a computer store, I don't sell anything, and I don't give anything away without the owner's permission; but beyond that, I promise nothing.

How Long Can You Tread Water?
As I was writing the above, my son Alex called. I could hear noises in the background.

"Tell your readers to be sure there's good drainage in the computer room," he said.

"What?"

"One of our clients is [a large newspaper]. One of the urinals backed up and then a pipe burst, and the computer room was flooded. We were making coffins of books and documents. I finally called the fire department. They are pumping the water out until we can get the plumbing fixed."

I never thought of drainage as one requirement of a computer room, but the lesson here should be obvious. Just because modern tower-configured microcomputers don't need special air-conditioned rooms doesn't mean you don't have to pay some attention to where you put them. Especially if they run your whole newspaper....

To GUI or Not to GUI
Everybody keeps telling me that this is the year of the graphical user interface (GUI). There are times when I believe it myself.

If I'm going to GUI, the absolute first thing I need is a word processor that lets me get my work done. At present, I use Q&A Write from Symantec, just as I use the Q&A Database to take care of my correspondence, including letters I get from readers, preliminary copies of the column for the people mentioned, product inquiries, and so forth. (Actually, Roberta and John use Q&A to record all that; I only get the benefits.) Symantec hasn't updated Q&A in a couple of years, and I keep telling myself there has to be something better; Q&A Write has some annoying bugs that must be overcome in newer products.

So, although Q&A Write isn't exactly broke, there are things about it that need fixing; and there's also some pressure to find a GUI word processor I can live with. A GUI word processor has features such as charting and drawing capability. I do a lot of communication by fax now, and my Intel Satisfaxion board can take files with drawings and charts and send them out. What with Operation Desert Storm and renewed interest in the SSX space shuttle, I do have reason to be able to send sketches and maps and such as part of my letters, so while I don't need drawing and chart capabilities every day, I sure would like to have them around.

Ami Pro, a friend said. Has all the features you could ever want, and it's easy to learn and easy to use. I'd heard others say the same thing, so when a new copy of it arrived, I figured this was as good a time as any to install it. The Arche Legacy 386/33 has an updated beta copy of MS-DOS 5.0 (you're going to like MS-DOS 5.0 a lot), so I thought I'd start with that machine. Of course, I don't have Windows on the Arche, but Lotus sent a run-time (single application environment) version of Windows 2.11, and that looked simple enough to install. After all, if I liked Ami Pro, I'd put it on the Premier 9000, which is the primary Windows machine, and if I liked it a lot, I'd consider installing Windows on my main machine and be done with it.

The Arche, like many new machines, has a 3½-inch A drive and a 5¼-inch B
drive. I put the Setup/Install disk in the B drive, logged onto that, and started in. The first few disks clearly have the Microsoft Setup/Install program on them; this has been perfected over the years and works very well indeed. It had absolutely no problem with installing from the B drive. This continued until it asked for the Ami Pro Program Disk One.

When that one came up, the environment changed; I was out of Microsoft Install and into the Ami Pro Install program. It first asked for my name and my company name; then it wanted me to enter the serial number that was written on the disk. Some kind of copy-protection scheme. When it got all that, it wrote to the disk. It demanded that I put Program Disk One into drive A. Since Program Disk One is a 3½-inch floppy disk, it wasn't going to get into drive A. Nothing I could do would convince this wretched Install program to proceed. Moreover, most of the files on the disk are PKZIP-compressed files, so I couldn't just copy the stuff over.

I ended up rebooting. Then, just because I'm thorough, I put the new written-on Program Disk One back in the B drive, logged onto that, and typed Install. It all went fine, no problems. Apparently, it was the need to go play copy-protection games that confused the Install program: when it comes back, it has forgotten what drive it is installing from. Annoying, but not fatal.

Once the installation glitches were done, I could try Ami Pro. The Arche has a Rollermouse trackball installed, so I'd be able to test that, too. The good news is that Ami Pro works fine with the Rollermouse.

The bad news is that I just don't like Ami Pro.

This is a purely subjective opinion; as I've said, others I respect do like it. I can only describe my experiences and what I think is wrong.

First, the screen's too busy. The GUI demands that there be little icons and windows all over the place; certainly, Ami Pro has them, lots of them. There's a Scissors icon, and a Paste Pot icon, and a whole bunch of others. Now, of course, since the program has a ton of features, it needs a way to tell you about them; but I don't need them staring at me when all I'm trying to do is write text! One silly little pop-up style-selection window even covers some of the text. Both the icons and the window can be turned off, but that's annoying.

Still, none of that's fatal. I could probably get used to it if I liked everything else. The trouble is that I don't like everything else. I don't much care for the typefaces as they appear on-screen. The Courier, for instance, looks a lot like the one that was on my IBM Selectric. I wrote a few million words with that, so you'd think I'd like it, but I don't. I just don't.

So I changed to the equivalent of Times Roman, changed the point size from 10 to 12, and looked again; and again, it's just not very pretty. It's not easy to read, and it's unesthetic on-screen. Printed out, all's well, meaning that Ami Pro is very likely good enough to make documents that you'll print; but in my line of work, I don't make paper copies often, sometimes not at all, while I do spend a good part of my day looking at the screen.

Finally, when I typed words into Ami Pro in WYSIWYG mode, they would sit still for a moment, and then, when I let the keyboard stay idle for long, the words on-screen would jump around like fleas (i.e., they'd rearrange themselves to the proper proportional spacing). This is fine if you're not watching the screen, but it's enough to drive me out of my mind; I'd never be able to write with that going on. And, yes, I know that I can change the display mode from layout to draft.

So, I'm still looking for a word processor to use with Windows, one that won't be too distracting for creative writing.

On reflection, what I want is an editor that is character-based for writing, but which I can then zap to rearrange the screen into WYSIWYG. That way I'd have stability, yet be able to cut and paste in pictures, maps, and drawings when I need them. Indeed, Ami Pro would do just fine for that. I didn't have any problems editing with it (although I still think the on-screen typefaces are unattractive): it's when I wanted to do creative writing that the editor seemed to get in the way.

I'll keep looking. More next month.

MoreFonts

There's another way to go: instead of finding a WYSIWYG editor, use a character-based editor and a typescaler, such as MoreFonts from MicroLogic Software. A typescaler is a font generator; it takes a series of typefaces and builds fonts as needed. I expect I had better explain.

In standard typesetter terminology, a typeface is a style (e.g., Times Roman, Helvetica, Letter Gothic, and Schoolbook). Many typeface names are trademarked, but the typeface itself has been around long enough that it is in the public domain; thus, MicroLogic has Geneva rather than Helvetica, Tiempo rather than Times Roman, and so forth. To add
to the confusion, some copycat typefaces are not quite the same as the originals. In any event, a particular type style is called a typeface.

Each typeface has a series of faces and sizes. Faces are different variant styles, such as italic and boldface of the original type style. A font of type is a typeface, such as Times Roman, at a particular size, such as 10 point, in a particular face, such as italic. In the old letterpress typesetter days, a case of type would be specified by typeface (Times Roman) and size (12 point), and it would consist of a number of fonts of that typeface at that size. A case usually included the roman or normal font (called medium in sans serif typefaces), italic, boldface, bold italic, and small capitals; and these would be in both uppercase and lowercase. These were arranged in order so that a typesetter could grab exactly the letters needed to make up a line of type in a given font. Sometimes a letter would get into the wrong bin, and the typesetter wouldn’t catch it; that happened often enough that “wrong font” has a standard proofreader’s symbol.

Type vendors, particularly the newer ones who have appeared since the computer revolution, tend to use the word font when they mean face; thus, the claim of “12 fonts” usually means three typefaces, each in four faces, but scalable to a very large number of sizes. Moreover, there are faces other than the traditional ones given above.

MoreFonts uses yet another terminology: MicroLogic Software advertises 17 typefaces. What they mean is 8 typefaces: their versions of Helvetica (Geneva), Times Roman (Tiempo), Letter Gothic (Financial), Broadway (Showtime), Cooper Black (Burlesque), Coronet (Pageant), University Roman (Opera), and Bodini Bold (Poster). There are the traditional four faces (roman or normal, italic, boldface, and bold italic) of the first three typefaces and one each of the last five.

Alas, like most font packages, MoreFonts doesn’t give you a small capital face; but, being a typescaler program, it can generate an almost unlimited number of type sizes of the above, meaning that you can, with a bit of effort, make it generate small capitals to include in texts that need them. This is important to me because I use different faces of type to indicate different activities in my science fiction stories: Oath of Fealty, for example, used italic to indicate internal dialogue, block capitals to indicate computer-generated announcements over a loudspeaker, and small capitals to indicate when a computer was “talking” directly to an implanted receiver in a character’s head.

The neat things about MoreFonts are that it’s simple to use, works with all Windows 3.0 applications, and will also

---

**ABC Flowcharter for Windows**

*“Simply the easiest way to document procedures.”*

ABC Flowchart™ makes drawing and editing flowcharts easier than ever. It’s loaded with features that help you make and edit charts in a fraction of the time needed with other flowcharting or drawing programs.

ABC Flowchart’s advanced link feature lets you break complicated procedures into smaller, more manageable steps. Just click on a shape to display a sub-chart or procedure. It’s that easy.

Ask your dealer for a demonstration or call 1-800-227-0847 for more information. See for yourself why ABC Flowchart is quickly becoming the standard flowcharting tool for the Fortune 1000. Retail price $295.

Roikore™

2215 Filbert St.
San Francisco, CA 94123
415-563-9175
Finally, ESIX System V Release 4.0, the UNIX Operating System of choice is here. Based on AT&T® System V UNIX®, ESIX Release 4.0 is a stable, fully backward compatible and robust operating system with enhanced features and functionalities.

For all the current System V Release 3.2 owners, ESIX offers an easy upgrade path to ESIX Release 4.0. For more information about ESIX System V Release 4.0 product offerings, please call: 1(800) 821-0806 Ext: 2068 or (415) 683-2068

Fax: (415) 651-0728
4843 Milmont Dr.
Fremont, CA 94538, USA

ESIX Computer, Inc. is a subsidiary of Ferranti Siemens, Inc. All other company names and products are trademarks or registered trademarks of their respective companies.

Circle 110 on Inquiry Card.
work with some character-based word processors, including WordPerfect, XyWrite III Plus, and Microsoft Word 4.0 or higher. It prints on most LaserJet, DeskJet, and compatible printers; and the letters that it puts onto a Windows screen are much more handsome than the ugly, jagged things that come with Windows 3.0.

Tiempo is handsome in print. It’s not so pretty on-screen; at least I’ve seen better in the sizes I prefer to work with. However, it’s much better than what comes with Windows out of the box; and more important, I can use a character-based editor to create the text and then play around with WYSIWYG by changing over to MoreFonts.

A good typescaler may be one answer to my problems. MoreFonts is the only one I’ve had a chance to work with so far, so I can’t say what others are like; but this one is good enough for much of what I want to do. It’s fast, looks pretty good on-screen, and is easy to install. Although it has a limited number of typefaces, there are enough for me. Recommended.

Whither Networks?
I have a question: Isn’t it inevitable that someone will write a good shareware network program? I know, I know, very few people make money from shareware, so there’s no incentive to write something so complex; but then consider, there’s already a shareware Lotus 1-2-3 clone. LANtastic or something like it can do the hardware. There aren’t any secrets to file and record sharing, and real hackers write as much to impress each other as for money.

Add it all up, and you wonder: Why is NetWare so expensive?
Just asking.

Systat 5.0
I’ve written about Systat before; this is a program I wish mightily I had when I was an undergraduate, or in graduate school, or later in postdoctoral work. Put simply, this program will do everything I was ever taught to do in statistical inference, and then a lot more; and better, it will, studied diligently, teach you when to use it, as well as how.

There is an old canard about lies, damned lies, and statistics; but the fact is that everything we know is based on statistical inference. Some things are so overwhelmingly obvious that we treat them as established facts; but most of what we know isn’t quite so clear as all that.

One experiment in a high school physics lab is to take repeated measurements of some object. No matter how carefully the measurements are done, there will be a dispersion, but if enough measurements are taken, an average will be close to the true measure.

Close, but how close? If you’re measuring a meter stick in inches, for example, suppose you get an average of 39.36. What are the chances that the true value is 39.37? This is a statistical question, and one quite easily answered. Suppose, though, that you can’t measure the meter stick directly because you haven’t any reliable measuring tapes. Instead, you have to make some sticks that are as near the length of the meter stick as you can make them and measure them. Then you find that these sticks are made of different materials, and thus respond differently to changes in humidity. Can you still find the chances that the true length is 39.37 inches?

Actually, you can; more important,
Books to increase your productivity—without the hardware investment

**BASIC Programming: Inside & Out**
In-depth coverage for all BASIC, QuickBASIC, GW-BASIC and Turbo BASIC programmers. Explains how to use sound and graphics; create help screens and pulldown menus; manage windows in BASIC; use ML with BASIC; create business presentation graphics; print multiple columns and sideways for professional results and program parallel and interface. Has dozens of demo programs and routines you can easily adapt to your own programs. 600 pages with companion disk.

<table>
<thead>
<tr>
<th>ISBN</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-55755-084-0</td>
<td>$34.95</td>
</tr>
</tbody>
</table>

**Programming VGA Graphics**
VGA is becoming the standard display mode for PC applications. Learn techniques for writing by using the flexible and powerful VGA hardware and software. Includes new, unique DOS commands to perform dozens of VGA functions. Turbo Pascal and BASIC extensions for VGA display modes. 670 pages with 2 companion disks.

<table>
<thead>
<tr>
<th>ISBN</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-55755-099-9</td>
<td>$39.95</td>
</tr>
</tbody>
</table>

**Upgrading & Maintaining Your PC**
Shows you how to turn your PC into a high performance machine. Describes what you'll see when you open the "hood" and how all of the parts work together. You'll see how to add a hard drive, increase memory, upgrade to a higher resolution monitor, or turn your XT into a fast AT or 286 screamer, without having to be an electronics wizard.

<table>
<thead>
<tr>
<th>ISBN</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-55755-092-1</td>
<td>$24.95</td>
</tr>
</tbody>
</table>

**QuickBASIC Toolbox**
Packed with powerful, ready-to-use programs and routines to help you write your own programs faster and better. Topics include: complete routines for SAA interfacing; pull-down menus; windows; dialogue boxes and file requestors; BASIC Scanner program for printing completed project listings. Includes companion disk.

<table>
<thead>
<tr>
<th>ISBN</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-55755-104-9</td>
<td>$34.95</td>
</tr>
</tbody>
</table>

**Batch File Powertools**
Boost your computing productivity with this package for making truly powerful batch files. Includes dozens of new batch commands for writing time-saving, easy-to-use "power" batch files. Companion disk contains powerful "Batch BASIC" commands for writing even more useful batch programs. 240 pages with companion disk.

<table>
<thead>
<tr>
<th>ISBN</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-55755-102-2</td>
<td>$34.95</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>ISBN</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-55755-036-0</td>
<td>$59.95</td>
</tr>
</tbody>
</table>

**PC Assembly Language: Step by Step**
Teaches PC assembly and machine language from the ground up. You'll learn at your own pace using the unique simulator which shows you how each instruction works as the PC executes it. 420 pages with 2 companion disks. Also includes evaluation versions of A86 Assembler and D86 Debugger.

<table>
<thead>
<tr>
<th>ISBN</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-55755-096-4</td>
<td>$34.95</td>
</tr>
</tbody>
</table>

**Turbo Pascal Internals**
Gives you "know how" to program faster, easier, lighter 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 disks of more than 800K of source code.

<table>
<thead>
<tr>
<th>ISBN</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-55755-080-8</td>
<td>$49.95</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>ISBN</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-55755-036-0</td>
<td>$59.95</td>
</tr>
</tbody>
</table>

**QuickBASIC Toolbox**
Packed with powerful, ready-to-use programs and routines to help you write your own programs faster and better. Topics include: complete routines for SAA interfacing; pull-down menus; windows; dialogue boxes and file requestors; BASIC Scanner program for printing completed project listings. Includes companion disk.

<table>
<thead>
<tr>
<th>ISBN</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-55755-104-9</td>
<td>$34.95</td>
</tr>
</tbody>
</table>

**Batch File Powertools**
Boost your computing productivity with this package for making truly powerful batch files. Includes dozens of new batch commands for writing time-saving, easy-to-use "power" batch files. Companion disk contains powerful "Batch BASIC" commands for writing even more useful batch programs. 240 pages with companion disk.

<table>
<thead>
<tr>
<th>ISBN</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-55755-102-2</td>
<td>$34.95</td>
</tr>
</tbody>
</table>

**Assembly Language Step by Step**
Teaches PC assembly and machine language from the ground up. You'll learn at your own pace using the unique simulator which shows you how each instruction works as the PC executes it. 420 pages with 2 companion disks. Also includes evaluation versions of A86 Assembler and D86 Debugger.

<table>
<thead>
<tr>
<th>ISBN</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-55755-096-4</td>
<td>$34.95</td>
</tr>
</tbody>
</table>

**Turbo Pascal Internals**
Gives you "know how" to program faster, easier, lighter 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 disks of more than 800K of source code.

<table>
<thead>
<tr>
<th>ISBN</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-55755-080-8</td>
<td>$49.95</td>
</tr>
</tbody>
</table>
the case I have described is pretty simple compared with those routinely faced by social scientists, epidemiologists, criminologists, and many others. It may be fashionable to denigrate statistics, but billions of dollars are allocated by statistical inferences.

Statistics is popularly supposed to be a dry and dull subject, and in the old days it was; but a good part of that was due to the sheer tedium of the calculations required. Systat and small computers take the sting out of that.

I can't claim that Systat will make statistical inference as exciting as *Fallen Angels*; but I suspect you would get more out of studying Systat than reading the book. (Actually, I recommend that you do both.) There are very few professions, business or science, that don't have questions that can be answered only by statistical inference.

**Winding Down**

Well, I'm now in Washington, finishing this up on the Zenith SupersPort SX, which remains too heavy while traveling, but it's still the best machine to use when I get to where I'm going. It's time to get this on the wire.

The two books of the month are reissues: Jacques Barzun's classic *Teacher in America* and Bertrand de Jouvenel's *The Ethics of Distribution*. Both are available from Liberty Fund (7440 North Shadeland Ave., Indianapolis, IN 46250, (317) 842-0880). Liberty Fund has reprinted a number of classics in history and political science, and it's well worth getting their catalog.

The gizmo of the month is After Dark, a screen saver from Berkeley Systems. This has security stuff like optional passwords to get your screen back, but mostly it's just fun: you can put an aquarium, or flying toasters, on your PC's VGA screen. There is supposed to be a Windows version Real Soon Now.

It may be all over in the desert by the time you read this, but if you're curious about the new wizard weapons, the easiest way to learn is a $10 64-page illustrated book called *Desert Shield Fact Book* (GDW, P.O. Box 1646, Bloomington, IL 61702). I sure wish some of the reporters would read this. They might get fewer things wrong.


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."
ALTEC TOWERS
ABOVE THE REST

Now you can have the power and performance of Altec's fully loaded 486 EISA Tower delivered to your door! Check out these outstanding features:

486 EISA TOWER $5295
- Intel 486-25 CPU
- 4 Meg RAM
- 1.2 MB 5.25" drive
- 1.44 MB 3.5" drive
- 150 MB 18ms ESDI hard drive
- ESDI controller with 32K cache
- 16-bit VGA card with 1 MB 14" VGA monitor (1024x768)
- 2 serial, 1 parallel & 1 game ports
- 101-key Keyboard
- MS Window 3.0
- Hi-Res serial mouse
- MS-DOS 3.3 or 4.01

(486 ISA SYSTEM $3895)

"AltecClip 386s are sold machines featuring brand-name parts. A good buy, they are clearly affordable."

"Computer users should find Altec machine an excellent value with good performance."
PC Magazine, July 1990

Altec's Guarantee:
- 30 day money-back guarantee
- 2 year warranty for parts and labor
- Free 4 months on-site service
- Lifetime toll-free technical support

Altec sets the standard for the highest quality design and manufacturing of all our products. We're fast, friendly, and ready to help you select the right features for your needs.

Take a look at some of our other great systems:

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>386/33 VGA</td>
<td>$2695</td>
<td>Intel 386-33 CPU 64K Cache 4 Meg RAM 1.2 MB 5.25&quot; drive 1.44 MB 3.5&quot; drive 104 MB IDE hard drive 16-bit VGA card with 1 MB 14&quot; VGA monitor (1024x768) 2 serial, 1 parallel &amp; 1 game ports 101-key Keyboard MS Window 3.0 Hi-Res serial mouse MS-DOS 3.3 or 4.01</td>
</tr>
<tr>
<td>386/25 VGA</td>
<td>$2395</td>
<td>Intel 386-25 CPU 4 Meg RAM 1.2 MB 5.25&quot; drive 1.44 MB 3.5&quot; drive 104 MB IDE hard drive 16-bit VGA card with 1 MB 14&quot; VGA monitor (1024x768) 2 serial, 1 parallel &amp; 1 game ports 101-key Keyboard MS Window 3.0 Hi-Res serial mouse MS-DOS 3.3 or 4.01</td>
</tr>
<tr>
<td>386/SX VGA</td>
<td>$1795</td>
<td>2 Meg RAM 1.2 MB 5.25&quot; drive 1.44 MB 3.5&quot; drive 40MB IDE hard drive 16-bit VGA card with 512k 14&quot; VGA monitor (1024x768) 2 serial, 1 parallel &amp; 1 game ports 101-key Keyboard MS Window 3.0 Hi-Res serial mouse MS-DOS 3.3 or 4.01 (20 Mhz version add $150)</td>
</tr>
<tr>
<td>286/12 VGA COMBO</td>
<td>$1595</td>
<td>1 Meg RAM 1.2 MB 5.25&quot; drive 1.44 MB 3.5&quot; drive 40MB IDE hard drive 16-bit VGA card 14&quot; VGA monitor (640x480) 2 serial, 1 parallel &amp; 1 game ports 101-key Keyboard Serial Mouse MS-DOS 3.3 or 4.01 Panasonic 1180 printer Wicable Surge Protector</td>
</tr>
<tr>
<td>286/12 VGA STAR</td>
<td>$1195</td>
<td>1 Meg RAM 1.2 MB or 1.44MB drive 40MB IDE hard drive 16-bit VGA card 14&quot; VGA monitor (640x480, 41mm) 2 serial, 1 parallel &amp; 1 game ports 101-key Keyboard MS-DOS 3.3</td>
</tr>
</tbody>
</table>

ALTEC Technology Corp.
ORDER: 1-800-255-9971
Tech Support: 1-800-255-9968

Policy: Same day shipping with standard configurations for orders before 3 PM EST. Shipping and handling extra. Personal and company checks require 10 days to clear. Prices are subject to change, and all items are subject to availability. All returns must be shipped prepaid, insured, in original condition and complete with documentation. Returns must have RMA number. 30 day money-back guarantee does not include shipping. No exchange for Visa & Master Card, 2%, for American Express, 3%.

Altec Technology Corporation • 18555 East Gale Avenue • Industry, CA 91748 • 818/912-3688 • FAX: 818/912-8048

Circle 18 on Inquiry Card.
Renowned computer columnist. Industry luminary. Best-selling science fiction writer. Ph.D. in Psychology. Chairman of the Citizens' Advisory Council on Space. Dr. Jerry Pournelle has been a successful evaluator of computing trends for so many years that his first computer is on display at the Smithsonian.

So when Dr. Pournelle writes about a "CD-ROM explosion," and about the Pioneer CD-ROM Minichanger as a surprisingly effective way to help manage that explosion, he writes from experience.

One CD-ROM can hold up to 128,000 pages of information. The Pioneer CD-ROM Minichanger holds up to 6 discs at once — more than 3 gigabytes of data — in a compact, reliable, easy-loading magazine. And as Dr. Pournelle reports, "it's surprising how fast you can switch back and forth among them" (Byte, Jan., '91).

Why lose time searching for the right disc when it only takes seconds to search across discs to the right piece of data? You can even daisy-chain up to 7 Minichangers from the same controller for access to more than 5 million pages of data.

The Minichanger supports standard ISO 9660 file format through a SCSI interface for IBM, Macintosh, and other platforms. You can also use it as a CD-Audio jukebox.

PIONEER BUNDLES AN UNBEATABLE SIX PACK

Pioneer is currently selling a six pack of CD-ROMs (valued at $1,256) for only $395, less than 1/3 suggested retail price: Countries of the World (a valuable tool for businesses, libraries, universities and schools, with up-to-date geographic, economic, and demographic information as topical as the war in Iraq, plus detailed color maps); US History (more than 100 books); the complete works of Shakespeare; the complete Sherlock Holmes; Audubon's Birds of America (with color illustrations and actual bird calls); and Software Potpourri (including major software programs, a Movie Database, and the complete Bible.)

See the list below for the distributor or dealer nearest you, or call Pioneer at 1-800-LASER-ON.

To find out whether you qualify to become an authorized reseller, call Kent Ekberg, Director of Marketing, Pioneer Communications of America, at (201) 327-6400.

Let the final word on the Pioneer CD-ROM Minichanger come from Jerry Pournelle himself: "Recommended."

YOU HAVE TO BE PRETTY QUICK TO SURPRISE JERRY POURNELLE.

INTRODUCING THE FIRST AND ONLY CD-ROM MINICHANGER.

IDEAS THAT BECOME STANDARDS.

All product names are trademarks of their manufacturers.


Circle 259 on Inquiry Card.
could tell from the despair in the caller's voice that this wasn't going to be a happy conversation. The problem was a LAN installation in a publishing company that had too many standards. Some of the people in the company used IBM PC-compatible computers. Others used Macintoshes for publishing support, while other users had workstations that were linked with Ethernet using TCP/IP. To make matters even more confusing, a few people in the company had a small Token Ring LAN that used LAN Manager, while another group was running Novell NetWare. The company wanted to connect all users together, but it seemed impossible without making a majority of users change to something else.

While a little extreme, the condition that this company found itself in was not all that unusual. Many companies suffer from a LAN implementation strategy that is more accidental than anything. Usually what happens is that some workgroup finds that it needs the services of a LAN badly enough to convince the company to spend money on it. It gets a LAN installed and everything's fine. Somewhere else in the organization, some other group decides the same thing, gets its request funded, and installs a LAN. Since neither group has ever heard of the LAN that the other has, they proceed independently and end up with two systems that are mutually incompatible.

In the end, most large organizations that started out with LANs early ended up with islands of connectivity. People who were in these groups could communicate with each other, but they could not communicate with the rest of the company. Now that LANs have become widely accepted, the organizations involved have begun to move to a corporate enterprise network. The problem is, what do they do about those islands of connectivity that have existed for some time now? Should they find ways to integrate them, or should they make everyone change to a single standard?

**Standardization vs. Integration**

There are good reasons why some companies opt for standardization instead of working to find a way to integrate a variety of users into an overall heterogeneous LAN. When the Federal National Mortgage Association installed LANs in its headquarters and in its regional offices, for example, the organization chose to go with a Token Ring LAN and to convert any nonconforming LANs to that protocol. Likewise, the company standardized on Novell NetWare. In the case of the FNMA, this made sense, because relatively few LANs existed, and the cost of conversion was less than the cost of having to manage different kinds of LANs.

Unfortunately, this isn't true in every organization. Sometimes there are good technical reasons to have different LAN standards. Unix machines, such as Sun or Apollo workstations, aren't going to run NetWare. A Mac is going to work best with AppleShare. Some Structured Query Language database servers require that they be on a LAN Manager-based LAN. Other applications require Novell NetWare. In those cases, giving up a particular type of LAN would also mean giving up a service you need. If you'd rather not do that, then you need to find a way to integrate heterogeneous LANs.

**Heterophobia**

The two most common connections between different types of LANs are between Apple and Novell, and between TCP/IP and Novell. This is because Novell owns approximately 70 percent of the LAN marketplace; consequently, the vast majority of communications with different LANs involves Novell NetWare in some way. Fortunately, most of the means for connecting different LANs are available for Novell NetWare, which works out nicely. A few users also need to connect their LAN Manager LANs to NetWare LANs. For those users, the options list is much shorter.

Apple connectivity is becoming quite common now that Apple has lowered the price of Macs so that they at least approach rationality. In offices where there are only Macs, the choice is simple. All you need to do is connect an AppleTalk network to each machine, and you're in business. If you also have some IBM PC-compatible computers, however, you need to have
something more capable.

There are two good ways to connect a LAN of IBM compatibles to a Macintosh LAN. The first, used by Novell, is simply to support AppleShare within the file server. The second, used by Banyan, is to use a bridge to the Macs. Both choices work well, and both have their supporters. I've never noticed any overwhelming reason to use one approach over the other. You should know, though, that as this is written, you can only use Macs with Novell NetWare 286. The software for NetWare 386 is still not yet being shipped, although this may change soon. In any case, Banyan's bridge to Apple is available for all its products and has been for some time.

Installation of a bridge to an Apple network requires you to provide a computer and two network interface cards—one for the protocol you're using on the LAN and the other for AppleTalk—and to install the bridge software on that computer. This means that you must dedicate a computer to the task. With Banyan, this is your only choice; with NetWare 286, you can use a bridge or use the server directly.

Installing the Apple network on the NetWare server requires that you install an AppleTalk card in the NetWare server. This counts as one of the four network interface cards that NetWare can support in the same server. Once you install the card, you have to install a software driver called a value-added process. The VAP allows the Apple network to have access to the NetWare file server. This also means that it can share files with any other computer on the network.

With either Banyan's Vines or with Novell NetWare, the PC-based LAN appears to a Mac user as if it were a standard AppleShare network. Access to the network simply involves clicking on the network's icon. It then appears as if it were any other disk drive. The only real difference is that many of the PC data files cannot be used by Mac software without some conversion. In a few cases, such as with Microsoft Word and with WordPerfect, the conversions are simple.

**Uniquely Unix**

As the workstation market grows, and as more companies follow the U.S. government's lead into accepting Unix as a standard operating system, the need to connect Unix-based machines to PC LANs grows as well. The government POSIX standard and the GOSIP standard that accompanies it are providing a basis for compatibility that really hasn't been part of Unix before, despite the claims of the Unix believers. POSIX, of course, is really Unix by a different name. GOSIP is the communications standard for POSIX networks, and it includes TCP/IP. The GOSIP standard used to exclude TCP/IP, but users refused to give in, so the standard was changed.

In any case, Unix-based systems and close relatives usually communicate using TCP/IP. Other minicomputer and mainframe systems can also use TCP/IP, but users of Macs can communicate with them using TCP/IP. Other minicomputer and mainframe systems can also use TCP/IP, but users of Macs can communicate with them using TCP/IP.

As with the Apple networks above, there are ways to connect PC-based and TCP/IP-based networks. These connectivity solutions typically involve bridges, gateways, and routers. When you're connecting with a Unix-based system, you...
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 bars; nonparametrics; distribution fitting; multiple regression; general nonlinear estimation; logit/prediction analysis; general ANCOVA/MANCOVA; stepwise discriminant analysis; log-linear analysis; factor analysis; cluster analysis; multilevel analysis; tree 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 Stat 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. Quick Start handbook 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 graphs) 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 graphs 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/command 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).

Megaf ile Manager™ Comprehensive analytic data base management system. Unlimited size of files (up to 32,000 fields or 8 MB per record). Megaf ile 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 sf/h $7 per product; 14-day money back guarantee.

Circle 286 on Inquiry Card.

STATISTICA/Mac™ A Mac-compatible, comprehensive data analysis and graphics system designed for the Macintosh. Large selection of statistical methods fully integrated with presentation-quality graphics (incl. EDA, multiplet, a wide selection of interactively rotatable 3D graphs; MacDraw-style tools). Unlimited size of files. IBM compatibles, 640k or more. Price: $395.

Quick CSS/Mac™ A subset of STATISTICA/Mac: all basic statistical modules and the full, presentation-quality graphics capabilities of STATISTICA/Mac. Price: $245.
might find yourself using all three somewhere in the scheme.

Part of the reason for the complexity is that Unix systems and TCP/IP normally use Ethernet as the basis for their LAN systems. While it's now possible to run TCP/IP over Token Ring, it's still pretty rare. PC LANs, of course, can use any of several LAN protocols, although Ethernet, ARCnet, and Token Ring are the most common. This means that you need to connect a PC-based LAN that might be running on nearly anything to another LAN that's running on Ethernet. If your PCs are also using Ethernet, that simplifies the solution, but only partly.

If you're not already using Ethernet for your PCs, you will need to use a bridge to Ethernet. I talked about bridges in my March column, so you might want to check there to find out more about those devices. Once you've solved the Ethernet connectivity, you need to get your network operating system to understand TCP/IP.

Two common approaches exist for connectivity between LANs that involve TCP/IP. One approach, used by The Wollongong Group and others, employs a router. The other, used by Racal-InterLan, uses a gateway. Both approaches work well, although the approach you choose may depend to some extent on what you're already using for a LAN.

The Wollongong approach to TCP/IP connectivity puts a router on the Ethernet that looks for packets addressed to a TCP/IP device and converts them. The router consists of an IBM PC compatible with a network interface card and the company's TCP/IP router software. One connection to the LAN is required for the Ethernet and another for whatever else you're using. The router also looks for TCP/IP packets destined for a device on the PC LAN and converts them. The Wollongong device will support several types of LANs, although its best performance seems to be with Novell IPX-based LANs.

For LANs that are already based entirely on Ethernet or that are bridged elsewhere, Wollongong makes a product called WIN/TCP for DOS, which allows communications between a DOS workstation and a TCP/IP device. The DOS workstation can then access the TCP/IP device, and the device can send information to the LAN using TCP/IP's file transfer protocol to copy the file to a workstation. Since the file can be transferred to the virtual drive that appears when you're using the LAN, this means that you can move files from a TCP/IP device to the network file server.

Racal-InterLan uses a hardware solution for connectivity between Novell's IPX LANs and TCP/IP. Its latest product, called TCP Server, is a package of two circuit cards and some software that

---

**Knowledge SEEKER**

Fast, aggressive, cheap, tireless, impartial, intelligent, decisive & tenacious!

**EXPERT FOR HIRE**

$495

Knowledge SEEKER® - a brainy and tireless information analyst, will help you make sense of your mountains of Lotus®, dBase® or ASCII data. Use its statistical know-how to find significant facts, figures and trends that will help you make better decisions - faster than ever before! Buying this $495 PC software package will be the last decision you'll ever have to make on your own.

CALL 1-800-387-7335 NOW... For a FREE DEMO DISK.

---

**TELEBYTE TECHNOLOGY, INC.**

Make Any PC A Protocol Analyzer

Model 903 PC Comscope II™ Simplicity, Power & Flexibility

- Async and Blt async
- HDLC and X.25 options available
- Operates in XT/AT/386 or compatibles including laptops
- Split screen display for X.25 and SDLC
- Operator programmable using standard DOS services
- Supports most high level languages

1-800-835-3298

114 BYTE • MAY 1991

Circle 121 on Inquiry Card (RESELLERS: 122).

---

TELEBYTE TECHNOLOGY, INC.

270 E. Pulaski Rd., Greenlawn, NY
11740 • 516-423-3223 • 516-385-8080
1-800-835-3298 • Fax: 516-385-8184

Circle 299 on Inquiry Card (RESELLERS: 300).
With LANtastic Voice™, talk is cheap...

and award-winning.

If you're interested in collecting your share of awards, listen to this idea:

Inject sound into the software you develop with the LANtastic Voice Adapter and Voice Programmers Interface™ (VPI™).

Create educational or training programs that actually speak to students.

Transform your LAN's E-mail into voice mail. Develop talking software, music synthesis, or sound effects. The possibilities are as endless as your imagination — and as affordable as a one time-only cost of $195 for LANtastic VPI™ and either $99 for LANtastic Voice Adapter or $199 for LANtastic Voice MC Adapter (for Micro Channel® computers). That's a small price to pay for success.

LANtastic VPI is a set of simple, straight-forward software routines which use the Voice Adapter to record and play digitized sound. VPI uses a structure called the Voice Control Block (VCB) — similar to an NCB or MCB in the NetBIOS — which contains pointers to blocks of data which can be used for PLAY and RECORD. Commands can be no-wait, so the control returns to the calling program immediately while the VPI works in the background.

When the VPI command completes, your POST routine is called.

So make your software laugh, sob, growl, warble, wail, sing, talk — because the LANtastic Voice Adapter and VPI preserve your sounds in nearly their original fidelity, your software will enter a whole new dimension. LANtastic VPI is sold to developers directly through Artisoft. For more information, call 602-293-6383 or fax 602-293-8065.

©1991 by ARTISOFT, INC. All rights reserved. LANtastic, LANtastic Voice, LANtastic VPI, Voice Programmers Interface and VPI are trademarks of Artisoft, Inc. Micro Channel architecture is a registered trademark of International Business Machines Corporation.

Circle 34 on Inquiry Card.
must be installed in an IBM PC compatible. It provides full bidirectional connectivity between NetWare 286 or NetWare 386 and any TCP/IP LAN. The two cards include the company's server card and NP600/XL network interface card. You will need to provide another compatible network interface card. The Racal-InterLan product allows users on the TCP/IP network to have complete access to the NetWare LAN, just as if they were NetWare users. This is a more complete solution than the Wollongong approach, which supports mail and file transfer but not full interoperability.

Racal-InterLan also developed a solution to the thorny problem of providing interoperability between NetWare and LAN Manager networks. Using a product called the LMNS, users with NetWare and version 1.x of LAN Manager could have complete interoperability. Unfortunately, Racal-InterLan found that the rapidly shrinking LAN Manager market wouldn't support the product, so it withdrew it, but the company will still sell it to LAN Manager 1.x users on request. If you have version 1.x and a Novell LAN and have to connect them, LMNS is an excellent solution.

The Novell Approach
When Novell announced NetWare 386, the company said that it would provide support for LANs of many types, including AppleTalk and TCP/IP. While this support hasn't appeared as of this writing, the products are expected to appear along with the release of NetWare 3.11 in late March, so you'll probably be able to find them by the time you read this. The Novell solution is to base everything in the file server. To connect your Macs, for example, you will make sure that you have loaded a software driver called a NetWare loadable module, and the Macintosh connectivity should be transparent. The TCP/IP connectivity is supposed to work the same way.

Complete interoperability is still a ways off for TCP/IP. The standard TCP/IP support that's shipped with NetWare 3.11 simply allows NetWare servers to use a TCP/IP backbone to communicate with each other. The LAN Workspace for DOS gives workstation connectivity to TCP/IP LANs. Because Novell has already pledged to support Open Systems Interconnection and GOSIP, there's a good chance that the level of interoperability will increase as time goes by. Right now, though, you're still restricted to third-party products. Fortunately, some of them, including those from Wollongong and Racal-InterLan, are superb.

Putting It All Together
Now that you've seen that some types of interoperability are indeed possible, it's time to see how you'd make it all work. You've probably gathered that nearly any LAN can find a way to communicate with TCP/IP. In the case of otherwise insoluble problems, it's always possible to use TCP/IP as a way of providing limited communications between one type of LAN and another. Unfortunately, you won't always get the full interoperability that you may want, but you will get E-mail, file transfer, and possibly network management. If this is a sufficient level of support, then connectivity between different types of LANs is possible.

Likewise, most network operating systems have a way to connect with Macs. Now that Apple has announced that Macs will come with Ethernet as a standard, this connectivity may become easier. On the other hand, it may not. Apple, as is frequently the case, was confronted with the option of working within accepted industry standards or finding a way to keep the price to its customers up a little, and it opted to ignore industry standards and keep the price up. This means that while you will probably be able to connect your new Macs to an Ethernet LAN, it's not clear whether it will do you any good.

If there is one area of enterprise networking that remains more difficult than it probably should be, it's interconnecting different kinds of LANs. Part of the reason for this is that LAN standards have been a moving target for some time now. Another reason is that most vendors of LAN operating systems would prefer that you stay with their products exclusively. While this may be understandable from their viewpoint, it does little to meet your needs unless the LAN vendors provide a total solution. At this point, no vendors provide that kind of solution, unless your needs are quite simple.

Right now, it looks to me as if the LAN business is still in the process of settling out after the shock from 3Com's abandonment of the network-operating-system market. 3Com was a major vendor of LAN Manager, and the company announced in January that it was quitting that market entirely. This and other moves may indicate that LAN Manager is sinking, perhaps permanently. At this point, it's clear that the LAN Manager market share is shrinking in all segments except those users who insist on a true-blue approach to networking. Even this may not last long, as IBM and Novell are already having serious discussions about an IBM move to NetWare as a standard.

If LAN Manager does indeed suffer another blow, users will find their problems suddenly simpler, because there will be fewer players in the market to consider. Essentially, the PC LAN market will belong to Novell and Banyan. Of course, the fact that it's simpler also means that there's less choice and fewer competitors, and that's not likely to help users in the long run.

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 consults with federal and private sector clients on microcomputers and communications, and he is co-author 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’ll Like What’s Inside the CompuAdd 333T. *PC Magazine* Did!

- *PC Magazine* Editor's Choice *(December 25, 1990)*
- Finalist, *PC Magazine* Award for Technical Excellence, 1990
- CompuAdd’s award-winning customer service
Look Inside the "Power User's Dream Machine"

$2775

PC Magazine, December 25, 1990

Intel™ 33MHz 386 microprocessor,
Phoenix BIOS, 8KB cache, math
coprocessor socket,
supports Intel 80387
or Watek 3167)

Five half-height internal
drive bays.

Four half-height front-
access drive bays.

Parallel port and
two serial ports built
in to system board.

Motherboard designed
by CompuAdd
engineers to stretch
the 386 performance
envelope with the
optional high-speed
SRAM card.

CompuAdd exclusive
"hot slot" designed to
maximize performance
with the CompuAdd
Hi-Rez VGA card.

Room for up to 16MB
DRAM on memory
board.

FREE CompuAdd
mouse.

"The case features
quality construction
throughout." (PCM
12/25/90)

FREE CompuAdd
Windows 3.0, FREE
CompuAdd MS-DOS
4.01 and FREE
Microsoft Workng
Models preloaded on
hard drive models.
CompuAdd's Hot Slots Boost 333T Performance

Look inside the CompuAdd 333T. You'll see what prompted PC Magazine to call it "a speed demon" and "a power user's dream machine" in its review of 45 leading 33MHz 386 computers.

You'll see CompuAdd-exclusive "hot slots," two 16-bit expansion slots designed to maximize performance of the CompuAdd HardCache/ESDI controller card and the CompuAdd Hi-Rez VGA card. Each slot still works perfectly with a standard 16-bit expansion card, should you choose that option. And you'll see a motherboard designed by CompuAdd to take maximum advantage of the optional, ultrafast SRAM board.

Now, run the 333T. You'll see the speed that makes it the fastest 33MHz 386 computer you can buy — as measured by top scores on seven of nine PC Labs benchmarks, including the 386 Instruction Mix Text. In its review, PC Magazine said the CompuAdd 333T "scored the best time in the group, or close to it, on every test we put it through, boasting the best overall performance in the field."

The CompuAdd 333T is the right choice when you need full-scale multitasking capabilities in either a reliable network file server or a powerful standalone workstation.

Compare the 333T. You'll see why PC Magazine praised its "top-notch expandability" and its "quality construction throughout," and why PC Magazine concluded that the 333T was the "best value in an intelligently designed PC."

You'll see that in value and performance, the competition can't touch the CompuAdd 333T. With the CompuAdd 333T at the heart of your network, you'll have the power, speed and expandability you need. Speed to keep your work flowing. Power to run today's — and tomorrow's — 32-bit software. Expandability to grow with your business. And the CompuAdd commitment to quality and service.

Call today for a CompuAdd value on the computer PC Magazine says "will be hard to beat at any reasonable price."

CompuAdd®
Customer driven, by design.
12303 Technology, Austin, Texas 78727
CompuAdd 333T: Best Overall Performance

CompuAdd 333T
The 333T is a proven winner, picked as Editors' Choice in PC Magazine, December 25, 1990! And picked as a finalist for PC Magazine's 1990 PC Technical Excellence award! It's the fastest 33MHz 386 system you can buy — as determined by top scores on seven of nine PC Labs benchmarks. In selecting the 333T as Editors' Choice, the editors credited the CompuAdd 333T with "the best overall performance in the field."

CompuAdd 333 Full Profile
The CompuAdd 333 Full Profile desktop system has the exact same performance as the 333T. Only the case is slimmed down. The Full Profile model sports three half-height front access and two half-height internal 5.25" drive bays, six 16-bit and one 8-bit expansion slots. So you have plenty of room to add extra drives and option cards.

Whether you use it as a network server or as a powerful standalone workstation for CAD/CAM, database management, spreadsheet applications or desktop publishing, the CompuAdd 333T or 333 gives you the fastest 32-bit computing power you can get in a 33MHz 386 system!

CompuAdd Value
CompuAdd built its reputation on giving you high performance computers at unbeatable values! Don't just take our word for it. An independent vendor-neutral survey of PC users asked people how satisfied they are with their PC purchases. CompuAdd received the best endorsement any manufacturer could ask for — CompuAdd ranked #1 for Value/Price, Quality, Commitment to the Customer and Overall Satisfaction!

The researchers did not use vendor-supplied customer lists. The independent, statistically valid survey ranked 25 leading PC manufacturers, including IBM, Compaq, Apple and Hewlett-Packard.

Call today for more details on CompuAdd's award-winning products and service!

CompuAdd 333T and 333FP

Features
- 80386 microprocessor running at 33MHz
- 4MB DRAM expandable to 16MB
- 0 wait-state cache memory
- High-speed cache memory controller with 64KB SRAM cache
- 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Dual diskette controller
- Six 16-bit and one 8-bit expansion slots
- Four half-height front access and five half-height internal 5.25" drive bays (Full Profile has three half-height front access and two half-height internal 5.25" drive bays)
- One built-in parallel and two serial ports
- 80387 or Weitek 3167 math coprocessor socket
- FREE CompuAdd serial mouse $24.95 value
- FREE CompuAdd Windows 3.0 $149 value
- FREE Microsoft Working Models
- FREE CompuAdd MS-DOS 4.01 $89 value

CompuAdd 333T base system $2775 - 66666
CompuAdd 333 Full Profile base system $2595 - 66665
Enhanced 333 systems upgrade base system features with: 150MB ESDI drive, CompuAdd HardCache/ESDI controller with 1MB RAM, 1024 x 768 color monitor, CompuAdd Hi-Rez VGA card with 512KB RAM and 640KB SRAM card.

CompuAdd Enhanced 333 Full Profile $5395 - 66669
CompuAdd Enhanced 333T $5575 - 66660

CompuAdd 333 Monitor and Hard Drive Options

MGA CVGA
333T 80MB $6665L - $3375 6665L - $4055
333T 200MB $6667L - $3975 6667L - $4455
333 R0MB $6667 - $3395 6667 - $3875
333 200MB $6670 - $3795 6670 - $4275

Call 800-456-6008 Key Code 814

Call 800-387-3266 95-800-010-0401 800-373-5353 0130-6009 1-40364949

Circle 70 on Inquiry Card.
Is It Time to Telecommute?

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.

TOM THOMPSON: The outlook for both the U.S. economy and environment seems grim. According to the Administration, our energy policy is going to promote little conservation. So we'll still be driving inefficient cars, polluting the air, while domestic oil exploration could damage our environment. But with the network of wires, cables, and fibers, why can't more employees telecommute via modem? If a significant percentage of employees worked via modem out of their homes, we would win in several areas: less oil consumption, less pollution, and less traffic, which would give our crumbling infrastructure a reprieve. But can telecommuting work? Will we miss the synergy of minds meeting around the coffee pot? Will some people simply goof off? Is enough of an "electronic infrastructure" in place for telecommuting to work?

STAN MIASTKOWSKI: From 1982 to 1986, I worked for a company whose entire structure was based on telecommuting. The company had about 150 employees. I was publications manager and had a staff of eight writers and editors scattered across the country.

Telecommuting is tough. Managers have to trust their employees, and the people who work for them have to be those ever-popular "self-starters" who can work independently. I had the most luck hiring people who had spent substantial parts of their careers working as freelancers.

The biggest problem wasn't lack of communication. We had E-mail, daily telephone talks, and weekly conference calls. The biggest problem was being alone in the house most of the time. After a while, you feel incredibly isolated (especially in a rural area). Productivity, however, was very high. People were free from the tyranny of the time clock and could attune their work to their body clocks. Telecommuting also requires top management that's committed to the idea and willing to back it.

BEN SMITH: I spent the year before starting at BYTE telecommuting. At least once a day, I would walk to the neighbors' just to see some human beings. My work was solid, though. Unlike working at BYTE, my phone rang only when there was something important or a scheduled, daily conversation. I found that I worked an easy 10-hour day, because I was able to mix work with doing the household chores, which provided a nice break from sitting at my desk.

OWEN LINDERHOLM: It does work, but telecommuting isn't a good substitute for human contact. I only get to know all of you by way of the rather impersonal conferencing system on BIX, occasional phone conversations, and rare personal meetings. The personal meetings are extremely important. They allow me to add some real images and insights when I am dealing with you all on BIX. I can understand some of the subtleties, crosscurrents, and undercurrents much better than I can with people I've never met.

It is very important to have a conferencing system like BIX. E-mail doesn't work because it is too difficult for more than one person to access a single message and, hence, whatever ideas and thoughts it contains.

JERRY POURNELLE: Arthur D. Little has for years encouraged senior analysts to stay home at least two days a week, but also insists they come to the office for two days. Everyone is supposed to be there the same two days, as I recall.

FRED LANGA: I recently spoke with some laptop designers toying with the idea of bundling something like PC Anywhere or Carbon Copy with their next round of
LARRY LOEB: The essence of a meeting can be captured on a conferencing system, as this very conference shows. Each message interacts with those that have come before it, extends a thought, and crystallizes it. Body language and subliminal messages get lost over a phone line. But for discrete, task-oriented work (like writing articles), conferencing is the way we will be working in the future.

DON CRABB: Remote telecommuting software that incorporates sampled video (for a sort of Keystone Cops look) displayed on each telecommuter's screen helps to restore that lost body language. I've used the Farallon setup remotely, with nothing fancier than a couple of inexpensive 8mm Sony Camcorders feeding their sampled signal, plus compressed voice, into the text stream of the meeting. It's impressive what the pictures can bring to the mix and the "live real meeting" feel.

WAYNE RASH JR.: Even if not everyone has E-mail, getting such a thing is clearly within the capabilities of those who wish to have such. Actually, even if telecommuting required a fax machine, computer, modem, and E-mail account, it would require far less in financial and energy resources than does the purchase of an automobile. Goofing off isn't a problem, since there are ways to measure productivity that don't require a time clock, and ways of defining a job that don't require a person's presence.

Much work is done in ways that don't lend themselves to telecommuting. Some of the most important ideas in any company come from the dynamics of people.
SUBJECT:
V.P., Engineering

PROBLEM:
Your competitor has announced the product. 
Your Engineering team isn’t even working on it. 
Your customers want it now. 
What’s your answer?

SOLUTION:
MICRONICS

Today, time-to-market is everything. Everyone wants the latest technology. You have to have a product when the demand is hot. And it has to work.

Before investing time and money now, and still miss the window, turn to Micronics for your system board needs.

Dedicated to advanced engineering, Micronics has a full line of 80386 and 80486 ISA/EISA products.

We provide excellent time-to-market and superior design without sacrificing performance or reliability. In fact, we have a proven record with hundreds of thousands of system boards in the field today.

Our own designs, FCC certification, complete compatibility testing and less than 1% field failure rates make Micronics system boards the industry leaders.

Micronics is your answer. Give us a call today.

MICRONICS
COMPUTERS INC.

The Power

232 E. Warren Avenue
Fremont, California 94539
(415) 651-2300
Fax (415) 651-5666

Circle 208 on Inquiry Card.
Backplanes

Call or write for descriptive brochure and prices:

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**

**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**

**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?

**ROUNDTABLE**

meeting in the physical presence of others. A great deal comes from a person's words, but a great deal also comes from people's gestures—their language if you will—and even how they conduct themselves at a meeting while they aren't speaking. Much of this information cannot be carried over the line on a conference call, much less carried in E-mail. The bandwidth of electronic media is still too narrow for the communications that people actually use.

The result is that in a telecommuting workplace, those who get ahead will still be those who are physically present at least part of the time, simply because it will be their ideas that are presented most effectively. This will limit telecommuting to certain specialties (like COBOL coding) that can be done by solitary workers, and even those will require some physical presence. In any case, while telecommuting is technically possible, I'm not sure that it's socially possible yet, and I don't think it will be until we get communications that work with more than just what we can currently squeeze through a modem.

**PETE WAYNER:** Everyone has probably heard the apocryphal urban folklore about the young office star who would come in at 4 a.m., get all the work done by 9 a.m., and then spend the rest of the day chatting with everyone. Pleased his boss and knew everything about the company. Electronics don't work for that.

**CRABB:** Wow! Telecommuting is only useful for certain specialties like COBOL coding? Give me a break, Wayne! A 1989 Department of Commerce survey showed that almost 28 million people either worked at home as sole entrepreneurs or as part of their office job. Another 10 million are expected over the next two years to do more and more of their office work at home as telecommuters. These figures already indicate that the home office and home workplace are far more than just places where specialty workers are and will be working.

**MIASTKOWSKI:** I see little possibility of full-time telecommuting becoming a reality in the next five years or so. In my experience, the biggest roadblock is old-style management that thinks employees must be watched and controlled. Admittedly, some people do fall into this category, but employees who are trusted and rewarded can give companies incredible productivity. I think telecommuting will ease into reality, with more and more people spending a couple days at home and a couple at the office.

Another problem with working full-time at home is that there's no easy break between home and work. When I worked at home full-time, I often felt as though I never left work, often going back into my office after dinner. It's a habit that's hard to break. Even though I now spend a full-time week at the BYTE office, I often spend my evenings working at home.

**LINDERHOLM:** People using E-mail and conferencing systems seem to be ruder than they are in person (perhaps to do with "talking to a machine"). I believe that studies show that frequently the same individual will be a lot ruder in communicating over E-mail than in person or by letter. If it is true, then it is a serious hindrance to telecommuting and will be a social issue for telecommuters.

**JON UDDELL:** On the other hand, it's often noted that E-mail exerts a kind of social leveling effect—that is, it flattens a hierarchy and puts participants on a more equal footing than they would be face to face. Some corporations value that. Others, I suppose, would be threatened by it.

**KEN SHELDON:** It can work, but it sometimes doesn't. Case in point: I came into the office on Saturday before heading out for a business trip, hoping to get a lot of work done. A lot of the things I had to do involved BIX. Guess what? BIX was down for maintenance for the couple of hours that I was in the office. I was extremely frustrated.

**CRABB:** The inherent unreliability (because of complexity, overstressed systems, and other reasons) argues for everyone who plans to use electronic communications systems to have several backups ready to go. Something like a macro that lets you step through BIX, MCI Mail, and CompuServe until you make a connection and get through.

This kind of intelligent networking (where a background agent runs through the connection possibilities for you, makes the connection, dumps your messages, downloads new mail, and so on) might help ameliorate the inherent unreliability in each service. Remote systems that accomplish this intelligent connection without any user control (the way a good private-branch-exchange switch automatically selects the cheapest and most reliable outgoing long-distance telephone service for each call it will complete) might be the real breakthrough technology in portable computing.
Here's what the experts are saying about the hottest high performance graphics board available—the Hercules Graphics Station Card™!

“At $1,024, the Hercules Graphics Station Card is state of the art at an exceptional price.”

“...1024 x 768 non-interlaced 256 colour mode is the only way Windows should ever be run.”
Personal Computer World, Guy Swarbrick, Hercules Graphics Station Card, June 1990, UK

“If you do a lot of different kinds of graphics but don’t want to spend too much, the Graphics Station Card is for you. Highly recommended.”
CADalyst, Ralph Grabowski, August 1990

“The Hercules Graphics Station Card combines an extraordinary set of features designed to handle your most...well...Herculean graphics tasks.”

“...Hercules will have proved, twice, that you don’t have to be IBM to set standards.”
Personal Computer World, Guy Swarbrick, Hercules Graphics Station Card, June 1990, UK

To find out where you can buy your Hercules Graphics Station Card, call 800 532-0600, ext. 745.

For People With High Standards!
Microsoft's OLE technology and HP's New Wave make it easier to combine text and graphics in "compound documents" for Windows

MARTIN HELLER

When I did my Ph.D. thesis "on the computer," more years ago than I care to admit, I was faced with 2 hours of pasteup every time I produced a draft. The thesis was done on the mainframe, all right, but the text was printed out on a line printer while the figures came off a Calcomp plotter.

My thesis was, in fact, a "compound document": It combined materials from several sources on one page. This magazine article is another compound document: It combines text, screen images, and artwork on the printed page. Corporate annual reports are another good example; typically, they combine text, financial statements, photographs, charts, and artwork in a slick package designed to make investors feel good about a company.

One of the goals of the desktop publishing revolution has been to eliminate the pasteup step from the printing process. For very high-quality documents, the goal is technologically unrealistic: You're just not going to get photographic quality from today's scanners and laser printers—certainly not anywhere near the quality of good four-color lithography. But for less demanding documents—an internal memo on fourth-quarter sales, for instance—the technology is more than adequate.

Documents are no longer just static text. HP's New Wave and Microsoft's recently announced OLE are two technologies that let documents contain text, graphics, and spreadsheets that are linked together and automatically update each other.

Out of Data and Missing Links
So why don't more people produce compound documents? Because it's a pain in the neck, that's why. Consider the classic example of a spreadsheet that's used in a word processing document. Say, for instance, that the spreadsheet was produced by Excel and is named SHEET.XLS. You use the Copy command in Excel; then you can either Paste or Paste Link in your word processor, such as Word for Windows.

If you choose Paste in Word, what you'll get is an image of SHEET.XLS as it existed
the moment it was created. You can now format the spreadsheet as a table and produce your memo. Pasting doesn’t involve Dynamic Data Exchange (DDE); it uses the Clipboard to pass all the information. However, when the spreadsheet changes (e.g., when the new sales numbers come in on the second day of the month), you’ll have toCopy the spreadsheet to the Clipboard and Paste it over the old image. If you forget to update the Word document after you update the spreadsheet, you’ll have the embarrassing experience of circulating a memo containing last month’s numbers.

On the other hand, you could choose Paste Link from Word for Windows. Paste Link uses the Clipboard to tell the application what to link; the actual linking is done using DDE. After you choose Paste Link, you’ll get a little dialog box asking if you want the link to update anytime the sheet changes; if you say yes, Excel will control when updates happen. If you say no, Word will control when updates happen. You’ll also see the specification for the link, which may be something like E:\EXCEL\SHEET.XLS. (See figure 1.)

Assuming that the DDE transfer works (and it might or might not, depending on how you’ve configured your system), you’ll see the spreadsheet information appear in your document, and you’ll be able to format it as a table and print it. Next month when you bring up the document it should automatically try to reestablish the link and get the updated spreadsheet. The key word here is should—the automatic update doesn’t always work, either.

Here’s why: Suppose you give a copy of your document to someone else in your company. Inside the document, there will be a field with the information DDE “E:\EXCEL\SHEET.XLS.” But SHEET.XLS won’t be on your colleague’s E drive. That person may not even have an E drive and, most likely, won’t have an E:\EXCEL directory. Even if you give him or her a copy of SHEET.XLS, that person will have to edit the DDE field in Word to point to the directory in which he or she chooses to place the spreadsheet (see figure 2).

It isn’t so bad to update one field. But suppose there were 100 fields and each one had to be manually corrected anytime the file was transmitted. It happened to me—one—when I had to edit a manual someone else had written. Suffice it to say I’d rather not repeat the experience.

Clearly, the broken link problem can be serious—even more so than the obsolete image problem. But there are solutions. HP’s solution for both problems is New Wave, which has been around for three years. Microsoft’s solution, called OLE, is a specification for integrating information from multiple applications in a single compound document. I have a production copy of New Wave 3.0 installed on my machine, and I’m running it now; I have a beta-test copy of the OLE developer’s kit and a handful of OLE applications installed as well. In fact, you can run both at once, and if you are a developer, you can make your programs support both.

Microsoft’s OLE

OLE, which stands for Object Linking and Embedding, is Microsoft’s open, industry-wide specification for compound documents. "Industry-wide" in this case means that Microsoft incorporated input from other major software developers—Lotus, Aldus, WordPerfect, and Micrografx. Linking refers to a process very much like clipboard pasting—which isn’t actually clipboard pasting—that lets one document’s application contain information created by a second application in the second application’s native format.

I mentioned earlier that DDE doesn’t always work because of setup problems. OLE takes care of the setup problems by registering all OLE-aware applications in a central database. It takes care of the DDE problem of one application needing to know the details of another by establishing a protocol of standard topics and procedures with which the applications talk to each other.

An example is in order here. Suppose you’re working on that same old sales memo—the one with the spreadsheet numbers. And suppose you want to have, in addition to the spreadsheet, an illustrative graphic and a chart based on the spreadsheet. And suppose that you’ve got a word processor that supports
OLE, along with a spreadsheet, a chart maker, and a drawing program that all support OLE. You can set up the compound document with embedding, linking, or both. Since you’re going to update the numbers every month, you do the spreadsheet and chart with linking. Since the graphic won’t change often, you do it with embedding.

You write your memo. When you come to the spreadsheet, you insert a field that links you to the spreadsheet using OLE— as opposed to the DDE field you used to use. The OLE link is pretty much guaranteed to work, because all OLE applications know how to communicate with each other, and the information needed to start each OLE application is kept in a central database. (That isn’t true of DDE applications.)

So you see the spreadsheet figures in your document. Only this time, instead of seeing raw numbers that you have to format in Word, you see the spreadsheet as it would be displayed by Excel. This is because, as part of OLE compliance, Excel has provided a spreadsheet “viewer” for use by other applications.

Now things start to get tricky. You want the chart to be based on the spreadsheet, and the chart in turn to appear in the word processing document. Can you do it? Sure enough: You can create the chart within the spreadsheet as an embedded document (Excel knows enough to update internally linked graphics from data) and then link the chart to the word processing document. When you change the numbers in the spreadsheet, the chart changes automatically, and both change automatically in the word processing document (see figure 3).

Finally, you create and incorporate the graphic. You can use an OLE-compliant version of Windows Paintbrush to create the graphic. How? Either from Paintbrush, or directly from the OLE-compliant version of Word. To do the latter, you’d Insert Embedded Object (or something like that) in Word and then select Paintbrush as your server. Paintbrush would automatically open up and tell you that you were editing an embedded object. You’d draw your graphic and close Paintbrush. Instead of going into a .BMP file, the drawing would go directly into the compound word processing document.

Anytime you wanted to modify the drawing, you’d double-click on it within Word, and Paintbrush would come up with the drawing loaded. Pretty neat stuff, and not that far out: I have versions of Cardfile and Paint modified for OLE that work in just this way. (Obviously, the drawings go on cards rather than on a Word page, but the mechanism is the same.)

One thing that isn’t fixed by the current implementation of OLE is the broken link problem. If you create links and then move the documents, the links will break. If you embed rather than link, you don’t have to worry about the connection breaking, but you do have to worry about the copy becoming obsolete. So you have to decide in each case whether to embed or link. Embedding gives you a copy of the document that won’t get lost but might become obsolete; linking gives you a connection to the document that won’t become obsolete but might get broken.

OOFS: Files as Objects, Objects as Files
OOFS is an acronym for Object-Oriented File System. In programming jargon, the combination of some data and a program that knows how to deal with the data is an object. This terminology is widely abused and very confusing (since object has a much more generic meaning in common usage), but it’s what object means in this case. The combination of Paintbrush and a bit-mapped image can be an object, for instance, and it is an object that can be contained within the OLE specification.

Objects don’t necessarily have to be what you’d normally think of in terms of a written document. Given sound-recording...
Uncle Sam Says

WE BUY SAFETY, EXPERIENCED SUPPORT AND SOUNDNESS.

You too can enjoy the same proven safety. Over the past ten years more than 700 of my agencies and their contractors bought computers from Iverson, because of their experienced support and soundness.

Committed!
Iverson is committed to delivering total quality.
Total Quality Control means incoming, in line, test and burn in, cosmetic, packaging, and shipping inspection. Furthermore, individual custom foam packing of each system insures safest shipping.

Established!
Iverson has invested in the plant and staff resources to stand behind your IBM® PS/2® purchase.
Iverson operates two huge classified systems integration contracts nationwide, over $15 million a year for each
Iverson customizes and manufactures computers in the firm's own 48,000-square-foot plant in Clearwater, Florida.
Iverson operates its own full service FCC laboratory at the Florida plant.

Responsive!
Iverson understands the support you need and is committed to providing it.
For only $99, we will send our technician/trainer to your home or office to provide 90 minutes of instruction for up to four people. This service is available in most cities nationwide.

Supportive!
Iverson offers full integration services.
- Design and Install LANS
- Custom Hardware
- World-wide installation & Training
- Software loaded at plant
- Custom application software and printer drivers

Nationwide Training in home/office. Start-up course, only $99.

Experienced technical support or on-site service is only a phone call away. Iverson support includes 24-hour toll-free technical and service support hotlines. Our 7000-square-foot repair depot supports ten Iverson field service offices and 150 TRW service offices in the U.S. and 100 in Canada with over 4,500 different parts.

IBM and PS/2 are registered trademarks of International Business Machines Corporation

Traded on American Stock Exchange (IVT) IVERSON TECH
MOST IBM® SYSTEMS

- TEMPEST
- Removable Drives
- Ruggedized
- Custom Applications

Over 700 customers worldwide have benefited from ITC's customization of IBM products. From laptops to desktops, micros to mid-range processors, International Technology has an IBM-based solution for your special computing needs. So why risk your critical application on anything less than IBM quality and reliability.

- Specializing in re-engineering of 9370 (9332) DASD to provide removability.

**Model 50Z**
**with Removable Hard Disk**
Over 500 shipped to date

- Additional customizing and quick delivery.

GSA Contract #: GSOOK90AGS5276

CALL 1-800-388-GSA1

EXPERIENCED SUPPORT
FINANCIAL STRENGTH

SINCE 1978

P.O. Box 6250 • 1356 Beverly Road
McLean, Virginia, 22106-6250

INT’L TECHNOLOGY CORP
A Subsidiary of

IVERSON TECH

Circle 172 on Inquiry Card (RESELLERS: 173).
FUTURE DOCUMENTS

OLE LINKS

Figure 3: With OLE links, the format of the linked documents is automatically applied because there is a central database and a set of "reader" programs for OLE-compliant applications. Here, a word processor document contains links to a spreadsheet and its embedded graph.

MAINTAINING LINKS

Figure 4: The object-oriented file system will resolve the problem of broken links described in figure 2. Any file that is moved leaves a forwarding address.

and playback capabilities, voice, music, and sounds can be objects. Given an animation player, animations can be objects. Given a way to record and play back handwriting, handwritten notes can be objects. Given a videotape or CD-ROM controller, video segments can be objects.

Back to the image object. All of Paintbrush is not carried around inside a Word document. The "object" contained in this case can either be an embedded object (in which case the data is actually inside the Word document) along with a flag that says what program knows how to edit the data, or it can be a linked object, in which case what is inside the Word document is the name of the linked document along with the flag for the program to use to edit the data.

Back to the subject of an "object-oriented file system." What this term seems to promise—and no more than promise, as Microsoft is both to tell more—is a file system that can track objects and is oriented to, and knows about, the sorts of compound documents and linkages I've been talking about.

You can hope, at least, that the object-oriented file system would be able to remember that your spreadsheet is linked to your word processing document. You can also hope that, when you mail your document electronically across a network to a colleague, the file system recognizes and automatically ships all the linked documents along with the container document, or it maintains the linkages across the network. You can also hope that, when you have a major housecleaning and reorganize your hard disk, the file system will know that the spreadsheet previously in E:\EXCEL\SHEET.XLS is now at G:\EXCEL_DATA\SHEET.XLS. Think of the file system as a telephone exchange; you want the file system to do the equivalent of forwarding your calls when you change offices (see figure 4).

Old New Wave

Unlike OLE, HP's New Wave is well beyond the planning and development stage. It has been running on HP Vectras (and other similar machines) for several years now. It is also about to ship on HP-UX workstations.

New Wave is implemented as a layer on top of Windows. The New Wave Office window is a "root" object that owns all New Wave tools and objects. Tools are resources (e.g., printers), represented on the desktop as three-dimensional icons. Objects are data (e.g., files) of specific types (e.g., applications), which may in turn contain other objects.

People familiar with the Macintosh or the old Xerox Star will find New Wave easy to work with—much more so than Windows itself. You throw things away by dragging them to the trashcan (later, you can root through the trashcan or empty it). You put files in folders by dragging them to the folder icon. You put folders in the file cabinet by dragging them to the cabinet icon. You print a file by dragging it to the printer icon. You open a folder, file, or any object by double-clicking on its icon.

New Wave also has helpful agents, which are scripts for automating activities. (The agent icon wears FBI-ish sunglasses, a little pun.) New Wave also has bridges, its own version of the .PIF file that contains the information on how to run both DOS and Windows applications. (Bridges are much more complex and important than .PIF files.) And New Wave has object containment links (described below).

While OLE requires you to choose between embedding and linking at each step of producing a compound document, New Wave links between parent and child objects with a more integrated strategy: object containment links. These are internal links to external files, the information maintained in a database. As long as you use New Wave (rather than DOS or Windows) to work with New Wave documents, your links are unbreakable, even when you send documents across a network.

New Wave's intelligent database, the Object Management Facility (OMF), maintains linkages using a second NAME space, a second file-system directory that maintains its own list of New Wave-style filenames and the DOS paths to them. (You can convert documents to and from DOS files.) In the far future (with Windows 4.0 and DOS 6.0), Microsoft file systems will maintain linkages in a single name space. Microsoft is not likely to ship such an object-oriented file system before 1992, and in any case, it will require the Installable File System capability scheduled for inclusion in DOS 6.0.

New Wave is reliable with the current DOS file system, and it is fully hierarchical. New Wave objects can be moved into folders, and folders can be moved into the file cabinet. Objects can be contained in other objects, and they can be shared. You can use a single TIFF image in multiple New Wave Write documents and also have the image available from the New Wave Office desktop as an icon.

continued
HIGHEST QUALITY  BEST PRICE-PERFORMANCE

486/33 MHz EISA w/64K Cache .......... $4131
486/25MHz w/8Kcache ........... .......... $1949
386/33MHz w/64K cache ........... .......... $1199
386/25MHz w/64K cache ........... .......... $1082
386/25MHz .................. .......... $997
386SX/20MHz ................. .......... $920
386SX/16MHz .................. .......... $669
286/12 MHz .................. .......... $499

Features: 1MB w/o wait state, 1.2 or 1.4 MB floppy drive, 1 parallel/2 serial ports, 101 Keyboard, Floppy/IDE controller & 200W power supply

MOST EXTENSIVE  CUSTOMER SUPPORT  IN PC INDUSTRY

• One-year on-site Warranty
• Toll-free technical hot-line
• 30-day money back guarantee
• On-site maintenance by TRW throughout USA and Canada
• Free installation of DOS if purchased with system
• Other software loaded at our low hourly rate

HARD DRIVE OPTIONS

IDE
40 MB .......... $257
80 MB .......... 422
120 MB .......... 597
179 MB .......... 786
200 MB .......... 879

ESDI w/ controllers
40 MB .......... $1,283
150 MB .......... 1,770
340 MB .......... 2,711
1 GB .......... $5,580

SCSI
12" Mono TTL, 720 x 350 .......... $135
14" Mono VGA, 640 x 480 .......... 257
14" Color VGA, 640 x 480 .......... 384
14" Color VGA, 640 x 480 .......... 425
14" Color VGA, 1024 x 768 .......... 519
16" Color VGA, 1024 x 768 .......... 933
20" Color VGA, 1024x768 .......... 1948

DISPLAY OPTIONS
(price includes monitor & adapter)

486/33 MHz EISA w/64K Cache .......... $4131
486/25MHz w/8Kcache ........... .......... $1949
386/33MHz w/64K cache ........... .......... $1199
386/25MHz w/64K cache ........... .......... $1082
386/25MHz .................. .......... $997
386SX/20MHz ................. .......... $920
386SX/16MHz .................. .......... $669
286/12 MHz .................. .......... $499

Features: 1MB w/o wait state, 1.2 or 1.4 MB floppy drive, 1 parallel/2 serial ports, 101 Keyboard, Floppy/IDE controller & 200W power supply

HARD DRIVE OPTIONS

IDE
40 MB .......... $257
80 MB .......... 422
120 MB .......... 597
179 MB .......... 786
200 MB .......... 879

ESDI w/ controllers
40 MB .......... $1,283
150 MB .......... 1,770
340 MB .......... 2,711
1 GB .......... $5,580

SCSI
12" Mono TTL, 720 x 350 .......... $135
14" Mono VGA, 640 x 480 .......... 257
14" Color VGA, 640 x 480 .......... 384
14" Color VGA, 640 x 480 .......... 425
14" Color VGA, 1024 x 768 .......... 519
16" Color VGA, 1024 x 768 .......... 933
20" Color VGA, 1024x768 .......... 1948

DISPLAY OPTIONS
(price includes monitor & adapter)

486/33 MHz EISA w/64K Cache .......... $4131
486/25MHz w/8Kcache ........... .......... $1949
386/33MHz w/64K cache ........... .......... $1199
386/25MHz w/64K cache ........... .......... $1082
386/25MHz .................. .......... $997
386SX/20MHz ................. .......... $920
386SX/16MHz .................. .......... $669
286/12 MHz .................. .......... $499

Features: 1MB w/o wait state, 1.2 or 1.4 MB floppy drive, 1 parallel/2 serial ports, 101 Keyboard, Floppy/IDE controller & 200W power supply

ORDER TODAY  1-800-444-PC90

P.O. Box 6250  •  1356 Beverly Road
McLean, Virginia, 22106-6250

IVERSON COMPUTER CORPORATION
A Subsidiary of
IVERSON TECH

Circle 174 on Inquiry Card (RESELLERS: 175).
If there is a problem with New Wave, it is that relatively few applications are available that fully support it. Why is this the case? For one thing, New Wave was not very practical for end users before Windows 3.0 was introduced. For another, New Wave development has been difficult: Most developers had difficulty getting their applications working as stand-alone applications under Windows, a few hardy souls implemented DDE and Clipboard transfers, and only the bravest went on to support New Wave. Developing a program that is part of a larger system is very different from developing a program that is a "thing unto itself," alone in its own universe.

HP is currently working hard to make New Wave support easier for developers to implement. The company is enhancing New Wave's bridge capability to stay ahead of OLE, but it is hedging its investment by redesigning the New Wave developer's kit so that applications supporting OLE will need very few changes to also support New Wave.

**OLE Implementation**

As it is currently designed for Windows and Presentation Manager, OLE manages compound documents using the Clipboard and DDE. Copy commands offer multiple formats to the Clipboard in order of their fidelity (the most preferable ones first). Applications that want to use the Clipboard should specify a format as well as content. An application wanting to paste from the Clipboard should take the first object with an appropriate format. (You wouldn't, for instance, paste a picture where text was expected.) Link is one of the possible formats on the Clipboard; it is offered only if the copying application can act as a DDE server.

Along with standard, descriptive formats like Rich Text File and BIFF, applications can use native formats for private data, and OwnerLink formats for embedded objects. Native and OwnerLink data can be handled by object-specific libraries; the "viewer DLL" concept helps to make OLE more object-oriented and extensible than ordinary DDE.

Suppose you are writing an OLE-compliant application that supports compound documents. You have in the middle of your private data format a "foreign" format—the embedded object. Somehow you have to connect this unknown format with a server that knows about this object.

The information on what server handles what formats goes in a central registration database. In the beta-test version of OLE, the registration database is just a few lines in WIN.INI. The final implementation, however, will have a real database to handle registrations, presumably to efficiently look up the hundreds—or thousands—of OLE servers that will become available.

**Clients and Servers**

An application that wants to receive or contain data from another application is called a client or a container. An application that can provide the data or edit an embedded object format is called a server. The terminology isn't much changed from that of DDE clients and DDE servers. But a few things have been added to make DDE work better; one of these is protocols.

For instance, the standard OLE protocol is called StdFileEditing. If a client has an embedded object that the user has double-clicked, the container sees that MyApp is the server for this object. Then the container checks that MyApp can support StdFileEditing with an OLE library call:

```c
if(EcdCreateFromClip("StdFileEditing",
    pStruct,&lpObj,
    option,cfFormat)==ECD_OK) {
    //actually do the editing
}
```

As you can see from the above code, OLE library calls begin with the prefix Ecd and return a status defined with the prefix ECD_. ECD stands for Extensible Compound Document, which was one of the many early names for OLE.

The OLE interface makes heavy use of a table of function pointers, called a vtbl, and a pointer to this table, called a vptr. The return codes from all the OLE functions are an enumerated type (ECDSTATUS) with values ECD_OK, ECD_ERROR_MEMORY, and so on. A general object structure, struct _ECDOBJECT, is provided for internal use by the libraries; client applications work with a long pointer to the object rather than the object itself.

Client applications provide a callback function so that servers can notify them of events that need action: for instance, notification that the object has changed and must be redrawn. Clients also provide streams that the library can use for loading and saving objects. OLE provides three different rendering options: The client can do all the drawing of objects, it can let the library manage the data, or it can let the library manage both the drawing and the data.

The OLE library includes functions for managing the Clipboard, managing links, doing file I/O, creating and manipulating objects, and rendering objects. Handlers specific to each object implement the details of many of these functions; the appropriate handler is called by the OLE library through a function table pointer (the vptr mentioned above).

Most of the library functionality is embodied in object methods. An object method has the same arguments as the corresponding application programming interface function; a handler may override any of the method functions. For instance, the API function

```c
ECDSTATUS FAR PASCAL
EcdDraw(lpObject,hDC,lpBounds,hFormatDC)
```

has a corresponding method:

```c
ECDSTATUS (FAR PASCAL *Draw) (lpObject,hDC,lpBounds,hFormatDC)
```

whose pointer is kept in a vtbl.

An OLE server has only one API: EcdRegisterServer. For the most part, a server is a supplier of methods. The client application calls the OLE library with requests, and the OLE library in turn invokes methods supplied by the server.

In the current implementation of OLE, links are done with DDE. Since all the client application does is call the OLE client API, and all the server application does is execute methods called by the OLE server library, the client-server implementation details don't matter. If a better communication method than DDE comes along in the future and the OLE dynamic link libraries change, it shouldn't matter at all to applications using the libraries.

---

**FOR MORE INFO**

HP New Wave ISV Support Group
Hewlett-Packard
3410 Central Expy.
Santa Clara, CA 95051
(408) 773-7799
Circle 1081 on Inquiry Card.

Microsoft ISV Support Group
Microsoft Corp.
One Microsoft Way
Redmond, WA 98052
(206) 882-8080
Circle 1080 on Inquiry Card.
New Wave Implementation

In contrast to OLE's reliance on DDE, New Wave relies on the OMF for managing application-data binding, information links, and object integration. The object hierarchy descends from the New Wave Office desktop through office tools (e.g., a file cabinet), container objects (e.g., a file folder), compound objects (e.g., a compound New Wave Write document), and simple objects (e.g., a piece of text, a chart, or an image).

The OMF keeps track of object relationships through information links. Each link has a parent (the container, corresponding to an OLE client) and a child (the contained object). Information links are managed entirely within the OMF; there is no need for DDE in New Wave, nor is there any need to physically copy or embed data, since the OMF information link is quite robust. An information link is both dynamic (like OLE linking) and persistent (like OLE embedding).

In addition to simple containment links, OMF supports views, which are links combined with additional information that the child will pass to the parent on request or when the data is updated. Visual views allow the child's application to display information in the parent's window. Data views pass the underlying data from child to parent, after which the parent is responsible for displaying the data.

New Wave applications communicate with other New Wave applications, New Wave system services, Microsoft Windows, and the OMF via messages. Normally in Windows, messages are passed only to active programs. OMF enhances the Windows message-passing facility by automatically launching inactive programs when they are the recipient of a message. Effectively, a New Wave program can send a message to any object and be sure that the message will arrive whether or not the object's associated code is currently loaded.

New Wave messages are quite general; individual objects need to supply methods to implement any appropriate messages. A New Wave object supports each message for which it has a method. Messages are sent among applications via the OMF's interobject message facility; interobject messages are addressed using the sender's reference name for the recipient, the message type, and message parameters. The OMF returns the status to the sender after the message has been delivered and the appropriate action taken.

In addition to the OMF, New Wave has APIs for agents (a systemwide task-automation facility) and CBT (computer-based training), as well as for context-sensitive help. Agent Tasks in particular offer a high level of flexibility and automation to the end user.

There is no question that, because of Microsoft's influence on PC users, OLE will achieve acceptance. But HP's New Wave is tried and true, and always offers users at least one more feature than OLE. With HP finally delivering New Wave for Motif, the company is offering its design to the largest growing base of new systems as well. Both OLE and New Wave are winners.

New Wave adds a lot of useful functionality to Windows, at the expense of some extra overhead. OLE will add some of the same features as New Wave, primarily compound documents. But even if OLE is widely implemented, New Wave will offer extra features: object management, agent scripts, and so on. The ideal strategy for developers wishing to play in the new "information at your fingertips" arena is to write applications to fully support both OLE and New Wave.

Martin Heller, a contributing editor for BYTE, is a software developer. He is currently writing an advanced Windows programming book. You can reach him on BIX as "mheller."
**Discover Parallel Processing**

**Quadputer™**

The Microway Quadputer is the world's most popular PC Transputer development environment. It can be purchased with two to four Transputers and one to four megabytes of RAM per processor. The Quadputer runs all the popular Transputer development software, all of which is available from Microway. It is compatible with our Monoputer™ which provides 110 megaray of RAM and a single T600, our Videoputer™ which comes in VGA and higher resolution versions and is powered by a memory mapped pair (T800 and 34010), and our Linkputer™ whose crossbar switching network can dynamically link up to 32 Transputers. Finally, all Microway Transputer products can be used with our Number Smasher-860 to provide out-of-this-world numeric performance.

For more information, please call 508-746-7341.

**NDP Fortran-860, C-860 and C++860**

Microway NDP 860 Compilers make it easy to recompile your favorite mainframe, 80386 or PC application for the 80860. The resulting code runs on our XTEND-860™ environment under DOS, UNIX or XENIX.
If you’re involved in industrial design, your CAD files may be your bridge to the future. Or they may anchor you to the past.

That’s because new technology is emerging that lets you create objects on-screen. Once your design is finished, you can produce a three-dimensional physical model of the object (up to a cubic foot in size), much the same as you use a laser printer with desktop publishing software to create a facsimile of a printed page.

All you have to do is transmit the CAD data in a special format to a rapid automated prototyping or toolless model-making machine. Using one of several processes, this machine will “grow” your model from raw material, untouched by human hands.

So far, the new technology is used mostly for making industrial design models (or prototypes) out of plastic or investment casting wax (i.e., wax that is melted away to create a mold). Such models are integral to the industrial design process, either for “form, fit, and function” testing or just for aesthetic visualization.

Making a complex model by hand or by numerical-control (NC) milling machines can take weeks and may have to be redone for each stage of the design process. Rapid automated prototyping, however, allows even the most complex prototypes to be made overnight—an advantage so compelling that this process is already being widely used in the automotive, aerospace, and medical fields. Experts agree that anyone in the design field is likely to encounter this technology in the next few years.

That also means that many industrial design organizations will have to update their methods, since 2-D CAD is not adequate for the process of rapid automated prototyping. Even 3-D wireframes are usually not adequate. Generally, you need 3-D surface models, and solid-object models are still better, if only because you don’t have to worry about whether the surfaces of the models have gaps in the corners. (Solid-object models contain information about what’s inside an object, rather than just what appears on the surface of the object.)

From Screen to Reality
There are several approaches to toolless model-making, but generally, the process starts with a workstation CAD design that is output to a file using a special format. This format, called STL (for stereo-lithography, a technology used to produce models), is supported by over 40 CAD packages.

Using an approach similar to one that many CAD packages use to draw surfaces of on-screen images, an STL file defines the surface of an object as a set of interfacing triangles. Each triangle is defined with three vertices and a normal, which identifies which side faces out and which faces in. The STL file can use any unit of measure as long as there are no zero or negative coordinates.

The file is then fed to the toolless model-making machine, which generally has a powerful microcomputer for its controller. The controller uses special software to slice the object described by the STL file into cross sections, or layers. The machine then uses one of several techniques to deposit a material in a container in a precisely controlled manner, building the defined object one layer at a time (see the figure).

If cross sections of an object are taken at random points in the process, they may produce unconnected “islands.” Therefore, some techniques will require that you add thin webbing to a design to keep the object from breaking up.

BYTE ACTION SUMMARY
Now you can create small 3-D models from a personal computer, just as you can use a printer to create 2-D images—but the units aren’t cheap, and it’s best to have a CAD system that uses solid-object modeling.
together during construction. You peel off the webbing later in
the process.
Aside from the size restriction and the limited range of mate-
rials that can (so far) be used, the main limitation of toolless
model-making is the tolerances that can be achieved. A model
that will be used for a production mold will typically require
tolerances of \( \frac{1}{5000} \) inch or better. Tolerances claimed for tool-
less model-making machines, meanwhile, average about \( \frac{1}{2000} \)
inch. Skilled operators, however, have been known to produce
small models that could go straight into production.

Stereo-Lithography: Printing in 3-D
The leading technology in the field of rapid automated proto-
typing is stereo-lithography. This process was pioneered in
1987 by 3D Systems (Valencia, CA)—the company that created
the STL file format.
In stereo-lithography, an ultraviolet laser scans the first layer
of a sliced object onto the surface of a vat of a special resin. The
resin polymerizes (solidifies) when it is hit by the ultraviolet
light. The system then lowers the model slightly into the tank
and scans the next layer. This process continues, adding layer

Rapid automated prototyping, a technology that is now available on microcomputers and workstations, lets you build prototypes
from solid-model CAD drawings—just as you use a printer to create 2-D printouts of screen images.
NO CHARGE!

We Added...to DesignCAD 3D version 3.1: A Basic-like programming language entitled BasicCAD. We added new commands. We added hardware support for dozens and dozens of new devices. We made hundreds of overall internal enhancements!

We improved the manuals, the packaging and the speed.


Oh, sure...our accountant said we could increase the price. Our lawyer said there was no legal reason not to charge more. A minister said we had no moral obligation to keep the same price!

So, why didn’t we raise the price for DesignCAD 3D version 3.1?

Because...in the Great American Tradition we said

“Aw...What the Heck. Let’s see the other guys beat this price!”

DesignCAD 3D version 3.1 sells for $399.

Does this include everything? Yes. We include everything! The programming language, the hardware device drivers (more than 450), built-in shading capability, hidden line removal capability, solid-object modeling capability, translators to-and-from other file formats, are all included!

How can you afford to sell a program like this at such a low price?

This is our most often asked question. We have a simple answer. Volume. We sell thousands of these programs each month! If we were to charge thousands of dollars per copy (like our competitors) we would restrict our sales to the professional trades only.

By lowering our price we sell to professional architects and engineers as well as the ordinary individual! Many ordinary individuals purchase DesignCAD 3D for personal projects. Many people purchase DesignCAD 3D and perform CAD Drafting at nights and on weekends as a second job!

People design “dream homes” and “widgets”.

The uses are limited only by YOUR imagination!

If there ever was a CAD program out to prove that AutoCAD, CADKEY, VersaCAD, and other $3000 programs are overpriced, it’s DesignCAD!

(MicroCAD News review)

DesignCAD 3D

$399

Remember - American Small Business Computers also sells a 2D version of DesignCAD. It costs only $399!

Write or call for FREE brochures that will help you determine which program best suits your need.

Circle 24 on Inquiry Card.
DESKTOP PROTOTYPING

•

- Selective laser sintering, a process developed by DTM, starts with a surface model CAD design (a). A laser then "welds" together particles of wax or plastic (b) to create a single cross section of the model. The system builds layer upon layer to create a model, which is used to make the finished object—in this case, a gear (c).

Prototyping service bureaus still receive design files in every conceivable format, including on the backs of envelopes.

upon layer, until the model is finished. You must add webbing to your design to keep parts from floating away, and the object has to be cured after the modeling is finished. 3D's machines range in price from $95,000 to $385,000 and use 386 computers as system controllers.

Another stereo-lithography machine uses a slightly different technique: Instead of lowering a model into a vat, it raises the resin level. This $195,000 system from QuadraX Laser Technologies (Portsmouth, RI) uses a more powerful visible-light laser that partially cures each layer as it goes along. The system also controls the diameter of the laser beam, making it thinner for drawing a perimeter and thicker for filling an interior. The QuadraX unit is controlled by an i486 CPU and accepts STL input as well as input directly from I-DEAS, a solid-object modeling CAD software system from Structural Dynamics Research Corp. (SDRC) in Cincinnati, Ohio.

Another, more elaborate version of stereo-lithography is available from Cubital (Herzlia, Israel). The company's $490,000 Solidor 5600 makes models with the "solid base" curing process. This process exposes each layer of polymer resin to powerful but conventional ultraviolet light through a photomask. The system makes a new mask for each layer using electrostatic toner. The ultraviolet light is powerful enough to cure each layer of polymer immediately. After curing, the system removes the unpolymerized resin and replaces it with molten wax. It cools the new polymer-wax layer and mills it to the correct thickness. Then the next layer of polymer is deposited, and that new layer is treated the same as the one before. When the model is finished, the wax is washed or melted away.

Despite the number of steps in this process, the Cubital machine can deposit 60 to 100 layers per hour, each with an average thickness of 0.15 millimeter. The unit is controlled by a VAXstation 3100 over an Ethernet connection. Cubital accepts STL, SDRC, and other CAD formats but converts them to its proprietary Cubital Facet Language format. Because the wax supports any floating pieces until they are attached, designs do not need webbing.

Sintering and Plotting

An entirely different approach, called selective laser sintering, comes from DTM (for desktop manufacturing) of Austin, Texas. This technology involves depositing a layer of fine powder (usually investment casting wax or plastic) in a container and heating it nearly to the powder's melting point. A powerful laser then sinters the powder—welds the particles together without melting them—to produce a cross section of the desired object. Another layer of powder is then deposited, and the next cross section is produced (see photo 1). This is followed by
How to make the work go faster and the money go slower.

For advanced applications like CAD/CAM, presentation graphics or financial modeling, you can't go wrong with the PowerMate® 386™/25S.

For far less than comparable 386 systems, you get 25MHz speed, 2MB of RAM (easily expandable to 16MB via SIM modules) and a 32K memory cache. You also get something you can't get from anyone else at any price: NEC. For more information call 1-800-NEC-INFO.
The 3D Modeler from Stratasys deposits a filament of melted plastic—much as a pen plotter creates a 2-D drawing—of objects as simple as the head of a golf club (top, model on left, finished club on right) or as complex as a turbo fan (bottom).

Photo 2: The 3D Modeler from Stratasys deposits a filament of melted plastic—much as a pen plotter creates a 2-D drawing—of objects as simple as the head of a golf club (top, model on left, finished club on right) or as complex as a turbo fan (bottom).

more layers until the object is complete. Since the unused powder supports overhangs, the system needs no webbing. But the major attraction of the process is that it could conceivably be used with metal as well as plastic and wax, allowing you to make working parts on demand. That, however, appears to be several years away.

The DTM unit is controlled by a 386 microcomputer running Unix, and it accepts input in the STL format. DTM hopes to be selling end-user machines next year.

Meanwhile, a start-up company has entered the field—with a technology that has attracted immediate attention because of its comparatively low price and because it does not use exotic chemicals or heat. The 3D Modeler from Stratasys (Minneapolis, MN) is basically a pen plotter that deposits a filament of melted plastic or investment casting wax instead of ink (see photo 2). The device moves at 15 inches per second, building a model of up to 1 cubic foot through successive laminations.

Prototyping the Future

In the days to come, vendors of rapid automated prototyping equipment will be shooting for better tolerances, lower prices, and a larger market. Another likely major development in the field is an enhancement or replacement of the current STL file format. That's because STL is too limited for the things manufacturers would like to do.

"The approximations it uses keeps us from hitting the tolerances we are working toward," says Ray Hill, general manager at Quadrax. Hill notes that curves are often hard to fit with triangles. Also, for the purpose of adding "offsets" to various curves (to compensate for expected shrinkage during curing), it would be nice if the file description could divide the object into its geometric components. "But with STL, a cross section of an object looks like one entity—a cross section of a box is seen as one line instead of four." Quadrax is working on a replacement for STL but hasn't released details.

Others feel that STL, while not perfect, is better than nothing. Kent Nutt of DTM says, "I agree that STL is not adequate, but it's a good first step, and we need an industry standard right now." Nutt noted that most CAD packages that support STL let you set the resolution, allowing you to use more and smaller triangles for complex surfaces. Of course, this takes more disk space and processing time.

Another change that will need to occur is among users, who do as much as three-fourths of all design work with 2-D CAD systems. Operators of rapid prototyping service bureaus report that they still receive design files in every conceivable format, including on the backs of envelopes.

Al Cassista, principal engineer at DEC in Maynard, Massachusetts, says, "Rapid prototyping is only a small part of the things possible because of solid-object modeling CAD. Thanks to the volumetric information it gives you, you can do tolerance analysis, play what-if games for manufacturing, or try different materials before making the part."

Cassista admits that DEC was markedly unsuccessful in promoting solid-object modeling until they were able to demonstrate these other types of analyses. Once they did, they saw a migration to solid-object modeling.

Today, you can actually have a 3-D prototype of your CAD creation on the table the day after you design it, while someone without a rapid automated prototyping system may work for months to get their design off paper. That's why, according to Structural Dynamics' Chuck Kuess, "we see a tremendous need among our customers for rapid prototyping, and we have to believe that the customers of other CAD vendors are similar to ours. It's a small field today, but we think it will become big. It will be something you encounter more and more often in the design field."

Lamont Wood is a freelance writer specializing in high technology. He can be reached on BIX as "lwood."
"With on-site service included, these Zenith Data Systems PCs give me total confidence for the future."

ZENITH DATA SYSTEMS INNOVATES AGAIN™

Now the Total Performance™ TotalCare Bonus gives you on-site TotalCare™ Service with eligible Zenith Data Systems PCs!

Today, you need confidence that the PCs you choose can carry your business into the future and stay up and running when you need them. That's why some of our most advanced desktop PCs are now available with a very special feature—one full year of on-site TotalCare Service™ at no additional charge.

TotalCare protects your PC investment. Just one toll-free call to our 24-hour National Response Center puts you in touch with a North American network of over 2000 employees. And if you need on-site service, an experienced Customer Service Engineer will travel to your business to make things right—the next day in most cases! You can even purchase TotalCare contracts to cover other manufacturers' products.

This special offer includes hard drive models of the Z-386SX/20™ PC, the Z-386/20™ and Z-386/25™ Workstations, the Z-386/33E™ File Server and the Z-486/25E™ Personal Workstation. All come with MS-DOS® 4.0 and Microsoft® Windows™ version 3.0 pre-installed, plus a Microsoft Mouse.

Add our award-winning Flat Technology Monitor or our advanced 16" (15" v) high-resolution monitor for our Z-486/25E, and you've got The Seamless Solution—our formula for total performance in today's graphical computing environment.

But you'll have to hurry to take advantage of the Total Performance™ TotalCare Bonus—offer ends May 24, 1991.

For more information and the name of your Zenith Data Systems Representative, call 1-800-523-9393.

ZENITH DATA SYSTEMS

Groupe Bull

*See TotalCare Service agreement and call your Zenith Data Systems representative for details. One year on-site service also good on monitor when purchased with eligible PC. A predetermined cash amount may be substituted for one year on-site service. Graphics simulate Microsoft Windows version 3.0, a product and trademark of Microsoft Corporation. Intel386SX, 386 and 486 are trademarks of Intel Corporation. MS-DOS is a registered trademark of Microsoft Corporation. TotalCare is a trademark of Bull HN Information Systems, Inc. Copyright © 1991, Zenith Data Systems Corporation.

Circle 346 on Inquiry Card.
Use CodeBase++ with C++ to build multi-user, dBASE compatible programs. Take advantage of object oriented programming to quickly create maintainable, readable software.

**dBASE Compatible**

Use CodeBase++ classes to access and change the data, index and memo files of dBASE IV and III. Use other classes to manipulate strings, sort at high speed, perform date arithmetic, evaluate dBASE expressions, manipulate linked lists and manage memory.

**Portable**

Port your programs between DOS, Microsoft Windows, and OS/2. Keep all the profits as you distribute your programs royalty free.

**Fast**

Watch as your C++ programs execute much faster than corresponding dBASE, Clipper or FoxPro programs. Be surprised at the small executables and low memory requirements. Examine the C++ source code, which is completely included, to learn good object orientated programming techniques.

**Order Today**

Order today at $295 and discover why Sequiter Software Inc. and most dealers offer a 60-day money back guarantee.

Call (403) 448-0313
Fax (403) 448-0315

P.O. Box 5659, Station L, Edmonton, Alberta, Canada T6C 4G1

Circle 276 on Inquiry Card.
Data Acquisition: PCs on the Bench

Data acquisition tools have migrated from specialized test equipment to general-purpose personal computers

NICHOLAS BARAN

Measuring and analyzing real-world conditions has always been a major component of research, design, testing, and manufacturing. Whether you are measuring voltage, temperature, pressure, or other physical phenomena, data acquisition is the process of converting sensor or transducer signals into data that can be processed and analyzed on a computer (see figure 1).

While data acquisition can be broadly defined as including sound and image processing, these categories of data acquisition have become separate technologies in their own right and were covered in detail in the In Depth section of the December 1989 BYTE. Here, I'll focus primarily on data acquisition using personal computers and workstations—that is, data acquisition in the laboratory as it applies to physical phenomena other than sound and images.

Before the advent of the personal computer, data acquisition was primarily the domain of expensive and specialized test equipment, as well as minicomputers and mainframes. But the personal computer has changed all that. While early 8-bit personal computers had limited data acquisition capabilities, today's 16-bit and 32-bit machines offer the power and flexibility to handle the great majority of data acquisition tasks. Chart recorders and oscilloscopes are giving way to graphical displays on personal computers connected directly to the physical experiment or environment, displaying the physical data in real time.

The photo shows a real-time measurement system using a Mac Ilx running National Instruments' LabView software. The system monitors and controls furnace temperatures aboard a NASA KC-135 aircraft to test near-zero-gravity high-temperature superconductor materials. A video image of the material inside the furnace is displayed, as are the voltage being applied to the furnace, the temperature of the specimen, and the gravity level during the experiment.

Data acquisition boards are available for all types of personal computers and workstations. Dozens of manufacturers make boards for all major bus architectures, including the XT and AT, Micro Channel, NuBus (Macintosh), Multibus, VME, and SBus.

Boards vary greatly in performance and capability; they range from simple 8-bit boards for XT's to 32-bit boards with coprocessors or digital signal processors (DSPs) and digital I/O capabilities. You can obtain data acquisition boards that not only acquire data but also control equipment depending on the data readings. External data acquisition instruments
DATA ACQUISITION

THE DATA ACQUISITION PROCESS

Figure 1: Data acquisition involves measuring some physical phenomena, such as temperature, pressure, or voltage (left), using sensors or transducers. The captured signals must then be conditioned, either by a separate unit (top) or by one built into a stand-alone data acquisition unit (bottom). The signal is then converted to digital form, and the data is manipulated and displayed on a computer equipped with data acquisition software.

A Mac IIx running National Instruments' LabView monitors and controls furnace temperatures aboard a NASA KC-135 aircraft used to test near-zero-gravity high-temperature superconductor materials. (Courtesy of National Instruments)

that connect to the personal computer or workstation are also available.

The appropriate data acquisition system depends on the desired type of application. For a simple temperature-measurement application, you can make do with an 8-bit XT board, while for a high-frequency vibration analysis, you need a high-performance 32-bit system.

Some applications require an external data acquisition instrument that connects to the host computer instead of an internal plug-in board. I'll discuss performance requirements and the pros and cons of internal versus external data acquisition systems in more detail later.

There are many methods of transmitting information from a physical system; for example, a simple electromechanical relay can indicate an open or closed circuit. But, regardless of the application, a data acquisition process is composed of four basic components:

- measurement of the physical conditions using sensors or transducers
- conditioning the signal (e.g., amplification, linearization, and buffering)
- A/D conversion of the signal
- interface to the computer (usually includes both hardware and software)

Sensors and Transducers

Although there is a wide variety of sensors on the market, most fall into a few major categories. Probably the oldest and one of the most common types of sensors is the thermocouple. A thermocouple is a junction of two dissimilar metals that produces a voltage dependent on temperature.

In a thermocouple, the relationship between output voltage and temperature is nonlinear and is dependent on the cold-junction temperature of the thermocouple. Cold-junction temperature is a baseline temperature from which all measurements must be taken. Therefore, thermocouple manufacturers provide specifications for linearizing their output. Many data acquisition systems are set up to automatically perform the linearization for particular thermocouple types. Standard industry thermocouples (e.g., types J, K, and T) are available that operate within various temperature ranges.

Variable resistance sensors include strain gauges, resistance temperature detectors, and voltage, current, or frequency detectors. As their name suggests, variable resistance sensors measure a specific physical quantity (e.g., temperature or pressure) by changing their resistance. For example, you can use strain gauges to measure pressure, force, or displacement—they measure the resistance (or output voltage) as a function of the applied load. The strain gauge is calibrated so that a particular voltage reading corresponds to a particular displacement. Once the displacement is known, other quantities, such as force or pressure, can be calculated.

Signal Conditioning and A/D Conversion

Transducers or sensors generate an electrical signal that usually requires some form of conditioning before it can be processed by the A/D converter and other processing components of the data acquisition hardware. The most frequent type of conditioning involves the amplification of the signal (which is usually accomplished by means of a gain amplifier), so that the voltage of the signal is within the voltage sensitivity range of the ADC.

For example, an ADC may have a sensitivity range of 2.44 millivolts; that would indicate that the ADC can detect a voltage change of 2.44 mV. However, the signal from the transducer may transmit a voltage change of only 0.025 mV. In that case, the programmable gain amplifier in the data acquisition system would be set to 100 to amplify the signal enough for the ADC to detect it.

As I mentioned earlier, conditioning can involve the linearization of the signal as well as isolation, buffering, or attenuation. For example, signals from the transducer could change more rapidly than the ADC can process them. In this case, a sample/hold (S/H) circuit would be employed to buffer the signal and hold it to a constant value until the A/D conversion is complete.

The ADC's job is to take the analog output from the signal conditioner and transform it into binary code that the computer
DATA ACQUISITION

... can process. Signal conditioning is a process that is tightly coupled with the ADC, which is the heart of the data acquisition system. In other words, conditioning components such as the gain amplifier and the S/H circuit are designed to work with a specific ADC.

The ADC’s the Key
The ADC specifications largely determine the performance and accuracy of the data acquisition system. These features include the resolution (number of bits), sampling rate (speed), accuracy, input and dynamic range, linearity, and noise rejection capability. Obviously, these factors determine the cost of the ADC. Covering all these factors in detail is beyond the scope of this article, but I’ll take a brief look at resolution, sampling rates, and noise rejection.

The resolution is the number of bits (usually 8, 12, or 16) used to represent the analog signal. It determines the voltage sensitivity, also called the least significant bit, or the code width of the ADC.

You can determine the voltage sensitivity by dividing the voltage range by the total binary range (represented by the number of bits). An 8-bit resolution represents a range of 256 ($2^8$), while a 16-bit converter has a binary range of 65,536. If, for example, a converter’s voltage range is 0 to 10 volts, an 8-bit converter would have a sensitivity of 10 divided by 256, or 0.0391 V (39.1 mV). A 12-bit converter would have a sensitivity of 2.44 mV, while a 16-bit converter would have a sensitivity of 0.2 mV.

Coupled with a gain amplifier, the gain factor increases the sensitivity proportionally. For example, a gain of 100 would allow the 12-bit converter to pick up a signal of 0.0244 mV. Clearly, the type of signal that is being processed dictates the required sensitivity. You can handle most data acquisition tasks with either 8-bit or 12-bit converters and appropriate gain amplifiers.

The sampling rate, also called the throughput rate, determines how frequently the ADC can convert signals. The greater the sampling rate, the more accurately an analog signal can be represented. The Nyquist Sampling Theorem states that the sampling rate must be more than twice the rate of the maximum frequency of the signal being acquired. For example, audio signals can have frequencies as high as 20 kHz, requiring a sampling rate of at least 40 kHz. However, most laboratory applications require a sampling rate of under 25 kHz. The sampling rate is usually given for one channel; using multiple channels reduces the sampling rate proportionally. For example, a 20-kHz data acquisition board with two channels yields a sampling rate of 10 kHz per channel.

Noise rejection is another important factor in data acquisition applications. If the noise level in the system approaches the minimum voltage sensitivity of the ADC, the converter cannot distinguish between noise signals and the actual signals that are being acquired. This condition results in errors and is more of a problem for plug-in data acquisition units than for external systems. The proximity of other boards, such as graphics and modem cards, can generate noise interference.

BYTE ACTION SUMMARY

If you need to analyze or experiment with quantitative conditions, personal computer–based data acquisition boards may be for you. 

continued

Introducing a completely different way to create business applications:

GIVE YOUR COMPUTER A BRAIN.

The Brain is an incredible new system that will save you hours and hours of time and trouble in the creation of DOS business applications. Now you can forget about using high level languages in development and execution. With the Brain, you simply use plain, everyday English with no need for complex codes, testing, debugging, or modifying. Programmers and non-programmers alike will be amazed at how much more your computer will do for you once it has a Brain. Call, write or FAX Ingenio today at (404) 441-1547 (FAX 404 441-1703) for a demo disk.

BRAIN

INGENIO

6025 The Corners Parkway, Suite 205, Norcross, GA 30092

Circle 159 on Inquiry Card (RESELLERS: 160).
Putting It All Together

Acquiring the signal, conditioning it, and converting it from analog to digital are functions common to all data acquisition systems. Beyond these features, data acquisition systems vary considerably.

As you have already seen, the resolution, sampling rate, and number of channels can vary. In addition, some systems include additional circuitry such as counter/timers and digital and analog output functions, as well as on-board DSPs that provide floating-point operations independent of the host computer system. These features add flexibility and power to the data acquisition system.

Personal computer– and workstation-based data acquisition systems can be either internal add-in or plug-in boards. They can also be external front ends—such as those provided by John Fluke Manufacturing (Everett, WA). Among the manufacturers of personal computer–based internal boards are Contec Microelectronics (San Jose, CA) and Data Translation (Marlborough, MA). External front-end data acquisition systems are stand-alone devices connected to the personal computer via the RS-232 serial line. They can also be connected via a special interface called the General Purpose Interface Bus (GPIB) or IEEE 488 bus (a major supplier of this device is Iotech, Cleveland, OH).

The IEEE 488 or GPIB has become the standard interface for data acquisition systems. This parallel interface provides a transfer rate of 1 megabyte per second and can support up to 15 devices simultaneously.

The RS-232 interface is a serial interface with a maximum transfer rate of 19,200 bps, and it can support only one device per port. However, it has the advantage of being built into virtually all personal computers and workstations, while an IEEE 488 board must be purchased separately.

Front-end systems usually have built-in signal conditioning and can support a large number of measurement channels. In addition, they have better isolation and noise rejection characteristics than internal plug-in boards. As a result, they can be used in higher-frequency applications. Another advantage to external devices is that you can access them remotely from the host computer; with plug-in boards, you must locate the host computer in the immediate vicinity of the physical experiment or test.
DATA ACQUISITION

While not as versatile as external front ends, internal plug-in boards are suitable for many applications. In general, plug-in data acquisition boards cost less than external devices, since they don't require separate power supplies and cabinets and support fewer channels and instrumentation. Figure 2 shows the block diagram of a data acquisition board for IBM PC compatibles with 12-bit resolution, four measurement channels, and 1 million samples per second.

Most internal data acquisition boards require separate signal-conditioning modules. Although some boards have built-in signal-conditioning modules for particular sensors or transducers, most users select separate signal-conditioning modules, depending on the application, to allow greater flexibility.

If you decide to use an internal data acquisition board for a specific application, make sure you carefully weigh the pros and cons, since such boards do have limitations. The physical size of the board's connection interface limits the number of measurement channels. In addition, when you run high-frequency applications, there may be crossover noise from other boards in the system.

Internal plug-in data acquisition boards are ideal for a specific application that is not expected to change over time and for which the internal board produces reliable and accurate results. External devices may be a better choice if you frequently change the measurement application—a situation that requires continual reconfiguration of the transducers and signal-conditioning modules.

The Software

The final component of the data acquisition system is the software. Traditionally, many engineers and scientists have written their own programs, in a high-level language such as BASIC or C, to interface with the test equipment. The IEEE 488 interface supports an ASCII command set, and there are operating-system commands for the RS-232 port that you can use to set up a software interface.

Nevertheless, the trend today is toward commercial software applications that manage the entire data acquisition process. Applications like LabWindows from National Instruments (Austin, TX) or ViewDaC from Keithley Metrabyte (Taunton, MA) provide a full graphical interface with "virtual instruments" for simulating actual instrument control panels on the screen.

Most software applications include a development language for designing custom data acquisition interfaces. Commercial software applications generally support a wide variety of data acquisition boards and external devices with either RS-232 or IEEE 488 interfaces.

Data Acquisition: A Growth Market

The growth of the personal computer has mainly focused on personal and office productivity. But data acquisition in the laboratory is a rapidly growing technology that is ideally suited for personal computers and workstations, particularly as they gain processing power and graphics capability.

The combination of live video, sound, and real-time data acquisition offers enormous possibilities in many areas of scientific research and development. While not for everybody, data acquisition is an exciting field that should produce some dazzling applications in the next few years.

Nicholas Baran is a contributing editor for BYTE. He is also the editor of Baran's Tech Letter (Sandpoint, ID), a newsletter covering Next computers. You can contact him on BIX as "nickbaran."
Daily, the mountain of data to be processed into useful information grows. Larger and larger, it looms with no end in sight. The more reports we receive, the more we need. The more we read, the more we need to read, and the more we get eyestrain.

Between the almost-paperless office and networking, managing all this computerized data is a monumental task. We must find ways to make sense of it all. I mean, how many gigabytes can you read and make sense of in a day?

The Information Age may be here, according to the pundits, but most companies are still trying to handle all that data. Hardware and software aids are appearing at an increasing rate. In "The Data Swamp," Bob Ryan discusses different approaches to managing large amounts of data and turning it into useful information in a business environment.

BYTE columnist and noted science fiction author Jerry Pournelle says that by the year 2000 anyone will be able to get the answer to any question. If that’s true—and, knowing Jerry, it probably is—wide-area information servers may contribute many of those answers. Imagine having access to the Library of Congress—on-line! In "Browsing Through Terabytes," Richard Marlon Stein looks at WAISes—what they are and how they work.

But to turn data into useful information, you need a means of judging what is useful. How do you prioritize the various forms of data? What criteria do you use to determine that one piece of data is more or less important than another? In "Prioritizing Information," Rear Adm. Grace Hopper, USN, Ret., expounds on a subject that has interested her for many years: how to assess the value of data.

An MIT research project has taken this assessment a step further in one particular application: E-mail. The Information Lens constructs intelligent filters that can determine what mail you must see right now and what can wait. In "Through a Lens Smartly," Mike Robinson describes this intelligent assistant, which is beginning to show up in products, and the tasks it can handle. You’ll be amazed at how "intelligent" this system really is.

Another concern of data management is the security of your data. When you add the complexities of networked systems—and heterogeneous ones at that—to the personal computer environment, the permutations of possible problems grow exponentially. In "From Pyramids to Peers," Tom Toperczer looks at data management applications and the facilities they provide so that you can examine and manipulate data and make it safe in a distributed, networked environment.

No section on managing gigabytes would be complete without talking about physical storage and the media that can hold gigabytes of information. In "Giga-Storage," Richard A. Peters describes primary and secondary storage with capacities in this range. And in a related text box, "Native or Compressed?" Grant Wilcox talks about how data compression can increase storage and how much you should—or should not—rely on it.

The management of huge amounts of data is a subject that spans many topics, some concrete and some more esoteric. The concrete aspects have been dealt with quite successfully, between massive-capacity backup tapes and optical jukeboxes, but the more esoteric aspects are more elusive, in definition and in solution.

Grace Hopper says, "For a couple of decades now, I’ve been asking people how they value their information. I haven’t received any answers, but I have received a really great assortment of blank stares." Well, the time for blank stares is over. If we don’t get a handle on what’s important in all this data, that mountain will bury us—and our businesses—in trivia.

-Jane Morrill Tazelaar
Senior Editor,
State of the Art

The Data Swamp
BY BOB RYAN
153

Browsing Through Terabytes
BY RICHARD MARLON STEIN
157

Prioritizing Information
REMARKS OF GRACE HOPPER
COMPILED BY JANET BARRON
169

Through a Lens Smartly
BY MIKE ROBINSON
177

From Pyramids to Peers
BY TOM TOPERCZER
191

Giga-Storage
BY RICHARD A. PETERS
201

Resource Guide: Massive Mass Storage
213
As long as you love us, it's all right. And love us you will. Statistical software from SPSS is designed to work the way you work. By giving you the power to enter, edit, manage, analyze and present data on virtually every type of PC, workstation, minicomputer and mainframe. By giving you better decision-making ability through the most comprehensive set of statistical procedures available. And by giving you a choice of options to meet your specific data analysis needs. So if you're thinking about statistical software, think about flexibility. Because flexibility means value. And when it comes to value, we top the charts.

The Accessibility of SPSS makes it ideal for beginners and advanced users alike. With its straightforward menus and context-sensitive help and statistical glossary, SPSS gets you started fast. And with the help of our time-saving programming facilities, including macros and a matrix language, you'll have the power to go deeper even faster. And regardless of your experience with statistics, you'll be supported by the documentation and training that's set the industry standard for over 25 years. Documentation that InfoWorld calls "The Best in the Business."

The Statistical Procedures in SPSS give you the power to examine data more thoroughly, revealing patterns that might otherwise go unnoticed. We offer the most in-depth group of statistical procedures available, including univariate and multivariate descriptives, model building, hypothesis testing, clustering and classification, survival analysis, time series and perceptual mapping. No matter your question, SPSS provides the flexibility to find the answer.

The Data and File Management capabilities of SPSS give you unparalleled flexibility when preparing data for analysis. With SPSS, information can be quickly reorganized, cleaned and transformed, regardless of size or structure. Multiple missing values for nonresponses can be defined and labeled according to your specifications, while built-in controls easily manage information stored in complex file formats, including custom file formats. Self-documenting portable files give you the freedom to move your analysis from one computing environment to the next, saving time and resources. And because SPSS supports most popular microcomputer file types including Lotus, DBF and SYLK, and offers free interfaces to such leading SQL-based database management systems as Informix, ORACLE and Sybase, there's no need to re-enter data or write out intermediate files.

The Choice of Options offered by SPSS provides the flexibility to meet both your immediate and future data analysis needs. Unlike other statistical packages, we give you more than just the ability to choose between the options you may or may not need. We give you a choice of options designed to work together. Options that work as a system, providing the best possible software solution. Options for data entry and editing, Or producing publication-ready tables and reports. Options to analyze the past and help predict the future. Or to present your results with over 40 high-impact color displays, including a variety of charts and maps. No matter what you do, SPSS can help you do it better.

So if you're in the market for statistical software, keep an open mind. Go with the value of SPSS, suppliers of statistical solutions to over 2 million users worldwide. Because when you have the advantage of flexibility, the chances are you'll still be a hit tomorrow.

Call 1(800) 543-5835 or FAX (312) 329-3668.
State of the Art

The Data Swamp

Bill Gates talks about Information at Your Fingertips, but what about that slime on your boots?

Bob Ryan

Futurists, commentators, megatrendists, and other darlings of the best-seller lists have been saying for some time that humankind has entered a new age—the Information Age—where the basis of all wealth, power, security, and good manners is access to information. Welcome to the information society, where knowledge is power, the service economy is king, and a good agent can get you a $300,000 advance.

Spend a few days in this brave new world, however, and you come away with a markedly different perspective. Rather than inaugurating the Information Age, computers have just mired us in the data swamp. They give you access to mountains of data, but in many cases they have not made it easier to glean useful information from all that data. Some call this condition information overload, but it is really data overload. Until you can get a handle on all the data available to you, the Information Age will remain little more than a blurb on a dust jacket.

Managing a large amount of data in a business environment—and extracting useful information from it—is a hardware and software function. As with most areas of computing, the hardware is well ahead at this point. Powerful data-handling software is available, but primarily in structured environments, such as DBMSes.

Storage and Delivery
The hardware side of managing data concerns storage and delivery. Although magnetic storage systems provide faster access and higher data transmission rates than do optical systems, the cost per
megabyte of such storage is much greater. In fact, given the removable nature of optical media, its cost advantage over magnetic media can border on the ridiculous. Even without considering removable cartridges, the advantage is significant.

The latest advances in optical storage concern multidrive systems and multiple-media systems (not to be confused with multimedia). Multidrive systems, known as jukeboxes, let you store incredible amounts of data on-line. For example, the Hitachi OL321 Optical Library Unit stores nearly a half a terabyte (500 gigabytes) on 64 WORM disks and can mount any disk in less than 10 seconds. Multiple-media systems, available from many companies, let you use different types of optical media in the same drive. These are a godsend if you need to access CD-ROM, WORM, and rewritable optical disks.

In the past five years, optical storage costs have enabled applications that were not economically feasible with magnetic disk drives. At Children's Hospital in Boston, Stephen Wertheim uses an image database to store full-color neural images acquired with a 35mm scanner and a video frame buffer attached to a microscope.

The images are used in research and in teaching neuroanatomy to second-year Harvard medical students, with different Supercard stacks (Silicon Beach Software, San Diego, CA) providing different interfaces to researchers and students. The images are stored on two Sony rewritable optical disks and accessed via a database running on Mac IIs.

Requiring between 3 and 4 gigabytes of storage, the system would be prohibitively expensive using magnetic media. Thus, optical media not only increases the amount of storage available to you, but also enables new applications.

On the Move
Providing storage is only half the battle. It is also important to move the data from the storage device into memory—where it can be massaged into information—as expeditiously as possible. The limiting factor here is the communications bandwidth between the storage subsystem and the memory of your personal computer or workstation. More and more, you find that mass-storage subsystems are shared by many users in a network.

Communications bandwidth is dependent on many factors. Beyond the storage subsystem's latency, you have to deal with the interconnects between the subsystem and the memory. These can include the server's bus system, the network connectors and media between your machine and the server, the bus in your own system, and the software that controls all these disparate pieces of hardware.

Interestingly, with the sudden rise in network connections, the expected battle royal between the Micro Channel and EISA bus systems has failed to materialize. Given that the network medium is the slowest link between your largest mass-storage devices and memory, the speed of the bus in the end-user system is not very relevant. What is relevant is the bus in the server, which handles many requests simultaneously and moves data out to the network as quickly as possible. While 32-bit buses have not had a big impact on the desktop, they are critical in the LAN closet.

The emergence of the network server as the prime data depository has led to a new class of server personal computers. Included in this class are machines, such as the NetFrame from NetFrame Systems (Milpitas, CA), that are built around a proprietary architecture and those, like the Compaq Systempro, that are built around an open architecture.

Perhaps the biggest change brought about by networks is the ongoing transformation of minicomputer and mainframe platforms from the primary computational devices on a network to big, fast servers. As desktop computers become more and more powerful and cost-effective, it is inevitable that they will replace larger systems as your company's primary computational resource. Minicomputers and mainframes will continue to do what they do most effectively: move tremendous amounts of data rapidly.

Given fast servers—whether microcomputer-, minicomputer-, or mainframe-based—the current bottleneck in transmitting large amounts of data is the network. While fast networks, such as the Fiber Distributed Data Interface, have appeared as backbones, most network nodes are still serviced by media that range from AppleTalk's 230,000 bps to Token Ring's 16 megabits per second. As more and more data comes in graphical format, the need for a mechanism to economically bring FDDI-level speed (100 Mbps) to the desktop increases.

In response to this need, a number of companies are working on FDDI implementations over twisted-pair wiring. Currently, the ANSI standard specifies an interface that supports wiring distances up to 2 kilometers, and only optical cabling meets this standard.

However, the vast majority of network nodes are much closer than that. Realizing this, companies such as SynOptics (Santa Clara, CA) and Cabletron Systems (Rochester, NH) are working on delivering FDDI over twisted pair. Without the requirement for optical cabling, FDDI could soon be an economical option for many desktops.

With the enormous volume of storage available with optical and high-capacity magnetic media, and with the platforms and networks available to deliver it, the crunch in managing large amounts of data is not on the hardware side, but in software. After all, only software is capable of helping you transform data into information.

Structured Data Management
You can classify computer data according to the degree it is structured. The most common example of highly structured data is a DBMS, where individual items are assigned to two-dimensional relational tables. Highly unstructured data is best exemplified by the text files you create with a word processor, which may consist of little more than variable-length paragraphs separated by carriage returns.
The management of structured data is as old as computing and is still the prime task of computers at most companies. Database systems, spreadsheets, and accounting packages all work with data whose structure is well defined; each data item is a specific type that determines how the software processes it.

Most companies manage their structured data using a relational DBMS and will continue to do so for the foreseeable future. With networks taking over, the chief database management concern is providing access to the data without compromising its integrity.

In the past few years, client-server database implementation has been ascendant. This model divides the database function into two parts: front-end client software that generates data queries and back-end server software that processes queries and returns the resultant data to the client. The server handles all data management functions, including security, file and record locking, and atomizing transactions.

The advantages of the client-server model are twofold. First, it is much easier to manage the database if all data is stored in one location. Second, the separation of the data engine from the front end lets any type of application access the database, including spreadsheets, business graphics programs, and accounting packages. Any application that generates acceptable queries can access the database.

While wonderful in theory, client-server implementations are less than ideal. A server can only handle queries that conform to its specifications, yet there is no single standard for generating queries. The closest we have to a standard is Structured Query Language.

The problem with SQL is that you rarely find an ANSI standard implementation of the language. Different database vendors extend the language in different ways, making it difficult for those who supply client software to know what version of the language to implement. Thus, you can have situations where a spreadsheet client might support Gupta’s server engine but not Sybase’s or IBM’s DB2.

The problem is not technical, but one of politics and marketing. The best hope is that one of the engines will gain a large enough market share that it becomes the de facto standard.

The second problem that is engendered by the client-server model is technological. By its very nature, a database server will be the busiest node on any network, and it will therefore be the biggest bottleneck in the network.

Faster network cabling will help, as will schemes that give the server more packet buffers and greater access to the network. With token-passing implementations, this latter might mean that the server node will get the token more often. In collision-detection schemes, such as Ethernet, this may mean giving the server node a shorter time-out on average than other nodes.

Eventually, if hundreds or thousands of users need to share your database, it may be necessary to distribute the database over different servers. This introduces myriad consistency problems and negates the virtues of a centralized server, but it may be the only way to make data available to clients without saturating a network segment.

Handling Multimedia Data
Over the past few years, one of the major themes in computing has been the explosion of applications that rely on data that can’t be structured the way an address list can. Computers now regularly access pictures, animations, sounds, music, and other types of data that aren’t well suited to a tabular structure. As a result, researchers are looking at different ways of handling unstructured data.

Two major concepts of how masses of irregular data should be dealt with have emerged. The first is to provide extensions to the current relational model; the second is to create object-oriented databases by enabling the storage and retrieval of persistent objects.

The object-oriented database is more radical and more reactionary than the extended relational model—radical because it seeks to store data and the methods used to access the data together rather than keeping data and methods segregated, and reactionary because in many ways it harkens back to the CODASYL-network-database model that was supplanted by the relational model in the early 1980s.

At present, the relational model remains unsurpassed for handling the most common types of data you encounter in a business environment. Object-oriented databases, however, seem better suited to handling less traditional data, such as CAD drawings, image files, and other types of data normally associated with multimedia applications.

For the time being, a multimedia database that can handle traditional and non-traditional data with equal facility is not in the cards. Businesses that use multimedia applications require specialized storage systems that cannot be easily
integrated with the company database. This situation will only improve if market pressure for such integration increases markedly.

The Text Dilemma
Ironically, the greatest impediment to realizing the Information Age is how computers handle—or fail to handle—good old text files. Much of the information you need to work effectively can’t be reduced to a relational table or encapsulated in a simple object. This information comes to you in the form of memos, E-mail, newspapers, wire-service news copy, journal articles, and so on.

Between E-mail services, on-line databases, and CD-ROM products, you have trillions of bits of relatively free-form data available to you at any time. So, the problem is one not of access but of culling significant bits from all those floating around in the ether.

The problem of getting the information you need—and only the information you need—appears in two primary aspects. The first involves the difficulty of obtaining just the information you need by searching electronic sources. The second involves dealing with all the information that just naturally comes your way in the course of the day. (This second area is discussed in “Through a Lens Smartly” on page 177.) I’ll concentrate on the problems of information retrieval from external databases.

Searching for Answers
If you’ve ever tried to research a topic using an on-line information service, you know the frustration of data overload. You must first decide which databases to search and then construct queries that not only garner the information you need but also weed out extraneous material. Of these two situations, the latter is usually far more serious than the former. A simple search of a news wire can result in thousands of “hits,” which is only marginally better than a query that results in no hits at all.

The basic problem is that, unlike the structured data in a relational database, there are no fixed keys for searching through text documents. Effective indexing of unstructured data requires that someone read the document and provide keys that permit it to be retrieved when and only when it fits the search profile. (See “The Dark Side of DIP” in the April BYTE for more information about the process and problems of indexing.)

Currently, due to the great number of information providers and the different indexing schemes and vocabularies used by them, it is extraordinarily difficult for an individual to effectively use more than a few data sources. For example, in researching the topic of indexing for this article, I had to try various combinations of terms, such as indexing, searching, retrieval, text retrieval, text databases, information bases, on-line information, queries, on-line queries, trends, technology, artificial intelligence, information filters, information refineries, and agents, as search keys on a popular on-line database.

The process was only partially successful, because I didn’t know the exact vocabulary the indexers used to describe the relevant stories (and the indexers were apparently less than consistent in applying their vocabulary, if they had one at all). I wound up going through a lot of irrelevant material because I wasn’t used to the quirks of that particular database.

That’s just one database. The problem becomes magnified when the information you need is in several databases. You could spend so much time finding what you need that you have no time to read it!

Solutions to this type of data overload are continually evolving. Some are commercial realities; others are university-based research projects. The best will eventually usher in that oft-proclaimed Information Age.

Golden Retrievers
One way to deal with information retrieval is to have someone else deal with it. Individual Incorporated (Cambridge, MA) is an “information refiner.” The company captures data from dozens of on-line news feeds and provides you with information relevant to your needs, using a sophisticated information filter. By continually querying you about the effectiveness of the refined information you receive, Individual can closely tailor a filter to your needs. Once a day, the company sends you the filtered information via E-mail or fax.

NewsEdge/PC from Desktop Data (Waltham, MA) is useful if you require near-real-time information. Attached to an FM receiver, it can run in the background on your personal computer, notifying you of stories matching a keyword profile you’ve specified. At NetWorld ’91 in Boston, Desktop Data showed products that work with LANs and corporate E-mail systems.

Another significant information-retrieval product is Topic Real-Time from Verity (Mountain View, CA). Instead of relying on keywords, Topic Real-Time uses concept-retrieval technology, using multilevel queries, where you assign different weights to different subjects. This approach can be much more effective than Boolean searches, which treat each keyword equally. In addition, Topic Real-Time can refine its results by taking advantage of the structure that some publishers use in delivering information.

A drawback to using these information-retrieval systems is that, although they can greatly increase the relevancy of the information you download, you must still read the information to extract the meaning. Logically, the next step is to automate that process, too.

Cut to the Quick
The System for Conceptual Information Summarization, Organization, and Retrieval is a project at the GE Research and Development Center (Schenectady, NY). Unlike many retrieval products, SCISOR operates in a limited domain—specifically, it pulls information concerning mergers and acquisitions from Dow Jones News/Retrieval—and it is able to do more than simply flag interesting stories.

Written in Common Lisp and running on a Sun workstation, SCISOR employs different techniques to retrieve relevant stories and extract information. Among these are many from the AI field, including natural-language processing and knowledge representation, and other more prosaic techniques (e.g., lexical analysis and word searches).

Using these techniques, SCISOR retrieves the stories and extracts information, such as the names of the companies involved in an acquisition and the per-share and total price of their offers. In addition, SCISOR can answer natural-language questions about the information that it collects with natural-language responses.

Information from Data
SCISOR and the other examples above demonstrate ways you can use computers to deal with the very problem computers made possible—data overload. By making it easier to find what you want and, as with SCISOR, by performing some basic analysis of the data for you, products like these can keep you on top of developments critical to your business.

Together, hardware and software developments are making it easier to handle massive amounts of data. We have yet to be extricated from the data swamp, but the wading sure is a lot easier.

Bob Ryan is a BYTE technical editor. You can reach him on BIX as "b.ryan."
All The Space You’ll Ever Need...
MICROPOLIS. The Name for High-Capacity Disk Drives.

For over a decade, Micropolis has been dedicated to designing, developing and perfecting high-capacity, high-performance disk drives. Drives that most of the biggest names in the computer industry put their names on. Employing rigorous testing regimens, our OEM customers have been the most demanding and unforgiving. So it's no accident that these hardest-to-please professionals have made Micropolis their supplier of choice for high-capacity storage.

In keeping with this tradition of technological leadership, Micropolis recently introduced the world's first two-giga-byte (GB) 5¼ inch disk drive*. This powerhouse provides mainframe-class capacity and performance levels at the lowest price per megabyte (MB) of any disk drive. With models ranging from 180 MB to 2 GB, including the most extensive "over 1 GB" product offering available, it's easy to see why Micropolis is truly the name for high capacity.

*Currently available for evaluation.
MICROPOLIS, The Name For High-Performance Disk Drives.

High-capacity storage demands higher performance. In other words, faster is better... and much faster is a lot better. With effective access times as low as 3.9 milliseconds, Micropolis high-capacity HS Series Drives are easily the fastest in the world. In fact, BYTE magazine, Nov. 1990, reports: "The Micropolis 1684 combined exemplary sequential write numbers and killer results on the tree-copy tests, to earn first place overall."

Results like these don't happen by accident. They happen by design. Unique design and engineering subtleties that make for dramatic differences. Our patented spindle design and one-piece balanced actuator provide greatly increased drive reliability and data integrity.

Add to that some of the highest data transfer rates for 5¼" disk drives, and it's no wonder Micropolis is the name for high performance.
The HS (High-Speed) Family of Fast SCSI Drives

It's a fact: Even the most powerful computer systems and networks can be bottlenecked by slow disk drives. As applications get more complex, files get larger, and network traffic increases, disk drive speed becomes more critical to overall system performance. That's why a Micropolis HS Series drive, boasting an unprecedented effective access time as low as 3.9 milliseconds, should be the next drive you install. With drive performance up to 300% faster, you'll see the difference.

And after testing 15 high-capacity disk drives, BYTE magazine agrees: "Based on performance alone, we chose the Micropolis 1684 (HS Drive) as the top drive . . . ."

NetWare Ready™

Now you can enjoy the assurance of being Novell® NetWare Ready on Micropolis HS Series drives at no additional cost. Our 180 MB and 380 MB (and soon our 760 MB, 1.2 GB and 2.0 GB) SCSI drives are all 100% NetWare Ready — right out of the box.

Micropolis PC PAKs™: The Performance Advantage

As a professional installer, you'll appreciate the convenience and cost advantage of our exclusive, pre-tested Performance Advantage Kits (PC PAKs) for PCs. Each PC PAK contains all you need to give your system the Micropolis power and performance edge, including SCSI host adaptor or ESDI controller, documentation, software, everything right down to the cables and mounting rails. And, of course, worldwide installation and applications support are included.

Micropolis. A Tradition of Quality

In 1983, we introduced our first high-capacity 5¼ inch disk drive. Since then, we've shipped over 1,000,000 300+ MB drives, and our customers have come to rely on us for making fast, high-capacity drives that are known for their reliability. Backed by a full FIVE YEAR warranty* and a team of dedicated technical support experts, our drives simply store more data, run faster and last longer than anyone else's.

To find out more about the Micropolis line of high-capacity, high-performance disk drives, or to locate the reseller nearest to you, please call:

1-800-395-3748
1-800-395-DRIVE

*Limited warranty, restrictions apply. Contact Micropolis for details. All trademarks and registered trademarks are the property of their respective owners.
STATE OF THE ART

BROWSING THROUGH TERABYTES

Wide-area information servers open a new frontier in personal and corporate information services

RICHARD MARLON STEIN

The Library of Congress archives roughly 25 terabytes in its collection. To browse through this volume on your own would be nearly impossible. Wide-area information servers supply the means to achieve this goal by providing the user-interface structure and underlying information-retrieval protocol necessary to automatically collate, collect, and integrate diverse data streams. WAISes can distill the contents of vast archives into neatly manageable and browsable folders.

On-line information services, such as BIX and CompuServe, attest to the need for this kind of technology. Information has acquired a commodity-like status. While not on a par with wheat, pork bellies, or gold futures, the information-service industry fills a vital role. The next phase of information commerce will add WAIS capabilities to existing on-line services, opening a new frontier in personal and corporate information services.

Intentions and Goals
Initiated in early 1989, the WAIS engineering effort is spearheaded by Thinking Machines (Cambridge, MA), the manufacturer of the Connection Machine, a massively parallel supercomputer (see reference 1). The principal goal of the research project is to demonstrate "how current technology can be used to open a market of information services that will allow a user's workstation to act as librarian and information collection agent from a large number of sources." (See reference 2.) WAISes aim to enhance existing information services and provide a utilitarian mechanism for the industry.

continued
Information servers already provide direct access to many databases and archive structures. You can easily check the local weather, make travel reservations, obtain entertainment schedules, or browse through the latest stock-market quotes on-line. These services are highly interactive, charging users on the basis of minutes spent on-line, and each has a unique user interface.

WAISes alleviate unnecessary user interaction through a predominantly computer-to-computer approach to remote information retrieval. By minimizing human interaction with a remote information server, they handle requests for information expeditiously and inexpensively. WAISes also alleviate unnecessary complexity by moving all user interaction to the local workstation and by having WAIS software handle all transactions with the remote server.

On-line servers are limited in their connectivity. While many services, such as BIX, CompuServe, and AppleLink, incorporate wide-area network structures, sharing information between different services is not a wholly transparent option. This restriction constrains information commerce and hampers the circulation of potentially useful ideas.

WAISes circumvent this barrier with a standard information-exchange protocol that offers unlimited connectivity and retrieval functionality. All servers can apply the WAIS protocol to their archive structures to conduct information retrieval. (Unlimited connectivity also raises concerns of security and privacy. See the text box "The Right to Privacy" on page 160.)

Organized and coherent information of topical importance has value. Individuals and companies should be able to market their information to the widest possible audience. Current on-line services can't easily accomplish this, since their connectivity is restricted.

To direct your information to the best marketplace, you could subscribe to multiple on-line sources and post the same message on all of them. But it would be more efficient to post the data on one server and have the data, or an abstract of it, broadcast to the others. Using the WAIS protocol, WAISes facilitate this server function.

Suppose, for example, you have reviewed the latest set of RISC microprocessor benchmarks, taking note of specific architectural advantages, and you wish to make this information available to others. The benchmark review is kept on your home computer (i.e., the local WAIS), which is equipped with WAIS technology. The nearest remote WAIS, a hub within a network of servers, also has a folder for RISC microprocessors. So you make a posting to the nearest hub server that inserts a pointer to the review on your home computer.

Everyone with a computer running the WAIS user-interface software can present information to a server and receive compensation for whatever portion of it other WAIS subscribers access. The compensation can be monetary, or you can barter your information for someone else's.

Even publishers of books, magazines, newspapers, and music can participate and profit from WAISes. For example, how much money could a newspaper save in circulation costs if you received the morning paper electronically instead of printed on paper? Similarly, how much money could a book publisher save if you purchased a new best-selling novel electronically instead of at a bookstore?

Traditional information delivery is expensive, and costs are rising. The U.S. Postal Service frequently raises its fees to cover increases in the cost of handling and transporting information. Traditional information transport also represents a significant fraction of transport volume and collateral energy consumption. Moving information electronically can result in enormous savings.

Computer networks such as Internet are conduits of information transport. To replace manual transportation methods, the existing electronic infrastructure must accommodate the newly anticipated volume of traffic. Plans for "a national network of data superhighways," which will be installed within the next few years, are under way (see references 3 and 4).

A principal motivation for WAIS technology is to be able to retrieve topical information for research or investigation, not just to deliver consumable items like newspapers or books. Toward this end, WAISes rely on a novel structure for information retrieval, the dynamic folder.

To use a WAIS, you formulate a question (see figure 1), find the information servers that provide satisfactory responses, and create a dynamic folder. The purpose of the dynamic folder is to constantly or periodically update its contents with new material on the subject.

Formulating a question is natural to us all. The difficult part is locating the pertinent information to answer it. Manually locating the information can be laborious and tedious. WAISes automate the search-and-retrieval process. To determine which servers hold the information most pertinent to your question, and where you should submit dynamic folders, you may want to consult server directories.

Server Directories
WAIS directories are servers that support a directory-services function. They are indexes to other services within the WAIS network and are organized to help you locate information. Like telephone-directory services, WAIS directories list pointers to servers, which are grouped according to content and function.

A directory-entry header contains sufficient data to describe the service, such as an English-language description of the server, the parent server (if the server is a subsidiary of a larger one), related servers, contact information (including networks and human-interface points), and cost information.

The local workstation, when equipped with a WAIS, should maintain a directory entry that includes the directory-entry header, a locally determined rank, subscription information (if any), user comments, and the time of last contact. You can use this information to decide whether to contact the server and how to handle the responses.

By using content navigation, you can find the most appropriate server to
INTERNATIONAL BUSINESS MACHINES CORP., APPLE COMPUTER INC. and other big computer makers are staking out positions in the nascent market for "note-pad computers," small machines that let users enter data by writing rather than tapping keys. The note pads typically recognize numbers and letters printed on a screen with a special pen and convert them into conventional electronic characters. The information is then stored for later transfer to a personal computer or a company's main computers.

The size of the market for note-pad computers isn't clear, but Infocorp, a Santa Clara, Calif., market-research firm, estimates the market will grow to 3.4 million units sold in 1995 from 22,000 units this year. Only one company, Tandy Corp.'s Grid Systems unit, currently sells note-pad computers in the U.S.; its model, introduced last September, is priced at $3,000. But new ventures are expected to introduce several note-pad machines this year. And already, big computer makers are fighting quietly for control over software standards for these gadgets, which require different programs from those used on conventional computers.
The Right to Privacy

W

AlStation, a prototype user interface developed by the Thinking Machines wide-area information server project staff, embodies many functional aspects of WAIS technology. Forming and refining queries via relevance feedback, server selection, and dynamic folders are the principal features that this prototype supports. These assets provide a powerful tool set for information retrieval. While WAISStation achieves several desirable technical goals, the security and privacy issues have not yet received serious attention and need refinement.

Security and privacy issues are not specific to WAISStation or WAISes in general, but are endemic, topical concerns of the information-retrieval industry as a whole. WAIS technology seeks to extend connectivity through the WAIS protocol, thus intensifying the urgency of security measures and standards. Greater connectivity promotes information commerce, but it also adds to the risk of compromising the privacy and confidentiality of electronic transactions.

Individuals and corporations that subscribe to WAISes must safeguard proprietary information. The tendency to organize information within a computer for ease of access or to act as a convenient archive creates a security and privacy dilemma. And if the sensitive data is located on a machine with high connectivity, the risk is multiplied.

A WAISStation that holds personal information, such as tax forms, diaries, business transactions, medical records, or bank accounts, must be protected from intrusion by unauthorized individuals. A computer system storing this information "knows" more about you than you can instantly recall. Access to this personal data must be protected, controlled, and limited to authorized individuals.

The WAIS protocol is an application-layer protocol that runs over X.25 communications, modems, or IEEE 802.3 (Ethernet) backbones. Residing beneath this protocol is the WAISStation host computer and operating system. Extracting information from the server depends on access granted through a recognition and authentication system that the host computer operates. Only authorized subscribers can access information from the server.

The WAIS protocol is stateless, so each transaction, whether a query or document-retrieval process, exists in a separate context at the server. Subversion of the WAIS protocol, whether intentional or accidental, might unlock or bypass a server's native file-system protection structure. If it did, the entire archive contents would be available to the intruding party.

The WAIS protocol should be noncorruptible and should detect privileged transactions (i.e., those data streams that possess restricted command sequences). However, to be effective as a noncorruptible application-layer protocol, the underlying computer system must also be unbreakable.

Unfortunately, you cannot always guarantee protection. In 1988, a virus introduced through a known port assaulted computer systems attached to Internet. Subsequent sleuthing discovered that a remote system could activate the debug mode of the Unix mailer, forcing the instigator into a privileged state. The debug mode then permitted the virus to propagate and multiply.

Can a rogue dynamic folder, fashioned after the Internet virus, intentionally access information from strategic servers running WAIS software? How will WAISes safeguard information against illegal intrusion?

The right to privacy is inalienable, and WAIS technology or any enabling system that promotes information commerce must preserve it. A cautious approach toward implementing WAIS technology is necessary and appropriate. Several legal issues must be addressed to secure both privacy and fair business practice.

handle a query. For example, a question on RISC microprocessor benchmarks would list directory entries for servers as well as pointers to articles on the subject. When you retrieve a document, the directory entry is also provided. Thus, you obtain ranking information for questions of similar content.

Each server, then, contains information of value to certain subscribers. The dynamic folder can continuously poll newspaper servers for new articles as they arrive from the news wires, while it would probably query a dictionary or encyclopedia server only once, since the content changes much less frequently.

Policing the large number of anticipated servers (in the tens of thousands) requires an independent quality-control mechanism. An audit of the server directory would reflect any server that frequently returns erroneous information or does not perform. An independent agency like Consumer Reports, the Better Business Bureau, or other watchdog groups could create rating servers, which monitor and rate other servers in the directory.

These rating servers resemble movie and TV critics. Consumers acquire confidence in the reports and reviews that certain critics issue because they share similar tastes. Just as moviegoers start to trust a particular reviewer who has agreed with them on past movies, WAIS users will begin to trust the specific rating services that agree with them.

A subscriber base generates income for a server. The rating servers will attract subscribers as well, for they direct trends in the information marketplace. In fact, they may become the first "information speculators" as a by-product of WAIS technology.

Dynamic Folders

A folder, like those found on the Macintosh, provides the WAIS framework for organizing questions. A folder is a repository for documents. A file system, in the Macintosh sense, is full of folders organized in a tree structure that supports an efficient document-location mechanism.

To find a document within a file system, you typically use the find command under Unix or Finder on the Mac.
Finally, a fast, powerful text editor that integrates your favorite programming tools and uses no memory!

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

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

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

VEDIT Jr. - Unmatched performance for only $29.

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

VEDIT - A best value at only $69.

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

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

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

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

FREE
Fully Functional Evaluation Copy
Call 1-800-45- VEDIT

- Mouse Support
- Pull-down menus
- Columnar blocks
- 1000 Level Undo
- Regular expressions
- Small 70K size, fast

- Emulate Wordstar, Word Perfect, Brief, vi, others
- Edit text and binary files of any size and line length
- Powerful macro programming language for instant "off-the-cuff" macros

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

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

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

BENCHMARKS IN 3 MEG FILE

<table>
<thead>
<tr>
<th></th>
<th>VEDIT</th>
<th>BRIEF</th>
<th>Sage</th>
<th>QEdit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple search</td>
<td>57 sec</td>
<td>1:17 min</td>
<td>28 sec</td>
<td>Cannot</td>
</tr>
<tr>
<td>Save and continue</td>
<td>52 sec</td>
<td>3:52 min</td>
<td>1:47 min</td>
<td>Cannot</td>
</tr>
<tr>
<td>Load, modify, save, exit</td>
<td>21 sec</td>
<td>49 sec</td>
<td>1:38 min</td>
<td>Cannot</td>
</tr>
<tr>
<td>Block-column copy (40x200)</td>
<td>2 sec</td>
<td>30 sec</td>
<td>2 sec</td>
<td>2 sec</td>
</tr>
<tr>
<td>Delete one column in file</td>
<td>9:58 min</td>
<td>1:50 hour</td>
<td>1:03 hour</td>
<td>Cannot</td>
</tr>
<tr>
<td>60,000 replacements</td>
<td>3:16 min</td>
<td>1:44 hour</td>
<td>1:32 hour</td>
<td>Cannot</td>
</tr>
</tbody>
</table>

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

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

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

Greenview Data
P.O. Box 1586, Ann Arbor, MI 48106
(313) 996-1299, Fax (313) 996-1308

Circle 133 on Inquiry Card.
The fastest omnifont OCR Software operating in MS-DOS and Microsoft Windows environment

Dealers are welcome
Call for your demo diskette today:
(1-800-254-6OCR), PO Box 0218 Los Angeles, CA 90048 Tel: (408) 749-9935 Fax: (408) 790-1180

**RECOGNITA PLUS**
SPEED, ACCURACY AND FLEXIBILITY!

With one of these tools, you can locate the position of a file and gain access to its contents. Path-driven locators search an information base for a document's name, but they do not provide a means to examine its contents.

Retrieving documents pertinent to a specific question requires content navigation (i.e., examining the contents of a document, or a representative abstract or index for the document, for its relevance to the question). The similarity between the question and the document's index determines a retrieval score, an indication of the likelihood that the document is pertinent.

WAISes rely on the dynamic folder to encapsulate a question. In its most passive form, it contains a question and a set of servers to target. The WAIS posts the dynamic folder to servers of known quality and functionality, and then query processing begins.

The dynamic folder executes a remote query that sends questions to the remote servers. There the questions find relevant information and return a list of document titles (document pointers) encapsulated within the originating folder to the local WAIS system. The results from the query may initially include a list of documents with fair, good, or high similarities.

Now you can refine your query strategy by perusing the document titles to determine which are the most appropriate documents. WAIS technology, in the form of the WAIStation user interface (see reference 5), assists this process through a content-associativity function known as similar to.

The similar to function informs the WAIS user interface that a document is "interesting." The server uses this information to find other documents that are similar to the one you have chosen. This search strategy, an embedded component of WAISes, represents a significant improvement over traditional database methods, such as Structured Query Language (SQL) and Boolean search.

This form of query execution is known as relevance feedback. It lets you extend the query to incorporate a "more-like-that-one" functionality and lets you retrieve documents that have similar contents. The WAIS user interface is organized around the English language, and English-language-oriented query structures are easier to use than SQL.
The similar to function is like working with a reference librarian. First, you state the topic of your research, which the librarian translates into queries. After you examine the results of the queries, you indicate which results were on the mark; thus, the librarian gains a better understanding of your needs and can improve the search.

With relevance feedback, WAISes can retrieve documents with greater ease and speed. You no longer need to alter a SQL Boolean operator to adjust the query filter; instead, you can ask for “more documents like this one.”

Dynamic folders can also possess vitality, which gives the folder a continuous charter to execute queries periodically and update its contents with new material. A folder’s charter expresses purpose, intent, and the goal that you want the query to accomplish. You can build the folder to periodically poll servers known to receive frequently updated material that matches its charter.

If the search retrieves an interesting document, WAISes let you select a portion of the text and use it as an adjunct to the initial query. Selecting text from a portion of a document that may contain some particularly topical or relevant information and using it to refine the search is an innovative approach for exploring subjects (see figure 2).

WAISes also let you chain questions by taking the results of a previous search, starting a new question with different subject matter, and dragging the previous results into the similar to menu box (see figure 3). Chaining questions can either broaden or narrow a search, depending on the relevance-feedback results.

The recursive capacity of dynamic folders to initiate “sibling” folders demonstrates the WAIS potential to harness and refine subject matter. Query refinement alters the charter of a dynamic folder. Sibling dynamic folders execute directed searches and can have an autonomous authority to broaden the range of server choices.

Controlling the extent of search expansion is a critical issue. For individuals, cost can be an overwhelming concern. WAIS technology does not yet contain an accounting system to govern search criteria. Participating information services will have to engineer this element of the technology themselves.

WAIS Protocol
WAISes promote connectivity and access to remote electronic-information sources through a standard protocol, the WAIS protocol. This protocol is an extension of the National Information Standards Organization (NISO) Z39.50-1988 specification, which defines an interface to remote information-retrieval services and library-protocol applications. The Z39.50 standard is the backbone of the WAIS protocol and the foundation for WAIS applications development.

Incorporating the Z39.50 standard into the WAIS protocol frees developers to build articulated user interfaces for WAIS applications. The interface standard isolates the server’s text-retrieval method, such as SQL, giving the application a transparent access mode. The particulars of database queries are hidden beneath the interface. A developer only needs to be sure that the server possesses an equivalent functionality to conduct remote information-retrieval transactions from a local WAIS workstation.

Concealing the server’s implementation through the WAIS protocol is important in another respect as well. Isolating the implementation implies that you can specify a single, more palatable query language. The WAIS protocol also lets you use an English-language-style query

Figure 3: Chaining questions permits you to use a query on multiple information sources by opening a new question and dragging previous query results into the similar to field. You can also apply the similar to operation to invoke a new document search, as in this example. (Courtesy of Thinking Machines Corp.)
BROWSING THROUGH TERABYTES

While still a research project that is undergoing development and refinement, the WAIS holds immense promise.

The WAIS protocol is designed to transport information through modems, X.25 communications, or network backbones. This flexibility provides an enormous framework within which to conduct retrieval transactions. For example, with a portable computer, you could connect with a WAIS hub through a modem and post dynamic folders, directing the query results to be routed to your office system for later examination.

Retrieval Technology

The computing infrastructure needed to implement WAISes varies with a server's functionality. A Library of Congress WAIS, with 25 terabytes of data, could not expeditiously dispatch queries and function if a serial computer were used to process the information. For a problem of this magnitude, massive parallelism is needed. The Connection Machine's Text-Retrieval System is a viable information-retrieval system for gigabyte-size databases.

The Dow-Quest service from Dow Jones runs on the Connection Machine. The service incorporates approximately 1 gigabyte of original text derived from over 400 sources. The Wall Street Journal, the Washington Post, Barron's, Fortune, Forbes, and several regional business and technical journals are included, covering the previous eight calendar months. The search time with a 100-word query composed of typed English and relevance feedback (e.g., "more like that one") is less than half a second. The system can provide access to many gigabytes of text and to thousands of users interactively.

The projections for the Connection Machine system indicate that when it is scaled to a 1-terabyte database with 10-word queries, obtaining an answer within 10 seconds or less is highly probable. This performance is accomplished by harnessing the Connection Machine's 65,536 separate processors to execute a parallel index algorithm (see reference 6). These estimates are phenomenal and truly indicative of the computing power manifest in parallel systems. No serial machine can even come close to this level of performance.

The Connection Machine system generates these results by searching the entire contents of an archive, not a representative abstract of a keyword frequency table. Each document within the archive is used to determine a match. This is not typical for systems organized around serial computers, and it is another dramatic demonstration of parallel-computing technology.

The cost of a system like the Connection Machine runs in the millions of dollars. But a Macintosh with a 100-megabyte hard disk drive or a 386-based PC can serve the typical WAIS user.

Immense Promise

The prototype WAIS user interface and protocol are currently being beta-tested at Thinking Machines, Apple Computer, and Dow Jones News/Retrieval. Thinking Machines, the principal developer of the WAIS architecture and software, plans to share the WAIS protocol free of charge and hopes to help user-interface developers build interfaces to WAIS servers.

While still a research project that is undergoing development and refinement, the WAIS holds immense promise. Informa-tion commerce, buoyed through the widespread acceptance of computer systems and networks, forces individuals and companies to expedite transactions and simplify activities. These coveted sources of efficiency stand out as prominent allies of competitive advantage.

ACKNOWLEDGMENT

I'd like to thank Annie Romanekteck, Franklin Davis, Ben Rewis, and Brewster Kahle of Thinking Machines for their assistance during the preparation of this article.

REFERENCES


Richard Marlon Stein is a software consultant and freelance writer from Van Nuys, California. He has a B.S. in physics from the University of California at Irvine. You can reach him on BIX c/o "editors."
Whether you're protecting frontiers and temples in Manchuria, or software and data on the PC or Mac, the Great Wall is a lesson Rainbow Technologies has learned very well.

Software developers must deal daily with the consequences of unauthorized copies and millions of dollars in lost revenue. At the same time, both individual and corporate users must be able to make and distribute copies within legal guidelines.

Today's information-driven companies must secure their data files against theft and unauthorized access. No less than protecting personal wealth and tangible property, guarding data files is a necessary investment in competitive survival.

Protecting "intellectual property" is the security challenge for the '90s. Which is why Rainbow Technologies builds a little of the Great Wall into every key it makes.

For developers, the Software Sentinel " family of keys protects IBM, PS/2 and compatible software, while Eve" guards software for the Mac. Rainbow's DataSentry " is the solution for PC data protection.

Software and data protection from Rainbow Technologies. Information on how you can have a little piece of the Great Wall to protect your software and data worldwide is as close as a toll-free call.

Copyright ©1991 Rainbow Technologies, Inc.
Now That You Know Which Laptop or Notebook to Get, We Think You Ought to Know Where to Buy It.

Competitive Price Must Be Presented To Us Prior To Purchase From Us.

<table>
<thead>
<tr>
<th>Premium® Exec™</th>
<th>286/40MB with</th>
<th>386SX/40MB with</th>
</tr>
</thead>
<tbody>
<tr>
<td>1MB................N/A</td>
<td>2MB................N/A</td>
<td>2MB...................N/A</td>
</tr>
<tr>
<td>2MB................$1948.00</td>
<td>2MB................$2228.00</td>
<td>4MB...................$2608.00</td>
</tr>
<tr>
<td>4MB................$2328.00</td>
<td>4MB................$2678.00</td>
<td>5MB...................$2708.00</td>
</tr>
<tr>
<td>5MB................$2428.00</td>
<td>5MB................$2778.00</td>
<td>8MB...................$3188.00</td>
</tr>
<tr>
<td>8MB................$2908.00</td>
<td>8MB................$3258.00</td>
<td>8MB...................$3813.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T1000SE with</th>
<th>T1600SX/20MB with</th>
<th>T3200SX/120MB with</th>
</tr>
</thead>
<tbody>
<tr>
<td>2MB.............$1138.00</td>
<td>5MB................$2548.00</td>
<td>3MB................$3858.00</td>
</tr>
<tr>
<td>3MB.............$1278.00</td>
<td>5MB................$2658.00</td>
<td>4MB...................$2748.00</td>
</tr>
<tr>
<td>5MB.............$1518.00</td>
<td>5MB................$2668.00</td>
<td>5MB...................$2858.00</td>
</tr>
<tr>
<td>9MB.............$1738.00</td>
<td>5MB................$2688.00</td>
<td>6MB...................$3048.00</td>
</tr>
<tr>
<td>T1000XE/20MB with</td>
<td>T2000SX/20MB with</td>
<td>T3500SX/120MB with</td>
</tr>
<tr>
<td>2MB.............$1278.00</td>
<td>3MB................$3358.00</td>
<td>4MB...................$4048.00</td>
</tr>
<tr>
<td>3MB.............$1588.00</td>
<td>3MB................$3358.00</td>
<td>5MB...................$4148.00</td>
</tr>
<tr>
<td>5MB.............$1878.00</td>
<td>3MB................$3458.00</td>
<td>6MB...................$4248.00</td>
</tr>
<tr>
<td>9MB.............$2078.00</td>
<td>3MB................$3558.00</td>
<td>7MB...................$4348.00</td>
</tr>
<tr>
<td>T1000LE/20MB with</td>
<td>T2000/40MB with</td>
<td>T3500SX/120MB with</td>
</tr>
<tr>
<td>2MB.............$1378.00</td>
<td>3MB................$3558.00</td>
<td>4MB...................$4448.00</td>
</tr>
<tr>
<td>3MB.............$1588.00</td>
<td>3MB................$3658.00</td>
<td>5MB...................$4548.00</td>
</tr>
<tr>
<td>5MB.............$1878.00</td>
<td>3MB................$3758.00</td>
<td>6MB...................$4648.00</td>
</tr>
<tr>
<td>T1200XE/20MB with</td>
<td>T2000SX/40MB with</td>
<td>T3600SX/60MB with</td>
</tr>
<tr>
<td>3MB.............$1948.00</td>
<td>3MB................$3858.00</td>
<td>3MB................$4148.00</td>
</tr>
<tr>
<td>5MB.............$2248.00</td>
<td>3MB................$3958.00</td>
<td>4MB...................$4248.00</td>
</tr>
<tr>
<td>T1200XE/20MB with</td>
<td>T2000SX/40MB with</td>
<td>T3600SX/60MB with</td>
</tr>
<tr>
<td>3MB.............$2048.00</td>
<td>3MB................$4058.00</td>
<td>4MB...................$4348.00</td>
</tr>
<tr>
<td>5MB.............$2348.00</td>
<td>3MB................$4158.00</td>
<td>5MB...................$4448.00</td>
</tr>
<tr>
<td>7MB.............$2548.00</td>
<td>3MB................$4258.00</td>
<td>6MB...................$4548.00</td>
</tr>
<tr>
<td>9MB.............$2748.00</td>
<td>3MB................$4358.00</td>
<td>7MB...................$4648.00</td>
</tr>
<tr>
<td>T1200XE/20MB with</td>
<td>T2000/40MB with</td>
<td>T3600SX/60MB with</td>
</tr>
<tr>
<td>3MB.............$2148.00</td>
<td>3MB................$4458.00</td>
<td>4MB...................$4548.00</td>
</tr>
<tr>
<td>5MB.............$2448.00</td>
<td>3MB................$4558.00</td>
<td>5MB...................$4648.00</td>
</tr>
<tr>
<td>7MB.............$2748.00</td>
<td>3MB................$4658.00</td>
<td>6MB...................$4748.00</td>
</tr>
<tr>
<td>9MB.............$3048.00</td>
<td>3MB................$4858.00</td>
<td>7MB...................$4948.00</td>
</tr>
</tbody>
</table>

"If the laptop or notebook you're considering isn't on this list, then maybe it's not worth considering!"

**TOSHIBA T8500 Power Desktop**
14MB RAM, 100MB Hard Disk, VGA Display, Windows 3.1, Excel, Draw, WP-51, etc
ONLY $4188.00

**TOSHIBA T1200F**
2-Floppies, Windows 3.1, 1MB RAM, 2400B Den. Modem
ONLY $1268.00

10% better than the best current advertised price you find on memory upgrades, modems & fax/modems
We want to make your life simpler. Instead of wasting valuable time and effort haggling with various dealers over the phone, we suggest you simply look for the lowest current advertised price you can find on memory upgrades, modems and fax/modems. And that applies to ANY PUBLICATION! Take 10% off that price, and that is what you'll pay us. You see, when you buy memory upgrades from us you're doing business direct with the factory. And everybody knows that nothing beats that. Remember, time is money!!

All prices subject to change without advanced notice. We are not liable for typographical errors.

**tote-a-lap**
"Experts in portable intelligence"
(415) 578-1901, ext. 924 • FAX (415) 578-1914
Limited to stock on hand. All prices reflect cash discounts.
Guaranteed 10% lower than the best advertised price you find on memory upgrades, modems, and fax/modems.

APPLE MACINTOSH

2MB for Apple Macintosh Classic/Classic SE $128.00
6MB for Apple Macintosh IIci/IIciIsi $128.00
4MB for Apple Macintosh II/IIc/IIci $68.00
2MB for Apple Macintosh IIc/IIci $245.00
1MB for Apple Macintosh IIci Isi $998.00

IBM

1MB for IBM PC/XT 286, 386, 586, 586SX, 586/60 $248.00
1MB for IBM PC/XT 286, 386, 586, 586SX $128.00
2MB for IBM PC/XT 286, 586, 586SX $288.00

For Compaq SL7298

3MB $149.00
5MB $248.00
8MB $382.00

SUN MICROSYSTEMS


1MB $119.00
2MB $249.00
4MB $449.00
A 85MB 655.80

TANDY

1MB for Tandy 1000 HD $149.00
2MB for Tandy 280HD $279.00
5MB for Tandy 280HD $382.00

TOSHIBA

1MB for T1000SE/SE/EX/T1000SX $138.00
1MB for T1000SE/EX/T1000SX $228.00
2MB for T1000F/T2000/T3000 $228.00
3MB for T1000F/T2000/T3000 $449.00
5MB for T1000F/T2000/T3000 $655.80

3MB for T1000F/T2000/T3000 Suncl $655.80
5MB for T1000F/T2000/T3000 Suncl $1199.00

1MB for T2200 $228.00
2MB for T2200 $449.00
4MB for T2200 $998.00

We are not brokers. We manufacture each memory upgrade ourselves, which is why we can offer such low prices. Our guarantee is simple: We won’t just meet any advertised price, but will beat any competitor’s current advertised price on memory upgrades you find BY A WHOPPING 10%! Nothing beats doing business direct with the factory. (Note: This guarantee does not apply to closeouts and the like. Competitive price must be presented prior to purchase from us.)

So You Can See, Our Closet Competition Doesn’t Even Come Close
tote-a-lap
"Experts in portable intelligence"
(415) 578-1901, ext. 924 • FAX (415) 578-1914
Limited to stock on hand. All prices reflect cash discounts.

LAPTOPS

Toshiba

T1000XE/2MB with 3MB $1,218.00
T1000XE/2MB with 5MB $1,858.00
T112000XE/2MB with 3MB $1,218.00
T12000XE/2MB with 3MB $2,688.00
T13000XE/2MB with 3MB $3,138.00
T13000XE/2MB with 5MB $3,528.00
T13000XE/2MB with 7MB $3,978.00
T13000XE/2MB with 9MB $4,808.00
T20000XE/2MB with 3MB $1,218.00
T20000XE/2MB with 5MB $1,858.00
T20000XE/2MB with 7MB $2,688.00
T20000XE/2MB with 9MB $3,138.00

T1000VE/2MB with 3MB $1,218.00
T1000VE/2MB with 5MB $1,858.00
T12000VE/2MB with 3MB $2,688.00
T13000VE/2MB with 3MB $3,528.00
T13000VE/2MB with 5MB $4,458.00
T20000VE/2MB with 3MB $2,688.00
T20000VE/2MB with 5MB $3,528.00

Call today and we’ll fax you our most current and most comprehensive price list for laptops and peripherals.
Finding the four best laser printers is easy. Choosing which Canon to buy is a little tougher.

Come on, now—we can't do everything for you. We've produced a complete line of Canon Laser Beam Printers for crisp text and stunning graphics. We've given them features unmatched in their price range—such as built-in scalable typefaces that look great from the finest fine print to poster-sized headlines—with legendary Canon quality.

But we can't tell you that what you need is the compact size (and compact price) of the 4-page-per-minute LBP*-4. You're the only one who knows how convenient its 14" x 16" size and quiet operation would be on your home or office desktop. And how can we even guess what you'd do with the standard video interface for fast, high-resolution applications?

We're not going to insist that you should get the LBP-8 Mark III™ for its 8-ppm speed, or for the ability to boost its standard 1.5MB all the way to 4.5MB. Sure, it can accept our IC cards for additional typefaces and capabilities, but so can the others.

Maybe you never need to print letterhead plus second sheets, or long unattended jobs. So why should we brag about the Mark IIIIT™ with dual paper cassettes that can hold up to 400 sheets? Just because it can combine portrait and landscape text? Big deal—that's standard for Canon Laser Beam Printers.

And unless you want the ultimate in capability and convenience, you'd have no interest in the Mark IIIIT™ with dual cassettes and duplex printing for newsletters, and lengthy reports. Even though, like the others (yawn), it supports all popular word-processing and DTP software.

Visit your Canon dealer—call us toll free at 1 (800) 848-4123 for the one nearest you. We've done our part, with four Canon Laser Beam Printers that set a new standard.

But the hard part is up to you.

Genuine Adobe® PostScript® is now available for the LBP-4 and the LBP-8 Mark III Series printers.

A printer driver kit is provided free with each printer containing all printer definition files currently available on diskette, plus complete installation instructions.

Canon is now available on CompuServe.* Type Go Canon at any "!" prompt to access the Canon Forum.
MODEL Ts totally changed the world of transportation. They cost between $300 and $600, and all of a sudden, people could afford to buy and own cars. The whole world changed because of the Model T, and yet, somehow, we totally neglected the underlying concept—transportation as a whole. Because we didn’t look at transportation as a whole, today roadbeds and railroads are falling apart all over the U.S.

Now we’re at the real beginning of a relatively new industry [the computer industry] that will eventually be the largest in this country. And I am very much afraid we’ll make the same mistake all over again. I’m afraid we’ll continue to go out and buy pieces of hardware with flashing lights and lovely “user-unfriendly” software and totally neglect the underlying subject—the total flow of information through any organization, activity, company, and so forth. We should be looking at the information flow and then selecting the equipment to implement that information flow.

Of course, to use our best equipment for handling the most valuable information, the first thing we need to know is which is the most valuable information. For a couple of decades now, I’ve been asking people how they value their information. I haven’t received any answers, but I have received a really great assortment of blank stares. Some people even question that there’s a difference in the value of information.

I know of an oil refinery that’s operated by computer. Information comes in from marketing and goes to the computer, which opens valves and pushes...
stuff through pipes and tells inventory how much of the finished product has been made. The computer puts out payroll reports and makes out the checks, as well as generating reports on all the activity that occurs.

Let's suppose that two pieces of data simultaneously enter that flow. One comes from a valve out in the plant and says, "If you don’t open me, the plant’s going to blow up. You have 45 seconds to act to save 78 lives and a $120 million plant." At the very same instant, from another part of the system, comes the fact that Joe did 2 hours of overtime. Which is the more valuable piece of information? And what are our criteria?

Finding the Value of Data
Most large companies insure their databases against damage, inability to access them, and other perils. What happens when the insurance company or the FBI asks, “How much is it worth?” Probably one of the biggest jobs we have ahead of us is to determine that value.

We have totally failed to consider the criteria for the value of information. We haven’t even defined our criteria. And yet we must know something about the value of the information and data we are processing.

I think we must create several priorities: the time you have to act on the data and the number of lives and the number of dollars at stake. But there’s another one—the importance of that piece of data in making decisions.

**BYTE ACTION SUMMARY**

The total flow of information through any organization, activity, company, and so forth is what matters. Look first at the information flow, and then select the right equipment to implement that flow. To use the best equipment to handle the most valuable information, you need to know which is the most valuable information. That’s the hard part. How do you value your information?

We have totally failed to consider the criteria for the value of information.
The best got better.

SYSTAT 5.0's new menus make the top-rated statistical program even easier to use.

**New Features**
- Menus or commands - your choice
- Rewritten documentation includes statistics tutorials
- Fast, built-in drivers for SYGRAPH
- Global mapping and many new plots
- Multi way repeated measures
- Interactive stepwise regression.

**Statistics**
- Basic statistics, frequencies, t-tests, post-hoc tests
- Multi way crosstabs with log-linear modeling, association coefficients
- Nonparametric statistics (sign, runs, Wilcoxon, Kruskal-Wallis, Friedman two-way ANOVA, Mann-Whitney U, Kolmogorov-Smirnov, Lilliefors, Kendall coefficient of concordance)
- Pairwise/listwise deletion of missing values, Pearson correlation, SSCP, covariance, Spearman, Gamma, Kendall Tau, Euclidean distances, binary similarities
- Linear, polynomial, multiple, stepwise, weighted regression with extended diagnostics
- Multivariate general linear model includes multi way ANOVA, ANCOVA, MANOVA, repeated measures, canonical correlation
- Principal components, factor analysis, rotations, components scores
- Multidimensional scaling
- Multiple and canonical discriminant analysis, Bayesian classification
- Cluster analysis (hierarchical, single, average, complete, median, centroid linkage, k-means, cases, variables)
- Time series (smoothers, exponential smoothing, seasonal and nonseasonal ARIMA, ACF, PACF, CCF, transformations, Fourier analysis)
- Nonlinear estimation (nonlinear regression, maximum likelihood estimation, and more).

**Graphics**
- Overlay plots
- Drivers for most graphics devices
- Two-dimensional: Error bars, Scatterplots, Line and vector graphs
- Vector, dot, bubble and quantile plots
- Box plots (single and grouped)
- Stem-and-leaf diagrams
- Linear, quadratic, step, spline, polynomial, LOWESS, exponential smoothing
- Confidence intervals and ellipses (any alpha value)
- Smooth mathematical functions
- Rectangular or polar coordinates
- Log and power scales
- ANOVA interaction plots
- Histograms (regular, cumulative, fuzzy)
- Strip and jitter plots
- Gaussian histogram smoothing
- Scatterplot matrices
- Voronoi tessellations
- Minimum spanning trees
- Maps with geographic projections (U.S. state boundary file included, county and world boundary files available)
- Chernoff faces
- Star plots
- Fourier plots
- Pie charts
- Contour plots on regularly and irregularly spaced points
- Control charts and limits
- Three-dimensional: Data plots, Smooth function plots, Vector plots
- Linear, quadratic, spline, least squares surface smoothing
- Typefaces that print in perspective.

**Data Management**
- Import/export Lotus, dBase, and DIF files
- Full screen data editor
- Full screen text editor
- Unlimited cases
- Missing data, arrays, character variables
- Capability to process hierarchical, rectangular or triangular files, irregular length records
- Character, numeric, and nested sorts
- Merge and append large files
- Unlimited numeric and character variable transformations
- Subgroup processing with SELECT and BY
- Value labels and RECODE statements
- Macro processor with programming language, screen control, file manipulation, applications generation, and report writing.

SYSTAT operates on IBM PCs® and compatibles, MS-DOS®, VAX®/Microvax and Macintosh®. Site licenses, quantity prices and training seminars available. No fees for technical support.

SYSTAT. Intelligent software.
PRIORITIZING INFORMATION

Someday, under “Other Assets,” there’s going to be an entry on the corporate balance sheet—“Information”—with a value on it. I asked the IRS how they plan to depreciate the value of information. They didn’t answer me.

A Question of Accuracy

There are some other issues regarding information that we need to address, such as accuracy—correctness of the information that comes from your computer. One year I turned in my budget, and even though it added up right and had beautiful charts in it, it was rejected for inaccuracy. I put it through my computer again, and it came up with the same answers. Certainly, it was correct because it came from the computers. We’ve gone that way for too long.

When one of my supervisors heard about this situation, he decided to find out the possible costs of incorrect information in a data-processing system. He found a section of the privacy law applying to government employees in the military that dealt with this issue.

It states that if there is inaccurate data in a personnel file and, because of it, someone is denied a raise or a promotion or otherwise treated improperly, they have a right to sue the federal government. The fact this law is on the books shows how serious a situation the military considers the possible consequences of inaccurate information. There are few cases an individual is given the right to directly sue the federal government.

This officer decided to analyze the possible costs to the government of inaccurate information in a personnel file. He used a hypothetical case and extrapolated, using statistical probabilities, and estimated the damages in a best-case scenario.

He came up with the fact that in just one possible situation, inaccurate information in a personnel file could cost an organization in the range of $500,000. Now, this half-million-dollar projection was just for one not-so-bad case of incorrect data unintentionally finding its way into a small percentage of one department’s personnel files.

You can use your imagination and multiply that figure by a factor of n. Then you can see for yourself how many millions of dollars of damage (not to mention the grief of those who get turned down for jobs, raises in salary, and so forth) that inaccurate computer information can cause. And the issue can’t be resolved by going to your boss and asking for hundreds of thousands of dollars to correct the files and save the company.
LIKE MAGIC, CREATE SIGNS, LABELS AND STICKERS INSTANTLY!

Introducing the magic of STIKA!
STIKA is the revolutionary, compact and simple sign-making system from Roland Digital Group!
You can use STIKA with or without a computer. The built-in scanner allows you to easily scan and cut artwork (from any original, clip-art or printed piece) to create your own signs, labels, stickers and reverse iron-on transfers from
either vinyl or flock material measuring up to 3" x 23"!
With a wide variety of colors you can apply your creations permanently to walls, windows, cars, RV's, boats, cycles, shirts, hats and a lot more!
The magic of STIKA!
Now the power to cut graphics and text from vinyl and flock rests directly in the palm of your hand.

Experience the Wizardry of STIKA!

1. Scan and Cut. With STIKA's built-in scanner, simply scan the original art or text. Then with one push of a button, STIKA will cut your design in vinyl or flock.

2. Apply. Your design is easily applied to just about any surface with pressure-sensitive vinyl or iron-on flock material.

3. It's finished! Signs, labels or stickers are now ready for permanent display!
SAVE AN AMAZING 60% OF THE DESK OR COUNTER SPACE NOW TAKEN BY A STANDARD KEYBOARD AND ENJOY IMPROVED FUNCTIONALITY AT THE SAME TIME. ACTUAL SIZE IS 273 X 152MM (10.75" X 6.0"). THE NEW MICROTYPE KEYBOARD IS RAPIDLY GAINING accepts as a truly advanced alternative to the original IBM layout for many applications. Reliability of the MICROTYPE has been amply proven through extensive use in trading areas of several major stock exchanges as well as in many banks, brokerages, stores and at factory work stations.

SPACE IS SAVED BY COMPRESSING ROWS (NOT COLUMNS) AND ELIMINATING WIDE BORDERS. RE-ARRANGING AND ELEVATING THE AUXILIARY KEY CLUSTERS ALSO SAVES SPACE WHILE IMPROVING ACCESSIBILITY WITH REDUCED EYESCAN AND HEAD MOVEMENT. KEYS HAVE FULL TRAVEL WITH A LIGHT TACTILLY RESPONSIVE TOUCH. ALL STANDARD FEATURES SUCH AS AUTO-REPEAT, CAPS, NUM AND SCROLL LOCK ARE INCLUDED ON THE MICROTYPE.

PC XT/AT, PS/2 IBM AND CLONE COMPATIBILITY. AVAILABLE IN US AND MOST EUROPEAN LANGUAGE VERSIONS. MADE IN USA WITH 1 YEAR WARRANTY.

ORDER DIRECT FROM STOCK WITH 15 DAY FULL RETURN PRIVILEGES. VISA, MASTERCARD, EUROCARD CHARGES AND COD ACCEPTED.

USA 1-800-DATALUX Fax 703-662-1682 $124.50 + 6.00 s/h
EUROPE 44+306-76718 Fax 44+306-76742 £99.00 + VAT + P&P
CANADA 514-694-0870 Fax 514-694-0871 $189.00 CDN + s/h

OEM AND RESELLER VOLUME DISCOUNTS AVAILABLE. KEYTOP LEGEND AND COLOR CUSTOMIZATION OFFERED.

...BEAUTIFULLY SENSITIVE AND HANDLES BOTH TYPISTS WITH LIGHT TOUCH AND THOSE WHO REALLY BANG AWAY.

COMPUTER BUYER'S GUIDE

"...THIS COULD BE THE PERFECT LAYOUT FOR AN ENHANCED KEYBOARD THAT MUST FIT INTO A SMALL AREA..."

COMPU MAG

DATALUX CORPORATION
2836 CESSNA DRIVE
WINCHESTER, VIRGINIA 22601

DATALUX INTERNATIONAL LTD.
EURO HOUSE
CURTIS ROAD, 11 OLD WATER ROAD
DORKING, SURREY, UK

NEW

A NEW SPACE-SAVER PRODUCT FROM DATALUX — MICROTYPE KEYBOARD AND LCD MONITOR COMBINATION. VGA RESOLUTION, BACKLIT, SUPPLIED WITH ADAPTOR CARD. CALL FOR PRICE AND AVAILABILITY.

A new Space-saver product from DATALUX — Microtype keyboard and LCD monitor combination. VGA resolution, backlit, supplied with adaptot card. Call for price and availability.

PRIORITIZING INFORMATION

Money. We’ve got to find out something about, and analyze, the cost of incorrect information, and it’s a subject we’ve totally failed to address.

The Flow of Information

Consider the concept of a river. It starts with little tiny rills, tiny drops of water going downhill. These drops coalesce into a small brook. That process continues on and on until somebody decides to use some of that water. So, they build a little dam and create a small pool. They use the water there. Then it coalesces again and runs on down and finally gets to be quite a good-size brook, and the brook runs into another dam before it enters a lake.

People use the lake water locally before they send it into the lake itself, from which some of the water flows out into a main river, which goes into some part of the state. Everywhere along the way, there are dams and reservoirs, and the water’s used, coalesced, and sent in a broader stream on down until it finally reaches the sea.

I think data ought to behave this way. It should be collected locally at a branch office or somewhere and used there. Then it ought to be coalesced and forwarded to a regional office and used there, coalesced, and finally end up at a headquarters. Then there also would be a reverse flow that matches the river flow.

Telephone lines parallel rivers. When headquarters decides that something needs to be done, it sends orders back out to all these parallel branches, out to the branch office. That’s a real flow of information, where the data goes both ways, and it’s used locally before it’s sent on down to headquarters. It’s not centralized. There’s no sense in sending every detail that concerns the branch office into Washington, D.C.

It makes sense that when the data-processing and MIS departments within a company look only at the computers and the telephone lines that they control, they’re not doing their jobs. They’re not looking at the information itself, at the value of that information, or at who uses it and why. We have to learn to manage information and its flow. If we don’t, it will all end up in turbulence.

ACKNOWLEDGMENT

The information in this article is from a speech by and an interview with Grace Hopper.

Janet J. Barron is a BYTE technical editor. She can be contacted on BIX as "neural."
Guaranteed upgrade to a 60 MB hard disk for only $499. 
(Contact Altima for details.)

The race is on to see who could make the smallest computer. Only problem is you’re the one who ends up losing. Because as computers get smaller, features become fewer.

That’s why Altima created the NSX computer. It provides you desktop features in a notebook package. All at a price you can afford.

**Large VGA display.** The NSX offers a large size, 10.4" screen with paper-white VGA display. The result is a screen size that delivers up to 50% more viewing area than most other notebooks.

**Full size keyboard and keys.** Unlike other notebook computers that cause you to use a pencil eraser when pushing extremely small keys, NSX provides a full size keyboard and normal size keys. That means working with the NSX is as easy as working with a desktop computer.

**Features that make the difference.** You’ll appreciate that the 2 megabytes of RAM, the 2400 baud modem, and NSX’s send fax capability are all included in the price. And while you’re saving money, you’ll be able to save something else: DATA. Because thanks to exciting data compression software that’s included with every NSX, you can save up to 30 MB* of information.

Why pay more for less? Check out the Altima NSX. It was made to be small. But not to short you on features.

---

*Data compression software increases the capacity of the Altima NSX 20MB hard drive as much as fifty percent.
Windows™ 3.0 enables you to push your PC to new levels of performance and productivity. To take full advantage of its application versatility and powerful features, upgrade your monitor to the Diamond Scan 16L from Mitsubishi Electronics.

With a 16" CRT, the Diamond Scan 16L provides 42% more display area than conventional 14" monitors but without taking up additional desktop space. This larger screen size enables you to see more of the Windows™ graphical environment and work more easily with a variety of on-screen applications at the same time. With the Diamond Scan 16L and Windows 3.0, opportunities are unlimited!

In addition, the Diamond Scan 16L supports today's high resolution graphic standards.

From VGA™ through 1024 x 768, this microprocessor-enhanced monitor is compatible with any Windows 3.0 application resolution.

The Diamond Scan 16L—and Diamond Scan 20L (the larger 20" model)—are both engineered with the latest technology and manufactured using only the finest materials and components available. It's the reason why Mitsubishi™ continues to be the proven leader in monitor quality, performance and value.

Call or write Mitsubishi Electronics today and we'll show you how our high performance 16" and 20" color display monitors can help you open more windows of opportunity. For more information on these or other models in Mitsubishi's comprehensive monitor product line, call 1-800-843-2515.

Mitsubishi Electronics America, Inc., Information Systems Division, 991 Knox Street, Torrance, CA 90502
Mitsubishi Electric Sales Canada, Inc., 8885 Woodbine Avenue, Markham, Ontario L3R 5G1

© 1991 Mitsubishi Electronics America, Inc. Mitsubishi is a registered trademark of Mitsubishi Electric Corp., Tokyo. Windows is a trademark of Microsoft Corp. VGA is a trademark of International Business Machines Corp. Actual untouchable screen images produced from the following companies: Autodesk, Inc. (AutoCAD - Release III), Computer Support Corp. (Art & Letters).
Information overload is something like the weather, only a bit better: Yes, everyone complains about it, but some people are trying to do something about it.

Consider E-mail. Almost every company already has some form of E-mail, and information overload is often as much of a problem with such systems as it is with in-boxes; many users receive anywhere from 30 to 100 messages daily. Handling that amount of mail, especially when you have been away for a day—not to mention several days or a week—is daunting, to say the least.

What's more, the problem will grow worse. The number of electronic mailboxes will soar from 17.4 million in 1990 to 64.7 million in 1995, according to International Data Corp. (Framingham, MA). E-mail systems will increasingly be interconnected, a trend that's already well under way. And beyond the messages themselves lies all that information you may want to find, made available electronically by on-line news, stock quotations, and a host of other services.

**Enter Information Lens**

Information Lens, a research project at MIT's Sloan School of Management, addresses electronic information overload by attacking not just the problem of dealing with the sea of messages many people receive, but also the problem of finding the information people need or want.

Dubbed an *information-sharing system*, Information Lens uses concepts from AI and graphical-user-interface (GUI) design to create a kind of secretary or "intelligent assistant" that can sort incoming messages into meaningful
From Information to Objects

THROUGH A LENS SMARTLY

The Information Lens project ended in 1989, when it was, in effect, transformed into the Object Lens project. Called "the second generation" of the Information Lens system, Object Lens builds on the experience Malone and his team had in using and enhancing the Information Lens. It therefore contains a large number of enhancements suggested for the original project.

These changes created a "significant generalization" of the Information Lens, so that the Object Lens can far exceed it in the kinds of knowledge that can be represented and the ways that information can be manipulated. The result is a knowledge-based system for developing cooperative work applications. Another way its developers look at the system is as a user interface that integrates hypertext, object-oriented databases, electronic messaging, and rule-based intelligent agents.

Like the Information Lens, the Object Lens relies on semistructured templates and rule-based processing, as well as a consistent graphical user interface and an inheritance network. But it goes beyond the Information Lens in that you can represent information not only about messages, but also about many other types of information—for example, people, tasks, and products. Such representation is possible because of the Object Lens's object-oriented database.

Objects and Agents
You create objects using semistructured templates and matching editors. These templates and editors are also based on fields and resemble familiar forms. You can group the objects into customizable folders, which are themselves special kinds of objects. (You can also customize the way a summary of the contents of a folder is displayed, as well as how the objects themselves are shown.)

Finally, the Information Lens's concept of rule sets has been extended to one of rule-based intelligent agents. The agents are semiautonomous: You are in control in that you specify what they do to what, and when, and you can always change or delete them. (You can also have them refer an object to you for action.) They are, however, autonomous in the sense that once you have created them, they can act without your doing anything further if you so specify.

The ability to specify "when" is an important addition to the Object Lens. Not only can you have rules trigger, or "fire," when mail arrives, but you can also specify a time or times for them to fire instead.

Coming Attractions
MIT is making the Object Lens technology (for which it has several patents pending) available for a modest fee. In fact, Beyond and DEC have licensed the technology. In addition, Agility Systems is considering signing a licensing agreement.

Beyond has incorporated some elements of the Object Lens system into BeyondMail (see the text box "Going to Market" on page 182), but it is unwilling to discuss them. Some aspects are, in effect, present now; others are included in the system architecture as a basis for enhancements in later versions of the product.

With its emphasis on managing other kinds of information, Agility Systems' Wilfit looks more like the Object Lens than like the Information Lens (see the text box "From Rules to Agents" on page 186). Perhaps more important, it borrows from the Object Lens in its use of intelligent agents instead of mere rule sets and in its ability to have the agents act at particular times.

DEC has several research projects based on both the Information Lens and the Object Lens. The projects, conducted by the Advanced Development group of the Business Office Systems Engineering division, are in two main areas—advanced information management and interpersonal computing. More specifically, they deal with such areas as the management of mail, news feeds, and other information, and the use of agents to maintain things like appointment calendars and travel itineraries. And last summer at DECWorld in Boston, DEC showed mail filtering and context-based retrieval of information as part of its "Office of the Future."

Lens Elements
Malone's ideas coalesced into a system built on five elements: semistructured message templates (frames, in AI parlance); sets of rules to process messages (AI's production rules); a consistent set of display-oriented (graphical) editors for composing messages, creating rules,
ANNOUNCING

PASCAL+

A High Performance Option For Turbo Pascal Users

We agree that Borland Turbo Pascal® is a great street machine. But when your applications demand the ultimate in performance, the Stony Brook Pascal+ optimizing compiler has the extra power you need — and an unbeatable list of standard features.

DON'T CHANGE A LINE OF YOUR CODE

It couldn't be easier to trade up to Pascal+. We're 100% language-compatible with Turbo Pascal V6. You don't change your Turbo Pascal programs at all. Just compile with Pascal+ and get:

- Execution speeds up to 100% faster
- Code size up to 30% smaller

You get fully optimized code with NO difference in your program's operation!

ELIMINATE ROADBLOCKS

Pascal+ comes fully equipped to handle ANY programming problem you encounter. Unlike Turbo Pascal, we produce standard Microsoft® objects, support all memory models, and give you complete control over procedure-calling and parameter passing conventions.

INSTANTLY LINK TO OTHER LANGUAGES

With Pascal+ it's easy to interface with code written in any other language. This means, for instance, that you can have immediate access to millions of lines of commercial library code written by and for C programmers.

AND WE DO WINDOWS!

Stony Brook Pascal+ comes with full support for Microsoft Windows 3.0. We provide the interface units, and you use the windows API exactly as you would with Microsoft C.

In fact, anything you can do with Microsoft® C or TurboC®, you can do with Stony Brook Pascal+!

So get on the track with Stony Brook Pascal+. You'll qualify for races you never could enter before.

CALL NOW OR WRITE FOR INFORMATION

187 E. Wilbur Rd., Suite 9, Thousand Oaks, CA 91360
Makers of Stony Brook Professional Modula-2 and QuickMod

SAVE $100! WITH OUR SPECIAL INTRODUCTORY OFFER!

Buy directly from us by 7/31/91 and pay only:

<table>
<thead>
<tr>
<th>Product</th>
<th>Price</th>
<th>After Offer Expire</th>
</tr>
</thead>
<tbody>
<tr>
<td>$295</td>
<td>$395</td>
<td>$475</td>
</tr>
</tbody>
</table>

Turbo Pascal and Turbo C are registered trademarks of Borland International, Inc. Microsoft and Windows are registered trademarks of the Microsoft Corporation. Stony Brook Software and Pascal+ are trademarks of Gogesich Micro Systems, Inc.

Circle 287 on Inquiry Card (RESELLERS: 288).
and defining new message templates; a frame-inheritance lattice, or network, for message types; and a public mailbox, called the Anyone server.

- **Semistructured message templates:** Semistructured messages are the basis of the Information Lens system. They make possible the powerful processing and highly graphical display-oriented editors that characterize Information Lens. Using specific message types further expands the potential power of any rules and of the editors. Specific message types also help the system present intelligent options for what you might want to do after reading a message.

Electronic messages, like the paper memos they emulate, already exhibit some structure, specifying basic kinds of information, signaled by To, From, cc, Date, and Subject. Beyond these fields, some types of messages have other fields or provide information that additional fields can easily specify; meeting announcements are an obvious example. Using templates containing appropriate fields makes it possible to automatically process a much wider range of information than you could otherwise. The fields, or structure, represent enough information that simple rules can provide relatively powerful processing, and sophisticated rules can provide even more power. Without fields, you would need an "intelligent agent" capable of natural-language parsing and free-text understanding.

Semistructured messages offer several other advantages, some realizable even without automatic processing. A simple one is standardization, given that everyone in a group or organization uses the same message types. Another advantage is having essential information, like an action request and its deadline, immediately apparent in its own fields, instead of requiring you to read a message to find out what you have to do and when it has to be done. (On the other hand, semistructured messages still give you the flexibility to say anything you want in the text field, and the fields can be edited as desired.) Message types and their fields reflect the processing that people naturally do with the messages and mail they receive.

- **Rule sets:** Rules consist of a test (IF) imposed on the information in the fields (and, if specified, in the free-text part of a message) and an action (THEN). Grouped into sets, they allow much more powerful processing than simple Boolean queries, enabling you to specify extended reasoning chains about what you want done with your messages and any information available from on-line services.
- **Display-oriented editors:** Graphical editors—also called direct-manipulation editors—that resemble what is being edited greatly simplify the editing process, making it easy even for novice computer users. Information Lens uses three similar editors: one for composing messages, one for creating rules, and one for defining new message types. All are based on representations of message types, and much of the editing is done using menus of options.

- **Inheritance network:** Organizing the message types in an inheritance network simplifies the definition and use of semistructured messages and of the processing rules as well. With the inheritance network, which is an aspect of object-oriented design, certain types of messages are special kinds, or subsets, of other types of messages and automatically inherit properties and processing rules from the more general message type (i.e., the parent) they are descended from.

- **The Anyone server:** The Anyone server is the only one of the five basic elements specifically designed to let you go out and find messages or information not addressed to you. It is a public mailbox that runs on its own workstation and acts in some ways as a postal substation. You can send a message to Anyone, in addition to the designated addressee or distribution list, indicating that the message may be automatically redistributed to anyone who is interested. On-line services could also be fed into Anyone. The Anyone server then distributes its messages and feeds according to the processing rules for selection that individuals have written (see figure 1).

**Figure 1:** An intelligent public mailbox, the Anyone server receives messages that include "Anyone" as an addressee and redistributes them according to rules written by individual users.

To Have or Have Not

Taken together, the above elements yield a system that offers a distinct advantage over most other intelligent systems: incremental adoption, both by individuals and by groups. In Malone's phrase, you don't have to "scale a cliff of learning" before receiving any benefit. Instead, you can adopt the Information Lens system in a "series of small steps, each of which requires only a small amount of learning and provides an immediate benefit, and each of which can be taken or not taken," as you prefer.

In other words, you could initially adopt the most basic feature of Information Lens—message types (templates)—

**BYTE ACTION SUMMARY**

As an MIT-based research project, Information Lens focused on methods that let you handle large amounts of E-mail and other on-line communications. Many of the intelligent-assistant concepts developed for Information Lens are now being applied to commercial products.
World-class Optical Storage for Novell

COREL announces the finest in data security and mass storage for Novell networks. As the world’s leading developer of optical interface software for IBM and Macintosh computers, COREL brings you its award-winning line of optical disk sub-systems, the most powerful NetWare compatible optical drives on the market today. Whether you need the permanence of WORM storage, the convenience of erasable optical or the power and flexibility of our new multi-function drive and CD-ROM drives, COREL offers you the most flexible and effective storage solutions anywhere, providing massive archiving capabilities and exceptionally high security options.

COREL software is completely compatible with Novell NetWare utilities, security levels, and all existing applications. The world’s leading developer of optical disk interface software invites you to make the networking breakthrough. For details, contact COREL Systems today!

Corel Systems Corporation: the universal choice for optical innovation.

Circle 77 on Inquiry Card (RESELLERS: 78).
Beyond (Cambridge, MA), a productivity-software developer for personal computer users, is readying a product, BeyondMail, that’s based on the Information Lens project from MIT. The company was founded in mid-1988 by Charles Digate, a former senior vice president of analytic products (spreadsheets) at Lotus Development (Cambridge, MA).

Digate’s first employee was Eugene Lee, who received an M.S. in management from MIT’s Sloan School of Management, where he took one of Thomas W. Malone’s classes.

Lee is now director of product planning for Beyond. He is responsible for the overall architecture of Beyond’s product line, the detailed definition of the products, and management of the development organization.

Beyond seems to have taken the Information Lens approach—to create a system that helps but doesn’t necessarily solve the whole problem—even more to heart than the original developers did. The company has scaled back the reach of Information Lens, discarding not only the Anyone server and the idea of giving people the ability to find information that was not sent directly to them, but also the frame-inheritance network.

Nevertheless, Beyond has added several useful capabilities and features to the Information Lens concept. The most significant of these enhancements is the ability to launch an application from within the program.

BeyondMail uses the three other basic elements of Information Lens—semistructured message templates, processing-rule sets, and display-oriented editors—and a similar capability for incremental adoption.

The product is itself a complete E-mail front end. The company also stresses BeyondMail’s role as a personal productivity tool for mailbox management and its function as a potential platform for the development of workgroup applications.

Currently, BeyondMail has three message types: the standard E-mail form, a phone message, and a request form. A meeting-announcement type is nearing completion, and Lee says that a fifth message type will be added by the time BeyondMail ships.

With BeyondMail, you can create multiple rule sets—for instance, a standard set, one for when you are traveling, and one for when you are on vacation—and you can turn the sets on and off as needed. Another added feature is that you can send and share your rules with others.

Also new is the AutoTickle. With this feature, you can have the program automatically “tickling” a message, moving it into a folder when it is time for you to do some particular task—such as return a phone call to someone who has been away.

You can also use rules to create beeps or customized visual alerts to signal you when certain kinds of messages arrive. Finally, you can configure BeyondMail’s initial setup, so that it can, for example, start your e-mail session by showing you a list of those messages marked urgent.

BeyondMail was announced on January 28 and demonstrated at NetWorld ’91 in February. The initial release, for IBM PCs and compatibles, uses Novell’s Message Handling Service standard for LAN messaging. It also works with native MHS products (e.g., Da Vinci eMail), through gateways, with public E-mail systems (e.g., cc:Mail, MCI Mail, and All-in-1), and with systems that conform to the X.400 standard.

BeyondMail runs in character mode under DOS or Windows 3.0 (a native Windows version is in development). The program requires at least a 286 processor and 1 megabyte of RAM. Ship- ment is slated for the middle of this year. The price is $250 for a single-user copy and $1395 for an eight-user LAN package.
Anti-Obsolescent.
Forval Super High-Speed V.32bis/V.42bis Modems.

Enhancements for your modem are just a phone call away. Simply dial FORVAL's headquarters and FORVAL-Link™ assures speed or feature upgrades automatically.
Your modem is protected against obsolescence.

With FORVAL Turbo Interface™, data integrity is ensured even at speeds greater than 19.2Kbps.

Modem can be used horizontally—or vertically when you need to save desktop space.

Now you can get all this for the same amount you would spend on an ordinary V.32 modem.
Introducing the SA14400 from Forval. The first super high-speed modem designed to discourage obsolescence.
And don't worry about compatibility. Forval modems are compatible with all dial-up modem standards. So you can talk to anyone. Anywhere. No matter what the line conditions.

Your investment is also protected with a five-year warranty. And free high-speed communications software is included in the package.
So if you want a super high-speed modem that has it all, think of us. Forval.
To learn more about our complete line of modems, call us today at 1-800-FORVAL-1.
FORVAL AMERICA, INC., Modern Division, 6985 Union Park Center, Suite 425, Midvale, Utah 84047, Tel: (801) 561-8080, Fax: (801) 561-8777.

The Modem With A Future.™

©Copyright 1991, FORVAL AMERICA, INC. FORVAL-Link and FORVAL Turbo Interface are trademarks of FORVAL AMERICA, INC.
Circle 124 on Inquiry Card (RESELLERS: 125).
and then proceed to adopt other features at various times. By using just the message type component, you would obtain the benefit of standard, semistructured forms (plus, in some cases, fields with default values filled in).

Adopting simple rules gives you useful automatic processing procedures, and you can go on from there. You gain much of the benefit of rule-based processing even if no one else uses the system, since all E-mail messages contain basic fields on which your rules can work. By gradually adding new rules, you can continually increase the usefulness of the system. When groups of people who communicate frequently with each other all use the same message types, they gain further benefits from standardization. More important, as they increase the usefulness or power of their rules, they gain the ability to create applications that support a variety of coordination and communication procedures, like task tracking. By creating new message types and applications, groups, too, can continually increase the system's usefulness.

**The Lens in Action**

Information Lens was first implemented as a prototype system, mainly through the work of Kenneth R. Grant, who was a research staff member at MIT at the time. The system was under development in various forms throughout the project's lifetime. Written in Interlisp-D using Loops (an object-oriented extension of Lisp) and running on Xerox 1100 series workstations connected by an Ethernet network, Information Lens was built on top of the existing E-mail system. Thus, people could keep using the existing E-mail system and be free to adopt as much or as little of Information Lens as they wanted.

Information Lens has three basic message types—Action Request, Notice, and Commitment—that are distinguished by purpose, as well as a general, all-embracing message type called Message (see figure 2). Below those three basic types, the researchers created a variety of others; some are general enough to be applicable to any organization, such as Meeting Announcement, and some are

---

**Figure 2:** The message templates are arranged in a network with more general types (to the left) and more specific types (to the right).
specific to the Information Lens project, such as LENS Meeting Announcement. The more general a message type, the more likely it is to be applicable to a variety of organizations.

The template for each message type contains a number of fields. Associated with each field are three properties: a default value, a list of possible alternative values, and an explanation of why that particular field is part of the template. Some templates may have some of their fields' default values already filled in (see figure 3).

To compose a message, you click on the message type you want, as listed in the message network. The template appears on the screen. Clicking on a field brings up the basic editing menu for that field, showing its name and giving you a choice of viewing the default value, the explanation of the field's purpose (if you are not familiar with the template), or the list of alternative values (see figure 3). If you choose a value, it is automatically inserted in the text of the field. You can also directly edit any field at any time.

To find, filter, or sort messages, you call up the rule editor. This editor uses rule templates based on those used for the message types (see figure 4). It includes the fields of the message type that you have chosen, plus other appropriate fields for the IF section, as well as a field for the THEN section. Pop-up menus appear on the left side of the screen to aid you in filling in the fields.

Because of frame inheritance, message types inherit the rules of all the types above them in the message network. However, just as with the fields and field characteristics that a message type inherits, you can delete or change any inherited rule.

**Shifting into Automatic**

To create a rule, you choose the message type you want it to apply to, select Edit a Local Rule Set, and then select Add. (Local rules are those that apply to individual mailboxes.) To specify the IF part of a rule, you fill in selection specifications for the message fields. The simplest kind is a string.

You can create more complex specifications by combining strings with AND, OR, NOT, and parentheses; in other words, you can use arbitrary Boolean combinations within any field. If you create specifications for more than one field, all the specifications must be met for the action to occur; that is, the specifications in different fields are combined using an AND operation.

To specify an action, you click on THEN and choose from the menu. Typical actions put a message in a specific folder (Move To) or remove it (Delete) (see figure 5). The system includes the ability to create folders. Move To and Delete do not physically expunge a message; in the case of Move To, therefore, subsequent rules can put copies of a moved message into other folders.

Every rule template includes a field labeled Characteristics. You create a rule to set the characteristics of a message; then you can create other rules to test a message for those characteristics. For example, you could create a rule that determines whether a message is from a VIP (e.g., if the message is from President Bush, then it's a VIP message) and then test for that characteristic using other rules.

This mechanism has the obvious advantage of eliminating the need to repeat the specification of who is a VIP in all the rules that test for that characteristic.

---

**Figure 4:** Rules for processing messages are composed using the same kind of editor and the same templates as those used for composing messages.

**Figure 5:** Examples of simple rules. Move To (a) and Delete (b) are two basic actions. The action can be to set a characteristic, and another rule can test for that characteristic (c).
From Rules to Agents

Agility Systems of Waltham, Massachusetts, was founded in August 1989 by John Landry and Thomas W. Malone to, in Landry's words, "exploit some of the things that had been done with the Information Lens system and to develop other things that Malone had not thought of." It is now readying such a product, which also incorporates an element of the Object Lens system.

Agility retained much of the "information-sharing" nature of the Information Lens—that is, both the basic management of electronic messages and the information-finding aspect. The latter function, however, is directed not at public messages but, rather, at on-line services and a company's internal databases. (In other words, there is no Anyone server.) Thus, the system is aimed at people who don't want to be bothered with the syntax of, say, the CompuServe services or Structured Query Language (SQL) queries for relational databases. Indeed, when describing Agility's WiJit (for With Information Just in Time) product, Landry puts the use of E-mail to get information out of public and private database systems above the management of internal E-mail.

WiJit in Action

In addition to Information Lens functions and features such as incremental adoption, WiJit adds the Object Lens system's more powerful concept of semiautonomous agents (see the text box "From Information to Objects" on page 178). With agents, you group sets of rules together to take actions for you at a time or times that you specify. Indeed, Landry says that WiJit is "truly agent-based software." As such, he continues, the product makes possible "deferred connectivity," rather than real-time connectivity, to external and internal databases.

Like the Information Lens, WiJit runs on top of an existing mail system. It starts with three of the basic Information Lens elements: message templates, rule-based processing, and graphical editors. While Information Lens enables you to apply rules to just your inbox, WiJit applies them to the contents of a particular folder according to the specified status of the documents or messages—for example, new, opened (read), or all.

More specifically, as with the Information Lens, you group your rules into sets, called tasks in WiJit. An agent performs a series of tasks in order. Thus, you could have WiJit dial up the Dow Jones News/Retrieval every day at predetermined times, get specific stock quotes, arrange them in a particular way, and put them into a Stock Quotes folder. You could even have WiJit signal you if a stock rose or fell beyond a specified range. WiJit includes an interface to DynaComm, a Windows-based communications link. Through Windows' Dynamic Data Exchange, you could also have the quotes put into a spreadsheet and launch your spreadsheet program.

Furthermore, you can program the system through messages—what WiJit calls "metatags." That is, you can install a new message template using the Install New Template message and a new agent using the Install Script message.

WiJit runs under Windows 3.0 on PCs with a 286 microprocessor or high-

your actions are limited to Show and setting characteristics. Show causes Anyone to pass the selected messages to the central mail server for distribution to your mailbox.

In addition to individual rules, Information Lens lets groups construct more sophisticated rules for dealing with specialized message types. Thus, groups can create applications that automate a variety of communication and coordination procedures, thereby increasing the benefits to be gained from using Information Lens.

Finally, you can edit message types for your own use. You click on the message types you want to change and select Edit Message Template. The message template editor appears for that particular message type, and you then modify any property of any field in the template in much the same way that you would create a message.

New message types are created by the message template administrator. He or she has a more powerful template editor that works similarly but also specifies new message types for the system. Each new message type inherits the fields and properties of its parent unless the admin-
er. There are plans for a version that will run under OS/2 Presentation Manager, to be developed shortly after the DOS Windows release, as well as for a version for the Macintosh sometime later.

**Future WiJit**

WiJit was scheduled to be formally introduced at the Platforms for Computing Forum on March 16 in Tucson, Arizona. It was supposed to be ready for beta shipment shortly thereafter. The exact product status and timing are uncertain, however, because Landry became executive vice president for R&D at Dun & Bradstreet Software in December 1990. As this article was being prepared, the Wall Street Journal reported (February 28, 1991) that WiJit is “likely to be acquired by Dun & Bradstreet’s software unit.”

According to Landry, D&B is “in an excellent position to use WiJit as a key component of a new system architecture.” He also notes that easy access through E-mail makes all the parent company’s information more valuable. Therefore, he is “very confident” that D&B will use the WiJit technology. The question, he says, is whether Agility’s arrangement with D&B will be exclusive. If so, that puts the schedule for beta testing and general release, as well as pricing, in D&B’s hands. If not, others, too, may license the WiJit technology. Agility will probably continue as a company, but it may not sell products to end users.

**Future Lens**

Information Lens is an extremely powerful, flexible system for coping with the information overload of E-mail and online-service users. It gains much of its power from rule-based processing and the use of semistructured message templates, and much of its ease of use from GUI design concepts. Much of its power also comes from its firm grounding in how people already process information.

In addition to providing the basis of the ongoing Object Lens project at MIT (see the text box “From Information to Objects” on page 178), the concepts embodied in Information Lens are also beginning to appear in commercial products (see the text boxes “Going to Market” on page 182 and “From Rules to Agents” at left). The first of these will appear this year.

Information Lens is capable of doing so much partly because its developers had a seemingly modest goal: They sought to develop a “somewhat intelligent” system, not an intelligent, autonomous one. What they came up with was, as Malone rather modestly puts it, “a system that can give you some help but does not have to solve the whole problem.”

**ACKNOWLEDGMENT**

I’d like to thank Professor Thomas W. Malone of the Sloan School of Management at MIT for his extensive cooperation in preparing this article.

**BIBLIOGRAPHY**


Mike Robinson is a freelance writer and editor in Lexington, Massachusetts, specializing in a variety of electronics technologies. Previously, he served as managing editor at the Technology Research Group (Boston, MA), a strategic consulting and market-research firm focusing on advanced electronics technologies for industry. You can reach him on BIX c/o “editors.”
A PC that looks good in your office won't look good for long out in the plant. Heat murders microprocessors. Dust decimates disk drives. Vibration victimizes video cards. Any or all can wreck your entire operation.

The Texas Micro line of rugged, reliable ISA Bus products and systems are specifically engineered for those brutal industrial environments that eat pretty PCs for breakfast.

**Durability built in from scratch**

To ensure maximum durability we design and manufacture from scratch practically everything that goes into our systems, like passive backplanes which we pioneered for microcomputers in 1983. These backplanes accommodate a full complement of convenient, plug-in components, all compatible with Compaq DeskPro®. They're why our Mean Time To Repair (MTTR) is a phenomenal 10 minutes.

You won't find passive backplanes—or lower MTTR—in any of the leading office PCs.

**More options mean more choices**

We also build industrial-strength option cards to handle myriad functions, in addition to our 286, 386SX™, 386DX™ and 486™ CPU cards in a full range of processor speeds. Our CPU card designs use Very Large Scale Integrated circuits and programmable array logic devices to reduce component counts by 50–60% which enhances reliability and resistance to physical stress. Ultimately, the design contributes to our remarkably long Mean Time Between Failures (MTBF): 70,000–100,000 hours, calculated against the MIL Standard Handbook 217E.

You won't find that kind of card selection—or MTBF—among the leading PC makers.

**We pretest, test, and then retest**

You won't find them torturing their systems like we torture ours either. Not only do we perform extensive "shake, rattle and roll" tests on each new design, we pretest all our systems before they leave our dock. We burn them in at 55°C/131°F for 48 hours straight.
just to make sure they can take the heat.

What's more, we shock mount our disk drives to stand up to vibrations surpassing Richter scale proportions and we use only high-reliability power supplies that can go for 100,000 hours MTBF.

**Our guarantee is your guarantee**

With all this reliability designed into our products, is it any wonder that we guarantee better support than any of the other leading PC makers? Every system comes with a full one-year, on-site warranty. Theirs don't. We also offer a toll-free number for technical and sales information, a regional network of sales engineers and engineering support for system integration.

**Why the competition is no competition**

<table>
<thead>
<tr>
<th></th>
<th>Backplane architecture</th>
<th>Shock mounted drives</th>
<th>48Hr burn-in at 131 degrees</th>
<th>Total ISA slots</th>
<th>100,000 MTBF Power supply</th>
<th>Built like an M1A1</th>
<th>Manufacturer SRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compaq 386SX Model 86</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>5</td>
<td>No</td>
<td>No</td>
<td>$3699</td>
</tr>
<tr>
<td>Texas Micro 2003</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>10</td>
<td>Yes</td>
<td>Yes</td>
<td>$3990</td>
</tr>
</tbody>
</table>

Both systems similarly configured with 2MB RAM, Texas Micro-104MB hard drive, COMPAQ-84MB hard drive, 1.2MB Boppy, VGA graphics, keyboard, monitor not included, purchase price discounts may vary by quantity and reseller.

**Tough systems at gentle prices**

The leading office PCs may look prettier than ours. But our industrial-strength systems are designed to be more reliable, and to do it for no more money than it costs for the fancy office system.

Which makes a Texas Micro PC look a whole lot better in two places where it really counts:

Your production line and your bottom line.

For technical or sales information, call: **1-800-627-8700**

Mission Critical Benchtop 2003: With 10 option slots and 2 drive bays the 2003 makes desktop computing possible in extreme environments. A complete 386SX system from $3950 without monitor.

Circle 303 on Inquiry Card.
MicroWay's IBM compatible Monoputer, Quadputer, Videoputer, and Linkputer boards work together using INMOS transputers to provide expandable, plug-in mainframe performance for your desktop PC.

**NumberSmasher-848™**

Personal Workstation magazine, June 1990, said, "The NumberSmasher-486 lives up to its name as a number cruncher. Many of all 25 MHz systems we've tested to date, it gives you top 486 performance for the best price." NumberSmasher-486™ — MicroWay's family of 486 motherboards includes ISA and EISA models running at 25 and 33 MHz. All take advantage of 486 Burstmode and the top of the line includes a 256K second level cache, and SIMM sockets for up to 64 megabytes of RAM, and a 4167 socket.

**Math Coprocessors**

WEITEK, INTEL, CYRIX

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>80387-16 SX</td>
<td>$280</td>
</tr>
<tr>
<td>80387-20</td>
<td>$300</td>
</tr>
<tr>
<td>80387-20SX</td>
<td>$345</td>
</tr>
<tr>
<td>80387-25</td>
<td>$359</td>
</tr>
<tr>
<td>80387-25SX</td>
<td>$375</td>
</tr>
<tr>
<td>80387-33</td>
<td>$449</td>
</tr>
</tbody>
</table>

---

**The i860 Has Arrived!**

Nine years ago, MicroWay used a similar headline to proclaim the arrival of the Intel 8087. In 1982, our runtime libraries made it possible to use an 8087 with the IBM FORTRAN, BASIC and PASCAL compilers. Since then we have sold hundreds of thousands of INTEL math coprocessors. We think that the 8087 is still the best single instruction that can do everything from designing refineries to predicting the weather.

One of the first major customers for the i860 was Number Smasher-860. We developed the compiler to drive the i860. These compilers include features that make porting from the 866 or VAX a snap, including Intel VAX coprocessor and MC extensions to NDC. We also offer a growing list of tools that make it easier to take advantage of the i860 (see descriptions below).

How useful are our languages? Each NDP compiler comes with an i860 DOS Extender that makes it possible to call MS DOS directly from an i860 application. Our FORTRAN 860 graphics library includes the MS C graphics routines as a subset and automatically drives all popular video adapters. If you are reluctant to run an 80 megaflop processor under MS-DOS, we can provide device drivers and interfaces that let our board run the three popular flavors of UNIX or run on a UNIX network as a computation server. If you prefer DOS, like most of our customers, we have versions of our extender that are compatible with both DESQview and Windows 3.0. To sum it up, about the only excuse you have for not switching to a Number Smasher-860 is that you either enjoy waiting to get results back or you get a thrill spending the hundreds of dollars per day it costs to rent a 390 or Cray.

For more information, please call MicroWay's Technical Support Dept. at (508) 746-7341.
How important is it to manage network data? In 1989, an Infonetics Research Institute (San Jose, CA) survey of Fortune 1000 companies found that networked corporations lost nearly $3.5 million annually in employee productivity due to LAN downtime, some of which was directly related to failed storage devices. These same companies reported annual revenue losses in lost data and lower employee productivity averaging more than $660,000. Data management in networked environments can significantly reduce these losses.

Before the personal computer explosion, data management followed a simple procedure in a mainframe environment. A mainframe system typically has a CPU connected to terminals for input, peripherals (e.g., printers and plotters) for output, and storage devices for filing and archiving data and holding applications software. Its storage devices usually take two forms: hard disk drives, or direct-access storage devices (DASDs), for primary on-line storage and for application program and file retrieval; and tape drives for secondary off-line storage and archived-data retrieval.

The classic pyramid-shaped storage hierarchy (see figure 1) is a good model for data management on mainframes. DASD space is allocated on the basis of user privilege, usage, and media cost. The operating system provides centralized systems-resource management in this single-vendor environment.

The advent of the personal computer made managing data easier for the individual—a one-on-one, or single-dimension, task. While personal computers do
not require the extensive data management software used on mainframes, they do need simple tools to help you back up and navigate through your hard disk's data. The pyramid storage-hierarchy model, although not necessary in this simpler environment, still applies.

When LANs came on the scene, realizing the benefits of combining personal computer power, data management took on another dimension. With more than one person using the data, how do you manage it? Who is responsible for backing up the file server and the hard disk? How do you prevent file servers from running out of space, and when they do, how do you get rid of the old, unused files? Are the shared resources of the network being used to their greatest advantage?

A third dimension was added when diverse hardware, operating systems, and applications software became more available and the need or desire to combine these data resources arose. Trying to shoehorn multiple personal computers and network operating systems, vendors, and network-transport protocols was too much for the classic pyramid model, and the concept of client-server computing was born.

The Client-Server Concept
Client-server computing formalizes the natural distinction in an application between those components that request services and those that provide them. This model's advantages over traditional networking include the following:

- It acknowledges the personal computer or workstation as the desktop device of choice;
- It takes advantage of the unique computing, networking, storage, and printing capabilities of the desktop device and the specialized servers;
- It recognizes the benefits of networking flexibility, modular expansion, and compatibility of resources in dissimilar systems.

According to Forrester Research (Cambridge, MA), client-server computing will continue to emerge as a distinct market through 1992, and by 1993, that market, including associated software and services, will total $2.9 billion in sales.

Distributed Processing
Personal computer networks can also be very efficient computing tools when they are used in a distributed environment. Distributed processing lets you allocate computing tasks in the most efficient way. For example, a specialized task like CAD might be allocated to a system that has a special large-screen monitor.

The ability to distribute the processing makes a network more flexible and efficient than single-host processing. Since networks are composed of many intelligent machines, any of them, regardless of whether they are file servers or workstations, can support the processing.

Since distributed processing allocates system components among processors, the key to its sound implementation is an effective interprocess communication mechanism. The resulting system is more robust than a client-server implementation because client-server architectures do not take full advantage of the network's capabilities.

It's important to realize that distributed computing does not automatically indicate dynamic load balancing. (Dynamic load balancing refers to real-time allocation of computing power among the requesting network applications.) Applications can be distributed a priori. For example, you decide which machine to install a server process on, and it stays there. If a task requires data or some other resource that resides only on that machine, the server process may not be able to offload it dynamically.

Distributed Applications
Distributed applications form a special case for the client-server model. In a

BYTE ACTION SUMMARY

The problems of managing data on a single computer are significant enough, but when you add the complexity of a LAN, and a heterogeneous one to boot, the problems can become overwhelming. Proper data management enables you to ensure data integrity, manipulate data, obtain detailed reports on data usage, and completely recover your data after a catastrophic failure—a major money-saver. Data management applications let you view, organize, and secure your data in a fully distributed environment.
Developers: Lock Up Your Profits

The ProTech 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. The solution, ProTech.

- Custom hardware and software for each developer
- Encrypted interrogation routines and debug disablers
- 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

ProTech's the key. Call us for more information or a demonstration package.

1-800-843-0413

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

Circle 261 on Inquiry Card.
distributed application, a process may be a client for its own native workstation and a server for everyone else. The distinction between client and server depends on who you are within the network. If the process on your machine requests services from another machine, it is a client; if it has services requested of it by other machines, it is a server.

The implications of distributed applications oftentimes relate to their modularity. In the particular case of data management, it is likely that each application will be sold as a separate product. At the moment, backup, server-based backup, librarian, and related products (e.g., virus protection) are sold by separate vendors.

Even as greater numbers of vendors sell more applications, the software will in all probability be packaged and priced separately so that customers can pick and choose exactly what they want. This is particularly true as vendors start to support different operating systems and CPUs. In the future, modular packaging and pricing will become the rule rather than the exception with distributed-applications software.

Data Management
Leading industry analysts define data management as “the administration of data in a system such that it can be stored, backed up, cataloged, retrieved, and protected in the most cost-effective way.” Data is the lifeblood of all computing needs, and it is imperative to maintain its integrity.

Proper data management enables you to ensure data integrity, manipulate data, obtain detailed reports on data usage, and completely recover all data after a catastrophic failure.

According to Peripheral Strategies (Santa Barbara, CA), 1.3 million personal computer LANs were in operation worldwide in 1990, and 38 percent of all personal computers installed worldwide were connected to them. Peripheral Strategies predicts that by 1995 LANs will number 2.4 million worldwide, and the percentage of business personal computers attached to them will increase to 89.2 percent.

As LANs support more users and interconnect with other LANs and wide-area networks, new strategies and methods for managing these large, multivendor networks will be needed. Several approaches become more important when managing data in a multivendor environment.

One approach, enterprise networking, is well suited to large multivendor networks. This approach provides a managed backbone that LANs can attach to and receive services from. This allows organizations that span continents to be maintained as one unit.

However, data management is typically left to local network administrators, while a centralized support staff handles backbone maintenance. The local network administrator still has to perform backup and data management duties. This approach forces local sites to handle data management.

Unlike the traditional client-server method, which processes each request for shared information through the file server, the peer-to-peer services approach identifies each of the workstations as an entity in the network and allows communications and resource sharing between entities without the intermediary functions that a file server performs. Thus, each workstation ap-
pears to be a small server of resources.

Another approach you may want to incorporate is directory and naming services, a component of several network data management environments. Similar in concept to the White Pages and Yellow Pages of a telephone book, these services map names to network addresses and provide lookup and cataloging of hardware, users, and system resources. You can search network addresses by name, as in the White Pages, or by service type, as in the Yellow Pages. Directory and naming services are becoming key resources of the network and its management.

The Challenge
Different networks are made up of differing host computers, operating systems, and file systems. A typical networked environment might consist of several PCs on a LAN running Novell’s NetWare or Microsoft’s LAN Manager, connected to another LAN with several Macintoshes using AppleShare. The LANs may all be Ethernet-based, but the similarities will probably stop there.

As more and more network software vendors enter the market, the more complex data management becomes. Single-source support for all of these multivendor environments is not available. Data management in these environments must provide a seamless, transparent, and logical method of managing data and address each of the following issues:

- **Storage requirements.** As more companies have realized the potential of the networked personal computer as a business machine, the size and complexity of applications and data have grown. Many networks now face increased requirements for both primary on-line and secondary off-line storage. It is not unusual to find networks with 1 gigabyte of primary storage and, in order to provide sufficient backup capacity, several gigabytes of secondary storage.
- **Ease of use.** Data management must also be made easy. Graphical user interfaces have made applications development much easier by providing an intuitive environment. GUIs can be useful tools here as well.
- **Shared resources.** Following the client-server model, data management software should offer shared resources. A data management server must be able to handle requests from multiple clients at the same time. In addition, access to offline storage devices must be provided in a distributed, multiuser fashion, whether the device is attached to a file server or another workstation in the network.
- **Interoperability.** This is the key to network industry growth. It allows client-server environments from multiple vendors to work together. The focused efforts of the major desktop and network operating-system vendors are necessary to achieve successful interoperability. With effective data management solutions and interoperability, heterogeneous computer systems can offer effective and viable enterprise-networking solutions (see figure 2).

The Solution
A network data management system is an example of an application that can benefit from distributed computing. This architecture separates the various components of the system: peer-to-peer communications, front-end applications, and storage-management services. The front
end runs on the workstation and becomes a client for data management services. The back-end server centralizes data management processes and services requests from all the clients.

Distributed applications yield several benefits. A well-designed distributed application reduces network traffic by centralizing some processes that all users can share and by allocating other processes to individual workstations. This improves the performance of the network and the application, particularly when using shared resources like tape backup. Modularity in distributed computing is more flexible, making it easier to manage and install additional components.

The following elements help to ensure data integrity on networks. They are particularly effective when designed as distributed applications that can interact with each other throughout the network:

- **Data backup and transfer, and hard disk navigation.** In a distributed environment, this element should provide all network users and administrators with a
Printer Sharing Solutions

5 or 10 Ports

- Reliable Automatic Switching
- Easy to Install and Use
- No PC RAM Memory Required
- Toll-Free Technical Support
- 45-Day Money-Back Guarantee

Save Money by Sharing Office Resources:

The SL is the peripheral sharing solution which enables everyone to share lasers, printers, plotters, and modems. The HWP is ideally suited for sending large graphics files, but is economical enough for any kind of printing within a small workgroup.

Greater access by more users reduces unproductive idle time and the expense of purchasing additional peripherals. With a buffer, all users can simultaneously send print data and quickly release their PCs to continue working.

AS-41 5 Ports $200

Smart Switch – No Pop-up or Buffer:
Four parallel inputs to one parallel output, electronic automatic switch with no buffer

SPPS (not shown) $100

Interface Converter – No Buffer
Combination serial-to-parallel, or parallel-to-serial interface converter in a single unit; low-power CMOS design derives power from serial connection, no power supply needed; supports 9,600 to 115,200 bps, DIP switch configurable

BUFFALO

We are the world's largest manufacturer of buffered data switches for PCs which assures your getting the best value and highest performance from our products.

Call For More Information
(800) 345-2356
Fax (503) 585-4505

Buffalo Products, Inc.
2805 19th St. SE, Salem, OR 97302-1520

Circle 399 on Inquiry Card.
FROM PYRAMIDS TO PEERS

DISTRIBUTED-APPLICATIONS CONNECTIONS

Process 1

Peer-to-peer connection

Process 2

Process 3

Figure 3: Distributed applications connect much as Tinkertoys do. Instead of using multicolored sticks, however, they connect via the network and peer-to-peer communications.

pictorial (icon-based) view of both the file server and all published local hard disks on a network. (When a local workstation makes some or all of its hard disk data available to other network users, that disk is considered to be published.) This workstation would also contain the utilities necessary to transfer data anywhere in the network and to back up the data, either to a local tape device or to another tape device in the network.

• **Peer-to-peer.** This element provides communications between all clients in a network. It is a required addition in networks where peer-to-peer facilities do not already exist. Peer-to-peer communications should operate over several network protocols (IPX, NetBIOS, AppleTalk, and TCP/IP) so that file-system navigation and data transfer can take place over heterogeneous networks.

• **Tape/media cataloging and maintenance.** An ongoing problem with traditional network-backup methods is handling tape logistics—which tapes to use, and in what order. This problem becomes more unmanageable as more sites are included in the data management process and the amount of maintained data increases. While tape/media cataloging and maintenance is often a popular topic of industry forums and white papers, few companies have been able to implement satisfactory solutions.

• **File grooming and data migration.** Primary on-line hard disk space is at a premium in most networking environments. It seems users will fill whatever space is available. Creating more hard disk space usually means investing in additional resources. Grooming old, out-of-use hard disk files and migrating the data onto secondary storage media would free up valuable on-line resources.

• **Virus protection.** Viruses can jeopardize data integrity and the operation of the entire system. The fear of lost or corrupted data has fueled a new market for virus protection and detection software. Note the difference between virus protection and detection. The former implies active search, detection, and eradication of known viruses. The latter refers to the systematic detection of corrupted data and prompt notification of the proper person to correct the problem. Data management applications should warn you if data integrity is compromised.

• **Reporting services.** Advanced data analysis is necessary to understand and monitor data usage trends. It provides the information necessary to make intelligent decisions on how to place and optimize network data resources to maximize file-server performance. These services should be uniformly accessible from all client applications. Targeting data-access bottlenecks and resource allocation, you could generate reports on file-server free space, usage, and custom variations.

Green Sticks and Wire

You could compare distributed applications to Tinkertoys that are connected. Perhaps this explains why the term *sockets* caught on so quickly among network systems programmers. Instead of green sticks, distributed-processing applications are held together by network “wire” and peer-to-peer communications (see figure 3).

Distributed computing has taken hold, especially in corporate environments. Data management applications provide the means to view, organize, and secure data in a fully distributed environment. These applications, when properly implemented, will provide the same reliability and confidence in distributed personal computer systems in the future that centralized mainframe storage systems have enjoyed in the past.

Tom Toperczer is vice president of marketing for Mountain Network Solutions (Campbell, CA). You can reach him on BIX c/o “editors.”
We know capacity.

Whether it is simply backing up your workstation hard disk or online access to sequential data sets, EXABYTE has the right 8mm data storage solution.

With its ability to store up to 2.5 gigabytes of information on a single 8mm cartridge, the EXB-8200 8mm Cartridge Tape Subsystem is the answer for today’s data-intensive storage requirements. And with over 180,000 installed worldwide, the EXB-8200 has become the de facto storage standard in workstation, midrange system, and file server environments.

The EXB-8500 8mm Cartridge Tape Subsystem advances beyond the performance of the EXB-8200 by achieving an extraordinary data transfer rate of 500 Kbytes/second, while providing over 5 gigabytes of storage capacity. In addition, high-speed search at 37.5 Mbytes/second allows rapid file retrieval. Keeping pace with today’s phenomenal disk capacities, the EXB-8500 can back up a 760 megabyte disk drive in approximately 25 minutes!

Featuring an unparalleled compact design, the EXB-10 Cartridge Handling Subsystem provides access to as much as 30 gigabytes of information. An integral robotic handler performs automatic loading and unloading of up to ten 8mm data cartridges. Eliminating the need for manual intervention, the EXB-10 is well-suited for LAN and super minicomputer backup applications.

Circle 113 on Inquiry Card (RESELLERS: 114).

And if you have an application that demands extraordinary storage capacity, the EXB-120 Cartridge Handling Subsystem delivers up to 580 gigabytes of storage in only 4 square feet of floor space. It’s ideal for the backup of large computer systems or near-line access to network data bases. With a potential for 12 days of nonstop, hands-off data recording, the robotically-driven EXB-120 makes long-term unattended storage a reality.

So whatever your application — backup/restore, journaling, archiving, data interchange, data acquisition, or software distribution — call the regional office nearest you or write EXABYTE Corporation at 1685 38th Street, Boulder, CO 80301.

©1991 EXABYTE Corporation
The day starts early for LaserStor Erasable Optical. It runs long. And it runs fast, at near-Winchester speed, actually. This is one dynamic storage system with a voracious and versatile appetite for work.

Here's what you get: • easy movement of an infinite amount of cartridge-resident data from near-line to on-line, without using valuable hard disk space • the most reliable and convenient data backup and archiving solution available • primary storage performance, for everyday or emergency use • lock-it-away data security or carry-it-away portability.

Now check the credentials. Seek times as fast as 35 ms. Bootability. Random and instant access to files. The industry's most comprehensive set of utilities software, including ARCserve® for backup. And your choice of 650 megabyte or one gigabyte cartridges, with certified data life of up to 25 years. Little wonder the PC Digest Ratings Report awarded us the highest rating for "capacity and overall performance unmatched by the other systems."

Day or night, as a tool for productivity or a device for data protection, LaserStor Erasable Optical is a timely choice. So call now. (408) 879-0300. Storage Dimensions, 2145 Hamilton Avenue, San Jose, CA 95125.

Sony-based products now available!
GIGA-STORAGE

Choosing among mass-storage technologies
in a multigigabyte PC environment isn't simple; there are conflicting criteria

RICHARD A. PETERS

Powerful 386- and i486-based PCs are placing new demands on data-storage systems. With the proliferation of gigabyte-plus database applications, the need arises for greater storage capacities and increased operating efficiencies. This is evident in applications such as high-performance CAE and desktop publishing workstations, as well as data-packed LAN file servers.

Many PC applications need 1 gigabyte of storage capacity or more, and mass-storage technology must keep pace with this need. A variety of technologies are available for this new multigigabyte environment, and conflicting considerations are involved in choosing among them.

Primary-Storage Choices
A wide range of mass-storage technologies for high-capacity systems exists on the market today. They compete with and often complement each other (see table 1). Any examination of what to buy begins with knowing if you intend to use the device as the primary- or backup-storage medium.

The hard disk drive is almost omnipresent with personal computer systems today. It is the dominant primary data-storage product and will remain so until the next century.

Hard disk drives supplanted tape drives more than 10 years ago as the preeminent primary-storage medium because the technology could randomly access data. Random access makes it possible to retrieve data anywhere on the disk in milliseconds. Many suppliers provide 1-gigabyte-plus hard disk drives with varying costs, capacities, and
The right choice isn't necessarily easy; it may require balancing your needs against your wallet.

BYTE ACTION SUMMARY

The increasing storage needs of large applications for 386- and i486-based PCs have brought a surge of high- and higher-capacity mass-storage devices. A variety of different disk and tape choices exists, including some more-suited to primary storage and others more appropriate for backup. Making the right choice isn't necessarily easy; it may require balancing your needs against your wallet.

Table 1: The wide range of mass-storage technologies for gigabyte storage on the market today provides a full range of advantages and disadvantages. Weighing the pluses and minuses against your needs is the challenge.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Benefits</th>
<th>Negative Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard disk</td>
<td>Random access</td>
<td>Lack of removability</td>
</tr>
<tr>
<td></td>
<td>High capacity</td>
<td></td>
</tr>
<tr>
<td>Rewritable optical</td>
<td>Random access</td>
<td>High drive cost</td>
</tr>
<tr>
<td></td>
<td>High capacity</td>
<td>High media cost</td>
</tr>
<tr>
<td>Quarter-inch cartridge</td>
<td>Low cost</td>
<td>Lack of compatibility</td>
</tr>
<tr>
<td></td>
<td>Compatible among multiple sources</td>
<td>are evolving quickly</td>
</tr>
<tr>
<td>4-mm DAT helical scan</td>
<td>High capacity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low media cost</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fast search capability</td>
<td></td>
</tr>
<tr>
<td>8-mm helical scan</td>
<td>High capacity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low media cost</td>
<td></td>
</tr>
</tbody>
</table>

Backup Storage

To protect against catastrophic data loss, you need to keep a backup copy of the data stored on your primary devices. Periodic system backups performed to copy data from the primary device to an off-line medium become increasing time-consuming and impractical with the growing size of a database.

With today's multigigabyte PC applications, having a backup mass-storage unit is a necessity. You use the backup device to make copies of frequently used data, transfer older data from the primary unit, and retrieve archived data with maximum efficiency. While tape drives are no longer used as primary-storage devices, they remain the most attractive medium for inexpensive, removable, and high-capacity backup storage.

The quarter-inch cartridge is the leading tape-drive technology. It was invented specifically for data-processing applications. QICs now account for more than two-thirds of all tape-drive shipments, and they will continue to be the dominant backup technology well into the mid-1990s. The QIC manufacturing community began introducing products with storage capacities above 1 gigabyte late last year, and 6-gigabyte products are projected by early 1993.

In comparison with competing technologies, QIC drives are low in cost, with retail prices under $2000 for a 1.3-gigabyte system; 1.3-gigabyte cartridges retail for about $35. Data transfer rates for current products reach up to 600,000 bps, allowing backup of 1 gigabyte in under 30 minutes. Any file can be accessed in 40 seconds or less in a gigabyte-plus tape device.

give you a maximum of 300 MB per side—you must then manually turn them over to obtain additional storage. This amount of storage may be too small for LANs with more than 10 users.

Rewritable optical disk drives have some utility in backup and archiving applications, but high costs for the drive and medium make the technology cost-effective only when it is justified by other applications.

Another type of optical technology should also be noted. You can only write to WORM (write once, read many times) optical disks once, but you can read them as often as you need to—much like a phonograph record (if anybody still remembers what they are). WORM drives are useful in specialized backup and archival applications, such as the storage of legal and financial documents, because the stored information cannot be altered.

Software-derived performance features.

Hard disk drives are fixed devices with finite storage capacities. The finite capacity makes it important to know how much storage you really need—now and in the future. Since the medium is not removable, the data-processing system needs to provide for backup of the database. Backup data-storage systems must be rewritable and use removable media.

The rewritable optical disk drive is becoming a popular option for primary storage. Rewritable optical drives, currently featuring up to 600-megabyte capacities per removable disk, record data on extremely thin platters that can be moved like floppy disks and moved easily from system to system. The optical disk provides a two-sided medium that you must manually turn over to access the other half of available storage.

Demand for optical-storage technology began with the advent of rewritable optical devices, which you can reliably reuse as often as you wish. In fact, testing by manufacturers has demonstrated that you can perform 1000 read/write cycles per day for 40 years with no degradation of data, disk, or drive mechanism. There are three main OEMs of rewritable optical disk drives—Ricoh (San Jose, CA), Sony Corp. of America (San Jose, CA), and Hitachi America (Tarrytown, NY).

Ideal as primary-storage devices in image-oriented applications in vertical markets, optical drives also have notable drawbacks. The key drawback is their access times. The random-access times for optical drives are 5 to 7½ times higher than those for hard disk drives (50 to 150 ms compared with 10 to 20 ms). A primary factor is the weight of the intricate optical drive head. Even though the respective weights can be measured in grams, these heads tend to be 20 to 50 times heavier than hard disk drive heads.

The up-front cost for rewritable optical disk technology is also very high. The average price for a 300-MB rewritable optical disk drive is about $5500, compared with below $3000 for a 300-MB hard disk drive.

Finally, while hard disk drives can give you more than 1 gigabyte of continuous storage, current rewritable opticals...
One Word About Your Hard Disk Controller

SLOW

One Word About the PSI hyperSTORE Controllers

FAST

Intelligent Mass Storage Controllers

Virtually all applications are disk bound. Today's PCs have over 60 times the power of their ancestors of just ten years ago, while hard disk performance has only just tripled. This makes mass storage the PC's worst bottleneck. PSI has eliminated this bottleneck with the hyperSTORE Caching Disk Controller, a sort of mass storage co-processor. The hyperSTORE does for disk-intensive programs what a math co-processor does for number-crunching software. Databases, file servers, multiuser applications start screaming... frustrated users stop screaming! Call (800)486-FAST now to find out more about PSI's line of intelligent controllers. All you have to gain is time.

hyperSTORE FEATURE HIGHLIGHTS

- Data access in 0.28ms or less, at 3-4MB/sec
- Works in any 286, 386, or i486 system
- Simultaneously control any drive interface: MFM, RLL, ESDI, SCSI, or AT/IDE
- Controls up to 28 physical disk drives
- 0KB to 20MB of SIMM-based cache memory
- Supports all PC-based operating systems: DOS, Windows, UNIX/Xenix, Netware, etc.
- Data mirroring option for fault tolerance
- NO DEVICE DRIVERS REQUIRED

"Normally, it's a bit hard to pick the most impressive item at Comdex [Spring 1990].... This time it was easy,... the hyperSTORE/1600."
- Dr. Jerry Pournelle, Byte Magazine, September 1990

"The real-world result will be blazing record handling from within a data file as well as unstoppably fast program loads."
- Bill O'Brien, PC Magazine, February 13, 1990

"PSI has created the power user's ultimate Lego set for disk controllers: the hyperSTORE/1600"
- Alfred Poor, PC Magazine, June 12, 1990

"Not only is it the fastest controller available, it's the most flexible, too."
- Byte Awards, Byte Magazine, January 1991

Circle 252 on Inquiry Card (RESELLERS: 253).
**Table 2: In deciding which technology to purchase for gigabyte storage among the primary-storage media (hard disk or rewritable optical) and the secondary-storage media (QIC, 4-mm DAT helical scan, or 8-mm helical scan), the following are the criteria you should consider.**

<table>
<thead>
<tr>
<th>Specification-related criteria</th>
<th>Application-related criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Random/sequential access</strong></td>
<td>Security:</td>
</tr>
<tr>
<td>Capacity</td>
<td>Shock</td>
</tr>
<tr>
<td>Speed:</td>
<td>Environment</td>
</tr>
<tr>
<td>Transfer rate</td>
<td>Data:</td>
</tr>
<tr>
<td>Access time</td>
<td>Shell life</td>
</tr>
<tr>
<td><strong>Compatibility</strong></td>
<td>Transportability</td>
</tr>
<tr>
<td>Fault tolerance</td>
<td>Quality</td>
</tr>
<tr>
<td>Data integrity</td>
<td>Mixes and matches</td>
</tr>
</tbody>
</table>

**New Storage Trends**

Recent technological breakthroughs in rewritable optical disk drives and high-capacity tape drives have at least one common thread: They all provide unlimited storage because they use high-capacity media that you can quickly insert and withdraw from the drive.

This trend toward removability is further supported by jukeboxes, or autochangers. These devices have recently become available for all three major storage technologies, although optical devices seem to be leading the way. A jukebox typically contains two drives and a mechanical arm used to select and load one of many disks stored within it. A newly announced optical jukebox contains 32 optical disks for a total storage capacity of 17.9 gigabytes.

Another development unfolding, particularly for very large storage applications, is the mixed-media mass-storage systems. These systems use a combination of hard disks, optical disks, and tape-to-store files. Where the data is stored depends on how frequently it is used—a particular file will automatically migrate from on-line hard disk storage to slower optical and tape systems as the frequency of its use decreases. Such mixed-media systems allow you to take advantage of all technologies, using each to its maximum potential.

**Buying Considerations**

There are several criteria you should consider when you plan to purchase a mass-storage medium (see table 2). The issues relate to the specifications of the products and to the particulars of your individual applications.

Several specifications are fundamental to choosing appropriate primary and backup storage, beginning with how a mass-storage device obtains data—randomly or sequentially. A random-access device stores data randomly and retrieves it using an identifying address. A sequential-access device stores data in a prescribed ascending or descending sequence and retrieves it by searching for it from the beginning to the end of the file.

Random access is typical of hard disk and optical disk drives, and sequential access is typical of tape drives. Random access is a more direct and faster method of accessing data, but you must weigh that against the increased cost, the size of
Native or Compressed?

Grant Wilcox

The compress-or-not-compress issue has existed for years, but the advent of data-compression chips, performing what is termed lossless compression, has made it popular again.

Data compression maintains data integrity and compresses the data in real time—transparently. It removes redundancy from a closed set of information symbols (i.e., a data block) without any loss of information. In simple terms, it records more data in a smaller space. Compression ratio is the length of compressed output relative to the length of uncompressed input. The key is that data stored in a compressed form must be reliably retrievable. (For more detailed information on data compression, see “Getting Your Byte’s Worth,” November 1990 BYTE, and “Putting the Squeeze on Graphics,” December 1990 BYTE.)

Benefits can be derived from implementing data compression at the peripheral level. You can theoretically increase the peripheral's capacity by the factor of the compression ratio and can increase the peripheral's internal continuous-transfer rate because it's recording less data. For example, a 2-to-1 compression factor could double the peripheral's sustained data rate.

However, Mike Casey from InfoCorp (Cupertino, CA) pointed out, “If data compression is implemented at the system level, no benefit will be obtained by incorporated data compression in an intelligent disk or tape drive.” Also, if data interchange is a requirement, all systems involved not only need compression but must use the same hardware/firmware implementation of it, or they will find their data unreadable.

Remember, not all data lends itself to compression. First, the benefits will vary because the amount of data redundancy varies widely among types of data; this variation changes the compression ratio. Second, you will benefit from compression only if the host system can support the higher continuous-transfer rates. Third, the benefits will be negated if the compression process cannot keep up with system needs. Fourth, compressed data may actually expand when compressed again. With compression, there are no hard and fast rules.

Compression is not the complete answer to the need for increased capacity and data rate. The decision to adopt data compression must be carefully thought out because of its associated risks. If you are interested in unattended backup, it's wise to rely on native capacity instead of compressed capacity. With native capacity, you know the data will fit on a particular medium and that it will take a certain length of time to back up.

Many standards and implementations of data compression exist, such as Hewlett-Packard's, STAC's, IBM's, and a number of other proprietary algorithms. You could almost say it's *algorithme du jour*. Given the rapid advances in computer technology, it is extremely important that the compression algorithm be able to handle the higher data rates of future systems. Some cannot.

In addition, different companies, using the same compression algorithm, may offer unique implementations of it. Furthermore, multiple compression algorithms on top of multiple formats (e.g., digital audiotape’s DDS and DAT/DAT) create more confusion. You can only roll the dice and hope your selected product, format, algorithm, and vendor are around in the coming years.

Whole sections of the computer industry, mainly at the high end, are attracted to 8-mm tape’s large data-storage capabilities and low cost, but they’ve held back because of transfer rate. In these cases, adding data compression will satisfy their needs until 8-mm products with further native-performance increases are introduced.

When looking to the future, technologies that can be extended without compression are ultimately much better than those that can only be extended with compression. You can always improve the native performance by adding compression to it. Exabyte (Boulder, CO) currently has plans to extend the 8-mm tape's transfer rate to 1 megabyte per second and the cartridge capacity up to 10 gigabytes using current native technology.

Be aware that some backup peripherals are being advertised with large capacities and high transfer rates—improvements made by using data compression. Because so many variables affect data compression, you may not be able to achieve these large advertised performance capabilities as promised.

Data compression is an added benefit, but it’s not the total answer. Native capacity and transfer rate are also important.

Grant Wilcox is in product marketing for Exabyte, Boulder, Colorado. You can contact him on BIX or via the editors.
Sometimes it's difficult to know how fast is fast enough. You must weigh the importance of speed against your other needs. A few milliseconds' worth of speed could come with an unacceptable price tag.

It is also worth noting that the data-rate capability of a storage device is often not the limiting factor on a system's ability to move data to and from the device. Average data transfer rates above 300,000 bps for peripheral devices are unusual on today's PC systems, so a tape drive's data transfer rate of only 200,000 bps is often the optimum solution.

Compatibility of the mass-storage device with the LAN operating systems and topologies in which it must operate is also important. Widely used LAN operating systems include Novell's Netware 286/386 and Microsoft's MS-Net for IBM PC-compatible LAN environments, and AppleTalk/Appleshare and A/UX from Apple and TOS from Sun Microsystems for the Macintosh world.

Topology refers to the physical layout of the components of a LAN—a bus topology connects all devices in one line; a ring topology connects each workstation to two other workstations in a circle. The topology that you employ can affect how the storage device will perform. With ring topologies, for example, the more PCs that are present, the slower the LAN, which can slow down data access and transfer times.

You will also want to examine fault-tolerance features: Do you want or need duplicate systems for continuous storage operation in the event that one should fail? What data-integrity features does the product provide to prevent accidental erasing or contamination of your data?

**Further Factors**

There are a number of other issues that you need to take into account before choosing a 1-gigabyte-plus mass-storage device.

Data security is the first of these issues. What happens if the drive or the medium is dropped? The ability of the device to withstand shock is very important. Is the device rugged and impervious to the environment? Some mass-storage units are sensitive to magnetic fields and x-rays. You also need to find out the unit's operational range in terms of temperature and humidity.

You should consider the projected longevity (shelf life) of the storage medium and drive, and how long you intend to store the data on the device. The demand for WORM optical drives continues in spite of the arrival of rewritable optical technologies because WORM technology provides permanent storage that can't be overwritten.

The transportability of the medium and drive can be a key factor. Data-storage applications used in banks, insurance companies, government agencies, corporate records departments, and multiple-site companies require easily transportable storage equipment, sometimes above all other considerations.

Product quality is fundamental. This is basically a question of looking at the steps the manufacturer has taken to ensure reliable performance. These steps include user troubleshooting and fault-isolation diagnostic routines, the warranty of the mass-storage unit, the availability of information from the manufacturer or supplier, and post-sale support.

Another critical issue is how well the device mixes and matches with other mass-storage devices that may already be in place in the computer system. Are the devices compatible with each other, and do their collective data capacities equal what you need?

The growth potential of the respective technologies is also worth looking at in terms of selecting a solution that you will be able to live and grow with in the long term. QIC's relatively low data densities and large available tape area make upward migration to larger capacities an ongoing evolutionary process.

The very high data densities of DAT permit using a small cassette with a small available recording area, making upward migration more difficult. The 8-mm helical scan also has higher data density than QIC and a larger available record area than DAT.

Current QIC densities are about 0.6 MB per square inch, while 4-mm DAT is about 3.8 MB per square inch on a medium area of less than 25 percent of QIC. QIC has more room to grow. Table 3 summarizes the current comparative situation for backup-tape technologies.

Hard disk technology appears to achieve higher data capacities almost monthly, while rewritable optical disk capacities are moving at a slower pace.

Last but not least, there are the costs of the storage device and medium. The cost of a mass-storage subsystem varies greatly, depending on the technology and manufacturer. However, cost increases with capacity. As important as cost is, it comes into perspective when you think about the possibility of losing your data due to a choice made on the basis of cost alone.

**Narrowed Choices and Trade-Offs**

When you draw up your list of requirements—How much capacity do you need? How much speed? What kinds of compatibility?—the choices of mass-storage systems narrow. There will be inevitable trade-offs involving price, functionality, and performance. A lower-cost unit will not display lightning-quick throughput speed; you may not be able to readily move a very high-capacity system; or you may not be able to afford the most reliable system.

Optimizing your PC data-storage capabilities is a multistep process that involves many different considerations—taking particular care to plan for growth. Nothing is cost-effective if it does not provide what you need.

Richard A. Peters is vice president of marketing at Tandberg Data, Inc. (Westlake Village, CA). You can reach him on BIX c/o "editors."
If you need more megabytes than your hard disk can swallow, don't buy a new drive. Stretch it with Stacker.

Stacker is the fastest, most economical way to safely double your hard disk capacity. Without sacrificing DOS compatibility. It's the new standard in real-time data compression.

- Increase storage 100%
- Compatible with DOS 3.x, 4.x
- Industry's fastest real-time data compression
- Includes disk caching
- Fastest, easiest installation
- Toll-free technical support
- 90-day money-back guarantee

And it's the only product of its kind available in both software and coprocessor versions.

Stacker is fully compatible with Windows 3.0 and all your favorite disk utilities, too. Plus, Stacker includes a powerful disk caching program for added performance.

And when you add the Stacker coprocessor card you also get the fastest data compression in the business.

No wonder there are already over a million satisfied users of Stac's compression technology.

So call today and double your disk capacity tomorrow. You can purchase the Stacker software-only version—perfect for laptops—for only $149. Or get the entire Stacker high performance system with software and coprocessor card for just $229.

Order today. Visa, MasterCard, American Express cards accepted.

1-800-522-7822
Or see your local computer/software dealer.
Technical support at 3 a.m. is just one reason why...
Northgate makes it safe to buy business computers direct.

A 24-hour business hotline service for your 24-hour business. Many companies don't realize the importance of 'round the clock technical support ... until they need it. But, chances are, you or someone you know has had questions about computing after normal office hours. If you purchased your systems from one of our competitors, you probably had to wait to get help. Time-wasting. Inefficient. Costly.

Northgate treats you right! Across town or around the world, Northgate's business customers have a special hotline that gives immediate 24-hour access to Northgate's team of technical experts. Compare this with our competitors. Many have limited hours (like 9 a.m. to 2 p.m. on Saturdays; closed Sundays), some won't answer the phone during lunch hour and close up shop at night. While others offer little or no support at all.

Northgate's commitment to customer service and support caught the attention of the 1990 Microcomputer Marketing Council who selected Northgate as the first winner of the Association's Service and Support Award. When you buy from Northgate, rest assured we're here to serve you—in person—all day, every day. And the call's always on us.

From our spectacular SlimLine 386SX to our powerful Elegance 486 file servers, Northgate backs them all with quality in every respect.

Industry's highest performing systems. In an industry overflowing with companies all claiming top performance, only one company is consistently ahead of the pack: Northgate. Since January of 1989 when our first PC Magazine Editor's choice was awarded, our name has become synonymous with pace setting performance. Seven Editors' Choice awards, eight Computer Shopper "Best Buy" Awards and three InfoWorld recognitions are proof.

Quality systems through manufacturing and testing. As a manufacturer, Northgate does not subscribe to the industry trend of taking shortcuts in technology to boost performance gains and keep prices down. Rather, we thoroughly test components for compatibility, performance and value. In fact, if you were to order a hundred of our machines with the same configuration, everyone would have the exact same performance. From hard drives all the way to our ALPS keyboard switches. And every stop in between. No "parts of the month" surprises or compatibility problems. We stake our reputation on it.

Unparalleled compatibility with your current industry standard systems and software. One of our competitors recently announced they set up an "FCC Testing Lab" At Northgate, this is nothing new. For years, Northgate has gone the extra step to ensure that our systems are FCC Class B certified. And, we've invested hundreds of thousands of dollars to make sure our systems are compatible with MS-DOS, OS/2, Novell, Banyan, UNIX, SCO and other software. It's no wonder why many major software developers use Northgate to design, develop and "debug" their new software.

Dollar for dollar, Northgate is your smartest business decision. No doubt you can pay less for computers. And you can certainly pay more. But you won't get the product, performance, service and support that has positioned Northgate as the new industry leader. No matter what the price, you just can't buy better than Northgate.

Free pre-purchase consultation. Nobody spends thousands of dollars on systems during the first phone call. You know it, we know it. Instead, we offer a no-obligation pre-purchase consultation with one of our highly-trained Technical Consultants. You won't get high-pressure tactics or commission-hungry salespeople. Just friendly assistance in matching your business needs with the appropriate Northgate solution.

CALL TOLL-FREE 800-345-8709 IN U.S.A AND CANADA
Major corporations, volume purchasers and government agencies call National Business Accounts: 800-448-3510
Notice to the hearing impaired: Northgate has TDD capability. Dial 800-535-0602.

Circle 226 on Inquiry Card.
PC Magazine said it best...
"Northgate stops at nothing to please its customers!"

Call Northgate® Now.

Northgate Exclusive!
Edsun CEG Chip available with SlimLine 396/33!
Award-winning performance, unequalled service and incredible support for a price IBM®, Compaq® and Dell® can’t hope to match.

The power of 386™ computing is the lifeblood of business today. And more and more, Northgate is the vendor of choice. Why? Northgate is the only company who consistently earns top ratings for performance, service, support and bottom-line value. Industry experts and users worldwide agree.

Northgate 386... computing’s most decorated line. Northgate’s rise to the pinnacle of 386 technology started in 1988 when Computer Shopper readers voted Northgate’s 386 Power System both a “Best Buy” and Overall Best Buy. A few months later, PC Magazine named Northgate 386/20 and 386/25 “Editors’ Choice.” Later that year, our 386/33 received the same honor. Along the way, our 386 systems won several InfoWorld recognitions as well.

Revolutionary systems of the 90’s: Northgate SlimLine™

Often copied, never duplicated! It seems like everyone has jumped on the SlimLine bandwagon these days. Truth is, Northgate pioneered this incredible technology. We were the first to introduce full power 386 systems in a case measuring only 4.25” high.

Architecture that stunned the industry! SlimLine’s fully-integrated motherboard features built-in IDE hard drive and floppy drive controllers, one parallel and two serial ports plus a 16-bit VGA controller. And we didn’t scrimp on expansion capabilities. Our unique expansion tree has three full-length 16-bit and two half-length 8-bit slots for all your add-ons and peripherals.

Perfect single-user workstation or network terminal. SlimLine is ideal for use where you need full-size 386 power, but space is a premium.

For comprehensive system features and popular configurations, see next page.

Northgate Elegance™: Full-size 386 power and expandability.

The business systems of choice. Elegance’s award-winning reputation has made them the choice of Fortune 1000 corporations, government agencies and universities around the world. With good reason.

Elegance full-size systems are designed to allow you to easily expand your system as your business needs increase. You only pay for the components you need now.

Power for every application. From “simple” tasks like word processing and desktop publishing to advanced CAD/CAE and database management applications, Elegance delivers. To find out what systems are right for you, see next page for system configurations and upgrade options.

Northgate wins 1990 Microcomputer Marketing Council’s Service and Support Award!

- 30-day no-risk trial period
- Full one year warranty on systems, 5 years on OmniKey keyboards.
- Northgate responds to your needs with overnight shipment of parts—at our expense!
- Free on-site service to most locations for one year if we can’t solve your needs over the phone.
- Unique 24-hour toll-free technical support—the industry’s best!
- We accept VISA, MasterCard, Discover and Northgate’s Big ‘N’ card. We offer leasing and financing options, too!

Free pre-purchase consultation. Nobody spends thousands of dollars on systems during the first phone call. You know it, we know it. Instead, we offer a no-obligation pre-purchase consultation with one of our highly-trained Technical Consultants. You won’t get high-pressure tactics or commission-hungry salespeople. Just friendly assistance in matching your business needs with the appropriate Northgate solution.

CALL TOLL-FREE 800-345-8709

Fortune 1000 corporations, government agencies and education institutions, call National Business Accounts 800-548-3510

Notice to the hearing impaired: Northgate has TDD capability. Dial 800-535-0602.

Circle 227 on Inquiry Card.
Only Northgate offers a full range of 386™ systems in SlimLine™ Desktop, and Vertical Power Cases!

SlimLine...a Northgate original!

**SlimLine Features:**
- Small footprint (16.5" square x 4.25" high) SlimLine case with room for two exposed and one internal half-height devices
- Intel® and Weitek math coprocessor support
- 150 watt power supply
- Clock calendar chip rated at 5 years
- Front mounted reset and high/low speed controls
- MS-DOS 4.01 and GW-BASIC installed
- On-line user's guide to MS-DOS 4.01
- QA Plus Diagnostic and utility software
- FCC Class B certified

*SlimLine 386SX/16 and 20 MHz with 64K Cache*
- Intel 80386SX/16 or 20 MHz processor
- 2Mb of RAM on motherboard
- 40Mb hard drive
- 64K SRAM read/write-back cache
- 1.2Mb and 1.44Mb floppy drives
- 14" VGA color monitor
- OmniKey® keyboard

$2399.00 / $2599.00
Or as low as $750.00 / $800.00 per month*

*SlimLine 386/25 MHz with 64K Cache*
- Intel 80386/25 MHz processor
- 4Mb of RAM on motherboard
- 100Mb hard drive
- 64K SRAM read/write-back cache
- 1.2Mb and 1.44Mb floppy drives
- 14" VGA color monitor
- OmniKey® keyboard

$3399.00
Or as low as $1050.00 per month*

*SlimLine 386/33 MHz with 64K Cache*
Exclusive! Now, the revolutionary Edsun CEG chip is available with SlimLine 386/33. This device emulates up to 2048 x 2048 resolution and lets your standard VGA monitor display an incredible 750,000 colors. Plus, it smooths out the jagged edges around images giving you clarity and brilliance you must see to believe! Call for pricing.

- Intel 80386/33 MHz processor
- 4Mb of RAM on motherboard
- 200Mb hard drive
- 64K SRAM read/write-back cache
- 1.2Mb and 1.44Mb floppy drives
- 14" VGA color monitor
- OmniKey® keyboard

$3899.00
Or as low as $1200.00 per month*

Editors’ Choice—all Elegance™ systems

**Elegance Features:**
- 5-bay desktop case with room for 3 exposed and 2 internal half-height devices with 200 watt power supply.
- Optional 7-bay vertical power case has 220W power supply
- RAM expansion up to 8Mb on motherboard (16Mb total RAM with 32-bit memory card)
- 16-bit VGA video adapter
- One parallel and two serial ports
- MS-DOS 4.01 and GW-BASIC installed
- QA Plus Diagnostic and utility software
- FCC Class B and Novell certified

*Northgate Elegance 386/25*
- Intel 80386/25 MHz processor
- 4Mb of RAM
- 100Mb hard drive
- 64K SRAM read/write-back cache
- 1.44Mb and 1.2Mb floppy drives
- 16-bit VGA Adaptor
- Desktop case
- 14" VGA color monitor
- OmniKey® keyboard
- Microsoft Windows and mouse

$3699.00
Or as low as $1150.00 per month*

*Northgate Elegance 386/33*
- Intel 80386/33 MHz processor
- 4Mb of RAM
- 200Mb hard drive
- 64K SRAM read/write-back cache
- 1.44Mb and 1.2Mb floppy drives
- 16-bit VGA Adaptor
- Vertical power case
- 14" VGA color monitor
- OmniKey® keyboard
- Microsoft Windows and mouse

$4449.00
Or as low as $1400.00 per month*

If one of these popular SlimLine or Elegance models doesn't meet your needs, CALL! We'll custom build one just for you!

CALL TOLL-FREE
800-345-8709
IN U.S.A. AND CANADA

“Smart Tools For Business”

Major corporations, volume purchasers and government agencies call National Business Accounts:
800-548-3510

7075 Flying Cloud Drive,
Eden Prairie, Minnesota 55344

Circle 228 on Inquiry Card.
Massive Mass Storage

For real mass storage, be prepared to drop a couple of hundred thousand dimes in the jukebox. Jukeboxes (also called auto-changers) provide unprecedented on-line storage for PC, workstation, and LAN users. They range in capacity from a few tens of gigabytes to over a terabyte, and they are available in CD-ROM, WORM (write once, read many times), rewritable optical, and tape-based configurations.

Listed below are some manufacturers of jukebox mass-storage systems.

Advanced Graphics
Applications, Inc.
90 Fifth Ave.
New York, NY 10011
(212) 337-4200
Circle 1060 on Inquiry Card.

Alphatron, Inc.
2300 Englett Dr., Suite C
Research Triangle Park, NC 27709
(919) 544-0001
fax: (919) 544-4079
Circle 1061 on Inquiry Card.

Aquidneck Systems
International, Inc.
650 Ten Rod Rd.
North Kingstown, RI 02852
(401) 295-2091
fax: (401) 295-1851
Circle 1255 on Inquiry Card.

AT&T
100 Southgate Pkwy.
Morristown, NJ 07960
(800) 247-1212
(201) 898-8000
Circle 1062 on Inquiry Card.

Bell & Howell Document Management Products Co.
6800 McCormick Rd.
Chicago, IL 60645
(708) 675-7600
fax: (708) 675-9721
Circle 1063 on Inquiry Card.

Control Data Corp.
P.O. Box 0
Minneapolis, MN 55440
(612) 853-8100
fax: (612) 853-5300
Circle 1264 on Inquiry Card.

Cygnex Systems, Inc.
2560 Junctions Ave.
San Jose, CA 95134
(408) 954-1800
fax: (408) 954-9991
Circle 1065 on Inquiry Card.

Delta Microsystems, Inc.
5039 Preston Ave.
Livermore, CA 94550
(415) 449-6881
fax: (415) 449-6885
Circle 1066 on Inquiry Card.

Digital Equipment Corp.
146 Main St.
Maynard, MA 01754
(508) 493-5114
fax: (508) 493-8780
Circle 1067 on Inquiry Card.

Dilog Corp.
1555 South Sinclair St.
Anaheim, CA 92806
(714) 937-5700
fax: (714) 979-2420
Circle 1068 on Inquiry Card.

Epoch Systems
8 Technology Dr.
Westborough, MA 01581
(508) 836-4300
fax: (508) 836-3802
Circle 1069 on Inquiry Card.

Exabyte Corp.
1685 38th St.
Boulder, CO 80301
(303) 442-4333
fax: (303) 442-4269
Circle 1070 on Inquiry Card.

FileNet Corp.
3565 Harbor Blvd.
Costa Mesa, CA 92626
(714) 966-3400
fax: (714) 966-3490
Circle 1071 on Inquiry Card.

Hewlett-Packard Co., Inc.
Disk Storage Systems Division
11413 Chadion Blvd.
Boise, ID 83714
(208) 323-3290
fax: (208) 323-3991
Circle 1072 on Inquiry Card.

Hitachi America, Ltd.
Computer Division
Peripheral & Systems Marketing, MS:500
Hitachi Plaza
2000 Sierra Point Pkwy.
Brisbane, CA 94005
(800) 283-4080, ext. 877
(415) 589-8300
Circle 1073 on Inquiry Card.

Laser Magnetic Storage International Co.
4425 Arrows West Dr.
Colorado Springs, CO 80907
(719) 593-7900
Circle 1256 on Inquiry Card.

Literal Corp.
2180 Executive Cir.
Colorado Springs, CO 80906
(719) 579-0460
fax: (719) 579-0450
Circle 1074 on Inquiry Card.

Memorex Telex Corp.
6422 East 41st St.
Tulsa, OK 74155
(800) 930-3455
(918) 627-1111
fax: (918) 628-2768
Circle 1257 on Inquiry Card.

Micro Design International, Inc.
6985 University Blvd.
Winter Park, FL 32792
(800) 228-0891
(407) 677-8333
fax: (407) 677-8365
Circle 1258 on Inquiry Card.

Optimem
297 North Bernard Ave.
Mountain View, CA 94043
(415) 961-1800
fax: (415) 961-8913
Circle 1259 on Inquiry Card.

Pinnacle Micro, Inc.
15265 Alton Pkwy.
Irvine, CA 92718
(800) 553-7070
(714) 727-3300
fax: (714) 727-1913
Circle 1260 on Inquiry Card.

Pioneer Communications
600 East Crescent Ave.
Upper Saddle River, NJ 07458
(201) 327-6400
fax: (201) 327-9379
Circle 1262 on Inquiry Card.

Reflection Systems, Inc.
P.O. Box 611608
San Jose, CA 95161
(408) 432-0943
fax: (408) 432-0843
Circle 1263 on Inquiry Card.

Ricoh Corp.
Sales Office
3567 Parkway Lane,
Suite 150
Norcross, GA 30092
(404) 446-3533
fax: (404) 447-4102
Circle 1264 on Inquiry Card.

Sony Corp. of America
Peripheral Systems Co.
Sony Park Ridge, NJ 07656
(201) 930-1000
fax: (201) 573-8608
Circle 1265 on Inquiry Card.

Storage Dimensions, Inc.
2145 Hamilton Ave.
San Jose, CA 95125
(408) 879-0300
fax: (408) 879-3397
Circle 1266 on Inquiry Card.

Storage Technology Corp.
2270 South 88th St.
Louisville, CO 80028
(303) 675-7600
fax: (303) 675-9271
Circle 1267 on Inquiry Card.

Summus Computer Systems
17171 Park Row, Suite 300
Houston, TX 77084
(713) 492-6611
Circle 1268 on Inquiry Card.

Trimarchi, Inc.
P.O. Box 560
State College, PA 16804
(814) 353-9120
Circle 1270 on Inquiry Card.

Wang Laboratories, Inc.
One Industrial Ave.
Lowell, MA 01851
(508) 459-5000
Circle 1272 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 1061 on Inquiry Card.
Circle 1062 on Inquiry Card.
Circle 1063 on Inquiry Card.
Circle 1064 on Inquiry Card.
Circle 1065 on Inquiry Card.
Circle 1066 on Inquiry Card.
Circle 1067 on Inquiry Card.
Circle 1068 on Inquiry Card.
Circle 1069 on Inquiry Card.
Circle 1070 on Inquiry Card.
Circle 1071 on Inquiry Card.
Circle 1072 on Inquiry Card.
Circle 1073 on Inquiry Card.
Circle 1256 on Inquiry Card.
Circle 1074 on Inquiry Card.
Circle 1075 on Inquiry Card.
Circle 1257 on Inquiry Card.
Circle 1258 on Inquiry Card.
Circle 1259 on Inquiry Card.
Circle 1260 on Inquiry Card.
Circle 1262 on Inquiry Card.
Circle 1263 on Inquiry Card.
Circle 1264 on Inquiry Card.
Circle 1265 on Inquiry Card.
Circle 1266 on Inquiry Card.
Circle 1267 on Inquiry Card.
Circle 1268 on Inquiry Card.
Circle 1270 on Inquiry Card.

MAY 1991 • BYTE 213
Northgate® 486™/25 & 33 MHz

486 ISA...486 EISA.
Only Northgate gives you a choice!
Number One! Elegance™
486/25 & 33 MHz ISA

InfoWorld's Product of the Year! After outscoring the competition in 
InfoWorld's 1990 reviews, 
and being praised 
as "tops in support 
and value," Elegance 
486/25i was awarded the publication's 
highest honor: Product of the Year. 
This was the fourth award given to an 
Elegance 486 system... no other company comes close!

PC Magazine says 
"Editors' Choice" When reviewing 486/25 
systems, they said 
"Only one machine 
stands out... you 
could pay less for a 486 
System, but not get the 
bonuses that are offered 
with the Elegance."††† 
In the February 12, 1991 issue, PC 
Magazine declared Elegance 486/33 
Editors' Choice, saying the system was 
a "sure winner in its class."

Computer Shopper 
readers agree! Elegance 
486/25i breezed past the 
competition and captured 
a 1990 "Best Buy" award. 
This makes three years 
in a row, a Northgate 
Elegance system was voted 
tops by Computer Shopper readers.

ISA 486 System Features:
- Intel 486/25 or 33 MHz processor
- 4Mb RAM; expandable to 8Mb on 
motherboard
- 200MB IDE hard drive
- 1.2Mb and 1.44Mb floppy drives
- 64K SRAM read/write-back cache
- ISA bus
- One parallel and two serial ports
- Vertical "Power" case (desktop available)
- 16-bit VGA graphics adaptor with 
512K video RAM (expandable to 1MB)
- 16-bit SVGA color monitor
- OmniKey®/ULTRA keyboard
- MS-DOS 3.31 or 3.3 and GW-BASIC 
software installed
- Microsoft® Windows® 3.0 and mouse
- FCC Class B Certified

$5399.00 / 25 MHz
$6299.00 / 33 MHz

486 EISA gives you full 
32-bit performance!

Performance that rivals RISC-based 
minicomputers costing thousands 
more! New 32-bit EISA bus gives you 
the power to transfer data along your 
network at burst mode speeds up to 33 
me腹部es per second. That's a 15-fold 
 improvement over 16-bit AT buses 
serving medium-to-large networks.

Complete compatibility! Elegance 
486e is 100% compatible with UNIX, 
Novell® and DOS. Plus, Elegance is 
compatible with existing 8-bit and 
16-bit ISA adapters, so you benefit 
from downward compatibility.

Compare Elegance 486e performance 
and Northgate service and support 
with any other vendor's in the industry. 
You'll find you can't buy better than 
Northgate! Call now... let 
Northgate build your system today!

True EISA 486 System Features:
- Intel 486/25 or 33 MHz processor
- 4Mb RAM; expandable to 32Mb on 
motherboard
- 1MB EISA caching SCSI controller
- 200MB EISA hard drive
- 1.2Mb and 1.44Mb floppy drives
- 512K SRAM read/write-back cache
- EISA bus
- Eight 32-bit EISA slots; six bus master 
and two slave
- One parallel and two serial ports
- 16-bit VGA graphics adapter with 
512K video RAM (expandable to 1MB)
- 14" SVGA monochrome monitor
- Vertical "Power" case
- 300 watt power supply
- OmniKey®/ULTRA keyboard
- MS-DOS 4.01 or 3.3 and GW-BASIC 
software installed
- Microsoft mouse
- 25 MHz EISA Class B Certified 
(33 MHz FCC Class A)

$8199.00 / 25 MHz
$9199.00 / 33 MHz

Northgate wins 1990 
Microcomputer Marketing 
Council's Service and 
Support Award!

- 30 Day No-Risk Trial. To assure your 
complete satisfaction, Northgate gives you a 30-day No-Risk Trial.
- Full parts and labor warranties:
  - 1 year on systems; 5 years on 
OmniKey keyboards.
- Overnight shipment of replacement 
parts when needed — at our expense.
- Northgate's unique 24-hour 
toll-free technical support leads 
the industry — most needs are 
met with just one call!
- Free on-site service to most locations 
if we can't meet your technical 
needs over the phone.
- Easy financing: Use your Northgate 
Big 'N' VISA, MasterCard or Discover 
Card. Leasing terms up to five years also available.

Free Pre-purchase Consultation

Nobody spends thousands of 
dollars on systems during the 
first phone call. You know it, 
we know it. Instead, we offer a 
no-obligation pre-purchase 
consultation with one of our 
highly-trained Technical 
Consultants. You'll receive 
friendly assistance in matching 
your business needs with the 
appropriate Northgate solution.

CALL TOLL-FREE
800-345-8709
IN U.S.A. AND CANADA

Fortune 1000 corporations, government 
agencies and education institutions call 
National Business
Accounts
800-548-3510

Notice to the hearing impaired: Northgate 
has TDD capability. Dial 800-335-0602.

©1990 Northgate Computer Systems, Inc.
All rights reserved. Notice: Computers and the supercomputer are no longer on the 
front page of the daily business daily. Computers and supercomputer are no longer 
the primary focus of attention. No effort has been made to prepare this document. We support the 
values of the community. In our view, the benefits of using computers and supercomputers have 
not been realized. As a result, this document is not intended to be a comprehensive guide to 
using computers and supercomputers. It is intended to be a guide to the use of computers and 
supercomputers in the context of the community. It is not intended to be a guide to 
the use of computers and supercomputers in the context of the community. It is not intended 
to be a comprehensive guide to the use of computers and supercomputers. It is intended 
to be a guide to the use of computers and supercomputers in the context of the community. 
It is not intended to be a comprehensive guide to the use of computers and supercomputers. 
It is intended to be a guide to the use of computers and supercomputers in the context of the 
community. It is not intended to be a comprehensive guide to the use of computers and supercomputers. 
It is intended to be a guide to the use of computers and supercomputers in the context of the 
community. It is not intended to be a comprehensive guide to the use of computers and supercomputers. 
It is intended to be a guide to the use of computers and supercomputers in the context of the 
community. It is not intended to be a comprehensive guide to the use of computers and supercomputers. 
It is intended to be a guide to the use of computers and supercomputers in the context of the 
community. It is not intended to be a comprehensive guide to the use of computers and supercomputers. 
It is intended to be a guide to the use of computers and supercomputers in the context of the 
community. It is not intended to be a comprehensive guide to the use of computers and supercomputers. 
It is intended to be a guide to the use of computers and supercomputers in the context of the 
community. It is not intended to be a comprehensive guide to the use of computers and supercomputers. 
It is intended to be a guide to the use of computers and supercomputers in the context of the 
community. It is not intended to be a comprehensive guide to the use of computers and supercomputers. 
It is intended to be a guide to the use of computers and supercomputers in the context of the 
community. It is not intended to be a comprehensive guide to the use of computers and supercomputers. 
It is intended to be a guide to the use of computers and supercomputers in the context of the 
community. It is not intended to be a comprehensive guide to the use of computers and supercomputers.
486 EISA: BORN TO BLAZE

The new systems are fast, but a few problems make us wonder if EISA has really arrived

STEVE APIKI AND STANFORD DIEHL

When it comes to heroes, we like the underdog, but when it comes to our workstations, we want nothing less than pure, unadulterated power. We want our disks to scream and our video to sparkle. We want to do whatever the job requires without running into frustrating hardware constraints. We want to sense the power rumbling beneath our fingertips.

This month the BYTE Lab looks at the up-and-coming standard in high-end systems: the powerful combination of Intel's 33-MHz i486 and the 32-bit EISA bus. These new machines beg for more than casual applications. System vendors pitch them as file servers, multiuser Unix hosts, and high-performance workstations (see the text box “EISA and i486: Workstation Class?” on page 220).

We didn't optimize these systems for any one application, however. Instead, we asked vendors for a general-purpose configuration that included 4 megabytes of system RAM, a VGA or better graphics subsystem and monitor, a 300-MB hard disk drive, and a 150-MB tape backup unit. Surprisingly, vendors didn't always supply EISA components with their systems (see the features summary table on pages 218 and 219).

The lure of buying the latest and greatest technology can be irresistible, but if you don't look beyond the glitz, you're likely to make a bad decision. You'll end up with more power than you need or, worse, with an expensive, immature product. When we began testing these machines, we had our usual object in mind: to pick the best of the bunch. But after getting our hands dirty, we started to question whether the EISA market has really arrived.

The Promise of EISA
The i486 processor, with its built-in FPU and 8K-byte cache, is fantastically fast, but the 16-bit ISA bus and its slow attendant peripherals drag down the performance of i486 systems. The i486 promises improvements over the 386 (see the text box “i486—Evolution, Not Revolution” on page 228), and EISA promises
ACTION SUMMARY

• 33-MHZ 486 EISA SYSTEMS

• WHAT YOU’LL LIKE
  These high-end systems deliver unprecedented speed. EISA technology promises still greater performance when EISA peripherals become more widely available.

• WHAT YOU’LL DISLIKE
  EISA systems still experience the configuration and reliability problems associated with developing technology.

• WHAT WE RECOMMEND
  Currently, the best mix of price, performance, and ease of operation are in the midrange systems. Machines from Dell, Zeos, and Acma stand out. If you don’t need a system right way, consider holding off on buying until EISA peripherals become more plentiful and more stable. In another six months, vendors should have ironed out many of the wrinkles with current add-in boards, and many new boards should be available.

peripherals that can supply data as fast as the processor can handle it. EISA’s 32-bit bus is twice as wide as the ISA bus, making it capable of delivering twice the data. EISA can also handle multiple bus masters, which may dramatically improve the throughput of I/O-bound tasks. Finally, EISA’s software-based board configuration should make board installations easier. (For an in-depth look at EISA, see “Inside EISA,” November 1989 BYTE.)

EISA’s greater bandwidth makes it ideal for networks and multiuser environments, which require fast access to system peripherals. However, EISA peripherals have been slow in coming. Most EISA devices introduced to date have been disk drive controllers (included in most of our test machines) and network interface cards. Other EISA peripherals, such as video controllers, aren’t readily available.

Software-based configuration means that you use a vendor-supplied EISA setup disk to add peripherals or to modify the configuration of any of the boards. You can set the parameters of each EISA device from the EISA setup utility, choosing IRQ numbers, ROM addresses, and other settings.
PRODUCT FOCUS

33-MHZ 486 EISA SYSTEMS: FEATURES SUMMARY

Price and performance varied widely among these systems, but most manufacturers assembled systems from a common pool of components. Machines with similar disk drive controllers and amounts of disk drive cache often turned in similar benchmark results (N/A = not applicable).

<table>
<thead>
<tr>
<th>System</th>
<th>List price</th>
<th>Size (inches)</th>
<th>Maximum off-chip cache</th>
<th>ROM BIOS</th>
<th>EISA ISA slots</th>
<th>Hard disk drive</th>
<th>Capacity (MB)</th>
<th>Avg. seek time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Systems:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acme 486/33</td>
<td>$7790</td>
<td>7.5 x 25.5 x 17</td>
<td>64 MB</td>
<td>Award</td>
<td>6/2</td>
<td>Maxtor 8305</td>
<td>360</td>
<td>14.5</td>
</tr>
<tr>
<td>ALR PowerPro VM</td>
<td>$13,477</td>
<td>7.25 x 24 x 18.5</td>
<td>49 MB</td>
<td>Phoenix</td>
<td>8/2</td>
<td>Seagate ST2263E</td>
<td>320</td>
<td>16.0</td>
</tr>
<tr>
<td>American Micat 4280G</td>
<td>$13,185</td>
<td>8.7 x 23.6 x 19.7</td>
<td>64 MB</td>
<td>Phoenix</td>
<td>6/2</td>
<td>Maxtor 8305</td>
<td>320</td>
<td>14.5</td>
</tr>
<tr>
<td>AT&amp;T ServerStar S</td>
<td>$17,679</td>
<td>7.75 x 25.5 x 31.4</td>
<td>64 MB</td>
<td>Phoenix</td>
<td>10/0</td>
<td>Seagate ST4376N</td>
<td>376</td>
<td>17.5</td>
</tr>
<tr>
<td>BlueStar 486/33E</td>
<td>$7249</td>
<td>17.25 x 7 x 16.25</td>
<td>64 MB</td>
<td>AIR/Phoenix</td>
<td>8/0</td>
<td>Seagate 360</td>
<td>330</td>
<td>16.0</td>
</tr>
<tr>
<td>CCS 466-33c</td>
<td>$14,247</td>
<td>11 x 26 x 17.5</td>
<td>32 MB</td>
<td>Mylex</td>
<td>8/6</td>
<td>Fujitsu M2248S</td>
<td>318</td>
<td>18.0</td>
</tr>
<tr>
<td>Compaq Deskpro 486/33</td>
<td>$21,835</td>
<td>9.75 x 24.5 x 18</td>
<td>100 MB</td>
<td>Phoenix</td>
<td>7/0</td>
<td>Seagate ST2263E</td>
<td>320</td>
<td>16.0</td>
</tr>
<tr>
<td>Dell 433TE</td>
<td>$10,958</td>
<td>7.25 x 24.5 x 18</td>
<td>64 MB</td>
<td>Phoenix</td>
<td>8/0</td>
<td>Micropolis 1954E</td>
<td>345</td>
<td>14.0</td>
</tr>
<tr>
<td>Dyna Micro Work Master 486</td>
<td>$9999</td>
<td>7.75 x 16 x 16</td>
<td>64 MB</td>
<td>AIR/Phoenix</td>
<td>8/0</td>
<td>Seagate ST2263E</td>
<td>320</td>
<td>16.0</td>
</tr>
<tr>
<td>Lucky 486/33E</td>
<td>$7250</td>
<td>21.25 x 6.25 x 16.5</td>
<td>64 MB</td>
<td>Phoenix</td>
<td>8/0</td>
<td>Mylex 1558</td>
<td>340</td>
<td>16.0</td>
</tr>
<tr>
<td>Micro Express ME 486</td>
<td>$7672</td>
<td>11 x 26 x 17.5</td>
<td>64 MB</td>
<td>Mylex</td>
<td>8/0</td>
<td>Micropolis 1558</td>
<td>340</td>
<td>16.0</td>
</tr>
<tr>
<td>Miyati EISA/33MHz</td>
<td>$8960</td>
<td>25.5 x 9.3 x 18.5</td>
<td>96 MB</td>
<td>AMI</td>
<td>7/1</td>
<td>Maxtor XT4305E</td>
<td>340</td>
<td>16.0</td>
</tr>
<tr>
<td>PC Craft 2304/33D</td>
<td>$9082</td>
<td>21.25 x 6.25 x 16.5</td>
<td>64 MB</td>
<td>AIR/Phoenix</td>
<td>8/0</td>
<td>Seagate ST2263E</td>
<td>340</td>
<td>16.0</td>
</tr>
<tr>
<td>SAI 486/33</td>
<td>$7495</td>
<td>21.25 x 6.25 x 16.5</td>
<td>64 MB</td>
<td>AMI</td>
<td>6/0</td>
<td>LXT-3405Y</td>
<td>340</td>
<td>15.0</td>
</tr>
<tr>
<td>Tandon DT 486/33</td>
<td>$9956</td>
<td>21.25 x 6.25 x 16.5</td>
<td>64 MB</td>
<td>Tandon</td>
<td>6/2</td>
<td>Seagate ST2262N</td>
<td>320</td>
<td>16.0</td>
</tr>
<tr>
<td>Tangent 486/33</td>
<td>$8999</td>
<td>7.5 x 25.5 x 17</td>
<td>32 MB</td>
<td>Mylex</td>
<td>8/0</td>
<td>LXT-3405Y</td>
<td>360</td>
<td>14.5</td>
</tr>
<tr>
<td>Touch 5550T</td>
<td>$6117</td>
<td>11 x 26 x 17.5</td>
<td>64 MB</td>
<td>Mylex</td>
<td>7/1</td>
<td>Maxtor XT8305E</td>
<td>376</td>
<td>17.5</td>
</tr>
<tr>
<td>Zeos 486-33C</td>
<td>$9190</td>
<td>21.25 x 6.25 x 16.5</td>
<td>64 MB</td>
<td>Mylex</td>
<td>8/0</td>
<td>Seagate ST4376N</td>
<td>330</td>
<td>16.0</td>
</tr>
<tr>
<td>Portable System:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bitwise 433E/FVP</td>
<td>$12,499</td>
<td>16 x 10.5 x 8.5</td>
<td>32 MB</td>
<td>None</td>
<td>N/A</td>
<td>N/A</td>
<td>200</td>
<td>14.5</td>
</tr>
</tbody>
</table>

1. Price includes 4 MB of system memory, VGA or Super VGA graphics with monitor, hard disk drive of about 300 MB, a 150-MB tape backup unit, parallel port, and 101-key Enhanced keyboard.
2. Minimum supported configuration.
3. Other models are available with additional cache.
4. Pixels x pixels x colors.
5. System tested and priced with 5 MB; 4-MB configuration not available.

that usually require DIP switches or jumper blocks.

Unfortunately, EISA subsystems and supporting software are still quite new, and most aren't totally wrinkle-free. A few systems presented inaccurate EISA configuration information; with others, reconfiguring an option produced some odd side effects. For example, LapLink couldn't find the parallel port on the Blue Star system's motherboard even though the EISA configuration software showed the port as enabled. We fixed the problem by disabling and then reenabling the port through software. On every system, running the configuration utility was unbearably time-consuming, making the prospect of opening the system and fiddling with DIP switches more appealing.

Common Threads

Given the newness of EISA technology, it's not surprising that many of these systems share many of the same components. Three EISA motherboards and two EISA disk drive controllers form the core hardware for many of these machines. None offers an EISA video controller, but many include fast 16-bit Super VGA controllers. Since similar components mean similar features, we'll discuss some of the more popular components here.

The most popular motherboard among our test systems was Advanced Integration Research's 486EL, which uses Intel's EISA chip set. It supports an i486 at 25 or 33 MHz, with up to a 256K-byte static RAM (SRAM) cache and a socket for a Weitek WTL4167 math coprocessor. The motherboard's 16 single inline memory module sockets accept up to 64 MB of on-board memory when loaded with 4-MB SIMMs. The AIR board has.
### 33-MHz 486 EISA Systems: Features Summary

<table>
<thead>
<tr>
<th>Interface</th>
<th>Disk drive controller</th>
<th>Disk drive controller cache</th>
<th>Floppy disk drive</th>
<th>Disk drive bays</th>
<th>Serial ports</th>
<th>Other ports</th>
<th>Video controller</th>
<th>Video RAM</th>
<th>Maximum resolution</th>
<th>Power supply (W)</th>
<th>Distribution channel</th>
<th>Warranty (years)</th>
<th>On-site service</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESDI</td>
<td>UltraStor 22C</td>
<td>512 KB 1.2 MB/1.44 MB</td>
<td>6</td>
<td>9-pin, 25-pin</td>
<td>Game</td>
<td>Orchid</td>
<td>ProDesignII</td>
<td>1 MB</td>
<td>1024 x 768 x 256</td>
<td>230</td>
<td>Mail order</td>
<td>1</td>
<td>1 year</td>
</tr>
<tr>
<td>ESDI</td>
<td>Western Digital WD-1009V/SE1</td>
<td>64 KB 1.2 MB/1.44 MB</td>
<td>6</td>
<td>9-pin, 25-pin</td>
<td>None</td>
<td>ALRParadise</td>
<td></td>
<td>236 KB</td>
<td>800 x 800 x 16</td>
<td>300</td>
<td>Dealer, reseller</td>
<td>1</td>
<td>Option</td>
</tr>
<tr>
<td>SCSI</td>
<td>Mylex DCE-376</td>
<td>1 MB 1.2 MB/1.44 MB</td>
<td>5</td>
<td>2-pin</td>
<td>Mouse</td>
<td>Matrox</td>
<td></td>
<td>512 KB</td>
<td>1024 x 768 x 16</td>
<td>300</td>
<td>Distributor, reseller</td>
<td>1</td>
<td>1 year</td>
</tr>
<tr>
<td>SCSI</td>
<td>DPT</td>
<td>128 KB 1.2 MB/1.44 MB</td>
<td>8</td>
<td>2-pin</td>
<td>Mouse, 2nd parallel</td>
<td>AT&amp;T</td>
<td>VDC 600</td>
<td>256 KB</td>
<td>800 x 800 x 16</td>
<td>300</td>
<td>Dealer, reseller</td>
<td>1</td>
<td>1 year</td>
</tr>
<tr>
<td>ESDI</td>
<td>UltraStor 22C</td>
<td>512 KB 1.2 MB/1.44 MB</td>
<td>6</td>
<td>9-pin, 25-pin</td>
<td>Mouse</td>
<td>Diamond Computer</td>
<td>SpeedStar VGA</td>
<td>1 MB</td>
<td>1024 x 768 x 256</td>
<td>230</td>
<td>Dealer, reseller</td>
<td>1</td>
<td>Option</td>
</tr>
<tr>
<td>SCSI</td>
<td>Mylex DCE-376</td>
<td>1 MB 1.2 MB/1.44 MB</td>
<td>10</td>
<td>2-pin</td>
<td>2nd parallel</td>
<td>Diamond Computer</td>
<td>SpeedStar VGA</td>
<td>1 MB</td>
<td>1024 x 768 x 256</td>
<td>375</td>
<td>Dealer, reseller</td>
<td>1</td>
<td>No</td>
</tr>
<tr>
<td>ESDI</td>
<td>Compaq</td>
<td>None 1.2 MB/1.44 MB</td>
<td>7</td>
<td>2-pin</td>
<td>Mouse</td>
<td>Compaq AG-1024</td>
<td></td>
<td>1 MB</td>
<td>1024 x 768 x 256</td>
<td>300</td>
<td>Dealer, reseller</td>
<td>1</td>
<td>No</td>
</tr>
<tr>
<td>ESDI</td>
<td>UltraStor 12F</td>
<td>32 KB 1.44 MB/1.44 MB</td>
<td>11</td>
<td>2-pin</td>
<td>Mouse</td>
<td>Dell</td>
<td></td>
<td>512 KB</td>
<td>1024 x 768 x 16</td>
<td>300</td>
<td>Mail order, retail</td>
<td>1</td>
<td>1 year</td>
</tr>
<tr>
<td>ESDI</td>
<td>UltraStor 22C</td>
<td>512 KB 1.2 MB/1.44 MB</td>
<td>5</td>
<td>2-pin</td>
<td>Mouse</td>
<td>Orchid</td>
<td>ProDesignII</td>
<td>1 MB</td>
<td>1024 x 768 x 256</td>
<td>230</td>
<td>Mail order</td>
<td>1</td>
<td>Option</td>
</tr>
<tr>
<td>ESDI</td>
<td>UltraStor 22C</td>
<td>512 KB 1.2 MB/1.44 MB</td>
<td>5</td>
<td>9-pin</td>
<td>None</td>
<td>STB Systems</td>
<td>PowerGraph VGA</td>
<td>1 MB</td>
<td>1024 x 768 x 256</td>
<td>220</td>
<td>Mail order, retail</td>
<td>1</td>
<td>Option</td>
</tr>
<tr>
<td>ESDI</td>
<td>UltraStor 22C</td>
<td>512 KB 1.2 MB/1.44 MB</td>
<td>10</td>
<td>9-pin</td>
<td>None</td>
<td>Micro Express</td>
<td>Extended VGA</td>
<td>1 MB</td>
<td>1024 x 768 x 256</td>
<td>300</td>
<td>Mail order</td>
<td>2</td>
<td>No</td>
</tr>
<tr>
<td>ESDI</td>
<td>UltraStor 22C</td>
<td>512 KB 1.2 MB/1.44 MB</td>
<td>6</td>
<td>9-pin, 25-pin</td>
<td>Tape</td>
<td>Definition</td>
<td>HiRes 1024</td>
<td>1 MB</td>
<td>1024 x 768 x 256</td>
<td>250</td>
<td>Mail order</td>
<td>3</td>
<td>Yes</td>
</tr>
<tr>
<td>ESDI</td>
<td>UltraStor 22C</td>
<td>512 KB 1.2 MB/1.44 MB</td>
<td>5</td>
<td>9-pin, 25-pin</td>
<td>Game, mouse</td>
<td>ATI</td>
<td>VEGA 1024</td>
<td>256 KB</td>
<td>800 x 800 x 16</td>
<td>220</td>
<td>Reseller, OEM</td>
<td>1</td>
<td>1 year</td>
</tr>
<tr>
<td>ESDI</td>
<td>Data Technology</td>
<td>4 MB 1.2 MB/1.44 MB</td>
<td>5</td>
<td>2-pin</td>
<td>Game</td>
<td>Diamond Computer</td>
<td>SpeedStar VGA</td>
<td>1 MB</td>
<td>1024 x 768 x 256</td>
<td>120</td>
<td>Mail order</td>
<td>1</td>
<td>Option</td>
</tr>
<tr>
<td>SCSI</td>
<td>Mylex DCE-376</td>
<td>4 MB 1.2 MB/1.44 MB</td>
<td>5</td>
<td>9-pin, 25-pin</td>
<td>None</td>
<td>Orchid</td>
<td>ProDesignII</td>
<td>1 MB</td>
<td>1024 x 768 x 256</td>
<td>230</td>
<td>Mail order</td>
<td>1</td>
<td>1 year</td>
</tr>
<tr>
<td>SCSI</td>
<td>Mylex DCE-376</td>
<td>4 MB 1.2 MB/1.44 MB</td>
<td>6</td>
<td>9-pin, 25-pin</td>
<td>None</td>
<td>Orchid</td>
<td>ProDesignII</td>
<td>512 KB</td>
<td>1024 x 768 x 16</td>
<td>270</td>
<td>Mail order</td>
<td>1</td>
<td>1 year</td>
</tr>
<tr>
<td>ESDI</td>
<td>UltraStor 22C</td>
<td>512 KB 1.2 MB/1.44 MB</td>
<td>10</td>
<td>2-pin</td>
<td>2nd parallel</td>
<td>Orchid</td>
<td>ProDesignII</td>
<td>1 MB</td>
<td>1024 x 768 x 256</td>
<td>450</td>
<td>Mail order</td>
<td>1</td>
<td>Option</td>
</tr>
<tr>
<td>SCSI</td>
<td>Mylex DCE-376</td>
<td>2 MB 1.2 MB/1.44 MB</td>
<td>5</td>
<td>9-pin, 25-pin</td>
<td>Game</td>
<td>Diamond Computer</td>
<td>SpeedStar VGA</td>
<td>1 MB</td>
<td>1024 x 768 x 256</td>
<td>450</td>
<td>Mail order</td>
<td>1</td>
<td>Option</td>
</tr>
<tr>
<td>SCSI</td>
<td>Mylex DCE-376</td>
<td>4 MB 1.2 MB/1.44 MB</td>
<td>3</td>
<td>22-pin</td>
<td>None</td>
<td>Ahead Systems</td>
<td>VGA Wizard</td>
<td>512 KB</td>
<td>1024 x 768 x 16^2</td>
<td>200</td>
<td>Mail order</td>
<td>1</td>
<td>No</td>
</tr>
</tbody>
</table>

Eight EISA slots, six of which support EISA bus-master devices. Systems that are equipped with the AIR motherboard tended to fare worse than other systems on our CPU benchmarks.

Mylex's MAE486 motherboard also supports the i486 at 25 or 33 MHz and includes a Weitek coprocessor socket. Its external processor cache can hold up to 128K bytes of SRAM, and its eight SIMM sockets hold up to 32 MB of system RAM. All eight EISA slots on the MBE486 can handle bus-master devices.

The American Megatrends, Inc., Enterprise motherboard holds up to 96 MB of memory: 32 MB in the board's eight SIMM sockets and 64 MB on a proprietary 32-bit expansion board. AMI offers a 64K- or 256K-byte external processor cache and includes a Weitek socket, seven EISA bus expansion slots, and an 8-bit slot. The proprietary memory board occupies one of the motherboard's EISA slots.

Regardless of motherboard, all but one of the systems supported video BIOS and system BIOS shadowing. The sole exception was Dell's 433TE, which shadows video BIOS only. We found that, for most applications, video BIOS shadowing improves performance more significantly than system BIOS shadowing.

Since even the fastest hard disk drives can't supply data fast enough to take advantage of the EISA bus, all EISA hard disk drive controllers use a cache. Eight machines used UltraStor's Ultra 22C caching ESDI controller; six went with Mylex's DCE-376 caching SCSI controller. Most vendors used Seagate or Maxtor hard disk drives with average seek times in the 14- to 17-millisecond range.

We asked system vendors that supplied caching disk drive controllers to include the minimum amount of cache RAM,
EISA and i486: Workstation Class?

Hardly a month passes that we don't see the introduction of a new system or system component that promises to further blur the distinction between PCs, workstations, and minicomputers. The i486 microprocessor and industry support for the 32-bit EISA bus are two significant developments pushing PCs across the fuzzy line onto workstation turf. But despite these advances, the currently available i486 systems don't quite measure up to the RISC-based Unix workstations.

The 33-MHz i486 is a top-notch microprocessor. Innovative caching schemes have further enhanced the i486 so that, in terms of raw integer performance measures like Dhrystones, it almost holds its own with a 25-MHz SPARC processor and gives the powerful 20-MHz MIPS R3000 chip set a run for its money (see the table below). Even without a Weitek WTL4167 FPU, the i486 is more than a match for the 25-MHz SPARC in floating-point operations, although it pales beside faster SPARC's and other RISC processors. RISC-based workstations now sell in the $10,000 to $20,000 range and thus directly compete with high-end i486 machines.

The critical issues that separate the workstations from PCs have less to do with raw performance, and more to do with compatibility and ease of integration. SPARC-based workstations currently enjoy two significant advantages over i486 PCs: cleaner hardware and more Unix software.

Expansion boards designed for Sun's SPBus work right out of the box; many EISA devices that we've seen don't. Most problems revolve around resource conflicts that manufacturers will likely fix with firmware revisions. But for the moment, SPARC workstations have more stable and easier-to-maintain peripherals.

But the biggest hurdle that 486 PCs must overcome to compete with SPARC workstations is the lack of portability between PC implementations of Unix. Currently, PC Unix software developers must choose sides and decide which variation of Unix to support. Hardware companies have to develop drivers for multiple versions of Unix. Both are severely hampered by the lack of binary compatibility from system to system. SPARC developers, because of cross-SPARC binary compatibility, have only a single architecture to target. It's not surprising, therefore, that the range of Unix applications for SPARC workstations is broader than that for i486 PCs.

The operating-system problems and the subsequent software gap show signs of closing, however. The latest version of Unix, System V release 4, promises a much deeper level of binary compatibility across versions of Unix supplied by different vendors. Release 4, which you should see by the end of this year, may finally boost high-end PCs into the workstation arena.

<table>
<thead>
<tr>
<th>COMPARATIVE UNIX BENCHMARK INDEXES BY PROCESSOR TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BYTE Unix benchmark indexes for machines that use i486, SPARC, and MIPS CPUs. The i486 holds an edge over the SPARC in floating-point operations but lags in raw integer performance (Dhrystones).</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
</tr>
<tr>
<td>Processor Type</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>33-MHz i486</td>
</tr>
<tr>
<td>25-MHz SPARC</td>
</tr>
<tr>
<td>20-MHz MIPS R3000</td>
</tr>
</tbody>
</table>

EISA Roundup

We tested eighteen 33-MHz i486 EISA systems in both desktop and tower configurations. We also tested what may be the first i486 EISA portable computer (see the text box “Bitwise 433E/VP Portable” on page 230). Some of the i486 systems we tested are high-end models sold exclusively through resellers and dealers. Others are assembled from common off-the-shelf components and are available directly from the manufacturer. Performance differs widely within their ranks, but every one of these systems is an outstanding performer relative to the last generation of 386 and 486 systems.

We rated the machines on their performance, price, and difficulty of setup and configuration. To measure the system...
Add HP NewWave to Windows and what do you get?
Simply a breakthrough.

Windows 3.0 is a great step forward. It just doesn't go far enough. You still have to overcome barriers you thought you'd left behind. Such as DOS. The complexities of file management and application integration. And working in two environments.

The solution? Simply add HP NewWave. In this one simple step, you turn your PC into the most powerful, easiest-to-use information tool in business. To prove it, we've put an eye-opening, interactive demonstration on disk. It shows how NewWave's simple object model lets you work on one desktop environment, instead of having to use both the Program and File Managers. You don't have to understand the DOS file system at all. And it works with the Windows applications you already have. Integrating NewWave applications is astoundingly simple. Just drag and drop. "Drill down" editing lets you make changes in part of a document, such as a chart, without leaving it. And with "hot links," your data changes automatically in all connected files.

To evaluate NewWave, call (408) 376-2727 for your interactive demonstration disk. (Handling charge $3.95.) Then experience one of the most dramatic breakthroughs ever brought to your screen.
performance, we used BYTE’s low-level benchmarks, DOS application benchmarks, and Unix system benchmarks (see the figures on pages 224 and 225). The low-level tests isolate specific performance areas, such as CPU and memory or the graphics subsystem. The DOS application benchmarks give a comprehensive overview of system performance under DOS for seven different categories: word processing, desktop publishing, database, compilers, CAD, scientific/engineering, and spreadsheet. Both the low-level and the application-level results are indexed against an IBM AT. The Unix tests measure system speed when running a complex, multitasking, protected-mode environment. Descriptions of the eighteen individual machines follow.

Acma 486/33

Any of the systems covered here represent the most powerful model from a company. Advanced Logic Research is one of a few companies that sell several variations of 33-MHz i486 systems. The PowerPro VM, which we tested, is the low-end model in ALR’s premier PowerPro line.

ALR designed the PowerPro to compete with Compaq’s Systempro. It features a modular design that can support multiple i486 processor modules and an external processor cache of up to 1 MB. The PowerPro VM that we tested included one processor with a 64K-byte external SRAM cache and 5 MB of system RAM, an ALR/Paradise VGA board with 256 MB of RAM, an ISA-bus ESDI hard disk drive and controller, and a color VGA monitor for $13,477.

The processor card plugs into a proprietary slot on the motherboard, as does the system cache. CPU performance was outstanding, but ALR’s choice of a noncaching ISA-bus controller instead of a caching ISA-bus controller resulted in a consistent, if mediocre, performance. ALR’s higher-end models have an EISA SCSI bus-master disk drive controller. You’ll pay a premium price for the PowerPro, which gives you the added flexibility of adding a second CPU and cache. That’s important if you want to use this system as a multiprocessor Unix host or as a network server on a Vines network. Otherwise, other systems may better suit your needs.

American Mitac 4280G

In a collection of systems notable for the number of cookie-cutter clones, American Mitac’s 4280G stands out with several design innovations. The motherboard holds a 128K-byte processor cache but no system memory; for this you need a Mitac add-in card that plugs into a proprietary memory slot. A single 16-bit multifunction board integrates VGA with 512K bytes of RAM, a floppy disk drive controller, and I/O port circuitry. Our test configuration also included a color monitor and a 1-MB Iylex SCSI EISA-bus caching hard disk drive controller for $13,185.

The large tower case has convenience features such as a lockable cover for the floppy disk drives and the power, a system lock, and reset switches. One full-height drive bay works like a sliding drive drawer.

As a weak raw CPU showing and a smaller disk cache than some other systems, the Mitac system’s application benchmark scores placed it close to the top. We would expect it to match the fastest systems if equipped with a larger disk cache.

AT&T StarServer S

Beneath the imposing AT&T logo and the extra-large tower case of the StarServer S lies a fast, well-designed 486/33 system board. This system, equipped with a 128K-byte CPU cache, turned in some of the best CPU test results we’ve seen. Unfortunately, the relatively underdeveloped 128K-byte disk cache and its slow video performance dragged the StarServer S down to nearly the bottom of the list on our application tests.

The StarServer S configuration we tested sells for $17,679. The system included an AT&T VDC600 VGA card with 256K bytes of VRAM. The StarServer S is about as tall and as wide as an average PC tower system, but twice as deep. AT&T puts the extra room to good use by packing in eight half-height drive bays and 10 EISA expansion slots—more than any other system.

As an AT&T box, the StarServer S will likely see action in a Unix environment. However, its BYTE Unix benchmark results were poor. We compile the Unix benchmark suite on each system, so the performance results represent the efficiency of the operating system and development environment as well as the underlying hardware. Our default PC Unix system is SCO Unix, which includes an outstanding optimizing compiler. The relatively slow C compiler in AT&T Unix penalized the StarServer S on Unix tests. The results demonstrate the performance you can expect if you plan to develop Unix software on the StarServer S.

continued
To see the future of motherboards, look at the past.

You'll discover since 1985, one company has consistently given both resellers and end users the highest level of performance, quality and support at the lowest possible price. ATronics.

In fact, we were the very first company to produce AT-compatible motherboards. The result is ATronics delivers the best choice for quality U.S. designed-and-made products. And with standards that meet or exceed other motherboards that would cost you far more. ATronics offers one of the lowest failure rates in the business. Standard benchmark tests prove their performance.

No other motherboard company delivers it all like ATronics. Prove it to yourself right now. Pick up the phone and call toll free for information and documentation on current and upcoming products. You'll be on your way to a bigger, better and brighter future.

1-800-488-7776.

Ask us about our FCC Class B Bare-bone Systems!

1985. ATronics introduces the ATI-1000. The first AT-compatible motherboard.


1830 McCandless Dr., Milpitas, CA 95035-6844, USA
Tel. (408)942-3344. Fax (408)942-1674

ATronics 1991©. ATI-1000, ATI-386/B2 and ATI-486/B2 are trademarks and ATI is a registered trademark of ATronics, International, Inc. All other products mentioned are trademarks of their respective holders.
The BYTE DOS benchmark test results, ranked by cumulative application index score, show the Tandon DT 486/33 in the top spot. This results from its large disk cache and hides a relatively poor showing in the low-level video tests. For each index score, an 8-MHz IBM AT = 1.
### UNIX BENCHMARKS

**Blue Star 486/33E**

The Blue Star desktop 486/33E uses an AIR motherboard with a 256K-byte cache, coupled with an Ultra 22C disk drive controller with a 512K-byte cache, and a 1-MB SpeedStar VGA board. Its overall performance was slightly better than average.

Our test system had problems remembering its EISA configuration information; it sometimes booted with the parallel port on the motherboard mysteriously disabled. A session with the EISA configuration utility cleared up the problem, but its intermittent nature made it especially frustrating.

At $7249, the mail-order Blue Star 486/33E is a bargain. However, the support we got when trying to solve configuration conflicts with the Ultra 22C controller was disappointing; the company representative simply passed along UltraStor’s phone number. It’s unlikely that the level of support will improve as long as EISA systems and peripherals remain in the realm of new technology.

**Custom Computer Systems 486-33c**

The Custom Computer Systems (CCS) 486-33c puts a Mylex motherboard with a 128K-byte CPU cache in a tower case. Our test system included a Mylex 1-MB caching EISA-bus controller and a 1-MB SpeedStar VGA board for $14,247. The tower case lacks a reset switch, positions the power inconveniently at the rear of the unit, and doesn’t offer easy access to the expansion slots.

The CCS machine posted excellent benchmark scores, no doubt boosted by the Mylex caching SCSI controller (the five best performers had this controller installed). The system also posted strong numbers on the CPU and video indexes.

Despite repeated efforts, we could not get Unix properly installed. A Mylex engineer said that timing problems required a BIOS upgrade, but even a new motherboard didn’t fix the problem. The Zeos system has a similar configuration (the Mylex motherboard and DCE-376 controller) but ran without a hitch. The problem made us wonder if these systems are heading out the door too soon.

**Compaq Deskpro 486/33L**

The Deskpro 486/33L exhibits all the qualities for which Compaq machines are known: good performance, quality construction, reliable operation—and
a big price. The Deskpro 486/33L, at $21,835, is by far the most expensive system we reviewed.

Paying top dollar doesn’t always bring top quality, but with the Deskpro 486/33L the two go hand in hand. This desktop system includes Compaq’s fast ISA ESDI controller, a system board with a 128K-byte processor cache, and Compaq’s high-speed, high-resolution AG-1024 video controller, which uses Texas Instruments’ 34010 graphics coprocessor. The combination earned the Deskpro 486/33L second place on the low-level video tests. It placed sixth on the application benchmarks, despite not having a caching disk drive controller. The Deskpro 486/33L ran flawlessly and was one of the easiest systems to set up and configure.

The Deskpro is one of the heaviest machines we tested—the locking case includes a lot of heavy steel, with a power supply that runs from the front to the rear of the case. You can access the drive bays from the front or back of the machine.

If price were no object, we’d recommend this system in a heartbeat. But even after considering dealer discounts, the Deskpro 486/33L’s stellar price puts it out of the range of all but the most dedicated Compaq shops.

**Dell 433TE**

Although Dell’s 433TE garnered only average numbers on most of our benchmarks, this was one of our favorite systems. The 433TE’s flawless operation, solid construction, and ample room for expansion make it an excellent choice for its moderate $10,958 price.

Dell earns high marks for its attention to detail. The system came well packed, with good documentation, and was easy to set up. Once you unlock the case, one full side of the tower case snaps off without removing a single screw, allowing access to the system board, drive bays, and expansion slots (see photo 2).

The case accommodates up to 11 half-height drives, the most generous of any of the systems we reviewed. All system memory mounts on a plug-in card that accepts Dell’s proprietary memory modules.

The 433TE earned high scores on all the low-level benchmarks and took the top spot in the video tests. Unfortunately, these numbers didn’t carry over into the Unix and DOS application benchmarks. The UltraStor Ultra 12F ISA-bus ESDI controller, which offers a small 32K-byte track buffer instead of a full cache, caused the 433TE to lag behind on some DOS applications. Like Compaq and ALR, Dell opted for a more proven cache , an Ultra 22C ESDI EISA disk drive controller, and a Pro Designer II VGA board with I MB of RAM. The best performance numbers came in the low-level CPU tests; the system trailed the top finishers by a small margin in the video tests. High-level DOS application and Unix benchmark numbers were average.

We didn’t experience any problems with the Lucky 486/33E once we had it set up and running, but we did have to open up the unit initially to reattach some loose disk drive cables. And while the system uses brand-name components inside, the overall fit-and-finish was below par. This system is for those who know their way around the inside of a computer and for whom price is the deciding factor.

**Micro Express ME 486**

The ME 486, a mail-order machine, comes in at the low end of the spectrum at $7672. Using the same tower case as the CCS and Touche systems, Micro Express did a better job laying out the internal components. The drive bay housing does block one of the 32-bit EISA slots, however, it can’t accept a full-length card. The unit ships with a half-length I/O card in this slot. Micro Express uses an AIR motherboard, an Ultra 22C EISA caching disk drive controller, and a 340-MB Maxtor ESDI hard disk drive. The Super VGA adapter, configured with 1 MB of RAM, carried a Micro Express label.

The unit scored well on the video benchmarks, but sub-par disk performance kept it in the middle of the pack overall. As configured, the system came with only a 512K-byte disk cache, so a heftier cache would probably make it a stellar performer.

**Misys EISA/33MHz**

Misys has assembled its EISA/33MHz system around the AMI Enterprise motherboard and packaged it in a sturdy tower case. The case has front-mounted turbo, reset, and power switches. The system accepts up to 32 MB of RAM on
The 4167’s 10 MFLOPS performance delivers 3X the speed of the 486!

The new Weitek 4167 coprocessor outperforms the 486 by 3 to 1 in numeric processing. Capable of 10 MFLOPS, the 4167 has sockets in some of the most sophisticated 486 systems on the market, including Compaq, Intel, Hewlett-Packard, and Microway. The 4167 is object-code compatible with the WEITEK 3167 FPU and Microway’s mW3167-PS add-in card for the MicroChannel—offering easy access to a broad base of existing CAD/CAM, scientific and engineering applications like Mathematica, CADKEY, HOOPS and Microway’s NDP compilers. And look for 4167 support on upcoming products from AutoDesk!

**Number Smasher® 486** converts your old AT or 386 into a powerful 486 workstation. In a review of 25 MHz 486 motherboards, Mike George of *Personal Workstation* magazine wrote, “Microway’s Number Smasher-486 gives you top 486 numeric performance for the best price...Number Smasher's numeric performance exceeds that of all 25 MHz 486 systems we’ve tested to date.” Running the Microway Benchmark Suite, the 4167-equipped Number Smasher-486 achieves 11.9 MegaWhetstones. The board features a Burst Bus™ memory interface that makes it stand out in numeric problems that involve large arrays. Burst cycle response in a 486 system is much more important than second level caches, which are usually too small to be of any use on the megabyte arrays found in real world problems.

The ideal solution for numerically or I/O intensive applications is Microway’s new Number Smasher-486/33T workstation. Two configurations are available, each incorporating state-of-the-art power and cooling with 300 to 600 megabyte drives.

**NDP Fortran-486, NDP C-486 and NDP C++** are your keys to unlocking the power of the 4167. Each compiler generates globally optimized, mainframe quality code and has special features that take advantage of the 4167, such as register caching, loop unrolling and automatic inlining of small procedures. These optimizations are handed off to a code generator that is tuned for the 4167, and takes advantage of its advanced instructions like multiply accumulate. In addition, the 486 versions of NDP Fortran, C++ and C properly sequence 486 and 4167 instructions so that the 486’s prefetch queue has time to "breathe." NDP compilers are also available for the 386SX, 386 and i860 under DOS, UNIX, XENIX and SunOS. Thousands of Microway’s satisfied customers have discovered that you can’t buy a better scientific Fortran or C compiler. And our technical support is the best in the industry.

For more information, please call 508-746-7341.

Microway®

The World Leader in PC Numerics

Corporate Headquarters, Research Park, Box 79, Kingston, MA 02364
TEL. 508-746-7341 • FAX 508-746-4678
U.K. - 32 High St., Kingston-Upon-Thames, 081-541-5466 • Italy 02-74.90.749
Holland 40 836455 • Norway 9 876565 • Japan 81 3 222 0544
i486—Evolution, Not Revolution

The introduction of the 386 microprocessor in 1986 revolutionized the industry by opening a whole new bag of tricks for DOS-based systems: true multiprocessing, 32-bit operation, access to gigabytes of memory, and significantly enhanced performance.

The 386 is a tough act to follow. Given the advances of the 386 over the 286, the i486, the latest generation in Intel's bread-and-butter processor line, looks more like an upgrade than a brand-new chip. And with Intel's new marketing strategy, the differences will be even less noteworthy. The company will sell less expensive versions of the chip with the on-board cache or the FPU module disabled.

The most important feature of the i486 is its binary compatibility with the 386DX and SX, 286, 8086, and 8088 processors. Programs written for these earlier processors should run without modification on the i486. Technically, the i486 instruction set is a superset of the 386's with a few added instructions. Still, the new chip is object-code compatible with the 386. In fact, to most software programs the features of the i486 are identical to those of the 386.

The i486 does sport some notable enhancements. For the most part, Intel has simply put some important support functions under one umbrella. An evaluation of performance quickly reveals, however, that the i486 is greater than the sum of its parts. Integration clearly has performance advantages.

Typically, 386-based systems include a discrete memory cache along with the Intel 82385 cache controller. The i486 has an on-board 8K-byte internal four-way set-associative cache and controller. Each memory address has a tag assigned to it. When the i486 requests data from memory, it compares the address to each tag simultaneously. If it finds a match (a cache hit), it fetches the data from the fast static RAM. On memory writes, the i486 cache updates both cache memory and main memory (write-through).

Integrated caching hasn't deterred vendors from adding their own external CPU cache designs. An external cache increases the hit rate, but as its size increases, the law of diminishing returns takes hold. A 64K-byte external cache should account for most cache hits. Larger caches only marginally enhance the speed of memory access. We found only small differences in CPU performance between a system with a 64K-byte cache and a similar model with a 256K-byte cache.

The i486 also incorporates a math co-processor that's object-code compatible with the 80387. If you have many math-intensive applications, the i486 is enticing, since you won't have to buy a separate math chip. Remember, though, that your applications must recognize and enable floating-point functions.

Perhaps the biggest change the i486 has wrought lies in how the rest of the system unit has had to change with the times. These new systems typically include larger and faster hard disk drives, caching disk drive controllers, high-resolution video components, and high-performance EISA expansion buses. These i486-based systems require a complex mix of new components that far surpasses what most souped-up 386 systems offer. Clearly, this new breed is targeted for high-end applications.

PC Craft 2304/33D

PC Craft designed its system around the same third-party motherboard included in the Acma 486/33, although it opted for a smaller, 64K-byte processor cache. Our test system carried a list price of $9082, which put it squarely in the middle of the price spectrum. Processing power was quite respectable, and the Ultra 22C caching ESDI EISA disk drive controller contributed to the system's average disk drive performance; unfortunately, we ran into several annoying flaws while working with the machine. In the end, these problems tempered our enthusiasm for this system.

The bulk of the problems were minor and had to do with poor configuration at the factory. Our system had 4 MB of RAM, but the motherboard was configured for 2 MB. The unit arrived with the disk drive cables completely disconnected from the controller card. Our 1-MB ATI VGA1024 video card came configured for 8-bit operation. (Setting it for 16-bit mode gave better performance and didn't cause any conflicts.) And PC Craft mounted the parallel port so close to the bottom of the system case that it was impossible to plug in a standard printer cable. Eventually we worked around all these problems, but tracking them down was an annoyance that should have been unnecessary. Users making such a major purchase expect to receive a system that is carefully constructed and properly configured.

More critically, the PC Craft system posted below-average benchmark scores. Slow video performance kept the 2304/33D at the bottom of our DOS application benchmarks. With video BIOS shadowing active, we detected no increase in speed on our BIOS-call-intensive video benchmarks. As it turned out, shadowing is always on. PC Craft disabled the setup toggle due to problems with the system's Award BIOS, which it says should be fixed in the next release.

continued
Introducing an inexpensive solution to America's savings crisis.

You've always wanted to own a tape drive. Unfortunately one small thing has always stood in your way. Your savings account.

Well, now you can buy an internal tape drive that can back up from 40 to 120 megabytes for as little as $419.*

Our Irwin SX Series™ Tape Backup Systems are ready to go right out of the box. Unlike others, they're complete systems—with all the hardware and software you need—as well as a tape cartridge.

The Irwin SX Series also includes a model that can back up 80 to a whopping 250 megabytes.

But that's not all. Every Irwin SX drive comes bundled with Central Point Backup™ software. This award-winning program works with a wide array of IBM AT, PS/2 and compatibles.

Whether you choose an internal or an external system, you can back up a 40 megabyte hard drive in less than 12 minutes. Visual file selection, unattended backup and mouse support are just a few of the features that make this the favorite backup utility of over one million PC users.

To save you even more money, we also include a coupon that lets you buy Central Point PC Tools Deluxe™ for just $50. A $99 savings from its usual $149 price tag.

So if you want to back up on tape without emptying your bank account, pick up an SX Series system at your nearest Irwin dealer.

Or, call 800-BACKUP1 for more information. And we'll help end your savings crisis.

In more ways than one.

*Manufacturer's Suggested Retail Price. ©1988, Irwin Magnetic Systems, a subsidiary of Archon Corporation, 2381 Commonwealth Blvd., Ann Arbor, MI 48108-1540. Irwin and the Irwin logo are registered trademarks and the SX Series by Irwin is a trademark of Irwin Magnetic Systems, Inc. Central Point Backup and PC Tools Deluxe are trademarks of Central Point Software, Inc. All other trademarks or registered trademarks are the property of their respective holders.

Circle 171 on Inquiry Card.
Bitwise 433E/VP Portable

You can do a lot with the 33-MHz 486 EISA systems from Compaq, ALR, and the other big names. You can set them up as network or workgroup servers, or you can configure them as powerful CAD workstations. You cannot, however, carry one over your shoulder or conveniently stash it away in the overhead bin on an airplane.

The Bitwise 433E/VP adds the extra feature of portability to the already impressive performance features of 486-based EISA systems. The 433E/VP packs a 33-MHz 1486, six EISA slots, three half-height drive bays, two serial ports, and one parallel port into a standard "lunchbox" case that's about the size of a Compaq Portable III. At a hefty 22 pounds, this isn't the kind of machine you want to haul around on every trip. But for the processing power it contains, the 433E/VP's weight is more than reasonable.

Bitwise Designs is one of the first vendors to release a 486/33 EISA portable—the system competes with IBM's PS/2 Model P75 (see "The Fastest Portable: IBM's P75 Road Warrior," April BYTE). The 433E/VP is faster and cheaper than IBM's Micro Channel portable, but the PS/2 Model P75 is much more ruggedly designed.

Our test unit, which included a Mylex caching SCSI disk drive controller with 4 megabytes of RAM and a 200-MB hard disk drive, turned in DOS and Unix benchmark results worthy of any of the 486 desktops (see the figures). There is a performance penalty to pay for reduced size, however. The Bitwise portable is built around a baby version of the AIR motherboard found in several desktops, and it has no external processor cache. The result is weak performance on CPU benchmarks, relative to the other 486/33s.

The case construction is good, but the two flimsy folding brackets that hold the orange gas-plasma display tend to stick if you aren't careful when folding and unfolding the screen. The display itself has good contrast and is quite readable. Since the system includes a Super VGA card, you can set up a high-resolution graphics system by jacking in an external analog monitor. We noticed, however, that this FCC Class A portable causes significant interference on some external monitors.

Our test system sells for $12,495, making it somewhat more costly than the bulk of the systems reviewed. But add a tape drive and a high-resolution monitor, and it's a totable alternative to most desktop models, although with slightly lower CPU performance.

The 433E/VP works best as a desktop machine that you can take with you on occasion. All peripherals plug into standard ports, so you can add an external keyboard and monitor, and there are enough slots to add a network adapter.

Software developers and CAD users who take work home or travel with their systems will also find the Bitwise system attractive. While the 433E/VP can handle network chores or be used to process large databases, portability presents a security problem you may not want to risk. But if you need a 486 EISA system and are willing to sacrifice a bit of processing power for portability, the 433E/VP is a good choice.

SAI 486/33

SAI Systems Laboratories' $7495 486/33 desktop system is one of a group of systems vying for bargain status. Our test unit included an AIR motherboard with a 256K-byte CPU cache, a SpeedStar VGA board with 1 MB of VRAM, and Data Technology's caching ESDI EISA bus-mastering disk drive controller with a 4-MB cache. By going with the Data Technology controller, SAI bucked the UltraStor ESDI disk drive controller trend set by other vendors. Data Technology's board performed well, but because it caches disk reads only, it didn't quite match the numbers posted by the Zeos, Tangent, and Tandon systems using Mylex controllers. If you require extremely high data reliability, however, Data Technology's no-write cache is arguably a safer design.

The 486/33 appears to be assembled well, and its overall performance is better than average. Its sole problem was an intermittent keyboard failure.

Tandon DT 486/33

The top spot on our application benchmark performance index belongs to Tandon's DT 486/33, which edged out other systems with large disk caches. Tandon's entry included a 64K-byte processor cache, a Mylex caching disk drive controller with a 4-MB cache, and a Pro-Designer II VGA board with 1 MB of RAM for $9956. This price doesn't include a tape backup unit, as do the other systems we tested.

The Tandon motherboard has an Intelligent Drive Electronics interface but no RAM sockets; Tandon put system memory on a card that fits into a proprietary 32-bit slot. The case design makes for easy access to the internal components.

Tandon's enhanced BIOS and DOS include several useful utilities. For example, the BIOS lets you choose whether you want to boot from a disk or from the hard disk partition of your choice when the system starts up. If you intend to run more than one operating system, this is a
Power Packed & Built To Last.

STANDARD 150 $69
Economical  This UL approved, fully tested unit is one of the best generic 150s available. Ideal for basic systems.

SILENCER 150 $119
Ultra-Quiet  Stop that irritating noise with the Silencier 150. 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.

HIGH PERFORMANCE 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 275 $169
Slim & Powerful  Give your Slimline or Mini-Tower computer up to 100% more power and cooling with our low profile, direct replacement Turbo-Cool 275. With a peak capacity of 350 watts, it will easily start even the largest hard drives and peripherals!

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 Silencier 220. Its high-efficiency, adjustable-speed fan offers 69% less noise with standard cooling. Quieter than most hard drives. Great in the executive suite or home office.

TURBO-COOL 300 $189
High Performance  Upgrade your AT/386 with our powerful Turbo-Cool 300. This popular OEM unit features built-in line conditioning, UL/CSA/TUV approval, 2 year warranty, and a high-capacity, adjustable-speed fan that keeps your system 20° to 35° cooler for up to three times longer life. Great value!

TURBO-COOL 450 $349
Maximum Performance  The choice of PC professionals, our Turbo-Cool 450 features built-in line conditioning, autoselect input, independent regulation, external DC voltage adjustment, triple-stage output filter, 50cfm cooling fan, UL/CSA/TUV approval, 200,000 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
Desktop Upgrade  The power user's power supply! Our direct replacement CD270 gives your 8086/286/386 Desktop up to 70% more power and the reliability it deserves. Prevents nuisance rebooting. Advanced design includes autoselect 110V/220V, 2-year warranty.

INTERNAL UPS!

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.
Circle 368 on Inquiry Card (RESELLERS: 369).

**GEOGRAPHIC DISTRIBUTION OF CUSTOMER BASE**

Create Symbol Maps in proportion to your data, scaled in the horizontal direction, vertical direction, or both. You can use the built-in symbols, create your own, or import symbols from other applications using the Windows Clipboard.

**<MapViewer™** supports multiple layers, allowing you to combine different map types (Hatch Maps, Dot Density Maps, Pie Maps, Symbol Maps, and Prism Maps) into a single map. Use data files created with other programs including Lotus 1-2-3, Microsoft Excel, and standard ASCII files.

**MapViewer™** comes with boundary files for the countries of the world, all 50 states, and all the counties in the U.S. There is no need to purchase additional boundary files or data sets. Everything you need to create stunning full-color maps is included in one low price.

---

**PRODUCT FOCUS**

**Tangent 486/33**

Tangent's system included a Mylex disk drive controller with a 4-GB cache. Its 128K-byte external processor cache and ProDesigner II VGA board with 512K bytes of RAM propelled it nearly to the top on most of our benchmarks. These top-of-the-line components come mounted on a Mylex EISA motherboard and in a generic tower case, for $8999.

The system had just a few minor problems. The floppy disk drive cables weren't connected when the system arrived, and the system experienced an unrecoverable disk error while it was running Unix. The disk error occurred only once. These problems aside, we found the unit fast and sturdy. Like some of the other midrange systems we've seen, the Tangent 486/33 offers a good mix of speed and consistency.

**Touche 5550T**

At $6117 for our standard test configuration, the Touche 5550T offers strong features at an attractive price. The system uses the Ultra 22C disk drive controller and the Maxtor XT-8380E ESDI hard disk drive with a fast 14.5-ms average seek time. The system also uses the ProDesigner II video adapter with 1 MB of VRAM. The Touche's 450-watt power supply was one of the largest we tested.

The system uses AMI's Enterprise motherboard with a 128K-byte processor cache. The internal layout doesn't seem well thought out, however. The drive bay housing partially blocks two of the seven EISA slots in the system, so they can't accept full-length boards. The case design also prevents you from placing a screwdriver squarely into the expansion slot screws.

Despite its relatively small (512K-byte) disk cache, the Touche performed well, posting consistent numbers across the board. At this price, the Touche deserves a close look.

**Zeos 486-33C**

Most of the machines we tested offer either performance or reliability. Zeos's 486-33C desktop machine was one of the few that offered both. The system finished close to the top on both our DOS application and Unix tests, and it ran without a single snag for the several weeks that we used it (see photo 3).

Our test system used a Mylex motherboard with a 2-GB Mylex caching hard disk drive controller and a SpeedStar VGA board with 1 MB of VRAM. Like Touche, Zeos powers its system with a rugged 450-W power supply.

Zeos's price/performance ratio is good. The 486-33C's price of $9190 sits at the midpoint. Together with the reliability we've seen and the company's generally good reputation for support, the 486-33C looks like an excellent choice.

**Thinking It Over**

EISA technology has been around for well over a year, but EISA expansion-board manufacturers are still working out the kinks. EISA peripherals have yet to reach the point where you can confidently buy off the shelf and expect to assemble a system without difficulty.

The problems we experienced make us leery of buying one of these complex systems.
EFFICIENT DESIGN

Birds, turtles, crocodiles — just as the egg is nature’s most efficient design for delivering complex life systems, DTK's KEEN-3300 Series is the ideal 386 computer with which to build your network or multi-user system. As a fileserver, networkstation or standalone system, its unique write-back cache (64KB/256KB) and competitive price make it one of the most cost-efficient, high-speed systems available.

HIGH DEPENDABILITY

Over 100 full-time design and manufacturing engineers work together to ensure that dependability is “built-in.” Then, QC personnel scrutinize every DTK motherboard and system to the most stringent standards in the industry. Over 2,000,000 satisfied customers testify to our reputation for quality and dependability.

GROWTH POTENTIAL

Like the egg, the basic KEEN-3300 is merely the beginning. Its 16 MBytes of high-speed RAM, 8 expansion slots and 7 drive bays (server) provide the flexibility you need to expand your system as your requirements grow.

The KEEN-3300 — a powerful beginning at a price that won’t crack your budget. Call for the dealer nearest you, DTK Computer Inc., (818) 333-7533. 15711 E. Valley Blvd., City of Industry, CA 91744. Fax: (818) 333-5429.

A reputation for success.
machines from the ultralow-cost mail-order clone vendors. Unless the added performance is crucial and you’re on a tight budget, consider paying a little more for added support and stability.

On the other hand, the conservative approach of the very high-end system vendors generally means that you’ll be paying top dollar without reaping the performance advantages of EISA components. The ALR multiprocessing system offers extra power, but you’ll want more than this bottom-line configuration to fully exploit the EISA bus and deliver the speed you expect.

A few systems between the two extremes blend reliability, good performance, and affordability. The three most outstanding were systems built by Zeos, Dell, and Acma.

Zeos’s 486-33C scored very well on our benchmarks; its price is moderate, and the manufacturer has a good reputation for service. Dell’s 433TE, while not quite as fast, is reliable and ruggedly constructed. The company builds the 433TE from the ground up, giving it better control of the interaction between components than is the case with systems that are assembled from third-party subsystems.

Finally, Acma’s 486/33 offers speed and reliability at an outstanding price. Our best advice is simply to wait for the technology to develop further. Six months from now, reliable, full EISA 486s should be available. For now, however, buying into EISA means accepting the risks as well as the benefits of pioneering new technology.

Steve Apki and Stanford Diehl are testing editors for the BYTE Lab. You can reach them on BIX as “apiki” and “sdiehl,” respectively.
Cache Computers announces the fastest 486 boards in the world. Our BAT486-50, the first 50MHz 486 “Baby AT” board, races past the competition at over 22 MIPS! Using Velox’s patented IceCap “supercomputer” cooling technology and CACHE’s advanced design, BAT486-50 sets a new speed record while others crash and burn.

Our BAT486-40 “Baby AT” board hits 18 MIPS at 40MHz and offers up to 32MB of onboard RAM.

Need an EISA system you can depend on when the heat is on? Try CACHE486-33/EISA. With up to 256K of cache and up to 64MB of RAM, this board is for the most intense file server or workstation applications.

CACHE486-33/AT’s reliability makes it a winner in any 486 workstation. The full-size AT system board runs at 25 or 33MHz, with 128K of cache, and up to 16MB of RAM.

Cache ensures maximum reliability at high speed by testing every 486 board at 50°C to verify the extra margin for “worst case” timing.

Even at these extremes, our boards perform as cool as cucumbers.

The 486 family complements Cache’s line of high-performance 386SX and 386DX system boards. Available with AT/EISA or cache/non-cache options, Cache offers the most comprehensive line of All-American products in the industry.

If your 486 systems crash and burn at high temperatures or at high speeds, call Cache Computers now. We’ll put cold, hard cash in your pocket.
THE CHOICE IS YOURS!

Take your pick: Order your own ZEOS 25MHz or 33MHz '486 EISA system at new low prices.

Choose from our broad selection of money saving packages or let us custom configure a system just for you.

Whatever you decide, you'll see why ZEOS is the technology leader in high speed '486 EISA systems.

Call now to order! 800-423-5891
**THE POWER AND THE PROMISE DELIVERED!**

Available right now! ZEOS harnesses the incredible power of the '486. Then we combine it with all the advantages of the EISA bus. The result is the finest computing platform you can buy. And it's ready for you today!

**THE POWER OF THE '486**

The '486 chip is a technological marvel. It includes not only an advanced processor core but also a built-in cache controller, memory cache, floating point math coprocessor, and an advanced memory management unit. Running 40%-50% faster than similar '386 chips, the '486 makes short work of any processor-intensive applications. But where does it really shine?

**THE PROMISE OF EISA**

It really shines when ZEOS combines it with the EISA 32-bit bus! The '486 is a 32-bit processor. It runs 32-bit software. And, to bring out its full potential, it demands a 32-bit bus. That bus is EISA. It is the perfect bus for the '486 and it is the only bus you should consider if you are purchasing a '486 system. Why?

Compatibility for starters. Just as the '486 processor offers full compatibility with all of your software, the EISA bus accepts your present 8-bit and 16-bit expansion cards and runs them without a hitch. And then the performance really kicks in.

We're talking about 32-bit hardware performance. It's the reason the '486 was invented. To unleash the potential of 32-bit software and hardware. And ZEOS gives you both.

**ZEOS '486 EISA. INCREDIBLE VALUE!**

Price, Performance, Quality and Support. Value. These are the ZEOS hallmarks. Remember, it was ZEOS that invented 24 Hour a Day Toll Free Technical Support. Others have since copied us, but no one can match ZEOS support. It's the best in the business.

And that's only the start of your ZEOS Customer Satisfaction package. Add to it 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!*

**ORDER YOUR OWN ZEOS '486 EISA TODAY!**

Ordering your own ZEOS '486 is easy. Simply pick up the phone and give us a call at 800-423-5891. For a personal workstation, file server or any high performance application, your ZEOS '486 EISA is the perfect solution. That's not just a promise. That's a Guarantee.

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

**DON'T FORGET THE OPTIONS!**

ZEOS has them all. Starting with blazing 32-bit EISA cards and every other high performance option you could want. Choose from a huge selection of hard drives, video packages, and more. Whatever you need to equip your system to your exact needs. On-site service is available too. Call 800-423-5891 for details.
Even though workstation costs are coming down, they’re still by no means cheap: A fully configured color workstation for less than $9000 is a rare find. But the power of Unix and the visual impact and ease of use of the X Window System may not be too expensive to put on every desk in the office—that is, if you consider using X terminals.

Even though they’ve been available for some time, there is still confusion about what an X terminal is and what it does. Simply stated, X terminals are to graphics workstations what serial “dumb” terminals are to text-based multiuser systems. Both allow you to run applications without having to sit in front of the host system. But while a serial terminal’s internal software is mostly limited to displaying text (at a particular position and with certain attributes), an X terminal runs MIT’s X Window System graphical windowing software.

Thus, instead of merely displaying one text application that occupies the entire screen, an X terminal can display several applications, textual and graphical, simultaneously. What’s more, each application can be running on a different host; and since the connection is via 10-megabit-per-second Ethernet, display performance is often fast enough to rival (or beat) the workstation’s original display.

The thing that distinguishes an X terminal from a diskless workstation is that the applications load and run on a remote host. Display output, along with mouse and keyboard input requests, is routed through the network from the host to the terminal. X Window software can’t tell the difference.

In theory, any X Window software that your workstation can run will operate identically at an X terminal. And, with few exceptions, that’s just how it works. The exceptions come when applications developers depart from the standard for reasons of their own, or when the underlying software itself is flawed. Any “properly behaved” X application, written using quality X Window libraries, operates every bit as well on an X terminal as on the host’s display.

The Common Threads

Up to a point, every X terminal I looked at was much like the others. They all run the same software—MIT’s X Window System 11 release 4 (X11.4)—and provide a similar range of services to users. The X Window standard is broad and specific, leaving (thankfully) little room for the kind of innovation that breaks things. What differentiates X terminals from one another are issues not related to their basic capabilities, so I focused my testing on application and host compatibility, configuration interface, ease of connection, and performance.

It might surprise you that performance was the last thing that I concerned myself with when evaluating these terminals. Great, deep political debates are raging over whether X Window performance can reliably be gauged at all, but my reason for not worrying about it is much simpler: Once a terminal goes past the “fast enough” mark, it matters little if one scrolls text 10 percent faster than another. The point is to obtain a cost-effective terminal that hooks up easily and runs everything it’s asked to run.

This review was not intended to include every X terminal ever made. I selected five high-resolution color units that are representative of what you’ll find on the market. The units were supplied
X TERMINALS

WHAT YOU’LL LIKE
These X terminals provide an excellent way to put graphics power on every desk while keeping costs down.

WHAT YOU’LL DISLIKE
Some terminals’ setup and host connection software made the task more difficult than it needed to be. Some X applications still make unreasonable assumptions about hardware and servers, affecting the ability of certain terminals to run a small class of applications.

WHAT WE RECOMMEND
For overall value, the HDS ViewStation for $5199 provides a large viewing area, high resolution, and excellent software on tape. Its standard 2-MB memory may cramp a demanding user, but it is expandable. For a smaller terminal, the 17-inch NCR X-Station had a slight edge over the NCD NCD17c in cost-effectiveness and quality software.

WHAT YOU’LL PAY
HDS ViewStation: $5199
NCD NCD17c: $5050
NCR X-Station: $4800
Tektronix XP29: $7495
Visual Technology XDS: $7555

by Human Designed Systems (HDS), Network Computing Devices (NCD), NCR, Tektronix, and Visual Technology. All provide a minimum display of 1024 by 768 pixels in 256 colors on a 17-inch or larger screen.

I connected the terminals to BYTE’s Unix Lab network via thin-wire Ethernet cable. I ran X applications from the following hosts: a Sun IPC running Open Windows 2.0, an Alto System 5000 running Alto Unix (with The Santa Cruz Operation’s Open Desktop), a Multi-micro 386/33 running Interactive Unix 2.2 and X Window 1.2, an IBM RISC System 6000 running AIX, and an Arche 486/33 running Intel System V release 4.

The suite of applications that I ran included FrameMaker 2.1x, IslandWrite, IslandPaint, and IslandDraw 2.3 for Open Look, Uniplex Windows, Looking
They've Got Connections

You might think, with all this rampant connectivity, that an X terminal would be a plug-and-play device. Well, not quite. I'd hardly call it an ordeal, but configuring an X terminal for your environment is anything but automatic.

The terminals came with X11.4, configuration utilities, and telnet network terminal emulation programs in ROM. Generally, all that was needed to make the first connection was to load the terminal's TCP/IP address into configuration RAM, reboot, and use telnet to connect to the host to run the xterm terminal program. Each X terminal comes with a tiny selection of X Window fonts in memory, just enough to get basic applications (e.g., terminal emulator windows) running. To do any real work, you must create a way for the terminal to access the 200-plus fonts that come standard with X11.4.

On a workstation, an X server can load fonts off the hard disk as needed. Lacking local disks, X terminals fetch fonts in a rather clever way. A cartridge tape is provided that contains font bit maps. You load the tape onto a workstation's hard disk and then configure the terminal with the network address and directory name in which the fonts are stored. Because some applications (e.g., Looking Glass) require special fonts, some tapes also include tools for converting fonts from their original format to one the X terminal can use.

Configured fonts are downloaded into the X terminal's RAM from the font host as needed. In addition to fonts, color tables, ASCII configuration files, and even server binary images can be stored on and loaded from remote hosts. The server image download capability is a nice touch; some of these terminals' server software can be upgraded with a tape rather than firmware.

All the tested terminals include some form of point-and-click configuration utility; some are graphical, while others are mostly text based. How they work is covered in the individual discussions that follow. The monitors, keyboards, and mice are not discussed below because all but the Visual Technology X Display Station's monitor, which had an adjustment problem, were of excellent quality.

HDS ViewStation

The HDS ViewStation came with a 19-inch color display, 2 megabytes of memory, and a 1280-by-1024-pixel resolution. Like most of the other terminals, it is a "monitor base" style, a slim case on which the monitor can stand. This takes up the least desk space and places the power switches and indicator lights within easy reach.

HDS's configuration program has a plain, even primitive, interface; it is really a text application with mouse sensitivity. It has its good points, like the informative header displays showing the terminal's Ethernet address, but it has some drawbacks, too. The most serious problem with the configuration manager is its tendency to have immovable pop-up windows that obscure important information in underlying windows. It's possible to get so deep in pop-up windows that you lose track of what you're modifying. Descriptive window titles would avoid confusion.

When you make a change to the configuration, a set of prompts appears at the bottom of the main window telling you what steps you need to take to commit those changes. "Apply Changes" or "Save Settings in NV-RAM" (nonvolatile memory) will light up, depending on the changes you make, and these instructions are a little bit ambiguous. "Apply Changes" should really read "Apply Changes to Current Session Only."

The HDS ViewStation mostly breezed through the tests.

The HDS ViewStation mostly breezed through the tests, performing well with the mix of Open Look and Motif applications. This is partly thanks to the excellent assortment of fonts and conversion utilities provided by the company. HDS's was the only tape that included a program to convert fonts from one binary type to another. I used this program while testing the other terminals to get programs such as Looking Glass to work; Looking Glass provided its fonts only in a binary form compatible with Interactive's X Window System.

The ViewStation did, however, exhibit compatibility problems with IslandWrite and X.desktop 2.0. In the first case, fonts were jumbled beyond recognition. This isn't necessarily the ViewStation's fault; IslandWrite uses Sun's scalable font mechanism, which may make assumptions about byte order when font bit maps are uploaded to the X server. And X.desktop's large, imaginative cursor bit maps would only display in part (the upper-left part, to be exact). This problem has reportedly been fixed; existing HDS customers can download a new server image from HDS's BBS.

The configuration manager, along with the telnet terminal emulator, benefits from being an X application. When you connect to your primary host and fire up a window manager, the configuration manager is re-parented: Its window takes on the same border and window manager characteristics that any host-run application would. Thus, the configuration manager and terminal emulator are always an icon click away, even after the first X session is started.

The ViewStation's best attribute is the tape of software included with it. I had no trouble getting fuzzy applications like Looking Glass to run. The ViewStation fared only a little worse than the other terminals in performance and compatibility. Large windows could be seen redrawing from top to bottom after being moved, and text scrolled visibly more slowly than with other terminals. Still, performance was well within reasonable boundaries, and the minor speed differences had little or no impact on the tested applications.

NCD NCD17c

NCD provided its NCD17c terminal with a 17-inch display (1024 by 768 pixels in 256 colors), 4 MB of memory, and both PROM-based and downloadable servers. NCD's configuration manager has a much better interface than HDS's, but neither it nor the telnet terminal emulation program is an X application. They both take over the terminal to the exclusion of X applications. A display request from a host is held up until the configuration manager and telnet programs are exited. The latest version of NCD's downloadable server software does offer a "local client" implementation of telnet for terminals with sufficient memory, but you still have to hang up X Window to run the configuration program.

The optional ROM in the NCD17c contained a default version of the X11.4
server, without the local client support. To access the local clients (which include serial communications and DEC network terminal server access; a Motif-look-alike window manager was also provided in prerelease form as a local client), you need to load a binary image from the optional tape onto a selected Unix host. That host must be equipped with the programs bootpd and tftpd. NCD supplies the source code for these programs on the tape—a boon, since the chosen server was a Sun IPC that lacked these two utilities. Once equipped, the X server executable is loaded into the terminal from the network host instead of from ROM.

Incidentally, all five terminals required that at least tftpd be present and running on the host. Even if you don’t use it to download the X server software to the terminal, you need it to support later font downloads. Most terminals also support Network File System connections for fonts, but tftp was easier to manage and incurred less overhead.

Compared to the HDS ViewStation, the NCD17c was fast. This was partly due to the lower resolution, but the difference in speed was very noticeable. Moved windows snapped instantly into their new positions, and scrolling text and graphics, such as Looking Glass’s scrolling icons in the file view window, were appreciably faster. Something like this won’t necessarily make you more productive, but it does seem to make the environment a little easier to live with.

Overall, the NCD17c performed well, running every application without complaint and responding quickly to host requests.

NCR X-Station
The NCR X-Station was configured with a 17-inch, 1024- by 768-pixel, 256-color display. The unit had 6 MB of memory and an X Window server in PROM. The font tape installed easily, but I was displeased that it clobbered the crucial color table file during installation. The NCR unit had a monitor-base case style, but it had a problem: the push-button power switch, once pushed, couldn’t be popped out again.

The X-Station had, by far, the best setup software. The graphical interface was clear and responsive, and it was tuned to reducing unnecessary keystrokes and mouse movements. For example, once configured, the X-Station could connect to selected hosts through a simple icon click (the icons were named for the hosts). The host-resident configuration file can specify a different connect command for each host. This was the easiest connection mechanism offered by any of the terminals’ software.

I also liked the X-Station’s ability to have a large virtual screen. Even though its resolution is 1024 by 768 pixels, the configuration file lets you fix the terminal “pretend” it has a 1024- by 1024-pixel screen. The display scrolls rapidly when the mouse is advanced off the top or bottom of the screen.

The setup software is done in multiple, modeless windows (all windows are active at once; positioning the mouse determines which one is “listening”). They are true X applications and are always available, even during an active session. Oddly, the setup windows were reparentable by the Motif window manager, but not by Open Look’s. The latter was not incompatible; it just didn’t seem to notice the setup windows.

Running Open Look did bring out a rather unusual flaw in NCR’s implementation. Open Look uses hot dog-shaped connection mechanism offered by any of the terminals’ software.

I also liked the X-Station’s ability to have a large virtual screen. Even though its resolution is 1024 by 768 pixels, the configuration file lets you fix the terminal to “pretend” it has a 1024- by 1024-pixel screen. The display scrolls rapidly when the mouse is advanced off the top or bottom of the screen.

The setup software is done in multiple, modeless windows (all windows are active at once; positioning the mouse determines which one is “listening”). They are true X applications and are always available, even during an active session. Oddly, the setup windows were reparentable by the Motif window manager, but not by Open Look’s. The latter was not incompatible; it just didn’t seem to notice the setup windows.

Running! the X-Station had, by far, the best setup software. The graphical interface was clear and responsive, and it was tuned to reducing unnecessary keystrokes and mouse movements. For example, once configured, the X-Station could connect to selected hosts through a simple icon click (the icons were named for the hosts). The host-resident configuration file can specify a different connect command for each host. This was the easiest connection mechanism offered by any of the terminals’ software.

I also liked the X-Station’s ability to have a large virtual screen. Even though its resolution is 1024 by 768 pixels, the configuration file lets you fix the terminal "pretend" it has a 1024- by 1024-pixel screen. The display scrolls rapidly when the mouse is advanced off the top or bottom of the screen.

The setup software is done in multiple, modeless windows (all windows are active at once; positioning the mouse determines which one is "listening"). They are true X applications and are always available, even during an active session. Oddly, the setup windows were reparentable by the Motif window manager, but not by Open Look's. The latter was not incompatible; it just didn't seem to notice the setup windows.

Running Open Look did bring out a rather unusual flaw in NCR's implementation. Open Look uses hot dog-shaped connection mechanism offered by any of the terminals' software.

I also liked the X-Station's ability to have a large virtual screen. Even though its resolution is 1024 by 768 pixels, the configuration file lets you fix the terminal to "pretend" it has a 1024- by 1024-pixel screen. The display scrolls rapidly when the mouse is advanced off the top or bottom of the screen.

The setup software is done in multiple, modeless windows (all windows are active at once; positioning the mouse determines which one is "listening"). They are true X applications and are always available, even during an active session. Oddly, the setup windows were reparentable by the Motif window manager, but not by Open Look's. The latter was not incompatible; it just didn't seem to notice the setup windows.
outlines to highlight menu selections. The X-Station drew these shapes pain­fully slowly—slowly enough to have a se­rious impact on application usage. I ran other tests that drew ellipses and circles, and the X-Station kept up well. Open Look menus turned out to be the only performance problem.

Like the ViewStation, the X-Station couldn’t run properly with IslandWrite. The symptoms were identical—apparently, another byte-ordering mismatch. The X-Station passed all other application tests and turned in a solid performance.

**Tektronix XP29**

Tektronix provided an XP29 terminal with a 19-inch display (1280 by 1024 pixels in 256 colors). The memory was strangely split between graphics and I/O memory: An extra 4 MB of graphics memory was installed, but 3.5 MB was used for I/O memory.

The Tektronix unit was the only one that needed to have its case opened. The XP29’s logic is housed in a small tower case. This arrangement takes up unnecessary desk space, and the construction of the case feels shabby. The unit didn’t operate when it arrived—the cards had shaken loose. Removing the top of the case revealed that the cards were not—and can’t be—fastened to their connectors. The case top has a few niches that keep the cards straight, but I found the boards scattered inside the case when the unit arrived.

The logic unit was not matched to the monitor it was sent with. When I reas­sembled and booted it, the display spun around in a syncless frenzy. It was ex­plained to me that I needed to wait until some swimming dots appeared that “looked something like a prompt” and that I then type monset followed by a monitor setting number. The manual lists three different 1280- by 1024-pixel monitor settings. I found the right num­ber after a couple of tries, but I came away feeling that the whole ordeal was a waste of time.

The XP29 has an attractive and quite usable configuration interface. Again, the internal setup and telnet programs turned out to be X applications. I was also impressed with the quality of the host tape installation program. After you load a short portion of the tape by hand (the manual provides the commands for several types of workstations), a friendly installation script takes over, loading the rest of the tape and configuring the workstation to support the terminal. Fol­lowing installation, I got the XP29 con­nected quickly.

Once over all the initial ht:rdles, the XP29 held its own. I encountered no compatibility problems in the application tests. I’m not sure how much the extra memory helped, but the XP29’s perfor­mance was superb. The only compatibil­ity problem I encountered was with the Open Look fonts that Tektronix pro­vided. They seem to differ from the style of the standard Open Look fonts. I could have lived with that, but some common fonts were so much larger than their stan­dard counterparts that applications grew too large for their default windows.

**Visual Technology XDS**

Visual Technology rounded out this monitor group with its 21-inch, 1280- by 1024-pixel, 256-color X Display Station (XDS). It came configured with 6 MB of memory and a PROM-resident server.

The XDS’s setup software was the most primitive of all those that I tested, presenting the user with a text-based configuration interface.
Choose It and Use It.

Remember when you were a little kid? Put a penny in the gumball machine and wait to see what would roll out. Sure, you'd want the red one but it seemed like the green one would always appear. Until now, using a video display terminal was like buying a gumball. Cumbersome setup menus and complex commands would leave you hoping for one result but receiving another.

With the Infinity Series from Falco Data Products, you always know what you're getting. The Infinity Interface makes sure of that. Employing a DOS application-like feel, the Infinity Interface effortlessly guides you through terminal setup and windowing configuration. With a mouse or a cursor, you choose the configuration and windowing capability and use the full power of the world's most technologically advanced video display terminals. Point and choose. No cryptic commands. It's that simple.

It's also what you would expect from Falco—a VDT industry leader for ten years. So, rather than spending your pennies and hoping that what you see is what you'll get, call Falco and choose your favorite flavor. ANSI, ASCII, or Multiple Personality. With or without graphics. The choice is yours.

FALCO
1-800-FALCO-4-U

Falco Data Products, Inc.
Sunnyvale, CA 94086
Tel: 408-745-7123
FAX: 408-745-7860

Falco-Europe
Tel: (33) (1) 9043-1446
FAX: (39) (1) 3064-0557

All trademarks are registered to their respective owners.
Circle 115 on Inquiry Card.
interface that understood mouse-clicks but didn’t display a cursor to highlight the current position. The configuration and telnet sessions were like those of the NCD17c: X clients were not allowed to connect until setup and telnet were dismissed. The XDS did have the only telnet program to provide emulation of an xterm terminal emulator window. The telnet window can be suspended with Alt-SYSRQ; this resumes the operation of the X server.

The terminal performed well, passing all the applications tests, with one glitch: When I ran the Open Look window manager, certain cursor shapes appeared scrambled. Under Motif, the Motif cursor shapes (which appear when resizing windows and so on) looked fine, but the root window’s cursor was scrambled.

The XDS was the only terminal I reviewed that came with an optical mouse. The supplied mouse pad was flexible, however, and I didn’t have any objection to using Visual Technology’s pad instead of one of my own.

The 21-inch display was badly in need of adjustment, displaying annoying ghosts around the edges of black characters against a white background. The display didn’t seem to have any external adjustments to compensate for this.

Which Brand X Terminal?
It’s difficult to choose an overall winner from this group. With rare exceptions, the terminals all did what I asked of them. I was a little put off by Island-Write’s failure on the HDS ViewStation and the NCR X-Station, but that is only one application. These terminals also exhibited minor performance problems that I didn’t see in the others. But at $5199 (with a 19-inch display and 2 MB of memory), the HDS ViewStation turned out to be the best value among the 1280-by-1024-pixel terminals I tested, and an excellent value in general. It has the most complete host font/server tape, and it’s more than $2000 less than the Tektronix and Visual Technology units. The ViewStation had less memory than these other terminals, but the difference in cost was far more than the price of memory.

The Visual Technology XDS delivered fair value for the money at $7555 for 6 MB of memory and a 21-inch monitor. The loser in the large-screen, high-resolution category would have to be the Tektronix XP29. The quality of construction was unimpressive, and the blind monitor configuration struck me as something that the factory should suffer through, not the user. Its $7495 price tag seemed high, although it did include expanded graphics and user memory.

For the 1024-by-768-pixel terminals, I liked both the NCD NCD17c and the NCR X-Station about equally, but I have to give the nod to NCR for its aggressive pricing, great setup/configuration/telnet software, and 1024-by-1024-pixel logical screen size. The NCD17c was blazingly fast, and at $3050 with 4 MB of memory, it’s still a good buy. Nevertheless, I judged the NCR X-Station to be the better of the two smaller terminals in terms of cost and features. At around $5000, neither of these terminals should have any trouble competing against diskless workstations and PCs.
Lahey F77L-EM/32 by Lahey Computer Systems, Inc.
Fast & powerful 32-bit FORTRAN compiler enables users to write & port programs as large as 96 Megabytes on 80386/486's. Version 4.0 includes FORTRAN 90 features: Allocatable arrays, CASE constructs, CYCLE & EXIT, & many other new features. Package includes Edit/Make Utility, Full 17 Standard support, VAX & IBM VS mainframe extensions, fast compilation, excellent diagnostics & a powerful debugger. New OS/386 includes virtual memory & DESQview support, & free unlimited runtime licenses.
LIST: $1390 PS Price: $1655
FastFacts 334-013

Lahey F77L-EM/32

386 DEVELOPMENT

<table>
<thead>
<tr>
<th>Product</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>F77L-EM/32</td>
<td>$1390</td>
</tr>
<tr>
<td>386/DOS Extender by Pharlap</td>
<td>$790</td>
</tr>
<tr>
<td>DESCView 386</td>
<td>$189</td>
</tr>
<tr>
<td>F77-EM32 + Ergo OS/386</td>
<td>$1055</td>
</tr>
<tr>
<td>FoxBASE+386</td>
<td>$479</td>
</tr>
<tr>
<td>Metaware High C 386/486</td>
<td>$919</td>
</tr>
<tr>
<td>NDP Fortran 386</td>
<td>$829</td>
</tr>
<tr>
<td>QEMM 386</td>
<td>$89</td>
</tr>
<tr>
<td>WATCOM C8.0 386 Prof.</td>
<td>$1155</td>
</tr>
<tr>
<td>Zorich C++ 386 Dev.</td>
<td>$865</td>
</tr>
</tbody>
</table>

ASSEMBLY

<table>
<thead>
<tr>
<th>Product</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS MASM</td>
<td>$105</td>
</tr>
<tr>
<td>Spontaneous Assembly</td>
<td>$179</td>
</tr>
<tr>
<td>Turbo Debugger &amp; Tools</td>
<td>$119</td>
</tr>
</tbody>
</table>

BASIC & ADD-ONS

<table>
<thead>
<tr>
<th>Product</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAS-C Commercial</td>
<td>$229</td>
</tr>
<tr>
<td>DBLIB Professional</td>
<td>$179</td>
</tr>
<tr>
<td>MS QuickBasic V4.5</td>
<td>$69</td>
</tr>
<tr>
<td>QuickPack Prof. V3.21</td>
<td>$189</td>
</tr>
</tbody>
</table>

C LANGUAGE COMPILERS

<table>
<thead>
<tr>
<th>Product</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instant C</td>
<td>$769</td>
</tr>
<tr>
<td>Microsoft C 8.0</td>
<td>$549</td>
</tr>
</tbody>
</table>

CASE & PROTOTYPERS

<table>
<thead>
<tr>
<th>Product</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demo II V3.0</td>
<td>$239</td>
</tr>
<tr>
<td>EasyCase Plus</td>
<td>$279</td>
</tr>
<tr>
<td>EasyFlow</td>
<td>$159</td>
</tr>
<tr>
<td>Instant Replay III</td>
<td>$139</td>
</tr>
<tr>
<td>Layout</td>
<td>$239</td>
</tr>
<tr>
<td>MetaDesign</td>
<td>$329</td>
</tr>
<tr>
<td>Pro-C w/Workbench</td>
<td>$735</td>
</tr>
<tr>
<td>ProtoFinish by Genesis</td>
<td>$289</td>
</tr>
<tr>
<td>Show Partner FX</td>
<td>$345</td>
</tr>
</tbody>
</table>

COMMUNICATIONS

<table>
<thead>
<tr>
<th>Product</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awynch Manager 3.0</td>
<td>$159</td>
</tr>
<tr>
<td>Essential COMM</td>
<td>$249</td>
</tr>
<tr>
<td>Greenleaf Comm Library</td>
<td>$329</td>
</tr>
<tr>
<td>QuickComm</td>
<td>$129</td>
</tr>
</tbody>
</table>

DATABASE

<table>
<thead>
<tr>
<th>Product</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clipper 5.0</td>
<td>$550</td>
</tr>
<tr>
<td>dBASE IV</td>
<td>$549</td>
</tr>
<tr>
<td>dBASEV/PLUS</td>
<td>$515</td>
</tr>
<tr>
<td>dBASE IV</td>
<td>$219</td>
</tr>
<tr>
<td>dXML</td>
<td>$179</td>
</tr>
<tr>
<td>FoxPro</td>
<td>$495</td>
</tr>
<tr>
<td>FoxBASE + V2.1</td>
<td>$279</td>
</tr>
<tr>
<td>QuickSilver</td>
<td>$429</td>
</tr>
</tbody>
</table>

DEVELOPMENT TOOLS

<table>
<thead>
<tr>
<th>Product</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASM/LOW Prof.</td>
<td>$179</td>
</tr>
<tr>
<td>Buzzwords dANALYST Gold</td>
<td>$190</td>
</tr>
<tr>
<td>C-DOC</td>
<td>$179</td>
</tr>
<tr>
<td>CLEAR for C</td>
<td>$179</td>
</tr>
<tr>
<td>Codan</td>
<td>$349</td>
</tr>
<tr>
<td>The Documentor</td>
<td>$229</td>
</tr>
<tr>
<td>INSIDE</td>
<td>$119</td>
</tr>
<tr>
<td>MKS RCS</td>
<td>$175</td>
</tr>
<tr>
<td>PC-Lint</td>
<td>$115</td>
</tr>
<tr>
<td>Plik/LTO</td>
<td>$439</td>
</tr>
<tr>
<td>PolyMake</td>
<td>$159</td>
</tr>
</tbody>
</table>

THE PROGRAMMER'S SHOP 1-800-421-8006
The Programmer's Shop is

**NEW PRODUCT**
WindowsMAKER™ Professional New!
by Blue Sky Software

The fastest way to create MS-Windows applications in C+
Generates the Windows .EXE w/ complete source & production files
(no royalties). Just Point & Click to define the Windows user interface.
Lets you animate your design to instantly test look & feel and make changes on the fly without needing to compile. Custom code is perserved during code regeneration. This is the power-user version of the best-seller WindowsMAKER with a lot of added functionality.

LIST: $995
PS Price: $519
FastFacts 2001-006

**TEXT SCREEN ADD-ONS**

- C Worthy w/Forms w/ARCH 359
- Greenleaf DataWindows 399
- Hi-SCREEN XL Professional 269
- Lexical Resolution 199
- POWER SCREEN by Blaise 129
- Vitamin C - source, menus 369
- VG Screen - painter 139
- Vermont Views Obj. + source 819

**UNIX/XENIX**

- C++ for Unix 386 by Zortech 438
- Computer Innovations C++ 475
- db_FILE/RETRIEVE MU 569
- ESIX Systems
  - ESIXV 386 Dev. (2 user) 569
  - ESIXV 386 Dev. unlimited 795
- Informix SQL
  - Interactive Systems
    - Architect Wkrstn Platform 1199
    - Architect Wkrstn Developer 1850
- LPI-FORTAN 929
- M++ for Unix by Dyad 379
- M++ for Unix w/ source 579
- Norton Utilities for Unix 249
- Unix System V.4 Complete 1425
- WordTech Quicksilver 1295

**WINDOWS**

- ACTOR 449
- ACTOR Professional 449
- BRIEF for OS/2 Call
  - Case: PM (for C or C++) 1899
  - Case: W Corporate Version 969
  - C talk/Views 419
- C-Tile/Windows 385
- dBFAST/Windows 395
- Graphics Server SDK 455
- Instant Windows 2.2 479
- KnowledgePro Windows 569
- M++ V2.0 by Dyad Software 279
- MKS Toolkit V3.1 299
- MS Windows V3.1 119
- MS Windows SDK V3.0 365
- MS Windows SDK V3.0 365
- MultiScope OS/2 Debugger 329
- MultiScope OS/2 Debugger 329
- MultiScope Windows Debugger 329
- Object/1 895
- OS/2 PM Toolkit 369
- Smalltalk/V PM 435
- Tempo for Windows 1.1 89
- Windows Maker 715
- Windows Maker Professional 919

**OTHER PRODUCTS**

- Carbon Copy Plus 159
- Dan Bricklin's PageGarden 89
- Duplicator Toolkit - Pro 3.0 119
- Fast!
  - Flow Charting III 199
- HEADROOM 69
- Hijack 179
- LapLink II 129
- Link & Locate ++ - ROM MSC 295
- Math Advantage 475
- Norton Utilities 5.0 149
- pcANYWHERE IV 159
- PC Tools Deluxe 6.0 99
- PC-KWIK Power Pak 119
- Pre Cursor 89
- Remote2 139
- SpinRite II 89
- System Sleuth 109
- TimeSheet Prof. 165

**OBJECT-ORIENTED/C++**

- Borland C++ 379
- M+ by Dyad Software Corp. 279
- Smalltalk/V 79
- Zirc Interface Library 175
- Zortech C ++ Dev. Edition 399

**PVCs Professional**

- 439
- .RTLINK Plus - by PocketSoft 419
- Sourcerer's Apprentice Prof. 459
- TLIB 5.0 Version Control 125

**EDITORS**

- BRIEF Call
  - Epsilon 175
- KEDIT 139
- Sage Professional Editor 249
- SFP/PC - V2.1 195
- Vedit + 159

**GRAPHICS**

- Essential Graphics v3.0 349
- GraphIC 319
- graphics-Menu 165
- GSS Graphics Dev't Toolkit 699
- HALO 279
- MetaWINDOWPLUS 369
- PCX Programmer's Toolkit 229

**INTRODUCING Essential Communications VERSION 4.0!!!**
by South Mountain Software

Powerful asynchronous communications library, supports interrupt driven communications up to 115,200 baud. Drives 34 ports with buffers to 500K. Supports V.32, MNP V, Hayes compatible modems, Hayes OFF/ON , XMODEM (CRC and Checksum), XMODEM 96, YMODEM, K, YMODEM, KERMIT, ZMODEM and more. Provides ANSI and VT 52/100 terminal emulations. Use with our President C/C++ library to write background communications applications. Contains all source code, a BBS demo. No royalties.

LIST: $329
PS Price: $349

**HiJakk Release 2.0**
by Inset Systems Inc.

HiJakk 2.0 is a graphics conversion and capture utility that translates more than 36 graphics file formats. HiJakk provides batch conversion capability from the DOS command line or from the user interface. Supported formats include: LBM, PICT, TIFF, PCX, HPGL, GRE, PIC, DXF, and many others. Use HiJakk to apply modem object-oriented PCANYWHERE IV 159 KnowledgePro Windows 589 programming techniques to create your Windows applications; and TURBO PASCAL

**TURBO PASCAL**

- Turbo ASYNCH PLUS 159
- Turbo Pascal 6.0 by Borland 107
- Turbo Professional 109

**THE PROGRAMMER'S SHOP**

1-800-421-8006
Windows Programming for Everyone!

KnowledgePro Windows (KPWIN)
by Knowledge Garden

Is an environment for rapid application development in Windows 3 or DOS. Interactive design tools and high-level object-oriented (OOP) language give easy control of Windows screen objects, fonts, icons and bitmaps. Full support of DDE and DLL allows integration of Windows and DOS programs into one application. Experienced developers and power-users can use KPWIN to build fast, runtime free applications in record time. Featured in "Best of '90," PC Magazine, 1/15/91.

List: $695  PS Price: $589
FastFacts 1419-012

CHEETAH 2.2
by Software Science

Over 300 features make Cheetah the world's most powerful editor for dBASE, FoxBase, Clipper, QuickSilver, Forre and word processing. Pull-down menus give you all the editing features you need and expect, and let you compile, link, and run your application form inside Cheetah. Extensive language help, direct access to creating and viewing indexed dBASE files, built-in calculator, source formatter, and spelling checker are just the tip of the iceberg.

List: $145  PS Price: $95
FastFacts 1843-003

Sage Professional Editor
by Sage Software

The Sage Professional Editor is designed to create the applications of the 90's. Its highly configurable and has an advanced windowed user interface with integrated mouse support, on-line help and menu-driven commands. Has emulations for Brief, VI, EMACS/Epallion and WordStar, and a virtual memory system for large files. Includes MS-DOS, OS/2 and Dual Mode versions on 3.5" and 5.25" diskettes.

List: $450  PS Price: $395
FastFacts 111-060

What is FastFacts?

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

800-421-8000 National Accounts
800-446-1185

3 Pond 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.
Mylex has the best EISA solution. At least that's what people tell us.

"The Mylex MAE486 with its 32-bit EISA SCSI controller kills the competition for reading large sequential files in the IOBench 2 tests under UNIX."  
Personal Workstation, June 1990

"If I wanted to replace my entire system for optimum all-around performance, I'd build it from Mylex EISA-based boards."
Personal Workstation, June 1990

"The GXE020A TIGA board...scored as much as 45 percent higher on our low-level benchmark tests than any other TIGA board evaluated."
BYTE, April 1990

"Mylex has done a lot of work with EISA, and we plan to use its motherboard and adapters in a LAN Labs 'super-AT' server."
PC Magazine, May 1990

Of course, we've tested our EISA peripherals for compatibility with major EISA systems. To see what our high-performance EISA solutions can do for your system, call us at 1-800-446-9539, or fax us at 1-415-683-4662. In California, call 1-415-683-4600.
"Smart" UPSes Alert LANs to Power Problems

RICK GREHAN

Uninterruptible power supplies (UPSes) are heavy metallic boxes that sit under your desk, hum distantly, and remain forgotten unless utility power goes off suddenly. Right? Not anymore.

A new generation of network-based UPSes can continually apprise you of such important conditions as battery level, current input load, power quality, and impending malfunctions. So rather than a box that passively sits around waiting for power problems, your UPS becomes an active device that can help you head off potential damage.

To test that, I selected three UPSes that, to varying degrees, provide this kind of intelligence: American Power Conversion's (APC) Smart-UPS 900 (900 volt-amperes), Elgar's IPS/A.I. 800 (800 VA), and Tripp Lite/Unison's UniPower PS8.0 (800 VA). I chose 800- and 900-VA sizes because they are appropriate for a network the size of the BYTE Lab's. The Minuteman series of UPSes from Para Systems also offers intelligent network features.

Common attributes of these units include software that can inform network users about a power failure and instruct them to log off. Also, the software can automatically shut down the network server after a designated log-off period. Each unit accommodates a variety of network operating systems. For evaluation, I chose the NetWare 386 configuration.

Smart-UPS 900
APC's PowerDoctor software lets you monitor the Smart-UPS 900 in real time. As screen 1 shows, PowerDoctor displays bar graphs that indicate the current battery voltage, line voltage, and UPS load. Other statistics include line frequency, the internal temperature of the UPS, and whether the UPS is supplying utility power or running off the internal battery.

PowerDoctor consists of two modules: a foreground monitoring program and a background logging program. The background logging program runs as a TSR program: You can program it to regularly sample the status of the Smart-UPS and record the results in a log file. You can easily move log-file results into spreadsheet programs, such as Lotus 1-2-3 or Microsoft Excel.

APC's PowerChute software runs on the network server and brings PowerDoctor's logging and display capabilities to the network operating system. It monitors the status of the Smart-UPS and signals workstations of a shutdown. Network managers select the shutdown time; when shutdown time expires, PowerChute gives one last warning to network users and "downs" the network.

The front plate of the Smart-UPS 900 has plenty of LEDs to provide status information. This includes two vertical-bar-graph LEDs and a load-indicator bar graph that displays the current load as a percentage of the UPS's capacity. The bar graphs provide a range of data, including battery charge and utility-power voltage levels (in steps of 6 volts starting at 98 V). Another LED tells you if the system is connected to acceptable utility power, and an "on battery" light shows when the Smart-UPS is running on battery power. (With the "replace battery" light, the Smart-UPS tells you when its battery can no longer hold a charge. Normally, this will occur once every two to three years, according to the company.)

When the Smart-UPS detects that utility voltage has fallen to brownout levels of between 90 V and 103 V, it can raise incoming power by up to 12 percent with SmartBoost, an internal step-up transformer. If the Smart-UPS 900 senses a brownout, it first switches to the battery and then monitors the line for 4 seconds to ensure that voltage levels aren't worsening. If the line is stable, the UPS enables the SmartBoost feature and takes the battery off-line so extended brownouts don't consume battery power.

The UniPower PS8.0
Unlike the other UPS systems in this review, the UniPower is not meant to sit on the floor, hidden under a desk. Its small footprint makes it ideal for placement
between the CPU case and the monitor. This means you won’t have to get down on your hands and knees to access it. Also, the unit’s designers recessed a light in the front panel, so if power goes out, this backup light can illuminate your keyboard while you type in a shutdown sequence.

The UniPower also provides a “remote-on” feature using two RJ-11C telephone jacks that let you connect the UPS to a telephone and a modem. You flip a toggle switch to enable the remote-on feature. Whenever the UniPower detects the ring signal of an incoming phone call, it turns on automatically, thus applying power to your computer system. Your AUTOEXEC.BAT file launches any application that you want to run remotely. When you’ve finished and you disconnect, the UniPower waits 2 minutes for your applications software to terminate and then shuts itself off and waits for the next ring. (APC’s documentation describes a similar remote-on accessory for the Smart-UPS 900, but I didn’t receive this accessory in time for testing.)

The UniPower’s front panel looks absolutely Spartan compared to the other units. An AC status light and audible alarm signal power conditions with various colors and flashing lights. The alarm sings in pulses of various durations depending on the problem, so you can tell what’s happening to your UPS even if you can’t see the front-panel lights. The other front-panel LED indicates battery charge levels.

Tripp Lite/Unison sells Ocean Isle’s Network Monitor to run with the UniPower. This software runs as a NetWare loadable module (NLM) under Novell’s NetWare 386 (there is also a value-added-process version of Network Monitor for NetWare 286). It keeps an eye on the serial-port signals running from the UniPower, and, in case of a power failure, it signals workstations of the upcoming shutdown. After a supervisor-selectable delay to allow users to log off, Network Monitor sends a last broadcast.
Spikes. Surges. Overvoltage. Undervoltage. Brownouts. These things happen. And they can do irreparable damage to your equipment and data. Unless you’re protected with Minuteman Uninterruptible Power Supplies.

Minuteman protects all your equipment and data. All the time. In fact, in the event of power failure, it will safely and automatically shut down your network, using your operating system or our own software. Even if you’re not there.

There’s a Minuteman to fit your needs, large or small. Including 220-volt international models. And we ship orders the same day they’re received.

So call us. You can’t stop disaster from striking. But you can keep it from hurting you. 1-800-238-7272

STANDBY UPS MODELS
300 VA to 2300 VA
Sinewave output: 1 msec Transfer

ON-LINE UPS MODELS
500 VA to 10,000 VA
Static by-pass standard
True on-line sinewave outputs

STANDBY UPS MODELS
300 VA to 2300 VA
Sinewave output: 1 msec Transfer

ON-LINE UPS MODELS
500 VA to 10,000 VA
Static by-pass standard
True on-line sinewave outputs

UNATTENDED SHUTDOWN
Via your operating system or our software, interfacing:
Novell 286 VAP and 386 NLM
ELS Level II
AIX for IBM RS6000 Version 3.1 & up
AIX for IBM RT Version 2.2.1 & up
3COM LAN Manager
Banyan Vines

AT&T 382
AT&T UNIX 386 Version 3.2
SCO UNIX 386 Version 3.2 & up
SCO XENIX 386 Version 2.3.2 & up
SCO XENIX 286 Version 2.2.1 & up
Sun OS Sun 4 Version 4.03 & 4.10 & up
Sun SPARC Version 4.03 & 4.10 & up

SUN OS Sun 3 Version 4.01 & up
DEC VMS Version 5.1 & up
Custom configuration any system

© Para Systems, Inc. 1455 LeMay Drive, Carrollton, Texas 75007 Phone: 214-446-7363 FAX: 214-446-9011

Circle 238 on Inquiry Card.
“SMART” UPSES

Screen 2: LanSafe A.I.+ control software for Elgar’s IPS/A.I. shows instantaneous values for incoming voltage and line frequency, outgoing power and equivalent volt-amperes, battery level, and other parameters.

BYTES ACTION SUMMARY

- LAN-BASED UPSES
- WHAT THEY DO
  Combined with “smart” software, they inform network users about a power failure, broadcast log-off messages, and automatically shut down the network server. By continually monitoring battery levels and power quality, they can help you head off potential damage caused by faulty power conditions.

- WHAT WE RECOMMEND
  Our highest marks go to the Smart-UPS 900 because of its long holdup time, its power-monitoring software, and the SmartBoost feature, which helps the UPS survive extended brownouts.

- WHAT YOU’LL PAY
  Smart-UPS 900: $999; PowerChute software (available for Novell’s NetWare 286 and 386, IBM LAN Server, SCO Xenix, and AppleShare): $99.95; LANSafe A.I. for Novell NetWare 286 and 386: $99.95; UniPower PS8.0: $999; Network Monitor for Novell NetWare 286 and 386: $99.95

message of impending shutdown. About a minute later, it downs the server.

IPS/A.I. 800
Elgar’s IPS/A.I. 800 uses LanSafe A.I. control software to view the status of the UPS and provide a software control panel to adjust internal parameters and run system tests. With the optional software, the unit continuously updates status display (see screen 2) to show instantaneous values for incoming voltage and line frequency, outgoing power and equivalent volt-amperes, battery level, and other parameters. If you have a significant number of power problems that you’d like documented, you can program the software (a portion of which runs as a TSR) to periodically write line-status information to a log file. Since part of the software runs as a TSR, even when you’re in another application a pop-up window can alert you to a problem.

LanSafe A.I.+ is a network version of the IPS/A.I.’s control software. I tested it under NetWare 386. To run LanSafe, you create a user named LanSafe with supervisor and console rights. You then install an NLM that’s loaded when the server boots up. Once it’s installed, the NLM acts like a user and will respond to English-language messages. The lexicon is limited but more than sufficient for this purpose. For example, if you enter

Send “What is the power status” to LanSafe

you’ll get a quick response of

“Commercial power and batteries are OK.”

Under normal circumstances, this command interface is active for only 10 minutes after the network boots up. After that, you have to send a “Set User Command Interface On” message to LanSafe. When you’re done talking to this artificial user, you send a “Set User Command Interface Off” message. This keeps LanSafe from responding sporadically to broadcast messages.

Other network workstations with an attached IPS/A.I. UPS and running LanSafe become “power nodes.” That is, you can execute LanSafe’s console program and view the status screen of another user’s UPS. (The screen is identical to the single-user version of IPS/A.I. software.) You can even issue self-tests across the network so a network administrator can monitor the entire network without leaving his or her office.

As with the other network packages tested, LanSafe continuously monitors the condition of the UPS. If a power outage occurs, LanSafe warns all network users of the condition. After a sufficient delay, LanSafe downs the network.

The front panel of the UPS contains five LEDs that illuminate various colors and flash sequences. This variety is not simply meant to impress. A single glance at the LEDs tells you about the condition of a host of line conditions. The trick, of course, is to remember the language of the LEDs: I found it necessary to keep the IPS/A.I.’s 15-page manual handy for that reason.

The UPS uses a 15-pin female connector for communication with a host system. The function of this connector can be set by DIP switches to either standard or smart mode.

Holdup Times
My evaluation focused on the software that ships with each of these units. But power reliability remains the most important job of a UPS. To test this, I recorded holdup times—the period between the interruption of utility power and when the UPS shuts off its outputs. I charged each UPS overnight and connected them one at a time to a load workstation. I installed a variable transformer between the UPS and the utility power and ran the input voltage down to 0.

Shutdown time varies depending on the size of the load. My load workstation was a 10-MHz AT clone with a 5¼-inch floppy disk drive, a hard disk drive, a Western Digital network adapter, and a VGA card connected to a Tatung monitor. This amounted to a power draw of about 120 watts (the VA rating was about 240).

Based on these tests, the Smart-UPS 900 performed the best, with a holdup...
Let Phar Lap's new 286DOS-Extender™ turn your Microsoft C compiler into a multi-megabyte power tool!

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

You've been hearing a lot lately about DOS Extenders and their ability to let you create large programs beyond the 640K DOS limit. Now Phar Lap® makes it easier than ever!

With your copy of Microsoft C and our new 286DOS-Extender you've got all the tools you'll need to quickly and easily build multi-megabyte protected-mode applications - often by simply relinking without making source code changes. 286DOS-Extender enables you to build programs that have room for more features and capabilities without having to suffer with overlays or EMS. But the best news is you don't have to give up any of your Microsoft C tools, including your CodeView debugger.

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

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

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

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

So if DOS is looking smaller than ever, call Phar Lap today.
And C what it’s like beyond 640K.
Phar Lap 286DOS-Extender SDK $495.
We open a world of memory.

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

“SMART” UPSES

Compared to the other two units, the UniPower PS8.0 suffers from fewer AC outlets: four, as opposed to six on the others. This could be remedied with a bus strip, but that might tempt users to overextend the capacity of the UPS. The UniPower is also the least intelligent of the three. Given that the UniPower is in the same price class as the others, I don’t recommend it unless you need its remote-on feature.

The race between the Smart-UPS 900 and the IPS/A.I. 800 is almost a dead heat. Although the Smart-UPS performed noticeably better than the IPS in the holdup tests, both manufacturers say the UPSes can sustain equivalent battery loads for approximately the same amount of time. Ultimately, I would choose the Smart-UPS based on its SmartBoost feature. Given the vagaries of utility power in many parts of the country, this feature could help the Smart-UPS survive extended brownouts that would send the IPS/A.I. onto battery power.

Rick Crehan is the technical director of the BYTE Lab. You can reach him on BIX as “rick_g.”

COMPANY INFORMATION

American Power Conversion
(Smart-UPS 900)
132 Fairgrounds Rd.
P.O. Box 278
West Kingston, RI 02892
(800) 541-8896
(401) 789-5735
fax: (401) 789-3710
Circle 1228 on Inquiry Card.

Elgar Corp.
(IPS/A.I. 800)
9250 Brown Deer Rd.
San Diego, CA 92121
(800) 733-5427
(619) 458-0250
fax: (619) 458-0267
Circle 1229 on Inquiry Card.

Tripp Lite/Unison
(UniPower PS8.0)
500 North Orleans
Chicago, IL 60610
(312) 329-1777
fax: (312) 644-6505
Circle 1230 on Inquiry Card.
Get the real thing for the price of a reproduction.

True PostScript® printing for only $1,999*: 
microlaser™ PS17 from Texas Instruments.

Now you can afford the powerful font and graphics capabilities of the industry-standard PostScript software from Adobe®.

The microlaser PS17 features true Adobe PostScript printing so you don't have to settle for an imitation that costs about the same, but gives you less. Plus, microlaser offers these other advantages:

17 Scalable fonts. Plenty to get you started. If you need more, choose the microlaser PS35 model, with 35 PostScript fonts. Both PS17 and PS35 models feature the new Adobe ATM™ font rendering technology, which improves the quality of PostScript fonts and prints them significantly faster.

The industry standard. With microlaser and PostScript, you can access more than 600 high-quality typefaces and over 4,000 software applications. It's also compatible with the HP LaserJet® Series II and allows you to switch between the HP and PostScript modes easily. Plus, you can connect microlaser to your PC, Macintosh®, or virtually any type of computer hardware.

Superior paper handling.
microlaser's paper drawer holds 250 sheets — and it conveniently slides inside the printer to save space. An optional, second 250-sheet paper drawer and envelope feeder are available for extra versatility.

The smallest footprint you'll find. At only 13.4" wide and 14.2" deep, microlaser offers what BYTE magazine calls, "an exquisitely small footprint and a compact design, destined for a cramped desktop."

If you're not ready for PostScript yet, you can buy the standard microlaser for $1,449*. Then as your needs grow, so does microlaser's capabilities — without tools or technicians. Just add upgrade boards for PostScript software, more memory and optional interfaces. Or plug in microCartridges for additional fonts and emulations.

With all of this capability, why settle for less than the microlaser with PostScript?

Call us for additional information and the name of a dealer near you.

1-800-527-3500.
Even This Is More Confining Than Clipper.

Just as the vast expanse of the American West gave its settlers a new perspective on opportunity, Clipper's open architecture lends unprecedented freedom to application development.

Unlike fixed systems, Clipper never forces you to "make do". Its language is fully extensible with user-defined functions and new user-defined commands. You can extend the language with routines written in Clipper itself, or integrate code from other languages like C, Assembler, dBASE® and Pascal. Odds are, you already have knowledge you can use with Clipper!

But if a customizable language isn’t enough, there’s even more elbow room. Database and I/O drivers can be supplemented or replaced. Even Clipper's linker knocks down barriers by allowing you to develop applications larger than available memory, without defining overlays! And when you’re done, Clipper's compiler generates stand-alone, executable files for cost-free, unrestricted distribution.

So, don’t let the bounds of fixed systems fence you in. Unleash your imagination in the wide-open spaces of Clipper. To find out more, give us a call today.

Clipper® 5.0
The Application Development Standard
213/390-7923
Ask For Department-A

Nantucket Corporation, 12755 West Jefferson Boulevard, Los Angeles, CA 90066. TEL.: 213/390-7923; FAX: 213/207-4468; TELEX: 650-2574125. Nantucket, the Nantucket logo and Clipper are registered trademarks of Nantucket Corporation. Other brand and product names are used for identification purposes only and may be trademarks or registered trademarks of their respective holders. Entire contents copyright ©1990 Nantucket Corporation.
SOFTWARE

QEMM-386 and 386Max
Square Off Under Windows

BRETT GLASS

Any PC users rely on an expanded-memory manager (EMM) to deal with DOS's 640K-byte memory barrier, but users who run Windows in enhanced mode on 386-based systems have a particularly strong incentive. The TSR programs and device drivers that they load into the lower 640K bytes of DOS memory reduce the amount of space available in every DOS window.

EMMs help by loading device drivers, network shells, TSRs, and parts of DOS into the high memory area between 640K bytes and 1 megabyte—freeing between 64K and 128K bytes of conventional RAM. They also support the Extended Memory Specification (XMS), the Expanded Memory Specification (EMS), and the Virtual Control Program Interface (VCPI). Two other features—the ability to backfill conventional RAM if your system has less than 640K bytes, and to sort memory by speed—won't work if you're running Windows in enhanced mode.

The combination of Windows and a third-party EMM is by no means bulletproof. I tested two industry leaders—QEMM-386 and 386Max—to see just how well these products work in general, and in the Windows environment in particular. I also installed BlueMax, the Qualitas version of 386Max with special features for IBM's PS/2 computers. All the products support Microsoft's VxD driver standard, which allows EMMs to launch Windows in enhanced mode.

I tested Quarterdeck's QEMM-386 Version 5.12 and Qualitas' 386Max 5.1 and BlueMax 5.1 for PS/2s. For each product, I compared features and compatibility with Windows 3.00a. I also compared how much high RAM each made available for loading programs above conventional memory (see the table).

My test-bed included an Everex Step 386/33 system with 4 MB of RAM, and a Northgate Elegance 386/33 system running MS-DOS 3.3 with 1 MB of fast 32-bit RAM on the motherboard and a 3-MB AST RAMvantage memory card in the backplane. I also tested BlueMax and QEMM-386 on an IBM Micro Channel PS/2 Model 55 SX running PC-DOS 4.0, with 2 MB of RAM.

All systems included a color VGA monitor. I installed a Microsoft Serial Mouse and Windows 3.00a on all machines. I ran CHKDSK from the main DOS prompt and from within Windows, running in both standard and enhanced mode, to determine available memory. I also ran several DOS and Windows applications to test system stability.

QEMM-386
Version 5.12 of QEMM-386 has several improvements over earlier versions, including a better VxD driver, support for standard mode and foreign-language versions of Windows, and the ability to use the "Close Window" command on a VCPI application running in a DOS window. Also included is VIDRAM, a utility that lets you use EGA and VGA high memory space to increase DOS memory by up to 96K bytes when running text-mode programs. Finally, Quarterdeck bundles Manifest, a system analyzer (see photo 1).

Both QEMM and 386Max write to the distribution disk during installation. Both can damage your disks by doing so, but QEMM is more likely to because it writes to a low-density disk from what is most likely a high-density drive. Install from a copy to be safe.

The installation program then showed a summary of the default options and asked me if I wanted to change them. I did and entered a series of dialogues that gave me a chance to make the changes. Alas, the options shown on the summary screen don't quite match the ones that you see if you decide to change them later. For instance, the option "Fill all high memory with RAM?" later becomes "Do you want to load resident pro-

Photo 1: Manifest graphically illustrates how your system uses memory and lets you tune QEMM for maximum efficiency. This screen shows how my test system has allocated the lower 1 MB of system memory.

Photo 2: Qualitas's ASQ, a companion utility for 386Max, includes an excellent on-line tutorial on memory management. Like Manifest, it displays system information graphically, but it doesn't offer as much detail.
A 386 memory manager makes more high memory available so you can move more device drivers and TSR programs above the 640K-byte space. I ran each program's optimizer to see how much high RAM it made available on the Northgate and IBM PS/2 Model 55 SX test machines. 386Max freed less high memory initially because it excluded part of the monochrome display area. When I forced 386Max to include this area, the number increased to 112K bytes, but about 64K bytes of memory was lost in each DOS window. BlueMax excelled on the PS/2 due to its BIOS compression capability. Note that I allocated a 64K-byte EMS page frame during testing. If you don't run programs that require EMS outside of Windows, all three EMMs will yield another 64K bytes of space for loading TSRs high. (N/A = not applicable.)

<table>
<thead>
<tr>
<th>Northgate</th>
<th>IBM PS/2 Model 55 SX</th>
</tr>
</thead>
<tbody>
<tr>
<td>386Max</td>
<td>112K bytes</td>
</tr>
<tr>
<td>386Max</td>
<td>88K bytes</td>
</tr>
<tr>
<td>BlueMax</td>
<td>N/A</td>
</tr>
<tr>
<td>BlueMax</td>
<td>152K bytes</td>
</tr>
</tbody>
</table>

The remainder of the installation went smoothly. I ran QEMM's Optimize utility, which configures your system to load TSRs and device drivers high. The utility worked without a hitch but didn't offer me the option of excluding drivers that I know misbehave when loaded high.

I then rebooted, only to get an error message and a beep each time the machine started up. The cause: QEMM had not removed HIMEM.SYS, which was trying to load on top of QEMM in the CONFIG.SYS file. I took the line out manually to eliminate the message. I then ran Manifest, which offered more suggestions for tuning the system. It told me that I could save additional memory by adding the line STACKS 0,0 to my CONFIG.SYS file. Optimize, when tuning my system, didn't point out this potential optimization.

Optimize is generous with high RAM space—a trait that may motivate you to reconfigure things later. On the PS/2 (with 2 MB of RAM, 1092K bytes available to DOS), I could not open a DOS window in enhanced mode due to insufficient memory. Manifest revealed that QEMM had mapped extended memory into as much of the upper address space as it could, even where it hadn't loaded any programs. I solved the problem by reconfiguring QEMM to return some of this space to the pool of available RAM.

On the Everex Step 386/33, I detected another waste of RAM. The Everex BIOS ROM copies itself into high memory to improve speed. But Optimize, in an attempt to speed up the system, did this a second time, thus wasting precious space. (It didn't notice that there was no speedup obtained by doing this.)

Once QEMM was installed, all the machines ran fine under DOS, but Windows didn't work until I tinkered with the options manually and consulted special information not in the standard documentation. The Windows 3.0 supplement to the manual contains a few tips, but the truly necessary advice comes in the form of three technical notes—designated W3, WT, and WR—that are available from Quarterdeck or from the Desqview conference on BIX. Once I finally chose the right options, Windows ran well.

**386Max and BlueMax**

386Max works with any 386-based AT clone; BlueMax adds special features for IBM's PS/2s. Qualitas claims that both have significant advantages over QEMM when handling TSRs in Windows and on IBM PS/2s. They do, however, have one distinct disadvantage: Both support Windows only in enhanced mode. (I'll refer to both as 386Max, except where features are specific to BlueMax.)

The installation process is easier than with QEMM, and it's Windows-aware. It noticed Windows on my disk and offered to support it. Queries included information on how my answers would affect Windows. The installation program removed HIMEM.SYS and swapped in 386MAX.SYS automatically. The Maximize optimization program lets you load TSRs and device drivers low if you know that they won't work when loaded high. I didn't need to read any technical notes—or even look at the manual—to get an installation that worked the first time.

QEMM has one feature that 386Max lacks. It always allocates extended and expanded memory from a common pool, so you needn't decide in advance how much to devote to each. 386Max must know in advance how much to give to each, and you can't change your mind without rebooting. There's one exception: When you start Windows in enhanced mode, 386Max can pull a switch and make as much memory as possible into XMS RAM. Windows then provides EMS emulation for DOS windows.
Before You Blow $500 On Lotus 1-2-3, Excel Or Quattro Pro, Read This.

CA Shocks Spreadsheet World With 70% Price Cut: Highly-Rated SuperCalc5
Now Only $149.00

CAMBRIDGE, Mass — Early today Computer Associates announced a dramatic price reduction on one of the industry's most popular and best-selling spreadsheet programs, SuperCalc5. Effective immediately, the suggested retail list price for SuperCalc5 has been slashed from $495.00 to $149.00. This means that the new street price for SuperCalc5 — which is Lotus 1-2-3 compatible — will very likely be under $100.00.

This bold, new pricing strategy is great news for spreadsheet users. It means now everyone can afford to trade up to the most advanced spreadsheet technology in the industry. And unlike Lotus 1-2-3, 3.0 or Excel, down, which is new low price is by far the best value in the spreadsheet industry.

Initial reaction amongst spreadsheet users and software dealers has been overwhelmingly positive. "This is terrific," said one user. "It's about time!"

"We've always listened closely to what users want and they've been concerned with high spreadsheet prices and the expensive hardware upgrades which are often required," said a CA spokesperson. "Users told us that they wanted the latest spreadsheet technology, but they needed it at a price they could afford and in one application that would run on all of their PCs. That is exactly what we're giving them. SuperCalc5 at this new low price is by far the best value in the spreadsheet industry."

More than 3,000,000 copies have been sold and unlike some others, SuperCalc5 runs on virtually every type of PC that exists.

If you've been thinking about moving up to a more powerful, full-featured spreadsheet, now's the time. Move up to SuperCalc5 and get everything you've always wanted for hundreds of dollars less than Lotus 1-2-3, Excel or Quattro Pro. For the name of your nearest SuperCalc5 dealer call 1-800-CALC-149.

Do it right now. After all, at this price, why wait?
QEMM-386 and 386Max Square Off

386Max freed up approximately the same amount of conventional memory as QEMM did under DOS, and BlueMax did something better. It rearranged the mapping of PS/2 peripherals to provide the greatest possible amount of contiguous high RAM. Its BIOS compression feature reclaimed the space that was used by IBM's BIOS (advanced BIOS), power-on self test, and ROM BASIC—parts of the ROM seldom (if ever) used under DOS. BlueMax made almost 64K bytes more memory available for loading programs high on the PS/2 than did QEMM.

The TSR instancing feature makes life easier for heavy Windows users. If you load a TSR before Windows and then bring it up simultaneously in multiple DOS windows, your actions in one window may confuse the instance of the TSR running in the next, potentially scrambling data. Qualitas' instancing feature gives each invocation of the TSR its own copy of the data, preventing conflicts.

The 386UTIL memory-snoping utility isn't as good as Manifest. Qualitas also offers a more advanced, Manifest-like utility, called ASQ (see photo 2), for free. It's better, but still not quite as good as Manifest. It's not bundled with 386Max, so you'll have to download it from CompuServe or ask Qualitas to send it to you.

On Your Own

You're more likely to need help with QEMM than with 386Max or BlueMax. But if either package fails to work, the installation process becomes a trial-and-error exercise. The technical-support departments of both companies are overburdened; expect busy signals and long waits on hold. Neither company has a toll-free help line. When I called Quaterdeck, the line was continuously busy. When I finally got through, I waited for more than 15 minutes to speak with a representative. Qualitas' voice-mail system gave me the option of holding, talking to a receptionist, or leaving a voice-mail message; I spent less time on hold, and a support technician called back quickly after I left a message.

QEMM-386 and 386Max both do the basics well. In terms of the amount of memory provided at the DOS prompt, my test results showed a dead heat except in a DOS window in enhanced mode on the PS/2. In this case, QEMM came out ahead by about 30K bytes. On the other hand, BlueMax did better at providing high RAM on the same machine.

Either 386Max or BlueMax is a good choice if you're looking for a simple installation process that's likely to work the first time. You'll also want 386Max if you intend to pop up multiple copies of a TSR in several virtual DOS windows.

Choose QEMM-386 if you want to use Desqview as your DOS multitasker. It's the only choice if you want to run Windows in standard mode or if you want to backfill your DOS RAM to 640K bytes. And it's better if you run a mix of programs outside Windows that demand both XMS and EMS memory. QEMM requires more experimentation, but Manifest is a great help when you're fine-tuning. Its VIDRAM utility, which reallocates up to 96K bytes from the EGA and VGA high memory area to conventional memory, is excellent if you're Brett Glass, a frequent contributor to BYTE, is a programmer, hardware designer, author, and consultant in Palo Alto, California. You can reach him on BIX as 'glass.'
WATCOM C8.0/386
Optimizing C Compiler and Tools
for 386 Extended DOS

WATCOM C/386
for Windows

Unleash 386 Power on
Your Microsoft C Code.

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

Experts Agree on WATCOM C:

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

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

“Microsoft library- and source-compatibility makes WATCOM C7.0/386 ideal for porting DOS applications to 32-bit native mode. This compiler enables full 386 performance without 640K limitations.”
Richard M. Smith, President, Phar Lap Software, Inc.

“WATCOM is definitely the leader in object-level optimizations... For flat-out executable speed, WATCOM C showed shining performance.”
Computer Language, February 1989

WATCOM C8.0/386 Professional
- 100% ANSI C optimizing compiler
- Protected-mode version of compiler
- 386 run-time library object code
- Windowed source level debugger
- Profiler
- Editor
- 386 graphics library
- MAKE
- Linker
- Object-code librarian
- Object-code disassembler
- Supports Phar Lap and ERGO DOS extenders

1-800-265-4555

WATCOM C/386 for Windows

- Enables 32-bit Windows 3.0 GUI applications
- Interactive debugger for 32-bit Windows GUI applications
- Ideal for porting 32-bit Unix applications to Windows
- 32-bit flat model simplifies Windows memory management
- Royalty-free run-time license
- Requires Windows 3.0 SDK, does not require DOS extenders
YOU MAY BE MISSING THE BOAT...

If you're a C or PASCAL software engineer and haven't tried Ada yet!

Since 1983 Ada has become one of the fastest growing programming languages. Ada software engineers are in high demand. Colleges are graduating more and more Ada engineers. From the space shuttle to the Persian Gulf, Ada's the law for all Defense Department, NASA and NATO related programming. Overseas, Ada's the law for all European Community programming. And here at home, more and more Fortune 500 companies are switching to Ada to solve their software engineering problems.

Sounds big doesn't it? Yet few software engineers have given Ada even a glance. But Ada's coming and now you can hop on board for $149.95. We've even made it simple. A complete, validated Ada Programming Environment that's more than just a compiler—a full color, seamless, user-friendly environment with pull-down windows, a language sensitive editor, a linker, operates on 8086, 80286, 80386, and 80486, and requires no math CoProcessor.

Everything to begin software engineering in Ada. Serious, production quality, software engineering! And we're so sure that Ada will change the way you think about software engineering, we offer a money back guarantee. No questions asked. We also offer Ada tutorials and educational discounts.

So if you're currently a PASCAL or C software engineer, here's your chance to give Ada a try for only $149.95.

Your ship may have just come in.

To order call 1-800-232-3989 or send in the Coupon. For faster service Fax (203) 395-1355

---

GEMTECH
The Ada Company

GEM Technologies, Inc.
100 Main Street, Old Saybrook, CT 06475
1-800-232-3989

YES please send me GEM Technologies Complete Ada Programming Environment for $149.95.

☐ 5¼ disc ☐ 3½ disc
CT residents add 8% sales tax.

☐ I want to learn more about software engineering in Ada. Please send me the free Complete Ada Programming Environment Demo disc ☐ 5¼-disc ☐ 3½-disc.

Name ________________________________
Address ________________________________
City __________________________ Zip ______
State __________________________
Telephone __________________________

☐ Check ☐ VISA ☐ MC ☐ Money Order
Card # ______ Exp. date ______

I currently program in: ☐ COLBOL ☐ PASCAL ☐ Ada
☐ BASIC ☐ Other

GEM Technologies, Inc.
100 Main Street, Old Saybrook, CT 06475
(203) 395-1426 FAX (203) 395-1355

Circle 129 on Inquiry Card (RESELLERS: 130).
When Less Is More: Making Mac Images Manageable

STEVEN J. VAUGHAN-NICHOLS

Storm's PicturePress accelerator card and software compress Macintosh-based image files using three types of compression schemes.

Pity the poor Macintosh-based multimedia producer. Most of us have trouble fitting all our programs and data files on a hard disk drive. Multimedia fans have fits squeezing just a handful of files into the same drive. A single 24-bit color image can occupy more than a megabyte of storage.

Fortunately, the oversize file problem is becoming manageable, whether you produce multimedia presentations, four-color magazines, or desktop published brochures. Image-compression software and hardware now hitting the market let you shrink graphics files to maximize storage space. They also save on communications costs if you transmit massive files over a network or telephone line.

Storm Technology, with its PicturePress hardware and software, is an early entrant into the image-compression field. At press time, several other vendors had announced software and hardware compression products for the Mac but were unable to send commercial versions in time for testing. They include Micron Technology, Radius, Sigma Designs, and SuperMac Technology.

Tandem Hardware and Software

Storm Technology's PicturePress compression software and PicturePress Accelerator, a NuBus card, work in tandem to provide image compression for Macintosh users. The pair implement three different flavors of image compression: JPEG, JPEG++, and lossless (see the text box "An Image-Compression Glossary" on page 264). The card itself doesn't include compression routines in ROM. You can upload PicturePress software to the card and its twin 60-MHz digital signal processors. This innovative approach makes adding improvements simple. Only the program needs to be upgraded, not the card. This more than makes up for the slightly poorer performance of the general-purpose DSPs versus customized data-compression chips with embedded code.

PicturePress software works without the board, but do yourself a favor-use the two together. In my tests on a Mac IIc1i running with a 25-MHz 68030, I compressed 1-MB images in 51 to 58 seconds with PicturePress software alone. Once I had armed the Macintosh with the PicturePress Accelerator, the compression times dropped to 5 to 8 seconds. The performance benefits far outweigh the additional costs for all but the most penny-pinching offices.

Another PicturePress advantage is that Storm Technology allows users to make copies of the decompression utility. You need only send the program with your images, and the recipient can expand them. Third-party JPEG systems, however, probably would not work with Storm Technology processed images, because the JPEG standard is still in the final stages of evolution. A welcome addition would be an exportable version of PicturePress for MS-DOS machines.

PicturePress runs on any properly equipped Mac II or SE/30. The program requires System 6.0.4 or higher and 32-Bit QuickDraw installed and running. Its hardware demands are minimal: You'll need at least 1 MB of RAM (2 MB are recommended) and 2 MB of free disk space.

Performance varies not only by file size but also by the content of the image being shrunk. A picture of an empty field with a blue sky shrinks faster and into a smaller file than that of a busy city street, for example; in other words, the greater the data redundancy, the higher the possible compression. I compressed a score of 24-bit color PICT files, ranging in size from 750K bytes to 1.5 MB, and found that the amount of detail was the most significant performance factor.

continued
Making Mac Images Manageable

An Image-Compression Glossary

The following dictionary highlights some image-compression technologies to help you thread your way through the maze of new names and acronyms.

Fractal Compression A developing and as yet unproven technology based on principles of fractal geometry. It promises high-resolution and impressive compression ratios.

Huffman Encoding A popular lossless-compression algorithm that replaces frequently occurring data strings with shorter codes. Some implementations include tables that predetermine what codes will be generated for a particular string. Other versions of the algorithm build the code table from the data stream during processing.

JPEG (for Joint Photographic Experts Group) An ISO and CCITT committee and a still-image-compression standard being developed by the committee. As of press time, the JPEG standard has not been approved. It uses a one-pass, threefold process to squeeze down images.

JPEG++ Storm Technology's proprietary extension of the JPEG algorithm. It lets users determine the degree of compression that the foreground and background of an image receive; for example, in a portrait, you could compress the face in the foreground only slightly, while you could compress it in the background to a much higher degree.

Lossless Image- and data-compression applications and algorithms, such as Huffman Encoding, that reduce a picture's size without losing any data.

Lossy Methods of image compression, such as JPEG, that reduce the size of an image by disregarding some pictorial information.


MPEG (for Moving Pictures Experts Group) Like JPEG, both a group and an algorithm. The algorithm, for compressing moving images, is being developed and is not yet available for use.

Px64 A compression technique used in real-time videoconferencing.

JPEG++

Lossless Image- and data-compression algorithms and applications, such as Huffman Encoding, that reduce a picture's size without losing any data.

Lossy Methods of image compression, such as JPEG, that reduce the size of an image by disregarding some pictorial information.


MPEG (for Moving Pictures Experts Group) Like JPEG, both a group and an algorithm. The algorithm, for compressing moving images, is being developed and is not yet available for use.

Px64 A compression technique used in real-time videoconferencing.

Compression at Work

PicturePress is a cinch to set up and install. I was ready for business in 5 minutes. Using PicturePress is almost as easy. You choose from five preset compression ratios. These ratios range from a 2-to-1 lossless reduction to a 40-to-1 lossy reduction. Even pictures that are shrunk to the lowest setting would be usable in either newspapers or desktop publishing. Images compressed at the 8-to-1 or 15-to-1 settings could be used in four-color slick publications or multimedia applications. You can also adjust the degree of compression to your heart's content by using the customization features. This way, you can squash pictures up to 200 times smaller than their original size. However, extreme compression is more useful as a special-effect toy than for any practical purpose. And be careful: Other than restoring from backups, there's no way of restoring an image to its original condition if it has been compressed into oblivion.

MPEG++, Storm Technology's expanded version of the JPEG standard, lets you divide pictures into foreground and background areas and compress them at different rates (see the screen). This feature was easy to use in PicturePress, and it worked as advertised. It's such a simple procedure that I suspect most users will use it by default.

PicturePress is so easy to install and use, you almost don't need a manual. If you do have questions, the complete, easy-to-read documentation will answer them.

Big-League Compression

The one problem I found with PicturePress is that it can only compress PICT format files. Although the company includes instructions for using third-party applications to transform TIFF images to PICT, I would have liked direct support of TIFF and other graphics formats.

PicturePress Accelerator is big-league technology. Image compression has never been easier or more efficient on the Macintosh. Anyone who works with still images on that platform should give this product serious consideration.

Steven J. Vaughan-Nichols is a technical writer and consultant based in Lanham, MD. He can be contacted on BIX as "sjvn."
See the Future.

The FLEXSCAN® 9070U has been designed to offer maximum CAD/CAE performance in the PC environment. Our 16" flicker-free display is ideal for creating 3-D projections, and the 20kHz-50kHz horizontal scan range allows PC CAD capabilities at resolutions of up to 1024 dots × 768 lines. In the CAD/CAE field, non mutual image interference in dual monitor systems is an important issue. Our advanced deflection yoke eliminates mutual interference with 15cm distance between both units as opposed to the regular requirement 60cm and thus allows you to take full advantage of dual systems.

The FLEXSCAN's ergonomic design minimizes static, glare, and magnetic radiation to provide the most user-friendly environment possible.

Other monitors meet the standards. FLEXSCAN® sets them.

NANAO

NANAO USA CORP.
23510 Tele Ave., Suite S
Torrance, CA 90605 USA
Phone (213)325-5202
Fax (213)550-1679

Circle 219 on Inquiry Card
(RESELLERS: 220).

FLEXSCAN 9070U
16" (15''), 0.28mm dot pitch CRT.
Scan Frequency: Automatic Adjustment
H: 20kHz-50kHz
V: 50Hz-80Hz
Front-mounted controls for easy access
2 Video inputs for professional use
VGA, Hi-Res VGA (up to 1024×768)
EGA and Mac II compatible
Personal computers are becoming more important than ever for today's graphics-intensive applications. Unfortunately, scanning or capturing video images doesn't always yield quality results because of flat tones or uninteresting compositions. To achieve images that merit notice for desktop publishing, slide presentations, or publications, you may need the help of image-enhancement software.

Two new packages, Picture Publisher Plus and Desktop Artist, let graphics professionals use their PCs to retouch and enhance bit-mapped images with impressive results.

By emphasizing printed-image quality, Micrografx markets Picture Publisher Plus 2.5 for desktop publishers (see photo 1). The $695 package operates under Windows 3.0 and offers continuous-tone manipulation of both gray-scale and 24-bit color RGB TIFFs. A version for the Macintosh is also available.

Desktop Computing's Desktop Artist 1.0 ($495) requires a Texas Instruments Graphics Architecture (TIGA) display adapter, and while image editing is its main function (see photo 2), the software caters to graphic artists by offering them draw and paint functions without loading images first. This allows the software to double as a stand-alone paint program for freehand creation of drawings. Desktop Artist supports gray-scale and 24-bit color or RGB TIFFs, plus PCX, TARGA, and GIF formats, which also makes it a useful file format-conversion tool.

Both packages directly support monochrome or color printers, including PostScript output devices. Both will also generate CMYK (cyan, magenta, yellow, black) color-separated printouts or Encapsulated PostScript (EPS) CMYK color-separation files.

Image-Editing Tools
Each package lets you burn in (overexpose specific image zones), dodge (underexpose zones), and correct overall contrast and brightness. You can repair cracks in an old photograph using clipping, pasting, and blending tools. By overlaying images, you can create montages and surrealistic compositions. Both products offer file editing of true 24-bit images (16.7 million colors), but they support only 8-bit (256-color) display output. Depending on your system, this is either a bane or a boon. If you now use a 24-bit display, as I do, backpedaling to 256-color image editing is cumbersome. However, users of standard VGA displays won't have to invest the extra dollars to process and edit 24-bit images. According to both manufacturers, 24-bit true-color display support should be available by the time you read this.

Picture Publisher requires 3 megabytes of free hard disk space; Desktop Artist uses 2 MB. Although Picture Publisher's system specifications recommend an IBM AT or XT, you shouldn't consider anything less than a fast 286 system for either program. I tested both on Zeos International's 486/25 EISA tower system under DOS 4.01, with 8 MB of memory and a Relisys RE1520 16-inch multisampling monitor. I used Diamond Computer Systems' SpeedStar Plus, a 1-MB Super VGA card, to test Picture Publisher. I ran Desktop Artist with the Hercules Graphics Station Card and Texas Instruments' 34010 TIGA adapter. Both programs and all adapters are capable of 8-bit, 640- by 480-pixel through 1024- by 768-pixel display resolutions.

To test PostScript printing, I used a Pacific Data Products PacificPage PE font cartridge with a Hewlett-Packard LaserJet IIP. I tested color output with Shinko's CHC-445 and QMS's ColorScript 100-30i printers. CMYK color separations, printouts, and EPS CMYK color separations from both packages were superb.

Picture Publisher
Picture Publisher was developed and originally sold by Astral Development,
which merged with Micrografx earlier this year. In the Microsoft Windows 3.0 environment, Picture Publisher loads standard and TIFF 5.0 files, which it displays as dithered, low-resolution reference images in preview windows. To conserve disk space, you can save and open TIFFs using Lempel-Ziv-Walsh 2-to-1 file compression. Pull-down menus let you globally adjust brightness, contrast, and gray-mapping levels. In Windows mode, the program applies these adjustments to the overall image.

Picture Publisher also provides graphs that summarize overall brightness, contrast, or gray-mapping levels. The graphs allowed me to gauge these image variables precisely and save my changes to disk as reference for later jobs. The package also includes hand-held calibration strips and display, printer, and scanner reference/calibration files. Device calibration allows you to gauge imaging variables against a known reference standard, ensuring that you can duplicate results when editing, scanning, or printing different images.

To edit images, you invoke Micrografx’s Picture Window by clicking in the Xchg (exchange) area. The program shells from Windows to a 320- by 200-pixel, 256-color VGA display environment (see photo 3). However, the SpeedStar Plus card also supports 256-color display at 1024- by 768-pixel resolution using Tseng Labs’ chip set. So I selected an appropriate Picture Window display driver from several I found in the Windows interface screen. I’m always leery of third-party device drivers, but Micrografx’s driver worked perfectly.

At 1024 by 768 pixels by 8 bits, you choose the direct image-editing functions of Edit, GrayMap, Retouch, Mask, and View from sidebar icons. The Mask function selectively segregates specific

---

**ACTION SUMMARY**

- **IMAGE-EDITING SOFTWARE**
  - **WHAT YOU’LL LIKE** You can use your PC to retouch, enhance, and correct exposures of bit-mapped images. Also, you can repair cracks in an old photograph and create montages.
  - **HOW THEY DIFFER** Picture Publisher Plus operates under Windows 3.0 and offers continuous-tone manipulation of both gray-scale and 24-bit color RGB TIFFs. Desktop Artist requires a TIGA display adapter and provides draw and paint functions. Desktop Artist supports PCX, TARGA, and GIF formats, which also makes it a useful file format—conversion tool.
  - **WHAT WE RECOMMEND** Choose Desktop Artist and its conversion-utility tool if you work with TIGA images. If you’re VGA-based, Picture Publisher, with its impressive documentation, is a winner.
  - **WHAT YOU’LL PAY** Picture Publisher Plus: $695; Desktop Artist: $495

**FOR MORE INFORMATION**

- **Desktop Artist 1.0**
  - Desktop Computing, Inc.
  - 4600 Bohannon Dr., Suite 220
  - Menlo Park, CA 94025
  - (415) 323-5535
  - fax: (415) 323-4434
  - Circle 1225 on Inquiry Card.

- **Picture Publisher Plus 2.5**
  - Micrografx, Inc.
  - 1303 East Arapaho Rd.
  - Richardson, TX 75081
  - (800) 733-3729
  - (214) 234-1769
  - fax: (214) 234-2410
  - Circle 1226 on Inquiry Card.
HIGH-QUALITY IMAGE EDITING

object zones within an image by rubberband clicking around image boundaries. After creating masks, you store them in multiple clipboard areas. You can then resize, flip, stretch, and paste masks into other images.

Using GrayMap functions, I was able to visually adjust the individual mask's ToneMap or the whole image ToneMap instantaneously. A ToneMap is the range of image highlight levels (whites), quarter tones, mid-tones, three-quarter tones (intermediate gray levels), and shadows (blacks). You adjust the ToneMap by sliding handles on a ramp-curve overlay graph or by placing quarter-tone icon markers within the image directly. At this display resolution, the additional quarter-tone pop-up icon markers are tiny but usable. Quarter tones are the gray-level values between ToneMap levels (e.g., shadows and mid-tones).

When you're editing RGB color TIFF images, Picture Publisher Plus adds hue, saturation, and lightness manipulation to the ToneMap ramp-curve graph for RGB color adjustments. I also used the ToneMap adjustments to create both color and monochrome posterizations, negatives, and black-and-white line-art images.

The View and Retouch functions were fun to work with and innovative. In View mode, you can enlarge images in increments of 100 percent to 600 percent. By using a rubber-banding box, even 1-pixel "zoom-ins" are easy. Retouch mode permits freehand painting of a protective red filter (Micrografx refers to it as rubiconing), which shields areas from retouching "slips." You can select retouch colors or gras directly from the image for painting or combine them with a blending/smoothing tool to soften or sharpen edges. You also can globally apply these functions to rubiconed areas only.

Picture Publisher's scanner, printer, and capture/display board drivers support a wide variety of manufacturers. The few I tested worked flawlessly. I used Willow Peripherals' Publishers' VGA card to capture images directly off videotape and a Microtek MSF-300Z scanner to import 24-bit color and monochrome TIFF images. I preferred Picture Publisher's scanner interface drivers over Microtek's stand-alone software (ImageStar) because it was easier to use. Picture Publisher offers photo prescan, which made it easy to drag resizing/cropping bars around the prescanned image area for the final 24-bit scanning process.

Desktop Artist

My first attempts at using Desktop Artist with the Hercules Graphics Station TIGA adapter were futile—the software repeatedly locked up after 5 minutes of use. When I installed a Texas Instruments TMS-34010 TIGA adapter and TI's TIGA drivers, the program worked fine at all display resolutions.

Initially, this looked like just a paint program, but I uncovered many unique features as I worked with the package. The program's main screen layout has a user-moving menu, an icon-brush toolbox, and a palette/pattern status bar. The icon toolbox sports Bézier-curve tools as well as standard paint tools, similar to the Windows 3.0 Paint program. Unlike Picture Publisher, Desktop Artist lets you generate and size text over images, ranging from pleasant-looking Dom Casual to Helvetica fonts.

The real eye-opener in this program is the "gadget box," which opens and surrounds an image. Its buttons invoke standard flip/rotate acrobatics for images and text. However, when you pull on any gadget-box corner, you stretch or warp the image and its perspective in the pull direction. You also use the gadget box to crop and paste clip images. Once you've pasted them, you can set transparency levels to allow bottom images and artwork to bleed through the top image, similar to sandwhiching 35mm slides. In addition, Desktop Artist offers many of the same image-editing characteristics as Picture Publisher.

Best of Both Worlds

Although both packages share some image-editing features, each is unique in its own right. I would like to see Desktop Artist take a cue from Picture Publisher with a non-TIGA, VGA version; I'm positive TIGA-less users would like access to the unique features this program offers. On the other hand, some direct paint functions implemented in Picture Publisher would be an asset for that product. In the end, your choice will hinge on whether you generate your final images exclusively for print as TIFFs or for presentation purposes as GIFs or TGA files.

For my own needs, most of my 16- and 24-bit images are born from three-dimensional animation packages using TARGA display adapters. Some are converted to 8-bit gray-scale TIFFs for inclusion in Ventura Publisher or PageMaker desktop publishing layouts. Desktop Artist performed excellently as a conversion/utility tool in this capacity.

However, if you are VGA-based, Picture Publisher's documentation helps it win hands down with the most thorough explanation of gray-scale/color image editing and print processing around. Finally, according to Micrografx, upcoming releases of Picture Publisher will support direct importation and conversion of other image file formats in the near future.

Whichever package you choose, the next time your images require attention-getting, eye-popping perfection, don't settle for stock images. Unleash your imagination and create them yourself.

Greg Loveria is a computer graphics and desktop publishing consultant, animator, and technical writer. You can reach him on BIX c/o "editors."
The new standard for debugging Windows, DOS and OS/2 has arrived.
A selection of unique features includes:

- 100% CodeView™-information compatible
- Windows and PM user interface
- Character-mode user interface
- Easy to learn and use
- Automatic display of global and local data
- Advanced graphical data structure display
- Advanced data browsing

Windows highlights:
- Single monitor support ("Windows-Windows" debugging)
- Debugs Windows Enhanced 386, Standard, and Real mode
- Advanced window message spying capability
- 386™/486™ watchpoint support

DOS highlights:
- Debugs ANY SIZE DOS application - takes only 12KB
- Loads drivers and TSRs in high memory for maximizing application’s memory space
- EMS 4.0 emulation, as well as VCPI services 386™/486™ watchpoint support

MultiScope Debuggers have easy to use Windows, PM and character mode user interfaces.

For more information and a free trial version, please call (800) 999-8846, (415) 968-4892, or FAX (415) 968-4622.
For European pricing call ++46-13-63189.

*CS1 and C60 support
All trademarks are property of their respective owners
Don't leave your customers HANGING...!

Before you ship any program, check it with

**Bounds-Checker™**

Finds out-of-bounds memory accesses automatically

Your program may have 10,000 to a million lines of code. It may occasionally hang mysteriously or it may appear to run flawlessly every time. But under DOS, how can you ever be sure that your program is not corrupting memory it does not own? The only way to be 100% sure is to **Bounds-Check** before you ship.

To use **Bounds-Checker** you build your program with debugging information (we support most compilers including Microsoft, Borland & JPI). Then you just type `<BC file-name>`. **Bounds-Checker** sets up the 386™/1486 for protection and lets your program fly. If your program accesses memory it does not own or overwrites its own code, **Bounds-Checker** pops up displaying the offending source-line or instruction.

Programming under DOS is a gamble, so why not stack the odds in your favor--CALL TODAY.

(603) 888-2386

---

Other fine Nu-Mega products...

The ultimate systems debugger.

**Debug**:
- Interrupt routines
- Device drivers
- T&SRs
- ROMs
- Applications
- Overlays

**Features**:
- Break out of a hung program
- Real time Break-Points
- Back-Trace history
- Works with other debuggers

If you are debugging an application, **Soft-ICE** is seamlessly integrated with **Bounds-Checker** so you can easily go back and forth between **Bounds-Checking** and debugging: a combination many programming professionals can't live without.

---

If you are debugging an application, **Soft-ICE** is seamlessly integrated with **Bounds-Checker** so you can easily go back and forth between **Bounds-Checking** and debugging: a combination many programming professionals can't live without.

---

Run **CodeView** for Windows on a single monitor

CV/1........$129
- Runs in a window
- No annoying flash
- Runs on any display that supports windows

---

Nu-Mega Technologies INC
P.O. Box 7780 • Nashua, NH • 03060-7780 U.S.A.
(603) 888-2386 • Fax (603) 888-2465

Circle 230 on Inquiry Card.
The MultiScope Debuggers

STEVEN KEARNS

My program has a bug! Awesome! No, these aren't the rantings of a demented programmer; it might be your reaction after mastering the MultiScope Debuggers. This tool for serious developers is packed with features that make debugging easier and almost fun.

MultiScope offers three different debugging packages, each with numerous configurations specialized for different uses. This is one of their main strengths. I reviewed the Debuggers for DOS version, which lets you debug DOS programs while the debugger uses either a character mode or Windows 3.0 interface. You can also debug a program remotely, through a serial line or network. The Debuggers for Windows and DOS version (not available at the time of this review) will let you debug Windows applications and use a second debugging monitor. There is also an OS/2 version.

In addition, each package includes postmortem debuggers. These are perfect for field-testing your program. You can compile your program so that when it crashes at a user's site, the program automatically takes a snapshot of the software and CPU state. The field testers can return this snapshot to the programmer, who can use the postmortem debugger to figure out what went wrong.

Speaking Your Language

Most PC language development systems come with a capable debugger that is customized for the particular language and compiler. In contrast to this, the MultiScope Debuggers work with any language/compiler that can generate the standard CodeView debugging information: These include the Microsoft family of languages, Zortech C, and others. Although C++ is not explicitly supported, I used the debugger with some success with Zortech C++. However, because C++ mangles variable and function names, several features become too difficult to use. As a result, I would not recommend the debugger for C++ programs until MultiScope explicitly provides support for it.

Keeping an Eye on Your Code

The MultiScope Debuggers provide a standard set of functions. These include stepping through a program one statement at a time; setting breakpoints on any statement of the program, enabling the programmer to run the program and regain control when the breakpoint is reached; examining the value of program variables and data structures while the program is running; and examining the call stack, which lists the functions that...
THE MULTISCOPE DEBUGGERS

were called to get to the current point, where they were called from, and the arguments they were called with. This last function is most useful when the program stops prematurely: Examining the call stack can often indicate the source of the problem.

The package has several advanced features, including the ability to set read/write watchpoints. A watchpoint on a memory location stops execution when any part of the program reads or writes to the location. This is crucial for locating parts of your program that write where they shouldn't. Accessing this feature is easy: Click on the variable you want to watch in the Data window and select Set Watchpoint. Best of all, the debugger uses the advanced features of the 386 processor to implement watchpoints with essentially no loss of execution speed. On a lesser processor, a program with a watchpoint may execute 10 times slower than normal, or worse.

Unfortunately, the MultiScope Debuggers allow you to set only five watchpoints. Also, when I tried to watch a whole structure, I was stuck, because the debugger prevented me from editing the size field of the Set Watchpoint dialog box. This type of user-interface snag cropped up in several situations.

Conditional breakpoints are another advanced feature. They are ignored unless a programmer-defined condition is met. Furthermore, when a conditional breakpoint is triggered, you can direct the debugger to take actions (e.g., logging a message or evaluating an expression) instead of stopping.

I found the conditional breakpoint interface particularly frustrating. If you accidentally input an erroneous condition into the dialog box, you are forced to reenter all the information from the beginning. Similarly, after you have set a breakpoint, there is no way to change it, short of deleting it and reentering a new one. Furthermore, the field for the condition is too small, and the expression evaluator is overly strict about types. I once spent 5 (frustrating) minutes trying to enter a breakpoint thanks to these problems.

Zooming In on Your Data
The Data window displays current values for a set of variables. Double-clicking on a pointer variable displays the values in the structure it points to. There are some unfortunate limitations to the Data window, though. You cannot specify exactly which variables you care to display. You show either all the locals or all the globals in a module. If you double-click on a pointer, you see what it points to, but you lose the display of the other local variables.

One of the niftiest features of the MultiScope Debuggers is the ability to automatically draw a picture of a data structure. For example, you can select the variable that points to the root of your binary tree, and the debugger will draw a snazzy picture complete with arrows and three-dimensional boxes. It knows the type of each variable, and it uses this information to recursively draw the object and any objects it points to.

However, this feature is more fun than useful. If a variable is an index into an array, for example, I'd like a debugger to picture both the variable and the array element pointed to. But the debugger would simply display it as an integer; of course, the debugger has no idea what the integer represents. I hope future
At Mount Sinai Hospital, some of the best brains in the country rely on Sony.

Fortunately, critical patient data is tucked into the safest place of all. A Sony data cartridge.

In fact, hundreds of detailed files can be accessed from one, single, solitary data cartridge.

Which is how the renowned doctors at Mount Sinai Hospital in New York City store patient diagnostic data.

Not one byte can be lost.

That's why Sony produces, with exacting care, a range of mini and ultra-high capacity data cartridges up to 525 megabytes.

And if Sony data cartridges can do all of this, they can also back up another vitally important life force with the utmost integrity.

Your business operations.

SONY
Circle 357 on Inquiry Card.
Computer Fails On Space Shuttle—
Threatening Astronomy Mission

Telescope Mechanism Clogged By Lint From Uniforms

NASA's orbiting shuttle Columbia and its astronomy mission was seriously jeopardized yesterday when an onboard computer overheated and failed to function. The apparent cause of the breakdown was lint from the astronauts' workers' uniforms.

Air ducts that lead to the computers were inspected by the crew and discovered to have been clogged by lint. The crew, however, had a handheld vacuum cleaner on-board and quickly and easily removed the large accumulation of lint. The computer offices in America use Data-Vac for preventive maintenance. Data-Vac keeps systems running smoothly—even in outer space. Affordably priced. Satisfaction guaranteed.

Contact your local computer/office products dealer today or

Call 1-800-VAC-1602

(in New York State, 914-357-1600)
Fax: 914-357-1640

Data-Vac Your Computer Now—Or Replace It Later

QuickTrace

QuickTrace is an automatic tracing tool which converts scanned "dot" images into vector based graphics. Instead of drawing by hand, try QuickTrace. It will help you to easily and quickly enter graphics like logos, maps and clip art, which would otherwise be difficult and time-consuming on your PC.

Developed by

Nakajima Bldg., 5F, 11-22, Shinjuku-ku, Tokyo 160, Japan
Phone: 5379-4770 / Fax: 5379-4717

QuickTrace can input images scanned by Nisca, Logitec ScanMan and etc. • OEM Inquiry welcome

The Automatic Tracing Program

THE MULTISCOPE DEBUGGERS

d debuggers will offer a simple way for programmers to create customized graphical displays for their program data.

Some debuggers let you capture and replay a set of debugging actions. This can be useful when it is time-consuming to set up your program to display a bug. The MultiScope Debuggers can display and save all your debugging actions but don’t offer any way to replay them.

Just Another Pretty Face?

Aside from the glitches of not allowing you to edit Size fields and forcing you to sometimes reenter information in a dialog box, the user interface is well designed. You can use either the character mode or Windows user interfaces; both work similarly. The most common operations, such as single-stepping, are compressed into single keystrokes. Operation is convenient with both mouse and keyboard. The menus are thoughtfully laid out. It is easy to switch between your program's output and the debugger's display. I especially appreciated that I could choose a font size and color for each window.

I was also impressed with the Remote Control, a small (text or graphical) window that pops up on the application screen. With it, you can perform simple debugging operations (e.g., run, stop, and single-step) with mouse-clicks on icons that mimic VCR control buttons. This is a nice touch, particularly for applications that take up most of the screen when they run.

Finally, a caution. I first used the MultiScope Debuggers to track down an actual bug. I spent several mostly enjoyable hours experimenting with it, using its myriad features in a fruitless attempt to pinpoint the bug. I finally gave up: I had to think about the bug. Within 2 minutes, the cause of the bug was clear, and a quick check with the debugger verified the problem. The moral: All the windows, colors, keys, waypoints, and fancy features of a debugger are no substitute for thinking.

As a replacement for the likes of CodeView, the MultiScope Debuggers are an excellent choice. In terms of features and configurations, they match the best debuggers available. However, the user interface needs refinement. I am looking forward to the next version.

Steven Kearns is the president of Software Truth, which is developing a next-generation programming environment. He earned a Ph.D. in computer science from Columbia University. He can be reached on BIX c/o "editors."
The Ultimate in Hardware Based Copy Protection

Compatible
Hardlock is designed for the "real world". Side effects from printers, laptops and technical issues such as static and true IBM printer port compatibility are virtually non-existent.

Flexible
Field programmability is now possible. Additionally our optional Crypto Programmer board permits the Hardlock to be uniquely programmed for your company.

Reliable
Our unique ASIC (Application Specific Integrated Circuit) extends the Hardlock's operating range below 2 volts. Since no idle current is required, there is no additional loading on the printer. Electronically erasable memory requires no battery.

Space-Saving
Hardlock measures only 1.75". Three of our units fit in approximately the same space as only two others. Hardlock with Memory may also be purchased on the smallest PC board you've ever seen. Perfect for those who don't want the device on the exterior of the computer.

Hardlock
Hardlock with (128 bytes) Memory
Hardlock with Memory on a Board

The Security System You've Asked For.

GLENCO ENGINEERING INC.
SERVING THE SOFTWARE INDUSTRY SINCE 1979
1-800-562-2543
270 Lexington Drive · Buffalo Grove, IL 60089 · 708-808-0300 · FAX 708-808-0313

Circle 132 on Inquiry Card.
Break Away from Ho-hum Mice & Scanners!

Presenting DFI's CHS-4000 Color Handy Scanner® and DMS-400 Mouse

Depart from the humdrum of ordinary scanners and mice. Live up to the full power of communication with DFI's new CHS-4000 Color Handy Scanner and DMS-400 Mouse.

For the serious scanning enthusiast, the CHS-4000 scanner has a 400 dpi resolution, color gray scale output, PC Paintbrush IV+, among others. And the quality that you've come to expect from the company that started handheld scanning.

The DMS-400 Mouse is an opto-mechanical, three-button, 400 dpi mouse that is compatible with Microsoft and Mouse Systems mice through an easy hardware switch. Totally redesigned for maximum comfort and minimal fatigue, it's the world's most comfortable mouse.

Live up to your full creative potentials with DFI's CHS-4000 and DMS-400 Mouse. Who knows where it will lead you?

Call or fax us today for more information.
Even with laser-printer prices dipping under $2000, good business sense argues against putting a printer on every desktop, especially since many people use printers sporadically throughout the day. A more efficient solution is for many users to share the same printer. This is the rationale behind the new printer-sharing devices hitting the market.

I reviewed three new sharing devices that don't require a LAN to provide multiple access to printers: Pacific Connect from Pacific Data Products, the Lasernet PSU-82SP from Western Telematic, and MultiSpool 2289A from Extended Systems. The latter two units are stand-alone boxes with serial and parallel interfaces, while Pacific Connect is a card that plugs directly into the Optional I/O slot of a Hewlett-Packard LaserJet II, IID, III, or IIID printer.

Job Queuing
Pacific Connect works with PCs and Macintoshes connected only to LaserJet printers. The other two units can attach to any printer with parallel or serial ports and can work with PCs and Macs, although Mac users can't take advantage of some utility software that ships with the Lasernet and MultiSpool. All three can store incoming data in an internal memory buffer before sending it to the attached printer. If one or more additional ports receive data at the same time, the device sets aside buffer memory for each new job. The jobs proceed to the printer in the order in which they are received.

To determine when one job ends and the next job begins, the devices use a pre-selected time-out period. When they stop receiving data into the active job port for the duration of the time-out period, the job is considered closed, and the next job in line then flows to the printer. The time-out lets you send multiple-page documents with brief time gaps in between, without other jobs sneaking in. In certain graphics or CAD applications, the computer may need to perform substantial processing between portions of the printer output. The time-out can ensure that a print job from another user does not get sent to the printer between portions of a graphics image.

I tested all three devices with simultaneous serial- and parallel-input connections and with several print jobs being submitted concurrently from different computers. Each of the units performed flawlessly in these tests, with no print jobs inadvertently corrupted. In some cases, I needed to adjust the time-out period to accommodate a lengthy delay between portions of a graphics image.

As expected, the parallel data transfer was substantially faster than the serial data transfer, and it is preferred when feasible, especially when you regularly transfer graphics images. In shared-printer environments, however, it is common for many or most PCs to be too far from the printer for parallel operation, so fast serial communications are important. Extended Systems' Multi-Spool, with its serial and parallel adapters, provides a unique solution for using parallel ports over long distances.

Pacific Connect
Easy to use and install, Pacific Connect is the simplest of the three devices. At $399 for the 256K-byte version (user-upgradable to 1.25 megabytes) and $499 for the 1.25-MB version that I reviewed, it is also the least expensive. However, it only works with HP LaserJet printers. In addition, the card provides only five computer connections—four serial and one parallel.

The device offers four RJ-11 phone jacks for the RS-232 serial inputs and a single 36-pin Centronics connector for the parallel input. It ships with four RJ-11 cables and four RJ-11-to-DB-25S adapters, making computer-to-serial port connections straightforward, especially for IBM PC compatibles with the standard 25-pin serial-port connector. Systems that have the IBM 9-pin serial-interface connector will need a 9-pin-to-25-pin adapter (readily available from many suppliers). Non-IBM-compatibles having a female DB-25 connector will need a male adapter.

You can individually select the data transfer rate and time-out (in 10-second increments) for each Pacific Connect port. (Only the time-out can be set for the parallel port.) The company includes a PACSET utility to easily configure the communication and time-out parameters.
Subscription Problems?

We want to help!
If you have a problem with your BYTE subscription, write us with 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 Subscription Service
P.O. Box 555
Hightstown, NJ 08520

EXTEND YOUR PRINTER'S REACH

from a PC. And because Pacific Connect has its own nonvolatile memory, it retains the setup values for all ports even when you shut down the power—a nice feature. Pressing the device's recessed test button generates a status printout, including all current communications port data transfer rates and time-outs.

This unit supports the widest range and fastest data transfer rates of the three units tested, including serial rates of up to 115,200 bps. Since the standard DOS MODE command (for PCs) will only support up to 19,200 bps, Pacific Connect comes with another utility, PAC-MODE, that permits you to specify a rate of up to 115,200 bps. This fast transfer rate has become proven in the PC industry with such programs as LapLink and Procomm. I tested Pacific Connect in a LaserJet III and found that the 115,200 bps transfer rate worked reliably and reduced transfer time substantially compared to the 19,200 bps I normally use. Pacific Connect cut 30 seconds off the transfer of a simple 300-dot-per-inch image, and it could easily reduce transfer time by minutes for a moderately complex image. In contrast, the Western Telematic and Extended Systems units support a maximum serial data transfer rate of 19,200 bps.

The serial ports normally use hardware (Data Terminal Ready) handshaking between the Pacific Connect unit and the attached PCs. Serial port 1, however, can optionally be configured to use software handshaking (XON/XOFF) for systems that may require this (e.g., certain minicomputer or mainframe systems). You can run the device with Macintoshes that have a LaserJet driver, but you must use a PC to configure transfer rates and time-outs.

Lasernet
The Lasernet supports eight connected computers (four serial and four parallel) and two printers (one serial and one parallel). You can purchase the Lasernet in four memory sizes: 256K bytes ($595), 512K bytes ($695), 1 MB ($795), and 2 MB ($995). I evaluated the 1-MB unit. This product doesn't include any cables, but it does use all standard printer input connectors (DB-25s for the serial ports and 36-pin Centronics connectors for the parallel ports). The two printer output connectors are also DB-25 types (one male and one female), matching the IBM PC standard interface pin-outs.

The full-size, standard connectors (instead of the "RJ" telephone jack connectors), coupled with the unit's internal power supply, account for the relatively

BYTE ACTION SUMMARY

- WHAT PRINTER SHARERS DO
  These devices efficiently let many users share one printer without a LAN.

- WHAT YOU'LL LIKE
  Easy installation, reliability, and the chance to maximize your printer resources.

- WHAT YOU'LL DISLIKE
  Not all of these devices work with all printers; some printer sharers operate at less than optimum transfer rates; and the cost of some fully configured units matches the price of personal laser printers.

- WHAT WE RECOMMEND
  For LaserJet users who can accept a five-user limitation, Pacific Connect clearly offers the most for the money.

  In the higher-cost, stand-alone arena, MultiSpool is the winner because of its flexibility and its ability to operate at long distances even with parallel ports.

- WHAT YOU'LL PAY
  Pacific Connect: $499 (1.25-MB unit); Lasernet PSU-82SP: $795 (1-MB unit); MultiSpool 2289A: $995 (as tested, 1-MB unit)

- FOR MORE INFORMATION
  Extended Systems, Inc.
  6123 North Meeker Ave.
  Boise, ID 83704
  (208) 322-7575
  fax: (208) 377-1906
  Circle 981 on Inquiry Card.

  Pacific Data Products
  9125 Rehco Rd.
  San Diego, CA 92121
  (619) 552-0880
  fax: (619) 552-0889
  Circle 979 on Inquiry Card.

  Western Telematic, Inc.
  5 Sterling
  Irvine, CA 92718
  (714) 586-9950
  fax: (714) 583-9514
  Circle 980 on Inquiry Card.
PC-diagnosis: preventive maintenance, benchmark testing, performance enhancement.

Speed Test Your PC

You've seen the Landmark Speed Test 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, update your system configuration on-the-fly. BYTE Special $19 + $3 shipping/handling.

PC Won't Boot? Then Just KickStart It!

Don't replace your motherboard, don't call service, use KickStart 2*. When serious hardware problems occur, nothing gets you up and running as fast. KickStart 2 measures power within 0.5% 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 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 OS (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 tool! With both supervisor and user levels of password protection, you can prevent unauthorized use of your PC and accidental running of destructive tests. Regularly $599, BYTE Special, SAVE $300 CALL NOW.

"KickStart 2 systems diagnostics board helps users check out virtually every aspect of a PC's hardware system... the judgment is remarkably accurate for computer maintenance." David Clarke, PC Week - December 24, 1990.

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 floppy drives 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 100 uses. Replacements and single drive size versions available. For all PCs and compatible. Regularly $249 (single size $149). BYTE Special, SAVE $30 CALL NOW.

Hard Core Testing for Professionals

Landmark/SupaSoft Service Diagnostics is ideal for professionals requiring the most exhaustive diagnostic test capabilities. Each module is CPU specific including the 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 testing 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; backup and restore hard disk image on unformatted floppy 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 tothe component level. Also available in a complete kit including: all CPU specific software, dual size floppy alignment software (see AlignIt), and PCXT & AT ROM POSTS. Winner of the PC Magazine Editor's Choice Award in August 1990.

Confused by Technical Computer Jargon?

Finally, with a single keystroke, you can define virtually every computer term known in a matter of seconds. This award-winning, easy-to-use utility, defines over 4000 computer terms and concepts for you without having to leave the program you're in.

The Computer Glossary® is a software version of the best-selling book by Alan Freedman installs as an application or hot-key accessed TSR. The definitions are written in concise, standard English. Plus, The Computer Glossary provides colorful industry "backgrounders" fascinating to the beginner and expert alike.

Get the most out of your software, manuals and computer magazines, buy The Computer Glossary and become a true POWER USER. Runs under DOS or M$-DOS 2.0, or later, with 256K of RAM and 1.4 MB of hard disk space on IBM PC, XT. AT and compatible computers. Regularly $59, BYTE Special, SAVE $30 CALL NOW.

Call (800) 683-6866

International use FAX (813) 443-6603
Voice (813) 443-1331

Visa © MC ® Amex ® CODs Accepted • Dealer Inquiries Welcome
First in PC testing... Since 1981
703 Grand Central Street * Clearwater, Florida 34616

Circle 187 on Inquiry Card.
large size of the Lasernet. A DIP switch at the rear of the unit lets you configure several default values. You can reset the values after power-up using one of the PC utilities included with the unit. You can set the serial-printer-output-port default to either 9600 or 19,200 bps and the serial-input ports for either 9600 or 19,200 bps (although not individually). You can also select one of four printer output modes: serial only (all output goes to the serial printer port), parallel only (all output goes to the parallel printer port), share mode (data passes to the first available printer port), and direct mode (data travels to the "default" printer port unless otherwise instructed by an embedded command to the LaserNet).

The LaserNet only supports 1-, 5-, 20-, or 90-second time-outs. The gap between 20 and 90 is large enough to be an irritation. For example, my CAD program needs a time-out of nearly 40 seconds. The additional 50 seconds wastes a lot of time in a device largely designed to save time.

The LaserNet’s maximum 19,200-bps input transfer rate, while the fastest most printers can accommodate, does not offer that extra performance boost that’s so notable with Pacific Connect. Ironically, like Pacific Connect, the LaserNet includes a new WMODE utility to replace DOS’s MODE command, allowing data transfer rates of up to 115,200 bps to be specified. However, the LaserNet will not support anything beyond 19,200 bps.

While hardware handshaking is the normal mode for the serial ports, a DIP-switch setting will let you configure the ports for XON/XOFF handshaking. Unfortunately, all the ports must use the same handshaking scheme. The LaserNet accepts certain embedded commands (from the print data stream) for altering the time-out, selecting the output printer, printing multiple copies, and other operations.

Western Telematic includes a disk with several utilities to support the unit. The LaserNet utility can change the default parameters (primarily the communications parameters), but it incorrectly identified my default port setting as 9600 bps when I had set it to 19,200 bps. It did make requested changes properly, but parameter changes are only valid until you shut off the power; the default DIP-switch settings then become active again.

MultiSpool
The stand-alone MultiSpool 2289A from Extended Systems includes a 1-MB buffer memory. Like the LaserNet, it can support a serial printer and a parallel printer (using PC standard DB-25 connectors), as well as a maximum of eight computers. Also, MultiSpool uses DIP switches to determine the power-up default operating parameters; it is limited to 19,200-bps serial operation; and it comes with no cables. It does, however, have many distinguishing features, including its small size. It is roughly one-third the size of the LaserNet, due in part to its external transformer.

But MultiSpool’s most notable features relate to its computer connection schemes. Extended Systems sells varying-length cables with an RJ-45 connector on each end, ranging from 25 feet to 100 feet in length, with special orders accepted for lengths of up to 500 feet. The standard 50-foot cables I used cost $25. One end of the cable simply plugs into one of the mating RJ-45 connectors at the

---

**EXTEND YOUR PRINTER'S REACH**

Actually, two programs. **Play It By Ear** and **RhythmAce**. Two musically essential software programs for any IBM PC.

**Play It By Ear** is an interactive program that trains you to pick out notes, tones, chords, intervals, and more. It shows you how to play everything back. Without sight reading. Choose from eight different exercises, six skill levels. Play an on-screen guitar fretboard or keyboard. Or straight from your MIDI instrument. The program automatically tracks your progress. Smart.

**New RhythmAce** helps you learn, practice and play rhythms. Perfect your grasp of tempo, time signatures, notation values, meters, and more. Keep the beat with a computer keyboard, mouse or MIDI instrument. Select single or two-handed rhythms. Choose a classical or jazz style. Tap your feet. Fun.

So, to have fun or get serious about music, get with these programs.

See your dealer or order now! Only $99.95 each for **Play It By Ear** or **RhythmAce**.

(415) 546-1917

**This 4½ Hour VHS Video Tape Course**

"**How To Install A NOVELL® Network**"

Will teach you in plain English all the basics required to install a Novell Network. Topics include: Network Boards, Cabling, File Servers, Hard Drives, Disk & Diskless Workstations, Software Installation, Network Management, Multi-User Applications, etc.

**For Orders Call** 1-800-654-1138

**Tech-support**

818-905-1262 **FAX** 818-905-1292

**$69.95 Plus$5 Shipping & Handling**

**Vogue Video Productions**

16250 Ventura Blvd., #202
ENCINO, CA 91436

---

Circle 152 on Inquiry Card.

Circle 331 on Inquiry Card (RESELLERS: 332).
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.

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.

1021 S. Wolfe Road
Sunnyvale, CA 94086
(408) 738-4387

Circle 282 on Inquiry Card.
rear of the MultiSpool. The other cable end attaches to your computer using either a serial or a parallel adapter. To connect to a standard 25-pin PC serial port, you use an ESI-7000PC adapter ($20), and to connect to an AT's 9-pin serial port, you use an ESI-7000AT adapter ($20). If you wish to connect to your computer's parallel port, you must buy an ESI-7000TX transmitter interface ($60) to take advantage of the company's proprietary ExtendedLink technology. The ExtendedLink adapter converts the parallel port to a high-speed serial link (at 23,000 bps) that is transparent to your computer's operation and allows reliable communications to up to 500 feet.

For RS-232 serial communications, you can individually configure each input port with DIP switches to operate at 9600 or 19,200 bps, and each port automatically handles both hardware and XON/XOFF handshaking. The unit defaults to a 20-second time-out period, but you can change this by sending commands to the unit via the PC's printer port. These changes, however, are only in effect as long as power remains applied. Like the Lasernet, MultiSpool also supports other commands to select the output printer and lets you print multiple copies.

You must purchase the required RJ-45 cables and adapters with MultiSpool to form a useful printer-sharing device. With these adapters, the device becomes a flexible system that allows any combination of serial- and parallel-port connections, and it supports long-distance data transfers at high speeds (see the photo). At $995, this device is not inexpensive, especially when you add the special cables and adapters. But it provides exceptional flexibility.

**Flexibility Pays**

These three printer-sharing devices are reliable, and they work as advertised. For LaserJet users who can accept a five-user limitation, Pacific Connect clearly offers the most bang for the buck. In the higher-cost, stand-alone arena, the LaserJet provides basic no-frills operation with standard interface connectors, but it offers little to help it stand out from the crowd. Because of its greater flexibility and the ability to operate long distances even with parallel ports, Extended Systems' MultiSpool 2289A is the clear winner.

Roger C. Alford is president of Programmable Designs, a Michigan-based consulting firm, and author of the Programmable Logic Designer's Guide (Howard W. Sams, 1989). You can reach him on BIX c/o "editors."

---

**CONVERSION WOES**

*Which is your conversion?*

- New hardware
- New operating system
- New language
- New package

*Conversions can be troublesome...*

- Editing scripts never quite seem to be correct.
- Programs never quite seem general enough.
- Everything seems so messy and hit or miss.
- Manual conversions are so tedious and error-prone.
- Subtle difficulties are not exposed up front.
- Time scales are hard to estimate.

*Help is at hand...*

We will write a dedicated translator program for you. First we will produce a precise analysis of the logic of your requirements. Then we will write a clean, syntax-directed translation program.

Overseas assignments accepted.

Telephone John Jackson.

---

**MicroSolutions**

Computer Products

132 W. Lincoln Hwy., Dekalb, IL 60115
(815) 756-3411
Fax: 756-2928

*See us at Comdex, Booth #2352*

---

**Dataflow Automata**

Distributed Ltd.

Parade House, 135 The Parade, High Street, Watford, Herts, WD1 1NS, UK.

*Telephone: +44 (0)923-246 404
Fax: +44 (0)923-246 301
Mobile: +44 (0)880-921 089
Telex: 917010 EuroG*

---

---
In 1972, Summagraphics introduced the first affordable desktop tablet. Eighteen years and more than 40 patents later, our SummaSketch® II is the industry standard in graphics tablets.

Our unsurpassed technology and proven reliability have made SummaSketch the best selling tablet in the world—with over 500,000 sold to date. More than any other manufacturer.

SummaSketch has also won every major editorial accolade, including PC Magazine Editors’ Choice, PC Week Corporate Satisfaction Poll, CADENCE’s Blue Ribbon Best of 1989, and CADalyst’s Dream Systems and Highly Recommended rating.

SummaSketch II. The people’s choice. The critics’ choice. And the easiest choice you have to make. For literature and the name of your local dealer call 1-800-888-2028, Ext. 304 or in Canada call 1-800-729-7866. For technical information call 203-881-5400.
The two most comprehensive
to bring you the largest selection of business & personal computing

SELECT 5 BOOKS
for only $4.95

Values to $140.75

The Ultimate DOS Programmer's Manual
by Mark Hammond & Bill Grindel
$27.95
Counts as 2

C
The Complete Reference
Second Edition
by Robert Lafore
$29.95
Counts as 2

SELECT 5 BOOKS
for only $4.95
computer clubs have joined forces references available ... at savings up to 50% off publishers’ prices!
The joy of C-scape
Elegant graphics and text

The C-scape™ Interface
Management System is a flexible library of C functions for data entry and validation, menus, text editing, context-sensitive help, and windowing. C-scape's powerful Look & Feel™ Screen Designer lets you create full-featured screens and automatically generates complete C source code.

C-scape includes easily modifiable high-level functions as well as primitives to construct new functions. Its object-oriented design helps you build more functional, more flexible, more portable, and more unique applications—and you'll have more fun doing it.

The industry standout. Many thousands of software developers worldwide have turned to the pleasure of C-scape. The press agrees: "C-scape is by far the best. A joy to use," wrote IEEE Computer. Major companies have selected C-scape as a standard for software development.

C-scape's open architecture lets you use it with data base, graphics, or other C and C++ libraries. C-scape runs in text or graphics mode, so you can display text and graphics simultaneously. To port from DOS or OS/2 to UNIX, AIX, QNX, or VMS, just recompile. C-scape also supports Phar Lap and Rational DOS extenders.

Trial with a smile. C-scape is powerful, flexible, portable, and easy to try. Test C-scape for 30 days. It offers a thorough manual and function reference, sample programs with source code, and an optional screen designer and source code generator. Oakland provides access to a 24-hour BBS, telephone services, and an international network of companies providing in-country support. No royalties, runtime licenses, runtime modules. After you register, you get complete library source code at no extra cost.

Supports DOS, OS/2, Unix, VMS. Call for demo.
Color Printing, Diconix Style: Vibrant but Slow

ALAN JOCH

In the battle for the eyes and minds of harried business people, desktop presentations rely on color as an essential tool. Ink-jet printers remain one of the most economical means of producing color transparencies and handouts, and Hewlett-Packard's PaintJet has carved out an appealing $1400 price point in that market.

Now Kodak has entered the competition for those who covet color with the Diconix Color 4, a desktop addition to the successful line of portable Diconix printers. At $1495, the Color 4 is $100 more expensive than its main rival, but Kodak has imbued the new printer with standard features that make it more versatile than the PaintJet, including a 50-page paper bin to augment the built-in tractor feeder. Unfortunately, the Color 4 can be excruciatingly slow.

Nevertheless, this is a well-designed printer. Its sleek, rounded-wedge shape lends a modern and unobtrusive profile to the desktop. The Color 4's silence while printing is a pleasant surprise: The advancing paper platen is the only sound you'll hear. The LED interface and the menuing system let you quickly select among resolutions, fonts, and media. In addition to Color 4-specific drivers, the Kodak printer emulates the PaintJet.

Easy setup is another plus. Color ink-jets conjure up installation nightmares thanks to ink cartridges that require priming and cleaning. The Color 4's cartridges need very little fussing. However, to prime them the first time, you must insert a straightened paper clip through a small hole in the cartridge and compress an ink bladder so that some drops squeeze through the nozzle. I punctured a disaster, and magenta-stained hands, as I gingerly poked at the bladders and wondered how much stress they could take. In the end, I suffered no mishaps, even when I punched the bladder harder than necessary for priming. The inks are not water-based and are permanent when dry. They refused to smear even when I repeatedly marked an image with an underliner or rubbed it with a moistened finger.

The Color 4 relies on four ink cartridges: yellow, cyan, magenta, and black. The PaintJet uses one black and one color cartridge. Thus, the Color 4 can save you some money if one color dominates your work. Replacements cost $14 for black and $20 each for the three colors. Kodak rates each cartridge at a maximum of 500 pages.

After installing the ink cartridges and

Kodak's Diconix Color 4 ink-jet printer offers paper-handling versatility and rich colors for business presentations.
The Diconix Color 4 produced bold but slightly off-register colors in the pie chart on the left. The Hewlett-Packard PaintJet printer (right) produced the same chart a minute faster.

a cleaning blotter, I merely connected the 8-bit Centronics cable and inserted the ROM card that holds a Microsoft Windows driver and other system information. (Kodak markets a version for the Macintosh with an RS-232 seven-eighths serial interface and cable for $1595.)

Contrast, the PaintJet comes only with a tractor feed, so if you’re printing cut sheets, you must manually insert them a page at a time. The Color 4 handled both types of paper without jams. Similarly, transparencies fed through the paper bin and printed without incident. The printer produced fine results on 20-pound copier paper, although colors looked even crispier when printed on specialty coated inkjet paper.

Using the front-panel menu, you can select three fonts: Prestige, in 10 and 12 characters per inch, and 18-cpi Gothic. You can print each in draft, near-letter-quality, and quality resolutions (96 by 96, 96 by 192, and 192 by 192 dots per inch, respectively).

Performance Tests
To test the Color 4’s speed and quality, I printed a series of color graphics and text files. I first generated a color graphics file produced with CorelDraw 2.0 and converted to a 42K-byte PCX file. Using Excel 3.0, I produced a color bar chart and a color pie chart, both of which included text and numerals. DesignView 2.0 enabled me to print a schematic...
Better Windows

DESQview has been discovered by DOS knowledgeable people and 286 PCs with additional memory everywhere. Over 1,000,000 people have bought DESQview.

**Multitask**
- Run multiple programs side-by-side in windows. "Background" programs can continue to run.
- See text and graphics side-by-side
  - Reference information in your graphics program while writing your report.
- Run Windows programs
  - DESQview even lets you run Microsoft Windows.

**Solve memory problems**
- QEMM 386 makes the most of every last 'K'. DESQview uses that memory to run multiple programs.

**Easy menu access to programs and DOS services**
- Access programs or DOS in a window with just a few keystrokes or mouse clicks. It's that simple.

**See multiple files**
- If your programs allow it, DESQview lets you run the same program in two or more windows. Great for comparing files.

**Cut and paste data**
- Transfer data between programs with a few keystrokes.

**Handle large programs**
- Run standard DOS programs side-by-side with DOS-extended programs like 1-2-3 Release 3.


Once the power user's secret, DESQview has been discovered by computer knowledgeable people everywhere. Over 1,000,000 people have bought DESQview.

Multitasking: windowing, using keyboard or mouse commands, it's all easy with DESQview.

DESQview 386 2.3 lets you use your favorite DOS and DOS-extended programs in windows side-by-side on 386SX, 80386 and i486 PCs. As you can see above, you can even run Microsoft Windows within DESQview.

Whatever programs you use—DOS, extended DOS or Windows—and whatever hardware you have, whether 8088 or i486 or something in between, DESQview is still the best way to get the most out of the hardware and software you own today.

DESQview. When you look into it, it's the obvious choice.

Quarterdeck Office Systems, 150 Pico Boulevard, Santa Monica, CA 90405 (213) 392-9851 Fax (213) 399-3802

Quarterdeck

Circle 264 on Inquiry Card.
drawing and specifications for a crane arm, a job designers might typically use a lower-resolution plotter for instead. Finally, I printed some text-only files from XyWrite III Plus, primarily to test for speed. I produced the same output on the PaintJet. In both cases, the tests used coated ink-jet paper, ink-jet transparency media, and 20-pound copier paper. None of the Color 4 tests uncovered any problems emulating the PaintJet.

The most obvious performance difference between these printers is speed. In quality mode, the Color 4 plods along, slowly applying ink in each bidirectional pass of the ink cartridges. The print head then stops, waits for the paper to advance a line, and makes another pass. The PaintJet prints at a steadier pace without a series of starts and stops.

My time tests gave numbers to my frustration. For example, the Color 4 needed an average of 2 minutes, 40 seconds to print the CorelDraw file; the PaintJet zipped out the same image in an average of 1 minute, 30 seconds. Similarly, the Color 4 produced the Excel charts in 2 minutes, 26 seconds and 2 minutes, 28 seconds, respectively. The same charts with the PaintJet: 1 minute, 31 seconds and 1 minute, 27 seconds. Although most people probably wouldn’t buy either model to print straight text, the XyWrite tests show that the occasional quality-resolution business memo could be a painful experience with the Color 4. Single text pages averaged 2 minutes, 46 seconds compared to just 50 seconds by the PaintJet.

To its credit, the Color 4 produced chart colors that were richer and more vibrant than the PaintJet’s (see the figure). The color richness was especially impressive when I displayed transparencies of the Excel charts with an overhead projector. Under the glare of the projection lamp, the PaintJet charts appeared to be washed out, with weak colors. By contrast, the Color 4 charts and text looked bolder and more eye-catching.

However, a couple of minor flaws lead me to dock points from the Color 4. On the transparency material, some distracting bands in the solid-fill areas detracted from the overall look. In some cases, the register was off slightly, so a faint edge of color appeared beyond black border lines in the Excel pie chart. And in the CorelDraw image, a custom red came out with too much purple and looked less like the original than the PaintJet’s output did. If color accuracy is of prime importance to you, these problems may be serious, but for those who use the Color 4 for presentations and who value vibrancy over accuracy, these may be minor flaws.

Color Champ

As a newcomer to an established market, the Color 4 has a tough job cracking through the competition. With this printer, Kodak has made a fine effort to design a more versatile, easier-to-use alternative to the PaintJet.

In the end, however, as much as I like the Color 4’s interface and print quality, I still prefer the PaintJet. It’s faster and its color reproduction is truer, and although the difference is small, the PaintJet costs less. Unless Kodak offers some more compelling reasons to switch from the market leader, the PaintJet remains my first choice.

Alan Joch is a technical editor with the BYTE Lab. He can be reached on BIX as "ajoch."
Actor® just got friendlier... 
...and Windows™ programming easier!

Actor is an interactive development system for both beginning and advanced Microsoft Windows programmers. Relying on the most modern object-oriented programming techniques, Actor boils down the complexities of the Windows API to a few, simple but powerful principles, called ObjectWindows™. Actor delivers ObjectWindows™ in an easy-to-use programming environment ideal for learning Windows while writing your programs one step at a time. Add to this support for C libraries and DDE, and you've got the fastest route to Windows. Order your copy today.

Actor 3.1 with Object-Windows™ Everything you need to start developing Windows applications. The quickest way to learn about Windows programming. Runtime generation system not included. $249

Actor 3.1 Professional with Object-Windows™ Includes Actor 3.1, The Whitewater Resource Toolkit®, Object-Graphics™ class library, and runtime generation system. Everything you need to develop and distribute unlimited copies of your Windows applications. An $895 value for just $495!

“Actor is a key tool for ushering in the next generation of graphical applications.”

“The Actor programming environment for Windows is exceptional... Using Actor, you can do most of the things you do with C in Windows in a lot less time.”
— Gary Entsminger, Computer Language, 3/91.

“If you need to do Windows programming, I believe that [with Actor] there has never been a better time or better way.”

“Using Actor has cut our development time by at least 75%.”
— Michael Fannin, Chairman, Open+Voice Inc., 12/90.

“Actor is the only way to develop applications for Microsoft® Windows that is worth the trouble it takes. Period.”
— Jeff Duntemann, Dr. Dobb's Journal, 12/89.

Actor 3.1 is an award winning product:
Finalist, Technical Excellence Award, 1988, 1990
PC Magazine

Winner, Programmer's Productivity Award, 1990
Computer Language Magazine

Best in its Class, 1989
Info World

Call 1-800-869-1144 for more information on Actor and Actor 3.1 Professional with ObjectWindows and the complete line of Whitewater Windows Development Tools. Or FAX your request for information to 708-328-9386.

Whitewater also provides expert training and consulting to ensure the success of your Windows development projects. Call 1-800-869-1144 for more information.

The Whitewater Group®
1800 Ridge Avenue, Evanston, IL 60201-3621 USA 708-328-3800

Copyright © 1991 by The Whitewater Group, Inc. Actor, the Actor logo, and Whitewater Resource Toolkit are registered trademarks and Actor Professional and Object-Graphics are trademarks of The Whitewater Group, Inc. Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation. ObjectWindows is a trademark of Borland International. The Whitewater Group is a registered servicemark.

Circle 337 on Inquiry Card.
IslandWrite, IslandDraw, and IslandPaint Offer an Isle of Productivity

PC users have it made. The PC has been a general market force for so long that software has stratified nicely into the low end, midrange, and high end of price and capability. Unix workstations, by comparison, are just coming into their own as general-purpose systems. The majority of software in that market is still priced high, with features targeting the most demanding users. While this feature-rich environment is part of what makes Unix attractive, it can also be frightening for those who aren’t power users. Falling workstation prices have resulted in the placement of Unix systems on desks that were once the exclusive domain of PCs and Macs. Unfortunately, software has been slow to keep pace; most prices are still high, and most workstation software is still best suited for power users.

IslandWrite, IslandDraw, and IslandPaint, an integrated desktop publishing and graphics package from Island Graphics, is the epitome of the perfect fit. The philosophy behind this bundled trio of applications is this: Users of workstations often need to generate documents and graphics, even though the generation of such material is not their main job. Why spend hours learning an intricate document preparation system when all you need is a proposal or a letter? Furthermore, why pay for capability that you probably won’t ever use?

I worked with version 2.3 of IslandWrite, IslandDraw, and IslandPaint on two SPARC-based systems: a Sun IPC and an Opus PM5000. Both are SPARC-1 machines with roughly identical performance. I used the Open Look version of the software, which ran in color under Open Windows 2.0 and SunOS 4.1.

IslandWrite
Thanks to their Open Look appearance, all three Island applications look sharp and share a common feel (see the photo). From my point of view, though, IslandWrite is the star of the bundle. Any user who feels squeamish about workstations will be immediately calmed by IslandWrite’s friendly manner.

If its function had to be identified, IslandWrite would come out somewhere between a WYSIWYG word processor and a desktop publisher. Like a word processor, IslandWrite is easy to learn and use and is built for speed: a first-time user can create and print a memo or fax document in about 5 minutes without using templates. Like a high-end desktop publisher, IslandWrite can do indexes and tables of contents, handle multiple master pages, and perform layout wonders like flowing text around irregularly shaped graphics. By taking a little while longer to run through the 38-page tutorial, most users are ready for practically anything.

I am amazed that IslandWrite’s designers have managed to build a simple document-preparation program without sacrificing functionality. When I first approached IslandWrite, I expected it to be full of holes because of its price and target audience. The more I worked with it and learned about it, however, the more I realized it isn’t kid’s stuff. In over a month of tests, I found only a few nit-picking things that IslandWrite can’t do. It is just good software.

Even with its simplicity, I can only begin to describe IslandWrite’s myriad features here. IslandWrite’s basic layout building block is the container. These are objects, as are most document elements throughout the Island series. As objects, containers have attributes and data associated with them. A container can hold text or graphics and can be any shape, although a rectangle is the most common one. Text flows according to connections between containers; for example, an ar-
article on page 1 can automatically flow to page 3 if that's your layout preference. Page layouts can be stored as formats, IslandWrite's master pages mechanism. A number of these pages can be stored and tagged according to left- or right-side placement. As you enter text, you can add new pages to a document automatically, or you can add them manually by selecting the desired format page.

From a user-interaction standpoint, IslandWrite is nicely done. Open Look's pushpin facility is used liberally; you can tack your most-used menus and dialog boxes onto the root window to create a sort of control panel. Aside from the interactive aspects, IslandWrite also has a markup language. Unfortunately, this language isn't documented; the only way to learn about it is to put together sample documents, request that they be saved as marked-up ASCII, and study them. Even though this is unacceptable to me, I was able to produce a sed script that used IslandWrite's markup facility to create attractive, three-column proofs of BYTE articles. But Island Graphics should have made markup language information more accessible.

IslandWrite's few other deficiencies are related to its environment. It uses Sun's scalable font mechanism, which produces hard-to-read text at small point sizes. The default page size and font are unacceptably small and squinty for interactive work. But the scalable fonts and zoom mechanism allow IslandWrite to run on workstations with limited display sizes. The downside of its scalable fonts, aside from their poor quality at low point sizes, is their inability to run on certain X Window System servers. When I used IslandWrite to test the X terminals in this month's group review (see page 238), I found one terminal that failed to display IslandWrite's fonts properly. Some other minor problems were related to Open Look/Open Windows: the barely visible text cursor in some dialog boxes and the occasionally unintuitive behavior (e.g., the Return key failing to activate a dialog box's OK or other main button). Although these problems will probably be solved in future releases of Open Windows and IslandWrite, they do not impede the user very much now.

IslandDraw and IslandPaint
The other two packages in the bundle are hardly incidental, but neither impressed me as much as IslandWrite did. IslandDraw creates polygon-based drawings, graphs, and charts. Basic drawing tools, including Bézier curves, can be combined to create drawings of simple to
C++/Views is a development tool for C++ programmers that not only reduces the complexity of Microsoft Windows 3.0 but also slashes development time by up to 75%.

Delivers on the promise of Object-Oriented Programming (OOP). Encapsulates more MS Windows 3.0 functionality than any other tool on the market today. Get MS Windows applications off to a fast start with a framework of over 75 tested and ready-to-go C++ classes.

Has the most complete C++ class library for MS Windows Development.
Get started with graphical user interface classes such as windows, views, bitmaps, dialog boxes, menus, popup menus, graphics, regions, pens, brushes, controls, buttons, listboxes, valuators, editors, printers and much more. Organize your data with foundation classes such as containers, collections, sets, dictionaries, files, strings, streams and so-on. Use other classes to manage the persistence of objects across files, to perform serial communications, and to activate timed events.

Provides support for the entire project.
Comes with a complete OOP development environment including the first fully functional C++ class hierarchy Browser. Also includes an Interface Generator for building C++ dialog classes and a Documenter for automatically producing high quality documentation of your classes.

Integrates leading-edge technology.
Combine C++/Views with Borland C++ or Zortech C++ for a cost-effective and highly productive development environment for building your next generation software systems.

Pays for itself on even the smallest project.
Only $495.00 with no royalties.
Comes complete with source code.

C++/Views from CNS, Inc.
CNS, Inc., Software Products Dept.
1250 Park Road, Chanhassen, MN 55317
(612) 474-7600 FAX (612) 474-6737
© Copyright 1990 CNS, Inc. All rights reserved. Microsoft is a registered trademark of Microsoft Corporation.

Circle 65 on Inquiry Card.
REVIEWER'S NOTEBOOK

moderate complexity. IslandDraw treats each polygon and text string as an object with a user-definable stacking order and set of attributes. Its precision and power are sufficient for charts, graphs, and presentation artwork, but it isn't CAD—it won't put CAD software makers out of business. The manual's tutorial works up a floor plan, which is a bit misleading, because IslandDraw is not a CAD package. Still, IslandDraw can pull it off. It excels at combining spline-based and polygonal graphics with shading and scalable text to produce knockout report and presentation graphics.

If I had a set of transparencies to produce, IslandDraw would be my tool of choice. In the hands of those who have little or no artistic talent, as in my case, IslandDraw is a boon. It keeps your lines straight and makes sure your boxes meet at the corners. If you can draw, IslandPaint gives you the raw materials to create freehand illustrations of surprising quality. IslandPaint contains the typical paint-package mix of brush, pattern, and polygon tools. If you need to import graphics, IslandPaint will read PostScript, Group 3 fax, MacPaint, Sun raster, X11 bit-map, and X11 window dump formats.

A Matched Set
The strength of these three publishing tools lies in working as a team. Drawings from IslandPaint and IslandDraw can be loaded into an IslandWrite container, cropped, and scaled. The programs all output PostScript (no other printer support is provided) and can, therefore, be integrated into existing Macintosh networks. PostScript-format file-saving capability permits other applications that read Encapsulated PostScript to use Island-produced graphics and finished pages. My tests proved that this works, but with a catch: Saving an Island drawing or page as an EPS file creates valid EPS code, but it includes a strange binary header that must be stripped before it can be used in another application.

I had trouble in general with the EPS import/export capability. IslandDraw refused to load EPS files that printed perfectly and displayed on the Open Windows pageview PostScript previewer. I notified Island Graphics of the problem, but apparently the company hadn't encountered it before. The problem may have been due to an error on my part, although we could not identify it; the import, export, and convert capabilities of the Island programs were the hardest for me to understand.

Still, I consider IslandWrite, IslandDraw, and IslandPaint to be an incredible package value at $995. I breezed through the tutorials and quickly cranked out documents that impressed even the Unix nonbelievers on BYTE's staff. It isn't completely perfect, but everything is perfectly usable. The Island applications stand as excellent examples of the versatility of the Open Look user interface with its pushpins for menus and dialog boxes and its drag-and-drop interface. The combination of this interface and the trio of integrated publishing tools that make up the Island Productivity Series is enough to make even Mac users a little envious.

—Tom Yager

Reviewer's Notebook provides new information—including version updates, new test data, long-term usage reports, and reader feedback—on products and product categories that have been previously reviewed in BYTE.
Our Systems Stack Up To Be The BEST!

SYSTEM FACTS
* Rugged, Reliable 19" Rackmount
* 18 inches deep with 3 drive bays
* 24 inches deep with 6 drive bays
* Accepts Motherboards
* Accepts Passive Backplanes
* EISA and ISA bus architectures
* 8, 12 or 16-slot configurations
* Cortex Split Backplanes
* 200W to 350W power supplies
* Custom Power Supplies available
* Front mounted keyboard socket
* Rackmount monitors
* Rackmount keyboard drawer
* MS-DOS, OS/2, Unix, Xenix
* Dual card cage cooling fans
* Master Control 16 controller
* Quick disconnect extending slides
* Tilting and extending slides

SYSTEM USAGE
* Network File Server / Duplexing
* Data Acquisition
* Factory Automation
* Motion Control / Robotics
* Communication Networks
* Voice Mail / Message Systems
* Broadcast Communications
* Military / Defense Systems
* Video Editing Studios
* Test System Controllers

ENGINEERING
* Steel Enclosure
* EMI RFI Plating
* Hard Coat Anodized Face Plate
* Custom Configurations
* Custom Engineering / Design

Cortex Corporation
1-800-888-RACK
12274 Nicollet Ave. S
Burnsville, MN 55337
(612)894-3354 Fax (2414)

Circle 79 on Inquiry Card.
Packet Drivers

If you follow networking, you've heard a lot about the Network Driver Interface Specification and the Open DataLink Interface (see “Mix-and-Match Network Adapters,” August 1990 BYTE). When network software uses protocols that conform to NDIS or ODI, those protocols can ride on top of any network adapter for which a corresponding NDIS or ODI driver exists. Conversely, adapter makers do not need to write and maintain separate drivers for each network product. Multiple protocols, moreover, can share the services of an adapter. All in all, these specifications yield tremendous benefits.

You may not have heard much about an alternative grass-roots effort that predates NDIS and ODI: the packet driver specification. This specification was originally written in 1986 to enable FTP Software's PC/TCP to coexist with a proprietary LAN system. It was enhanced and then released to the general public. Volunteers write drivers for various cards and contribute the drivers to users through Clarkson University and FTP Software.

The “Clarkson collection,” which consists of drivers and documentation, is available from several sources. It includes a variety of standard Ethernet drivers (e.g., for 3Com, Novell, InterLan, Tiara, and Western Digital). It also includes more exotic packet drivers: one for serial-line internet protocol and two piggybacking drivers that send IP packets by way of IPX and NetBIOS, respectively. To find out where to get copies of the drivers and the specification, see the text box “How to Get Packet Drivers” on page 298. For a list of adapter cards with existing packet drivers, and for network software products that support the packet driver, see table 1.

All network software products can potentially use packet drivers, but you've got to rewrite the protocol stack driver interface so it can talk to the packet driver interface. FTP Software's PC/TCP, of course, speaks packet driver, as do many of the other TCP implementations for DOS (e.g., Wollongong Group's WIN/TCP, Phil Karn's KA9Q TCP/IP, and Sun Microsystems' PC-NFS). NetWare users have relied on a packet-driver-compliant IPX shell that was developed at Brigham Young University. Thanks to that effort, users at BYU and around the world have been running TCP/IP and NetWare concurrently on DOS workstations since 1988, although Novell's own ODI-based solution has appeared only recently.

Version 2 of the BYU shell is freely available, but the newly developed version 3 is not. That's because Atlantix (formerly CocoNet) has licensed it for use with its Axcess server—an SMB/NetBIOS implementation for Unix. Atlantix's use of packet drivers and the BYU shell demonstrate the generality of the packet driver specification. Although they were invented to simplify FTP Software's adapter support chores and were...
subsequently used to enable TCP/IP-
NetWare coexistence, packet drivers can
be used in all sorts of applications. With
Aixcasec, for example, DOS workstations
can simultaneously converse with Net-
Ware servers (using the BYU shell) and
Unix-, DOS-, or OS/2-based SMB/Net-
BIOS servers (using Atlantix’s packet-
driver-compliant NetBIOS).

Note that packet drivers are distinctly
DOS creatures. Theoretically, you can
pile on protocol after protocol, but in
practice, you’ll run up against the real-
mode 640K-byte ceiling. High-loading
memory managers can offer some relief,
and Windows and other DOS-extended
applications running in extended mem-
ory can use the services that packet dri-
vers provide, but the existing drivers (and,
currently, most of the protocols that ride
on top of them) operate only in real
mode. You may find, therefore, that once
you have loaded TCP/IP and NetWare,
there is little elbow room remaining. Of
course, that’s simply a DOS restriction
that network software products using
packet drivers, NDIS, and ODI share
equally.

Using the Specification
With a packet driver, as with an NDIS
or ODI driver, protocol stacks gain device
independence and the ability to coexist
with other protocol stacks. Tailoring a
protocol stack to use the packet driver
interface is straightforward. Protocol
stacks have always had to support lots
of network cards, so they typically already
have a well-defined software interface
for calling drivers. Supporting the pack-
et driver is then simply a matter of map-
ing that interface to the packet driver in-
terface. According to BYU’s Kelly
McDonald, it was easy to convert one of
the sample hardware-coupled IPX dri-
vers included with Novell’s adapter driver
kit into a hardware-independent IPX
packet driver.

It’s trickier to write board-level dri-
vers that present a packet driver interface
if only because writing any device driver
is a tricky undertaking. The breadth of
the Clarkson collection is a testimony not
only of the ingenuity and dedication
shown by the volunteers who contributed
to it, but also of the scope of the problem
that the packet driver specification
solves. Moreover, not all packet drivers
represent the effort of volunteers, be-
cause it is largely in the interest of board
vendors to write packet drivers, too.
Packet driver support has to mean,
among other things, that even new ver-
sions of the vendors’ adapters will work
with existing applications.

The packet driver doesn’t allow two
instances of the same protocol stack to
access the driver at the same time. You
can’t, for example, use a public domain
TCP and a commercial one on the same
system at the same time.

The packet driver also doesn’t make
software independent of the network
media. The protocol stack still has to be
customized for Ethernet or Token Ring
or whatever the specific type of medium
is, because different medium require dif-
ferent packet-header formats, translation
techniques, and network station addre-
ses. TCP/IP uses 32-bit logical addresses
that are unique in the TCP/IP Internet,
and these addresses must be mapped to
the host’s hardware address. Other pro-
tool stacks use different representations
of network addresses.

The algorithm for mapping the ad-
dress varies depending on the network
media. While a packet driver could build
the hardware-level headers for the appli-
cation (although it doesn’t), it wouldn’t
be realistic to expect it to translate ad-
dresses. That approach would limit its
flexibility, as different protocol stacks
may use different addressing schemes
and translation algorithms.

Novell’s ODI differs from the packet
driver in that it builds hardware headers
for its client protocol stacks. However,
Open Intel's new 386/486 C Code Builder Kit. And tear into the increased memory and performance of 32-bit DOS protected mode.

Inside, you'll find everything you need to develop 32-bit applications. That means you get a Microsoft and ANSI compatible C Compiler and Libraries, Linker, Librarian, Make Utility, and Source Level Debugger. We've even enclosed a DOS Extender that's DPMI-compliant. Compliancy that enables easy migration to Windows® and OS/2® from Microsoft.

To make moving up even simpler, we've also included free Intel support and a $695 price tag. With no royalties to pay. Ever.

Try it at no risk. Purchase it from your Intel dealer with a 30-day, money-back guarantee. Or call 1-800-525-3019 for fax document #9901, or Intel customer service at 1-800-538-3373. Because with Code Builder, the hardest thing about getting into 32-bit programming is opening the box.

©1990 Intel Corporation. *DPMI compatibility with these operating environments is based upon publicly stated intentions of Microsoft Corporation. Intel is a registered trademark, and 386, 486, and Code Builder are trademarks of Intel Corporation. Windows is a registered trademark of Microsoft Corporation. OS/2 is a trademark of IBM.

Circle 358 on Inquiry Card (RESELLERS: 359)
PACKET-DRIVER-SUPPORTED HARDWARE AND SOFTWARE

Table 1: Adapter cards with existing packet drivers are listed below. Many free and commercial network software products support the packet driver.

**Adapters with packet drivers:**

- 3Com’s 3C501, 3C503, 3C505, 3C507, and 3C523
- Any SMC-mode ARCnet card
- Telesystems SLW’s radio modem
- Any AT&T Ethernet or StarLAN card
- D-Link Systems’ DE-600 Pocket LAN Adapter
- Simulated driver over NetWare’s IPX
- BICC Data Networks’ ISOLAN
- Apple Computer’s LocalTalk PC Card
- Sun/TOPS (Silka) FlashCard
- Simulated driver over NetBIOS
- NCR’s ET-1058
- Novell’s NE1000, NE2000, and clones
- RacaJ.1nterlan’s NL5010, NL5210, NL6510, and NL9210
- SLIP, using the PC’s 8250 serial chip
- Ungermann-Bass’s NIC and NICps/2
- NCR’s ET-1058
- Novell’s NE1000, NE2000, and clones
- RacaJ.lnterlan’s NL5010, NL5210, NL6510, and NL9210
- SLIP, using the PC’s 8250 serial chip
- Ungermann-Bass’s NIC and NICps/2
- All Western Digital’s models

**Freely available software that supports the packet driver:**

- NCSATelnet
- Clarkson NCSA Telnet
- Phil Karn’s KA9Q TCP/IP (freely copyable only for radio amateurs and educational institutions)
- Harvard PC-IP
- BYU’s IPX packet driver
- PCROUTE
- Joe Doupnik’s version of MIT’s NETWATCH
- SOS NFS Server
- PC-NFS drivers (requires Sun’s PC-NFS)

**Commercial software that supports the packet driver:**

- Atlantix’s Axcess
- FTP Software’s PC/TCP
- Sun Microsystems’ PC-NFS
- Wollongong Group’s WIN/TCP
- Gateway Communications’ packet driver
- D-Link Systems’ D-Link Ethernet card packet driver
- Beame & Whiteside Software’s BWNFS and Telnet packages
- Wiscware’s MS-DOS/IP
- Cabletron Systems’ Ethernet card packet driver

ODI doesn’t do address translation, so applications that use it still must retain some media-specific knowledge.

### How Packet Drivers Work

The packet driver interface revolves around a software interrupt that network applications call to perform a variety of functions: getting information about the network interface, transmitting packets, and registering to receive packets, for example. You load a packet driver first and then one or more protocol stacks that use it. Here’s a sample AUTOEXEC.BAT fragment that illustrates the process:

```batch
wd8003e 0x72 5 0x240 0xd000
ethdrv
ipx
```

The first line loads the Clarkson University packet driver for the Western Digital WD8003E Ethernet card; the second line loads the FTP Software PC/TCP kernel; and the third line loads the BYU packet driver NetWare shell. All establish themselves as TSR programs.

The packet driver presents a software interface to the network adapter in much the same way as DOS presents a software interface to a hard disk. Disks have several common operations: read a sector, write a sector, and get the disk’s characteristics. Similarly, the packet driver provides for the common network adapter operations.

### What Networks Look Like to Software

The basic unit of data on a network is a packet, conceptually not unlike a disk sector. You can write a sector to a disk regardless of what’s in the sector—a file, a part of a directory, whatever. You can also write a packet to an Ethernet regardless of what’s in the packet; it’s up to the receiver to figure it out.

To help the receiver, most networks have a way of providing a packet-type indication. On DEC-Intel-Xerox Ethernet, each packet has a 16-bit Type field; on IEEE Ethernet, each carries a Service Access Provider (SAP) field. TCP/IP always uses DIX formats on Ethernet.

Each computer on a network has a network address; address lengths vary depending on network type. Some networks support broadcast packet transmission, wherein a packet goes to all computers on the network. Some support multicast, which is a restricted broadcast to a subset of nodes. (Typically, the subset has its own special network address.) And some support promiscuous mode, in which the device is programmed to receive all packets regardless of their destination. This mode is used primarily by network monitors and analyzers.

Multicast reception tends to work in one of two ways. One approach is that you can often program the network interface with a set of multicast addresses that it should listen for. That way, the software doesn’t need to verify the addresses. The disadvantage of this approach is that hardware usually has small, fixed tables that allow only a certain number of multicast addresses to be listened for.

The other approach is that the interface can pass all multicast packets up to the software driver and have it screen out the addresses. This is rather like receiving broadcast packets, except that the extra overhead of screening out the undesired packets is incurred only by hosts using multicast and not by every host on the network.

Some software also needs to be able to set the address of its network interface. Most network (and all Ethernet) interfaces come with a globally unique
100,000 engineers and scientists already let MathCAD do their calculations for them.

Now that college is far behind you, perhaps it's time you graduated from spreadsheets, calculators, and programming.

Because in today's working world of engineering and science, there's no time for anything less than MathCAD. The software that lets you perform engineering and scientific calculations in a way that's faster, more natural, and less error-prone than any calculator, spreadsheet, or program you could write yourself.

Thanks to MathCAD's live document interface, you can enter equations anywhere on the screen, add text to support your work, and graph the results. It also comes complete with over 120 commonly used functions built right in. Perfect for creating complex equations and formulas, as well as exponentials, differentials, cubic splines, FFTs and matrices.

You get three-dimensional plotting, vivid graphing, and the ability to import HPGL files from most popular CAD programs, including AutoCAD®.

Done calculating? MathCAD prints all your analyses in presentation-quality documents, even on PostScript® compatible printers.

All of which has made MathCAD far and away the best-selling math software in the world. In fact, it's used by over 100,000 engineers and scientists—just like you.

There's MathCAD for the PC. MathCAD for the Mac, written to take full advantage of the Macintosh® interface. And a Unix® version that utilizes the speed and unlimited memory of your Unix workstation.

We also have Applications Packs for Advanced Math, Statistics, Mechanical, Chemical, and Electrical Engineering. Each is a collection of adaptable mathematical models, designed to let you start solving your real world problems right away.

For a free MathCAD demo disk, or upgrade information, dial 1-800-MATHCAD (in MA, 617-577-1017). Or see your software dealer.

Available for IBM® compatibles, Macintosh computers, and Unix workstations.

TM and ® signify manufacturer's trademark or registered trademark, respectively.

I-800-MATHCAD
Table 2: All packet driver calls enter with the function number in register AH and return with the carry flag set to indicate error. The error code is in register DH in that case.

get_parameters
IN
AH 10
OUT
ES:DI parameter structure
byte major version
byte minor version
byte length of structure
byte address length
word maximum transmission unit
word multicast address buffer size
word back to back receive
word successive transmits
word post-eoi interrupt

set_rcv_mode
IN
AH 20
BX handle
CX mode
1 turn off receiver
2 receive only unicast packets
3 mode 2 plus broadcast
4 mode 3 plus limited multicast
5 mode 4 plus all multicast
6 all packets
OUT no returns

get_rcv_mode
IN
AH 21
BX handle
AX mode
OUT no returns

set_multicast_list
IN
AH 22
CX address length
ES:DI address
OUT no returns

get_multicast_list
IN
AH 23
CX length of address list in bytes
ES:DI address list
OUT no returns

get_statistics
IN
AH 24
BX handle
OUT DS:SI statistics structure
dword packets received
dword packets transmitted
dword bytes received
dword bytes transmitted
dword errors received
dword errors transmitted
dword packets lost

set_address
IN
AH 25
CX address length
ES:DI address

E = extended function
H = high-performance function
network address stored in ROM on the board, but they can also override that address under software control.

In short, applications calling a network device driver need to perform the following operations:

- identify the network device
- read the device's network address
- send a packet
- receive a packet
- stop receiving packets
- manipulate multicast addresses

The packet driver interface supports all these operations.

First Things First
Before an application can use a packet driver, it has to figure out which software interrupt the packet driver has attached itself to. Although some programs may mandate a specific interrupt, other programs use the driver's facility for automatically locating the interrupt. It works by scanning interrupt vectors Ox60 through Ox80 and looking for a special signature string. The interrupt handler for the packet driver interrupt will point to a 3-byte jump instruction (or any 3 bytes; what they are doesn't matter to the system.) When it finds one, it must register itself with the driver by calling access_type.

Identifying the Network Device
After the application finds the packet driver, it can find out more about it by making two calls: driver_info and get_parameters. The driver_info call returns an indication of which packet driver calls are supported. Calls fall into three categories: basic, extended, and high performance. All packet drivers support basic calls. Most Clarkson collection drivers support all three modes.

The driver_info call also tells the application the version of the driver that is loaded, the class of network device being accessed (class is the network media, such as Ethernet), the type of network device being used (the model of the network interface), the number of the card (e.g., the first driver is 0; the next is 1), and the address of an ASCII string describing the interface. See table 3 for a list of currently defined classes.

A program calling the packet driver should scan the interrupt table and issue driver_info calls until it finds a driver with appropriate characteristics. Perhaps it can run only with an Ethernet driver and should, therefore, ignore any non-Ethernet packet drivers loaded into the system.) When it finds one, it must register itself with the driver by calling access_type.

Setting the Receive Mode
Most network cards can be in one of several receive modes. Each receive mode specifies which packet the card will keep, based on its destination address. The receive mode can be set by calling the set_rev_mode function. The simplest mode, mode 1, turns off the receiver. Applications are unlikely to want to do this.

In mode 2, the card receives only packets that are addressed directly to it. No broadcast or multicast packets are accepted. Again, applications are unlikely to do this, but this mode is included for completeness.

In mode 3, the card receives packets addressed to it and broadcast packets. Since few existing applications use network multicast addresses, most will want to run in this mode.

Mode 4 is equivalent to mode 3 plus multicast packets filtered by the card's in-hardware multicast address list (set by set_multicast_list). Some applications will use multicast to send data to a group of hosts without having to burden all hosts on the network as they would with broadcast. They would use this mode or mode 5.

Mode 5 is equivalent to mode 3 plus all multicast packets. The difference between mode 4 and mode 5 is that mode 4 depends on support for multicast filtering on the network adapter. Not all network adapters support multicast filtering, and those that do support it usually allow the application to register only a few addresses. If the application wants to listen to a lot of different multicast addresses, it can use mode 5 at the expense of extra software overhead to check if the received packet matches a desired multicast address.

Receiving Packets
To receive packets, an application must tell the packet driver which packets it wishes to receive and which handler to call when one shows up. The function access_type registers the handler and returns a handle, which is required by other functions.

The packet type is specified by passing the driver a string of bytes that tell it which packet type to watch for. Different network media have different ways of determining the type of a packet. For instance, a DIX Ethernet driver (Class 1) has a 2-byte Type field, starting at the twelfth byte in the packet. A packet is determined to be a TCP/IP packet only if these 2 bytes are Ox800.

However, an IEEE 802.3 Ethernet stores the packet length in this field and uses a SAP field after the 14-byte Ethernet header to determine how to dispatch
the packet. A SAP header can further indicate that a following Sub-Network Access Provider header must be consulted. With TCP/IP, the SNAP header is followed by a final header that carries a Type field indicating if the packet is an IP packet or an ARP packet (ARP is used to translate 32-bit IP addresses into 48-bit IEEE addresses). But only IP will have all these headers. Other protocols may not require the SNAP header or the IP-specific one. Thus, an IEEE 802.3 packet driver must be prepared to check a range of bytes to find which protocol stack a received packet is for.

The recent release (8.x) of the Clarkson collection solves a long-standing problem related to DIX versus IEEE formats. The new drivers may act as Class 1 (DIX) and Class 11 (IEEE) drivers. When an application calls access_type, it specifies a driver class. The Clarkson release 8.x drivers allow Class 1 drivers to accept Class 11 access_type calls and decide, by remembering the class each receiver is using, where in the packet to match Type fields. This allows simultaneous use of IEEE and DIX framing through one packet driver.

The Clarkson drivers also support a mode that allows the BYU Novell shell to pass Novell DIX format packets to the driver, which then converts them to IEEE-format packets for transmission and fixes up received Novell packets. Novell servers and clients use IEEE framing by default but violate the IEEE rules on SAP usage. A Novell system can be switched to DIX framing (where it properly uses the Type field) with the ECONFIG command. By having the packet driver do the conversion, the -n option to the Clarkson packet drivers allows use of the BYU shell (internally using DIX framing) without requiring users to convert the rest of their network to DIX framing.

After an application calls the access_type function, and any time a packet of its type is received, the handler is first called to get a buffer to store the packet. Register BX holds the handle the packet was received on, and register CX has the packet's length. AX is set to 0 on the first call. The application must return a buffer, pointed to by DS:SI, for the driver to store the packet in. If the application has no buffer space left, it can return 0:0, and the driver will discard the packet. Otherwise, the driver copies the packet into the memory DS:SI points to and calls the driver again, this time with AX set to 1 and DS:SI set to the address of the buffer the application passed to the driver. When the call returns, the driver is finished with this packet. Applications must be careful when handling these calls, as they may be called from an interrupt handler.

When an application is finished receiving packets, it should call the release_type function, passing it the handle that's returned by access_type. It's especially important that an application do this before exiting to DOS. Otherwise, the receive handler will be invalid and the system will probably crash the next time it receives a packet.

Transmitting Packets
An application must present packets for transmission by the packet driver as continuous chunks of memory. To transmit a packet, an application must first fill in the MAC header (for instance, the destination and source address and Type fields on a DIX Ethernet, or the destination and source address and SAP fields on an IEEE 802.3 Ethernet). It then calls the send_pkt function, passing it the address of the packet and the packet's length. When send_pkt returns, the application may reuse the memory where the packet was stored.

For higher-performance applications, recent packet drivers have supported a second function, as_send_pkt. This call operates like send_pkt, except that it takes an extra argument: the address of a function to call when the packet transmission is complete.

The function is called with the address of the packet that has been transmitted and an indication of the success or failure of the transmission. This new function allows applications to take advantage of dead time while the network card is waiting for the packet transmission to complete. The old call would sit and wait for the completion; the new one queues up packets for transmission and returns immediately, letting the application get on with other work (such as filling up other packets to be sent, reading a disk file, or writing to the display).

With as_send_pkt, the application must not modify the packet until the completion function has been called. This way, the packet driver can keep a queue of outgoing packets.

Address Handling
The packet driver supports several functions for manipulating addresses. They are get_address, set_address, get_multicast_list, and set_multicast_list.

Applications that need to know the address of their network card can find out by calling get_address and passing the driver a buffer in which to copy the address. They can also find out the length of their network address by calling get_parameters (most networks use fixed-length addresses; for instance, Ethernets use 6-byte addresses). All TCP/IP applications must do this. Applications that need to change their network address can do so by calling set_address and passing the driver a pointer to the new network address.

A packet driver may also provide multicast support. An application can get the list of multicast addresses currently listened for by calling get_multicast_list; then, it can set them by calling set_multicast_list. These functions are intended to work with multicast support provided by the hardware. If the application asks for more multicast addresses than the network card can support, the set function may return failure. In that case, the application should change the receive mode to mode 5 by using the set_recv_mode call described above and filter multicast packets itself.

Miscellaneous Control Functions
The packet driver specification also provides some miscellaneous control functions. They include the following calls:

- terminate: asks the driver to unload itself from memory. Not all drivers can support this call. All handles should be released before calling this function.
- reset_interface: allows the application to reinitialize the network interface. This call is useful if the interface appears to be jammed or otherwise not functioning correctly.
- get_parameters: allows the application to find out information about both the driver and the hardware, such as the version of the packet driver specification implemented by the driver, the length of an address, the maximum size of a packet for transmit or receive, and the number
Power C combines a high-performance C compiler with superb documentation, at a price that brings chuckles from over 50,000 satisfied customers. That’s because Power C performs favorably against compilers costing 10 times as much. And you can’t buy a compiler that’s more reliable or easier to use – at any price. Perhaps that’s why Power C has won Computer Shopper’s Best Buy award for three years running.

- compatible with ANSI C standard
- integrated Make utility
- library of over 450 functions
- IEEE software floating point
- supports 8088/286/386/486 CPU
- memory resident program support
- supports 8087/287/387 math chips
- small/medium/large memory models
- mixed model with near/fast/huge
- allows arrays larger than 64K
- CGA, EGA, VGA & Hercules graphics
- 650 page manual with tutorial

Power C Library Source includes our Power C assembler, plus the C and assembly language source code to over 450 functions in the Power C library. Unlike our competitors, who charge $150.00 or more for library source code, we’ve made ours very affordable.

Power C BCD Business Math includes binary coded decimal floating point routines and financial functions to calculate interest, depreciation, etc. BCD routines are used for dollars and cents calculations to eliminate inaccuracies caused by rounding.

Power C requires DOS 2.0 or later, 320K memory, 720K disk space. Master C requires DOS 3.0 or later, 364K memory, hard disk.

Power Ctrace combines state-of-the-art technology with a friendly interface, making it very easy to find and correct your programming mistakes. No time consuming edit/compile cycles are needed to track down bugs. Simply compile your program once with the trace option, and Power Ctrace does the rest. Multiple windows display your C source code, the values of all your program variables, program output, watch points, and assembly instructions. Put Power Ctrace to work for you, and we guarantee that you’ll be a more productive C programmer.

Order line: 1-800-333-0330
Technical Support: 1-214-783-6001
Fax: 1-214-783-1404
Mix Software, 1132 Commerce Drive, Richardson, TX 75081

Published by the highly acclaimed Waite Group, Master C is a revolutionary book/disk package that turns your PC into a C instructor. Master C teaches you, quizzes you, notices problems you are having, and recommends action. In a pilot study at IBM, students using Master C retained 19% more knowledge than students who learned from a lecturer. Now you can receive this $44.95 package absolutely FREE when you purchase all four Power C products described above. Just ask for the Master Pack.

"Master C eschew flash for elegant competence, and it works!"

Jeff Dunteman - PC Techniques
People are talking about us.

**F77L-EM/32 & Lahey Ergo OS/386**
Port mainframe programs as large as 96MB to 386/486's with the 386/486 VPS-Extender compiler. The Winner of PC Magazine's 1991 Readers' Choice Excellence Award just got better. New Version 4.0 includes: Precompiled modules, Writable 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. **$99**

**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**

---

**NOW VERSION 4**

**Full-featured scientific word processing**

ChiWriter gives you all the features of an advanced scientific word processor and more! The WYSIWYG screen display lets you enter and edit text and scientific notation exactly as you want it on your printout. Add easy math editing, font design, multiple undo and redo, automatic formatting, macros, foreign language capability, spell checker, and support for dot-matrix and laser printers—all for only $349.95 plus shipping and handling.*

Call today to order your ChiWriter package. Full 30-day money back guarantee. Bankcards welcome.  
* Chemistry Fonts $59.95,  
** Russian Fonts $29.95  
** 20% educational discount.  
** To order, call toll free  
1-800-736-8886

---

ChiWriter ****

**FEATURES**
- True WYSIWYG—no encoding or preview mode.  
- Easy formula editing is fully integrated into the program  
- Multiple Undo and Redo  
- Automatic text and formula formatting  
- Simultaneous editing of up to 10 documents  
- All standard math and scientific symbols included  
- Font designer—modify symbols or design your own  
- For IBM® PC or compatible systems with 512K memory

**HORSTMANN SOFTWARE DESIGN CORPORATION**
4 N. 2nd. St., Ste. 500 P.O. Box 1807 San Jose, CA 95109-1807, USA  
Phone (408) 298-0828 Fax (408) 298-6157

IBM is a registered trademark of International Business Machines Corporation.

---

**UNDER THE HOOD**

of multicast addresses the hardware supports for receive filtering.  
* get_statistics: allows the application to read counters, maintained by the hardware or driver, that indicate how many successful and how many failed transmit and receive operations have been accomplished.

**What Is the Packet Driver’s Future?**
Russell Nelson, a software development engineer for Clarkson University and a notable packet driver author/enthusiast, thinks the packet driver movement threatens promoted efforts such as 3Com’s NDIS and Novell’s ODI.

"I don’t see how [3Com and Novell] can catch up, because with every new release of ODI and NDIS drivers, there’s another packet driver," Nelson says. "I would be willing to guess that there are more packet drivers than ODI and NDIS drivers combined."

Others dispute this claim. Richard Watson, 3Com’s manager of enabling software, says that NDIS has more "corporate" acceptance, such as from IBM and Banyan. Furthermore, most commercial software vendors that have traditionally supported packet drivers intend to support NDIS and ODI. Volkonong’s WIN/TCP already supports NDIS, as does FTP Software’s PC/TCP (albeit by way of a packet-driver-to-NDIS converter). Even Kelly McDonald, who spearheaded the development of BYU’s popular packet-driver-compliant NetWare shell, expects eventually to switch over to Novell’s new ODI-based LAN Workplace for DOS.

Ultimately, the ideas promulgated in the packet driver specification are what matter the most. They will persist, probably in a variety of forms—and will continue to serve vendors and users. “You can argue back and forth about the details,” says Russ Nelson. “Practically, fundamentally, to the user there’s no difference, and they will see benefits. So long as they have a driver and the software talks to the driver, they’re home free.” Thanks to the packet driver specification and the grass-roots effort that surrounds it, those benefits became freely available years before their widespread commercial implementation.

John Romkey is a founder of FTP Software and currently a vice president for Epilogue Technology in Ventura, California. He can be reached on BIX as "romkey." Sharon Fisher is a San Francisco-based freelance writer specializing in data communications. She can be contacted on BIX as "sharonfisher."
WHAT MAKES A BEST SELLER A BEST SELLER?

A great plot begins with a great idea, easily translated through every phase of design with Generic CADD 5.0.

Deadline pressure is a thing of the past. Designs can be quickly edited and annotated to produce final working drawings.

No matter the complexity, symbols keep your workflow flowing uninterrupted. Tap our professional libraries or create your own symbols.

Need to fit a conventional design in a nonconventional space? Revise and improvise in less time with Generic CADD's one-stop convenience.

A GREAT PLOT.

Ask any of over 250,000 users of Generic CADD: They've discovered CADD that's powerful without being complicated. And professional without being pricey.

Our latest version, Generic CADD 5.0, is just $495. It's a complete design and drafting program backed by a support team that's drawing rave reviews.

Call us at 1-800-228-3601 for our free full-color CADDalog and portfolio of CADD drawings.

You'll see every plot has a great ending.

©1990 Generic Software, Inc. 11911 North Creek Parkway South, Bothell, WA 98011. FAX 206-483-6969. Generic CADD is a trademark and CADDalog a registered trademark of Generic Software, Inc.
KnowledgePro... your door into Windows

KnowledgePro is a high-level language for Windows or DOS. It lets you build fast, runtime free applications in record time.

Interactive design tools and easy-to-learn commands get you started quickly and a rich object-oriented language gives you the control you need to create serious solutions.

Selected for PC Magazine "Best of 90"

Hypertext and hypermedia provide depth and built-in expert systems technology lets you create smart links and intelligent programs.

Intelligent integration of Windows programs like Excel, Word and Superbase, is easy with DDE and DLLs. For more information, review reprints, the name of your nearest dealer or to order:

Call 518-766-3000
FAX 518-766-3003 or write to:
Knowledge Garden Inc.
473A Malden Bridge Rd.
Nassau, NY 12132, U.S.A.

Awarded InfoWorld Buyers Assurance Seal, Oct. 1, '90.

Circle 184 on Inquiry Card.

KnowledgePro and KPWIN are trademarks of Knowledge Garden Inc. Windows, Excel and Word are trademarks of Microsoft Corp. Superbase is a trademark of Precision Inc. Image by Robert Tinney.
I sometimes think of what’s happened to the computing environment over the last 10 years as a big bang that spread little bits of power away from the data center and onto the desktop. We’re left with heavily populated local networks, but, paradoxically, we’re spending lots of effort trying to make it all look like one big computer.

Most organizations operate with networks of systems and resources that, in reality, constitute a very poor multisystem model. Applications (and users) making use of intersystem communication must often have explicit knowledge of a network composed of individual systems. Network file systems alleviate this problem by returning to a mainframe view of on-line storage. The network is hidden; everything is synchronized through the file-system name space.

A similar coordination of other resources may never happen—at least, not with the current distribution. But projects such as Amoeba (a design for loosely coupled multiprocessors) and Plan 9 at Bell Labs may result in a reversal of the big bang, bringing together these distributed resources to offer a consistent mainframe view of a single, powerful system, without the problem of mainframe contention. In the meantime, though, computers need to talk to each other.

Why RPC?

At the client/server programming level, socket-oriented protocols represent the aforementioned poorly formed network view. For a client to request processing of a server task, it must explicitly open a connection to that task, perform data transactions to get the desired job done, and close the connection—just to do what amounts to some processing on another computer.

From an abstract view, this is an elaborate function-call interface to an opaque procedure: Pass some data, expect some well-defined processing to occur, and retrieve the results. High-level languages are supposed to hide all this from you: You don’t provide code to link together the procedures of your local application; why should you be expected to know the details of executing a function remotely?

The method of remote procedure calls does for procedure-level programming what the Network File System does for data sharing: It attempts to hide the view of the total system as discrete components. Where NFS abstracts the view of data through a single file-system name space, RPC abstracts the view of client/server requests in the programming domain: the procedure name space.

An RPC system makes it convenient to treat a server request with semantics similar to a local procedure request. A number of competing mechanisms support RPCs; I’ll describe a system from Sun Microsystems.

**RPC—Sun’s method of interprocess communications across a network—offers some convenient abstractions**
**Tools for Turbo 6.0**

Write powerful Turbo Pascal programs faster and easier using these tools.

**Object Professional**
A comprehensive object-oriented library provides user interfaces, data objects, and systems routines.

Only $189.

**B-Tree Filer**
A database toolbox for powerful network applications.

Only $189.

**TSRs Made Easy**
TSR routines from Object Professional at an economical price.

Only $49.

**Turbo Professional**
A non-OOP library of more than 600 powerful routines. The predecessor of Object Professional.

Only $125.

**Turbo Analyst**
Nine analytical tools in an integrated programming environment.

Only $129.

Call toll-free to order
1-800-333-4160

9AM-5PM PST M-F, US & Canada

All tools include full source code, complete documentation, and support direct from the authors. You pay no royalties.

---

**SOME ASSEMBLY REQUIRED**

Sun's RPC provides several different components. One is the external data representation (XDR) protocols, a mechanism that provides for the common understanding of data between different systems. Another component provides for the exchange of request and response information that makes up the RPC mechanism. Another one is the subsystem that coordinates and delivers messages. The last one consists of the tools that help to automate the production of code that makes use of RPCs.

**External Data Representation**
A fundamental objective in intercomputer communication is to make sure that the data flying around means the same thing to all systems involved. Data confusion can occur in many places and for many reasons, due to both software and hardware considerations.

The most common example of uncommon ground in data communications is the gnatty problem of byte order. Where some systems store integer data with the least significant byte at lower byte addresses, others store the same data in the opposite byte order. (The argument concerning which is a better form is never-ending, prompting the names "little-endian" and "big-endian," a pun on an argument in Gulliver's Travels about which end of the egg to open.)

At any rate, a 4-byte value of 3 on one system would be a value of 13,959,936 on another system (0x00000003 versus 0x03000000). Other representation issues include floating-point number format, address values, structure packing, and other language-related issues (e.g., the size of an int type in C).

XDR works by defining a system-independent form for all these kinds of data items. For two systems to communicate via XDR, each system must be able to translate to and from this standard form. Many of the size and packing problems are covered by making the smallest data size 4 bytes: A 2-byte int on one system is converted to a 4-byte quantity for transmission and reconverted to a 2-byte int on the other system.

The best part about XDR is that you don't have to know all that. The process of forming and unforming data is abstracted in terms of XDR routines. Each data type finds expression in a single XDR routine that can be used for sending, receiving, or deleting data. This also applies to aggregate types. A base XDR implementation provides the routines for primitive types; an application can build descriptions of more complex systems.

---

**BASIC DATA TYPES**

<table>
<thead>
<tr>
<th>Routine</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>xdr_char</td>
<td>char</td>
</tr>
<tr>
<td>xdr_u_char</td>
<td>unsigned char</td>
</tr>
<tr>
<td>xdr_int</td>
<td>int</td>
</tr>
<tr>
<td>xdr_u_int</td>
<td>unsigned int</td>
</tr>
<tr>
<td>xdr_long</td>
<td>long</td>
</tr>
<tr>
<td>xdr_u_long</td>
<td>unsigned long</td>
</tr>
<tr>
<td>xdr_short</td>
<td>short</td>
</tr>
<tr>
<td>xdr_u_short</td>
<td>unsigned short int</td>
</tr>
<tr>
<td>xdr_float</td>
<td>float</td>
</tr>
<tr>
<td>xdr_double</td>
<td>double</td>
</tr>
<tr>
<td>xdr_bool</td>
<td>Boolean (TRUE or FALSE)</td>
</tr>
<tr>
<td>xdr_enum</td>
<td>Enumerated constant (basically an int)</td>
</tr>
<tr>
<td>xdr_void</td>
<td>No data</td>
</tr>
</tbody>
</table>

---

**XDR ROUTINES**

<table>
<thead>
<tr>
<th>Routine</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>xdr_string( xP, strPP, maxlen )</td>
<td>A NULL-terminated string with a maximum length. The data item, strPP, is the address of a variable that points to the string.</td>
</tr>
<tr>
<td>xdr_bytes( xP, bufPP, lenPP, maxlen )</td>
<td>A counted byte array, where bufPP points to a variable that holds the address of the array. lenPP is the address of a variable that contains the number of bytes to send or receives the number of bytes received, and maxlen is the maximum length to deal with.</td>
</tr>
<tr>
<td>xdr_array( xP, dataPP, lenPP, maxlen, datasize, procP )</td>
<td>A counted array of data of any type, where dataPP is the address of a variable that points to the first array element. lenPP points to the length variable, maxlen is the maximum number of elements, datasize is the size of each array element, and procP is the address of an XDR routine that can deal with each array element. This routine takes only the XDR stream and data pointer as arguments.</td>
</tr>
<tr>
<td>xdr_vector( xP, dataPP, len, datasize, procP )</td>
<td>A fixed-length array, where dataPP is the address of the base of the array (not a variable that points to it), len is the number of array elements, datasize is the size of each element, and procP is the address of an XDR routine that defines each element.</td>
</tr>
</tbody>
</table>
types using them.

XOR functions operate on an XOR stream and a data item, and sometimes on other optional parameters. An XOR stream is like an stdio file stream: It's used as an object in sending, receiving, or deleting data, encapsulating the methods for performing these operations. Unlike stdio streams, though, the XOR stream also dictates the function. You can open an XOR stream and perform reads and writes on it by applying the corresponding function to that stream. With an XOR stream, you specify the function (i.e., read, write, or delete) when you create the stream, and this function is performed when you reference the stream in an XOR routine.

This leads to some interesting properties. Most significant is that the syntax involved in performing all operations is almost always the same.

For this reason, XOR routines always reference their data by address, not by value. This lets the data be stored as well as fetched or deleted. For example, the primitive function xdr_int is used for data of type int:

```c
xdr_int( xdrP, dP );
```

where xdrP is the address of an XOR stream block, and dP is the address of the data item. Depending on the mode of the stream, this routine will send, receive, or delete an item of type int (although, in fact, deletion of these primitive C types is a no-op; deletion applies only to pointer references). The routine returns a Boolean True (nonzero) if it succeeds and False (zero) if it doesn't. Other primitive XOR routines are provided by any base XOR implementation; table la lists those primitive routines that are related to basic types.

Some primitive XOR routines are provided for simple aggregates (see table 1b). For example, xdr_string turns a pointer to a string into the string's XOR, and vice versa.

When data is being sent, the pointer is followed, and the bytes of the string are placed on the stream. When data is being received, the bytes are counted to make sure they don't exceed the maximum length; new storage is allocated if necessary (i.e., if the pointer value is NULL), and the bytes are stored in the buffer pointed to by the referenced variable. On a delete operation, the buffer is deleted and the pointer reset to NULL.

Because of a universality in XOR routine operations, you can build up XOR routines for complex types. Consider a structure containing several basic types:
struct bounds {
    unsigned char flags;
    int min;
    int max;
};

You can easily write an XDR routine to encapsulate this structure by building on other XDR routines. For instance,

bool_t xdr_bounds(xP, boundsP)
    XDR *xP;
    struct bounds *boundsP;
    {
        return (xdr_u_char(xP, &boundsP->flags) 
                && xdr_int(xP, &boundsP->min) 
                && xdr_int(xP, &boundsP->max));
    }

The XDR routine is named after the type it represents. Here, the routine describes its members, in order, in terms of lower-level XDR routines. This will work whether the routine is sending or receiving the type in question.

An important offering of XDR is that of discriminated unions (à la Pascal). A C union offers multiple components, only one of which can be valid at a given time. A discriminated union is a union whose interpretation depends on an integer value. This usually matches the use of unions: The interpretation of a union depends on a current state, which can be represented as an integer. When communicating between processes, this is a very useful format. XDR provides the routine xdr_union for this:

xdr_union(xP, dvp, unionP, 
            tableP, defaultP)

where dvp is the address of a variable that contains the discrimination value, unionP is the address of the union, and tableP is the address of a table that contains pairs of (value, proc), with proc the address of an XDR routine that encapsulates the union when the discriminant matches the value. The end of this table is indicated by a proc of NULL. And defaultP is the address of an XDR routine that handles the default case (i.e., when no match is found in the table).

Those are the basics of XDR, although there are a number of nits for which there isn't space here. XDR is commonly used in conjunction with a network stream—using TCP/IP or User Datagram Protocol (UDP)—but it can also be used with an stdio stream (for file I/O) or with memory streams.

Sun's RPC Programming
Sun's RPC model provides for three levels of programming, from a high, hands-off level to a low, hands-on level.

The highest level of RPC programming is basically the consumer level. It's the interface that you provide by implementing an RPC service using the other levels.

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.
Introducing Omnistor™, the first 5¼" optical disk drive subsystem to support both Write-once (WORM) and Eraseable Magneto-Optic (MO) technology in a single multi-function unit. Utilizing ANSI/ISO standard 654 MB, sampled-servo 5¼" media, Omnistor provides a turnkey solution for both your intermediate and permanent archival data storage requirements. Omnistor is available for a wide variety of host environments, in both standalone and autochanger subsystem configurations.

Computer Upgrade Corp., a leader in optical archival storage solutions since 1986, offers OEM, VAD/VAR, and End-User pricing on both Omnistor and our traditional optical subsystem solutions. At Computer Upgrade the early bird catches more than the WORM; they catch the competitive advantage.

Call today for more information.

Computer Upgrade Corp.
2910 E. La Palma Ave.
Bldg A, Anaheim
CA 92806
FAX
(714) 630-9254

Computer Upgrade®
800/874-8807

A NEW CONCEPT IN OPTICAL DISK DRIVES.

Circle 363 on Inquiry Card (RESELLERS: 364).
Global ReLeaf comes in all shapes and sizes.

It's a fact. Planting trees is one of the best and easiest ways to help reduce global warming and other serious environmental problems.

That's why thousands of Americans — of all shapes and sizes — are doing their part for Global ReLeaf right in their own communities. And it's why we need more trees to shade our homes, beautify our town and country landscape, and reduce the heat-trapping CO2 build-up in the earth's atmosphere.

So grab your shovel and start planting. And call our special Action Line — 1-900-420-4545. The $5.00 charge actually pays for planting a tree while supporting Global ReLeaf action across the country. And, we'll also rush you detailed information on Global ReLeaf. You can make a world of difference.

1-900-420-4545

A program of The American Forestry Association

Citizens caring for trees & forests since 1875 P.O. Box 2000, Washington, DC 20013
AvCase™ 8051, 8096, 64180/Z80

Three finely-tuned instruments for embedded-system development.

*AvCase* C Compiler, Assembler, and Simulator from Avocet. Play them solo, for peak performance. Or bring them together in perfect harmony as an integrated system. AvCase will manage all the steps—from editing source code, compiling, assembling, and linking, all the way to debugging.  
- **High-level language in the key of C.** AvCase C Compiler is our biggest seller. It produces fast, tight, optimized code that helps speed development time.
- **Clear, concise scoring.** AvCase Assembler is the classic Avocet assembler tuned-up and ready for your most demanding applications.
- **Full dress rehearsal without leaving your desk.** AvCase Simulator lets you test code on your own PC. With the new source-level language level.** Let the music budget—and develop a high-quality, bug-free product—you simply can't do better than AvCase.

Find out more about these finely-tuned instruments. Fax, write, or call toll-free 1-800-448-8500 for complete information, including a free AvCase Brochure and Avocet Catalog.

Avocet Systems, Inc., 120 Union St., P.O. Box 490, Rockport, Maine 04856. Telephone 1-800-448-8500 in Maine, or outside the U.S. call 207-236-9055/FAX 207-236-6713. TLX 467210 Avocet Cl.
SOME ASSEMBLY REQUIRED

How do you get a job without experience? And how do you get experience without a job?

Most young people have one answer to this problem. They avoid it until they're out of college. But they could be getting solid work experience while they're still in college. With your company's help. And ours.

We're Co-op Education. A nationwide program that helps college students get real jobs for real pay, while they're getting an education.

But we can't do it without you. Those real jobs have to come from real companies. Like yours.

For more information on how you can participate in this valuable program, write Co-op Education, Box 775E, Boston, MA 02115.

Not only will you be giving students a chance to earn money and pick up the most valuable kind of knowledge, you'll be giving yourselves a chance to pick up the most valuable kind of employee.

Co-op Education.

You earn a future when you earn a degree.

Low-level

RPC services make use of a transport handle that represents a connection between the client and the server.

the routine register_rpc once for each service routine to be registered. For instance,

register_rpc(EVC_PROG, EVC_VER, EVC_CLIMATE, climate, xdr_int, xdr_climate);

The first three arguments are the program number, program version, and procedure number, as with call_rpc. Next is the address of the routine (i.e., climate) that processes the request. This is followed by the address of the XDR routine that receives any passed argument and the XDR routine that sends any return data.

With this form, each service routine takes a single argument that's the result of the XDR input and returns a pointer to data to be sent via XDR output. These are always declared as char pointers. The climate service routine would look something like this:

char *climate( dataP )
char *dataP; /* Input data */
{
    int bay_number;
    static climate climate;
    bay_number = (*int *)dataP;
    /* Code here to fetch information */
    /* Return the data */
    return( (char*) &climate );
}

After a server has registered all its procedures, it calls the routine svc_run(),
which loops, waiting for and processing requests; it never returns a value.

Lower Levels of RPC
You may be able to get by on just the middle-layer functions described above. But there are a number of reasons for using the lower layer. One is that the middle RPC implementation layer is based on UDP. UDP messages are fast but are not guaranteed to be delivered, and even then, not necessarily in order. In reality, UDP messages rarely go undelivered. Even so, the callrpc function incorporates retry logic to help make sure that requests get delivered and answered. Another reason is that you might want more explicit control of the way your messages are interpreted and answered.

Low-level RPC services use a transport handle that represents a connection between client and server. It can be used for multiple service requests without closing the connection between the two. It can use UDP, as with callrpc, or TCP/IP for reliable delivery of messages.

On the client side, this transport handle is a CLIENT type, created by a call to either clntudp_create (for UDP) or clnttcp_create (for TCP/IP):

```c
CLIENT *clientP;
int sock = RPC_ANYSOCK;
clientP = clntudp_create(&srvr, EVC_PROG, EVC_VER, timeout, &sock);
```

where srvr is an int sockaddr struct (sockaddr_in) describing the server system, timeout is a timeval struct with a timeout value for UDP retries, and sock is an int that receives a socket handle. Here, it's initialized to RPC_ANYSOCK so that the clntudp_create call will create the socket. If you have a valid socket already, you can pass it, and the function will use it rather than opening a new one.

If you want a TCP/IP handle, you might use clnttcp_create as follows:

```c
CLIENT *clientP;
sock = RPC_ANYSOCK;
clientP = clnttcp_create(&srvr, EVC_PROG, EVC_VER, &sock, insize, outsize);
```

where insize and outsize specify the size of input and output buffers receiving and sending.

To call a remote procedure with a client handle, use the routine clnt_call:

```c
status = clnt_call(clientP, EVC_CLIMATE, xdr_int, &res);
```

Listing 1: A sample RPC definition file.

```c
/* evc.x -- Sample RPC definition file for the get_climate example. */
/* The climate structure, returned by get_climate */
struct climate {
    int temp; /* Degrees C */
    int humidity; /* Relative humidity */
};
/* Definitions of service routines */
program EVC_PROG {
    version EVC_VER {
        /* The get_climate routine */
        get_climate(int i) = 1;
    }
} = 1;
} = 9999;
/* Program number is 9999 */
```

Listing 2a: The parts of listing 2 show the output produced by rpcgen for the evc.x file. This part shows the type definitions, evc.h.

```c
struct climate {
    int temp;
    int humidity;
};
typedef struct climate climate;
bool_t xdr_climate();
#define EVC_PROG ((u_long)9999)
#define EVC_VER ((u_long)1)
#define EVC_CLIMATE ((u_long)1)
extern climate *evc_climate();
```

Listing 2b: The client stub routines, evc_clnt.c.

```c
#include <rpc/rpc.h>
#include <sys/time.h>
#include "evc.h"
/* Default time-out can be changed by using clnt_conro!() */
static struct timeval TIMEOUT = { 25, 0 };
climate *
evc_climate(int argc, client)
    int *argc;
    CLIENT *clnt)
    { static climate res;
        bzero((char *) &res, sizeof(res));
        if (clnt_call(clnt, EVC_CLIMATE, xdr_int, argc, xdr_climate, &res, timeout) != RPC_SUCCESS)
            return (NULL);
        return (&res);
    }
```

Listing 2c: The server skeleton, evc_svc.c.

```c
#include <stdio.h>
#include <rpc/rpc.h>
co11ti11ued
```
The annual UniForum show is the place where the entire commercial world of Unix software and hardware gets together. This year was a special treat because it was also the tenth anniversary of the UniForum trade association that sponsors the show. Any firm that is involved in Unix past the "Hmmm... what about it?" stage should seriously consider joining the association, because its vendor and product information alone can save a great deal of time and money. (You can contact UniForum at 2901 Tassman Dr., Suite 201, Santa Clara, CA 95054, (408) 986-8840, fax: (408) 986-1645.)

Close to 300 vendors exhibited at UniForum, which was held at the Dallas InfoMart. In some ways, I'm glad that I didn't have to cover the show on a "real-time" basis, because the thought of even attempting to do more than the most shallow coverage would be daunting.

If I went to every booth during the show, I could spend only 5 minutes at each, while writing a simple 25-word paragraph about each booth would take four months' worth of these columns! Thus, this column is by no means "what I saw at UniForum"; rather, it's simply a look at a few items that I thought were interesting.

Interactive Unix
By the time you read this, Unix System V release 4.0 (SVR4) for the 386 and i486 should be available—the whole enchilada, including the new Virtual File System (Remote File System, Network File System [NFS], and more), virtual memory, and full internationalization. It will support Xenix, SunOS, Berkeley Standard Distribution (BSD) 4.2 and 4.3, and current System V programs. Also, almost every user interface known will be supported, including the X Window System version 11, release 4, X11/NeWS, Motif, and Open Look... and their toolkits!

The most important thing is that this won't be available from Intel (which was aggressively pushing its shrink-wrapped Unix last year). Intel has given its entire customer base to the new "principal publisher" of Unix SVR4: Interactive Systems. This puts Interactive in a pretty good position, because Unix SVR4 is positioned to be the Unix of the 1990s. While some may consider it almost too large for a 386-based machine (and who could have dreamed that four years ago?), it should be a perfect match for the computing machines we're actually going to be using in the 1990s. This move certainly adds a new wrinkle to the Interactive versus The Santa Cruz Operation (SCO) market-share battle for

David Fiedler is executive producer of Unix Video Quarterly and coauthor of the book Unix System Administration. He has helped start several Unix-related publications. 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.
CLEO's 3270LINKix™ can be your most cost-efficient way to achieve multi-user UNIX-to-mainframe connectivity.

Delivered on an economical synchronous interface board, it provides full emulation of IBM 3278 monochrome display terminals (models 2-5) and 3279 color display terminals (models 2A, 2B, 3A, and 3B).

You also get IBM 3274 controller emulation, plus IBM 3287 printer emulation (LU Types 1 and 3) for your UNIX-attached ASCII printers.

3270LINKix Remote links to your mainframe via a synchronous modem or modem eliminator at speeds of up to 19.2 Kbaud. It supports BSC or SNA/SDLC communications.

UNIX systems supported include SCO's UNIX System V/386 3.2, AT&T's UNIX System V/386, Interactive Systems' 386/ix, and others.

Features include:
- Application Program Interface (HLLAPI 3.0)
- INDSFILE file transfer for CMS, TSO, and CICS
- Support for IBM's NetView in SNA
- Up to 254 sessions for SNA, 32 sessions for BSC
- User-configurable keyboard remapping
- Easy menu-driven interface

To learn more, call us today at 1-800-233-2536. Or write to us at 3796 Plaza Drive, Ann Arbor, Michigan 48108. FAX: 313/662-1965.

A Division of Interface Systems, Inc.

AVAILABLE WORLDWIDE!
In Europe call Sintec Peripherals Ltd. in Slough, England, at 0753-811888 (FAX: 0753-811666).
Unix on Intel-based computers.

It's Not Unix, But... While Interactive has been supporting and working with AT&T Unix for a long time, a company by the name of Mt Xinu has done the same for BSD Unix (the company's name and logo seem to refer to a mountain, but read the name backward). Mt Xinu has now released the interesting Mach kernel for ISA 386-based computers. Along with the kernel, the release includes some "free" GNU utilities, the BSD Unix 4.3 interface, BSD NFS, and X11.4 for VGA monitors.

Mach is almost-but-not-exactly Unix, with a threaded architecture that makes it an interesting subject to study in computer science courses and a likely base for multiprocessor machines (see "Mach: The Model for Future Unix" in the November 1989 BYTE). The complete package costs $1995, which puts it out of the reach of most hobbyists. However, it's well within the budget of serious system software and hardware developers. With all the current interest in multiprocessors, I expect that Mt Xinu will have its hands full merely getting disks duplicated.

Home Sweet Suite
Some of the most interesting things at UniForum weren't on the show floor. A new firm called Clarity Software was showing a hot new product it calls Rapport, but you could see Rapport only by invitation to Clarity's hotel suite. At first glance, I thought I had walked into a porting lab. A half dozen different workstations littered the room, all running the same software. Contrary to most hotel-suite software introductions (where the developers have sweated blood to get the product running at all), Rapport was actually running fairly stably on all these machines. This is no small task for a product that needs 12 megabytes of RAM and 300 MB of disk space (predictably, Clarity used C++ in development).

Rapport is billed as a "document editor," but that's like calling California simply "a Western state" and describing it no further. Aside from regular text in an assortment of colors, Rapport users can put graphs, spreadsheets, raster images, drawings, fax images, and audio sound bites in their documents (and some video will be supported). This is made easier by the fact that Rapport has a built-in spreadsheet, drawing program, graphing tool, fax server, and audio editor.

More important than simply a list of features, however, is the intuitive way that these separate media work together within Rapport. Unix software hasn't had the reputation of being easy to use; Rapport can destroy that stereotype. While some of the icons may not be completely clear at first glance, working with Rapport seems to come naturally.

Commendably, Clarity has resisted the temptation to call Rapport a multimedia product. While it probably qualifies as multimedia under certain definitions of the term, Clarity refers to it as mixed-media instead, which is more accurate and less confusing.

But Rapport isn't just a fancy desktop publishing program. Anything you can do in a Rapport document can be sent via E-mail—and input and output converters let you exchange E-mail with people...
IDEK—THE FIRST COMPLETE FAMILY OF FST COLOR MONITORS

IDEK's MULTIFLAT Series of 17-Inch Color Monitors

IDEK's MULTIFLAT Series of 17-inch Color Monitors take full advantage of the remarkable properties of their Flat Square Tubes (FST) to deliver superior resolution and a sharper image that is easier on your eyes. A glimpse at our 17" Color Monitors reveals their matchless over-scanning capability that delivers a crisp, distortion-free display across the entire screen.

In addition, Automatic Frequency Scanning realizes outstanding performance for business graphics, CAD/CAM applications as well as desktop publishing on your Mac or IBM compatible system.

As you can see below, whether your requirements are simple or complex, IDEK has the Flat Screen Color Monitor that's just right for you. And priced right, too! See for yourself what a difference a Flat Screen Monitor from IDEK can make.

**MULTIFLAT Series (17" Flat CRT Monitors)**

<table>
<thead>
<tr>
<th>Model</th>
<th>H. Frequency</th>
<th>Dot</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>MF-5117</td>
<td>20 to 50kHz</td>
<td>0.28</td>
<td>1024 × 768</td>
</tr>
<tr>
<td>MF-5217</td>
<td>30 to 57kHz</td>
<td>0.28</td>
<td>1024 × 768</td>
</tr>
<tr>
<td>MF-5317 (Coming soon)</td>
<td>30 to 80kHz</td>
<td>0.28</td>
<td>1280 × 1280</td>
</tr>
</tbody>
</table>

**MULTIFLAT Series (21" Flat CRT Monitors)**

<table>
<thead>
<tr>
<th>Model</th>
<th>H. Frequency</th>
<th>Dot</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>MF-5021</td>
<td>15 to 38kHz</td>
<td>0.31</td>
<td>1024 × 768</td>
</tr>
<tr>
<td>MF-5121</td>
<td>21 to 50kHz</td>
<td>0.31</td>
<td>1024 × 768</td>
</tr>
<tr>
<td>MF-5221</td>
<td>30 to 80kHz</td>
<td>0.31</td>
<td>1280 × 1280</td>
</tr>
<tr>
<td>MF-5321 (A.R.Panel)</td>
<td>30 to 80kHz</td>
<td>0.31</td>
<td>1280 × 1280</td>
</tr>
<tr>
<td>MF-5421 (A.R.Panel)</td>
<td>30 to 80kHz</td>
<td>0.26</td>
<td>1600 × 1280</td>
</tr>
</tbody>
</table>

IDEK also offers its MULTIFLAT Series of 21-inch Flat Screen Color Monitors that deliver the same superior resolution and performance as the other members of the IDEK lineup.

IYAMA ELECTRIC CO., LTD.
Overseas Division
7th Fl., US Hanzomon Bldg., 2-13, Hayabusa-cho, Chiyoda-ku
Tokyo 102, Japan
Phone: (61) 3-3265-6081 Fax: (61) 3-3265-6083

IDEK Europe (Germany)
Neumannstrasse 38, 6000 Frankfurt a.M. 50, Germany
Phone: (49) 69-521 922 Fax: (49) 69-521 927

IYAMA North America Inc
650 Louis Drive, Suite 120, Warminster, PA 18974 U.S.A.
Phone: (1) 215-957-6543 Fax: (1) 215-957-6551

Circle 156 on Inquiry Card.
HANDS ON

Protect Your Copies of BYTE

NOW AVAILABLE: Custom-designed library files or binders in elegant blue simulated leather stamped in gold leaf.

Binders—Holds 6 issues, opens flat for easy reading.

$9.95 each, two for $18.95, or four for $35.95.

Files—Holds 6 issues.

$7.95 each, two for $14.95, or four for $27.95.

Order Now!

CALL TOLL FREE (24 hours):

1-800-825-6690

Send your check or money order today. Be sure to specify your NAME, ADDRESS, ZIP CODE, and the number of binders you wish to receive. Mail to BYTE, 326 Sixth Street, Mountain View, CA 94043.
The 386 and now the 486 microprocessors have focused a lot of attention on the multiuser, multitasking possibilities of advanced PCs. A myriad of software and hardware manufacturers are promising a new age of multiuser options in the '90s.

But when you take a closer look, only one solution focuses on the features you want and anticipates the capabilities you need to use your PCs to their greatest potential. That solution is PC-MOS™ from The Software Link, the first DOS-compatible, multiuser, multitasking operating system.

A Network Alternative
The advantage to the PC-MOS shared processing solution is its ability to maximize the available memory on your PC, taking full advantage of extended memory and sharing it with up to 25 users on inexpensive terminals or monitors. You can share data with the same speed and integrity of a network solution without the expense of network cards and the waste of under-utilized PCs. And no additional investment is required to get the multitasking capabilities inherent in PC-MOS.

A Network Enhancer
For affordable network expansion, PC-MOS servers can be connected to other servers with The Software Link's LANLink or with the PC-MOS

GATEWAY™ to Novell's NetWare®. This connectivity lets a business configure its automation systems for departmental efficiency and expand affordably as needs grow with LANs or even WANs.

DOS Compatible
The PC-MOS alternative is clear: DOS compatibility means your users can continue to use all the popular software packages. And that means no investment loss, no retraining and no limitations in available applications.

An Unbeatable Solution
The next decade of shared processing will be clouded with choices. Only one operating system was first to offer you DOS-compatible, multiuser, multitasking solutions. Only one operating system continues to provide unbeatable multiuser solutions for over 150,000 users. PC-MOS from The Software Link. Call today and set your computing sights on a more productive horizon.

THE SOFTWARE LINK
1-800-451-LINK
3577 Parkway Lane, Norcross, GA 30092
(404) 448-5465 FAX: (404) 263-6474 TELEX: 4996147 SWLINK

VARS and RESELLERS:
Ask about our Sales Support Program
GSA Schedule/GS00K 90 AGS6448

The AIX Alternative

Barry Nance

Not long ago, Wausau Insurance asked my company to port our DOS insurance-rating application to a networked, distributed Unix environment. Wausau wanted to use IBM RISC System/6000 workstations running AIX (IBM's Unix) as file servers, with PS/2 and PC workstations running DOS or Unix. The RISC System/6000 had to act as a host computer as well as a file server; we'd have to restructure our application into a client/server architecture. All the background tasks would run under AIX.

Our DOS application, written in a mix of assembly, compiled BASIC, and C, was already LAN-aware. We had designed it to perform file sharing and record locking on top of such network operating systems as NetWare, IBM's PC LAN Program, and LAN Manager. Background tasks ran on dedicated, unattended workstations. Our starting point wasn't too far from Wausau's DOS-and-Unix-combined client/server goal, so we felt confident we could do the job. Our first step was to use the RISC System/6000 successfully as a file server; then we would port the background tasks to run under AIX on that same machine.

Why AIX?

Wausau decided to use AIX rather than the more traditional, Systems Application Architecture-compliant OS/2-MVS combination. It cited several reasons, the biggest of which was scalability. OS/2 runs only on microcomputers (although IBM may be developing a version of OS/2 for the RISC System/6000).

Unix, on the other hand, runs on the PS/2, the RISC System/6000, and even mainframes. AIX also has many connectivity features, including Token Ring, Ethernet, X.25, asynchronous, and synchronous communications. AIX, on a RISC System/6000, supports IBM 3270 and 3151, DEC VT100, X Window System, and many other communication modes. On a PC, you can run DOS as a task under Unix. These are all important considerations when you want to keep your options open.

Wausau's plan also saves the company money by reducing the load on its mainframes, while distributing significant processing power to its 17 regional offices and more than 100 service offices. By sticking with common Unix facilities and system calls, we could provide Wausau with an application it wouldn't have to rewrite every three to five years—a typical problem under DOS, OS/2, and, to some extent, MVS.

Wausau briefly considered Novell's NetWare as a development platform and file server network operating system. However, it decided that the resulting server code, in the form of NetWare loadable modules, would be NetWare-specific and thus not as portable as code designed to run under AIX. Another scalability factor was that, with Unix, a PC can be a file server, a DOS workstation, or a terminal for RISC System/6000 applications without rebooting the machine. With only ordinary Unix-style coding techniques, tightly integrated client/server applications become possible between the Unix host and DOS workstations. The programmer does not have to think in terms of programming a file server. The server becomes just another Unix box.

In summary, Wausau could have its cake and eat it, too. It could strike out in a new technological direction, yet maintain its considerable investment in IBM-compatible computer architectures.

NFS vs. AADU

Not everything was honey and roses with Wausau's decision to use Unix as its base operating system. First off, we ran into the thorny design issue of choosing network support software. IBM offers several environments for file sharing under AIX. We distilled the choices down to two: IBM's version of Sun Microsystems' Network File System and its version of Locus Computing's PC Interface, which IBM calls AIX Access for DOS Users. Both NFS and AADU run on top of TCP/IP; we had to decide which would be the best tool for the job.

IBM licenses NFS 3.2 from Sun. The AIX Communications Handbook calls NFS "a de facto standard system for sharing directories across TCP/IP networks." IBM implementations of NFS are available for DOS, AIX, and for the MVS and VM host operating systems. That these implementations were interoperable impressed us; NFS became an early favorite.

NFS gives you the means to mount remote directories over empty local directories (i.e., directory stubs). Local programs access files on the remote machine as though they resided in the local directory. A client host mounts directories from remote computers; a server host lets other hosts mount its directories.

The server host exports a file system with an entry in /etc/exports. When a client host accesses a file in the mounted directory, NFS redirects the file request over the network to the remote server host. It supports only the exporting of entire file systems, however, and does not support inherited mounts.

NFS has no mechanism to
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 multiluser 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 multiluser 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 upgradeability make SmartCache Plus the only SCSI controller you'll ever need. For details, contact Distributed Processing Technology, 140 Candace Drive, Mail- land, FL 32751. Phone (407) 830-5522; FAX (407) 260-5366. In Europe (UK) phone 44 04 884 718; FAX 44 04 884 8892.

Circle 100 on Inquiry Card
(RESELLERS: 101).
map user names and permissions across the network. For security, administrators and programmers must configure networks that use NFS by conservatively restricting exports to file systems that everyone can access or by setting up separate, segregated file systems for shared access. You can set up various levels of Single System Images via a companion product called Yellow Pages. Yellow Pages provides a distributed network-lookup service and maintains a database of network maps that clients can query.

I found NFS and Yellow Pages extremely difficult to administer, however. For example, the superuser (root) on one system cannot remotely exercise powers on a host system; NFS maps the client root to the host nobody, who by default has no privileges on the host. If a Yellow Pages server dies, applications, utilities, and users hang endlessly waiting for the server to respond. And you need to take great care when setting up the parameters for the NFS and Yellow Pages mount commands.

NFS is a stateless protocol. It avoids complexity by deliberately forgetting about recent file requests from workstations and forcing each workstation to completely specify each file request. This approach goes hand in hand with the connectionless User Datagram Protocol that current implementations of NFS use for transport services. Although fine for reducing the chances of data loss when a server crashes, this technique gave me pause—it meant that NFS had to pass lots of extra information inside every file server request packet. The resulting extra LAN traffic might not be worthwhile.

One of NFS’s strong points is that it lets programs on different machines exchange data using the External Data Representation standard. This is a big consideration when you want an Intel-based PS/2 to talk to a RISC System/6000. Even something as simple as a 2-byte integer needs to be transformed between the two machines, because the Intel architecture puts the high-order byte last in memory, while the RISC System/6000 puts it first. If we didn’t use NFS, we’d have to worry about the numeric representation of nearly every field in our application.

The lockd daemon is an option in NFS 3.2. Without it, record and file locking aren’t possible. Unfortunately, IBM chose not to incorporate lockd into its NFS products, except as a component of AIX/370. To use NFS as a network operating system, I’d have to code the locking routines myself (I do most of the low-level coding within our application).

Tentatively, I designed a daemon that would use the Unix lockf() system call on the AIX machine to implement locking, and I prepared to make the DOS workstations coordinate with the daemon by way of TCP/IP. I figured I could make it work well enough for our application, but I knew the approach was awkward and a kludge.

On any LAN, the device drivers and TSR programs that accomplish file redirection take up memory. NFS, we found, uses about 90K bytes. Our application isn’t small, and we found precious little room left after we loaded TCP/IP and NFS on the DOS workstation.

Solving this problem—which is not unique to NFS—
Are you playing board games?

Choosing a board is serious business. The quality of the motherboard will determine the performance and reliability of your machine, and the success of your company.

That is why more OEMs and Integrators are using American Megatrends, Inc. for their motherboard needs. Already the industry leader in 386 and 486 BIOS, AMI has now established the standard for EISA and ISA boards.

EISA TECHNOLOGY
AMI has the expertise to provide you with premium 486 EISA boards. These 33 MHz systems can support up to 96 meg of memory and up to 256K of CPU cache. Used along with the optional SCSI Host Adapter, it creates a terrific high performance network server or UNIX hub.

ISA SOLUTIONS
If EISA is not required, the AMI 486 ISA boards are the answer. Operating at 33 MHz and possessing the fastest video speeds in the industry, they provide the perfect platform for graphic intensive applications.

THE AMI DIFFERENCE
Unlike any other motherboard, AMI boards provide total BIOS compatibility; this ensures the highest levels of performance and reliability.

Call today and see how the team at AMI will put you ahead of the game.

American Megatrends, Inc.
800-U-BUY-AMI or 800-828-9264, 404-263-8181, fax 404-263-9381
Circle 22 on Inquiry Card (RESELLERS: 23).
was tougher than creating a new locking mechanism. Because we couldn’t find a way to configure NFS to take up less memory, the answer we discovered was to use a 386 memory manager (e.g., QEMM-386 or 386Max). I used one to load all the device drivers and TSRs into the high-memory area between 640K bytes and 1 megabyte. This solution absolutely requires that DOS workstations be 386 machines. That was the tough part.

Another drawback to NFS is that it’s slow. You need a little more CPU power than you otherwise might if you want to get good performance. I suspect the slowness is a result of NFS’s statelessness: it obviously must spend time refreshing its memory about what it last did for a client.

I’m out of space, so I’ll defer telling you the good and bad points of AADU—and letting you know which one we chose—until next month. It wasn’t an easy choice. I’ll also describe how we interfaced to the RISC System/6000 version of Oracle from within our application. Our nonstandard approach to dealing with Oracle is designed to save workstation memory, and it will also save Wausau a great deal of money.

BEYOND DOS

Windows Tips and Tricks

Mark J. Minasi

I teach an awful lot of advanced Windows classes these days; it seems that everyone is using Windows 3.0. Teach anyone about anything, and you’ll get asked a lot of questions. When you get asked the same questions, however... Here are a few Windows questions that everybody asks (and, of course, the answers).

I’ve installed Windows, and it killed my hard disk drive. What caused this?

The two most common possibilities are that you’re using a driver that Windows doesn’t understand, or you’ve hit the path bug.

If you’re using a third-party device driver like Disk Manager, SpeedStor, or Vfeature, Windows gets confused when in 386-enhanced mode. Your system locks up at the initial Windows screen. The fix is simple: Look in the SYSTEM.INI file (it’s in the same directory as Windows) and find the line [386Enh]. Create a new line immediately after it and type the following command:

VirtualHDlirq=false

By the way, if you are using such a driver, you cannot create a permanent swap file on the part of the disk controlled by that driver.

What does VirtualHDlirq do? The hard disk drive controller generates hardware interrupts when it has data that’s ready for the CPU to transfer to memory. The program that responds to the interrupt is called an interrupt handler, and it’s generally located in the BIOS on most machines while running DOS.

When it’s in 386-enhanced mode, however, Windows attempts to “virtualize” all interrupt handling, and so provides a replacement for the BIOS interrupt handler. But that handler won’t work when you’re using Disk Manager or similar software. Therefore, Windows provides a back door: VirtualHDlirq. When set to false, VirtualHDlirq tells Windows not to virtualize disk interrupts and to route them through the normal handler. You pay a price in that it slows things down a bit.

Another problem that seems to occur with Windows, although it’s not a Windows bug, is the path bug. As you add a lot of Windows programs, you’ll end up running the installation programs that, among other things, lengthen your PATH statement. Now, you may know that your path cannot exceed 128 characters. But you may not know (here’s the bug) that when a batch file (e.g., AUTOEXEC.BAT) extends the path beyond 128 characters, DOS doesn’t notice. In the process, the overlong path overwrites part of DOS, leading to some interesting side effects. Once I saw the system start doing print screens; other times, it seems that the hard disk drive is dead. Be sure to double-check your path length.

I get a “not enough memory to load program” error, even though I clearly have plenty of memory. How can I fix this?

An extremely annoying message. One machine I saw this happen on had 8 megabytes of RAM and an 8-MB swap file. Running Word and Excel, there was no room left for Designer. What gives?

It turns out that there’s more to running a Windows application than memory. Two programs that do a lot of system management—GDI.EXE and USER.EXE—each have a 64K-byte stack that keeps information about every program that is running in the system (64K bytes because of a limitation of the 8088 through 286 chips). These stacks summarize all the activity in the system. Each Windows program’s local heap comes out of USER.EXE’s stack. The local heap for each program must be
Graphical User Interface CLEARING HOUSE
Specializing in products for Microsoft Windows and OS/2 Presentation Manager environments

G.U.I. CLEARING HOUSE - PM/Windows Catalog

File  Edit  Search  Order

1-800-522-4624
INTERNATIONAL CALL: 420-662-5246
Monday - Friday 9:00am to 8:00pm EST

GUI Clearing House is the only national retailer specializing exclusively in Windows and OS/2 Presentation Manager environments. This specialization is necessary in order to properly serve you, our customer, in this rapidly evolving market. Our goal is to provide you with the finest customer service in the industry and to ensure that the products you select are the correct ones for your application.

When you call GUI Clearing House, you will be greeted by one of our friendly, knowledgeable sales staff who will take the time to talk with you to understand your specific requirements. To further assist you, we maintain a staff of technical consultants available to answer in-depth technical questions on products; and to help customers in identifying applications to meet their needs.

Please Note: The applications listed in this ad represent only a small sample of the Windows and OS/2 Presentation Manager products available through GUI Clearing House. Call us for pricing on any Windows Presentation Manager application. We'll promptly get pricing and availability for you.

CALL TODAY!

Payment - Visa, MasterCard, Stores Club and Carte Blanche accepted. Personal and company checks accepted. Please allow 2 weeks for processing. Corporate and institutional purchase orders subject to credit approval and a minimum credit purchase $500, paid to C.O.O. or as required. C.O.O. minimum purchase is $500, maximum $5,000 payable by cash, company check, or money order. CT taxes and 8% sales tax.

Shipping - Shipping handling charge is 3% or $6 minimum. 8% for C.O.O. Larger shipments may require additional charges. Call for shipping information. All shipments to Alaska, Hawaii, and points outside the U.S. are for C.O.O. only.

Warranty - All products conform to manufacturer's written warranty only. Product warranties, guarantees, rebates, and period end offers, if any, are handled by the manufacturer.b. Defective items replaced or repaired at our discretion. We do not guarantee compatibility, item availability, price, terms, and policies subject to change without notice. Graphical User Interface CLEARING HOUSE is not liable for damage due to cosmetic or typographical errors. Mailing address is Graphical User Interface CLEARING HOUSE, P.O. Box 19, Sandy, UT 84070. (801) 459-4624.

Circle 138 on Inquiry Card.

Windows Applications

Development Tools
ACTOR 2.0 .................................. 795
Adept Expert Application Builder .... 595
Bridge 2.0 Tool Kit ....................... 629
C-TRIEVE/Windows (Commanded) ... 349
C-Talk/View ................................ 429
C-Talk/View ................................ 429
CASE 13.8 (CASEWorks) ............... 849
Graphics Server SDK .................. 379
Guide 3 ....................................... 3
Icon Author (Artich) ..................... call
Knowledge Pro Windows .............. 529
L modele PC ............................... 559
Microsoft SDK for Windows 3.0 ...... 349
Multiscope for DOS/Windows 3.0.... 159
ObjectGraphics (WhiteWater) ........ 409
Personal Case ........................... 179
PowerLBN ................................. 265
ProtoView ................................ 409
ProtoGen .................................. 409
PubTech BatchWorks .................. 89
SpeedStudio ................................ 255
ToolForge .................................. 240
The Whiter整整 Resource Toolkit ..... 189
WindowsMAKER (Candlelight) ....... 659
WinTieve .................................. 360
Zortech C++ Compiler ................. 179

Database/Forms
Access DB (dBase) ................. 1279
Chart Builder for Superbase ........ 169
dBase/Frants ......................... 295
EWhin .................................... 729
FormWorx Forms Publisher ......... 199
INTEGRAL SQ/C (Commanded) ..... 600
JetForm .................................. 300
MARIViV Image Database .......... 2365
Onlines Windows S/Smart ................ 795
Performs ................................ 295
Q+E/Windws ver 2.5 ................... 139
Superbase ver 1.2 ..................... 349
Superbase ver 4.2 ...................... 679
Thinx .................................... 399

Engineering/Planning
ABC Flowchart ................................ 249
CON-FLO, control valve analysis .... 179
Design/IDEF .............................. 2795
Design/Forge ............................ 749
DRAFIX Windows CAD ............... 459
Dynacomm (Windows) ....... 259
Dynacomm Elite ....................... 399
Facit for Windows: ............... 240
Microsoft II ................................ 260
Network Courier .................... CALL
TERM for Windows ............... 179
Windows Workstation ............ 559
WinComm ................................ 139
WinTerm .................................. 409

General/Productivity/Utilities
Adobe Type Manager ................ 59
Ami Professional ...................... 159
MaciTAX Professional Series ...... call

Publishing/Graphics
Adonis Clip-Art Window Shopper .... 42
Analog PageMaker ..................... 499
Adobe DESIGNER ....................... 795
Art and Letters Graphic Editor .... 509
CA Cricket Graph tv 1.3 ............ 159
CA Cricket Presents .................. 349
CorelDRAW 2.0 .......................... 399
dEd/2/screen capture/convert ........ 399
Image-In Full Pack ................... 679
Image-In Scan & Paint .............. 139
Image Prep ............................. 259
Import for Windows .................. 259
Instant ORGRCharting .............. NEW
Macro Charisma ....................... 349
Microsoft Office for Windows ...... 409
Picture Publisher .................... 489
Point Power for Windows .......... 395
PrintTech Multi-Tack ................ 139
Printbook 2.1 (Echelon) .......... 129
Printworks SuperSeries for Windows .. 550
WordScan Plus (Camera) .......... 795

Word Processing
Amp; ver 1.2 ................................ 159
Amp; Professional ver 1.2 ........... 318
Amp; mac-iit for Windows .......... 79
Language Master for Windows ...... 89
NBI Legacy ................................ 359
Palantir Windows Spell 3.0 ....... 80
Word for Windows .................... 329

Financial/Accounting
Accounting by Design ............... 1099
Blitz Accounting Partner .......... 55
Bookkeeping by Design ............. 55
CCA Enhanced Business Pkg ........ 795
Evolve (AS) ............................. 169
CCA Active Payroll .................. 169
CCA Job Costing Module ........... NEW

Hardware, etc.
Image Scanners
Logitech ScanMan 55G-FC/AT ...... call
Logitech ScanMan 250/MCA ........ 509
Microtek scanners ................. call

Boards
ATT/8141/8142 ................. 499
NEC Graphics Engine Bld (AT) ... 699
NEC Graphics Engine Bld (PS/2) .. 699
Paradise 8141 Plus (AT) ............ 699
Paradise 8141 Plus (MCA) ........ 795
Intel SafeFaxion board ............ call

MultiMedia Products
Super video Windows .............. 394
Virtual VideoX/XFRAMAUFFER ........ NEW
XYSYS 600Mb Erasable Optical Dev .NEW

GUI Clearing House offers a full line of hardware items selected to augment the Windows, Presentation Manager, and Multimedia based platforms. If you don't see a particular item, just ask...we will promptly obtain pricing and availability for you. Call us TODAY!
Some programs just love heap space, and they'll gobble up lots of it if they see that no other programs are loaded. So you end up with a situation where you've got megabytes and megabytes of free RAM, but no space left in one of those two tiny 64K-byte stacks, and no more Windows programs will load ("for want of a nail... ").

When you pull down the About Program Manager window in the Program Manager's Help menu, the Free System Resources number is telling you the amount of free space in the GDI.EXE and USER.EXE stacks. When it drops below 15 percent, Windows will refuse to launch any new applications.

The answer is to try loading the Windows programs in a different order. Load a stack-hog later in the sequence, and it will (if written well) allocate less stack space. This may not solve the problem, but it is worth trying. Again, buying more memory will not help here: The problem is Windows' reliance on the 286 chip. This is another reason why we need OS/2 2.0.

Can I change the way an icon looks?

Yes and no. A program's icon is a bit map (similar to a file created by PC Paintbrush) that's embedded in its .EXE file. To change it, you'd have to extract the bit map, change it, and reembed it in the .EXE file. The Whitewater Resource Toolkit (WRT) can edit icons (as well as dialog boxes, menus, string tables, and more) in place. It's the Windows version of the Mac's ResEdit. But what can you accomplish with Windows alone?

Windows does let you assign an alternate icon to a Windows application. Briefly, here's how. Click on the program's icon in the Program Manager (just single-click to select) and select File and Properties... from the Program Manager menu. Then click on the Change Icon push button in the Properties window. A Change Icon window will appear. One field shows the name of the program; that's where Windows looks to find the icon.

By default, Windows looks in program x for program x's icons. But it doesn't have to. If you overtype x's filename with another program's filename (call it y), you can associate any icon found in y with x. Unfortunately, this technique isn't a total solution. This new icon works only in the Program Manager. When the program is minimized, Windows reverts to the default icon. You'll need a true resource editor (e.g., WRT) to fix things so they'll stay fixed.

How do I make Notepad (or Write) default to a directory other than C:\WINDOWS?

Notepad is a pretty convenient little editor: two clicks and it's there. But it always defaults to C:\WINDOWS or whatever directory you've got Windows in. You can change that default in two ways; one is somewhat well known, the other is a bit offbeat.

Everybody who has played with Windows for a while has figured out that you can give a data file its own icon. Click on the icon, and Windows uses the file's extension to load the program that goes with the data file.

For example, I've got a file called TTD.TXT, a "things to do" list. It has its own icon.
HANDS ON

When I click on it, Windows knows that .TXT is the extension for Notepad files; so it starts up Notepad and loads TTD.TXT.

Here's a sneaky trick. Click once (not twice) on the Notepad icon in the Program Manager. Click on File in the Program Manager and then Properties.... You'll see that the command line contains NOTEPAD.EXE. Just change that to:

d:\subdir\NOTEPAD.EXE

where d:\subdir is the drive and subdirectory that you want Notepad to default to. Don't click OK yet, however. Click on Change Icon. The new window will include the filename d:\subdir\NOTEPAD.EXE. Change it to NOTEPAD.EXE; get rid of the d:\subdir. You will see the generic DOS icon rather than the Notepad icon.

Click on Next icon, and the regular Notepad icon will appear. Then click OK, and OK. You'll get a warning message, but ignore it.

By the way, does it annoy you that Notepad and Write always default to *.TXT and *.WRI in their respective File Open dialog boxes? Do you often override those defaults with *.*? Try this (courtesy of BIX user Jeff Detray): Save copies of NOTEPAD.EXE and WRITE.EXE, fire up Write, open each .EXE file (specifying no conversion), and do a search-and-replace to change *.TXT or *.WRI to *.*. Important: Put two spaces after *.* so you don't change the length of the strings embedded in the .EXE files. Could you use WRT to solve the problem more cleanly? Nope. The *.* strings are not defined as resources—naughty, Micro-

Windows is a multitasking platform for Windows programs: Excel can share the desktop with Corel Draw and Windows Tetris, with the Windows scheduler juggling them all. The 386-enhanced mode adds another layer of juggling. It views Windows and all Windows programs collectively as one virtual machine (VM).

What do those background priority and foreground priority numbers mean when you're running Windows in 386-enhanced mode?

You know that Windows is a multitasking platform for soft—so WRT cannot get at them.

What do those background priority and foreground priority numbers mean when you're running Windows in 386-enhanced mode?

You know that Windows is a multitasking platform for...
BYTE’s International Direct Response Postcards

From the most prestigious microcomputer magazine comes an inexpensive direct response medium – a postcard advertising insert bound into the highly-respected International Section of BYTE magazine called BYTE’s International Direct Response Postcards.

Postcard ads provide a direct-response vehicle that encourages prospects to respond to offers for information as well as direct sales. A postcard ad is versatile because it allows you to test your product to potential buyers. That’s because you can use your card to sell computer products, generate leads, conduct market research or sell books and periodicals. Each postcard is perforated so it can be easily torn out and returned directly to you without any intermediary—guaranteeing leads that are current and ‘hot.’

Expand your horizons into this valuable marketplace.

The Pan-European marketplace is preparing to open up to greatly expanded trade in 1992 with the breaking down of trade restrictions. And BYTE’s International Direct Response Postcards presents the perfect opportunity to test your product in this marketplace and to get your company positioned in the minds of the major buyers.

These unique advertising postcards which will be inserted in the International Section will reach 95,000 influential BYTE paid readers throughout Europe.

In the United States, contact:

Ed Ware
at 603-924-2596
BYTE Magazine
One Phoenix Mill Lane
Peterborough, NH 03458

programs all exist in the Windows VM.

The background and foreground priority numbers answer the question, “What proportion of the CPU’s time should be spent on each VM?”

Here’s how it works.

First, each VM has a background and foreground priority number. The Windows background/foreground pair can be set from the 386-enhanced option in the Control Panel. For non-Windows programs, these numbers are set in the Advanced dialog box under the program information file (PIF) editor or in the Settings…menu in the DOS program’s Control icon (accessed with Alt-space bar).

Second, only one VM—the one you see on the screen—has the foreground at any point in time. When you see the Windows desktop, Windows has the foreground. When you see the familiar blue WordPerfect screen, WordPerfect has the foreground. The others are in the background. If you’ve selected the Background check box in a program’s PIF file, it will continue to run, even if it’s in the background. (The PIF editor’s default is not to check the Background, so none of your programs will run—and this discussion is irrelevant—if you have not checked Background.)

With that background (no pun intended) in mind, here’s how priorities work.

Sum up all priority numbers. For the foreground VM, use its foreground number. For the background VMs, use their background numbers. That’s the priority total.

For all VMs, divide the VM’s priority number (background or foreground, whichever is relevant at the moment) by the priority total. That is the percentage of CPU time allotted to that VM.

Here’s an example. Suppose you’ve got dBASE and WordPerfect running with Windows. Give Windows a foreground of 100 and a background of 50. Say dBASE gets FG = 150 and BG = 25, and WordPerfect has FG = 200 and BG = 100. Remember that you control all these numbers with the Control Panel or the PIF editor.

When Windows is in the foreground, the total is 100 (Windows’ foreground number) plus 25 (dBASE’s background number) plus 100 (WordPerfect’s background number), for a total of 225. Windows gets 100/225 of the CPU time, almost one-half; dBASE gets 25/225, or one-ninth; and WordPerfect gets as much time as Windows.

Now put dBASE in the foreground. The priority total is then 50 (Windows) plus 150 (dBASE) plus 100 (WordPerfect), or 300. Windows gets 50/300, one-sixth of the CPU time; dBASE gets 150/300, one-half; and WordPerfect gets the rest.

And with WordPerfect in the foreground, the total is 50 (Windows) plus 25 (dBASE) plus 200 (WordPerfect), or 275. Windows sees 50/275 of the CPU time, there’s 25/225 for dBASE, and 200/275 goes to WordPerfect.

By adjusting these priorities, you can tune your Windows system to make the best of your various applications. Want a snappier Lotus 1-2-3? Increase its foreground priority. Want your word processor to print faster in the background? Play with its background priority. But be careful and keep notes; sometimes you can make the system run much worse by fiddling with these numbers!
Up to date.
Down to earth.

**hanging the world.** UNIX is hanging the world of computers, the world of business—quite simply, changing the world.

**The information you need.** That's why you need *UnixWorld*—the magazine that keeps you up to date on the rapidly changing world of open-systems computing. Each issue brings you the latest product trends and technical advances that can affect your business. The inside story on some of the world's biggest high-tech companies.

Easy-to-understand programming tips and tutorials that can help you and your company use UNIX to its fullest. And unbiased hardware and software reviews to help you invest wisely when you buy.

**The whole UNIX-verse.** *UnixWorld*'s in-depth features go beyond dry technical facts, to show how the pieces fit together—to tell you what's important about the advances and the strategies that are changing your world. And *UnixWorld* consistently offers the freshest, most down-to-earth writing you'll find in any computer publication.

**Subscribe and Save.** Subscribe today, and receive the next 12 issues of *UnixWorld* for just half the regular newsstand price.

Save even more by ordering for two or three years. You can't lose—every subscription to *UnixWorld* comes with a no-risk guarantee.

1 year $18.00 (save 50%)
2 years $32.00 (save 55%)
3 years $42.00 (save 60%)

**Subscribe now! Call toll-free:**
1-800-341-1522

**UnixWorld**

*If you're into UNIX, you need UnixWorld Magazine.*
Professional 3-D Graphics on the Mac

Don Crabb

By the time I got to Paracomp's office in San Francisco, I was a wreck. First of all, I had to drive like a maniac from the hotel to get there close to my appointed time, due to a last-minute incoming phone call. I trotted over to the Paracomp building and bolted up the stairs, arriving a mere 45 minutes late. I must have looked like a wild man, hair dripping wet, heart pounding, completely out of breath.

By the time I was finished with my private briefing (it was on the morning of the first day of the MacWorld Expo; these guys deserve a medal for putting up with me), I was considerably calmer, much drier, and very much impressed. Really impressed.

While I played around with Paracomp's bevy of graphics products before, I had never really gotten the complete picture on them as a whole. The Paracomp people fixed all that by giving me guided tours of Swivel 3D and 3D Professional and ModelShop 1.1 and II (in a beta version).

Armed with this knowledge and copies of the Paracomp software that had been sent to me, I spent most of the rest of January reimmersing myself into three-dimensional graphics, Paracomp-style. While many good 3-D products are available, I can't think of a single vendor that has its head screwed on as straight as Paracomp when it comes to making all its products work together. This is no mean feat considering that most of its stuff has been acquired from outside sources.

Even though ModelShop 1.1 isn't my favorite graphics program (ModelShop II fixes most of the interface goofs), it all manages to work together quite nicely. Once I saw how it worked and got into the mindset of the architects who use it, it seemed simple to build 3-D models of buildings and cities, move around outside and within them, and change the scale, display, perspective, and other parameters.

I quickly learned how to export my ModelShop creations to Swivel 3D Professional, where I could give them photorealistic rendering (which is Pixar's MacRenderMan's claim to fame, about which I'll have more to say in future columns) and use its Tween command to create dynamic animations (see the screen shot). I even learned how to take these Swivel creations and output them in all kinds of formats, from AutoCAD DXF to MacRenderMan RIB to 24-bit PICT files. I also figured out how to output files to more mundane formats: EPSF, PICT, PICT2, PICS, Paint, and Scrapbook files, so I could use images within HyperCard (see the screen shot). I even learned how to take these Swivel creations and output them in all kinds of formats, from AutoCAD DXF to MacRenderMan RIB to 24-bit PICT files. I also figured out how to output files to more mundane formats: EPSF, PICT, PICT2, PICS, Paint, and Scrapbook files, so I could use images within HyperCard.

In fact, I liked using Swivel 3D Professional so much, and found it so straightforward and intuitive, that I almost wished I was a graphics designer and got to do this stuff all day long. I expect that I'll be using the program's animation tools—especially the multiple key frames, tweening, animated camera views, and smoothed 3-D panels—in my teaching, research, and consulting.

I have a lot more to learn about Paracomp's products, and about competing 3-D vendors, too. For my money, though, the Mac is proving to be the premier middle-cost/middle-performance 3-D graphics engine now available. It won't displace the Silicon Graphics machines, but even a loaded Mac IIIfx doesn't cost $75,000.

There is one caveat, though: You shouldn't expect to use any of these Paracomp products without at least a 4-mega-byte Mac IIcx. And you'll be a lot happier with faster iron, such as a 5- to 17-MB IIi, an 8- to 32-MB IIci, or a 32-MB IIIfx.

Software of the Month: Screen Capturers

Why do you need a screen-capture utility? After all, the Finder includes a built-in one that grabs a Clipboard/Paint file when you want it (typing Command-Shift-3) and then dumps it into a MacPaint file. Why, then? Because that built-in one is pretty lame: It works only in black and white, yielding a MacPaint file. Nor does it handle anything over 640 by 480 pixels.

This void has been filled by a lot of good third-party software. Three I use are Capture 3.0 from Mainstay, Exposure 1.0 from Preferred Publishers, and SnapJot 3.0 from Wildflower Software.

While all these utilities do a good job of capturing screens, each has its own special prowess, which is why I keep them all on my disks. Capture and Exposure are INIT cdevs; SnapJot does its magic from a System INIT and a desktop accessory.

Capture 3.0 is probably the simplest of the three, and it's ultimately the most reliable. I've yet to have it crash any of my Macs, and I've got some pretty scary machines in my home and office computing plants.

Capture can grab full or partial screens as either Clipboard or PICT files in both 8- and 24-bit color. About the only problem I've encountered with it was at start-up, when it conflicted with the IDs of some other INITs. A simple renaming fixed that problem. Capture 3.0 costs $79.95.

Preferred Publishers has thrown in all kinds of useful...
DOES IT MAKE SENSE TO USE A COMPILER WITHOUT IT? NOT ANY MORE.

INTRODUCING TOPSPEED C++, C, PASCAL AND MODULA-2

Smartlinking is only one of the many unique and critically-acclaimed features in JPI's line of open-architecture, multilanguage/multiplatform compilers.

Whether your working in C, C++, Pascal or Modula-2, TopSpeed compilers will cut development time and give you the excellent code quality other TopSpeed users have come to expect.

"TopSpeed Is Tops in Programming"
- Peter Coffee, PC Week January 1991

TOPSPEED CODE GENERATION TECHNOLOGY All four TopSpeed languages share a common optimizing code generator. As a result, you can produce the same high quality, optimized code with any language you choose. And, unlike any other compiler vendor, JPI offers total compatibility between languages and the ability to reuse existing code.

WRITE DOS PROGRAMS AS LARGE AS 16MB If your program requires more than 640K, TopSpeed's powerful Code and Data Overlay Management System provides code and data overlays automatically to run your large applications.

MULTIPLE MEMORY MODELS All TopSpeed languages support five distinct memory models which allow you to adapt your program to make optimal use of the 80x86 family of processors. Additionally, TopSpeed provides a re-entrant library for multitasking projects (even under DOS).

WRITE YOUR PLATFORM All TopSpeed compilers are available for DOS, Windows 3 and OS/2 development.
HANDS ON

features with Exposure 1.0. The most interesting one is the movable palette menu bar. With it, you can not only capture a screen, but edit and annotate it as well, since Exposure is something of a mini Paint program, too. You can capture files to disk or send them to the printer directly. Exposure saves files in Scrapbook, Paint, StartupScreen, and PICT formats. Exposure costs $149.95.

Mark Edel of Wildflower Software kindly took the time to search me out at an Apple product preannouncement some months back to tell me about SnapJot. Since then, I've been a SnapJot fan.

I use SnapJot to capture the screens that appear in this column. It can handle simple and more complex screen capturing (e.g., capturing portions of the screen), and it can save files in the usual Paint/Clip-board and PICT formats. But if that's all you use SnapJot for, then you've missed the whole point of this superhandy utility.

SnapJot makes it trivially easy to micromanage your MultiFinder environment. If you're like me, you keep several programs up and running all day long. I personally tend to run VersaTerm-Pro, Nisus, FileMaker Pro, HyperCard, Inspiration, and Prograph every day.

Since I'm often working on different projects that have allied purposes, it's useful for me to cut and paste between different documents easily (yes, I can hardly wait for System 7.0's Inter-Application Communication hot links!). But if I have to keep the full windows of all these things displayed, I run out of screen real estate, even on my 19-inch SuperMac Technology 24-bit color monitors.

Enter SnapJot. I can capture part of a screen from a document, leave it on display in one corner of my monitor, and refer to it within another document. I use SnapJot as sort of the screen equivalent of Post-It Notes, because its captured screens remain actively displayed as long as you want them to. This is so handy, it's

MEET YOUR NEW UNIX SYSTEM ADMINISTRATOR!

Helios' EtherShare™ file server system lets you do system administration from any Macintosh on your network. Plus it gives you a PostScript® print server, a terminal server and an internet router that uses AppleTalk packet technology. All for about $100 per session!

Field proven in Europe for almost two years, EtherShare provides high speed file access to up to 200 PCs, Macs and your DEC, Sun, Sony or IBM workstations. You can even have several EtherShare systems working on the same Unix host at the same time. It looks like AppleShare to the Macs, but moves data at Ethernet rates, up to 10 Mbits/sec. And it integrates computers with other operating systems like a DEC VAX® under VMS or Ultrix and lets IBM PCs join in the fun, as well.

Obviously there's a big story here. If you want the details, we've prepared a full package of information we'll be glad to deliver to you via e-mail. Just dial up our CompuServe® number 74730, 1004 and we'll get it to you.

If you would like to speak with our National Sales Manager, contact Paul Lucero at 998 West Lynn Way, Suite 4, Cupertino, CA 95014. Phone 408-255-2503. AppleLink: Helios.USA; or send him e-mail on Internet: lucero@apple.com.
a wonder Apple didn't build it into the Finder long ago! SnapJot costs $59.95 and is well worth it.

**Tip of the Month**

I spent much of 1990 writing a book, *Using FileMaker Pro*, for Brady Books. For a variety of reasons that are too depressing and Byzantine to go into here, that book won't be appearing anytime soon. But my year of being immersed in things FileMaker has stood me in good stead here at the University of Chicago and among some of my consulting clients. I've become something of a FileMaker expert as a result of researching and writing the book.

One of the things I've found is that if you use FileMaker Pro a lot, you need some help, or else you spend too much time designing forms and fiddling with all the clever layout features of the program. While I love to fiddle around, it sure doesn't get the bills paid, so you can imagine how happy I was when I stumbled across the Elk Horn Library.

Elk Horn Publishing distributes a catalog full of FileMaker templates, data files, and other goodies. Not only are these doodads good, they are also sublimely cheap. An example is Network Messaging. This is a clever little FileMaker Pro template that lets you use FileMaker's multiuser file sharing capability to set up a simple mail/messaging server on your AppleTalk network. No, it won't replace Microsoft Mail, cc:Mail, QuickMail, or any other full-blown E-mail system. But it costs only $4. Or $2, if you are a subscriber to Elk Horn's excellent newsletter called *FileMaker Report*.

Continuing the networking theme, another Elk Horn Publishing template is the Network-To-Do-List 1.2, which will set you back $22. This handy little template comes in versions for FileMaker II (the old system) and FileMaker Pro. It works nicely as an appointment and task list for a workgroup. The template handles both people and facilities, as well as private and public information. Serious reporting layouts are also included with the package.

The Elk Horn catalog lists more than 100 templates, data files, and other FileMaker add-ons, costing between $2 and $125. If you use FileMaker, you owe it to yourself to call this company and get on its catalog list.

**ITEMS DISCUSSED**

<table>
<thead>
<tr>
<th>Product</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capture 3.0</td>
<td>$79.95</td>
</tr>
<tr>
<td>Mainstay</td>
<td></td>
</tr>
<tr>
<td>5311-B Derry Ave.</td>
<td></td>
</tr>
<tr>
<td>Agoura Hills, CA</td>
<td></td>
</tr>
<tr>
<td>91301</td>
<td></td>
</tr>
<tr>
<td>(818) 991-6540</td>
<td></td>
</tr>
<tr>
<td>fax: (818) 991-4587</td>
<td></td>
</tr>
<tr>
<td>Circle 1147 on Inquiry Card.</td>
<td></td>
</tr>
<tr>
<td>Elk Horn Library</td>
<td>$2 to $125</td>
</tr>
<tr>
<td>Elk Horn Publishing</td>
<td></td>
</tr>
<tr>
<td>P.O. Box 1300</td>
<td></td>
</tr>
<tr>
<td>Freedom, CA 95019</td>
<td></td>
</tr>
<tr>
<td>(408) 761-5466</td>
<td></td>
</tr>
<tr>
<td>fax: (408) 761-5468</td>
<td></td>
</tr>
<tr>
<td>Circle 1148 on Inquiry Card.</td>
<td></td>
</tr>
<tr>
<td>Exposure 1.0</td>
<td>$149.95</td>
</tr>
<tr>
<td>Preferred Publishers, Inc.</td>
<td></td>
</tr>
<tr>
<td>1770 Moriah Woods Blvd., Suite 14</td>
<td></td>
</tr>
<tr>
<td>Memphis, TN 38117</td>
<td></td>
</tr>
<tr>
<td>(800) 829-3383</td>
<td></td>
</tr>
<tr>
<td>(901) 683-3383</td>
<td></td>
</tr>
<tr>
<td>fax: (901) 683-4983</td>
<td></td>
</tr>
<tr>
<td>Circle 1149 on Inquiry Card.</td>
<td></td>
</tr>
<tr>
<td>ModelShop 1.1</td>
<td>$595</td>
</tr>
<tr>
<td>Professional</td>
<td>$695</td>
</tr>
<tr>
<td>Swivel</td>
<td></td>
</tr>
<tr>
<td>3D</td>
<td></td>
</tr>
<tr>
<td>Paracomp, Inc.</td>
<td></td>
</tr>
<tr>
<td>1725 Montgomery St., Second Floor</td>
<td></td>
</tr>
<tr>
<td>San Francisco, CA 94111</td>
<td></td>
</tr>
<tr>
<td>(415) 956-4091</td>
<td></td>
</tr>
<tr>
<td>fax: (415) 956-9525</td>
<td></td>
</tr>
<tr>
<td>Circle 1150 on Inquiry Card.</td>
<td></td>
</tr>
<tr>
<td>SnapJot 3.0</td>
<td>$59.95</td>
</tr>
<tr>
<td>Wildflower Software</td>
<td></td>
</tr>
<tr>
<td>21 West 171 Coronet Rd.</td>
<td></td>
</tr>
<tr>
<td>Lombard, IL 60048</td>
<td></td>
</tr>
<tr>
<td>(708) 916-9560</td>
<td></td>
</tr>
<tr>
<td>Circle 1151 on Inquiry Card.</td>
<td></td>
</tr>
</tbody>
</table>

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**

---

**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.
An Out-of-Towner's Introduction to the BIX Community

BIX is for people who use microcomputers for business, finance, research, and career and personal development. There's always something interesting happening here. No matter what you're into. The latest industry news. Top-notch software libraries. Private electronic mail. Real-time chatting. And every month, the complete text of BYTE magazine. (Read more about BIX, and how to join, on adjacent page.)

From Artificial Intelligence to Zenith Laptops...
Whatever your interest, BIX has a conference for you. Here's our latest list. (In each Exchange, Conference name appears on left, description on right.)

<table>
<thead>
<tr>
<th>Conference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amiga Exchange</td>
<td></td>
</tr>
<tr>
<td>Joanne Dow, Exchange Editor</td>
<td></td>
</tr>
<tr>
<td>amiga.user</td>
<td>Exchange ideas, solve problems, compare notes</td>
</tr>
<tr>
<td>amiga.sw</td>
<td>Amiga programming and developer issues</td>
</tr>
<tr>
<td>amiga.hw</td>
<td>Amiga hardware design, use, and hookup</td>
</tr>
<tr>
<td>amiga.arts</td>
<td>Artistry using the Amiga</td>
</tr>
<tr>
<td>amiga.int</td>
<td>Developing for the international Amiga</td>
</tr>
<tr>
<td>amiga.special</td>
<td>Special guests and events</td>
</tr>
<tr>
<td>amiga.dev</td>
<td>Commodore's conference for developers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM Exchange</td>
<td></td>
</tr>
<tr>
<td>Barry Nance, Exchange Editor</td>
<td></td>
</tr>
<tr>
<td>ibm.pc</td>
<td>The venerable PC</td>
</tr>
<tr>
<td>ibm.at</td>
<td>The AT series and workalikes</td>
</tr>
<tr>
<td>ibm.ps</td>
<td>The PS/2 series</td>
</tr>
<tr>
<td>ibm.os2</td>
<td>OS/2 operating system</td>
</tr>
<tr>
<td>ibm.dos</td>
<td>PC/DOS &amp; MS/DOS operating systems</td>
</tr>
<tr>
<td>ibm.os.386</td>
<td>Alternative 386 operating systems</td>
</tr>
<tr>
<td>ibm.utils</td>
<td>Utility software for IBM computers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writers' Exchange</td>
<td></td>
</tr>
<tr>
<td>Wayne Rash, Jr., Exchange Editor</td>
<td></td>
</tr>
<tr>
<td>desktop.pub</td>
<td>Using microcomputers for publishing</td>
</tr>
<tr>
<td>elfquest</td>
<td>Find out about things elven with Richard Pini</td>
</tr>
<tr>
<td>journalism</td>
<td>Reporting and writing news</td>
</tr>
<tr>
<td>journalism.pro</td>
<td>Interaction for working press only</td>
</tr>
<tr>
<td>lexicon</td>
<td>About words</td>
</tr>
<tr>
<td>marketing</td>
<td>Promos, sales, public relations and high tech</td>
</tr>
<tr>
<td>new.writers</td>
<td>Getting started in the writing business</td>
</tr>
<tr>
<td>poetry.prose</td>
<td>Writing both types of English</td>
</tr>
<tr>
<td>sf</td>
<td>Science Fiction, Star Trek, and fantasy fans</td>
</tr>
<tr>
<td>sfwa*</td>
<td>Science Fiction Writers of America</td>
</tr>
<tr>
<td>tech.news</td>
<td>Discuss Microbytes, product reports, items</td>
</tr>
<tr>
<td>word.processor</td>
<td>Word-processing programs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macintosh Exchange</td>
<td></td>
</tr>
<tr>
<td>Dr. Larry Loeb, Exchange Editor</td>
<td></td>
</tr>
<tr>
<td>mac.apple</td>
<td>The word from Cupertino</td>
</tr>
<tr>
<td>mac.business</td>
<td>Macs in the office</td>
</tr>
<tr>
<td>mac.desktop</td>
<td>Publishing with a Mac</td>
</tr>
<tr>
<td>mac.external</td>
<td>Information from all over</td>
</tr>
<tr>
<td>mac.hack</td>
<td>Technical information about the Mac</td>
</tr>
<tr>
<td>mac.hypercard</td>
<td>Using the HyperCard programming environment</td>
</tr>
<tr>
<td>mac.news</td>
<td>Up-to-the-minute information</td>
</tr>
<tr>
<td>mac.novice</td>
<td>For beginners</td>
</tr>
<tr>
<td>mac.products</td>
<td>Listings of new hardware and software</td>
</tr>
<tr>
<td>mac.sandbox</td>
<td>For off-hours fun</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jerry Pournelle, Exchange Editor</td>
<td></td>
</tr>
<tr>
<td>tojerry</td>
<td>Messages for and from Jerry Pournelle</td>
</tr>
<tr>
<td>chaos.manor</td>
<td>Computing at Chaos Manor</td>
</tr>
<tr>
<td>astronomy</td>
<td>A star party for amateur astronomers</td>
</tr>
<tr>
<td>contact</td>
<td>Science fiction meets science</td>
</tr>
<tr>
<td>disasters</td>
<td>Natural and man-made disasters</td>
</tr>
<tr>
<td>education</td>
<td>Computers in American classrooms</td>
</tr>
<tr>
<td>mathematics</td>
<td>Talk about high-level mathematics</td>
</tr>
<tr>
<td>sciences</td>
<td>Scientific programs</td>
</tr>
<tr>
<td>space</td>
<td>Space exploration and development</td>
</tr>
<tr>
<td>technology</td>
<td>New technologies and their impact</td>
</tr>
</tbody>
</table>

Please Note: Membership in this conference is limited to pre-screened specialists only.

Circle 450 on Inquiry Card.
Imagine a setting in which communal wisdom is on tap. A place that has the fit and feel of a small, friendly town, yet the sophistication and resources of a global community. One which you can visit electronically—to increase your knowledge of computers and their applications, hone your skills, share insights with thousands of other computer pros, and have fun. Such a community would be called BIX.

Subscribe to BIX, the flat-fee, on-line information service.
BIX is your access to industry news. And to many special interest Exchanges—such as our Amiga, IBM, Mac, Writers', and Interactive Games Exchanges—which include thousands of free, downloadable programs. All for just $39 per quarter.*

Subscribe via your computer...
Then hit the return key, and respond:

Prompt: You Enter:
login bix
Name? bix. ville
You may buy off-peak access via Tymnet at $20 per month or $3 per hour, or you may buy peak access at $6 per hour.**

*Based on a $156 annual fee, billed quarterly. Telecommunications charges are extra. You may cancel at any time without future charges.

**Available only in contiguous 48 states. Tymnet rates subject to change.

800-227-2983 • In NH 603-924-7681
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: BYTEWEEK.

BYTEWEEK 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. BYTEWEEK 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 BYTEWEEK 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.

BYTEWEEK offers a money-back guarantee if you are not completely satisfied.

YES! Sign me up as a subscriber to the Cream of the Crop, BYTEWEEK 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 ____________________________

Card # ____________________________
Exp. ____________________________
Signature ____________________________

BYTEWEEK
One Phoenix Mill Lane
Peterborough, NH 03458
ASK BYTE

The Cable the Cat Dragged In

I need help in locating a cable/connector and the pin-outs for a Mitsubishi MP 286L laptop computer. Its external floppy disk drive port is a female DB-26 connector. Although Office Depot, a local vendor, sells the laptop, it doesn’t sell — and refuses to order — the accompanying 5¼-inch floppy disk drive. All the computers in my wife’s office contain only 5¼-inch floppy disk drives.

Thus, she can’t use the laptop for the purpose for which it was purchased.

I called the Mitsubishi Electronics America Information Systems Division for help in locating a cable so I could hook up a 5¼-inch floppy disk drive. The company claimed I couldn’t get a cable unless I bought the disk drive for $700. I asked, “What if my cat ate the cable, and I needed a new one?” The answer was, “Sorry.” I asked a technician if he knew the pin-outs, and he said he didn’t. Since Mitsubishi retailers don’t sell the cable, it is not entirely unreasonable to expect a large company like that to support customers when its vendors don’t.

Jules Bartow
Clayton, OH

According to Mitsubishi technical support, the cable you’re after will work only with a Mitsubishi 5¼-inch floppy disk drive. The external floppy disk drive port on the MP 286L is a proprietary design. Even if you got your hands on the cable, you would not be able to hook a different floppy disk drive to it. I’m afraid the pin-outs wouldn’t do you much good, either.

If you want to use that port, you’ll have to buy the cable and the drive from a Mitsubishi dealer or from a third-party reseller that handles Mitsubishi-compatible drives. You should check the mail-order ads in BYTE or other computer magazines. I found an external 5¼-inch floppy disk drive for the MP 286L sold by Telephone Product Center (12603 Hoover St., Garden Grove, CA 92641, (800) 383-3199). The drive I found sells for $245. I’m sure you can find other dealers with such drives.

You do have a good point, though. If you sink $700 into an external drive, you should be able to replace a defective cable. I would check with some other Mitsubishi dealers in your area. You might call the following:

- J&R Enterprises, (513) 671-0339
- Tristate Data Supplies, (513) 891-4666
- NCC Systems, (513) 745-0190

Or you can call Mitsubishi at (800) 441-2345, ext. 54M, for the names and phone numbers of other dealers in your area. If you can’t find a replacement cable for the external drive, you have a valid complaint. I would not buy a disk drive if I could never get another cable for it. If all else fails, you could buy the drive and muzzle your cat.

Fortunately, you have other options. The easiest and least expensive way to go? Buy a copy of Traveling Software’s LapLink III (or a similar file transfer product). Your wife can then bring her laptop to work, plug one end of the included LapLink cable into the Mitsubishi’s serial or parallel port, and connect the other end to either port of any IBM-compatible desktop system. She can then transfer files to or from the desktop system. It’s fast (especially if she uses the parallel port and enable turbo mode) and simple. It will also let her transfer files that are greater than the storage capacity of a 5¼-inch floppy disk drive.

LapLink III costs about $95 and is available from most mail-order software houses. Check the ads in BYTE for a LapLink dealer.

Micro Solutions Computer Products (132 West Lincoln Hwy., DeKalb, IL 60115, (815) 756-3411) can also set you up. For $349, it sells an external floppy disk drive called the Backpack. It plugs into any standard PC parallel port, and the company offers a 5¼-inch 1.2-megabyte model. You can also get a break on the list price by comparing mail-order sources. Micro Solutions can give you a list of its mail-order outlets. If you order through Computer Options (800) 424-7678 or Central Computer Products (800) 456-4123 and say that you were referred to them by Micro Solutions, you’ll get an additional $10 discount. The Backpack will work with any laptop that has a standard parallel port.

— S. D.

Of Computers and Phones

A though I count myself in the ranks of IBM PC users, seeing the new Macs with built-in microphones has brought a product idea to mind. My hope is that someone has already implemented it.

With a microphone and the appropriate add-in board, what’s to keep the PC from working as a telephone? If you want to declutter your desk, you put your fax and telex into your PC, and, of course, the PC takes the place of the typewriter and calculator. What about the phone? That’s about the only thing left to incorporate.

Until now, to my knowledge, there has only been software for maintaining phone lists and for keeping records of phone activity. My idea is a complete phone substitue: It would do all the statistical call analysis, automatic dialing, prerecorded calls, call filtering, call routing to internal extensions, and voice-mail functions. A network version would be indispensable, with client and server versions of the add-in board, the server replacing the main phone, and the clients replacing the traditional phone extensions. The voice signal would travel by network, and all nodes could communicate by voice.

Finally, if someone has already implemented this idea, I hope it will be compatible with telecommunications regulations in Portugal.

Campos Santos
Figueira da Foz, Portugal

While no one to my knowledge has put together a PC-based telephone system that doesn’t require a handset, several vendors are working on the more sophisticated functions you suggest.

PC-based Touch-Tone voice-mail systems are already on the market. However, two maturing technologies, voice recognition and ISDN, have the potential to deliver...
sophisticated applications like the ones you seek.

Voice recognition should make it possible for the PC controlling the phone to handle a number of functions for any caller (e.g., call routing and message receiving). Alternatively, the digital data provided by ISDN can give you caller information, make it easy to maintain statistical databases, and aid in integrating voice and network applications.—S. A.

Forget-Me-Not

In the company where I work, we have one IBM XT and one IBM AT clone, the AT being used to run financial software. Every once in a while, the AT loses its CMOS setup information. At first I thought it was because of the battery. I replaced that, but the setup information kept getting erased.

I called the dealer, who said the software was erasing the CMOS. But the software vendor claimed it wasn’t possible for the software to affect CMOS settings. I got the hardware dealer to replace the motherboard, but no luck. After three motherboards from three different manufacturers, the AT still loses its setup information.

Is it possible that the financial software could accidentally change the CMOS contents? For once, it seems my computer’s problem isn’t hardware.

Renato Simoni
Belo Horizonte, Brazil

The people who wrote your financial software are wearing blinders. Yes, it’s very possible for software to wipe out the CMOS setup information. On a standard AT compatible, the CMOS storage is accessed by a pair of I/O ports at 70 and 71 hexadecimal. Badly behaved software that accidentally touches one of those ports could easily wipe out your settings.

Unfortunately, there isn’t any easy way to either protect your CMOS or find out how it’s being damaged. I’d suggest you go back to the software vendor, mention the three motherboard swaps, and ask the vendor to take another look at the software.—H. E.

Power to the Palmtop

As a BYTE subscriber, I have noticed the care your technical people take in testing various products.

I own a palmtop computer that is not 100 percent IBM compatible, the Atari Portfolio. It uses a DOS-compatible operating system, DIP-OS, rather than DOS itself; nonetheless, a variety of character-based programs written for DOS run on it. The Portfolio uses RAM cards rather than a conventional disk drive, and ROM cards for preconfigured applications.

This computer can be outfitted with a parallel port, and I am curious to know if the Micro Solutions Backpack is compatible with the Portfolio, its operating system, and its parallel port. Do you know whether this particular combination has ever been attempted? If the two will work together, the Portfolio suddenly becomes much more useful. You could keep a database on a floppy disk and access it from the Backpack drive; when the database isn’t needed, you wouldn’t have to carry the Backpack. To carry the same database on RAM cards might be prohibitively expensive. I suspect that Atari vendors would be very interested.

I don’t need a Backpack for my desktop computer, so I hesitate to test this hypothetical configuration for myself. I recently sent a query to Micro Solutions Computer Products about this matter and am enclosing a copy of the reply.

Harry C. Hutchins
Carbondale, IL

For maintaining a database, you would probably want more than a floppy disk drive. By the time you read this, XoterIX (818) 888-7390 should be selling a 20-megabyte hard disk drive that fits onto the bottom of the Portfolio, adding 12 ounces of weight and ¾ inch of height to the unit. It’s expensive at $899, but it would give you access to a significant chunk of storage space as well as another 512K bytes of RAM and rechargeable batteries. XoterIX also sells modems, RAM cards, and software for the Portfolio. If you need a relational database, it has one.

As for your specific question, I’m afraid I can’t give you a better answer than the one you received from Micro Solutions. As its letter pointed out, the two major stumbling blocks would be loading the necessary Backpack software drivers onto the Portfolio and the possibility of BIOS conflicts (the port address of the parallel printer adapter must be located at a particular BIOS data address).

Unfortunately, neither Micro Solutions nor Atari can say for sure if the combination will work. Atari says that its $79 Smart Parallel Interface conforms to the IBM standard, but the company has never tested it with a Backpack. My advice is to buy both products with the clear understanding that you can return them if they do not solve your problem. Micro Solutions will give you 30 days to return an item for a full refund; Atari will give you only 15 days to check out the Smart Parallel Interface. Even if the Backpack doesn’t work with the Portfolio parallel port, you may want to keep the Smart Parallel Interface for printer support and file transfers.—S. D.

A Hand for the Handicapped

I am a physician who customizes Macintosches for use by spastics and other handicapped individuals (e.g., subjects with reduced motor, audio, and phone ability). I’d like to get more information on dedicated devices, such as speech keyboards, voice controllers, speech-recognition units, Bliss language aids, and braille printers. I’m interested in devices for both the Mac and the IBM PC.

Dr. Raffaello de Masi
Atripalda, Italy

There’s a fairly large group of companies listed in “Opening Doors for the Disabled” in the August 1990 BYTE. Other magazines specifically cover this type of information. You might contact Exceptional Parent (1170 Commonwealth Ave., Boston, MA 02134). Besides its usual coverage of products and techniques, Exceptional Parent runs annual technology issues. The November/December 1990 issue has its latest technology directory, and it may have the information you seek.—H. E.
FREE Software Instantly On-Line With BYTE DEMOLINK

Download free demo software from top publishers directly to your computer...for just the cost of a phone call!

BYTE DEMOLINK lets you preview software instantly by calling the telephone number in the city nearest you. All you need to access BYTE DEMOLINK is a PC, a modem and a telecommunications program. The latest demo software is at your fingertips for your evaluation.

Call BYTE DEMOLINK today to connect with these free software demos—It's only a phone call away!

Here are the software packages available on DEMOLINK:

Quattro Pro 2.0
Borland’s powerful spreadsheet with features including flexible 3-D consolidation, macro building and debugging, full mouse support, pull-down menus, 128-character wide display, and 32 resizable windows provide modern user interface.
Select the file quattro.exe

ASQ
Memory manager freeware from Qualitas.
Select the file asq.exe

Think
The Think demo includes an AI tutorial which will introduce you to Expert Systems, Neural Networks and Natural Language. The demo actually talks through your PC speaker demonstrating the Thinking Software SoundBytes Toolkit which allows you to add speech synthesis to your programs.
Select the file think.exe

KnowledgeSEEKER
Combines artificial intelligence with statistical analysis techniques to link directly into dBASE, spreadsheet or ASCII files, turning data into information.
Select the file kseeker.exe

CommonView 2 Illustrator Diskette
Glockenspiel CommonView 2 is a C++ application framework for quick development of applications portable between Microsoft Windows, Presentation Manager, OS/2 and HP New Wave.
Select the file comview2.exe

Dr. Switch-ASE
Turn any dBASE program into a RAM resident program (TSR). Works with Clipper 87/5.0, dBASE III PLUS, dBASE IV, FoxBASE and FoxPro. Gives you hot key access to any dBASE application form and graphics or text-based programs.
Select the file switchase.exe

Other Software Packages Available:
C-scape With Look & Feel, Oakland Group
Lotus Magellan 2.0, Lotus
Multi-Platform Zortech C++, Zortech

*Call the nearest DEMOLINK office anytime. Telecom settings: 2400 or 1200 baud, 8 data bits, 1 stop bit, and no parity. Enter DEMOLINK at the prompt.

Circle 56 on Inquiry Card.
SmartLynx-MC
Intelligent Eight Port RS 232 Micro Channel Adapter for PS/2 Systems and Compilables.
Supports AIX, UNIX, XENIX, QNX PC-MOS and DOS.
Call for Special Introductory Offer 1-800-553-1170
JDR Microdevices

Experience the JDR Difference:
• 30-day Money Back Guarantee
• 1-Year Warranty on Every Product
• Toll-free Ordering and Support
JDR offers quality products at competitive prices. Our new 100-page catalog has thousands of PC products, from motherboards, monitors and cases to drives, controllers, integrated circuits, cables and connectors. Developers will find a selection of test equipment, programmers and prototyping products. Buy with confidence from JDR!
1-800-538-5000
Mention Key #1090
Circle 178 on Inquiry Card

Zericon

Factory Direct Savings on Large Format Plotters
Zericon is the low-price leader, offering the following plotters lines direct from the factory. The Valuline series of "D" Size plotters offers moderate performance at 15 IPS for under $2,000. The Designer series offers high performance at 25 IPS in MultiPen "A-E" sizes; prices under $3,000. All Zericon products are sold with a no-risk satisfaction guarantee.
1-800-727-6380
FAX 415-490-3906
Circle 348 on Inquiry Card

Hoolean

CUSTOM KEYBOARD PRODUCTS
Improve productivity and reduce training time by having your software commands color-coded and imprinted on your keyboard. Custom keys, SnapCap™ Keycaps, custom imprinted keytop and keyfront labels, templates, plus new macro devices and custom keyboards. WordPerfect and 5250 Emulation KeyCaps for IBM 101-keyboard; relegendable keys for IBM®, Cherry®, Wyse® and KeyTronic®; Keytop Label kits for WordPerfect™, DisplayWrite™, Data Entry and language conversions.
Call 602-634-7515 for FREE catalog.
Order Hotline 1-800-937-1337
Circle 146 on Inquiry Card

Annabooks

Send for Annabooks’ free catalog of PC-compatible engineering products.
The newest publication, "AT Bus Design," has the official timing information for the AT bus and the 8- and 16-bit parts of the EISA bus. Over 200 pages and 100 diagrams. Author is member of IEEE P996. Available now for $49.95. VISA, M/C, Amex, COD, P.O. S.O.K.
Annabooks, 12145 Alta Carmel Ct. #250, San Diego CA 92128
1-800-462-1042
FAX 619-592-0061
Readers Circle 28 on Inquiry Card
Resellers Circle 29 on Inquiry Card

National Instruments

Free 488-page full-color catalog describing instrumentation hardware and software products for personal computers and workstations. Application software for data analysis and presentation and for collecting data using instruments and plug-in boards. Features GPIB interfaces, data acquisition and DSP boards, driver level software, signal conditioning and VXI controllers.
1-512-794-0100
Circle 223 on Inquiry Card

Intel Development Tools

Choosing the right architecture for your embedded design is one of the most important decisions you face today. For successful embedded microcontroller development, Intel offers you a complete line of emulators, compilers and debuggers for the MCS-51, MCS-96, 1960, x86, Intel 386™, 486™ families of Intel architectures.
Our Development Tools Catalog lists all our embedded tools products in one guide. Call us at 1-800-874-6835, or FAX 503-696-4633 for your free copy.
Intel Corporation, DTO, 5200 NE Elam Young Parkway, JF1-15, Hillsboro, OR 97124
1-800-874-6835
FAX 503-696-4633
Circle 163 on Inquiry Card

Best Power Technology, Inc.

FREE, money-saving literature tells you how to protect your computer from power problems such as surges, sags, spikes, noise, brownouts, blackouts and lightning. These power problems can damage delicate equipment and cause loss of valuable data. Learn how Best Power Technology’s uninterruptible power systems, ranging from 500 VA to 18 KVA, can protect your computer. Contact: Best Power Technology, Inc., P.O. Box 280, Necheah, WI 54646.
1-608-565-5700, ext. 2175
Toll-free 1-800-536-5794, ext. 2175
Circle 42 on Inquiry Card

Dataq Instruments

Free catalog describing instrumentation hardware and software products for PCs with competitive comparisons and application information. We specialize in real-time 30,000 Hz sample rates to disk and display simultaneously. Our analysis software supports FFT, IFFT, Stats, X-Y, Digital Filtering, Integration, Differentiation, Arithmetic Operations and more. For a free catalog and demo disk, write or call Dataq Instruments, Inc., 825 Sweitzer Avenue, Akron, OH 44311.
1-800-553-9006
Circle 90 on Inquiry Card
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.


RATES: 1 issue—$675; 3 issues—$205; 6 issues—$600; 12 issues—$525

Prepayment must accompany each insertion. VISAMC 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.

---

ACCESSORIES

**SOFTWARE**

**Software Engineer Do Your Own Windows!**
At last a LISP programming environment which takes advantage of a GEL and protected mode on the PC. Software Engineer® for Windows® is a complete programming environment. It includes a LISP-aware text editor, allowing quick, easy and interactive Windows® development. Software Engineer supports GEL, GEL, the clipboard, dialog boxes. All software engineer is priced at $195.

Raindrop Software Corporation
455 S. Mountain, Richardson, TX 75081
(214) 234-2611 Fax: (214) 234-2874

---

PRINT BAR CODES/BIG TEXT FROM YOUR PROGRAM

Worthington Data Solutions
417A Ingle St., Santa Cruz, CA 95060
(408) 458-9583 (800) 346-6220

---

**PORTABLE READER**

Battery-operated, handheld reader with 64K static RAM, 512K EPROM, LCD display, 32-key keyboard, Real-Time-Clock, Wand or laser scaner. Program prompts and data checking through its own keyboard. Easy data transfer using RS-232 port or PC, 9520 keyboard. Doubles as On-Line Reader. 30-day $89 back.

Worthington Data Solutions
417A Ingle St., Santa Cruz, CA 95060
(408) 458-9583 (800) 346-6220

---

THE BUYER'S MART
A DIRECTORY OF PRODUCTS AND SERVICES
Inquiry 778.

**SECURITY**

**FIGHT PIRACY!**
Since 1986, companies worldwide have been choosing AzTech security products. If you demand the strongest protection available, why not choose one of these "proven leaders":

* **EVERLOCK Copy Protection**
* **EVERTRAK Software Security**
* **EVEYWARE Hardware "Key" Software Security**

For IBM and Compatibles, 30-day money-back guarantee. Free info and demo. Call.

AzTech Software, Inc.
30 East Central, Richmond, MI 48066
(800) 227-0644 Fax: (818) 776-5298

Inquiry 779.

**FREE SOFTWARE FOR IBM/Clones**
Monthly, get 5 disks with 10+ latest programs plus catalog — FREE! Pay only $5.50 for 5/3.25" or $8.50 for 3.5" disks. Join today for only $195 membership fee and get your first month's software—FREE!

SOFTWARE OF THE MONTH CLUB®

Inquiry 780.

**SOFTWARE/AUTOGRAPH**

**Cop's Copylock II**
The professional software protection with TRUE Machine Install, Option Board data. Supports DOS, OS/2, Windows and Tracs.

**LINK Computer/Dancotec N. Am.**
(45) 31223030 U/B/CAN: 800-344-3524 Fax: 405-293-7061

Inquiry 781.

**SOFTWARE/ACCOUNTING**

**Solomon III Software**
Software Accounting Software
Top rated last 6 years
No down time — No lost data
Unmatched Security System
Major Account discounts available
Can Debra J. Tucker
National Trainer, CBM Training
4420 Hotel Circle Cl., #30, San Diego CA 92108
619-210-6516 Fax: 619-220-6016

Inquiry 782.

**SOFTWARE/BUSINESS**

**Data Entry Software**
Full featured, heads-down data entry
Two-pass verification, edit language
Operator saves, much more
Designed for the PS2PC, PC, XT or AT compatibles.

**30 day trial**
Computer: Kayser
Tel: 206-779-0443
Fax: 206-779-7210

Inquiry 783.

**SOFTWARE/ENGINEERING**

**MATFOR**
Best Value for Numerical Computing

IBM Software says that there is clearly signif­icant scientific work embodied in the integrator—the program is lightest weight. Use it under 30-day unconditional guarantee. Lowest priced mathematical tool. From $150. Protected Mold versions also available.

Computational Engineering Associates
3035 Del Mar Heights Road, Suite 183, San Diego CA 92130
(619) 230-8883

Inquiry 784.

**SOFTWARE/GRAPHICS**

**FORTRAN TECHNICAL GRAPHICS**
Tekgraph is a library graphics for the VAX, BGA or Tec­tor Graphics Under VAX, includes Window­ DOM, VIEWPORT, AXIS. Support for HP, Hi plotters, Curve fitting, complete plotting program. Log, semilog, multi-axis, 3-D contours. Please call or write, for Free Catalog.

Rockware, Inc.
4251 Kipling St., Suite 589, Wheat Ridge, CO 80033 USA
(303) 423-5645 Fax: (303) 423-5671

Inquiry 785.

**SOFTWARE/GEOLOGICAL**

**Northern Valley Software**

Inquiry 786.

**SOFTWARE/ENGINEERING**

**Antivirus System**

IBM IMMUNE MSDOS COMPUTERS 100% INTERCEPT ALL VIRUS ACTIVITY

Ultimate Protection by 8-bit card.
Free Information, DEALERS WELCOME

TELSTAR ELECTRONICS
P.O. Box 217, 6169AE Beek, Netherlands, Dept. B1

Inquiry 787.

**SOFTWARE/ENGINEERING**

**CIRCUITS: SPICE**
Non-linear DC & Transient, Linear AC Analyses

*Version* SCI with BIT, MOSFET, JMET, diode, etc.

*NUTMEG* postprocessor with Screen Graphics, Operating Shell, HyperText & circuit file editor included.

*Version 208* now includes Operating Shell, circuit file editor and Touch Screen. Join today for only $999.

Northern Valley Software

Inquiry 788.

**Analog Circuit Simulation**

- Macintosh and PC CAE
- Schematic Entry
- SPICE Simulator
- Model Libraries
- Monte Carlo Analysis
- Plotting/Graphics Output

Intuosoft
The better low cost. F.O. Box 710, San Pedro, CA 90720
(310) 832-0170 Fax (313) 833-6585

Inquiry 789.

**SOFTWARE/ENGINEERING**

**Counterfeit Control**
YOUR PROFIT TO PROFIT
- Ultra secure • Cost effective®
- Choose where, when and usage data • Change parameters by phone • No money dongles or special disks • Hard disk and LAN support

Choose the Next Generation Copy Protection FREE Demo Disk and Info
800-337-640 ext. 212 816-924-8364

MICROCOM INC.

Inquiry 790.

**SOFTWARE/GEOLOGICAL**

**Geological Software**
Geological software for log plotting, grid/cell processing. Statistic & NURBS, fracture analysis, image processing, scout ticket manager, over 50 programs in catalog, Macintosh too! Please call or write, for Free Catalog!

THE BUYER'S MART

Inquiry 791.

**SOFTWARE/GRAPHICS**

**Advanced Systems Consultants**
21115 Devonshire St. #220, Chatsworth, CA 91311
(818) 407-1659

Inquiry 792.

**SOFTWARE/GRAPHICS**

**Tectek Software**
Tectek is a library graphics for the VAX, BGA or Tec­tor Graphics Under VAX, includes Window­ DOM, VIEWPORT, AXIS. Support for HP, Hi plotters, Curve fitting, complete plotting program. Log, semilog, multi-axis, 3-D contours. Please call or write, for Free Catalog.

Rockware, Inc.
4251 Kipling St., Suite 589, Wheat Ridge, CO 80033 USA
(303) 423-5645 Fax: (303) 423-5671

Inquiry 793.
SOFTWARE/GRAPHICS

PostScrip from C
Create a unique PostScript function library
Order today for $149.00
and receive FREE source code!
Barton Creek Software
2222 Western Trails Ste 100, Austin, TX 78745
512-441-8354

Inquiry 794.

SOFTWARE/GRAPHICS

ImageAccess
Create or work with Image files
ImageAccess, a quick and easy way to search, display, print, and organize. Create a data-base of pictures for EGA, VGA, 684A, MPR, PFX, TIFF formats, needs MS-DOS, 312K. See Jerry Pournoulis's recommendations in InterWorld 1/1990. $495 USA, $595 Overseas. Check, M.O., P.O. Satisfaction guaranteed.
Wierenga Software
PO. Box 695, Muskegon, MI 49443

Inquiry 800.

SOFTWARE/LANGUAGES

IntegriAda
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 $795

506 Stevens Ave, Ste. 212 Solana Beach, CA 92075
(818) 755-1277 Fax: (818) 755-7940

Inquiry 801.

SOFTWARE/MATHEMATICS

MATH EDITING FOR THE PC
\[ x^2 = \sum_{i=0}^{n} \left[ \frac{f_i}{2} \right] \]
MathEdit constructs math equations to be inserted into WordPerfect, Word, WordStar, and others.

WYSIWYG interface—no codes need to be learned. Mathematics
K-Talk Communications
30 West First Avenue, Suite 100
Columbia, Oregon 97419
(503) 294-5353

Inquiry 806.

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 range from $150-3000. Call:
1-800-942-MATH
MicroMath, Salt Lake City, UT 84121-0550

Inquiry 808.

SOFTWARE/SECURITY

AXXUM® Technical Graphics
FREE BROCHURE
800-548-5635 ext. 067
Create publication-quality graphs quickly and easily on your PC!
TriMatrix, Inc. 444 NE Ravenna Blvd., Ste 210-B
Seattle, WA 98115 FAX 206-522-9159

Inquiry 810.

SOFTWARE/GRAPHICS

FORTRAN GRAPHICS
GRAPHOMIC/PRINTWRIGHTER LIBRARIES
FORTRAN callable graphics Library for creating 2D and 3D graphics, contour plots and solid models. PRINTWRIGHTER and PLOTWRIGHTER provide high resolution FORTRAN callable and plotter drivers for your graphics.
$29.95. Supports Microsoft/StarDraw or FORTRAN compilers.
Jeffrey Kulak Software, Inc.
6400 East Ave SW, Seattle, WA 98108
1 (800) 284-2574

Inquiry 799.
**MULTI-SPEED III**

**9 TRACK TAPE SUBSYSTEM for IBM PC/AT/386**

**1 YEAR WARRANTY**

- IBM/386 compatible at 800'/1600'/3200 bpi
- Controller, cables and software included
- Interfacing for PS/2®, Xenix® and DEC®
- SCS®, AT or MCA® Bus I/O at 25/50/100 bps.

*Original equipment warranty only*

AKSystems Inc.
20741 Marina St.
Chatsworth, CA 91311
TEL: (818) 709-8100
FAX: (818) 407-5889

---

**FARS! / GREEK / ARABIC / RUSSIAN**

Hurewe, all European, Scandinavian, plus others Hindi, Punjabi, Bengali, Gujrati, Tamil, Telugu, Hangee, Wie, or IPA. Full-featured multi-language word processor supports on-screen foreign characters and XLD printing with no hardware modifications. Includes Font Editor. $345 dot matrix; $150 dot matrix. 30-day Guarantee. MCISA/AMEX

GAMMA PRODUCTIONS, INC.
710 Wilshire Blvd., Suite 609, Santa Monica, CA 90401

---

**Replace Proofreading**

Key, edit, or proof any file on your PC with Word-Processor® then import to your application. New two-pass proofing is faster, more accurate than proofreading or document comparators. Single $295. Multicopy discounts. Network version.

Computer Keyses
800-355-2033
21292 Makah Rd.
Woodway, WA 98020
Fax: 206-776-1219

---

**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

603-924-3754
or
Fax: 603-924-2683

---

**FREE CATALOG**

**RS-232C INTERFACE & MONITORING EQUIPMENT CATALOG**

WRITE IN CALL FOR YOUR FREE CATALOG TODAY! Pages and pages of: programmer's dream and illustrated, descriptive text by B&B's complete line of RS-232 converters, RS-422 converters, current loop converters, adapters, breakout boards, data switches, data splitters, short-haul modems, surge protectors, and much, much more. Most modules meet FCC Part 15J. Your RS-232 needs for quality service and competitive prices will be met with B&B ELECTRONICS. Manufacturer to you, so mid- dleman's money-back guarantee. Satisfaction guaranteed! One-year warranty on products!

Technical support is available. Write for your FREE Catalog Today!

B&B ELECTRONICS
4000 Baker Road P.O. Box 1040. Ottawa, IL 61350
Phone: 815-434-8846

---

**Circle 10 on Inquiry Card.**

---

**Circle 14 on Inquiry Card.**

---

**Circle 27 on Inquiry Card.**

---

**Circle 34 on Inquiry Card.**

---

**Circle 35 on Inquiry Card.**

---

**Write For Your FREE Catalog Today!**

---

**Circle 37 on Inquiry Card.**

---

**Circle 40 on Inquiry Card.**
### AMT International

**Computer Systems**

**AMT gyro 486-25 MHz w/128K Cache**
- 1MB RAM
- 50 MB 2.5" HARD DISK
- MATH Co-Processor Socket
- 1:1 28FD Controller
- 1:2 144 Floppy Drive
- 325 MEGA PORT
- 101 KEYBOARD
- FULL TOY CASE
- w/250 P/S
- SUPPORT UNIX, XENIX, DOS, QNX, NETWORK

**AMT gyro 386-33 MHz w/64K Cache**
- 1MB RAM
- 40 MB HARD DISK
- MATH Co-Processor Socket
- 1:1 28FD Controller
- 1:2 144 Floppy Drive
- 325 MEGA PORT
- 101 KEYBOARD
- MINI-TOWER CASE w/250 P/S
- SUPPORT UNIX, XENIX, DOS, QNX, NETWORK

**AMT gyro 386-25 MHz w/40 MB Hard Disk**
- 1MB RAM
- 40 MB HARD DISK
- INTEL 386-25 MHz CPU
- MATH Co-Processor Socket
- 1:1 28FD Controller
- 1:2 144 Floppy Drive
- 325 MEGA PORT
- 101 KEYBOARD
- AT CASE w/250 P/S
- SUPPORT UNIX, XENIX, DOS, QNX, NETWORK

**AMT gyro 386SX-16 MHz w/40 MB Hard Disk**
- 1MB RAM
- 40 MB HARD DISK
- INTEL 386SX-16 MHz CPU
- MATH Co-Processor Socket
- 1:1 28FD Controller
- 1:2 144 Floppy Drive
- 325 MEGA PORT
- 101 KEYBOARD
- AT CASE w/250 P/S
- SUPPORT UNIX, XENIX, DOS, QNX, NETWORK

---

**Memory Upgrades**

**IBM PS/2 Memory**

- Models 30-266, Exp. Board 147250
- Models 30-286, Exp. Board 147250

**Compaq Memory**

- DeskPro 386-25, 320MB$200
- DeskPro 386-33, 512MB$250
- DeskPro 486-33, 1GB$300

**AST Memory**

- Bravo 286, Workstation
- 512M $299
- 256M $250
- 128M $175

**RAM Memory**

- Desktop 386-20, 386SX-20
- 512M $299
- 256M $250
- 128M $175

**Mini-Packard Memory**

- Vactra 5875
- 512M $299
- 256M $250
- 128M $175

**HEWLETT-PACKARD MEMORY**

- Vactra GS151S
- 1MB $112
- 512K $65
- 256K $37

**DRAM MODULES**

- 2MB 8K$25 16M$35 64M$75
- 4MB 8K$50 32M$100 128M$200
- 8MB 8K$100 256M$500 1GB$1000

**SIMM Modules**

- 8MB 8K$25 32M$100 128M$200
- 16MB 8K$50 64M$100 256M$500
- 32MB 8K$100 512M$1000 1GB$2000

**CPU Chips**

- 80386SX-25 Mhz
- 80386SX-33 Mhz
- 80486-25 MHz

---

**Lowest Prices Same Day Shipping**

Circle 26 on Inquiry Card.
ANNOUNCING:
AN ADVANCE IN 9-TRACK OF VERY SMALL PROPORTIONS.

While everyone else is downsizing and simplifying computers and peripherals, 9-track tape drive manufacturers have somehow managed to buck this trend with drives that are huge and heavy or awkwardly manual loading. Too bad for them. Introducing the OD3210, designed and built by Overland Data to bring 9-track into the modern office. It's incredibly compact. Portable. Whisper quiet. Uses only 45 watts. And is extremely reliable. No other drive has fewer moving parts. Best of all, it's surprisingly affordable.

The OD3210 comes with a two year warranty, expert toll-free support, and the OD Special Service Program. So call us. And find out why some of the best advances are the smallest ones.

1-800-PC9-TRAK
(1-800-729-8725)

4727 Fremont Blvd., Fremont, CA 94539
Tel: 415-623-3818 Fax: 415-623-3840

408732-4500 CALL NOW 800 228 6648 Fax:408732-4570

DATAcap Inc.
914 347-7133 Fax 914 347-7136
Five West Main Elmsford, NY 10523

-handwriting recognition software for data entry:
• Faster than a data entry clerk
• More accurate than manual entry
• Puts your desktop scanner to work
• Reads numbers, letters and punctuation
• Input data from multiple choice check boxes
$895. Eval kit with complete manual: $79

Master your data entry problems. Design forms with Windows DTP or word processing software, aided by the PaperKey font. Fill in your forms with pen or pencil. Store data in any database via ASCII file or DDE. Paper Keyboard makes it fast and easy.
Move From DOS® to UNIX®
Without Compromising Your Standards

Is the productivity of your workgroup hindered by the inability to share programs, resources, and information?

If so, then let Archer Business Products, Inc., registered resellers of SCO®, WordPerfect®, and Lotus® products, release your company from the proprietary trap. We carry a large selection of UNIX operating system software, spreadsheet, database, office automation, word processing, and management tools. In addition to getting the best UNIX software, you’ll receive free technical support, competitive pricing, compatibility verification, prompt shipping, and personal service. Do what many UNIX users have already done. Call today for your free catalog of UNIX business applications.

1-800-288-8996

Archer Business Products, Inc.
427 S. Boston Ave., Suite 614
Tulsa, OK 74103

BY591

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, and entertainment programs. Up to 64 voice commands in RAM at once—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

Voice/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 Conner Street
Eugene, Oregon 97402

TEL (503) 342-1271
FAX (503) 342-1293
BBS (503) 342-4135

Circle 32 on Inquiry Card (RESELLERS: 33).

First Computer Systems, Inc.
3853 Pleasant Valley Road Suite 114
Atlanta, Georgia 30349

404-441-1191

Voice MasterCard

358 BYTE • MAY 1991

Circle 117 on Inquiry Card (RESELLERS: 118).

Circle 80 on Inquiry Card (RESELLERS: 81).
**WE GUARANTEE LOWEST PRICING ON:**
- SEAGATE, CONNER MINICLUSTER HARD DRIVE
- INTEL COPROCESSORS
- 84 & 101 KEY KEYBOARD
- PLUS ANY OTHER ITEM IN THIS AD

**Hcwlet Packard Memory BD**: 2Meg for HP-UX, or Ill (Specify) Expandable to 4Meg

**Your Price** 1399

---

**TOSHIBA MEMORY**

<table>
<thead>
<tr>
<th>Toshiba Model</th>
<th>Memory Capacity</th>
<th>Memory Type</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>PORTABLE 2000X</td>
<td>2MB</td>
<td>1000X &amp; XE</td>
<td>990</td>
</tr>
<tr>
<td>PORTABLE T1500</td>
<td>4MB</td>
<td>2500</td>
<td>1290</td>
</tr>
<tr>
<td>PORTABLE T32000</td>
<td>8MB</td>
<td>7200</td>
<td>1790</td>
</tr>
<tr>
<td>DESKTOP 7800</td>
<td>16MB</td>
<td>7200</td>
<td>2990</td>
</tr>
</tbody>
</table>

**ZENITH MEMORY**

<table>
<thead>
<tr>
<th>Zenith Model</th>
<th>Added Eqpt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>256PAT2020</td>
<td>2MB Module</td>
<td>129</td>
</tr>
<tr>
<td>256PAT4020</td>
<td>4MB Module</td>
<td>199</td>
</tr>
</tbody>
</table>

**EVEREX MEMORY BOARDS**

| RAM 3300 Deluxe | 2MB Meg | 1090 |
| RAM 3300-50Hz | 2MB Meg | 990 |
| RAM 3300-50Hz | 2MB Meg | 890 |

**ISIMM MODULES**

<table>
<thead>
<tr>
<th>Model</th>
<th>Added Eqpt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMM 2M</td>
<td>2MB Module</td>
<td>399</td>
</tr>
<tr>
<td>SIMM 4M</td>
<td>4MB Module</td>
<td>599</td>
</tr>
</tbody>
</table>

**OVERSTOCKED... CALL 800-654-7762... 30 - 70% OFF**

**Daisy Wheel Printer**

<table>
<thead>
<tr>
<th>Model</th>
<th>Added Eqpt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-4</td>
<td>4MB Module</td>
<td>1490</td>
</tr>
</tbody>
</table>

**INTEL COPROCESSORS**

<table>
<thead>
<tr>
<th>Intel Model</th>
<th>Memory Type</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>80586</td>
<td>80586</td>
<td>5990</td>
</tr>
<tr>
<td>80386</td>
<td>80386</td>
<td>7990</td>
</tr>
</tbody>
</table>

**INTEL COPROCESSORS SPECIAL**

<table>
<thead>
<tr>
<th>Intel Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>80386</td>
<td>1490</td>
</tr>
</tbody>
</table>

**IBM PS2 (BOARDS & MODULES)**

<table>
<thead>
<tr>
<th>IBM Model</th>
<th>Added Eqpt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>2900</td>
<td>2MB Module</td>
<td>1190</td>
</tr>
<tr>
<td>2901</td>
<td>4MB Module</td>
<td>1390</td>
</tr>
</tbody>
</table>

**COMPATIBLE MEMORY BOARDS**

<table>
<thead>
<tr>
<th>Model</th>
<th>Added Eqpt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMM 2M</td>
<td>2MB Module</td>
<td>399</td>
</tr>
<tr>
<td>SIMM 4M</td>
<td>4MB Module</td>
<td>599</td>
</tr>
</tbody>
</table>

**COMPATIBLE MEMORY MODULES**

<table>
<thead>
<tr>
<th>Model</th>
<th>Added Eqpt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMM 2M</td>
<td>2MB Module</td>
<td>399</td>
</tr>
<tr>
<td>SIMM 4M</td>
<td>4MB Module</td>
<td>599</td>
</tr>
</tbody>
</table>

**SEAGATE HARD DRIVE**

<table>
<thead>
<tr>
<th>Model</th>
<th>Added Eqpt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>5200</td>
<td>5200</td>
<td>990</td>
</tr>
<tr>
<td>5200</td>
<td>5200</td>
<td>1190</td>
</tr>
</tbody>
</table>

**Video Cards**

<table>
<thead>
<tr>
<th>Model</th>
<th>Added Eqpt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMM 2M</td>
<td>2MB Module</td>
<td>399</td>
</tr>
<tr>
<td>SIMM 4M</td>
<td>4MB Module</td>
<td>599</td>
</tr>
</tbody>
</table>

**Compaq Model | Added Eqpt | Price |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMM 2M</td>
<td>2MB Module</td>
<td>399</td>
</tr>
<tr>
<td>SIMM 4M</td>
<td>4MB Module</td>
<td>599</td>
</tr>
</tbody>
</table>

**Value Added Drive**

<table>
<thead>
<tr>
<th>Model</th>
<th>Added Eqpt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMM 2M</td>
<td>2MB Module</td>
<td>399</td>
</tr>
<tr>
<td>SIMM 4M</td>
<td>4MB Module</td>
<td>599</td>
</tr>
</tbody>
</table>

**Value Added Drive**

<table>
<thead>
<tr>
<th>Model</th>
<th>Added Eqpt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMM 2M</td>
<td>2MB Module</td>
<td>399</td>
</tr>
<tr>
<td>SIMM 4M</td>
<td>4MB Module</td>
<td>599</td>
</tr>
</tbody>
</table>

**Value Added Drive**

<table>
<thead>
<tr>
<th>Model</th>
<th>Added Eqpt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMM 2M</td>
<td>2MB Module</td>
<td>399</td>
</tr>
<tr>
<td>SIMM 4M</td>
<td>4MB Module</td>
<td>599</td>
</tr>
</tbody>
</table>

**SEAGATE HARD DRIVE**

<table>
<thead>
<tr>
<th>Model</th>
<th>Added Eqpt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMM 2M</td>
<td>2MB Module</td>
<td>399</td>
</tr>
<tr>
<td>SIMM 4M</td>
<td>4MB Module</td>
<td>599</td>
</tr>
</tbody>
</table>

**Video Cards**

<table>
<thead>
<tr>
<th>Model</th>
<th>Added Eqpt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMM 2M</td>
<td>2MB Module</td>
<td>399</td>
</tr>
<tr>
<td>SIMM 4M</td>
<td>4MB Module</td>
<td>599</td>
</tr>
</tbody>
</table>

**SEAGATE HARD DRIVE**

<table>
<thead>
<tr>
<th>Model</th>
<th>Added Eqpt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMM 2M</td>
<td>2MB Module</td>
<td>399</td>
</tr>
<tr>
<td>SIMM 4M</td>
<td>4MB Module</td>
<td>599</td>
</tr>
</tbody>
</table>

**SEAGATE HARD DRIVE**

<table>
<thead>
<tr>
<th>Model</th>
<th>Added Eqpt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMM 2M</td>
<td>2MB Module</td>
<td>399</td>
</tr>
<tr>
<td>SIMM 4M</td>
<td>4MB Module</td>
<td>599</td>
</tr>
</tbody>
</table>

**Video Cards**

<table>
<thead>
<tr>
<th>Model</th>
<th>Added Eqpt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMM 2M</td>
<td>2MB Module</td>
<td>399</td>
</tr>
<tr>
<td>SIMM 4M</td>
<td>4MB Module</td>
<td>599</td>
</tr>
</tbody>
</table>
The TransTerm S is a work station data entry/display terminal for on-line shop floor data collection into PC/AT based systems. The unit is one of a family of such terminals which feature LC displays for operator prompting and data entry via a membrane keyboard or an optional barcode wand (Code 39). A multi-terminal polling controller (up to 250 stations) and a dBASE III compatible software package are also available. System costs below $300.00 per station. Call for info.

Options: backlighting for display, RS-422 I/O, 20 Ms current loop I/O, dBASE is a registered trademark of Ashton-Tate, Inc.

COMPUTERVISE, INC.

302 N. Winchester • Olathe, KS 66062 • 913-829-0600 • Fax 913-829-0810

Circle 278 on Inquiry Card.
### IBM MEMORY

<table>
<thead>
<tr>
<th>Model/Type</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>512K MB</td>
<td>1</td>
<td>$79.00</td>
</tr>
<tr>
<td>2MB MB</td>
<td>1</td>
<td>$189.00</td>
</tr>
<tr>
<td>4MB MB</td>
<td>1</td>
<td>$359.00</td>
</tr>
</tbody>
</table>

### COMPAQ MEMORY

<table>
<thead>
<tr>
<th>Model/Type</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>DeskPro 386-3/3-10/20/25/33</td>
<td>1</td>
<td>$199.00</td>
</tr>
<tr>
<td>1MB MB</td>
<td>1</td>
<td>$299.00</td>
</tr>
<tr>
<td>2MB MB</td>
<td>1</td>
<td>$399.00</td>
</tr>
</tbody>
</table>

### LAPTOP MEMORY

<table>
<thead>
<tr>
<th>Model/Type</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toshiba</td>
<td>1</td>
<td>$199.00</td>
</tr>
</tbody>
</table>

### PRINTER MEMORY

<table>
<thead>
<tr>
<th>Type</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hewlett-Packard LaserJet 4400</td>
<td>1</td>
<td>$199.00</td>
</tr>
<tr>
<td>Canon</td>
<td>1</td>
<td>$199.00</td>
</tr>
</tbody>
</table>

### AST MEMORY

<table>
<thead>
<tr>
<th>Type</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premium 386 and 386-16</td>
<td>1</td>
<td>$199.00</td>
</tr>
<tr>
<td>1MB MB</td>
<td>1</td>
<td>$299.00</td>
</tr>
</tbody>
</table>

### ZENITH MEMORY

<table>
<thead>
<tr>
<th>Type</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zenith Z-386/25/25X/33X</td>
<td>1</td>
<td>$199.00</td>
</tr>
<tr>
<td>Zenith Z-386/33X</td>
<td>1</td>
<td>$299.00</td>
</tr>
</tbody>
</table>

### HEWLETT-PACKARD MEMORY

<table>
<thead>
<tr>
<th>Type</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vectro G3/1020/108 &amp; G3/128PC</td>
<td>1</td>
<td>$199.00</td>
</tr>
<tr>
<td>Vectro G3/1080/1000/1080/1200</td>
<td>1</td>
<td>$299.00</td>
</tr>
</tbody>
</table>

### SIMM MODULES

<table>
<thead>
<tr>
<th>Type</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple/Macintosh</td>
<td>1</td>
<td>$199.00</td>
</tr>
</tbody>
</table>

### EXPANSION BOARDS

<table>
<thead>
<tr>
<th>Type</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Everex RAM 3000 Deluxe</td>
<td>1</td>
<td>$199.00</td>
</tr>
</tbody>
</table>

### DRAM CHIPS

<table>
<thead>
<tr>
<th>Type</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1MBX1</td>
<td>1</td>
<td>$199.00</td>
</tr>
</tbody>
</table>

### WE ACCEPT INTERNATIONAL ORDERS!

3 DAY INTERNATIONAL DELIVERY VIA FED EX OR DHL
- QUALITY PRODUCTS • PRICES • SERVICE • WARRANTY
- UNLIMITED SELECTION • TECHNICAL SUPPORT
- WE ACCEPT PURCHASE ORDERS
- CALL 714-588-9866 OR FAX 714-588-9872

WE WILL BEAT ANY ADVERTISED PRICE! - WHY CALL ANYONE ELSE?

TOLL FREE FROM ANYWHERE IN THE US OR CANADA
ORDER NOW! 1-800-535-5892

WE ACCEPT VISA, MASTERCARD AND AMERICAN EXPRESS

No surcharge on Visa or Mastercard. Amex add 4%.

WE SHIP WORLDWIDE

Manufacturers part numbers are for your convenience. All products are third party. 100% compatible or full refund.

We will beat any advertised price of after good for Simms or Dram.
DEVELOPER'S TOOLS

NICE-51 satisfies you, who expects excellent functions, attractive price and easy to use. What a surprise, now you have it!

8051 IN-CIRCUIT EMULATOR NICE-51
PC BASED FROM $950
• Up to 12 MHz Real-Time without interrupting Interrupt, Serial Channel, 50 or Code Sync.
• Built-in programmer for EPROM & 8751
• Handles Binary, Hex. & Symbolic file and down-load data to external RAM
• With full screen editor, CCP, Code, External data, Interfacing data and BitBuffer
• Handles Binary, Hex., ASCII
• Features all standard 16-32 bit macros
• Simulates totally different processors
• Full down-load and upload of all 8051 files
• Enables 12MHz operation
• 24 hour support

COMPUTER MODULES INC.
(415) 623-9925
Fax: (415) 623-8816
44388 S. Gruimer Blvd., Fremont CA 94538

Circle 316 on Inquiry Card.
Circle 317 on Inquiry Card.
Circle 318 on Inquiry Card.

Circle 281 on Inquiry Card.
Circle 210 on Inquiry Card.
Circle 154 on Inquiry Card.

Circle 377 on Inquiry Card.
Circle 206 on Inquiry Card.
Circle 262 on Inquiry Card.
New Schematic and PCB Software
With support for extended and expanded memory, HiWIRE II can handle your most demanding schematic and PCB designs quickly and easily. The unique HiWIRE editor allows you to display and edit schematics and PCBs simultaneously, using the same commands for each. HiWIRE II is $995, and is guaranteed.

WINTEK Corporation
1801 South Street, Lafayette, IN 47904
(800) 742-6809 or (317) 448-1903

Circle 339 on Inquiry Card.

8051/8052 BASIC COMPILER
Saves Time And Money
• Compatible with all 8051 variants.
• Supports floating point, integer, byte and bit data types.
• Code runs 50 times faster than BASIC-52 interpreter.
• Flexible memory mapping options.
• Trace command for debugging. Improved error reporting.

$295.00

Upgrades: Vers. 1 to Vers. 3—$125.
Vers. 2 to Vers. 3—$75.
603-469-3232 • FAX: 603-448-3530

Binary Technology, Inc.

Circle 128 on Inquiry Card.

IMAGING CARDS
• Complete software
• Real time grab/display
• PC/XT/AT/386 compatible
CV-512 Advanced 8 bit board. 512 x 480 or 256 x 240 (4 images), in/out LUTS, 4 inputs, "ping pong" buffers, 24 bit RGB output $1,095
CV-02 256 x 240 x 8 bits, 2 inputs, cursor, 24 bit RGB output $595
CV-03 6 bit CV-02, 8 bit output $468

Control Vision
PO Box 596, Pittsburgh, Kansas 66762
800/292-1160, 316/231-6647

Circle 74 on Inquiry Card.

DEC/TEK Terminal Emulation
EM4105
• Tektronix 4050/4010/4014
• DEC VT520, VT220, VT102
• 16 color VGA/EQA support
• PostScript. HP Laserjet, plotter high resolution hardcopy
• Pan/Zoom, mouse support
• Extensive network support

EM320
• DEC VT520, VT220, VT102
• True 132 column display
• Remappable keyboard
• KERMIT Xmodem transfer
• DOS host (only 32 Kb)
• Extensive network support

Diversified Computer Systems, Inc.
3795 Ire Avenue, Suite 1B
Boulder, CO 80301 (303) 447-9291
FAX 303-447-1406

Circle 102 on Inquiry Card.

There is a Difference!
Lifetime Free Updates
CP-1128 $1295

A programmer is not just another programmer. That is why BP Microsystems is committed to bringing our customers the highest quality programmers at an affordable price. This commitment is evident in our CP-1128 Combination PROM/EPROM/PLD Programmer supporting over 1800 devices up to 28-pins. Call today!

BP Microsystems
1-800-225-2102
713/461-9430

Circle 52 on Inquiry Card.
NEWBORN OPPORTUNITIES

There is a new arrival in personal computing. Fujikama, a leader in the design and manufacture of high quality motherboards for major O.E.Ms, has given birth to a new line of upgradeable modular computers. Now, you can have exceptional performance at affordable prices. Never before has an opportunity existed for so much power and compatibility in a modular design.

Our 386SX and 386DX CPU modules utilize the Intel smart cache design to provide 10% more power over conventional cache memory design. The result is pure speed. Fujikama personal computers are available with Industry Standard Architecture (ISA) or Extended Industry Standard Architecture (EISA). Each features a modular design that is upgradeable so what you purchase today will not be obsolete tomorrow. When you are ready to upgrade or expand you replace only the CPU. There are no switches to set and your data remains intact. In less than five minutes you can increase your computer power from 286 to 486 with the snap of a new board. The cost for upgrading is just as easy. You pay only for the upgradeable board, not the whole computer.

Fujikama modular computers come in a desktop, middle or large tower model. They feature full technical support and service. Call now for more information on how we can fulfill your opportunity to own the new modular family of personal computers from Fujikama.

SEE US AT COMDEX/Spring '91! Booth 3843

FUJIKAMA is a registered trademark of FUJIKAMA O.A. Distribution. All other Registered Trademarks and other Trademarks are of their respective companies.

Circle 371 on Inquiry Card (RESELLERS: 372).
Now you can exchange data files between your IBM PC and any mainframe or mini-computer using IBM compatible 1600 or 6250 BPI 9-track tape. System can also be used for disk backup. Transfer rate is up to 4 mebibytes per minute on PCs and compatibles. Subsystems include 7” or 10” streaming tape drive, tape coupler card and DOS compatible software. For more information, call us today!
Data Acquisition & Control

TE-158 Telephone Control Card: Take total control over your telephone communication. Direct telephone line interface gives you control over line connect/disconnect, touch-tone decoding and encoding, and detects call progress. Set your computer to dial out automatically, to keep trying if busy signal, control voice synthesizer, tape recorder with complete in/out capability. FCC approved. TE-158: $190.00

8 Bit A to D: 8 Analog inputs. 0.51V-20mV steps. 7500 readings/sec. AD-142: $142

FA-154 High Speed 12 Bit A/D Converter: Blinding speed at low cost! Convert at 10 μs. Eight input channels accepting 0-5V signals. Special onboard variable gain amplifier lets you read signals less than 10LSB (1.2mV). For value combined with speed in data acquisition and signal processing, this converter leads the pack! FA-154: $179.00

A-Bus Adapters: IBM PC/XT/AT & compatibles. AR-133: $69

MicroChannel Adapter: Parallel adapters also available for Apple II, Commodore 64, 128, TRS-80. AR-17C: $93

Serial Adapter: Connect A-Bus systems to any RS-232 port. SA-129: $149

MicroChannel Adapter: Connect A-Bus systems to any RS-232 port. SA-129: $149

Serial Processor: Built in BASIC for off-line monitoring, logging, decision making. SP-127: $189

MAY 1991 • BY E 367
LOW PRICES SINCE 1983
International Orders
We Honor Manufacturer's Warranties
Call for details

EVEREX
Everex System I CALL
Everex Step 366SX-2 meg
40 meg VGA card and monitor

Everex System II CALL
Everex Step 366/33-4 meg
150 meg VGA card and monitor
* Call for models & configurations *

AGI COMPUTER
AGI 386SX-1 meg
40 meg VGA card and monitor
CALL FOR OTHER MODELS

PS/2 model 55SX-60 meg .......... 2595
PS/2 model 70-60 meg .......... 3195
PS/2 model 65SX-60 meg .......... 3325
PS/2 model 70-A21 ............ 4725
PS/2 model 95-320 meg .......... 14950
*** Monitor Extra ***

LENOVO SPECIALS
ELS I ................................. 599
ELS II ................................ 1250
Advance 286 V 2.15 .......... 2150
Advance SFT V 2.15 .......... 2999
Advance C 3.1 ................. 4995

NOVELL SPECIALS
ELS I .................................. 599
ELS II ................................ 1250
Advance 286 V 2.15 .......... 2150
Advance SFT V 2.15 .......... 2999
Advance C 3.1 ................. 4995

WE STOCK Toshiba

HARD DISKS
CONNER
CP3044 40 meg ............. 305
CP3014 100 meg .......... 525
CP30104 120 meg .......... 575
CP3204F 220 meg ...... 845
MAXTOR
XT8760E 676 meg ... 1895
XT8760S 676 meg .... 2150

SOFTWARE SPECIAL
Retrace 4.5 ................. 655
Wordperfect 5.1 .... 260
Adus Pagemaker .......... 495
Ventura Publisher .... 525
Clipper ...................... 535
WordStar 5.5 ........ 150
EasyExtra ................. 40

PACIFIC DATA PRODUCTS
P. Page II ................. 345
P. Page HP ............. 355
P. 1-2-4 Mem II .... 140
P. One Meg HP ........ 145
P. 25 in One ........ 250
P. Headlines ........ 245

LAPTOP MEMORY
2 meg Toshiba 3100SX .... 179
2 meg Toshiba 3200 .... 185
2 meg Toshiba 3200SX .... 180
1 meg Compaq SLT/LTE ..... 220
CALL FOR OTHER BRANDS

LAPTOP
Texas Instruments TM2000 .................................................. 1995
Texas Instruments TM3000 .................................................. 3495
AST Exec 366SX/20-40 meg .............................................. 3150
Compaq LTE/286-40 meg .................................................. 2875
Compaq LTE/386-60 meg .................................................. 4995
Sharp 6220-20 meg .................................................... 2195

COMPAQ
DeskPro Models
286E-40/120 meg ........ 1995/2150
386S-20 MHz 120 meg .................................................. 2575
386/20E-120 meg ........ 2995
386/25E-120 meg .......... 4395
386/33-320 meg .......... 8325
* Call for other models – Monitor Extra *

SOFTWARE SPECIAL
dBase IV .......... 455
Wordperfect 5.1 ...... 250
Adus Pagemaker ........ 495
Ventura Publisher .... 525
Clipper .............. 535
WordStar 5.5 ........ 150
EasyExtra ........ 40

NOVELL Authorized Dealer

P. Page II ............. 345
P. Page HP ............ 355
P. 1-2-4 Mem II ..... 140
P. One Meg HP ..... 145
P. 25 in One ........ 250
P. Headlines ........ 245

LAN BOARDS
8 bit Arctec ........ 110
16 bit Arctec .......... 220
8 bit Ethernet .... 190
16 bit Ethernet .... 276
6 port Active Hub ... 325
Token Ring Card .... 399
Tokenhub 4-port ... 355
Call for other LAN Accessories

SPECIALS
HP Scan Jet .......... 1425
HP Paint Jet .......... 965
Lotus Ver. 3.1 .... 355
Kodak 150P .......... 345
Canon BJ 10 .......... 345
Intel Satisfactio .... 425
Okidata 391 .......... 515
Epson LQ 1050 .... 625
HP-7475 Plotter .... 1495
IBM Token-Ring .... 655
Panasonic 1124 ... 299
Intel 80387-33 .... 565

PASCAL
P. Page II ........ 345
P. Page HP .... 355
P. 1-2-4 Mem II .... 140
P. One Meg HP ...... 145
P. 25 in One ........ 250
P. Headlines ........ 245

LASER PRINTERS
HP Laser IID ........ 2550
HP Laser 2P .......... 995
HP Laser III .......... 1650
Panasonic 4450 .... 1395
NEC 2 Model 90 ........ 1695
NEC 2 Model 290 .... 2675
TI PS17 ................. 1595

MODEMS
Everex 2400 Int/Mpp ... 179
Hayes 2400B ........ 315
Hayes 9600B .... 875
USRobotics Hst/Dual ... 1150
More in stock ........ 365

ALL QUOTED PRICES ARE CASH PRICES ONLY
Visa and MasterCard 3% higher,
American Express 5% higher
Prices subject to change without notice.
* Quantities are limited

Computerlane
Outside California: 1-800-526-3482
Inside California: 818-884-8644 • FAX: 818-884-8253
22107 Roscoe Blvd., Canoga Park, CA 91304 • 1/2 Block west of Topanga
Hours: Monday - Friday 9 - 6 Saturday 10 - 6
Corporate Accounts Welcome
Call for Volume Discounts
Consultants Call for Pricing
Exports Available

368 BYTE • MAY 1991
Circle 72 on Inquiry Card.
Circle 11 on Inquiry Card.

Circle 25 on Inquiry Card.

Circle 378 on Inquiry Card.

Circle 196 on Inquiry Card.

Circle 378 on Inquiry Card.

Circle 196 on Inquiry Card.

Circle 329 on Inquiry Card.

Circle 378 on Inquiry Card.

Circle 329 on Inquiry Card.

Circle 179 on Inquiry Card.

Circle 183 on Inquiry Card.

Circle 168 on Inquiry Card.

Circle 177 on Inquiry Card.
H. Co. Computer Products

America's Largest Selection of Memory

Orders: 1-800-726-2477 Ext 200
Tech Support: 1-714-833-3364

Information: 1-714-833-3222
FAX: 1-714-833-3387
17992 Sky Park Circle #F
Irvine, CA 92714

<table>
<thead>
<tr>
<th>Part #</th>
<th>EO</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>7836595</td>
<td>2</td>
<td>9.00</td>
</tr>
<tr>
<td>7872650</td>
<td>2</td>
<td>9.00</td>
</tr>
<tr>
<td>1057036</td>
<td>2MB</td>
<td>299.00</td>
</tr>
<tr>
<td>7835348</td>
<td>2MB</td>
<td>49.00</td>
</tr>
<tr>
<td>6450003</td>
<td>1MB</td>
<td>70.00</td>
</tr>
<tr>
<td>6450004</td>
<td>2MB</td>
<td>128.00</td>
</tr>
<tr>
<td>6450008</td>
<td>2MB</td>
<td>130.00</td>
</tr>
<tr>
<td>34F2303</td>
<td>2MB</td>
<td>149.00</td>
</tr>
<tr>
<td>6450375</td>
<td>1MB</td>
<td>80-041</td>
</tr>
<tr>
<td>6450379</td>
<td>2MB</td>
<td>119.00</td>
</tr>
<tr>
<td>6159609</td>
<td>2MB</td>
<td>195.00</td>
</tr>
<tr>
<td>6450402</td>
<td>2MB</td>
<td>199.00</td>
</tr>
<tr>
<td>6412248</td>
<td>2MB</td>
<td>229.00</td>
</tr>
<tr>
<td>6450905</td>
<td>2MB</td>
<td>429.00</td>
</tr>
<tr>
<td>34F2777</td>
<td>1MB</td>
<td>469.00</td>
</tr>
<tr>
<td>6450609</td>
<td>2MB</td>
<td>529.00</td>
</tr>
</tbody>
</table>

We Stock Memory for 99% of the Available Computers & Printers
Ask for Upgrades not Listed
We Will Match or Beat any Legitimate Advertised Price.
We Carry Floppy Drives.

Orders: 1-800-726-2477 Ext 200
In the BIX community we take care of people who use IBM PCs or their compatibles. For example, our IBM Exchange offers a growing list of programs which you can download for free. These 2,168 programs are the cream of the crop. All of them are tested in advance by BIX moderators so you know you’re getting top-quality, virus-free programs. Here are some of the most popular ones:

<table>
<thead>
<tr>
<th>BIX FILE NAME</th>
<th>BIX CONFERENCE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>stars.zip</td>
<td>microsoft</td>
<td>Utility that turns your Windows desktop into a view of deep space. Choose impulse or warp speed and launch several Windows utilities from a floating pop-up menu.</td>
</tr>
<tr>
<td>e.arc</td>
<td>ibm.utils</td>
<td>Public-domain text editor, with source code.</td>
</tr>
<tr>
<td>secrets2.arc</td>
<td>ibm.dos</td>
<td>Condensed and edited messages from the ibm.dos/secrets topic. Tricks and undocumented internals of MS/DOS.</td>
</tr>
<tr>
<td>tetris2.zip</td>
<td>microsoft</td>
<td>KLOTZ, a Tetris® clone for Microsoft Windows 3.</td>
</tr>
<tr>
<td>2zip25.zip</td>
<td>ibm.utils</td>
<td>Converts a variety of archive formats (including ARC, PAK, ZOO, LZH) to PKWare’s ZIP format.</td>
</tr>
<tr>
<td>w3icons.zip</td>
<td>microsoft</td>
<td>40 new icons for the Windows 3 Program Manager.</td>
</tr>
<tr>
<td>firework.zip</td>
<td>microsoft</td>
<td>Fireworks display in a window, for Windows 3.</td>
</tr>
<tr>
<td>monitor.arc</td>
<td>ibm.os2</td>
<td>Continuous display of CPU load for OS/2 Presentation Manager.</td>
</tr>
<tr>
<td>abort.exe</td>
<td>ibm.utils</td>
<td>TSR that aborts any program when you press Alt-C.</td>
</tr>
</tbody>
</table>

Besides great free programs, the IBM Exchange offers dozens of informative and provocative conferences on OS/2, PC/DOS and MS/DOS operating systems, alternative 386 operating systems, utility software, communications programs, LANs and more. There’s even a “Repairshop” conference, and maybe as a last resort, an IBM clearing house. Beyond our IBM Exchange, we provide industry news and product information that’s essential to your performance as a microcomputer pro. All of these privileges are yours with a subscription to BIX. To find out more, call our special Customer Service number: 1-800-227-2983 (in NH call 603-924-7681).
EDITORIAL INDEX BY COMPANY

Index of companies covered in articles, columns, or news stories in this issue
Each reference is to the first page of the article or section in which the company name appears

<table>
<thead>
<tr>
<th>Company, Page #</th>
<th>Inquiry #</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Abaton, 80</td>
<td>1310</td>
</tr>
<tr>
<td>Access Technology, 86</td>
<td>1275</td>
</tr>
<tr>
<td>Acme Computers, 216</td>
<td>1400</td>
</tr>
<tr>
<td>Adobe Systems, 29</td>
<td></td>
</tr>
<tr>
<td>Advanced Graphics</td>
<td></td>
</tr>
<tr>
<td>Applications, 213</td>
<td></td>
</tr>
<tr>
<td>Advanced Logic Research, 29, 216</td>
<td>1461</td>
</tr>
<tr>
<td>Agility Systems, 177</td>
<td>978</td>
</tr>
<tr>
<td>Aldus, 29, 58</td>
<td>1171</td>
</tr>
<tr>
<td>Alltela Software, 80</td>
<td>1313</td>
</tr>
<tr>
<td>Alphatronix, 213</td>
<td>0651</td>
</tr>
<tr>
<td>American Mic, 216</td>
<td>1402</td>
</tr>
<tr>
<td>American Power Conversion, 249</td>
<td>1288</td>
</tr>
<tr>
<td>Amstrad, 10</td>
<td></td>
</tr>
<tr>
<td>Apple Computer, 29, 48, 157</td>
<td>1165</td>
</tr>
<tr>
<td>Aquideck Systems</td>
<td></td>
</tr>
<tr>
<td>International, 213</td>
<td>1255</td>
</tr>
<tr>
<td>Arche Technologies, 68</td>
<td>1290</td>
</tr>
<tr>
<td>Archive, 201</td>
<td></td>
</tr>
<tr>
<td>Areal Technology, 29</td>
<td></td>
</tr>
<tr>
<td>AST Research, 29</td>
<td></td>
</tr>
<tr>
<td>AT&amp;T, 29, 213, 216</td>
<td>1062</td>
</tr>
<tr>
<td>Atari, 93</td>
<td>1159</td>
</tr>
<tr>
<td>Alto Technology, 70</td>
<td>1296</td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Belden Wire &amp; Cable, 29</td>
<td></td>
</tr>
<tr>
<td>Bell &amp; Howell Document Management Products, 213</td>
<td>1063</td>
</tr>
<tr>
<td>Belcore, 29</td>
<td></td>
</tr>
<tr>
<td>Berkeley Systems, 93</td>
<td>1157</td>
</tr>
<tr>
<td>Binmillennium, 90</td>
<td>1279</td>
</tr>
<tr>
<td>Bitstream, 29</td>
<td></td>
</tr>
<tr>
<td>Bitwise Designs, 216</td>
<td>1404</td>
</tr>
<tr>
<td>Blue Star Computers, 216</td>
<td>1405</td>
</tr>
<tr>
<td>Boca Research, 70</td>
<td>1299</td>
</tr>
<tr>
<td>Bordant International, 29, 56, 86</td>
<td>1167</td>
</tr>
<tr>
<td>Brigham Young University, 297</td>
<td>1277</td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Cablertron Systems, 78, 153</td>
<td>1309</td>
</tr>
<tr>
<td>Canon, 10, 29</td>
<td>1305</td>
</tr>
<tr>
<td>Casio, 74</td>
<td></td>
</tr>
<tr>
<td>Cedar Software, 386</td>
<td></td>
</tr>
<tr>
<td>Clarity Software, 318</td>
<td>1154</td>
</tr>
<tr>
<td>Clarkson University, 297</td>
<td></td>
</tr>
<tr>
<td>Compaq Computer, 28, 216</td>
<td>1406</td>
</tr>
<tr>
<td>Computer Associates, 29</td>
<td></td>
</tr>
<tr>
<td>Computer System Architects, 70</td>
<td></td>
</tr>
<tr>
<td>Contec Microelectronics U.S.A., 145</td>
<td></td>
</tr>
<tr>
<td>Control Data, 213</td>
<td>1064</td>
</tr>
<tr>
<td>Corporate Software, 29</td>
<td></td>
</tr>
<tr>
<td>CSA Interprint, 10</td>
<td></td>
</tr>
<tr>
<td>Cubital, 137</td>
<td></td>
</tr>
<tr>
<td>Custom Computer Systems, 216</td>
<td></td>
</tr>
<tr>
<td>Cygnets Systems, 213</td>
<td>1065</td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Data Translation, 145</td>
<td></td>
</tr>
<tr>
<td>Database Technologies, 29</td>
<td></td>
</tr>
<tr>
<td>Dell Computer, 29, 216</td>
<td>1408</td>
</tr>
<tr>
<td>Delta Microsystems, 213</td>
<td>1066</td>
</tr>
<tr>
<td>Desktop Computing, 266</td>
<td>1225</td>
</tr>
<tr>
<td>Desktop Data, 153</td>
<td></td>
</tr>
<tr>
<td>Digital Equipment, 137, 213</td>
<td>1067</td>
</tr>
<tr>
<td>Dilog, 213</td>
<td>1068</td>
</tr>
<tr>
<td>Dr. T's Music Software, 93</td>
<td>1156</td>
</tr>
<tr>
<td>Dow Jones News Retrieval, 157</td>
<td></td>
</tr>
<tr>
<td>DTM, 137</td>
<td></td>
</tr>
<tr>
<td>Dyna Micro, 216</td>
<td>1409</td>
</tr>
<tr>
<td>E</td>
<td></td>
</tr>
<tr>
<td>East Coast Software, 10</td>
<td></td>
</tr>
<tr>
<td>Edman Kodak, 287</td>
<td>1227</td>
</tr>
<tr>
<td>Eden Group, 29</td>
<td>1229</td>
</tr>
<tr>
<td>Elgar, 74, 249</td>
<td>1301</td>
</tr>
<tr>
<td>Elk Horn Publishing, 334</td>
<td>1148</td>
</tr>
<tr>
<td>Epoch Systems, 213</td>
<td>1069</td>
</tr>
<tr>
<td>Everex Systems, 70</td>
<td>1300</td>
</tr>
<tr>
<td>Exactum, 201, 123</td>
<td>1070</td>
</tr>
<tr>
<td>Extended Systems, 277</td>
<td>981</td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Facit, 74</td>
<td>1304</td>
</tr>
<tr>
<td>F-Chart Software, 90</td>
<td>1278</td>
</tr>
<tr>
<td>FileNet, 213</td>
<td>1071</td>
</tr>
<tr>
<td>Forrester Research, 191</td>
<td></td>
</tr>
<tr>
<td>Fujitsu, 29</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td></td>
</tr>
<tr>
<td>Gadgets by Small, 93</td>
<td>1162</td>
</tr>
<tr>
<td>GCC Technologies, 29</td>
<td></td>
</tr>
<tr>
<td>GE Research and Development Center, 153</td>
<td></td>
</tr>
<tr>
<td>GC Corp., 29</td>
<td></td>
</tr>
<tr>
<td>Grid Systems, 29</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td></td>
</tr>
<tr>
<td>Hertz Computer, 69</td>
<td>1295</td>
</tr>
<tr>
<td>Hewlett-Packard, 29, 44, 128, 213, 297</td>
<td>983</td>
</tr>
<tr>
<td>1298</td>
<td>1072</td>
</tr>
<tr>
<td>Hitachi America, 29, 201, 213</td>
<td>1081</td>
</tr>
<tr>
<td>Human Designed Systems, 238</td>
<td>1073</td>
</tr>
<tr>
<td>1074</td>
<td></td>
</tr>
<tr>
<td>IBM, 29</td>
<td>1026</td>
</tr>
<tr>
<td>IDEC, 70</td>
<td>1298</td>
</tr>
<tr>
<td>Individual Incorporated, 153</td>
<td></td>
</tr>
<tr>
<td>InfoCorp, 201</td>
<td></td>
</tr>
<tr>
<td>Information Research Institute, 29</td>
<td></td>
</tr>
<tr>
<td>Information Storage Devices, 29</td>
<td></td>
</tr>
<tr>
<td>Insight Development, 78</td>
<td>1308</td>
</tr>
<tr>
<td>Intel, 29</td>
<td></td>
</tr>
<tr>
<td>Interactive Systems, 318</td>
<td>1155</td>
</tr>
<tr>
<td>International Data, 177</td>
<td>978</td>
</tr>
<tr>
<td>Intuit, 93</td>
<td>1161</td>
</tr>
<tr>
<td>IRotech, 145</td>
<td></td>
</tr>
<tr>
<td>Irwin Magnetic Systems, 92</td>
<td>1284</td>
</tr>
<tr>
<td>Island Graphics, 292</td>
<td>1105</td>
</tr>
<tr>
<td>J</td>
<td></td>
</tr>
<tr>
<td>John Fluke Manufacturing, 145</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td></td>
</tr>
<tr>
<td>Keithley Metabyte, 145</td>
<td></td>
</tr>
<tr>
<td>Kyocera, 10, 29</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Laser Magnetic Storage International, 213</td>
<td>1256</td>
</tr>
<tr>
<td>Library of Congress, 157</td>
<td></td>
</tr>
<tr>
<td>Litera, 213</td>
<td></td>
</tr>
<tr>
<td>Lotus Development, 29, 93</td>
<td>1158</td>
</tr>
<tr>
<td>Lucky Computer, 216</td>
<td>1410</td>
</tr>
<tr>
<td>M</td>
<td></td>
</tr>
<tr>
<td>Mainstay, 334</td>
<td>1147</td>
</tr>
<tr>
<td>Mannesmann Tally, 56</td>
<td>1168</td>
</tr>
<tr>
<td>Memory Tech, 213</td>
<td>1257</td>
</tr>
<tr>
<td>Metaphor, 29</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td></td>
</tr>
<tr>
<td>National Information Standards Organization, 157</td>
<td></td>
</tr>
<tr>
<td>National Instruments, 145</td>
<td></td>
</tr>
<tr>
<td>National Semiconductor, 29</td>
<td></td>
</tr>
<tr>
<td>NCR, 236</td>
<td>1076</td>
</tr>
<tr>
<td>NEC, 10, 29</td>
<td></td>
</tr>
<tr>
<td>NetFrame Systems, 153</td>
<td></td>
</tr>
<tr>
<td>Network Computing Devices, 238</td>
<td>1079</td>
</tr>
<tr>
<td>Network Monitoring, 78</td>
<td>1307</td>
</tr>
<tr>
<td>Next, 29</td>
<td></td>
</tr>
<tr>
<td>Novell, 29, 111, 297</td>
<td>1222</td>
</tr>
<tr>
<td>O</td>
<td></td>
</tr>
<tr>
<td>Oakland Group, 84</td>
<td>1272</td>
</tr>
<tr>
<td>Oki, 29</td>
<td></td>
</tr>
<tr>
<td>Open, 84</td>
<td>1273</td>
</tr>
<tr>
<td>Optimin, 213</td>
<td>1260</td>
</tr>
<tr>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Pacific Data Products, 277</td>
<td>979</td>
</tr>
<tr>
<td>Panaces, 29</td>
<td></td>
</tr>
<tr>
<td>Paracomp, 334</td>
<td>1150</td>
</tr>
<tr>
<td>PC Craft, 216</td>
<td>1413</td>
</tr>
<tr>
<td>Peripheral Strategies, 191</td>
<td></td>
</tr>
<tr>
<td>Phil Key, 297</td>
<td></td>
</tr>
<tr>
<td>Pick Systems, 318</td>
<td>1153</td>
</tr>
<tr>
<td>Pinnacle Micro, 213</td>
<td>1261</td>
</tr>
<tr>
<td>Pioneer Communications, 213</td>
<td>1262</td>
</tr>
<tr>
<td>Pivotal Technologies, 80</td>
<td>1312</td>
</tr>
<tr>
<td>Preferred Publishers, 334</td>
<td>1149</td>
</tr>
<tr>
<td>PSI Integration, 80</td>
<td>1311</td>
</tr>
</tbody>
</table>
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
### ALPHABETICAL INDEX TO ADVERTISERS

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>367</td>
<td>89</td>
<td>414</td>
<td>90</td>
<td>468</td>
<td>124</td>
<td>487</td>
<td>14</td>
</tr>
<tr>
<td>401</td>
<td>19</td>
<td>402</td>
<td>76</td>
<td>403</td>
<td>21</td>
<td>404</td>
<td>25</td>
</tr>
<tr>
<td>405</td>
<td>29</td>
<td>406</td>
<td>33</td>
<td>407</td>
<td>35</td>
<td>408</td>
<td>39</td>
</tr>
<tr>
<td>409</td>
<td>43</td>
<td>410</td>
<td>47</td>
<td>411</td>
<td>51</td>
<td>412</td>
<td>55</td>
</tr>
<tr>
<td>413</td>
<td>59</td>
<td>414</td>
<td>63</td>
<td>415</td>
<td>67</td>
<td>416</td>
<td>71</td>
</tr>
<tr>
<td>417</td>
<td>75</td>
<td>418</td>
<td>79</td>
<td>419</td>
<td>83</td>
<td>420</td>
<td>87</td>
</tr>
<tr>
<td>421</td>
<td>91</td>
<td>422</td>
<td>95</td>
<td>423</td>
<td>99</td>
<td>424</td>
<td>103</td>
</tr>
<tr>
<td>425</td>
<td>107</td>
<td>426</td>
<td>111</td>
<td>427</td>
<td>115</td>
<td>428</td>
<td>119</td>
</tr>
<tr>
<td>429</td>
<td>123</td>
<td>430</td>
<td>127</td>
<td>431</td>
<td>131</td>
<td>432</td>
<td>135</td>
</tr>
<tr>
<td>433</td>
<td>139</td>
<td>434</td>
<td>143</td>
<td>435</td>
<td>147</td>
<td>436</td>
<td>151</td>
</tr>
<tr>
<td>437</td>
<td>155</td>
<td>438</td>
<td>159</td>
<td>439</td>
<td>163</td>
<td>440</td>
<td>167</td>
</tr>
<tr>
<td>441</td>
<td>171</td>
<td>442</td>
<td>175</td>
<td>443</td>
<td>179</td>
<td>444</td>
<td>183</td>
</tr>
<tr>
<td>445</td>
<td>187</td>
<td>446</td>
<td>191</td>
<td>447</td>
<td>195</td>
<td>448</td>
<td>199</td>
</tr>
<tr>
<td>449</td>
<td>203</td>
<td>450</td>
<td>207</td>
<td>451</td>
<td>211</td>
<td>452</td>
<td>215</td>
</tr>
<tr>
<td>453</td>
<td>219</td>
<td>454</td>
<td>223</td>
<td>455</td>
<td>227</td>
<td>456</td>
<td>231</td>
</tr>
<tr>
<td>457</td>
<td>235</td>
<td>458</td>
<td>239</td>
<td>459</td>
<td>243</td>
<td>460</td>
<td>247</td>
</tr>
</tbody>
</table>

* Correspond directly with company.
Inquiry No. Page No.

To get further information on the products advertised in BYTE, fill out the reader inquiry card by the publisher, who assumes no liability for errors or omissions.

BYTE ADVERTISING SALES STAFF:
Steven M. Vito, Associate Publisher/V.P. of Marketing, One Phoenix Mill Lane, Peterborough, NH 03458, tel. (603) 924-9281

Inquiry No. Page No.

International Advertising Sales Staff:
Uwe Kretschmar, European Advertising and Marketing Manager, BYTE Publications, McGraw-Hill Publishing Co., Wembley Bridge House, One Hartfield Road, Wembley, London, SW19 8RU, England, Tel: 44 81 543 1234, Fax: 44 81 540 3833

GERMANY, SWITZERLAND, AUSTRIA, PORTUGAL

Uwe Kretschmar (44 81 545 6266)

UNITED KINGDOM, FRANCE, ITALY

Barleyman (44 81 545 6266)

WATCOM

BENEFUL

Tel. (603) 924-2586

FRANCE, ITALY

France (33 1) 47 88 51 00

BENEFUL

Tel. (603) 924-2586

ISRAEL

Ehre (972) 3 33 58 111

BENEFUL

Tel. (603) 924-2586

JAPAN

Kawabata (81 3) 390 3100

BENEFUL

Tel. (603) 924-2586

KOREA

Lee (82 2) 740 3000

BENEFUL

Tel. (603) 924-2586

THAILAND

Sokhapim (66 2) 588 3222

BENEFUL

Tel. (603) 924-2586

Singapore (65) 227 0077

BENEFUL

Tel. (603) 924-2586

BRAZIL

MANOS

Brazil (55 11) 3013 0101

BENEFUL

Tel. (603) 924-2586

SOUTH AFRICA

Sokhapim (27 21) 784 3222

BENEFUL

Tel. (603) 924-2586

AUSTRALIA

Ehre (61 3) 33 58 111

BENEFUL

Tel. (603) 924-2586

NEW ZEALAND

Ehre (64 9) 33 58 111

BENEFUL

Tel. (603) 924-2586

NORTH AMERICA

Ehre (1) 212 218 5220

BENEFUL

Tel. (603) 924-2586

INTERNATIONAL SALES

Ehre (1) 212 218 5220

BENEFUL

Tel. (603) 924-2586

International Inquiry No. Page No.

COUNTRY

Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.

No. 253, 254

International Inquiry No. Page No.
INDEX TO ADVERTISERS BY PRODUCT CATEGORY

**HARDWARE**

<table>
<thead>
<tr>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>928</td>
<td>ADD-INS</td>
</tr>
<tr>
<td>20</td>
<td>AMD</td>
</tr>
<tr>
<td>22</td>
<td>AMERICAN MEGATRENDS</td>
</tr>
<tr>
<td>37</td>
<td>AMERICAN MEGATRENDS</td>
</tr>
<tr>
<td>512</td>
<td>ATOMIC SYSTEMS INC</td>
</tr>
<tr>
<td>25</td>
<td>ATOMIC SYSTEMS INC</td>
</tr>
<tr>
<td>206</td>
<td>MCTRONICS</td>
</tr>
<tr>
<td>210</td>
<td>MICROSTAR LABORATORIES</td>
</tr>
<tr>
<td>233</td>
<td>TRIBAL MICROSYSTEMS</td>
</tr>
<tr>
<td>356</td>
<td>TRIBAL MICROSYSTEMS</td>
</tr>
<tr>
<td>360</td>
<td>Z-WORLD</td>
</tr>
<tr>
<td>363</td>
<td>INSTRUMENTATION</td>
</tr>
<tr>
<td>369</td>
<td>JCTECH INC</td>
</tr>
<tr>
<td>383</td>
<td>HARDWARE PROGRAMMERS</td>
</tr>
</tbody>
</table>
| 378         | BAY TECH 
 889       | TE ACOMPUTER SOLUTIONS |
| 380         | VERSA SYSTEMS |
| 382         | AUTOMATED COMP.TECH.CORP |
| 384         | AUTOMATED ... |
| 386         | COVEX CORPORATION |
| 388         | COVEX CORPORATION |
| 390         | CYBER SHACK |
| 392         | DAIKU ELECTRONICS |
| 394         | DAIKU ELECTRONICS |
| 396         | MICROVISION |
| 398         | TEKTRONIX  |
| 400         | TEXAS INSTRUMENTS |
| 402         | TEXAS INSTRUMENTS |
| 404         | MULTIMEDIA FRAMEWORKS |
| 406         | ZENITH DATA SYSTEMS |

**SOFTWARE**

<table>
<thead>
<tr>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>940</td>
<td>SOFTWARE SECURITY</td>
</tr>
<tr>
<td>942</td>
<td>SOFTWARE SECURITY</td>
</tr>
<tr>
<td>944</td>
<td>ANDREWSOFT</td>
</tr>
<tr>
<td>946</td>
<td>ZEDS INTERNATIONAL</td>
</tr>
<tr>
<td>948</td>
<td>ZEDS INTERNATIONAL</td>
</tr>
<tr>
<td>950</td>
<td>MICROVISION</td>
</tr>
<tr>
<td>952</td>
<td>MICROVISION</td>
</tr>
<tr>
<td>954</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>956</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>958</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>960</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>962</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>964</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>966</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>968</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>970</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>972</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>974</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>976</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>978</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>980</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>982</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>984</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>986</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>988</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>990</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>992</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>994</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>996</td>
<td>MITSUBISHI</td>
</tr>
<tr>
<td>998</td>
<td>MITSUBISHI</td>
</tr>
</tbody>
</table>

**INDEX TO ADVERTISERS BY PRODUCT CATEGORY**

Correspond directly with company.

* Correspond directly with company.
To get further information on the products advertised in BYTE, fill out the reader service card by circling the numbers on the card that correspond to the inquiry number listed with the advertiser. This index is provided as an additional service by the publisher, who assumes no liability for errors or omissions.

*Correspond directly with company.
REQUEST FREE PRODUCT INFORMATION BY FAX

Just fax this page to 1-413-637-4343. Your request for information will be processed immediately!

Circle the numbers on Inquiry Card below which match the inquiry numbers assigned to items of interest to you.

Check off the answers to questions "A" through "E".

Print your name, address, and fax number clearly on the form.

Fill out this coupon carefully. PLEASE PRINT.

A. What is your primary job function/principal area of responsibility? (Check all that apply.)
   - 0 MIS/DP
   - 1 Programmer/Systems Analyst
   - 2 Administration/Management
   - 3 Sales/Marketing
   - 4 Engineer/Scientist
   - 5 Other

B. What is your level of management responsibility?
   - 0 Senior-level
   - 1 Middle-level
   - 2 Entry-level

C. Are you a reseller (VAR, VAD, Dealer, Consultant)?
   - 0 No
   - 1 Yes

D. What operating systems are you currently using? (Check all that apply.)
   - 0 Apple
   - 1 OS/2
   - 2 UNIX
   - 3 MacOS
   - 4 VAX/VMS

E. For how many people do you influence the purchase of hardware or software?
   - 1 1-2
   - 2 3-5
   - 3 6-9
   - 4 10 or more

Print this page or copy this page clearly and fax it to the number above.

Inquiry Numbers 1-495

<table>
<thead>
<tr>
<th>Name (Check one.)</th>
<th>0 MIS/DP</th>
<th>1 Programmer/Systems Analyst</th>
<th>2 Administration/Management</th>
<th>3 Sales/Marketing</th>
<th>4 Engineer/Scientist</th>
<th>5 Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>City</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phone Number</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fax Number</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Inquiry Numbers 436-590

<table>
<thead>
<tr>
<th>Name (Check one.)</th>
<th>0 MIS/DP</th>
<th>1 Programmer/Systems Analyst</th>
<th>2 Administration/Management</th>
<th>3 Sales/Marketing</th>
<th>4 Engineer/Scientist</th>
<th>5 Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>City</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phone Number</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fax Number</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Inquiry Numbers 991-1479

<table>
<thead>
<tr>
<th>Name (Check one.)</th>
<th>0 MIS/DP</th>
<th>1 Programmer/Systems Analyst</th>
<th>2 Administration/Management</th>
<th>3 Sales/Marketing</th>
<th>4 Engineer/Scientist</th>
<th>5 Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>City</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phone Number</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fax Number</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MAY 1991

Just fax this page to 1-413-637-4343. Your request for information will be processed immediately!
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.

---

© Direct Marketing Association, Inc. 1988
### DYNAMIC RAMS

<table>
<thead>
<tr>
<th>PART#</th>
<th>SIZE</th>
<th>SPEED</th>
<th>Pin#</th>
</tr>
</thead>
<tbody>
<tr>
<td>4116-12</td>
<td>16K</td>
<td>70ns</td>
<td>32</td>
</tr>
<tr>
<td>6264-16</td>
<td>16K</td>
<td>80ns</td>
<td>32</td>
</tr>
<tr>
<td>2716-256</td>
<td>64K</td>
<td>100ns</td>
<td>72</td>
</tr>
<tr>
<td>27256-1M</td>
<td>1M</td>
<td>120ns</td>
<td>144</td>
</tr>
</tbody>
</table>

### CASE-SLIDE TYPES

- **CASE-80 MINI SIZE 286-STYLE CASE**: $59.95
- **CASE-100 FULL-SIZE 286-STYLE CASE**: $89.95
- **CASE-120 UPRIGHT W/200 WATT PS**: $199.95
- **CASE-120 UPRIGHT W/200 WATT PS (SX)**: $249.95
- **CASE-70 FULL-SIZE 286-STYLE CASE**: $39.95

### CASE-SLIDE TYPE 8088-STVLE CASE**: $39.95

#### SIMM/SIP MODULES

<table>
<thead>
<tr>
<th>PART#</th>
<th>SIZE</th>
<th>SPEED</th>
<th>Pin#</th>
</tr>
</thead>
<tbody>
<tr>
<td>83D87-20</td>
<td>20MHz</td>
<td>319.95</td>
<td></td>
</tr>
<tr>
<td>83D87-25</td>
<td>25MHz</td>
<td>419.95</td>
<td></td>
</tr>
<tr>
<td>83587-16</td>
<td>16MHz</td>
<td>269.95</td>
<td></td>
</tr>
<tr>
<td>83587-20</td>
<td>20MHz</td>
<td>329.95</td>
<td></td>
</tr>
<tr>
<td>83587-25</td>
<td>25MHz</td>
<td>399.95</td>
<td></td>
</tr>
</tbody>
</table>

### MATH CO-PROCESSORS

- **P5-200X 200WATT PS FOR 8088 (110/220V)**: $89.95
- **P5-250 250WATT PS FOR 286/386 (110V)**: $129.95
- **PS-200 200WATT PS FOR 286/386 (110/220V)**: $89.95

### PROTOTYPE CARDS

- **PDS-601 16-CONDUCTOR CARD**: $79.95
- **PDS-600 16-CONDUCTOR CARD**: $49.95
- **PDS-610 16-CONDUCTOR CARD**: $99.95

### MATH CO-PROCESSORS

- **80387-33 33MHz**: $649.00
- **80387-20 20MHz**: $399.95
- **80387-16 16MHz**: $359.95
- **80387-SX 8MHz**: $199.95
- **80387-20 20MHz**: $399.95
- **80387-16 16MHz**: $129.95

### EPROMS

- **25MHz Cache 486**: $199.95
- **25MHz Cache 386**: $79.95
- **12MHz Mini 286**: $199.95

### MCT'S MODULAR PROGRAMMING SYSTEM

- **MCT-486M833 33MHz 833MHz**: $2,495.00
- **MCT-386SX 33MHz 3rd Voice**: $399.95
- **MCT-386SX-20 20MHz Version**: $449.95
- **MCT-386MC-33 33MHz 3rd Voice**: $1,199.50
- **MCT-386MC-25 25MHz 3rd Voice**: $799.95
- **MCT-386MC-20 20MHz 3rd Voice**: $599.95
- **MCT-286-12N 12MHz 286**: $399.95
- **MCT-286-12N 12MHz 286**: $399.95
- **MCT-286-10 10MHz 8088**: $99.95
- **MCT-TURBO 10 10MHz 8088**: $99.95

### DYNAMIC RAMS

<table>
<thead>
<tr>
<th>PART#</th>
<th>SIZE</th>
<th>Pin#</th>
</tr>
</thead>
<tbody>
<tr>
<td>4116-12</td>
<td>16K</td>
<td>60ns</td>
</tr>
<tr>
<td>4164-16</td>
<td>16K</td>
<td>70ns</td>
</tr>
<tr>
<td>4164-25</td>
<td>25K</td>
<td>80ns</td>
</tr>
<tr>
<td>42164-12</td>
<td>12K</td>
<td>70ns</td>
</tr>
<tr>
<td>422164-16</td>
<td>16K</td>
<td>70ns</td>
</tr>
<tr>
<td>422164-25</td>
<td>25K</td>
<td>70ns</td>
</tr>
<tr>
<td>422164-30</td>
<td>30K</td>
<td>70ns</td>
</tr>
<tr>
<td>422164-40</td>
<td>40K</td>
<td>70ns</td>
</tr>
<tr>
<td>422164-1M</td>
<td>1M</td>
<td>120ns</td>
</tr>
<tr>
<td>42256-1M</td>
<td>1M</td>
<td>120ns</td>
</tr>
<tr>
<td>42256-2M</td>
<td>2M</td>
<td>120ns</td>
</tr>
<tr>
<td>42256-4M</td>
<td>4M</td>
<td>120ns</td>
</tr>
<tr>
<td>42256-8M</td>
<td>8M</td>
<td>120ns</td>
</tr>
<tr>
<td>42256-16M</td>
<td>16M</td>
<td>120ns</td>
</tr>
<tr>
<td>42256-32M</td>
<td>32M</td>
<td>120ns</td>
</tr>
<tr>
<td>42256-64M</td>
<td>64M</td>
<td>120ns</td>
</tr>
<tr>
<td>42256-128M</td>
<td>128M</td>
<td>120ns</td>
</tr>
</tbody>
</table>

### EPROMS

<table>
<thead>
<tr>
<th>PART#</th>
<th>SIZE</th>
<th>Pin#</th>
</tr>
</thead>
<tbody>
<tr>
<td>27328A-128</td>
<td>128K</td>
<td>70ns</td>
</tr>
<tr>
<td>27256-200</td>
<td>200K</td>
<td>70ns</td>
</tr>
<tr>
<td>2716-256</td>
<td>256K</td>
<td>70ns</td>
</tr>
<tr>
<td>27256-256</td>
<td>256K</td>
<td>70ns</td>
</tr>
<tr>
<td>27256-512</td>
<td>512K</td>
<td>70ns</td>
</tr>
<tr>
<td>27256-1M</td>
<td>1M</td>
<td>70ns</td>
</tr>
<tr>
<td>27512-1M</td>
<td>1M</td>
<td>70ns</td>
</tr>
<tr>
<td>27512-2M</td>
<td>2M</td>
<td>70ns</td>
</tr>
<tr>
<td>27512-4M</td>
<td>4M</td>
<td>70ns</td>
</tr>
<tr>
<td>27512-8M</td>
<td>8M</td>
<td>70ns</td>
</tr>
</tbody>
</table>

**Note:** Items pictured may only be representative. For our entire Developers Union, please visit our website or call for more information. **Miniature Circuit Technology, Inc.**, a wholly owned subsidiary of **MCT MicroDevices, Inc.**, is not responsible for typographical errors or omissions. Please refer to our latest catalog for the most current information.

**JDR Microdevices** 7000 W. 158th Street Suite 101, Olathe, Kansas 66061 888-730-6910

**Web:** [www.jdrmicro.com](http://www.jdrmicro.com) **Fax:** 913-782-0710

**SALES: 780-669-9797** **TECHNICAL: 780-669-9798** **FAX: 780-669-9799** **EMAIL:** sales@jdrmicro.com **WEBSITE:** [www.jdrmicro.com](http://www.jdrmicro.com) **EMAIL:** tech@jdrmicro.com

**Circle 6 on Inquiry Card (RESELLERS: 7).**
### MODULAR CIRCUIT TECHNOLOGY

#### INTERFACE CARDS

<table>
<thead>
<tr>
<th>1.44MB FLOPPY CONTROLLER</th>
<th>$49.95</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 8088/86 COMPATIBLE</td>
<td></td>
</tr>
<tr>
<td>- SUPPORTS 2 FLOPPIES (360k, 720k, 1.2MB &amp; 1.44MB)</td>
<td></td>
</tr>
<tr>
<td>- SELECT AS PRIMARY OR SECONDARY (3RD OR 4TH)</td>
<td></td>
</tr>
<tr>
<td>MCT-FCF-FC</td>
<td>$49.95</td>
</tr>
<tr>
<td>MCT-FCF-DV-FLIP FLOPPY</td>
<td>$59.95</td>
</tr>
<tr>
<td>MCT-FCF-HDL-FLIP FLOPPY CONTROLLER</td>
<td>$29.95</td>
</tr>
<tr>
<td>MCT-FCF-HDL-RPL-FLIP FLOPPY CONTROLLER</td>
<td>$79.95</td>
</tr>
<tr>
<td>MCT-IEID</td>
<td>$39.95</td>
</tr>
<tr>
<td>MCT-EUID</td>
<td>$149.95</td>
</tr>
</tbody>
</table>

#### 16-BIT FLOPPY/HARD CONTROL

<table>
<thead>
<tr>
<th>16-BIT FLOPPY/HARD CONTROLLER</th>
<th>$149.95</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 16-BIT FRONT FOR IMPROVED PERFORMANCE</td>
<td></td>
</tr>
<tr>
<td>- SUPPORTS 2 HARD DRIVES</td>
<td></td>
</tr>
<tr>
<td>- SIMPLE HARD DRIVE OPERATION</td>
<td>$149.95</td>
</tr>
<tr>
<td>MCT-APF-FLR</td>
<td>$149.95</td>
</tr>
<tr>
<td>MCT-IDEPH</td>
<td>$69.95</td>
</tr>
<tr>
<td>MCT-IDEPH-MF</td>
<td>$79.95</td>
</tr>
<tr>
<td>MCT-IDEPH</td>
<td>$69.95</td>
</tr>
<tr>
<td>MCT-IDEPH-400MB</td>
<td>$89.95</td>
</tr>
<tr>
<td>MCT-APF-400MB</td>
<td>$89.95</td>
</tr>
<tr>
<td>MCT-APF-400MB</td>
<td>$89.95</td>
</tr>
</tbody>
</table>

#### 8/16-BIT VGA

<table>
<thead>
<tr>
<th>8/16-BIT VGA</th>
<th>$149.95</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 8/16 BIT VGA</td>
<td>$149.95</td>
</tr>
<tr>
<td>- 8/16 BIT VGA</td>
<td>$149.95</td>
</tr>
<tr>
<td>MCT-VGA-8</td>
<td>$149.95</td>
</tr>
<tr>
<td>MCT-VGA-16</td>
<td>$149.95</td>
</tr>
<tr>
<td>MCT-VGA-24</td>
<td>$149.95</td>
</tr>
<tr>
<td>MCT-VGA-32</td>
<td>$149.95</td>
</tr>
<tr>
<td>MCT-VGA-64</td>
<td>$149.95</td>
</tr>
<tr>
<td>MCT-VGA-128</td>
<td>$149.95</td>
</tr>
<tr>
<td>MCT-VGA-256</td>
<td>$149.95</td>
</tr>
<tr>
<td>MCT-VGA-512</td>
<td>$149.95</td>
</tr>
<tr>
<td>MCT-VGA-1024</td>
<td>$149.95</td>
</tr>
</tbody>
</table>

#### SYSTEM DIAGNOSTICS CARD

<table>
<thead>
<tr>
<th>1.44MB FLOPPY CONTROLLER</th>
<th>$49.95</th>
</tr>
</thead>
<tbody>
<tr>
<td>- WORKS WHEN SOFTWARE CAUGHT</td>
<td></td>
</tr>
<tr>
<td>- RUNS PROPERLY</td>
<td>$49.95</td>
</tr>
<tr>
<td>MCT-EID-EMS</td>
<td>$149.95</td>
</tr>
<tr>
<td>MCT-EMS-16BIT-EIDM CARD</td>
<td>$149.95</td>
</tr>
<tr>
<td>MCT-EMS-32BIT-EIDM CARD</td>
<td>$149.95</td>
</tr>
</tbody>
</table>

### BARGAIN HUNTER’S CORNER

#### NORTON UTILITIES ADVANCED EDITION V4.01

<table>
<thead>
<tr>
<th>NORTON UTILITIES ADVANCED EDITION V4.01</th>
<th>$34.95</th>
</tr>
</thead>
<tbody>
<tr>
<td>- THE WORLD’S MOST POPULAR DATA &amp; IMAGE MANAGEMENT PROGRAM</td>
<td></td>
</tr>
<tr>
<td>- RECOVERS LOST FILES AND DAMAGED DATA</td>
<td></td>
</tr>
<tr>
<td>- IMPROVES HARD DISK AUSING BY ORGANIZING DATA</td>
<td></td>
</tr>
<tr>
<td>- EASY-TO-USE WINDOWS &amp; MESSAGES</td>
<td></td>
</tr>
<tr>
<td>- UPGRADABLE VERSION 4.01</td>
<td></td>
</tr>
<tr>
<td>NORTON-4.01</td>
<td>$34.95</td>
</tr>
</tbody>
</table>

### CUSTOMER SERVICE

<table>
<thead>
<tr>
<th>CUSTOMER SERVICE</th>
<th>800-538-5001</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECHNICAL SUPPORT</td>
<td>800-538-5002</td>
</tr>
<tr>
<td>LOCAL/INTERNATIONAL</td>
<td>405-599-1200</td>
</tr>
<tr>
<td>BBS (9600/2400/1200)</td>
<td>405-599-2253</td>
</tr>
</tbody>
</table>

### ORDER TOLL-FREE

<table>
<thead>
<tr>
<th>ORDER TOLL-FREE</th>
<th>800-538-5000</th>
</tr>
</thead>
<tbody>
<tr>
<td>MON.-THU. 7 A.M. TO 5 P.M., SAT. 9 A.M. TO 3 P.M.</td>
<td>MAY 1991 • BYTE 383</td>
</tr>
</tbody>
</table>
SOME ASSEMBLY REQUIRED

Listing 2c continued
#include "evc.h"

static void evc_prog_l();

main()
{
    SVCXPRT *transp;
    (void)pmap_unset(EVC_PROG, EVC_VER);
    transp = svcudp_create(RPC_ANYSOCK);
    if (transp == NULL) {
        (void)fprintf(stderr, "Cannot create udp service.\n") ;
        exit(l) ;
    }
    if (!svc_re1'ister(transp, EVC_PROG, EVC_VER, evc_prog_l,
          IPPROTO.UDP)) {
        (void )fprintf(stderr, "unable to register {EVC_PROG,
          EVC_VER, udp}.\n");
        exit(l);
    }
    transp = svctcp_create(RPC_ANYSOCK, 0, 0);
    if (transp == NULL) {
        (void)fprintf(stderr, "Cannot create tcp service.\n" );
        exit(l) ;
    }
    if (lsvc_register(transp, EVC_PROG, EVC_VER, evc_prog_l,
          IPPROTO.RCP)) {
        (void)fprintf(stderr, "unable to register {EVC_PROG,
          EVC_VER, tcp}.\n" );
        exit(l);
    }
    svc_run();
    (void)fprintf(stderr, "svc_run returned\n") ;
    exit(l);}

static void
evc_prog_l(rqstp, transp)
struct svc_req *rqstp;
SVCXPRT *transp;

union {
    int evc_climate_l_arg;
} argument ;
char *result ;
bool_t (*xdr_argument)(), (*xdr_result)();
char (*local)();

switch(rqstp->rq_proc)
{
    case NULLPROC:
        (void)svc_sendreply(transp, xdr_void, (char *)NULL);
        return;
    case EVC_CLIMATE:
        xdr_argument = xdr_int;
xdr_result = xdr_climate;
        local = (char (*)(void))evc_climate_l;
        break;
    default:
        svcerr_noproc(transp);
        return;
    }
    bzero((char *)&argument, sizeof(argument));
    if (!svc_getargs(transp, xdr_argument, &argument))
        continue
        svcerr_decode(transp);continued from page 317
&bay_number,
xdr_climate, &climate,
timeout);

The procedure number, XDR routines,
and call and routine values are the
same as with the callrpc function. The
timeout value is a timeval struct pro
viding the retry time for UDP commu
nications. It's ignored for a TCP/IP link.

The corresponding server arrangement
uses an SVCXPRT transport handle,
which is created by sv cupid_create or
svctcp_create:

SVCXPRT *svcP;
svcP = svcudp_create(RPC_ANYSOCK);

svc_register(svcP, EVC_PROG,
EVC_VER, evcfunc, IPPROTO_UDP);

specifying the program number and pro
gram version, a routine to handle all re
quests for that program, and the type of
transport. Once the services have been
registered, the server calls svc_run.

The svc_register function, like
registerrpc, actually registers a ser
vice with a server program, the port
mapper. The port mapper accepts RPC
requests and delivers them to the ap­
propriate program so registered. Before re­
registering the function, you may wish to
unregister it to erase any lingering trace
of an old incarnation:

pmap_unset(EVC_PROG, EVC_VER);

A big difference in this server ar­
nangement is that the registered function
takes care of all the procedure numbers
for a particular program number. The
function (in this case, evcfunc) is passed
the address of a svc_req structure and
the transport handle. The function then
must check the rq_proc member of the
svc_req structure to find out which pro­
cedure was requested and handle it ap­
propriately.

By convention, all servers respond to a
procedure number of 0, as a sort of "are
you there?" request. The return value is
simply a void. If the procedure number is invalid, the server should respond by calling svc_noproc with the transport handle as the argument.

In processing valid requests, two procedures are used to get arguments and send replies:

```
svc_getargs( svcP, xdrproc, dataP );
```

fetches the argument described by the XDR procedure xdrproc; dataP is the address of a variable to receive the data (e.g., a basic type or a pointer to a structure).

```
svc_sendreply( svcP, xdrproc, dataP );
```

returns data using the same calling convention. To execute the deletion XDR function (if any pointer or variable-length data was received), use:

```
svc_freeargs( svcP, xdrproc, dataP );
```

You can also arrange to have your server program started automatically by inetd (the internet server daemon) when requests come in for it. This is controlled by information in the inetd configuration file; inetd runs the server program with a socket already opened on file descriptor 0. Thus, when you create the transport handle, you pass the socket number 0 instead of, say, RPC_ANYSOCK.

All this demonstration merely touches on the lower levels of RPC, enough to make use of the rpcgen RPC compiler. Some other low-level aspects include broadcasting, callbacks, and access authentication.

Automating All the Above

Some of what I have discussed looks pretty daunting, but it is really no more difficult than using any other abstracted I/O mechanism. Even so, a powerful tool helps automate the construction of RPC programs. It's called rpcgen, and you can use it to generate both XDR procedures and RPC server routines.

You describe your XDR data and service procedures in a file with, by convention, an extension of .x. This file contains C-like descriptions of data and procedure information. For example, when you give foo.x to rpcgen, the file is passed through the C preprocessor (so you can include regular preprocessor directives such as #include and #if).

Then, rpcgen produces up to four files: an .h file (foo.h) describing the data types produced from the XDR descriptions, a C file (foo_xdr.c) containing the XDR routines that represent those types, a C file (foo_clnt.c) containing stub routines for client calls, and a C file (foo_svc.c) containing a skeleton server routine.

```
Listing 1: XDR routines for described data, evo_xdr.c.

#include <rpc/rpc.h>
#include "evo.h"

bool_t
evo_climate(xdrs, ob JP)
XDR *xdrs;
climate *obJP;
{
  if (!xdr_int(xdrs, &objp->temp)) {
    return( FALSE );
  }
  if (!xdr_int(xdrs, &objp->humidity)) {
    return( FALSE );
  }
  return(TRUE);
}
```

make the interface to the RPC client routines the same as to the actual implementation routines. After all, it's that level of abstraction you're after. One test is to see if you can provide equivalent glue that simply calls the real routines and link your client and server routines together with this glue.

If you want to look at a toy example of RPC programming, a simple program is available electronically (see page 5 for details). The server side provides a few routines that access a set of definitions for conference rooms and meeting schedules. The client side uses the list-manipulation functions to provide commands that inquire and modify these lists. (Presumably, the server would be intelligent enough to schedule meetings based on the matches among room features, meeting requirements, and availability of invitees—but that is beyond the scope of this contrived example.)

Mark Mallett is an independent programmer at Zinn Computer Co., a writer, and an active BIX moderator. He lives in Litchfield, New Hampshire, and can be reached on BIX as "mma/lett."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.
Up from Rosie

Self-similarity rears its head in cats and fractals, cities, and a new collection of essays

Cats, to take a handy example, are fractal. Between Rosie, felis silvestris catus, who leaps onto my shoulder, and MGM's felis leo, whose leap I hope never to experience, we observe discrete steps—for example, House Cats < Bobcats < Panthers < Big Cats. Nothing smaller than Rosie’s kin, nothing larger than Leo’s. And although there’s a likeness, we’ve not identity of form: Enlarge Rosie to lion size, and you’d fool no one into thinking you were showing a lion. Apart from color, the mass about the shoulders is wrong, the size of the head. Still, similarity is evident at each scale, and we say, intuitively, “Cats.”

Carl von Linné (better known as Linnaeus) knew, circa 1735, that all those creatures were cats, and in the durable system he was constructing, he assigned them to genus felis. His genera were based on lists of characteristics, which seem cumbersome since we can often tell by just looking. What we can tell by just looking got firmly accommodated by science only in the past two decades, when fractal theory began speaking of self-similarity and defined similarity as statistical.

(Not that just looking is infallible. The Greeks named a cumbersome beast hippocopotamos, horse of the river, on the hunch that anything so big was horsey. They weren’t looking at form, they were looking at size. Linnaean principle says it’s an overscale pig.)

Similarity may resist rigorous proof, but the human eye is a similarity detector. Computers, which can choke on mismatched commas, are essentially difference detectors. If fractal science was made possible by the computer, that’s thanks to the ease with which a computer can show us zones of color to map ranges of numbers; thus, the eye is offered a pattern in which it spots self-similarities at stepwise reductions of scale. It’s amazing how much of the world of everyday experience answers to such analysis. Clouds, trees, rivers, coastlines... those are familiar examples. And there are more and more.

The discussion goes on refining its focus. Fractals and Chaos (edited by A. D. Crilly, R. A. Earnshaw, and H. Jones, Springer-Verlag, 1991, $39.50) grew from an international conference in London. It contains 13 papers and 146 figures, 57 in color. If you’ve only an hour, spend it with Michael Batty’s chapter “Cities as Fractals: Simulating Growth and Form” (24 pages, 46 references, four diagrams, and 14 color plates). Batty’s pages offer much of the gist of the book. He establishes that a city’s growth is, ah, dendriform (my word, not his; a useful word, it means “tree-like”).

The tree is a well-known fractal example. The trunk splits into limbs, limbs into branches, branches into twigs. A circulatory system, Rosie’s or mine, is likewise structured, arteries down to capillaries. So is the system of airways in our lungs, the system of neural branches in our brains (where neurologists speak of “dendrites”). Self-similar on a small number of diminishing scales, dendriformity seems to govern growth wherever we look. The seemingly random changes of direction that keep any example from just photocopying any other all point to the magic word, fractal: Although the details mutate endlessly,
the similarity of structure abides.

And how do cities grow? A few main roadways emanate from a core, drawn by who knows what dreams of advantage. Along them, developments, generating streets off which branch sub-developments. . . Dendriform! And the city grows slowly sparser as it grows outward: For myriad reasons, less and less of available space is built over. One reason may be that, remote from the core, developing gets chancier, developers cagier. That’s unless the core starts dying, which is another story.

We’re watching what for Batty is the constant renegotiation of a balance “between the desire to be as far away from the city as possible and the need to be within it.”

Here we encounter one of the dizzying leaps that characterize fractal discussions. For a mathematical model, we’re to look up papers on “viscous fingering, where a fluid of lower viscosity permeates one of higher viscosity (e.g., water permeating oil),” and on “dielectric breakdown, where a charge is released from some source and attracted towards a more distant sink of high potential.” So a population moves like a low-viscosity fluid, or a migrant to the suburbs like an electrical charge. That would have delighted the last group who tried to yoke New Science with common experience, the English “metaphysical” poets of the early 1600s. But Donne and Marvell and their like were not advantaged by a firm mathematical structure to hold disparate things together.

By the way, if you have been puzzled by Mandelbrot’s “fractal dimension,” which is neither 1 (a line) nor 2 (a plane), but something in between, like 1.72, you may be helped by Batty’s suggestion that the fractal dimension of a city simply measures how completely it fills the available space. If cities tend to get sparser as they grow outward, occupied space increases less fast than population. For a real city, a number near 1.6 seems to work.

Another enlightening paper is Alastair Horn’s “IFSs and Tiling Structures.” An IFS (iterated function system) is a tag associated with Michael F. Barnsley, who (with Alan D. Sloan) lighted the last group who tried to yoke New Science with common experience, the English “metaphysical” poets of the early 1600s. But Donne and Marvell and their like were not advantaged by a firm mathematical structure to hold disparate things together.

As another contributor, John Lansdown, emphasizes, one parameter is “a probability factor, which determines the density distribution of the random points” everywhere in the image. That ensures, for instance, that veins and stems won’t just sag into chaos but will receive due emphasis. And the payoff is, we can store a picture of a fern in a very small number of bytes. The trade-off? The time we’ll spend getting it back.

Horn now moves to heavier math than I’m willing to face this afternoon (and Rosie asks to be fed), although his 15 diagrams remain persuasive. What he’s moving toward is ISIS (Interactive System for Image Synthesis), which now runs on a Sun workstation and is open to “massively parallel” rendering that relies on the Sun as a host. We’re approaching a new domain of image storage, of image generation.

And that brings us to a surprising piece of programming, Dick Oliver’s Fractal Grafics (Cedar Software, Rt. 1-5140, Morrisville, VT 05661, (802) 888-5275, $79). This PC package is worth buying just for the 15 “History Lesson” pages of the manual that offer the cleanest short presentation I’ve seen of what fractal and chaos theory is all about. (I’d like to take Dick aside and impress on him the fact that “like” differs from “as.” Otherwise, impeccably lucid.)

My only further complaint about Fractal Grafics is that the manual needs just one more page, up front, to clarify a few fundamentals. For several hours I was calling in image templates (from the extensive library provided), only to see them superimposed on an initial display. I eventually discovered that pressing PageUp would clear that background.

Likewise, a menu runs down the right of the screen, and you naturally expect your up- and down-arrow keys to move the cursor up and down between items. Arrow keys move the image templates. To move the cursor down and up, you use space bar and Backspace, although intuition has those giving right and left movement. OK, if that is how Mr. Oliver wants it, but he might have told us up front. One spends too much time master­

D

Discussions of fractals are often characterized by dizzying leaps.

What makes the program worth the bother, though, is that it’s chiefly an elaborate implementation of Barnsley-style IFS. The library is a library of templates. The first one you’ll see is a cat’s face (a travesty of Rosie’s), and by elect­ing Draw, you can equip it with a fright wig of hair; then by elect­ing Paint, with cosmetic colored dotting.

A five-finger exercise, a trivial result. More rewarding: Load the Tree template. Examine the self-similarity of its four main elements (a sturdy trunk and three auxiliary members). Then Draw to get an elaborate tree with foliage; Paint to sprinkle it with dainty leaflets. Cut “paint” off with the Escape key if it’s getting too fussy. You can clear your tree and then bring it back, for shifting, enlarging, shrinking, skewing, squashing.

You can combine trees of different sizes and colors. Design a forest if you are so minded. All these operations are fast. You can also combine templates: Insert small Cheshire cats amid trees.

Dick Oliver deserves great credit for bringing the Barnsley system out to where PC users can lay hands on it. Apart from a few toy ferns and Sierpinski gaskets, it's hitherto been pretty inaccessible. And his manual, better on the big picture than on his own program, assumes a user who wants to understand the big picture. I'll hazard that it's as big a picture as this century has seen.

Numbers first described pyramids and temples, next the movement of stars. To draw the picture, you used a ruler or swung your arm. When Kepler’s ellipses supplanted circles, you could still use two pins and a string. Numbers, ruling wherever Euclid’s shapes pertained, next found Uranus and Neptune and then went chaotic: Cantor’s “dusts,” the “monsters” of Sierpinski and Koch. Then computer replaced string, ruler, pencil; and, lo, numbers describe a trans-Euclidean world we’ve always known and have always had to pretend was lacking in order.

Oh—Rosie has asked to go out. A tad dyslexic, even as Albert Einstein was, she’d misread “fractals” as “cattails” and sup­

posed I was discussing something important.

Hugh Kenner is a professor of English at Johns Hopkins University. He writes for publications ranging from the New York Times to Art & Antiques. His recent books include Mazes and Historical Fictions. He can be contacted on BIX as “hkenner.”

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.
Dateline: 1995. NEW YORK. The Organization of Information Producing Nations met today in New York, in an attempt to deal with what it described as the current infoglut. According to information industry analyst Don Jorak, "Information providers have flooded the market with cheap, easily accessible information, sending the price of information to record low levels. Of course, much of this is low-grade information and requires a great deal of refinement before it can be used."

In related news, the FCC reported that several major communications areas are in grave danger of experiencing "infolock," a situation in which vast quantities of transmitted information overwhelm the capabilities of the systems that were designed to handle it. Messages sit stalled in network traffic, businessespeople devote all their time to returning phone calls to people who were returning their calls, and automated calling systems leave messages with answering machines. And the economy slowly grinds to a halt.

You may laugh. But we are approaching the time when the tide of "useless information," as Mick Jagger called it, threatens to inundate us. We spend our days swimming against that tide, trying desperately to fit our work—whatever that may be—in between strokes.

For many years, the computer press has predicted the advent of the paperless office. Hah! We're beginning to realize that the phrase "paperless office" is an oxymoron, what with fax machines spewing endless pages of correspondence, laser printers cranking out multiple copies of E-mail messages that have been broadcast to everyone on the network, express mail packages arriving with mind-numbing regularity (remember when only important things got expressed?), and on, and on.

In the wake of this, separating the information wheat from the chaff is getting harder and harder to do. And we are increasingly reduced to being human filters for all that information. "Work" becomes what you fit in, in discrete chunks, between filtering out what you need to know from what you don't.

That kind of setting doesn't lend itself to long periods of deep thinking. Like our computers, we have learned to multitask—handling several projects at once, devoting small time slices to each one. It's becoming more and more difficult to accomplish anything that requires a long stretch of uninterrupted time, like creating, planning, or analyzing all that data.

Who's to blame for the current infoglut, the imminent infolock? Several culprits come to mind, but our own beloved personal computers are at the head of the lineup. The people who created the personal computer probably had no idea that their invention would become the Pandora's box of the information age, unleashing demons, awe-inspiring in their fecundity, terrifying in their omnipresence.

Don't get me wrong. I'm not arguing for a return to the dark ages (i.e., before we had laser printers). It is too late to close the box. We have already lost our innocence. We have been cursed with power. The question is, will we control that power?

To do so, we'll need new tools, like the Information Lens, a system developed at MIT that sorts through your incoming E-mail, organizing and prioritizing it for you (see "Through a Lens Smartly" on page 177).

We'll also need new attitudes, attitudes akin to those many of us are trying to adopt about the environment; a mind-set that makes us stop and think before we act. Do I really need to send this memo to everyone in the office? Do I need to print out that E-mail message? Is there anything of substance in the report I've just written, or am I just contributing to the deforestation of the wilderness and the clutter in my coworkers' offices?

There's a classic W. C. Fields film called The Man on the Flying Trapeze, in which Fields works in an office, with a desk that looks like mine—piled high with stacks of paper. At one point, an office boy tells Fields that his boss wants "a copy of that letter we wrote to Mr. Newt Schvendenborg... he thinks it was about four years ago." Fields turns to the desk, mutters about how people keep moving things on him, and proceeds to pluck the letter from the middle of a pile—adding that it was "three and a half years ago, to be correct."

Until we have systems that can do that for us, we're in danger of drowning in our own data. And we'd better think about filtering the flow before we let it out.
Take a Look at LabWindows®2.0

LabWindows 2.0 brings a new look to data acquisition and instrument control. The new look is graphical—a graphical user interface for your acquisition and control system.

Create a Graphical User Interface
With LabWindows 2.0, you can easily create custom graphics panels to interface with your DOS-based system. Using the graphical editor and standard development tools, you can develop a system that combines data acquisition, data analysis, and data presentation.

Program with C or BASIC
When you develop a system with LabWindows 2.0, you have the benefit of using standard programming languages with development tools designed specifically for data acquisition and instrument control.

Use any Acquisition Hardware
LabWindows 2.0 has libraries of functions to control data acquisition hardware ranging from plug-in boards to industry-standard GPIB, VXI, and RS-232 instruments. You can develop a system with LabWindows to meet all of your measurement and control needs.

Take a look at the new LabWindows 2.0. You’ll like what you see.
In 1983, we introduced the world's first laptop computer. We went on to engineer built-in software, easy-to-read screens and hard drives in notebook-size PCs.

AND NOW...

THE NEW TANDY® 2810 HD NOTEBOOK PC,

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>286 Power</td>
<td>The 80C286 microprocessor runs at 16 MHz for speed-intensive applications like Microsoft® Windows.</td>
</tr>
<tr>
<td>DeskMate® Interface</td>
<td>The DeskMate Graphical User Interface with ten applications is installed on the hard drive for instant-on ease of use.</td>
</tr>
<tr>
<td>VGA Graphics</td>
<td>Brilliant clarity with 640 x 480 graphics and a sharp 16/32-gray scale.</td>
</tr>
<tr>
<td>Resume Mode</td>
<td>Lets you shut off and come back right where you left off—also shuts down automatically to save battery life.</td>
</tr>
<tr>
<td>Built-In Hard Drive</td>
<td>20 megabytes of internal storage for rapid access, plus a 3.5&quot; 1.44MB floppy drive.</td>
</tr>
<tr>
<td>External Support</td>
<td>Attach a 101-key keyboard, a VGA color monitor, a printer, an external floppy drive and more.</td>
</tr>
<tr>
<td>MS-DOS® 4.01</td>
<td>The latest version of MS-DOS (4.01) comes already installed on the built-in hard drive.</td>
</tr>
<tr>
<td>1MB Memory</td>
<td>Expandable to five megabytes.</td>
</tr>
</tbody>
</table>

DESKTOP PERFORMANCE IN A 6.7-lb. PORTABLE

Continuing our tradition of innovation, the Tandy 2810 HD is a lightweight laptop for heavy use—at the office, at home, or on the road. With extremely durable construction, it's built for travel—but it can also support a full-size keyboard and monitor for true desktop power. AT® compatibility, stunning VGA graphics and DeskMate® productivity software. Only at Radio Shack. Again.