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Processor	Intel® Celeron™ processor 400MHz	Intel Pentium® II processor 450MHz	Intel Pentium II processor 400MHz	Intel Pentium II processor 450MHz	Intel Pentium II processor 450MHz
Cache	128KB internal L2 cache	512KB internal L2 cache	512KB internal L2 cache	512KB internal L2 cache	512KB internal L2 cache
RAM	64MB SDRAM	64MB 100MHz SDRAM	128MB 100MHz SDRAM	128MB 100MHz SDRAM	128MB 100MHz SDRAM
Hard Drive	8.4GB Ultra ATA hard drive*	13GB Ultra ATA hard drive*	13GB Ultra ATA hard drive*	13GB Ultra ATA hard drive*	25GB Ultra ATA hard drive*
Monitor	17" Micron 700Vx monitor (15.9" display)	17" Micron 700Vx monitor (15.9" display)	17" Micron 700Vx monitor (15.9" display)	17" Micron 700Vx monitor (15.9" display)	19" Micron 900Lx monitor (18" display)
DVD/CD-ROM	40X max speed CD-ROM drive	40X max speed CD-ROM drive	6X DVD-ROM drive (free upgrade from 4.8X DVD-ROM drive)	6X DVD-ROM drive (free upgrade from 4.8X DVD-ROM drive)	6X DVD-ROM drive (free upgrade from 4.8X DVD-ROM drive)
Modem	3Com US Robotics V.90 WinModem**	3Com US Robotics V.90 WinModem**	3Com US Robotics V.90 WinModem**	3Com US Robotics V.90 WinModem**	3Com US Robotcs V.90 WinModem**
Graphics	nVidia Riva 128, 8MB SGRAM 3D 2X AGP graphics	nVidia Riva 128, 8MB SGRAM 3D 2X AGP graphics	16MB Diamond Viper 550 TnT 2X APG graphics	16MB Diamond Viper 550 TnT 2X APG graphics	16MB Diamond Viper 550 TnT 2X APG graphics
Sound System	PCI 128-voice Wavetable sound Advent AV009 speakers	PCI 128-voice Wavetable sound Advent AV009 speakers	PCI 128-voice Wavetable sound Advent AV009 3-piece speaker system	PCI 128-voice Wavetable sound Advent AV009 3-piece speaker system	PCI 128-voice Wavetable sound Advent AV009 3-piece speaker system
Warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty
Additional Storage	3.5" floppy drive	3.5" floppy drive	3.5" floppy drive	3.5" floppy drive 100MB Iomega Zip drive	3.5" floppy drive 100MB Iomega Zip drive
Training	1-year free¬ training to Micron U online	1-year free¬ training to Micron U online	1-year free¬ training to Micron U online	1-year free¬ training to Micron U online	1-year free¬ training to Micron U online
Factory Direct Price	$1,299 $46/mo. Business. Lease 36 mos.**	$1,699 $59/mo. Business. Lease 36 mos.**	$1,799 $63/mo. Business. Lease 36 mos.**	$1,999 $70/mo. Business. Lease 36 mos.**	$2,499 $87/mo. Business. Lease 36 mos.**
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Cache	512KB L2 pipeline burst cache	512KB L2 pipeline burst cache	256KB L1 on die cache	256KB L1 on die cache	256KB L1 on die cache
RAM	32MB SDRAM	32MB SDRAM	64MB SDRAM	64MB SDRAM	128MB SDRAM
Hard Drive	3.2GB hard disk drive (removable)*	4GB hard disk drive (removable)*	4GB hard disk drive (removable)*	4GB hard disk drive (removable)*	4GB hard disk drive (removable)*
Monitor	12.1" SVGA TFT display	13.3" XGA TFT display	14.1" XGA TFT display	14.1" XGA TFT display	14.1" XGA TFT display
CD-ROM	24X CD-ROM drive (dedicated bay)	24X CD-ROM (dedicated bay)	24X CD-ROM drive (dedicated bay)	24X CD-ROM drive (dedicated bay)	24X CD-ROM drive (dedicated bay)
Graphics	4MB AGP graphics accelerator	4MB AGP graphics accelerator	4MB AGP graphics accelerator	4MB AGP graphics accelerator	4MB AGP graphics accelerator
Sound System	Built-in stereo speakers & microphone	Built-in stereo speakers & microphone	Built-in stereo speakers & microphone	Built-in stereo speakers & microphone	Built-in stereo speakers & microphone
Warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty
Operating System	Microsoft® Windows® 98	Microsoft Windows 98	Microsoft Windows 98	Microsoft Windows 98	Microsoft Windows NT® Workstation 4.0
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PC WORLD

MARCH

VOLUME 17 ◆ NUMBER 3

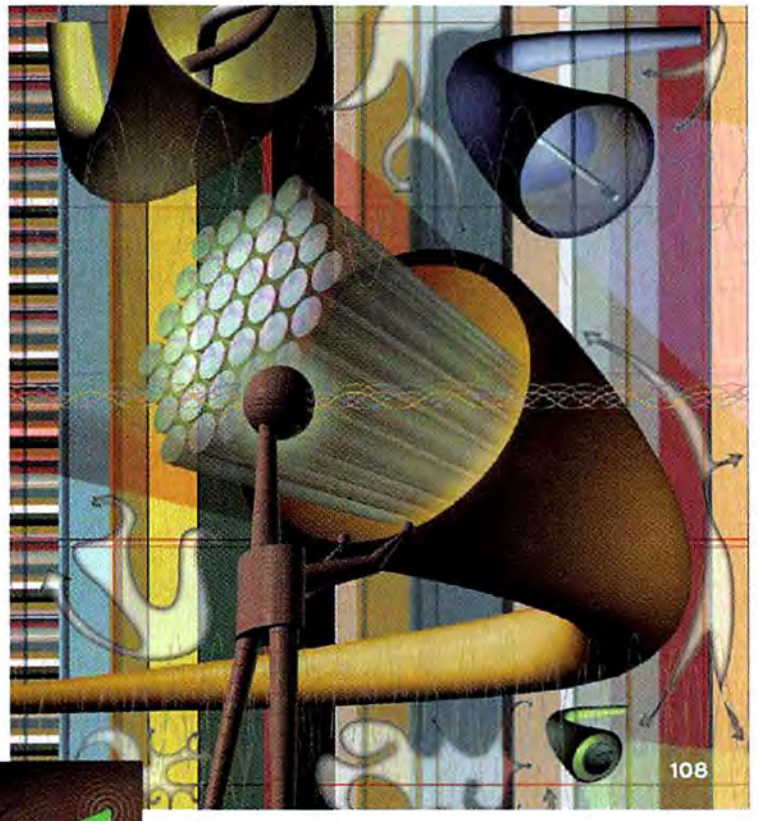
SPECIAL ISSUE

107 WEB @ WARP SPEED

It's happened to all of us. You get online and the Web seems stuck in low gear, grinding to a halt whenever you browse graphics-intensive sites, download audio files, even perform a simple search. So how do you turbocharge your Web access? With this *PC World* special guide to fast Internet access today, tomorrow, and beyond.

108 BANDWIDTH ON DEMAND

TREND Dial-up access might be dirt cheap, but the connection you get is snail slow. Fortunately, your high-speed choices are expanding rapidly. What's most promising? Cable modems for the home and DSL for business hookups. What's most disappointing? You may find neither option available in your area yet.



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Additional material available on PC World Online: www.pcworld.com

163 FAST FORWARD: FUTURE INTERNET

TREND In three years the Web will host 78 million surfers in the United States alone. They'll engage in untold bandwidth-hogging activities, from videoconferencing to online gaming. Can the Internet handle the stampede without being overrun?

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Ah yes, a server that never goes down. When you wake up from that dream, we'll tell you which of five servers with reliability features such as redundant hardware and hot-swappable drives will work best—even after the inevitable crash.

ICONS: JEFFREY PELO

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AOL acquires Netscape and its heavily trafficked Netcenter while prepping an innovative new Communicator 5 for release.

64 **UPSTART LINUX OPERATING SYSTEM: NOT JUST FOR GEEKS ANYMORE**
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TOP 100

193 **PENTIUM III RISING, PRICES FALLING**
TOP 100 It's coming! The release of the Pentium III, Intel's latest powerhouse chip, should send older systems' prices plummeting. When and what should you buy? That depends.

196 **POWER DESKTOPS**
TOP 20 Blazingly fast and network-ready, the OptiPlex Gx1p 450 is the latest Dell chart-topper. But keep your eye on Quantex's new $2549 QP6/450 SB-4, a loaded graphics-oriented workstation.

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220 **NOTEBOOKS**
TOP 10 Intel's just unleashed a pack of snazzy mobile CPUs. But for now, repeat winners from Dell, Gateway, and Unicent play musical chairs on the chart.

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TOP 10 Faster printers invade the home and small-business market, led by Okidata's OkiPage 10i, the best choice for speedy and good-looking text documents.

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TOP 10 Princeton's $187 15-incher holds the top position, while other affordable models from Panasonic and Sampo make their Top 10 debuts.

233 **GRAPHICS BOARDS**
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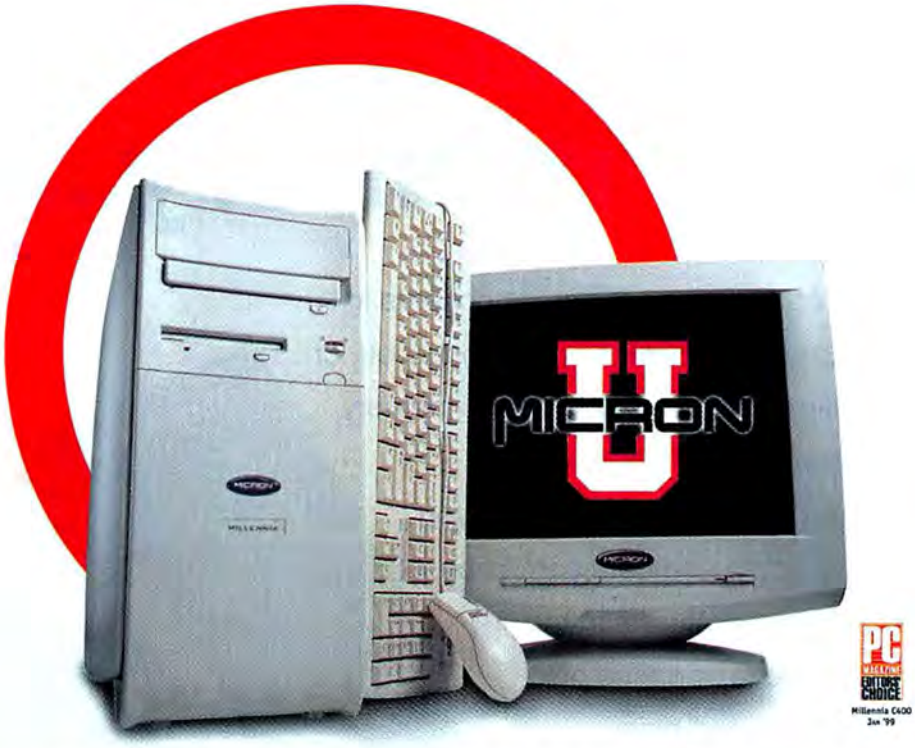

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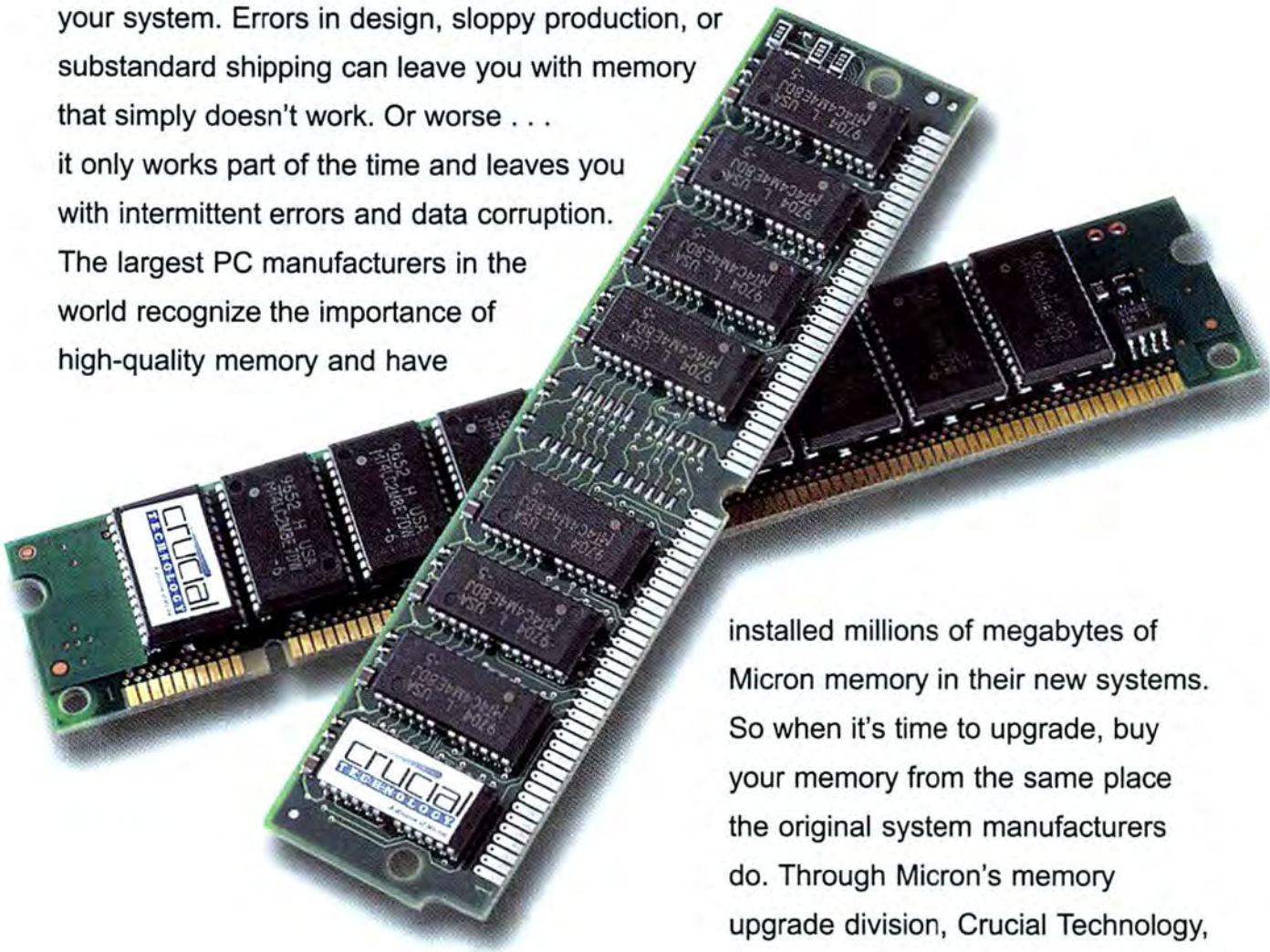

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Now's the Time for Fast Web Access

THE DAY AFTER Thanksgiving, traffic on Amazon.com more than quadrupled over the previous Thanksgiving's count. That surge signaled the start of this year's phenomenal online holiday shopping spree, which far exceeded predictions. Launched in mid-November, Macy's site got more than 10 million hits a day. At mail-order retailer Lands' End, Web traffic broke all records for the site.

Online auctioneer EBay crashed several times as hordes of shoppers placed bids. Under heavy traffic, barnesandnoble.com stumbled on order processing. America Online added more than 1 million new members in November and December, and all told, its members ordered $1.2 billion worth of goods. Even low-tech Victoria's Secret, which launched its site in early December and geared up for as many as 1000 visitors a second (both shoppers and peepers), reported record fourth-quarter sales.

Simultaneously, Internet stocks hit the stratosphere. At one point, AOL's market value topped Disney's, and Amazon.com was worth more than Barnes & Noble and Borders combined; EBay's value was more than five times that of Sotheby's, and Yahoo was worth more than CBS. As online stock trading surged, leading discount broker Charles Schwab, which now processes more trades online than it does through traditional venues, surpassed Merrill Lynch in value.

Overinflated stocks aside, 1998 marked a turning point for Internet business, which, according to market researcher International Data Corporation, will balloon into a $1 trillion economy in the coming decade, fueled by dropping PC prices.

For consumers, today's technology doesn't cut it. But optimists say the online logjam may be breaking.

FOR CONSUMERS, IT'S BACK TO REALITY

ALL THAT'S TERRIFIC for stockholders, but not so great for most online shoppers. Consider what it's like to access the Web from home over dial-up lines. Exactly what happened to work productivity during the holidays while all the electronic cash registers were ringing up sales? Were multitudes of workers staying late to try out the Lands' End Online "Personal Model" over their companies' high-speed T1 lines? How many online shoppers gave up and, like me, resorted to picking up the phone?

For consumers, today's access technology doesn't cut it. But the eternal optimists among us hope the logjam may finally be breaking. Last year, telecommunications and technology companies began rolling out cable modems and digital subscriber phone lines—the first high-speed Internet services for homes. This year, the pace is stepping up. Both Compaq and Dell now sell PCs with factory-installed DSL modems, and more PC companies are sure to follow. In early January, @Home, the largest provider of cable modem service, announced it will spend $100 million to build a high-speed fiber optic system for carrying both data and voice to TCI's nationwide digital cable subscribers. And AOL announced its first plans for DSL access for a $20 a month premium.

TWO PCs, ONE HIGH-SPEED LINE

DRIVEN BY SOARING Internet use and sales of second PCs to homes, a host of companies are also beginning to tackle the problem of high-bandwidth access *inside* residences—in other words, connecting multiple PCs to let them share one Internet connection. Diamond Multimedia, Proxim, and others are shipping new products that shuttle data wirelessly (via radio waves) or over phone and power lines already installed in the home. One drawback: Many of these devices still use dial-up 56-kbps modems to connect to the Internet.

For faster access, enter Cisco Systems, the networking powerhouse that makes most of the routers directing Internet traffic. Backed by 33 telephone, cable, ISP, and consumer electronics companies, Cisco announced a three-pronged strategy in early January. Targeting service providers, the company will sell new network products for carrying data, voice, and video over cable lines. It's also licensing cable modem technology to companies like Sony and Samsung; those companies are in turn selling to consumers. Finally, Cisco will develop and license a home network for connecting PCs, phones, and entertainment equipment over telephone lines with ethernet-like speeds of 10 megabits per second. Competitor 3Com will use this same phone-line technology in its HomeConnect brand; those modems are slated to begin selling this summer.

Change will no doubt occur more slowly than we want, and promises are easier to make than to fulfill, especially in the consumer market with its high standards for ease of use, service, and affordability. It's almost a year until the next holiday shopping season. Let's hope these ambitious plans at least partially succeed.

Cathryn Baskin is editor in chief of PC World. ■

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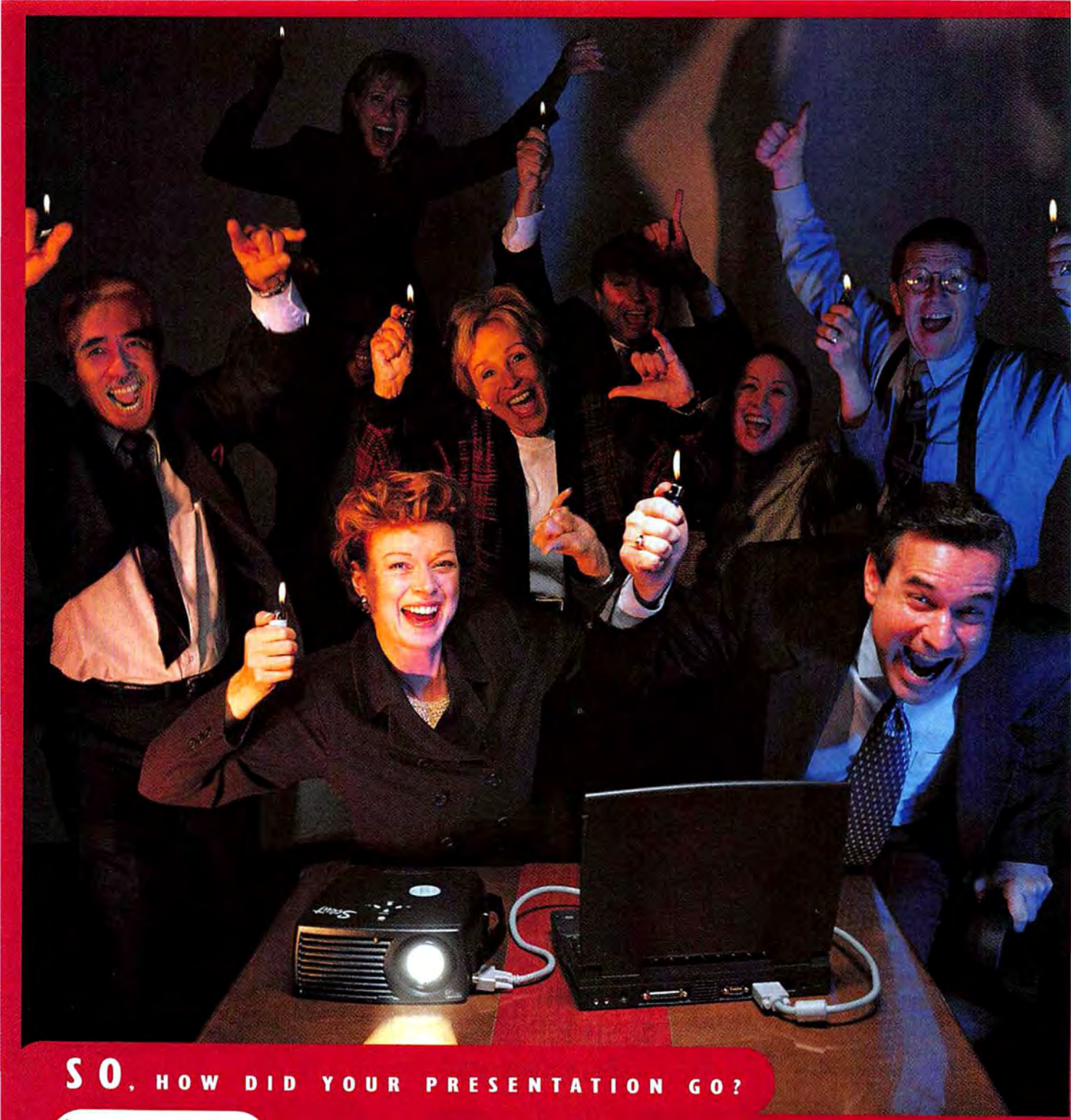

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DON'T LET YOUR ISP CUT OFF YOUR CHAT

IN THE ARTICLE "Don't Let Your ISP Cut You Off" [*Got a Problem?* January] Jeff Berger says, "ISPs and online services have to develop technology that understands when people are using the connection for important work—and not just playing in chat rooms." Quite frankly I was offended. I don't particularly like chat rooms either, but suggesting that people should have connections they paid for terminated because they are using them for recreation instead of "real work" is absurd. People paid for the connection, and what they're doing is not illegal.

Matt Miller, Austin, Texas

NET PORN LAW NOT NEEDED

IN REGARD TO Roberta Furger's January *Top of the News* article "Net Porn Law: Help for Kids, Pain for Business": I'm a minor myself, and I can say from personal experience that if a computer-savvy kid wants to see something on an Internet site, he or she can. You can put any verification systems and security features you want on a system, but if I really wanted to, I could get in, and so could any other halfway intelligent kid. I don't bother with porn sites because I don't care to, not because my way in has been blocked by any age verification or content-screening software. Explicit material will always be available to minors; the Internet has merely changed the process of acquiring it from tricks at the local bookstore to hacking past the security software. Instead of passing laws that we'll be able to get around anyway, why not just trust us to be responsible? You might be surprised.

James Simmons, age 17
Tualatin, Oregon

I UNDERSTAND the government's desire to shield children from pornography. But I don't understand why they ignore the easiest approach: Flag sites that contain adult-only material. This could be done with a .prn instead of .com or .net in the site's URL. Or all adult sites could be made to reregister their name with the word *adult* as the first part of the site name: "adult.whitehouse.com," for example. If all sites with adult content were so labeled, restricting access to them would be a very simple matter. Just set your browser to block them, and password-protect the configuration for that option.

Joe Fry
Oklahoma City, Oklahoma

WEB ADS DEFENDED

TO STEVE BASS: In "Unclog the Net: Eliminate Web Ads" [*Home Office*, January], you seem to think that Webmasters place these ads to become rich overnight. Most Web ▶

HOT BUTTON

Plague of Software Bugs Raises Readers' Hackles

YOUR "Software Bugs Run Rampant" cover story [January 1999] was on the mark! I work in the quality assurance department of a leading game developer. Nine times out of ten, bugs that users encounter were "written off" by the producer. That means we found them and told the producer, who decided they weren't worth fixing due to time constraints. "Making the quarterly numbers" is what most companies live for, it seems.

Mark Gutknecht, Baltimore

YOUR BUGGY SOFTWARE story hits one nail on the head; the other nails that need some attention are the total lack of user documentation and the absence of functional and performance standards.

Without user documentation, most people are aware of far less than half the capabilities of any software package they routinely use. I contend that the need for user documentation increases as complexity increases. Instead of producing more complex user manuals, however, vendors have eliminated them. This may help their bottom lines, but not their customers.

Despite the difficulty of assuring compatibility with so many different configurations of hardware and other software, consumers can justifiably demand a much higher standard of performance—and should.

Melvin J. Marion
Richmond, Massachusetts

AS A USER, I certainly support the ideal of bug-free software. But as a software professional, I know the magnitude of the task.

Many vendors test only functions they believe are affected by changes to their product—probably a major reason many packages are released with too many problems. However, our industry is moving toward the use of automated test tools, though it will take some time for these tools to mature.

Even so, given the size of today's popular programs, producing a totally bug-free release will never occur. Instead, the software industry should adopt standards on the number of bugs allowed.

Hardware interfaces pose another problem. More can be done to pressure hardware vendors to fully test and certify their compliance with established interface standards. *PC World* could help by testing and reporting whether each new product is compliant.

Robert Rosenberg
Horsham, Pennsylvania

IT SEEMS EVERYONE is ready to bash the software industry, but no one is willing to act on their criticism. The software industry exists to make money. As long as consumers purchase faulty software, what reason is there to change?

Guarav Verma,
Torrance, California

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Mike Fantau, Wayne, New Jersey

WORDPERFECT SWEETIE

YOUR ARTICLE on the new WordPerfect suite [*Top of the News*, January] says, "WordPerfect Office 2000...will not try to match Microsoft Office 2000 feature for feature"—implying that a buyer of Corel's suite is getting less as well as paying less. This is patently untrue. Many of the improvements in Word 97 had been in WP for several years. Corel's product is superior in the use of tables, databases (both are built into WP), macros, characters, hidden text, customization, and keyboards.

Gary Kukis, Humble, Texas

PC World *welcomes your responses, ideas, and other letters to the editor.* *See page 14 for contact information.* ■

CORRECTIONS AND CLARIFICATIONS

JANUARY'S *Hardware Tips* referred to replacing SIMMs and DIMMs one at a time to isolate a faulty memory chip. However, many older Pentium systems use 72-pin SIMMs that must be installed in sets of two. If you have such a system, with only two SIMMs, you will not be able to remove only one of them in an effort to isolate a defective SIMM.

In December's *Top of the News* story on phone-based e-mail services, the chart comparing the services did not note that the price for the Portico service includes all long-distance phone calls made to U.S. numbers.

In December's *Spreadsheets* column, the formula for counting the number of cells with a value from 1 to 10 should have read: =countif(data,">=1")-countif(data,">10").

PC World regrets the errors.

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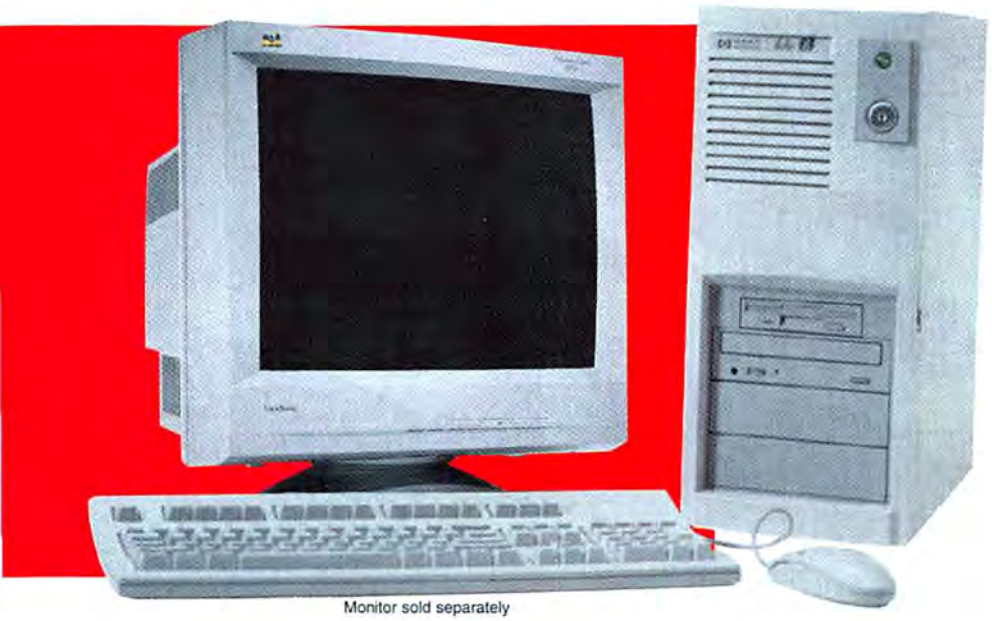

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The Check Is in the Mail (Really)

The Federal Trade Commission cracks down on vendors that fail to follow through on their rebate offers.

ILLUSTRATION: VICTOR JUHASZ

FOR YEARS, consumers have dutifully sent in rebate forms for hardware and software products and then waited—sometimes just a few weeks, often several months or more—for the check or merchandise to arrive. In some cases, nothing ever showed up.

But if the Federal Trade Commission has its way, the delays we've grown to expect with rebate offers may become a thing of the past.

In a landmark case that was settled last December, the FTC charged Iomega (maker of the Zip, Jaz, and Ditto drives) with violating the "Mail Order Rule" and the FTC Act by establishing a pattern of sending out rebate and merchandise premiums only after lengthy and repeated delays. As part of the settlement, Iomega agreed to pay a $900,000 civil penalty—the largest ever imposed for a nonfraudulent violation of the Mail Order Rule.

Besides levying the $900,000 fine, the FTC and Iomega agreed on strict guidelines to govern future rebate offers. Under these provisions, the company may not misrepresent the shipping time of any cash rebate or merchandise premium; it must send out rebates in the time frame specified on the rebate slip (or within 30 days if no time frame is given); and it must make sure that it has hired enough people to process rebate offers in a timely manner.

The staffing requirement is particularly noteworthy, since the usual refrain of companies that send out checks late is that the consumer response "overwhelmed" them. Though these guidelines technically apply only to Iomega, they may spur other companies to forecast response rates to premium offers more accurately—and to beef up personnel accordingly.

Susan Stillings, Iomega's director of corporate communications, acknowledges that the company fell behind in processing some of its first rebate offers, but she insists these problems are "part of Iomega's past." The delays, she says, involved rebates offered in late 1996 and early 1997. "We underestimated the response we would get, and the fulfillment house couldn't handle the requests," she explains. In early 1997 the company hired a new rebate fulfillment house, and now, Stillings says, rebates are processed "in ten days to two weeks."

A CLOSER LOOK

THE FTC'S INVESTIGATION and the sizable penalties it imposed should serve as a warning to other hardware and software companies, according to Matthew Gold, the FTC attorney who led the Iomega case. "This case signals a new level of scrutiny of the computer industry," he says. "The commission is looking very seriously at Mail Order Rule violations in the computer industry, and violators will be expected to pay a lot more than they have in the past."

The Mail Order Rule requires companies to ship merchandise within the time frame promised at the time of sale. If it does not identify a ship date, the seller must send off the goods within 30 days. If the company can't meet the specified (or implied) date, it must notify the customer of the delay and provide a "cost-free" method of canceling the order. ▶

COMING UP IN APRIL

MICROSOFT OFFICE 2000

Do you think of Microsoft Office as just Word and Excel with a few add-ons? Version 2000 offers extensive new intranet and Web collaboration tools, plus automatic personalized menus, "self-healing" installs, and extra apps like FrontPage, Publisher, and PhotoDraw.

INTERNET EXPLORER 5.0

IE 5.0 is on its way, but it may not be a must-upgrade for you. We'll review its navigation, desktop integration, e-mail, Web authoring tools, and more. Also, get a sneak peek at the latest version of Netscape Communicator and learn what it might mean for IE users.

SCAN AND DELIVER

We put 20 scanners priced at between $99 and $699 through a series of rigorous tests to separate the good from the bad and the ugly. We'll zero in on your needs as we name Best Buys for home, SOHO, and corporate users.

HOME, HOME ON THE WEB

The Web can be a fantastic resource for buying a home. We'll show you how it can help you sift through home listings and mortgage rates, calculate moving costs, and even find the best schools.

ALSO NEXT MONTH

▶**Top 100:** The Top Power Desktops, Budget Desktops, Notebooks, Home PCs, Printers, Monitors, Graphics Boards, and Modems.

▶**Here's How:** Windows Tips on navigating with the Favorites menu, Internet Tips on avoiding dangerous Web applets, and Hardware Tips on creating an emergency "super" boot-up disk.

PC WORLD

(Early last year, citing the Mail Order Rule, the FTC fined Dell Computer $800,000 for failing to send out software bundles for new computers within the promised time frame.)

Great, you say, but what does the Mail Order Rule have to do with rebate offers? Plenty, if the offer includes merchandise premiums, like the Zip drive accessories promised by Iomega. Though the Mail Order Rule is more often associated with delays in fulfilling new orders, it covers any product a company promises to deliver to a customer—including a merchandise premium. The Iomega case marks only the third time the FTC has used the Mail Order Rule in this manner, but Gold insists it won't be the last.

"It's a pretty hot issue," he says.

Because the Mail Order Rule doesn't cover cash rebate offers, the FTC argued that Iomega's poor record in handling cash rebates violated the broader FTC Act, which applies to all types of "unfair or deceptive acts or practices." The FTC Act lacks the attention-grabbing cash penalties of the Mail Order Rule (companies must violate a "cease and desist" order before the act authorizes the FTC to start fining them), but the message to hardware and software companies is clear: Don't make promises you can't keep. That message, says Gold, applies just as forcefully to cash offers as to merchandise premiums.

NO MORE EMPTY PROMISES?

THE IOMEGA SETTLEMENT is good news for consumers—and for companies that play by the rules, says Cleo Manuel, vice president of public affairs for the National Consumers League, a nonprofit advocacy group in Washington, D.C.

"Consumers like being able to shop for bargains," says Manuel. "But you need to know, when you enter into a contract by sending in forms, that the promise isn't going to be broken."

Too often companies renege on rebate promises—either by sending the check late (without notifying the consumer) or by failing to ship it at all. Since *PC World* first began looking into this issue in 1997, we have received hundreds of letters from consumers who are frustrated by the industry's inability or unwillingness to fulfill rebate offers on time.

In our investigation into rebate premiums last fall ("Rebate or Rip-Off?" October 1998, www.pcworld.com/oct98/rebate), *PC World* received 7 of 14 rebate checks on time—and a few of these even arrived early. But 3 of the checks arrived later than promised, and 4 never came at all.

Rebates have become a favorite marketing tool for hardware and software companies, which offer cash and merchandise premiums on everything from children's CD-ROM titles to printers, speakers, and new PCs. When fulfilled properly, they're a good deal for consumers and manufacturers: We get a little kickback for buying products we need, and companies get a sales boost. But too often the deal turns sour, as frustrated buyers try to badger vendors into delivering on their promises.

Enough. It's time for companies to play by the rules or get out of the game.

Contributing Editor Roberta Furger is the author of Does Jane Compute? Preserving Our Daughters' Place in the Cyber Revolution *(Warner Books, 1998).* ■

LATE REBATE?

IF YOU'RE TIRED of waiting for late rebate checks or goods, FTC attorney Matthew Gold suggests this four-step approach:

- Send a "polite but strongly worded" follow-up letter to the company, including photocopies of all supporting documentation (receipt, rebate form, UPS code, and other related paperwork).
- Give the company a reasonable amount of time to respond to your inquiry.
- If the company fails to respond, notify the FTC of the vendor's failure to send the promised rebate. You'll find an online complaint form at www.ftc.gov/ftc/complaint.htm, or you can send your letter (with supporting documentation) to the regional FTC office closest to you. (See www.ftc.gov/ro/romap2.htm for a list of regional contact information.)
- Send copies of the letter to the consumer-affairs department of the attorney general's office in your state and in the state where the company is located.

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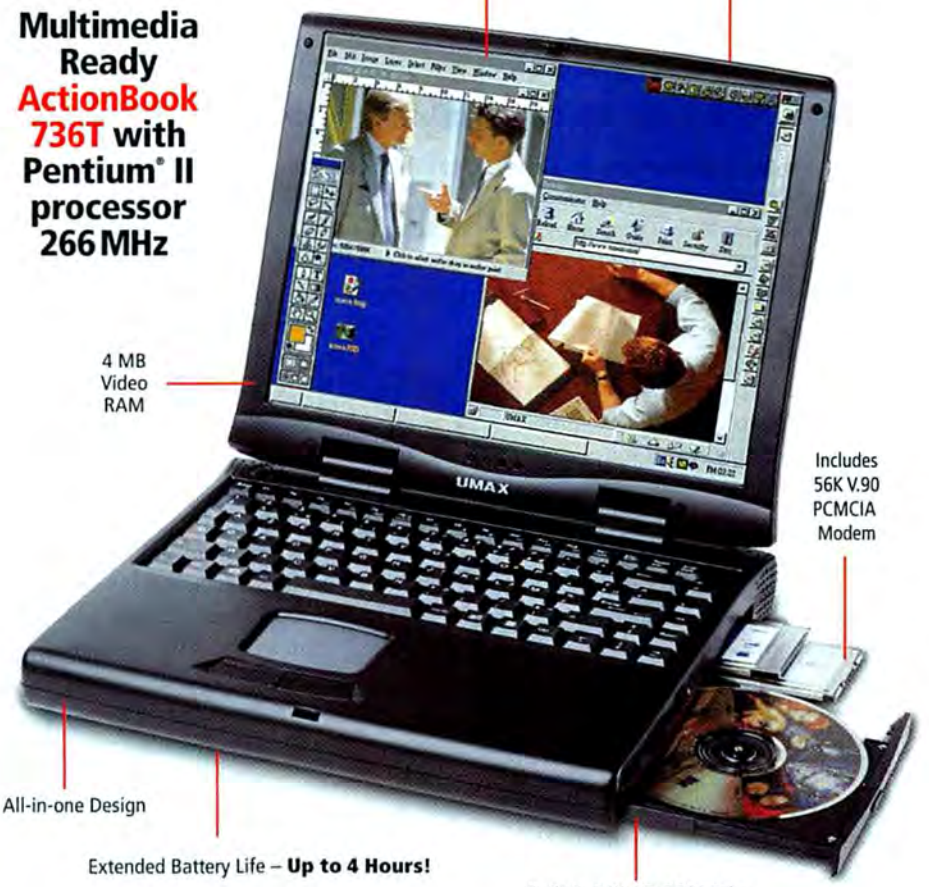

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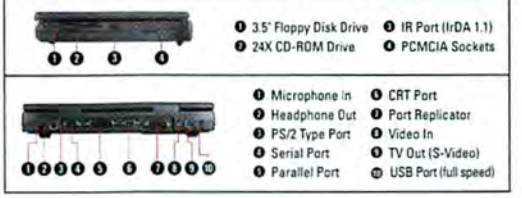

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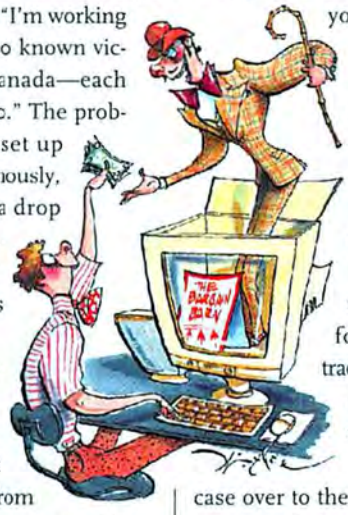
Send Money, Get Nothing in Return

YOU LOVE TO shop at auction sites, online classifieds, newsgroups, and bargain sites, right? Be warned: One of the nastiest scams on the Net involves being charged for goods you never get. In fact, at the National Fraud Information Center (www.fraud.com), three of the top five Internet scams concern undelivered wares.

For Sergeant Nick Muyo of the San Jose, California, Police Department's Rapid Enforcement Allied Computer Team, these rip-offs are a serious scourge. "Right now," says Muyo, "I'm working a case where...I've got 20 known victims in the U.S. and Canada—each out about $400 to $800." The problem is, scammers can set up shop quickly and anonymously, have checks mailed to a drop box, and disappear instantly. "In that case," says Muyo, "you can kiss your money good-bye."



Before you buy, protect yourself. Find out whether you can contact the seller if the product goes AWOL. Don't buy from a site that doesn't provide a street address and phone number. Get recommendations from other shoppers—in newsgroups and auction site chat rooms. And consider using an online escrow house like I-Escrow (www.iescrow.com) or Trade-direct (www.trade-direct.com). These firms charge about 5 percent to hold your money until you've inspected your purchase and given them the okay to pay the seller. Of course, the seller must agree to work with the escrow house.

If you do get bilked, notify the Better Business Bureau and the police in both your city and the seller's, so law enforcement officials can track the problem. If they see a pattern, they'll investigate or—if enough money is involved—turn the case over to the FBI. Also report online auction rackets to the auction site and post a warning in the site's feedback section.

Reporting the scam might even get your money back: A call from the police could scare a crook into sending you a refund.

Heads Up...

AFTER CLOSING SHOP, removable disk drive maker **SyQuest** filed for Chapter 11 bankruptcy on November 17 and has since reached an agreement with Iomega for the purchase of its assets. SyQuest is handling limited warranty repairs. For more info, see www.syquestsupport.com... Many readers have written that the peripherals maker **NewCom** is not honoring its rebate offer. A call to the company revealed that it has had difficulties with a troubled rebate fulfillment firm. For help, call NewCom at 800/563-9266... Watch out for telemarketing calls from printer refill hawkers. In this **known scam**, the caller recommends buying now before prices rise. But you'll be charged outrageously for both product and shipping, and the cartridges may not be factory fresh. So stick with a supplier you know. Check the Imaging Supplies Coalition (www.isc-inc.org) for more info... **EPS Technologies**, a notebook and desktop maker in Omaha, Nebraska, has ceased operations. If you sent a laptop for repairs, contact the original equipment manufacturer, Chicony, at 949/380-0928; have the serial number or service number handy. As for warranty repairs, Marilyn Bath of the Lincoln attorney general's office says, "Unfortunately, a lifetime warranty is only good for the lifetime of the business."

LETTER OF THE MONTH

I UPGRADED TO OmniPage Pro 8.0 at the end of September, in response to a mail offer from Caere. In November, I got an offer to upgrade to version 9.0 for the price of 8.0. A Caere rep told me the company provides free upgrades only for purchases made within 30 days of the newer release. I've barely had a chance to use the software. I think Caere's policy is unreasonable.

—S. K. Feingold
Sarasota, Florida

***PC World* responds:** I contacted Caere with Feingold's complaint. A representative agreed that if Feingold had missed the deadline by only a few days, customer service would have given him the free upgrade, as Caere is flexible about these deadlines. As it turns out, the company didn't owe Feingold the upgrade but gave it to him anyway: Feingold had calculated his date of purchase incorrectly; he missed the deadline for the upgrade offer by almost a month. ■

GOTTEN A RAW DEAL?

Or a great one? Send On Your Side *the details at onyourside@pcworld.com. We will investigate complaints and publish items of the broadest interest. Christina Wood is a contributing editor for* PC World.

ILLUSTRATION: MICHAEL WITTE

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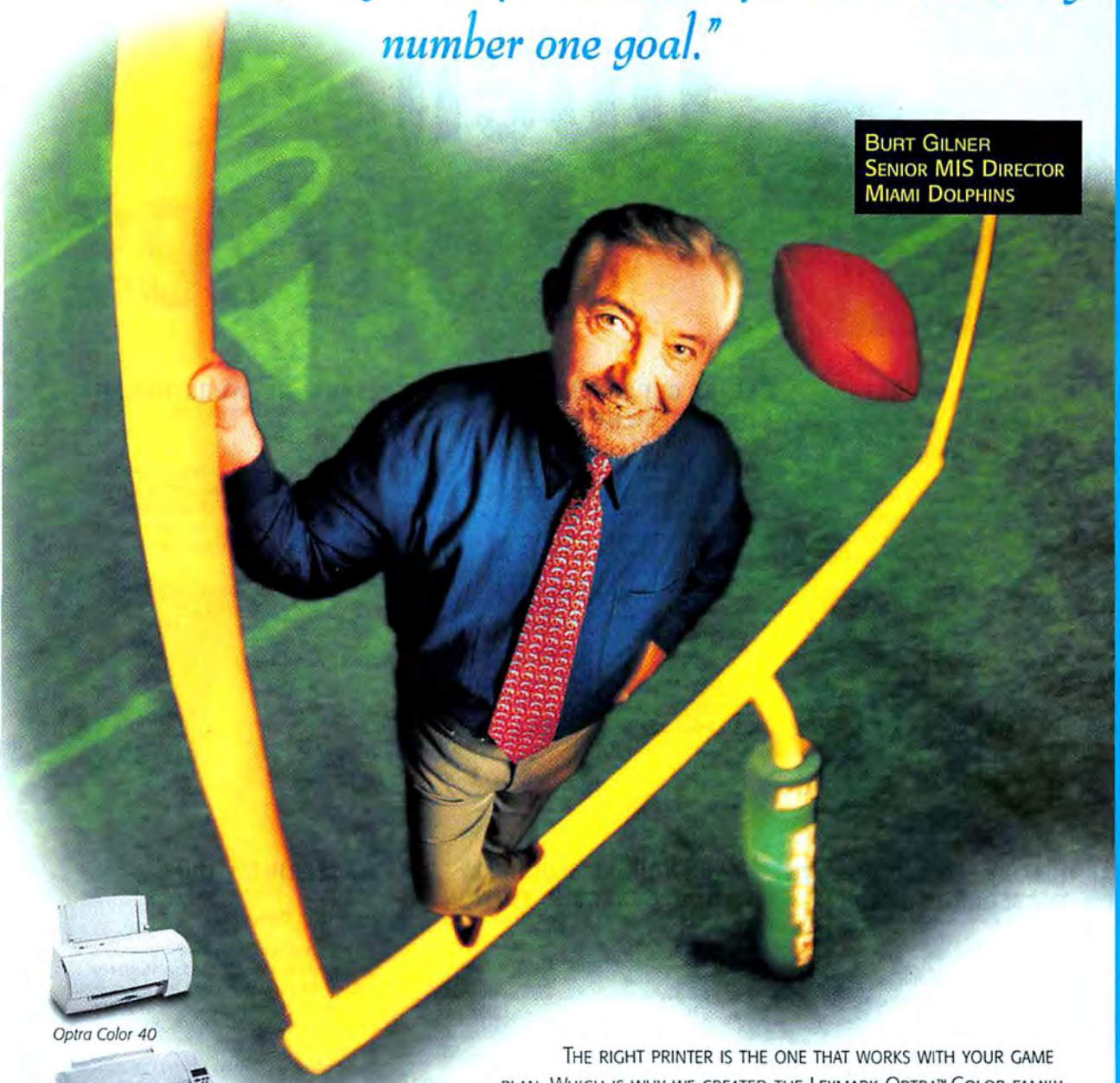

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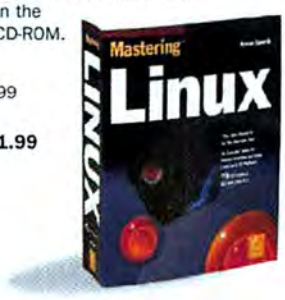

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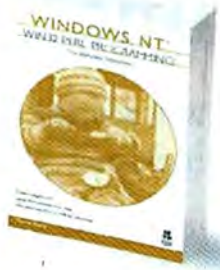

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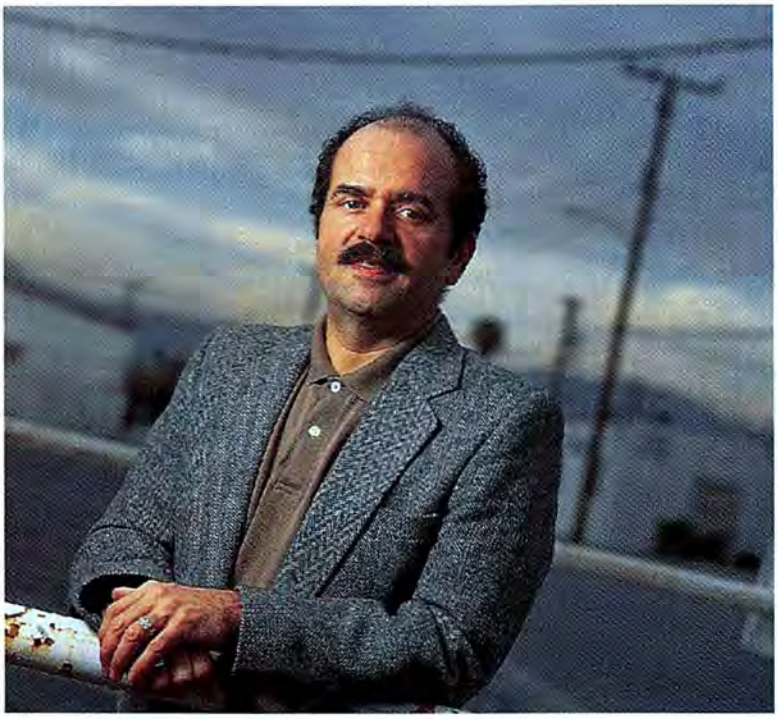
Playing the Domain Name Game

PROBLEM *You want a Web domain name—but traditional hosting services are costly and complex.*

SOLUTION *Let a URL redirection service do the job inexpensively and easily.*



GO ON, ADMIT IT: You want your own Web domain name. Maybe you're tired of a clunky home page address that dwells three directories deep on your Internet service provider's Web site. (Who can remember www.bigisp.net/users/jsmith/index.html?) Or perhaps you've finally decided to take your business online, in which case having a professional-sounding URL is even more important.

Registering a domain name with InterNIC, the organization that licenses and maintains all domain names, costs a reasonable $70 for the first two years, and $35 annually thereafter. The trouble is, the actual costs of using that name mount quickly. Most ISPs will gladly register the name for you and host (or store) your site on a Web server. But a special Web site hosting account costs at least $20 a month, on top of your monthly dial-up fee. And if you decide to move your site to another ISP, InterNIC must transfer the domain name to the new host—a bureaucratic procedure that can take days.

The alternative: Use a URL redirection service. When Web surfers type your custom domain name into their Web browsers, the service automatically forwards them to your existing home page, no matter where it's located or what its actual URL is. Redirection is transparent to your visitors—and simple and cheap for you (costing as little as a one-time-only fee of $49).

TONGUE-TWISTING URLs

RICHARD TARANGO, owner of RTC Computer Services, a consulting business in Whittier, California, knew it was time to get his own domain name when customers tripped over his Web address. "No matter how carefully I spelled it over the phone, people would miss a character," recalls Tarango, whose Web site resides in the space he receives with his EarthLink account.

At first, Tarango considered using EarthLink's domain-name registration and Web-hosting services but was put off by the additional fees. "I was already spending $34 a month for my ISDN account. Adding domain-name hosting would have increased that to $54 a month, not including $100 in one-time setup fees." Then one day he surfed across a banner ad for MyDomain, a company that promised cheap, fast URL redirection. "Fifteen minutes after I registered with MyDomain, anyone could type my new URL, www.rtc-computerservices.com, and get sent right to my site on EarthLink," he remembers. "No one knows the difference, and it costs me at least $240 less a year than it would to use EarthLink's services."

CLAIM YOUR DOMAIN

LIKE AN ISP, MyDomain and competitors such as NameSecure will register a domain name with InterNIC for you. But rather than hosting your site, they simply redirect your new domain name to any URL you specify—so surfers can avoid entering a complex URL such as www.bigisp.net/users/jsmith/index.html and just type www.johnsmith.com. These services also redirect e-mail, letting you use a snap-

PHOTOGRAPH: AMY ETRA

py address like jack@johnsmith.com.

Compared to ISP domain-name hosting services, URL directors offer rock-bottom fees, increased flexibility, and maximum convenience. After you pay InterNIC's $70 fee, for instance, MyDomain charges a one-time setup fee of $49—period. That fee covers both domain-name registration and redirection to any online location, such as the space that comes with your ISP account or the free space available at sites like GeoCities. And if you eventually decide to move your Web site to another ISP, MyDomain will reroute your domain quickly and for free.

DOMAIN LEGERDEMAIN

ON THE WEB, no one need know you're a one-person company. A domain name of your own suggests a sizable operation—and so do multiple e-mail addresses, available for little or no extra money from URL redirectors like MyDomain. For example, your solo catering business's home page might list several e-mail addresses besides the owner's: sales@uptowncatering.com, chef@uptowncatering.com, and webmaster@uptowncatering.com. A well-chosen set of addresses can also presort incoming messages for you.

Registering more than one domain name makes sense if you're worried about competitors grabbing a similar name—say, uptowncatering.net vs. uptowncatering.com. Or you may simply want to provide surfers with as many paths to your site as possible. For instance, in addition to uptowncatering.com, you might want to register cateringexperts.com. MyDomain charges $35 apiece for additional names (plus the $70 InterNIC fee).

If you're strapped for cash, consider a free URL redirection service such as CJB.Net or WebAlias.com. These services don't give you a true domain name, just a permanent subdirectory on their server (for example, http://jsmith.cjb.net) that redirects visitors to your real URL. Still, the addresses are simpler than many traditional URLs. And they offer one address where friends and family can reach you—no matter where a new ISP may take you.

CJB.Net Internet Services
Free; www.cjb.net

MyDomain
$49 one-time setup fee (not including $70 InterNIC registration fee); www.mydomain.com

NameSecure
$25 per year (not including $25 one-time setup fee and $70 InterNIC registration fee); 800/299-1288; www.namesecure.com

PC WORLD INFONET NO. 614

WebAlias.com
Free; www.webalias.com

Carla Thornton is a contributing editor for PC World. *If you're having trouble resolving a PC-related hardware or software problem, we'd like to hear from you. See page 14 for contact information.* ■

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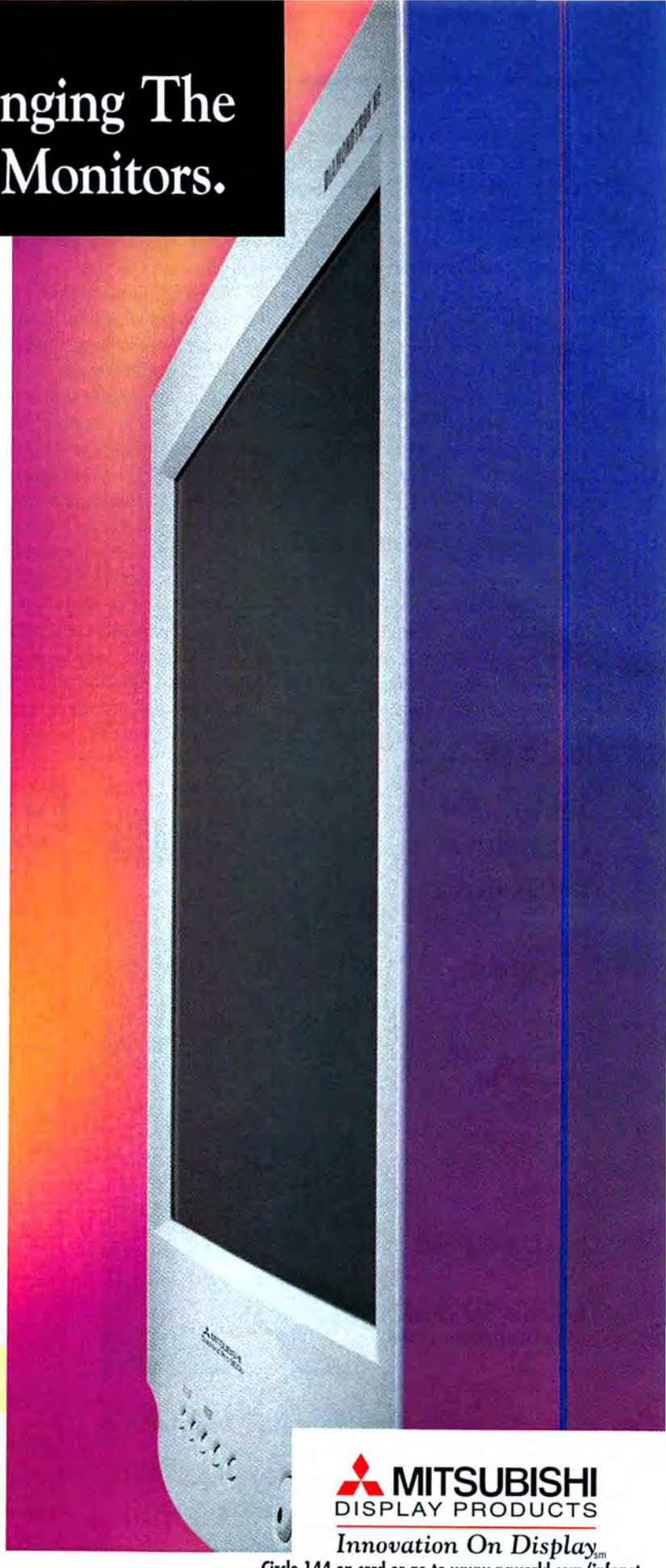

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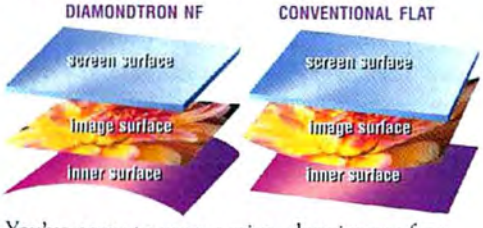

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The Click of Death Ate My Data

"CLICK." "CLICK-CLICK-CLICK." Hear that? It's the sound of my Iomega Jaz drive, along with the cartridge and all its data, kicking the bit bucket. It's also the sound of my 14-year relationship with Iomega coming to an end. Because I'm angry, no, *furious*. Iomega could have warned me—and the hordes of other Jaz and Zip drive users—about the Click of Death before I lost valuable data.

It's too late for me, but it's not too late for you. If you own a Zip or Jaz drive or are considering buying one, I have a terrific free utility and a few great resources for you, as well as a couple of suggestions for Iomega.

ILLUSTRATION: MARC ROSENTHAL

CLICKING FOR DUMMIES

THIS STORY started when I told an Iomega rep that I was doing an article on monster-size music and video files. Iomega sent me a 1GB Jaz drive and a 100MB Zip drive. For three months, I tested the dickens out of both, transferring lots of data and clocking the performance. I liked the Jaz so much I ended up buying one for my wife's system. Heck, the Jaz drive was so convenient I started using it to back up critical files on the fly.

Dummy that I was, the Click of Death issue (COD for short) didn't register on my radar screen. I missed the warning in *Bugs and Fixes* (see "Zip Drive Death Click Is for Real," May 1998, www.pcworld.com/may98/bugfix). And I foolishly ignored hundreds of COD victims' messages on newsgroups like alt.iomega.zip.jazz.

When the Jaz drive failed, I called my personal storage guru, drive expert Steve Gibson. Gibson is the creator of SpinRite, an indispensable utility for finding and fixing surface problems on hard drives.

Iomega's behavior is a textbook example of how not to handle a serious technical problem.

Gibson prayed for my Jaz drive—without success—but said Zip owners had more to worry about. First, the alignment in a Zip may be off, which can cause the drive's heads to "clip" the edge of the flexible floppy disk inside the Zip cartridge's plastic case. Second, Gibson says, the Zip drive may need lubrication, something that's not a problem for Jaz drives.

Okay, bad news first. There is no cure. Once a drive begins to circle the drain, it needs to go back to Iomega for service. Worse, you can deep-six a good cartridge—and all the data on it—if you insert it into a faulty drive. Neat, huh?

So Gibson wrote Trouble in Paradise, an aptly named, exquisitely simple utility to test the failure potential of Zip and Jaz drives. You'll find this free 66KB program on Gibson's Web site (www.grc.com), along with a thorough explanation of the Click of Death problem and a virtual clearinghouse of useful tips and links.

ET TU, IOMEGA?

OFFICIALLY, IOMEGA claims that the COD affected fewer than half of 1 percent of all Jaz and Zip users. But with more than 20 million Zip and 2 million Jaz drives in the world, that's a huge number of problems. (For the record, I pounded the Zip drive and didn't have an iota of trouble.) Some good news: Iomega says it will help users recover their data, sometimes free, sometimes for a fee.

Still, Iomega's behavior is a textbook example of how not to handle a serious technical problem. Instead of taking action at the first sign of trouble, it pretended there wasn't a problem. The company *finally* paid attention, but not quickly enough to avoid a class action lawsuit (see www.texasatty.com/iomgcod.html for details).

Iomega could have made it easier to get answers—like by sticking a link to COD info on the home page instead of burying it three layers deep (www.iomega.com/support/documents/2135.html). And then supplying *lots* of details, not just one page. Responding proactively to messages on newsgroups. Maybe extending the warranty. Sure, normal clicking sounds may alarm users who don't have a COD problem. But for goodness sake, *expect* customers to be worried—and take care of them.

Bottom line: The Jaz drive's up on the shelf—and that's where it stays. Because the data on the drive? It's *my* stuff.

Zip and Jaz external drives
Zip $110, Jaz $260 street; Iomega; 800/697-8833; www.iomega.com
PC WORLD INFONET NO. 613

online *Find files from this article on PC World Online at www.fileworld.com/magazine. Contributing Editor Steve Bass is a licensed marriage and family therapist and president of the Pasadena IBM Users Group. See page 14 for contact information.* ■

SONY

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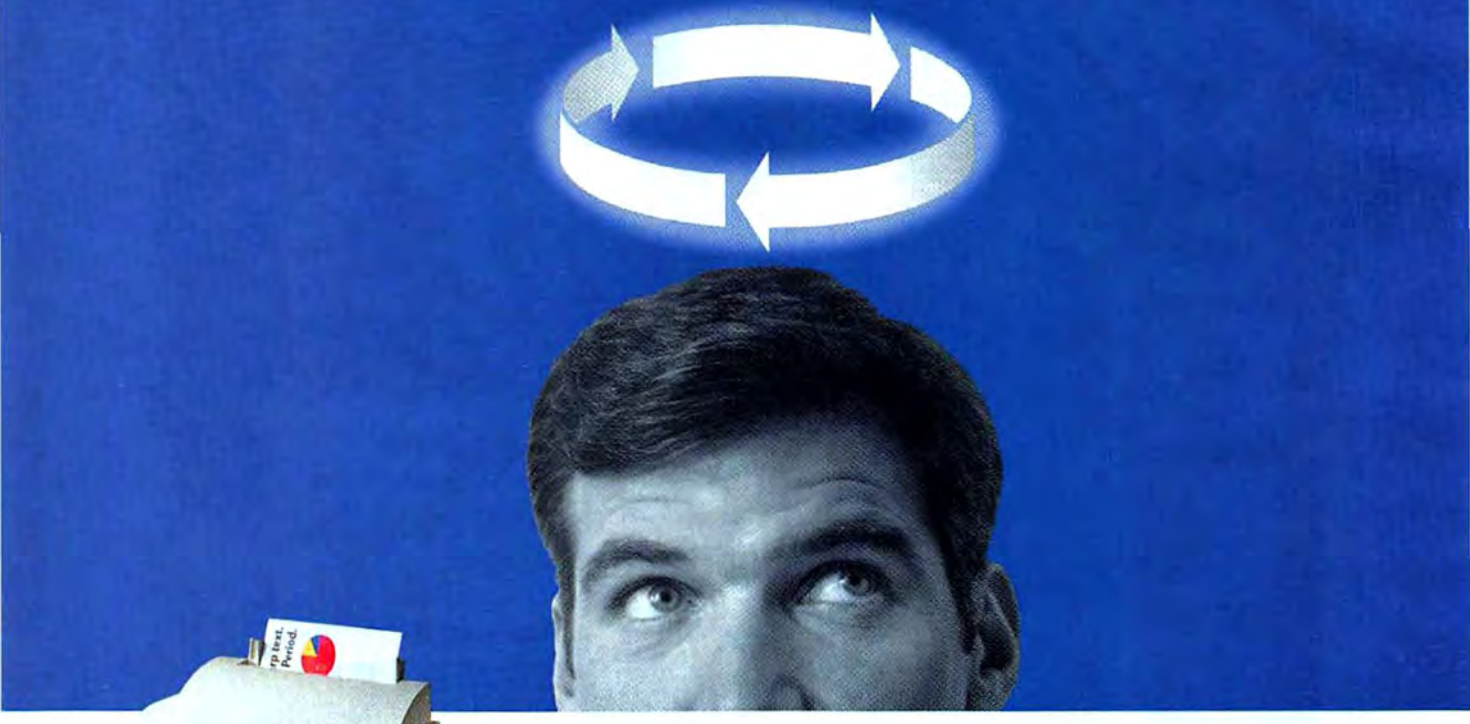

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Antivirus software falls ill ◆ Excel's shakiness ◆ **Quicken 99 atones**

VirusScan 4.0 Needs Its Shots

USERS OF Network Associates' VirusScan 4.0 antivirus software have flooded the company's discussion forums with complaints about conflicts with America Online and an inability to download updated program and virus definition files, among other grievances. Network Associates technicians responding to the complaints have found that the problems appear to be mostly irritating glitches rather than serious flaws. Still, sorting out the confusion ain't easy.

First, the AOL glitch. According to VirusScan product manager Ryan McGee, versions 4.0 of both VirusScan and AOL arrived at about the same time, and due to "bad timing and bad luck," they clashed. Specifically, McGee says, new online technology in VirusScan prevented the AOL 4.0 client software from connecting to the AOL network. The VirusScan 4.01 update fixed this problem, and a subsequent 4.02 version addressed other conflicts with corporate network installations.

ICON: JEFFREY PELO

Even Excel Is a Bit Insecure

SOFTWARE SECURITY, or the lack of it, has received a lot of attention lately, including in this column. Security holes, usually found in browsers, are logical flaws in a program's design that allow smart programmers with nothing better to do to access your files, crash your PC, or upload a nasty program to your computer and run it.

Microsoft recently admitted that both Excel 95 and 97 are vulnerable to these kinds of exploits, too. The problem, known as the Russian New Year Bug, concerns the program's Call function, which allows an Excel worksheet to run another external program. It sounds innocuous enough, until you consider that the external program could delete files, infect your system with a virus, or wreak other havoc. Unfortunately, Call doesn't warn you before running the external program. A disgruntled employee can simply create a nasty program, Call it in a worksheet's Autostart macro, and then attach the worksheet and the external program to an e-mail message.

Microsoft says no one has exploited this loophole yet, but the company offers a 132KB patch (available at officeupdate.microsoft.com/downloadDetails/xl97cfp.htm) that disables the Call function in worksheets. The patch requires that you've already installed Office 97 Service Release 2. However, the patch does not disable Call when used in a macro (such as the Autostart macro). For more details, visit support.microsoft.com/support/kb/articles/q196/7/91.asp.

However, many users could not get the program updates they needed because their downloads were cut off before the files finished transferring. Others found that the Web site wouldn't accept their valid VirusScan update product codes and passwords. Version 4.01 users who attempted to update the program or virus definitions received this charming error message: 'Validation code failed for ECOMMS.DLL—Re-install VirusScan'. Makes you want to put your machine out of its misery with a good dose of the Concept or Wazzu virus.

McGee admits that some of the company's Web server problems may have interrupted downloads. The VirusScan frequently-asked-questions file reports that the password and validation code problems have been fixed. But if you upgrade to version 4.01 and receive the nasty error message cited above, you'll need to work around it. First make sure you're connected to the Internet. Then go into the VirusScan folder on your hard drive (it should be under c:\program files\network associates\mcafee virusscan) and double-click on the file called ecengine.exe. The program will automatically download a new file and then perform program or virus definition updates. For more details, go to the Network Associates Internet Support Forum (support.nai.com/forums/page1.htm). Once there, look for the Internet Services section and click on the *Download Support* link.

online

You can find files mentioned in this article at PC World Online (www.fileworld.com/magazine). Scott Spanbauer is a contributing editor for PC World. ■

IN BRIEF

Quicken 99 Now More Divine

INTUIT HAS released Quicken 99 version 2. The company says the update resolves many of the problems reported in January's column, providing better file conversions for upgrades from Quicken 98 and fixes to online payment glitches. For instructions on how to install the update, see www.intuit.com/support/quicken/index/ndxw_8_updates.html.

WordPerfect Suite 8, Service Pack 5

A GOLD STAR TO COREL for supplying another timely collection of fixes for its flagship suite (too bad the software was so buggy in the first place). Download the 14MB patch from ftp.corel.com/pub/WordPerfect/wpwin/8/wp8sp5.exe. For a complete list of Service Pack 5's updates, see ftp.corel.com/pub/WordPerfect/wpwin/8/wp8sp5_readme.htm.

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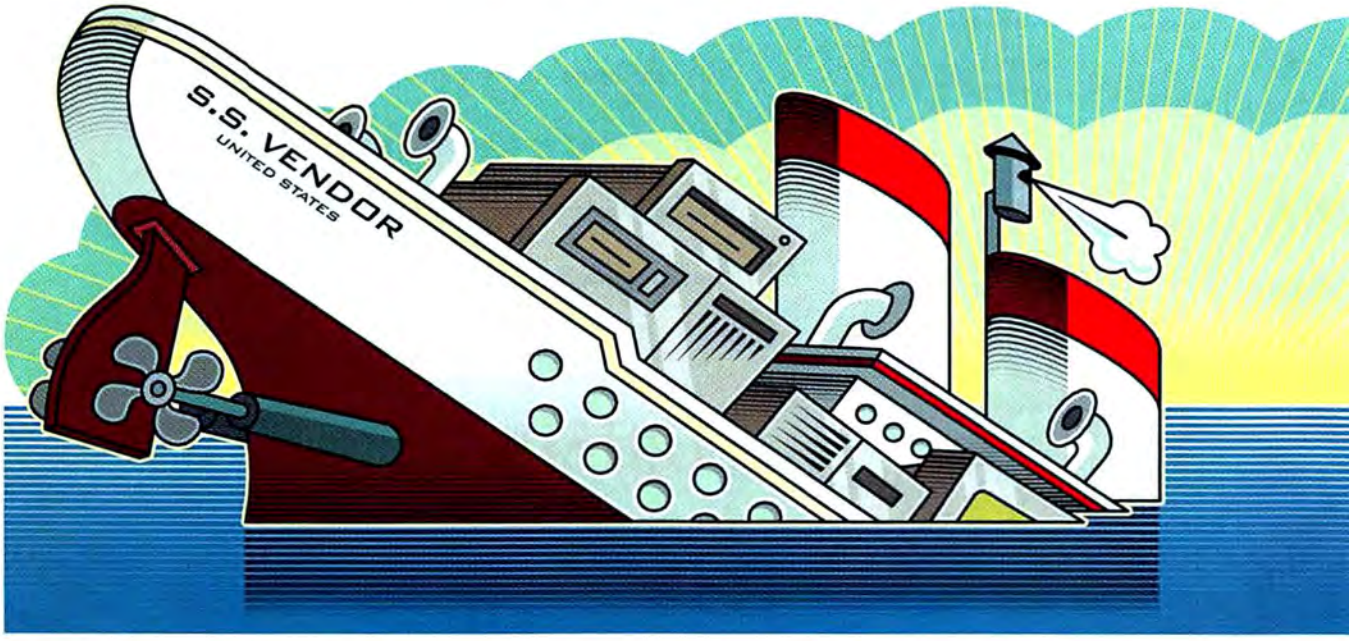
How to Stay Afloat When Your Vendor Sinks

Foundering **PC and peripheral** makers are leaving customers without rebates, support, or warranty service. **Sometimes they even disappear** without a trace. Here's what you can do.

◆ **By Christina Wood**



CONSUMER ALERT

MORGAN FRALICK'S SparQ drive started acting up last fall. So he called the maker, SyQuest, and asked for technical support. A company rep told Fralick, an optician in Aiken, South Carolina, to mail in the drive, saying that the company would send him a replacement in ten days. Fralick dutifully sent in the drive and waited. Ten days passed before he called the company. And called. And called. Finally he learned the bad news: SyQuest had suspended operations and filed for Chapter 11 bankruptcy protection. "I felt abandoned," Fralick says. "I did the research and bought a good product from a company that had the service to back it up. But I got caught in a bad situation."

What happened to Fralick and SyQuest are far from isolated incidents. In the past year, at least seven companies have fallen victim to the fierce price wars raging in the computer industry. In addition to SyQuest, a maker of removable drives, casualties include storage manufacturer Avatar Systems; scanner producers Storm Technologies and Info Peripherals; computer vendors Vektron International and EPS Technologies; and most recently Hayes, the modem pioneer. Each of these companies either has filed for bankruptcy or has closed its doors and disappeared quietly into the night. (SyQuest, like the other ailing firms, was unavailable for comment for this article; nobody's answering the phones or e-mail.)

MORGAN FRALICK'S broken SparQ drive was under warranty, but when SyQuest shut down he had no place to turn.

The real victims in these situations, of course, are customers like Fralick who are left without access to customer support, warranty service, or rebates they were promised. Fralick is out his drive, the nearly $200 he spent on it, and several months' worth of data backed up on disks only a SparQ drive can read. But there are steps you can take to prevent this from happening to you. The key is to find out about the companies you're buying from as well as the products you're buying.

SMALLER VENDORS, BIGGER RISK?

FRALICK RECOGNIZES that his problem could have been worse. "It's not as if it was a whole computer system," he points out. Tell that to David Chung, a theology student at Princeton University. Last year, he bought a system from EPS Technologies. One reason he chose EPS: the company's "Customer First" service plan. But that technical support is no good to him now—EPS closed shop in November 1998, rendering his warranty worthless. Next time, Chung says, "I'll be looking for a more mainstream company, like IBM or Dell. They probably won't go out of business."

Chung has the right idea (though even Dell was a dicey start-up once upon a time). Bruce Stephen, an analyst at International Data Corporation in Framingham, Massachusetts, explains that the PC industry is undergoing a tremendous revenue and profit squeeze. The bigger companies can afford to make the changes necessary to survive, he ▶

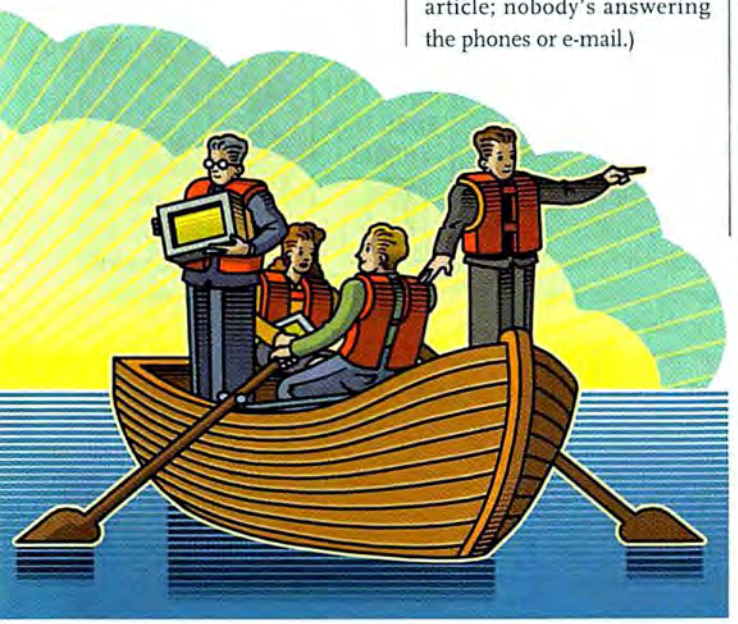


ILLUSTRATION: PETER HOEY; PHOTOGRAPH: JEFF AMBERG; ICONS: JEFFREY PELO

Win 98 Service Pack Coming Soon

THE FIRST significant revision of Windows 98 won't offer the average user much. Instead, it will focus on improved support for several promising but still rare technologies, including Device Bay hardware (a spec for a new PC bay that would allow users to add or upgrade peripherals, like hard drives, without opening the PC case); Universal Serial Bus modems; and Asynchronous Transfer Mode, an advanced networking technology that allows you to transmit voice and video as well as data. Microsoft says that the service pack should be available on new PCs and as a free download (at www.windowsupdate.microsoft.com) by the end of March.

HP's Sub-$100 Printers

THIS SPRING, Hewlett-Packard will introduce a new low-end line of ink jet printers under the Apollo brand name. These devices are being developed and sold by Apollo Consumer Products, a new HP subsidiary. Exact pricing wasn't available at press time, but the printers could sell for as little as $80 apiece, according to our estimates. On the downside, the devices will most likely hold a single ink cartridge, requiring you to switch between cartridges, depending on ▶

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says, but the crunch on third- and fourth-tier vendors will intensify. "It's usually the smaller companies that are driven out," Stephen says.

How do you protect yourself against buying from a failing PC vendor? Approach the purchase with the same caution you'd use when buying stock. "Be careful about the viability of the company [you're] buying from," Stephen advises. "Ask about the company's profitability, ask how many employees there are. Is the company expanding? All these are clues to the health of the organization."

You can get solid information about most companies with a little help from the Net. If the company is publicly traded, consult Company Sleuth (www.companysleuth.com). Register with the site, give it a list of the companies you're considering, and it'll e-mail you all kinds of information, including related news stories, filings with the Securities and Exchange Commission, analyst reports, job postings, and relevant online discussion groups. If the company is privately held, try looking for help at Companies Online (www.companiesonline.com), where you can order a Dun & Bradstreet report for about $20.

PRINCETON THEOLOGY STUDENT DAVID CHUNG was left high and dry when his PC vendor, EPS Technologies, shuttered its business.

PERIPHERAL PROBLEMS

PERIPHERAL MAKERS also live on the edge. Venerable modem maker Hayes, for example, announced in January that it was shutting its doors. "There's a lot of blood flowing in the modem industry," says John Navas, a communications consultant in Dublin, California. Among the causes of the bloodshed: Modem buyers aren't upgrading as often as they used to, and very serious competition from new technologies such as Digital Subscriber Line and cable modems is looming.

The outlook for modem vendors is pretty grim. Of the six companies represented in a recent *PC World Top 10 Modems* chart, one vendor (Zoom Telephonics) lost money in six of the previous eight quarters, while another (Boca Research) was in the red for seven of those quarters.

Scanner makers have weathered a nasty spell of their own: Within one month in late 1998, Storm Technologies of Mountain View, California, filed for Chapter 7 bankruptcy; and Visioneer of Fremont, California, sold its scanner business to Primax. Consumers who had previously benefited from intense price competition quickly became its unwitting victims. One *PC World* reader (who requested that we not print her name) bought a Storm scanner and applied for an advertised $30 rebate. She never received the rebate check and, according to the trustee for Storm Technologies' bankruptcy case, she probably never will.

Nevertheless, Kristy Holch, principal of the Boston-based InfoTrends Research Group, believes

PHOTOGRAPH: JOHN ABBOTT; ILLUSTRATION: PETER HOEY

How to Find Your AWOL Vendor

WHEN A COMPANY goes under, it rarely does so neatly. You won't receive a polite notice in the mail announcing its demise, with instructions for obtaining continued warranty support. More likely, you'll call for technical support one day and find yourself caught in a voice-mail loop, or you'll get an endless busy signal or no answer at all. Or you'll go to the company's Web site to download a driver update only to receive an error message indicating that the server no longer exists. (SyQuest's Web page rudely disappeared for weeks; it returned with a polite apology prominently displayed on the home page.)

DON'T PANIC

IF YOU SUSPECT that your vendor has gone belly-up, don't panic. First, if you can get through to its Web site, check the online press releases for any announcement of trouble. Nothing? Call the Better Business Bureau in the city where the company is located; the Bureau's Web site (www.bbb.org) can direct you to the right phone number. Still no answer? Visit the Company Sleuth site (www.companysleuth.com) for Internet scuttlebutt on the company. If things look bad, call the attorney general's office in the state where the company is headquartered. If all this research turns up nothing definitive, wait a week or two and then call the local bankruptcy court (check local directory assistance for the number). Many courts maintain automated response lines that allow you to punch in the company's name and obtain details on relevant pending cases.

Not all financially troubled companies go to the bother of filing for bankruptcy, of course—many simply disappear. If you need help tracking down one of these AWOL vendors, e-mail *PC World*'s *On Your Side* at onyourside@pcworld.com. If we know the status of a particular vendor, we'll let you know.

Down and Out

WHEN A COMPANY FAILS, it can do so in several ways. Initially, you may not care about the particulars, but these details can have a big impact on your ultimate recourse.

CHAPTER 11

IF A COMPANY has to file for bankruptcy, this is the best-case scenario for consumers. Chapter 11 protects a business from its creditors while it reorganizes and tries to recover. SyQuest is currently in Chapter 11. Hayes was under Chapter 11 protection until this past January, when the modem maker admitted defeat and said it was liquidating its remaining assets.

CHAPTER 7

THIS IS BAD news for you: Chapter 7 means that a company is liquidating its assets. Your only hope in this case is if the company sells its customer list to another firm that will then provide service or repairs—for a fee. Contact the trustee handling the case to get details; you can find the trustee's name through the bankruptcy court in the company's city. But the likelihood of getting back your money or goods is slim. You'll have to get in line behind the company's secured creditors—and if the company had any money to pay them, it probably wouldn't have filed Chapter 7.

AWOL

THOUGH NOT an official business term, *AWOL* describes a company that has closed up shop and disappeared without a trace. When this happens, you have almost no recourse. You can sue for damages, but you'll have to find the principals first. It's likely that any action you take—unless you can get in on a class-action suit—will end up costing you more than whatever you originally bought from the outfit.

that it's safe for consumers to purchase from the scanner makers that are left. "Most of the companies in the market have a reason for being there," she says. "The pressures of price cutting were fierce in 1998, but I don't think we'll see it continue." Many of the remaining scanner companies, Holch predicts, will adjust to market pressures by selling higher-quality products with higher profit margins.

The shakeout has already hit the removable-storage market: Unless SyQuest recovers under Chapter 11 protection, Iomega will be the only major vendor still standing. (However, new storage technologies—such as high-capacity floppies from Imation, Sony, and other companies—are already starting to arrive.) But according to Jim Porter, the president of Disk/Trends, a market research firm in Mountain View, California, SyQuest's demise may have been as much the result of errors in judgment as industry pressures. "[SyQuest management] sized the company at a level larger than the market it could attract," he explains.

SHOP SMART

FOR COMMODITY products like modems and scanners, checking a company's background before you buy may not be worth the trouble. Consultant Navas suggests buying a modem the same way you would a toaster. "Buy from a reputable retailer, and if [the product] doesn't work, take it back and try something else," he advises.

Even if you exhaustively research a company whose product you buy, there's no guarantee that it will stick around to support it. For instance, industry experts were caught off guard when SyQuest suspended operations, because the company looked to be on the rebound.

> Even **experts** were caught off guard when **SyQuest suspended** operations.

Fortunately, Morgan Fralick is feeling a glimmer of hope these days. In January, SyQuest's Web site suddenly returned from the dead to announce that the company had found funding for its Chapter 11 reorganization. Not long after that proclamation, Inter-Manufacturing Incorporated of Santa Clara, California, a contract manufacturer that once repaired drives for SyQuest, said it would provide limited warranty support for the ailing company's products. When Fralick contacted IMI, representatives there told him they could send him a replacement unit. The catch? Instead of getting it for free, as SyQuest's warranty promised, he has to pay for the new drive. ▶

whether you want to print color or monochrome. Meanwhile, by the time you read this, HP will have slashed the price of its DeskJet 420C ink jet printer from $119 to $99.

New SmartSuite

LOTUS EXPECTS to ship a new version of its SmartSuite office suite by midyear. It will sport an improved interface, additional voice support, more Web publishing features, and enhanced compatibility with Microsoft Office file formats. The as-yet-unnamed product will include beefed-up versions of the Approach database and the SmartCenter desktop utility, too. The package is anticipated to cost about the same as the current version of the suite, which runs $399, or $149 as an upgrade.

TidBytes

AST Reborn: Packard Bell founder and former CEO Beny Alagem bought the AST brand name from Samsung subsidiary AST Research. The new company, AST Computers, will sell PCs. AST Research will continue to service products it previously sold, but it won't make or sell new ones. **MindSpring Buys Netcom:** After the deal closes, most of Netcom's 400,000 dial-up customers will be able to keep using their existing Internet access numbers for at least 90 days. Netcom customers will also be permitted to retain their e-mail addresses. **@Home to Buy Excite:** @Home, which offers Net access via cable modem, will acquire Excite, a major Web portal site.

Foil PC Snoops With Voice ID, Smart Cards, and Fingerprint Scanners

ANALYSIS

QUICK, LOOK at your desktop. Is your monitor plastered with sticky Post-it notes sporting the passwords for your ISP or corporate local area network? Do you use obvious passwords like the word *password*? Do you seldom change your passwords?

HERE'S HELP

CHANCES ARE your answer is: "Guilty on all counts." If so, your privacy, your data, and even your job are at risk. But help is on the way. PC vendors, including key players like Compaq, Hewlett-Packard, and Microsoft, are rolling out security solutions that are cheaper, easier to use, and more powerful than anything the average PC user has been able to buy before.

Expect to see products that fall into two broad categories. *Biometrics* includes everything from fingerprint detection devices to voice recognition software to eyeball scanners. With these products, you won't be required to remember a password. Instead, your PC will identify you by your voice or by the unique pattern of one of your body parts. *Smart cards*, which resemble bank ATM cards, do require a password or personal identification number, but an intruder who knows your password still won't be able to break into your computer without your card.

Most of these security technologies have already been battle-tested: Biometric technology has been a mainstay in law enforcement for a decade, and smart cards have been used in Europe for years.

KEY TRONIC'S keyboard has a fingerprint scanner that lets only you log on to your PC.

SMART CARD READERS, similar to Gemplus's GemSafe, will be offered on new PCs later this year.

We examined several of the newest biometric and smart card products. Despite some limitations, these devices are worth considering as a password option if, for example, you want to keep kids from accessing the Net unsupervised, or you want to protect your proprietary data from garden-variety intruders. Most of the products cost less than $200. Eventually, some may be bundled free with new PCs.

THE BODY AS PASSWORD

BIOMETRIC PRODUCTS offer the most promising solution because you don't have to carry a card or remember a password. Moreover, prices of biometric devices have plummeted in the past year. Key Tronic has just introduced a keyboard with a built-in fingerprint scanner for $149. (A similar keyboard cost $800 last summer.) And Compaq offers a tiny $99 fingerprint scanner that plugs into your system between the keyboard and the PC. Identicator Technology makes the scanner units for both of these products.

Competition among developers of such security devices is also beginning to heat up, as several new companies enter the field. For example, the $149 U.are.U Plus fingerprint recognition system from Digital Persona uses a technology different from Identicator's.

We tested shipping units of Key Tronic's Secure Scanner Keyboard, Compaq's Fingerprint Identification Technology, and Digital Persona's U.are.U unit. The Key Tronic and Compaq devices connect to your computer's parallel port. We found their cabling and software setups a little tricky. Moreover, the Identicator technology proved finicky: It requires the user's finger to be placed carefully and precisely, which often took us several tries. Identicator claims that version 2.0 of the software (the devices we looked at used version 1.01), which will be available about the time you read this, will offer better ease of use as well as additional features for LAN managers.

The U.are.U unit was easier to use. It's a Universal Serial Bus unit, so setup was Plug and Play. The software installation was automatic, too. In addition, the U.are.U handled recognition quickly and was not at all fussy about finger placement, even recognizing upside-down prints. The system includes log-in protection plus a fingerprint-protected screen saver that shields your data from prying eyes when you're away from your desk.

PHOTOGRAPHS: KEVIN CANDLAND

All three fingerprint scanners prevented log-ins when we used different fingers or had someone else use theirs. But we easily defeated these entire security setups by booting from a DOS floppy disk. If your PC's BIOS settings allow a floppy boot (and most do by default), your system is vulnerable to intrusion. (Outsiders can access files from the DOS prompt, but they can't get into Windows. A sophisticated intruder, however, could log on to the network via DOS.)

The $199 U.are.U Deluxe package includes software for creating encrypted space on your PC that can be accessed only through a positive fingerprint identification. The software automatically encrypts and decrypts files stored on or retrieved from this space. Identicator says the next version of its software will also allow this.

SAY YOUR PASSWORD

T-NETIX'S $50 VoiceEntry II offers a low-cost alternative to fingerprint scanners. It lets you log on to a PC using your voice. It also includes a voice-activated screen saver feature that lets you lock your PC when you leave your desk. We tested a prerelease version of the program, which worked as advertised. And though it may seem to unwise to say your password aloud (because other people may overhear it), in our tests the program wouldn't let anyone else log on, no matter how credibly they imitated the registered user's voice. The software permits you to switch to standard password access as a backup log-in method, in case you catch a cold and the program can't recognize your voice. However, as with the fingerprint-based devices, a sophisticated intruder can bypass the security system by booting to DOS from a floppy disk.

The best protection for high-security installations or the truly paranoid comes from iris scanners. These products read the unique pattern formed by the tissues at the front of your eye. Because these patterns are even more distinctive than fingerprints, iris scanners are tougher to defeat than their fingerprint-based counterparts. In the past they have sold for thousands of dollars, but this spring IriScan will introduce a unit designed for PCs that costs about $500.

> These products may not stop a seasoned hacker, but they'll deter casual intruders like kids and coworkers.

ENTER A PIN TO ENTER YOUR LAN

SMART CARDS work much the way ATM cards do: You insert your card into a reader and enter a PIN to gain access to your data. And as with an ATM card, users will likely carry a smart card in their wallet. Thus, even if you tape your PIN to your desk, an intruder won't be able to break into your PC without the card. Today, smart cards are used to secure access to Web sites, such as intranets.

We tried Gemplus's GemSafe, a $99 smart card reader. The reader, which comes with a smart card, plugs into your PC's serial port. Installing the device and its accompanying smart card support software was easy. Currently, though, GemSafe functions more as a demonstration of smart card potential than as a genuinely useful tool for PC users, since the included software doesn't provide smart card access to your computer. In our test, we found that we could enter several secure demonstration Web sites by using the card.

This spring, Hewlett-Packard will offer smart card readers as an option on all of its Brio, Vectra, and Kayak PCs. Though initially these devices will be stand-alone units, the readers will eventually be incorporated into keyboards.

Microsoft is also getting into the act. The company is creating software to enable developers to write smart card applications; and Windows 2000 will support smart cards.

When heavyweights like Microsoft decide that something as dull sounding as PC security merits their attention, it's probably worth your time, too. Though the products currently available may not stop a seasoned hacker, they'll deter casual intruders like kids and coworkers. And think of all the money you'll save on yellow sticky notes.

—Stan Miastkowski ▶

PASSWORD ALTERNATIVES FEATURES COMPARISON

New Technologies Promise Less Hassle, Tighter Security

PRODUCT	Street price	Pros	Cons	PC World InfoNet number
Smart card reader				
Gemplus GemSafe 888/436-7627 www.gemplus.com	$99	Simple to use, recognition accuracy not an issue.	Card can be lost, user must remember a password.	741
Fingerprint scanner				
Compaq Fingerprint ID Technology 800/652-6672 www.compaq.com	$99	Nothing to lose or remember.	Can be clumsy to use, finicky about finger placement.	742
Digital Persona U.are.U Plus 877/378-2738 www.digitalpersona.com	$149	Nothing to lose or remember, not finicky.	Can be clumsy to use.	743
Key Tronic Secure Scanner Keyboard 800/262-6006 www.keytronic.com	$149	Nothing to lose or remember.	Can be clumsy to use, finicky about finger placement.	744
Voice identification software				
T-Netix VoiceEntry II 800/352-8628 www.t-netix.com	$50	Nothing to lose or remember, inexpensive.	Recognition can be a problem if, say, you have a cold.	745
Iris scanner				
IriScan PC Iris 800/333-6777 www.iriscan.com	$500	Nothing to lose or remember, most accurate recognition.	Expensive.	746

Color Laser Printers Smash the $2000 Barrier

Tektronix Phaser 740N

UNTIL NOW, offices that needed high-quality color printing at affordable prices had to settle for a networked ink jet printer. But that's about to change. Printer makers are now introducing color lasers that rival ink jets in price while surpassing them in performance and features, and often in output quality.

Consider this: One year ago *PC World* described Minolta's Color PageWorks laser as "inexpensive" at $2999. For this article, in contrast, we examined the first two color lasers selling for less than $2000: QMS's $1300 Magicolor 2 DeskLaser, and Tektronix's $1850 Phaser 740N, both of which are networkable. By the time you read this, Minolta's $1700 PageWorks L model should ship, and other vendors expect to introduce low-cost color lasers this year.

But not all inexpensive color laser printers are created equal. Based on our evaluations, we consider the Tektronix Phaser 740N a better value than the QMS Magicolor 2 DeskLaser—even though the Phaser costs $550 more.

LASERS VS. INK JETS

LASER PRINTERS have always been a better choice than ink jets for a busy office. Lasers print monochrome text better and much faster than ink jets. Lasers also hold more paper, so you don't need to restock them as often. And a laser's toner supply normally lasts five to ten times as long as an ink jet's. Furthermore, lasers are more versatile: Many models support such extras as high-capacity input trays, duplexers for double-sided printing, collators, and envelope feeders; some can even be upgraded to double as copiers.

To circumvent the limitations of ink jets and the historically high costs of color lasers, says Ed Lee, a senior analyst for Lyra Research, many businesses equip their office networks with an ink jet for color jobs and a high-speed monochrome laser for text. Late last year this option typically cost about $2500—or about $500 less than a color laser alone.

A BETTER SOLUTION

BUT THIS PRINTER-juggling strategy isn't always convenient. You may have to create two separate documents, or divvy up the pages of one document between two printers (at the risk of unintended repaginations) and then manually insert the color pages into the black-and-white document. And because color ink jet output never looks quite the same as the surrounding laser-printed pages, the resulting document can appear somewhat messy.

Sub-$2000 color lasers offer a money-saving alternative to the laser/ink-jet combination. For example, networkable versions of two top printers—Lexmark's monochrome Optra S 1855N and Hewlett-Packard's fast 2000 Cse ink jet—together cost about $2450.

For offices that print a lot of color documents, the savings don't stop there. Color laser toner generally costs less per page than the ink supplies for color ink jets. We estimate that printing color costs about 8.2 cents per page on the Tektronix Phaser 740N, and about 7.3 cents on the QMS Magicolor 2 DeskLaser. In comparison, the HP 2000 Cse ink jet uses about 8.4 cents' worth of ink for every page, and the high-quality paper required for the best ink jet output can add another 8 to 10 cents per page.

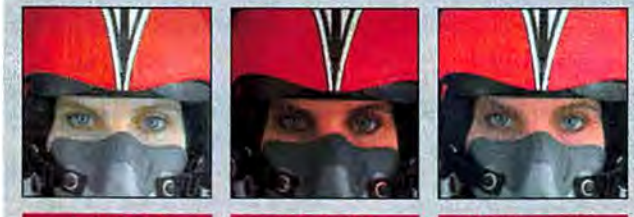
THE WORLD BELOW $2000

IN PC WORLD LAB tests, Tektronix's Phaser 740N blew away the QMS Magicolor 2 DeskLaser in speed, paper handling, and upgrade options. In terms of output quality, the two models are more evenly matched.

The Phaser 740N prints monochrome text at 8.9 pages per minute—faster than ▶

PRINT QUALITY SAMPLES

Color Lasers vs. Ink Jet



LASER	LASER	INK JET
QMS MAGICOLOR 2 DESKLASER	**TEKTRONIX PHASER 740N**	**HEWLETT-PACKARD 2000 CSE**
Preserves subtle shading and excellent image detail, but grayish flesh tones lack any sense of life.	Graphics show smooth shading and precise detail, but colors are noticeably dark and oversaturated.	Colors appear washed-out and banding leaves lines. On glossy paper, quality beats lasers.

PHOTOGRAPH: KEVIN CANDLAND

*Estimated reseller price for models 390/20U-70U. Actual prices may vary. mhz denotes microprocessor internal clock speed only; other factors may also affect application performance. gb=1 billion bytes for HDD capacity. PC's referred to in this ad include an operating system. IBM product names are trademarks of International Business Machines Corporation. Intel Inside, Pentium and MMX are registered trademarks of Intel Corporation. © 1999 IBM Corp. All rights reserved.

intel inside pentium II

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ThinkPad® 390	$1,699 to $2,399*	mobile Pentium® w/MMX™ technology or Pentium II processor 233 to 266 mhz	3.2/4.3gb hard drive, 32/64mb memory, integrated floppy/cd, 12.1" or 14.1" TFT display, optional 10/100 EtherJet card	ThinkPad 390. The most affordable ThinkPad. All of the essentials, ready for company-wide distribution. www.ibm.com/thinkpad or 800 426 7255, ext. 5040

e-business tools

PRINTERS

FEATURES COMPARISON

Can One Printer Really Do the Job of Two?

	PRODUCT	Speed for plain text/full-page color graphics (ppm)	Paper input capacity, base/max. (pages)	Ink/toner max. capacity (pages)	Comments
Old way	HP 2000 Cse (color ink jet)	not rated/1.2	150/400	1400 black/1900 color	The Lexmark is very fast on text and has extensive paper-handling options. The HP's color output is inferior to that of lasers (except on coated paper), and its ink and paper capacity is constrained.
	and				
	Lexmark Optra S 1855N (monochrome laser)	13.8/not rated	350/3350	17,600 (black only)	
New way	QMS Magicolor 2 DeskLaser (color laser)	3.3/1.1	250/500	10,000 black/6000 color	Very inexpensive and fast on graphics, but expensive to upgrade and quite slow on text.
	or				
	Tektronix Phaser 740N (color laser)	8.9/0.5	350/850	12,000 black/10,000 color	Fast on text, includes Adobe PostScript, inexpensive to upgrade; mediocre graphics speed.

most other color lasers we've tested, although not as fast as many monochrome lasers. (The Lexmark Optra S 1855N, for example, prints text at almost 14 ppm.) On complex color graphics, the Phaser runs at 0.5 ppm, matching the speed of many networkable ink jets and color lasers.

The Phaser 740N's print quality is fine for most business needs. Its text looks great, and its graphics display good detail and subtle shading, which means you'll get nice transparencies and presentation materials. But photos print overly dark, and some colors are too saturated.

The Tektronix Phaser 740N holds 350 sheets of paper and supports fancy paper-handling options such as a $695 duplexer with two 250-sheet paper trays. You can also add more memory to the 740N to support the higher resolution and other capabilities found in Tektronix's top-of-the-line $4200 Phaser 740DX.

QMS Magicolor 2 DeskLaser

QMS CUTS CORNERS

TO OFFER ITS DeskLaser for only $1300, QMS had to make lots of compromises. The printer's host-based design saves money on electronics, but it offloads processing to your PC. As a result, the DeskLaser is too slow for many offices. It prints monochrome text at only 3.3 ppm, slower than some ink jets. On color jobs, though, it produces about 1.1 pages per minute—slightly more than twice as fast as the Phaser 740N and about the same speed as that of the HP 2000 Cse ink jet.

Upgrading the DeskLaser is a high-cost, all-or-nothing proposition that requires replacing the controller with a $1250 part and adding memory. The change turns the printer into the QMS Magicolor 2 CX, an excellent laser that costs $2700 and aces the DeskLaser's print quality and performance. (The Magicolor 2 CX also supports additional paper-handling options, such as the ability to act as a copier.) QMS charges $479 to add another 250-sheet paper tray to the DeskLaser.

The DeskLaser's graphics, like those of the Tektronix, could be better. Colors appear somewhat faded and grayish, and a close look reveals an unpleasant dotty texture. Still, the DeskLaser does a great job of reproducing fine detail—noticeable on photos—and prints great text.

INK JET R.I.P.?

FOR SMALL offices or workgroups that need inexpensive color output and want to sidestep the expense and hassle of a networked ink jet printer, the arrival of sub-$2000 color lasers is a blessing indeed. If you're ready to buy now, consider Tektronix's $1850 Phaser 740N. If you can wait a few months, expect to see additional offerings.

For some offices, though, the two-printer solution—an ink jet for color and a laser for monochrome—may still be the best solution, particularly if you need to print oversize color documents. Tabloid-format color lasers typically cost $5000 or $6000—not a great price when you can buy a tabloid-format networkable ink jet for about $1200. Moreover, if you need to print high-quality photos and can afford the added expense of glossy paper, an ink jet will produce stunning color output that no laser printer can match.

Clearly, the ink jet remains a viable option. But with color lasers now selling for less than $2000, it pays to carefully assess your color-printing needs and shop around.

—Dan Littman ▶

QMS Magicolor 2 DeskLaser

$1300 street with network support; QMS; 800/523-2696; www.qms.com

PC WORLD INFONET NO. 733

Tektronix Phaser 740N

$1850 street with network support; Tektronix; 800/835-6100; www.tek.com

PC WORLD INFONET NO. 734

PHOTOGRAPH: KEVIN CANDLAND

*Estimated reseller price for models 560/9OU-BIU. Actual prices may vary. †Actual weight/thinness may vary due to vendor components, manufacturing process and options. Includes battery (and travel cover on ThinkPad 600 models) and excludes external diskette, cd/dvd drives, if applicable. mhz denotes microprocessor internal clock speed only; other factors may also affect application performance. gb=1 billion bytes for HDD capacity. PCs referred to in this ad include an operating system. IBM product names are trademarks of International Business Machines Corporation. Intel Inside and Pentium are registered trademarks of Intel Corporation. ©1999 IBM Corp. All rights reserved.

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ThinkPad® 560	$2,099 to $2,699*	4.2 lbs† 1.2" thin	mobile Pentium® II processor 233 to 300 mhz	4.0 or 6.4gb hard drive 32 or 64mb memory option: external cd	ThinkPad 560. The lightest, thinnest ThinkPad. For the road, for thousands of miles, for the humane treatment of businesspeople. www.ibm.com/thinkpad or 800 426 7255, ext. 5039.

e-business tools

Six New Mobile Chips From Intel Power the Fastest Notebooks You've Ever Seen

IT'S RAINING mobile CPUs from Intel. After releasing just five mobile microprocessors last year, Intel has suddenly ended the drought. This month the company is introducing six new chips, including some with significant design changes. Even though the flood of mobile CPUs may be confusing at first, there's plenty of good news here: These chips give a speed jolt to notebooks at both ends of the price spectrum.

REAL PIZZAZZ

AT THE HIGH end, you'll find a new generation of mobile Pentium II processors powering the fastest notebooks we've seen, while the first mobile Celeron CPUs bring some real pizzazz to midrange and budget notebooks. For this review, we looked at four new machines that use the new processors; they run the gamut from desktop replacement (Dell's Inspiron 7000 A366LT and Micron's TransPort Trek 2) to frequent flyer (Hewlett-Packard's OmniBook 900) to budget traveler (Gateway's Solo 2500SE). All of them come with 64MB of RAM, an active-matrix display, and a satisfactory to outstanding battery life rating.

CACHE COWS

INTEL'S NEW top-of-the-line notebook CPUs—the mobile PII-333 and PII-366—run at faster clock rates than that of the previous top dog, the mobile PII-300. But pumped-up megahertz ratings tell only part of the story. The new chips also sport a key design improvement: 256KB of on-chip secondary cache running at the CPU's full speed. This results in better performance than the old scheme—512KB of off-chip secondary cache running at half the processor's speed. Data travels faster between these new CPUs and their secondary cache, so application tasks take less time.

Intel's other two new mobile Pentium IIs, the PII-266PE and PII-300PE, also use a 256-KB on-chip secondary cache. (Intel will continue to make the original PII-266 and PII-300 at least until this summer; more on that later.) The new mobile Celeron-266 and Celeron-300 have a smaller—but still effective—128KB on-chip secondary cache.

THE HIGH GROUND

FOR PEOPLE WHO demand the fastest notebooks available, the mobile PII-333 and PII-366 chips are a long-awaited improvement. Dell's Inspiron 7000 A366LT PII-366 laptop scored 191 in our PC WorldBench 98 tests—a whopping 18 percent faster than the quickest Pentium II-300 notebook we've tested and about 22 percent faster than the average PII-300 notebook. Micron's TransPort Trek 2 PII-333 scored 179, meaning it runs a noticeable 14 percent faster than the average PII-300 notebook on business apps. (The Micron we tested was a preproduction unit; all others were shipping models.)

Somewhat surprisingly given its huge 15-inch screen, Dell's $3549 Inspiron delivered the second-best battery life of this bunch—nearly 3.5 hours. But the Inspiron makes a better desktop replacement than road companion. At its traveling weight of more than 10 pounds (including an AC adapter and a combination ▶

Gateway Solo 2500SE

Dell Inspiron 7000 A366LT

PHOTOGRAPHS: KEVIN CANDLAND

The ABCs of Mobile CPUs, From Celeron to PII-366

MOBILE CPU	Secondary cache	Estimated system prices[1]	The scoop
Celeron-266 and Celeron-300	128KB, on chip	$1500 to $2000	First mobile versions of Intel's budget chip. Systems run much like mobile PII-266 and PII-300 models.
PII-266 and PII-300	512KB, off chip	$2000 to $2700	Original PII-266 and PII-300 mobile chips have 512KB of secondary cache—but it's off the chip and runs at only half the CPU's speed.
PII-266PE and PII-300PE	256KB, on chip	$2500 to $3000	Revamped chips add on-chip secondary cache running at the CPU's full speed. Systems run a bit faster than PII-266 and -300 models.
PII-333 and PII-366	256KB, on chip	$3000 to $3600	New speed leaders for high-end notebooks. Systems leave mobile PII-300s in the dust.

*Estimated reseller price for models 600/35U-5AU. Actual prices may vary. *Actual weight/thinness may vary due to vendor components, manufacturing process and options. Includes battery (and travel cover on ThinkPad 600 models) and excludes external diskette, cd/dvd drives, if applicable. mhz denotes microprocessor internal clock speed only; other factors may also affect application performance. gb=1 billion bytes for HDD capacity. PCs referred to in this ad include an operating system. IBM product names are trademarks of International Business Machines Corporation. Intel Inside and Pentium are registered trademarks of Intel Corporation. © 1999 IBM Corp. All rights reserved.

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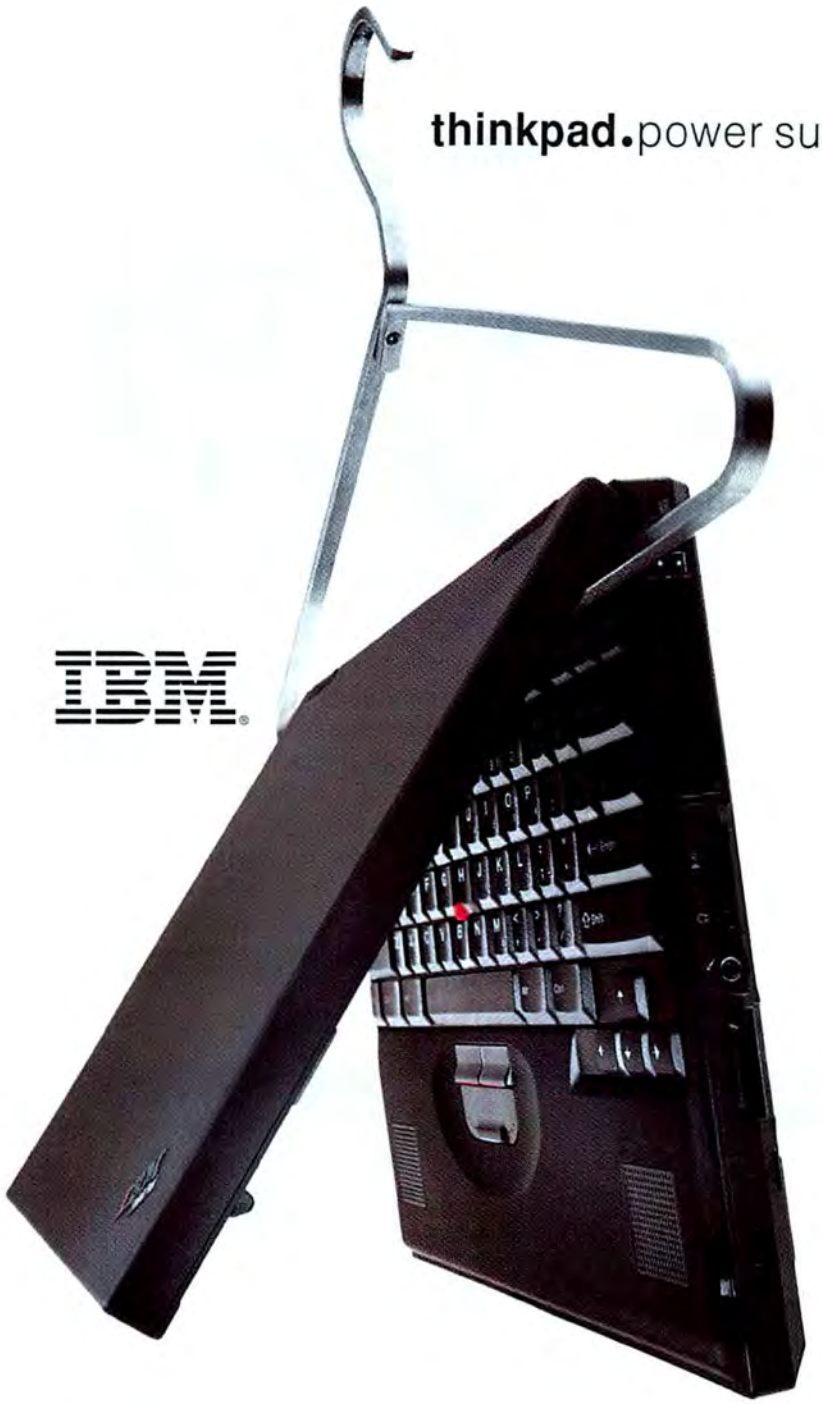

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e-business tools

floppy/2X DVD-ROM drive), you'll burn some calories lugging this brute. Its hardware is also well suited to the desktop: The unit we evaluated included an 8.1GB hard drive, a 56-kbps internal modem, Accelerated Graphics Port graphics with 8MB of memory, good stereo speakers, wavetable sound, and hardware-based MPEG support.

MIDRANGE MUDDLE

MICRON'S TransPort Trek 2, with a 14.1-inch screen, isn't as bulky as the Dell, but its 8.9-pound traveling weight does not make it the laptop for an airport jockey, either. Its battery life—a few minutes shy of 2.75 hours in our tests—is satisfactory. Our unit came with a 6.4GB hard disk, a 56-kbps PC Card modem, AGP graphics with 4MB of memory, a 2X DVD-ROM drive, and hardware-based MPEG support. At $2999, it suits notebook users who need serious speed at a reasonable price.

Whereas it's easy to see the value of the new high-end notebooks, you must shop more carefully in the midrange. Notebooks using the new PII-266PE and PII-300PE chips may be only so-so values, stuck in an awkward spot between the PII-333 models and the mobile Celerons.

The first PII-300PE portable we've tested, HP's $2599 OmniBook 900, is expensive given its feature set. However, it's the only model here designed with the frequent flyer in mind. A slim chassis houses a 12.1-inch screen. Traveling weight, including the AC adapter and an external bay holding a floppy drive, is only 6.1 pounds. (An optional 0.8-pound CD-ROM drive for the bay will set you back another $250.) The OmniBook's battery life of almost 2.75 hours is satisfactory. Our unit came with AGP graphics, a 4.3GB hard drive, hardware-based MPEG support, one wimpy speaker, and no modem.

The OmniBook 900 earned a PC WorldBench score of 168, which means it's only about 7 percent faster than the average PII-300 notebook. That difference will go unnoticed in most applications. So you may be wiser to pay just a bit more for a Pentium II-333 notebook, or a bit less for a Celeron model.

HP OmniBook 900

Will you still be able to find notebooks with the old-style PII-266 and PII-300 chips? Yes, for a while. Some vendors, including Toshiba, plan to continue using the older processors. But to encourage migration to the newer processors, Intel is charging computer vendors the same price for the mobile PE chips as for the older Pentium IIs. Direct vendors will likely move to the PE models quickly, while offering Pentium II notebooks to corporate customers who demand them. In retail stores, PE models will dominate within the next two to three months.

CELERON SUCCEEDS

NOTEBOOKS based on the mobile Celeron chips make more impressive debutantes than the PE models. Gateway's $1974 Solo 2500-SE is a value winner. This Celeron-266 system earned a PC WorldBench score of 149—slightly higher than that of the average Pentium II-266 notebook. The difference in performance should be imperceptible on general business applications, but the 8-pound Gateway offers tremendous battery life: In our tests, it ran for 5 hours and six minutes.

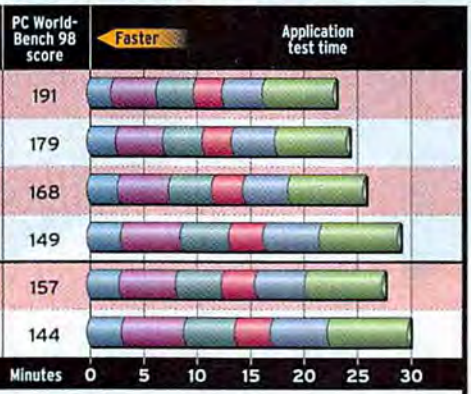
Gateway loaded this Solo with a 12.1-inch screen, a 6.4GB hard disk, and a 56-kbps PC Card modem. But you'll notice a few compromises here that the more ▶

PHOTOGRAPH: KEVIN CANDLAND

NOTEBOOK PCs: BUSINESS APPS TEST REPORT

Dell PII-366 Inspiron Sets New Speed Mark

SYSTEM	CPU	RAM (MB)	Secondary cache (KB)	PC WorldBench 98 score
Dell Inspiron 7000 A366LT	Pentium II-366	64	256[1]	191
Micron TransPort Trek 2	Pentium II-333	64	256[1]	179
HP OmniBook 900	Pentium II-300PE	64	256[1]	168
Gateway Solo 2500SE	Celeron-266	64	128[1]	149
Average of 14 notebooks	Pentium II-300	64	512	157
Average of 7 notebooks	Pentium II-266	64	512	144



TEST PC WORLD CENTER **HOW WE TEST** All systems are tested with PC WorldBench 98, *PC World*'s application-based benchmark. A higher PC WorldBench 98 score is better. For more details on our benchmark and how we run it, see PC World Online (www.pcworld.com/testing). Data based on testing conducted by the PC World Test Center. All rights reserved. [1]System's secondary cache resides on the CPU. The secondary cache of previously tested systems is separate from the CPU.

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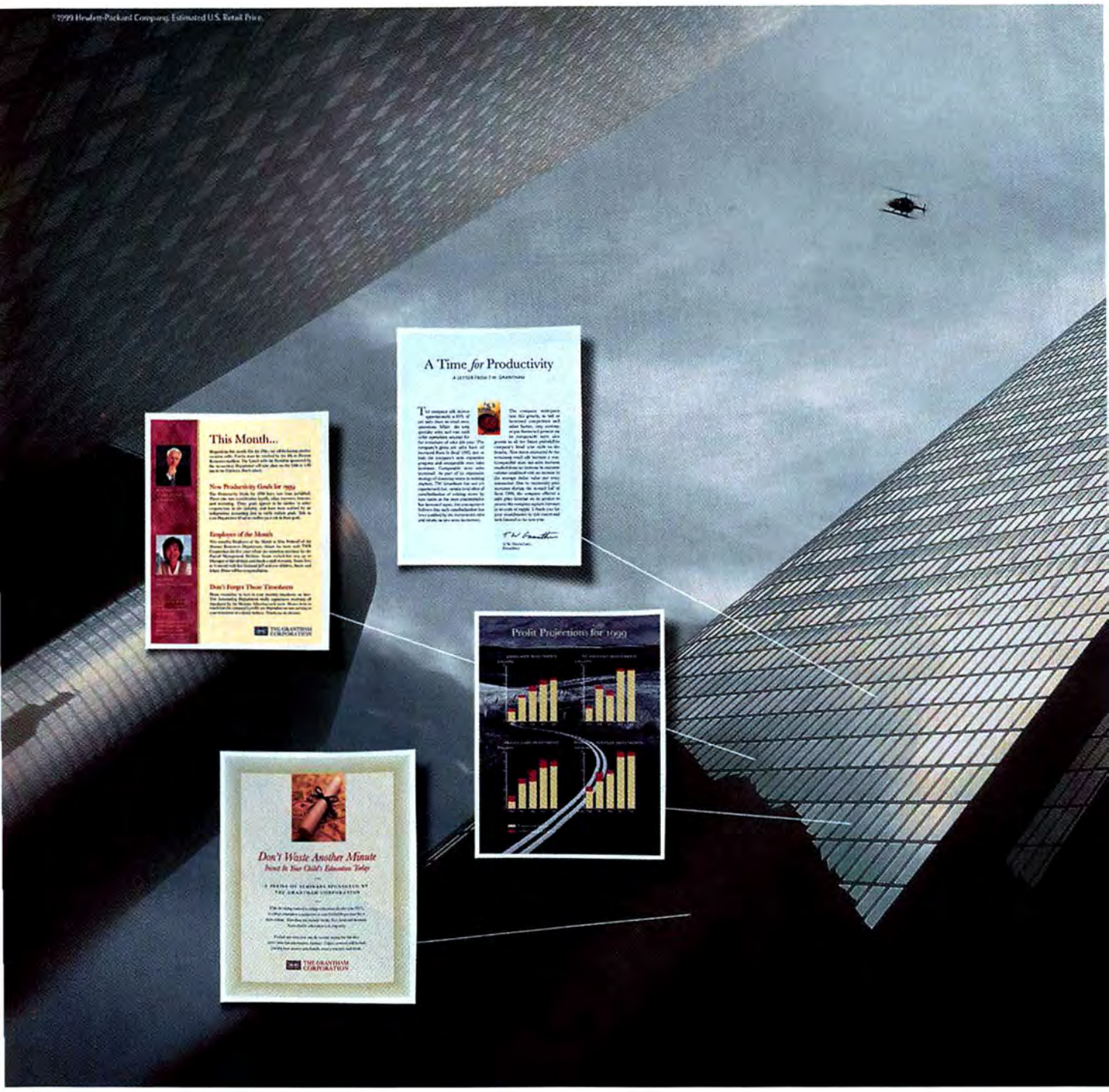

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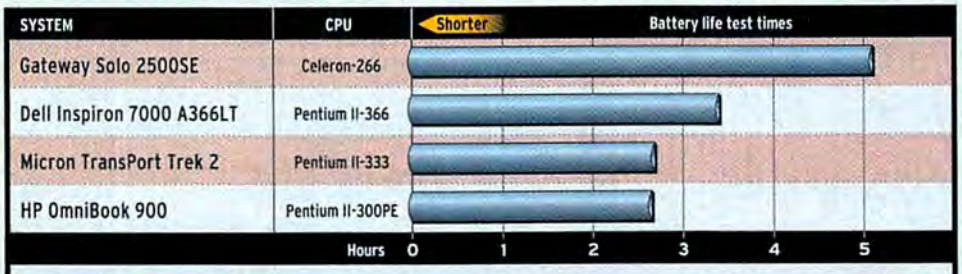
NOTEBOOK PCs: BATTERY LIFE TEST REPORT

Gateway Celeron-266 Lasts and Lasts and Lasts



TEST PC WORLD CENTER **HOW WE TEST** We drain and fully recharge the battery twice and set power-saving options to match a consistent profile where possible. Office workers use Windows 9*x* applications, periodically saving and allowing regular idle time. Notebooks are rotated among workers. We report the time elapsed when the notebook shuts itself off. Data based on tests designed and conducted by the PC World Test Center. All rights reserved.

expensive units avoid: The Solo uses PCI rather than AGP graphics, it lacks wavetable audio, and its MPEG support is software-based. Still, the Solo 2500SE is a lot of notebook for the money. In fact, by the time you read this, Gateway says it will offer an identically configured Celeron-300 notebook for the same price—a sweet deal, considering it'll be a smidge faster.

THE RIGHT NOTEBOOK

OUR ADVICE: If you need a notebook now, Intel's new mobile CPUs offer improved performance across the board. The PII-366 and PII-333 machines fly. But beware, even more speed is on the horizon: Intel is expected to ship notebook chips during the third quarter of this year that run as fast as 600 MHz.

Tread cautiously in the mid-range territory: The PII-333 and Celeron-300 notebooks may be more appealing than PE-based models. And bargain hunters can now look for fire sales on PII-266 and PII-300 laptops as retail stores clear shelves to make way for notebooks based on the new CPUs. Prices should also drop when laptops using AMD's mobile K6-2-300 and K6-2-333 chips arrive this quarter.

The Celeron-based notebooks outrun previous budget models handily, for moderate prices starting at about $1500. Currently, display costs make it tough to build a $999 notebook; we expect more $1200 to $1500 models by fall. For now, however, Intel's mobile-CPU downpour is a refreshing downpour. —*Yardena Arar*

Dell Inspiron 7000 A366LT
$3549 street; Dell Computer; 800/388-8542; www.dell.com
PC WORLD INFONET NO. 737

Gateway Solo 2500SE
$1974 street; Gateway; 800/315-2536; www.gateway.com
PC WORLD INFONET NO. 738

HP OmniBook 900
$2599 street; Hewlett-Packard; 800/752-0900; www.hp.com
PC WORLD INFONET NO. 739

Micron TransPort Trek 2
$2999 street; Micron; 800/652-7667; www.micron.com
PC WORLD INFONET NO. 740

AOL Gobbles Netscape, Readies New Version of Communicator

BETA

IF AMERICA ONLINE'S recent acquisition of Netscape proves anything, it's that the browser wars are over. The battle now is all about eyeballs.

AOL didn't buy the Web pioneer for its flagship browser. The real prize is Netscape's Netcenter Web site (www.netscape.com). With the acquisition, AOL now has two competing sites, AOL.com and Netcenter, that both enjoy extremely high traffic. According to Chris Charron, an analyst with Forrester Research, you can expect the two sites to be consolidated.

AOL is also expected to tweak future versions of Navigator so the browser steers users to that consolidated portal as well as to other AOL content, including ICQ (the popular chat service), Digital Cities (the network of locally focused Web sites), and its e-commerce sites. Charron predicts that Navigator will become a "traveling portal," a software tool that makes it easy to access AOL-owned content.

Then there's the little matter of a certain deal between AOL and Microsoft. Under that agreement, Internet Explorer is the default browser for AOL customers; in return, Microsoft ships AOL software with every copy of Windows. Until now, America Online customers had to jump through hoops if they wanted to use Navigator instead of IE. With the Netscape acquisition, AOL may make it easier for users to choose a browser.

Meanwhile, Netscape representatives say work on Communicator 5 continues without delay. Last December, the company released a developers-only preview version of Netscape's new rendering engine (the software shared by the browser and other Communicator modules that translates HTML code into what you see on screen). Code-named Gecko, this lean (it fits on a single floppy disk) and visibly faster engine has been rewritten from the ground up, eliminating the bloat. A public beta version of Communicator/Navigator 5—Gecko plus the user interface—is expected to be available by the second quarter. —*Yael Li-Ron* ▶

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Upstart Linux: Not Just for Geeks Anymore

ANALYSIS

IT WON'T be replacing Windows anytime soon, but a geeky, once-obscure variant of UNIX is winning the hearts and minds of a growing number of PC users. From its roots as Finnish student Linus Torvalds' pet project, Linux has evolved into a surprisingly popular Windows alternative. Last year, some 2.25 million commercial copies of the operating system were sold for desktop use alone. And by some estimates, the universe of commercial and freeware Linux users could grow to 10 million by the end of this year.

What's behind the Linux boom? In part, Gatesophobia. Plenty of users are happy to thumb their nose at Microsoft's CEO by using a rival product. But Bill-bashing alone doesn't explain those numbers.

SUPPORT ARRIVES

SYSTEM administrators and developers seeking alternatives to NT 4.0 or the long-delayed Windows 2000 tout Linux's stability and open source code, which simplifies customization and debugging. Red Hat Software and other commercial Linux distributors have made installation simpler than ever, layering graphical configuration tools over the basic OS's minimalist command-line interface. Red Hat's costly around-the-clock tech support is intended for system administrators, but the vendor is reportedly negotiating an agreement with IBM that could result in free support for IBM PCs with Linux preinstalled. Though UNIX lacks a standard graphical user interface, both Red Hat's upcoming Gnome and the freeware K Desktop Environment make Linux look a lot like—surprise!—Windows.

Linux is also acquiring the feature users care about most: applications. In December Corel started giving away WordPerfect 8.0 for Linux Personal Edition for noncommercial use. Later this year, it will offer WordPerfect Office 2000 for Linux as a free download. Computer Associates, IBM, Informix, Oracle, and Sybase have all pledged to port server apps to Linux.

Red Hat supports the most common PC devices, but finding and installing drivers for newer peripherals can be tricky. Red Hat's three free months of installation support may come in handy here.

Meanwhile, International Data Corporation reports that 2.9 million commercial copies of Linux were sold in 1998, an increase of 48 percent from 1997. (Server sales accounted for 750,000 of those units.) Still, on the overall OS radar screen, Linux is only a blip: PC Data estimates that Windows 95/98 sales reached 97 million last year.

THE UN-WINDOWS OSes

EVEN SO, Microsoft challengers persist. Last year Be raised $25 million in venture capital from Intel and others. BeOS 4.0, the first version for the PC , targets traditional Mac users—multimedia developers working with high-end graphics.

Like Linux, BeOS has earned a reputation for stability and speed. But hardware support for it is limited, so you might be forced to give up a particular sound card, graphics adapter, or other device if you switch to BeOS 4.0. Be doesn't support portables, and mainstream apps are in very short supply.

Be has hinted that its strategy is to convince PC makers to preinstall its OS with Windows in a dual-boot setup. But so far—perhaps because of the operating system's dearth of hardware support—only Hitachi has signed on, and only in Japan. Companies like Compaq or Dell are unlikely to offer a BeOS-equipped computer if half the PC's devices have to be disabled.

Linux has more momentum, but even a die-hard Gates foe would concede that Linux is unlikely to break Microsoft's stranglehold on your computer in the near future. Still, if there's an adventurous PC user in the house, don't be surprised if Linux turns up on a desktop near you.

—Scott Spanbauer ■

WINDOWS ALTERNATIVES FEATURES COMPARISON

Linux Holds the Hardware and Software Edge

OPERATING SYSTEM	List price	Hardware support	Software productivity suites	Browsers
BeOS 4.0	$100; $70 via Be Web site	limited	Be Basics, Gobe Productive	NetPositive
Linux	$50 CD-ROM; free download	extensive	WordPerfect 8 for Linux, Linux Office Suite 99, StarOffice 5.0, Applixware for Linux	Netscape Navigator, Opera

Official Red Hat Linux 5.2

$50 list for CD-ROM, free download; Red Hat Software; 888/733-4281; www.redhat.com

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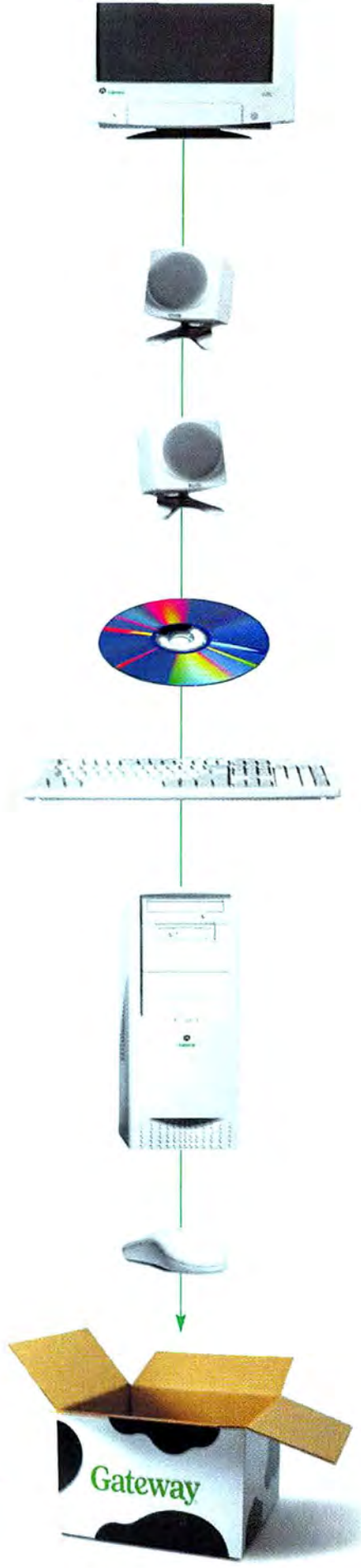

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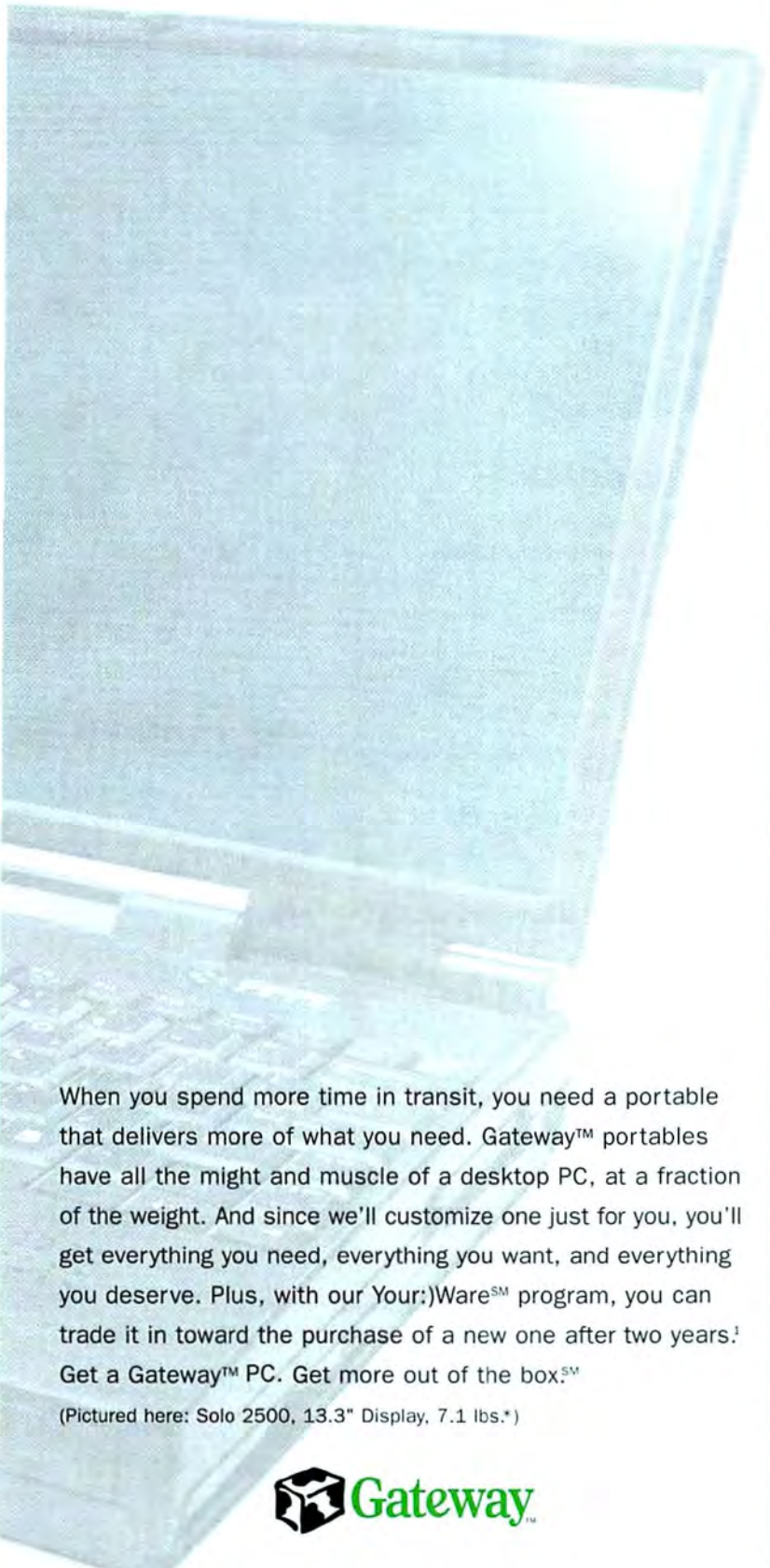

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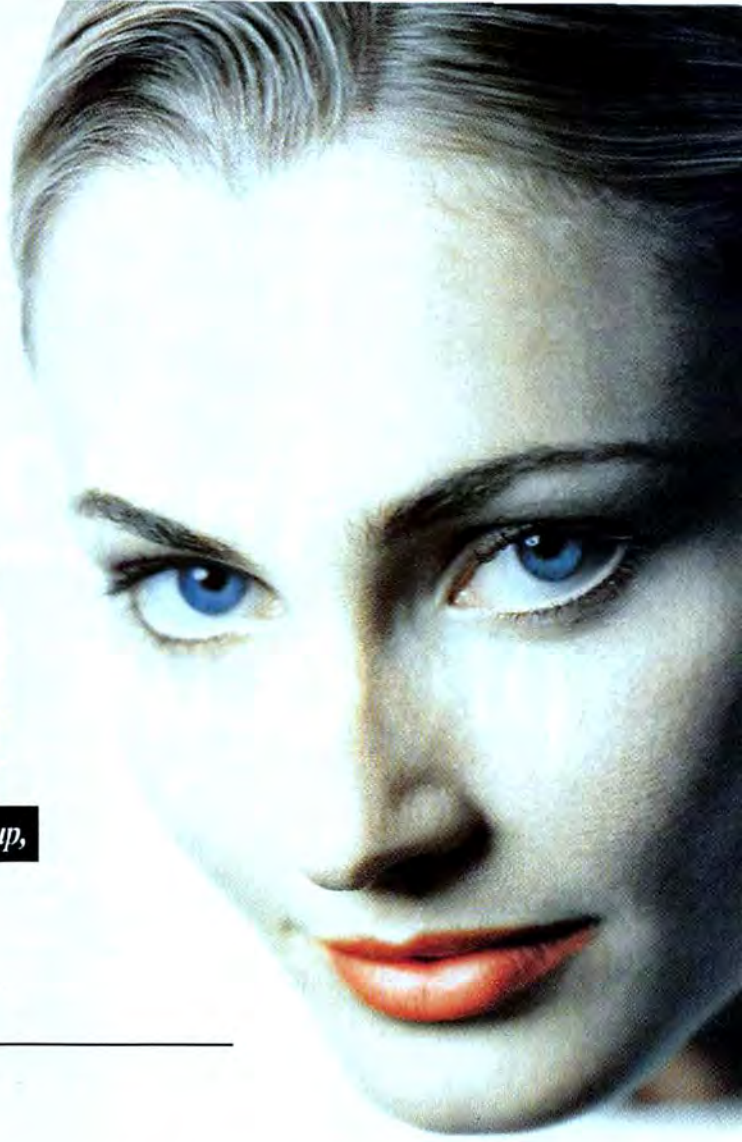

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SONY

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THE ANYTIME ANYWHERE Manager

Do you belong to the fast-growing legion of professionals whose job would not exist without portable technology?

As a mobile manager, what you do, and where you do it, is determined as much by your job description as by technology vendors. For example, vendors such as Vadem *(www.vadem.com)*, a San Jose, Calif.-based manufacturer of lightweight handheld computers, continues to advance the feature set and reduce the weight of its products, allowing you to carry your office in a briefcase. In doing so, these

THE MOBILE MANAGER SERIES • PART TWO

companies are responsible for elevating portable technology from gadget status to serious business tools.

THOROUGHLY WIRED

Yesterday's enabling technology consisted primarily of beepers. Today, it's notebooks and compact handheld computers. Tomorrow, expect graphical cell phones that will display color images and even video. At the present rate of new product innovations, which is a little like speed-reading a calendar, within three years you could order Dick Tracy's wrist communicator and use it to manage E-mail messages, images, and voice communications.

"Mobile technology has the potential to significantly change how we interact with our computer systems," says Jack Gold, an analyst at Meta Group. "Today, we look at them as dedicated operations for word processing. Three years from now, you will not be able to point to a single device and say 'this is my computer.'"

"Mobile technology has the potential to significantly change how we interact with our computer systems." -JACK GOLD, META GROUP

While Gary Price, the thoroughly wired director of business development at Norwalk, Conn.-based INTECO Corp., a consumer research firm, waits and watches for new technology, he relies on today's technology to empower him. "I could not do my job without my laptop," he says. Although Price's Toshiba laptop is the mainstay of his mobile arsenal, he increasingly relies on his recently acquired digital cell phone. "The laptop, the cell phone, and a soon-to-be-acquired Palm III [from 3Com *(www.palm.com)*], help me make more efficient use of downtime, time spent waiting or traveling."

VADEM LAPTOP

Price, whose job requires about 40% travel, most of it flying, purchased the cell phone because he believed he was missing messages sent to his beeper. And that translated into missed opportunities. "A vendor would send a page and I did not always receive it. With my new digital phone, if the message doesn't reach me, AT&T routes it into voice mail for storage and subsequent retrieval."

On the road, Price uses his laptop for PowerPoint presentations at customer sites. Before he leaves for a meeting, he asks his client to have a large screen monitor or projector available. As much as Price relies on and trusts his equipment, he also brings acetates of his presentation. "Just in case of a problem, I'm not relegated to doing hand shadows on the wall," he quips.

Another tip for avoiding hardware problems comes from American Power Conversion *(www.apcc.com)*. APC's recently introduced SurgeArrest, a portable surge protector made specifically for laptops, can help reduce the odds that transient power problems or telephone voltage spikes will damage your equipment. APC reports that nearly half of all data losses are caused by power problems. SurgeArrest installs inline with your laptop's power supply cable to protect your hardware and data. The eight-ounce device works with multiple voltages, making it suitable for use in the U.S. and Europe.

SOMETHING FOR EVERYONE

Whether you want to keep up with E-mail, dash off a memo, or write your autobiography, vendors have a variety of solutions to choose from. The trick is picking what's best for you. "There will be a lot of confusion regarding sub-notebooks that run Win 95/98 and Jupiter (Windows CE Pro), since they both look to be about the same size," says J. Gerry Purdy, president and CEO of Mobile Insights, Inc. in Mountain View, Calif. "This isn't about price. Both types of devices cost about $1,000, but it's about functionality at specific times. We'll

All notebooks travel. Is there one that soars?

Unlike other so-called "highly mobile" notebooks, the Compaq Armada 3500 doesn't swap performance for portability. Designed for the savvy traveler, its topflight specs include a Mobile Pentium® II processor soaring to 366 MHz—in a sleek package as light as 4.4 pounds.* With built-in 6.4 GB† hard drive, full-size keyboard, extended-life battery option and extra-durable magnesium alloy display casing, the Armada 3500 has everything you need for maximum flexibility—and unlimited mileage. To learn more, call 1-800-AT-COMPAQ. Or visit www.compaq.com/soar.

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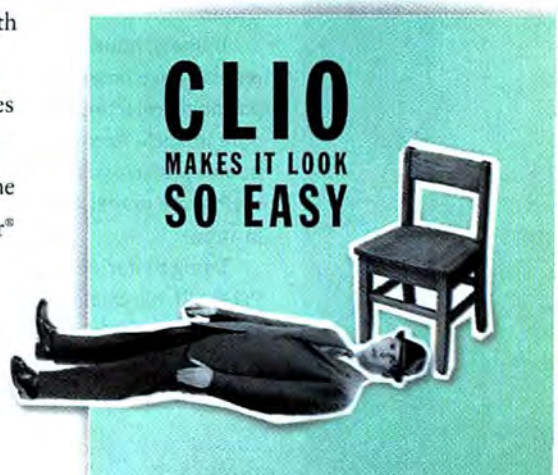

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see Jupiter be the companion you take into meetings along with a Palm or an equivalent."

For fast access to basic contact data such as a calendar and telephone numbers, analysts agree that 3Com's Palm III is the one to beat.

"The Palm III is great for referencing information quickly, like finding a phone number at the pay phone in the airport or looking up someone's E-mail address," says Purdy. "It is not good for text-intensive activities like E-mail, note taking, etc."

The new crop of lightweight handhelds, such as Vadem's Clio, which run Windows CE Pro, provide an ideal solution for sending and receiving E-mail, Internet/intranet access, and delivering a subset of Microsoft's Office suite applications including Word, Excel, and Outlook specifically designed for travelers.

APC PNOTE PRO

Combined with ultra-portable projectors such as Sony Electronics' *(www.sel.sony.com)* 8.3-pound CPJ-D500 LCD projector gives mobile presenters a combination of potent, totable tools.

"The presentation professional can now carry a true SVGA projector into a meeting as easily as a notebook computer and put a bright, uniform, dynamic image on the screen," says Jim Sandy, vice president of display products for Sony Electronics' Broadcast and Professional Group.

Trainers, educators, and presenters who regularly use projectors give high marks to portable projectors that can deliver bright, pure images. According to analysts, sub-10-pound projectors such as Sony's will double their share of market, to 28% of all units sold in 1999.

Trying to decide which of the profusion of PDAs, CE handhelds, Palm Pilots, PIMs, PC companions, sub-notebooks, laptops, and CE PRO devices is best for you? Purdy predicts that each of these machines solve increasingly specialized problems, and that one size does not fit all.

"People will use some combination of three mobile devices: notebooks for serious PC computing while in the office or mobile, Jupiter (Windows CE Pro-based) PCs for meetings, and PIM management and handhelds, like a Palm, to carry in their pocket for quick reference," says Purdy. "Later, we'll see SmartPhones, like the Qualcomm's new pdQ phone, integrate a PDA with a cell phone so we can easily look up a number, dial it, and surf the Web all while we walk around."

"It is truly amazing what vendors can pack into one small package."
-KEN DELANEY, GARTNER GROUP

SUCCESS STORY

Steven Benjamin, CEO of Chicago-based Steven Benjamin Inc., credits his success as a mobile manager to his choice of portable devices. A supplier of industrial infrared ovens, Benjamin proclaims: "I have a paperless of-

a tip for mobile managers: SPEEDING UP THE AIRPORT SPRINT

Gary Price, director of business development at Norwalk, Conn.-based INTECO Corp., offers a tip that someday might make the difference between catching or missing a flight.

"No matter how much time I leave for the ride to the airport, checking bags, and passing through the security check-in, delays sometime happen that are beyond my control. But I have one trick that I use to avoid one notorious time-waster. Security personnel often ask me to boot up my laptop. That can take as much as three to five minutes, an eternity when I'm rushing to catch a flight. So I routinely turn on my laptop before I get to the security checkpoint. Then, when the guard asks me to turn on the computer, I just tap a key. The computer's displays flashes to life, and I'm through in seconds instead of minutes." ✱

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fice. Every document I require for my business is stored on my hard drive."

Benjamin is one of the lucky few whose also has an "officeless" office.

"We design, but do not manufacture, ovens used in the plastics industry. We do the design work right at the client's site. Subsequently, manufacturers build the ovens to our specifications and we assemble the components on site."

Next to his do-all laptop and the Palm III that he uses to track appointments and addresses, Benjamin values his two cell phones. "I carry two phones because no one phone can give me reliable service everywhere that I travel," he says. "I sell big-ticket items, so I have just a select group of customers that I must provide with top-quality service. And that includes a fast response to their inquiries. I use what some people refer to as 'callability' or 'remote call forwarding.' My clients dial one 800 number and, no matter where I am, they reach me instantly."

Instant access saves Benjamin's clients money and time. "One of the biggest benefits that technology delivers is improved communications. When a client calls with a problem, I understand the problem and how to fix it. But in trying to describe the fix on the phone to someone else, they sometimes fix the wrong thing."

SOLUTIONS IN A SNAP

Searching for a way to improve communications and reduce travel, especially emergency travel, Benjamin hit upon the idea of exchanging digital images.

"Sony's Mavica digital camera has entirely changed my business life," says Benjamin. "I can now go into a factory and take pictures of their equipment. When they call for service or with a technical question, I have a detailed photographic record of the equipment for reference. I couldn't do that before, because most of my clients are sensitive about trade secrets so they limit the taking of photographs at the factory. With the Mavica, I can show them the photographs I took before I leave their premises."

SONY VPL-X600U

"I could not do my job without my laptop."
-GARY PRICE, INTECO CORP.

"When companies call me for service I often ask them to take a digital photograph of the problem and E-mail the photograph to me," says Benjamin. "If they say they do not own a camera, I suggest they buy one. For as little as $300, I can help them resolve the problem in the next couple of hours. However, if I have to fly out to the site, it will take at least a day and cost four times as much. They usually purchase one right away."

VADEM CLIO

Benjamin has one other arrow in his quiver to improve his client's access to him. He uses jfax.com, an online fax-receiving and forwarding service. "Customers send faxes to me and Jfax routes them to my E-mail."

Mobile managers like Benjamin and Price readily admit they owe some part of their success to today's enabling portable technology. Although they can only speculate about what the future holds, one industry analyst, Ken Dulaney at Gartner Group in San Jose, Calif., hints that vendor ingenuity promises evermore-advanced features and physically smaller devices. "It is truly amazing what vendors can pack into one small package," he says. However, he has no comment on the likelihood of a wrist communicator materializing anytime soon. *

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TIME TRAVELERS

John Paul Getty distilled his formula for success down to six words: "Rise early. Work hard. Strike oil." But he said that in the days BC, or Before Computers. Today, he might add: "Get organized."

Whether you're a small-business owner or an oil mogul, your time is one of your most limited and valuable resources. That's why organization is crucial. "To get a handle on your day, first get organized," advises time-management expert Paul Kerr of Quma Learning in Phoenix, Ariz.

Kerr, formerly with lifestyle product provider Franklin Covey, says that for optimal time management you must take the time to outline a task on paper. "The thinking is as important as the doing," he says.

COMPAQ ARMADA

To help in the thinking part, time management experts suggest using applications on your desktop as well as portable devices such as the Palm III or lightweight laptops such as Compaq's *(www.compaq.com)* new 4.5-pound Armada 3500. With its 13.3-inch screen, Li-Ion extended life battery, and 300 MHz Intel Mobile Pentium II processor, the 3500 lives a double life as a desktop and portable machine. For network connectivity back at the office, slip the 3500 into its Convenience Base.

Vendors continuously strive to make their products easier to use, which will help you commit to actually using them. Leveraging the best of today's technology with traditional organization can significantly improve the degree of the success you will achieve.

BANISHING TIME BANDITS

To paraphrase writer Peter Drucker, successful people focus on solutions, not problems, especially solutions that adhere to the KIS, Keep It Simple, principle. Robert Moskowitz, a productivity and telecommuting consultant based in Woodland Hills, Calif., and the author of How To Organize Your Work and Your Life, says the simplest way to keep busy during commuting downtime is to divide and conquer.

"Convert your projects into five-minute tasks you can do at a moment's notice," says Moskowitz. "Break down your projects into increasingly smaller units until each project is a series of tasks you can do in a single sitting." Depending on how you travel, Moskowitz suggests you carry a "travel resource box" packed with the necessary supplies for working while waiting at the airport, in a hotel, or at client sites.

The right mix of products when and where you need them can help you maximize your productivity. For example, UMAX Technologies, Inc.'s Computer System Division *(www.umax.com)* recently released ActionBook 333T. Powered by an AMD 333 MHz processor, the sub-$1,800 notebook will affordably meet the needs of the consumer and small-business market. Top features include a 12.1-inch active-

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WWW.PANASONIC.COM/PRESENTATIONS

matrix screen, built-in floppy, and 24X CD-ROM drives, plus extended support for resource-hungry 3D applications.

For the mobile manager seeking the foremost in presentation technology comes the latest portable, three-panel LCD projector from Panasonic, the PT-L797U BriteOptic, designed both for computer and video presentations. Its Dual Lamp Projection Systems permit optimal brightness regardless of room conditions. The PT-L797U can show images at a crisp 1600 ANSI lumens for ultra brightness. With its slim, compact design and weight of under 20 pounds, the PT-L797U displays vivid colors in 1,024 x 768 true XGA resolution and can project screens up to 1,280 x 1,024 with equal brightness and clarity.

Avoiding the ISP shuffle likewise saves time when traveling. Princeton, N.J.-based RCN Corp. *(www.rcn. com)*, an ISP and telecommunications service provider, has combined its four Internet service provider (ISP) operations (Erol's, UltraNet, JavaNet, and Interport) into a single group, rcn.com. This will give telecommuters and travelers in the northeastern United States a single point of presence and easy access to E-mail and the Web via RCN's fiber-optic network.

In the personal management bible *Seven Habits of Highly Effective People,* author Stephen R. Covey suggests that you ask yourself, "What one thing could you do, on a regular basis, that would make a tremendous positive difference in your life?" Maybe with the right mix of technology, organization, and a proportionate commitment to success, you too can strike oil. *

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A PRE-DEPARTURE CHECKLIST

BEFORE YOU LEAVE:

- ✓ Transfer the documents you will need on your trip to your laptop.
- ✓ Charge laptop battery.
- ✓ Change telephone (voice mail) message.
- ✓ Set up your desktop PC for remote access, if available.
- ✓ Have all your phone numbers: hotel, car services, travel agent, as well as car rental and hotel confirmation numbers.
- ✓ Print your itinerary.
- ✓ Print vital business documents, just in case.
- ✓ If you keep personal files on your laptop or handheld, password-protect or encrypt them, and activate the device's boot-up password.

EQUIPMENT AND ACCESSORIES:

- ✓ Laptop, handheld computer, PDA
- ✓ Cell phone or beeper
- ✓ AC to DC adapter and cables
- ✓ Removable floppy disk drive or CD-ROM drive
- ✓ Modem and any special cables
- ✓ Modem-to-phone jack wall cable
- ✓ Tool kit (screwdrivers, pliers, pocketknife, small flashlight, magnifying glass)
- ✓ Three-blade to two-blade AC receptacle adapter
- ✓ AC power extension cord
- ✓ 115- to 230-volt adapters and phone adapters, for international travel

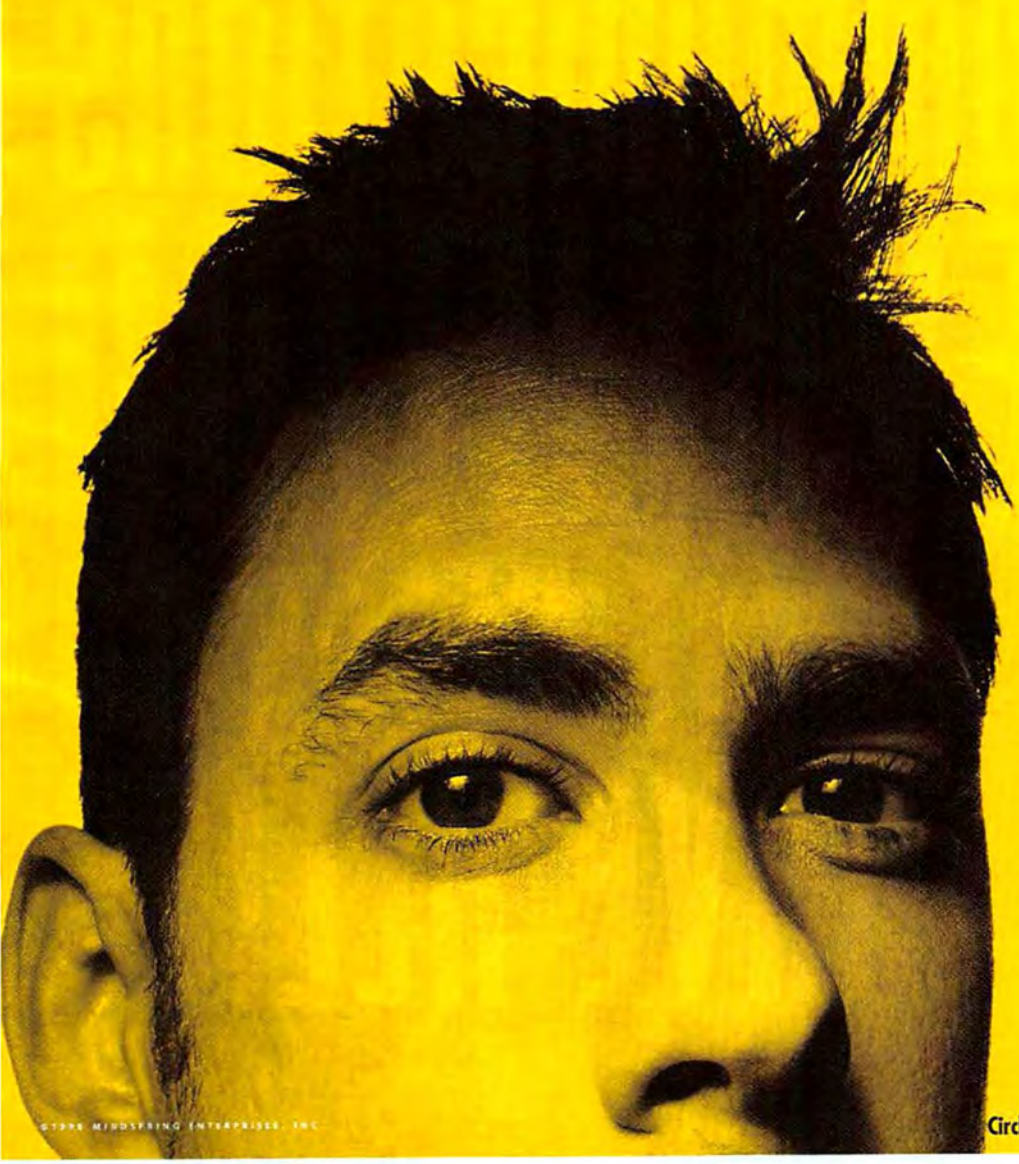
OPTIONAL ITEMS:

- ✓ Extra laptop battery
- ✓ Cellular phone's charger, spare battery, or car adapter
- ✓ Pager's spare battery
- ✓ RJ-11 coupler (to connect two short cables into one longer cable)
- ✓ RJ-11 splitter (to connect two devices to one jack)
- ✓ Short printer cable

LEAVE BEHIND:

- ✓ Destination phone number and estimated arrival time
- ✓ Your laptop's serial number
- ✓ A backup of your laptop's vital data

The Internet is made up of zeros and ones. Which does your provider make you feel like?



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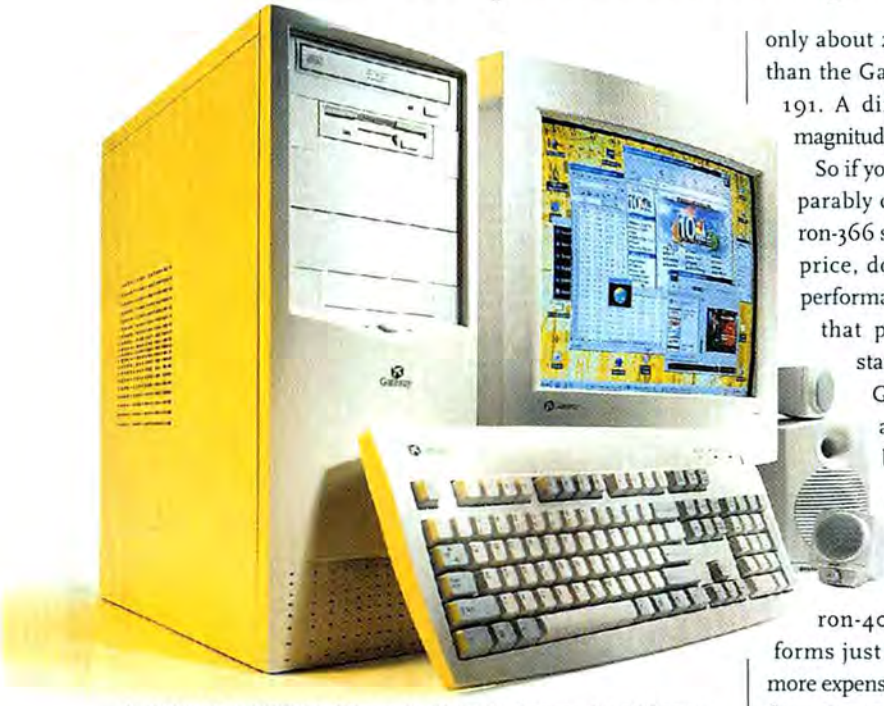
NEW PRODUCTS

First 400-MHz Celeron: Gateway Gets It Right



SURPRISE, SURPRISE: Gateway's 400-MHz Celeron G6-400c runs about as fast as more expensive PII-400 computers.

DESKTOP

REMEMBER THE old rule of thumb, "The PC you want always costs $2500"? These days, that figure is more like $1500. Case in point: Gateway's new **G6-400c**, the first desktop we've seen that's built around a 400-MHz version of Intel's Celeron chip. This $1439 system qualifies as an outstanding, power-on-the-cheap deal for the home office or for the family room.

The first Celeron machines were slow, but that's definitely not the case anymore. Like its immediate predecessors, the Celeron-333 and -366, the Celeron-400 carries a 128KB L2 cache, which speeds its application performance significantly.

Just how speedy is this Gateway system? Well, the shipping version that we looked at doesn't run a whole lot faster than the two speediest Celeron-366 systems we've tested: They earned PC WorldBench 98 scores of 186 and 188—only about 2 percent slower than the Gateway's score of 191. A difference of that magnitude is imperceptible.

So if you can find a comparably configured Celeron-366 system for a lower price, don't spurn it for performance reasons. But that proviso notwithstanding, Gateway's G6-400c delivers an excellent combination of speed and features for the price.

In addition, Gateway's Celeron-400 machine performs just about as well as more expensive (average price: $1900) systems built around the Pentium II-400. The G6-400c runs a scant 4 percent slower than the average PII-400 we've tested. In an app such as Word or Excel, you'd never notice the difference.

Like a number of Celeron-366 systems we've seen, the G6-400c comes loaded with high-end features. Gateway equipped our G6-400c with 64MB of RAM, a 10.2GB hard drive, an integrated 4MB ATI 3D Rage Pro Turbo AGP chip for graphics, a 17-inch monitor, a 4.8X Toshiba DVD-ROM drive, a U.S. Robotics V.90 modem, and integrated Creative Labs Sound Blaster Audio PCI 64V sound. The included three-piece Boston Acoustics BA635 speakers provide attractive high and midlevel tones; and though the subwoofer isn't strong enough to supply adequate audio for presentations in large rooms, it should be fine for the average living room or home office.

Our only additional quibble: We've seen some Celeron-366 systems with 8MB graphics cards in this same sub-$1500 price range. The extra graphics memory is a big plus when you play 3D games.

Gateway's 17-inch EV700 monitor doesn't look bad, but you won't want to push its resolution beyond 1024 by 768, at which its display of a 10-point Times New Roman font proved merely adequate.

SOFTWARE GALORE

THE G6-400c comes bundled with a cornucopia of home office–oriented software including Microsoft Home Essentials 98, a suite that packs both Word 97 and Microsoft Works 4.5—an integrated package with a spreadsheet, a database, and a modest word processor. On top of that, you get Microsoft's Encarta 98 Encyclopedia, Money 98, Hallmark Greeting Cards, and a music video DVD sampler.

The system is smartly designed with a well-ventilated, easy-to-open case. Though the minitower comes with four

PHOTOGRAPH: MARC SIMON

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98 Iomega Zip 250, Zip USB; Diamond Multimedia Rio PMP300
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open bays for extra drives, it doesn't have much room for add-in cards: One of the two memory sockets is empty, along with two PCI slots. But the one slot capable of accepting an ISA (or PCI) card is already occupied by the modem. In general, the pricier PII-based systems offer you more room for expansion.

As we've come to expect, Gateway's documentation is clear, concise, and accessible to users at all skill levels. The participants in *PC World*'s most recent reader survey (see "PC Reliability and Service: Who Can You Trust?" November 1998; www.pcworld.com/nov98/service) gave Gateway good marks for system reliability and fair marks for support quality. The company's support policies—including a three-year warranty on parts and labor and around-the-clock toll-free tech support—receive an outstanding score.

If other Celeron-400 models resemble Gateway's G6-400c, many users—home PC buyers in particular—will do well to skip over higher-priced Pentium II machines.

—Rex Farrance

Gateway G6-400c

PRO: Good speed and price for its configuration.

CON: Limited room for add-in cards.

VALUE: Attractive lower-price alternative to a PII-400.

List price: $1439

Gateway

800/315-2536

www.gateway.com

PC WORLD INFONET NO. 724

Norton Utilities: More Powerful, Less Intrusive

UTILITY

SINCE ITS original incarnation back in the days of DOS, Norton Utilities has offered a simple yet comprehensive approach to diagnosing PC problems and protecting data. But as it evolved and expanded to handle the complexities of new PC technology, the program risked growing so bloated that it might become a hindrance instead of a help. With **Norton Utilities 4.0**, Symantec has designed an upgraded package that successfully handles contemporary hardware and software without forcing your system to slow down when you use other applications.

Like its forebears, NU 4.0 includes such essential utilities as Disk Doctor for diagnosing and fixing hard drive problems, Speed Disk for high-level drive optimization, WinDoctor for troubleshooting Windows, and Crash Guard for saving your data when Windows crashes. The latest version adds some useful new applets, too: System Check performs complete system diagnostics; Registry Doctor analyzes and fixes Registry problems; Connection Doctor troubleshoots modem and communications snarls; and the WipeInfo data eraser—a staple of NU's DOS versions—has rejoined the suite in a new Windows guise.

MAKE YOUR CHOICE: Norton Utilities 4.0 offers a one-click system check and new, minimized installation options.

As always, you can have Norton Utilities run in the background, where it automatically watches for and fixes problems. But with 4.0, you also have the option of running it in manual mode—perfect for older, slower PCs or systems loaded with potentially incompatible hardware whose drivers sometimes trip up automatic utilities. (Of course, in manual mode, you may not catch a problem as it occurs.) With NU 4.0, you can run the utilities directly from the CD-ROM, without installing them.

Norton has an unenviable record of issuing buggy early releases, and we couldn't test NU 4.0 thoroughly enough to feel confident that the same thing won't happen this time. But the prerelease version we looked at ran without apparent problems. Overall, the new features, along with Symantec's deserved reputation for fine customer support, recommend NU 4.0 as an essential tool for all types of users.

—Stan Miastkowski ▶

Norton Utilities 4.0

PRO: Refined, updated utilities; less intrusive than previous versions.

CON: Manual mode can miss problems as they occur.

VALUE: The essential utility suite.

Street price: $60

Symantec

800/441-7234

www.symantec.com

PC WORLD INFONET NO. 725

online FOR MORE PRODUCT news and the latest announcements, check out the PC World Daily News Service at www.pcworld.com/news.

Toshiba's Portégé: Honey, I Shrunk the Laptop

SUBNOTEBOOK

ANYBODY WHO has ever had to schlep a 7- or 8-pound notebook to the farthest gate at an airport has uttered the same prayer halfway down the corridor: "Please, please, make my notebook lighter." Notebook manufacturers are attempting to answer such prayers with a new class of wafer-thin, bantamweight "ultraportables." The latest—Toshiba's new 3/4-inch thick, 2.9-pound (with its battery in place) **Portégé 3015CT**—packs a 266-MHz Pentium MMX processor, 32MB of RAM, and 2MB of video memory in an eye-pleasing case made of magnesium alloy. And it sells for a competitive $1799.

With a PC Worldbench 98 score of 102, the Portégé is no speed demon, but it keeps pace with many of its bulkier notebook brethren. Its standard extended lithium ion battery fueled the Portégé 3015CT for just over three hours on a single charge—middle-of-the-pack performance among the full-size notebooks we track in our monthly Top 10. The 3015CT counts onboard USB, fast IR, and two Type II PC Card slots. The bright, crisp, 10.4-inch active-matrix display with 800 by 600 resolution provides excellent screen quality for most work, though large spreadsheets inevitably look cramped.

WEIGHING ONLY 2.9 pounds, the 3015CT can go anywhere.

But to get a notebook this thin, light, and inexpensive, you have to relinquish some features. Like most subnotes, the 3015CT has no internal floppy or CD-ROM drive (an external floppy is included), and it lacks onboard serial, parallel, and PS/2 ports. To supply those, you need the included port expander, which adds about 4 ounces to the carrying weight and yet another doodad to keep track of before, during, and after trips.

Like keyboards on other subnotes, the Portégé's keys on the shipping unit are embedded in a wafer-thin membrane, and the resulting lack of "travel" takes some getting used to. The eraser-head stick mouse made cursor control too loose, even when adjusted via software.

Finally, because the 3015CT is so thin, it has no cooling fan. Instead, the CPU clock speed automatically drops when a certain internal temperature is reached (a feature that helps explain the model's less-than-scintillating performance scores).

Nevertheless, its relatively long battery life, space-saving shape, and light weight make the Portégé 3015CT an excellent carry-along for peripatetic professionals.

—Michael S. Lasky

Toshiba Portégé 3015CT

PRO: Competitively priced subnotebook boasts superior battery life.

CON: CPU speed falls periodically to reduce system heat; external attachment required for floppy and CD-ROM drives, and serial, parallel, and PS/2 ports.

VALUE: Excellent for pros on the go.

Street price: $1799

Toshiba America Information Systems

800/867-4422

www.toshiba.com

PC WORLD INFONET NO. 726

Shark's Pocket USB Modem Is a Killer

MODEM

SHARK'S **Leopard Pocket USB Modem** may be small, but it can swim rings around the other external V.90 modems floating around out there.

About the size of a pager and nestled in a translucent aquamarine case, this $80 Pocket USB is the smallest, lowest-cost external V.90 modem I've ever seen. I set up a shipping version simply by connecting the modem to my Dell 300-MHz Pentium II midtower's USB port and then following the on-screen instructions. And because the Leopard draws its power off the cable, I didn't have to futz around with a power supply.

THE SHARK LEOPARD POCKET USB MODEM may be the size of a pager but its performance matched those of larger models.

The Pocket USB is fast as well as convenient. In a series of hand-timed download tests, it marginally outperformed one of the fastest external modems on our Top 10 charts, Diamond's SupraExpress 56e.

Alas, USB ports are found only on newer PCs and notebooks, and they work best with Windows 98 and some USB-equipped Windows 95 PCs. But even with its drawbacks, this Shark is well worth catching.

—Bryan Hastings ▶

Leopard Pocket USB Modem

PRO: Inexpensive, small, very fast, doesn't need separate power supply.

CON: Requires a USB port and Windows 98; skimpy manuals.

VALUE: Instant connectivity and no power supply provide convenience, particularly for notebook users.

Street price: $80

Shark Multimedia

800/800-3321

www.sharkmm.com

PC WORLD INFONET NO. 727

You Name It, The XL²'s Got It.

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Home Networking for Dummies

NETWORKING

UNTIL RECENTLY, the idea of setting up a computer network at home was too daunting for most home users. Even if you had the technical expertise to link your PCs and peripherals, you still faced the problem of hiding all those unsightly cables. But a new wave of home networking kits could make the task as simple as hooking up a stereo.

Why would you want to network home PCs? Vendors say Internet access is the most popular application: Home networking kits include software programs that enable multiple PCs to access the Net simultaneously through a single ISP account. These kits also let users share other peripherals, and play multiplayer games.

ActionTec's **ActionLink Home Networking Kit** and Boca Research's **HAN Kit** (both examined in beta versions) use your home's existing phone line wires. Because the cards use a higher frequency than the phone line's voice band, you can still make calls while the PCs are linked.

Both kits are easy to set up. After I installed network PCI adapter cards inside my PCs, I completed the remainder of the process quickly and painlessly thanks to excellent documentation and to Windows Plug and Play's instant recognition of the installed boards. I connected a standard phone line from the card to the closest phone jack, ran through the installation utility—and was finished.

SNAP INSTALLATION

THE $149 ActionLink kit contains all of the components you'll need to link desktop systems: two PCI adapter cards, phone cables, and setup software. Similarly, Boca's $160 HAN Kit ("HAN" is an acronym for Home Area Network) features phone cables, two PCI boards, and two phone jack splitters (which let you keep your telephones plugged in at the same time as your network), as well as setup and utility software. Boca's HAN cards are a bit more sophisticated than ActionTec's. For example, with the proper wiring from the phone company, you can configure the HAN cards to connect through a single phone jack with two separate phone lines.

LINK PCs with the HomeFree Wireless Desktop Pac, top right, or the ActionLink Home Networking Kit, above.

Once I had them up and running, both phone line–based kits allowed me to transfer a 10MB file between two PCs in about 90 seconds. Previously, the only way to transfer large files between computers at home that quickly was via a direct connection between the two PCs' parallel ports. But that meant they had to be set up beside each other—a major inconvenience.

These two kits are restricted, though: They require your PC to sit near a phone jack. If you don't like that limitation, consider Diamond Multimedia's $200 **HomeFree Wireless Desktop Pac,** which uses wireless radio transmissions to connect multiple PCs. The HomeFree kit gives users one PCI adapter and one ISA-based adapter; each adapter includes an antenna on the back.

WIRELESS WONDER

LIKE THE TWO phone line products, the HomeFree wireless kit was a snap to install. With HomeFree, you can put your networked PCs anywhere in the house as long as they're within 150 feet of each other. Judged on performance, however, Diamond's wireless approach to networking couldn't match the phone line solutions. HomeFree took about 3.5 minutes to transfer my 10MB file. (Diamond plans to introduce a phone line–based product early this year.)

If your home has only one phone line jack or poor phone jack distribution, you're probably better off with a wireless product such as Diamond's HomeFree kit. But if you have telephone cabling throughout your house—and near your PCs—the faster throughput and slightly lower price of phone line products like the ActionTec and Boca Research kits make them a better deal.

—Dean Andrews ▶

ActionLink Home Networking Kit

PRO: High performance, convenient to use.
CON: Lacks phone line splitters.
VALUE: Good choice for home with multiple single-line jacks.
List price: $149
ActionTec Electronics
800/797-7001
www.actiontec.com
PC WORLD INFONET NO. 728

HAN Kit

PRO: Fine performance, easy to use, adapts to various phone line configurations.
CON: None.
VALUE: Best choice for complicated home phone wiring scenarios.
List price: $160
Boca Research
561/241-8088
www.bocaresearch.com
PC WORLD INFONET NO. 729

HomeFree Wireless Desktop Pac

PRO: Phone jacks not needed.
CON: 150-foot range limitation, slower performance.
VALUE: Good for small homes without multiple phone jacks.
Street price: $200
Diamond Multimedia Systems
800/468-5846
www.diamondmm.com/homefree
PC WORLD INFONET NO. 730

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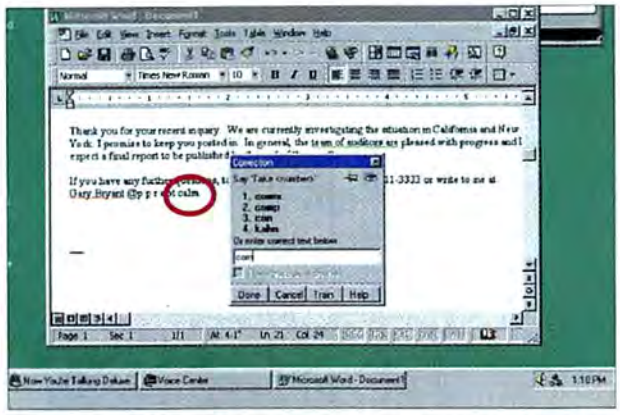
Make Your Computer Take Orders

SPEECH RECOGNITION

VOICE RECOGNITION programs let you do more than just plain dictation these days. For instance, Lernout & Hauspie's **Now You're Talking Deluxe** lets you snap orders at your PC to schedule meetings, amend your address book, browse the Web and review search results, and then go to a matching Web site. The program is designed for the small- or home-office talker and can offer you a hands-free way of getting your work done. But be prepared to spend a lot—and I mean *a lot*—of time training it to recognize your voice.

Like all voice recognition packages, NYTD can't take orders until it understands your voice. In my test of a prerelease version, I had to spend 50 minutes reading 229 chunks of text, and rereading one any time the program misrecognized a word. Even after training, the program often goofed—substituting, for example, "cocoa" for "total," and "the viewers theory" for "yours sincerely." The company says it's working on improving the training system.



NOW YOU'RE TALKING DELUXE hears "calm" when you said "com," but it lets you fix such goofs quickly in the text.

It should also work on the VoiceScheduler and AddressBook features, which I found clunky and not particularly intuitive to use. Once trained, though, NYTD works with almost any Windows-based app.

Unique to Now You're Talking Deluxe, Voice WebFinder works with Netscape Navigator 3.0 and up and Internet Explorer 3.0 and up. It lets you ask a question (like "What's the stock price of IBM today?") and specify the search engines you want to use and the number of hits you desire. From the resulting list of matches, you can view a summary of each site or go right to the URL. Searching by voice, however, was not faster than typing.

Now You're Talking is reasonably priced at $100, but it's not practical for long documents since editing and correcting by voice is an annoying, time-consuming task. It's great for e-mails, notes, or short letters, though; and if you suffer from repetitive strain injuries, hate typing, or just want to give your weary hands a break, NYTD offers an alternative to typing. Still, you'll probably find yourself itching to grab your mouse and keyboard when the program doesn't understand you.

—Aoife McEvoy

Now You're Talking Deluxe

PRO: Decent accuracy, superfriendly interface, handy Web search feature that competitors lack.

CON: Endless amount of retraining needed, usefulness of some features is spotty.

VALUE: A capable alternative to typing for light PC tasks.

Street price: $100

Lernout & Hauspie

800/380-1234

www.lhs.com

PC WORLD INFONET NO. 710

OneStep's Friendly PIM Scores

PIM

SIMPLE, INNOVATIVE, and inexpensive, OneStep's new **OneStep Connect** proves that there's always room for another effective personal information manager in an already-crowded market.

This $50 package's unique design (I tested a shipping version) melds your copy of Microsoft Word 95 or later into its user interface, letting you create letters, e-mail, faxes, and other correspondence right within the PIM. And creating these documents couldn't be simpler, since the package provides templates that step you through the process, even prompting you to print an envelope when appropriate. (If you don't have Word, you get a more basic text editor instead.) OneStep Connect's trim interface is a nice departure from convoluted packages such as Microsoft Outlook; true to the product's name, tasks take only a few clicks to accomplish.

But while you get all the essential features for managing your calendar and address book, as well as exchanging data with 3Com's PalmPilot personal digital assistants, some advanced tools are missing. For instance, you can't attach an external file (say, a spreadsheet) to a contact or an appointment. The correspondence templates are also a bit spartan, but creating your own is simple enough.

Even with its limitations, this newcomer easily ranks alongside such products as Lotus Organizer and Starfish's Sidekick as one of the finest entry-level PIMs.

—Harry McCracken ▶

OneStep Connect

PRO: Very simple to use, fine features for creating and managing correspondence.

CON: Lacks some advanced options, templates could be better.

VALUE: A top pick for PIM neophytes and casual users.

Street price: $50

OneStep

877/622-1616

www.onestepinc.com

PC WORLD INFONET NO. 711

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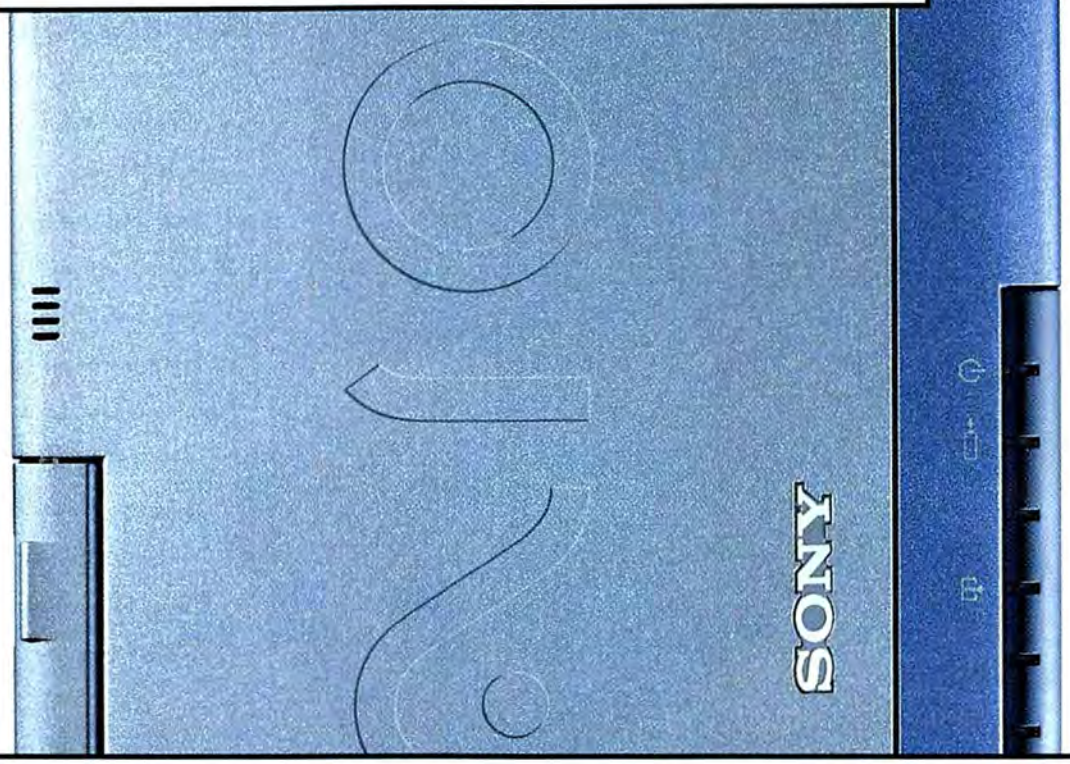

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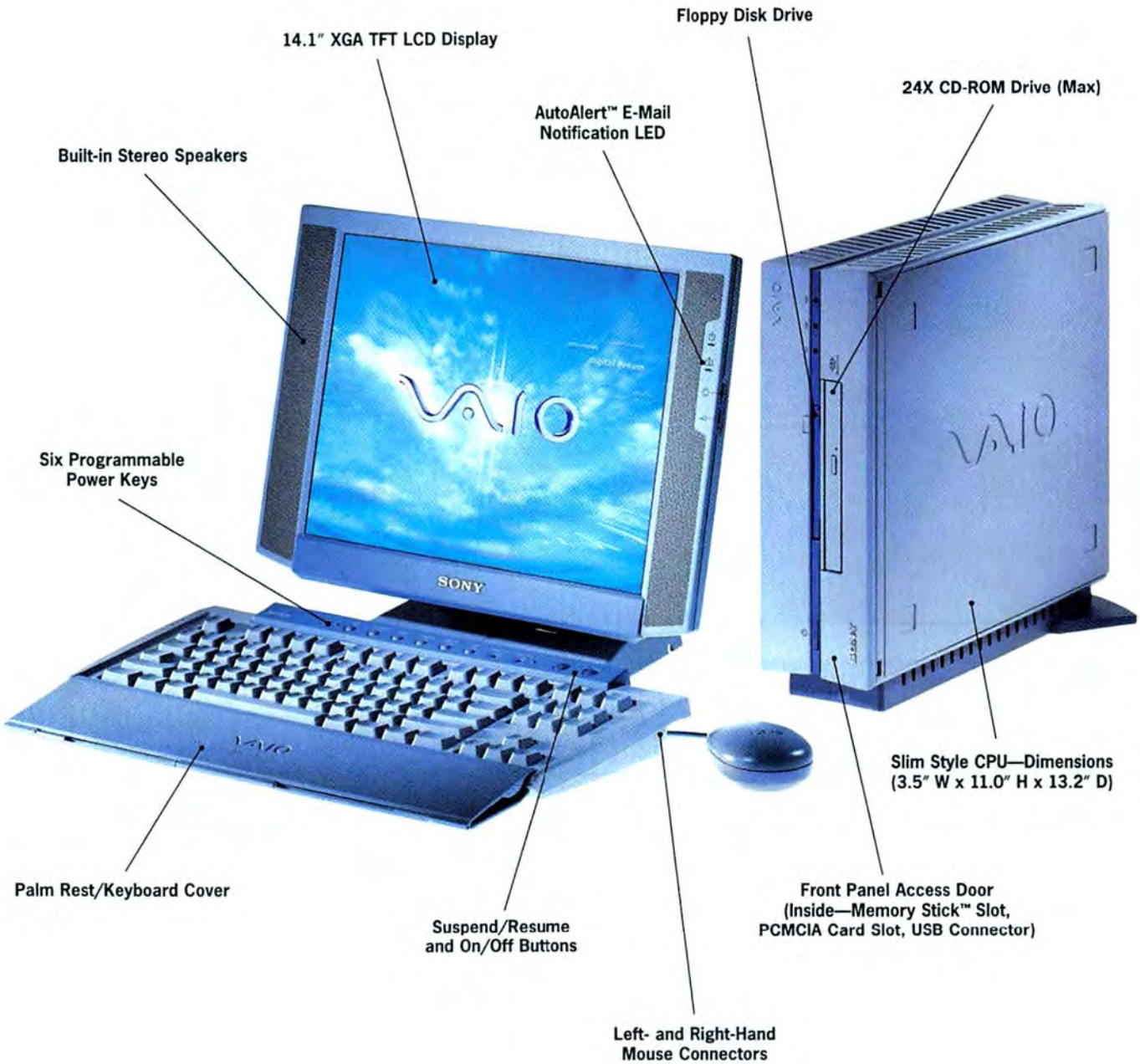
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SONY

The VAIO Slimtop™ LCD Computer. Power and beauty in equal measure.

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But it's not just about how good it looks on your desk. It's about how much more desk you have to look at. The sleek, space-saving design is 75% smaller than the average mini-tower—and still gives you all the power you'd expect from your standard gargantuan PC.

Plus it has features that make personal computing even more convenient. Things like an Ergo-Angle™ LCD Display, AutoAlert™ e-mail notification system and a Sony Memory Stick™ slot (see right for more details).

The VAIO Slimtop LCD Computer. It could only be from Sony.

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Quantex's Budget Flat-Panel PC

DESKTOP

WHAT A DIFFERENCE six months can make. In August 1998, prices for systems with LCD panels cost $3000 and more. But now Quantex is offering a sleek group of corporate PCs—dubbed Slimline—with 15-inch flat panels for as little as $1995, the cheapest we've seen for a system of this type. I checked out one of the first shipping units with the meatiest configuration. Despite some drawbacks, it is worth considering if you're looking to add fin-de-siècle finesse to a small desk.

QUANTEX'S VX 450 with Windows NT 4.0 offers a space-saving LCD flat panel on top of its compact CPU case.

The $2499 **VX 450** Slimline lives up to its family name, as it measures just 3 by 13 by 15 inches. Into this tight case Quantex packs a Pentium II-450 processor with 64MB of RAM and a huge 13GB hard drive. The bundled 15-inch analog LCD panel looks great, with sharp, crisp text and assertive graphics. The display panel has built-in speakers, but Quantex also throws in a pair of Altec Lansing ACS90 external speakers. To make the slim VX 450 appealing to businesses, Quantex preinstalls the Windows NT 4.0 operating system and a network card. Even though systems running Win NT usually score higher on our PC WorldBench 98 tests than those running Win 98, the VX 450 didn't set any speed records, clocking an unremarkable score of 231—close to the low end of the spectrum for this configuration. The likely culprit: LCD graphics drivers, which usually lower overall performance.

The VX's beauty is only skin deep. The small box means you'll have to push aside coiled, snaking wires if you want to add more memory in the DIMM sockets. And you can't add standard-size video or sound boards because Quantex uses half-height PCI cards scaled to fit inside the 3-inch-high box. Finally, forget about other peripherals like extra hard disks—the VX lacks even one open drive bay.

Overall, if you think you'll need to upgrade later, the lack of expansion capability makes the VX 450 a less-than-ideal choice. But for an office on a budget that needs a space-saving system running Windows NT, this PC fills the bill.

—Mick Lockey

VX 450

PRO: Compact design, bright LCD picture quality.

CON: Middling performance, limited expandability.

VALUE: You won't be able to fatten it up, but the price is right.

Street price: $2499

Quantex

800/896-4898

www.quantex.com

PC WORLD INFONET NO. 712

Microsoft Money: This Time It Means Business

PERSONAL FINANCE

MICROSOFT MONEY is getting down to business. **Money 99 Personal & Business** targets self-employed people, freelancers, and consultants who want a business finance package that also handles their personal finances. It offers tools for business bookkeeping plus all the tracking, planning, and Web-based features of the recently introduced Money 99 Financial Suite (see *New Products*, October 1998, www.pcworld.com/oct98/money).

If you file a Schedule C form with your personal federal income tax return—required to deduct expenses of a one-person business—this $85 package is designed for you. A major feature is line-by-line Schedule C help. It offers lists of expense and income categories for more than two dozen businesses—painting, catering, and so on. The categories are linked directly to lines in Schedule C, so the data can be transferred into popular tax-preparation programs.

Also included are 28 templates for invoices that can be generated using customer information from a basic, built-in contact manager. (Only contact data from Outlook and Outlook Express is supported for automatic synching.)

Since accounts as well as categories are designated as business or personal, you can generate reports for either. However, accounts you use for both—a checking account, for example—must be designated for business, and it's a bit tricky getting business accounts to also show up in your personal finance reports.

The package's contact manager, Schedule C help, and invoice templates exceed the tools in Intuit's competing Quicken Home and Business. But unless you keep your banking and other business accounts separate, Quicken is easier to use. Also note that the Microsoft program's file format is not backward-compatible with previous versions of Money.

—Yardena Arar ▶

Money 99 Personal & Business

PRO: Tax, invoice, and contact management tools for the self-employed who also need personal finance help.

CON: New file format is incompatible with earlier Money versions.

VALUE: Good for people with very small home businesses.

Street price: $85

Microsoft

800/426-9400

www.microsoft.com/money

PC WORLD INFONET NO. 713

SMALL-BIZ MARY

WEB-BIZ MARY

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Sharp's Image-Conscious CE Pro Portable

PORTABLE

IF YOU TRAVEL a lot and need a laptop PC to check e-mail, edit Microsoft Office documents, create PowerPoint presentations, and do some Web browsing on the road, a light, touch-typable device running the Windows CE Pro operating system may be the answer to your portable prayers. And if you need to add digital photography to that list of tasks, Sharp's **Mobilon Pro** is the CE Pro device for you. Its optional PC Card camera with software for photo editing makes it ideal for real estate agents, insurance adjusters, and others who want to capture images in the field without having to lug around extra digital cameras or a conventional notebook.

WITH ITS PC CARD camera, the Sharp Mobilon Pro gets your pictures, too.

Mobilon Pro

PRO: Good price, attractive touch screen, digital imaging option.

CON: Small keyboard, awkward PC Card camera costs $299 extra.

VALUE: Intriguing alternative for mobile digital photographers.

Street price: $899

Sharp

800/237-4277

www.sharp-usa.com

PC WORLD INFONET NO. 714

At 2.7 pounds and 9.3 by 7.7 inches, the Mobilon Pro has a slightly smaller footprint than most subnote-style CE Pro devices, but its 1.4-inch battery holder bar is slightly thicker than the norm. The 8.2-inch LCD panel on my shipping unit looks pleasingly bright for a touch screen. It also displays 4096 colors, while most competing models support only 256. Applications built into Windows CE Pro include Pocket Word, Excel, PowerPoint, Outlook, and Internet Explorer.

But what really sets the Mobilon Pro apart is its potential as a portable photo studio. The optional Sharp Digital Camera Card, basically a PC Card with a small camera lens attached, is certainly more awkward to use than a standard digital camera. To get your eye behind the viewfinder, you must lift the entire computer. But it can do the job, capturing images for immediate e-mailing or posting on a Web site. The included photo application lets you do some rudimentary editing and collect photos in albums.

By itself, the Mobilon Pro sells for $899—still $100 less to date than the competing Hewlett-Packard Jornada—and the PC Card camera will cost you another $299. The Jornada's slightly larger keyboard and touchpad may be worth the extra money for most users, but the Sharp's built-in digital imaging and aggressive price should please those who find a single picture worth a thousand touch-typed words.

—Yardena Arar

Uniden's Palm-Size PC: It's No Palm III

PDA

MICROSOFT AN underdog? Yes indeed, when it comes to competing with 3Com's wildly popular Palm III personal digital assistant. Devices based on Microsoft's Palm-size PC specification haven't exactly set the world on fire. The newest, Uniden's **UniPro,** isn't bad as Palm-size PCs go, but it also shows why the whole genre still needs work.

I tested a shipping version of the $449 UniPro PC100-A, a generously configured unit with 8MB of RAM, a built-in 28.8-kbps modem, and a PC docking station. Not only does this seven-ounce pocket-size PDA handle all the expected Windows CE functions—calendars, contacts, calculator, and memos—but because of its built-in modem, it's also one of the most portable e-mail devices you'll find.

Unfortunately, its two pen-based input systems (handwriting recognition and a tiny on-screen keyboard) are good only for entering brief messages. And although the e-mail application handles file attachments, it uses proprietary formats that greatly diminish this feature's value. For example, Pocket Word and Excel formats must be converted from their desktop counterparts before you can read them. Because most senders won't know that, they'll attach what will be unreadable documents.

More than anything else, the UniPro suffers from the complexity of the Windows CE user interface. The applications don't want for power, but screens are cluttered with icons and options, and you often have to burrow through dialog boxes to perform basic tasks. In contrast, the Palm III's sleek interface provides much quicker access to its features. And for e-mail and other text-intensive jobs, you may be better off with a larger, keyboard-based Windows CE device, such as Hewlett-Packard's Jornada or the new Mobilon Pro from Sharp (see review above).

—Harry McCracken ▶

UniPro PC100-A

PRO: Well equipped with 8MB of RAM, modem, and docking station.

CON: Complex Windows CE user interface, clumsy pen-based input.

VALUE: Respectable Palm-size PC, but the Palm III remains the PDA to beat.

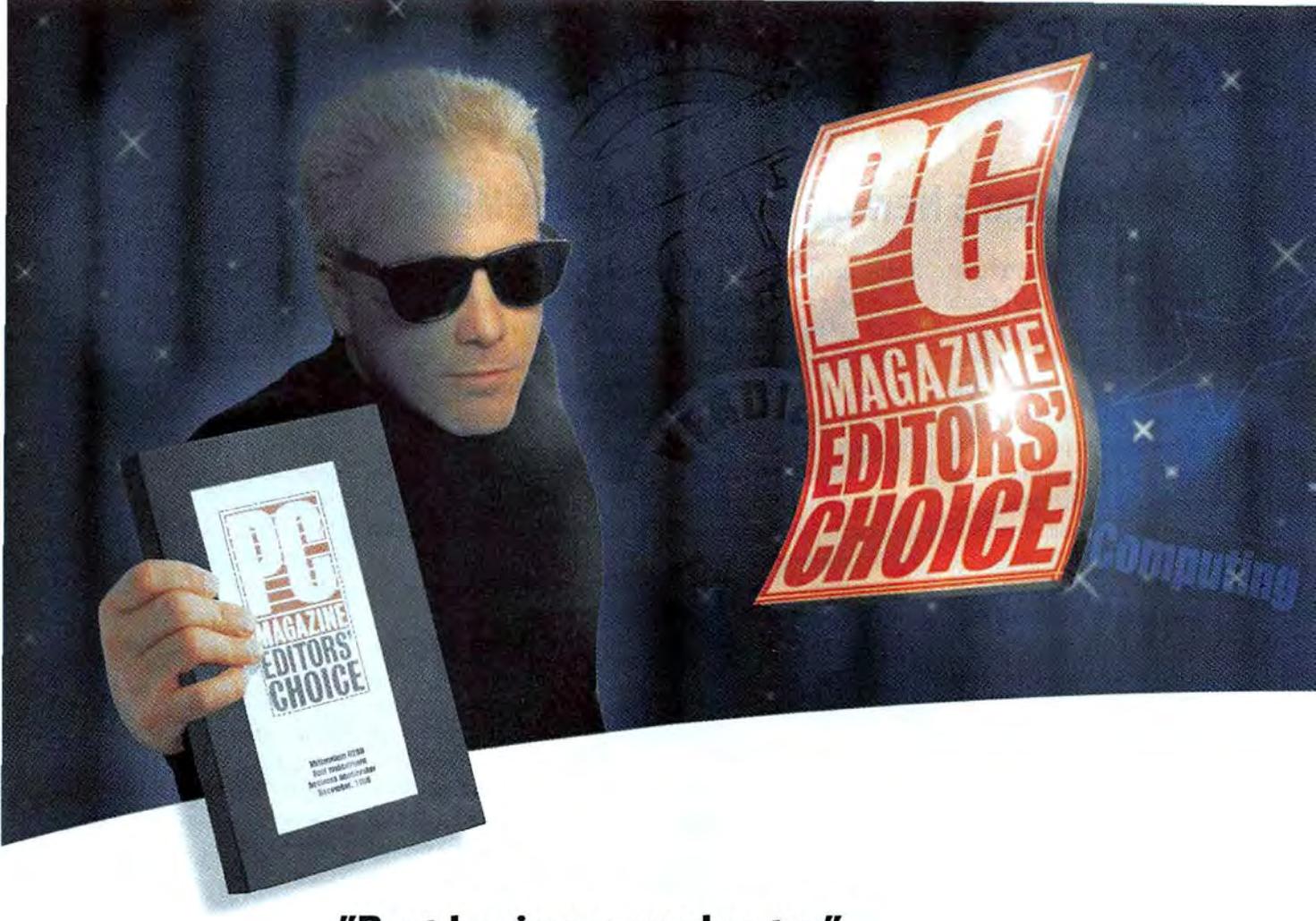
List price: $449

Uniden

888/686-4336

www.uniden.com

PC WORLD INFONET NO. 715



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Best high end corporate PC
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2D performance

Millennium G200 8MB AGP	135

WinBench 99 Business at 1280x1024x24bpp@75Hz

3D performance

Millennium G200 8MB AGP	368

3D WinBench 99 at 1024x768x16bpp@85Hz

The tests were performed without independent verification by Ziff-Davis. Ziff-Davis makes no representations or warranties as to the result of the tests. WinBench, 3D WinBench and WinMark are trademarks of Ziff-Davis Inc. in the US and other countries. All tests performed with Windows 98 on an Intel 440BX motherboard configured with a 400Mhz Pentium II and 128MB of 100Mhz SDRAM. WinBench 99 Business run at 1280x1024x24bppG75Hz refresh. 3D WinBench 99 run at 1024x768x16bpp triple buffered with 16bit Z at 85Hz refresh under DirectX 6.0. Matrox Millennium G200 configured with 8MB of SGRAM for the AGP bus and using driver revision 4.50.

matrox

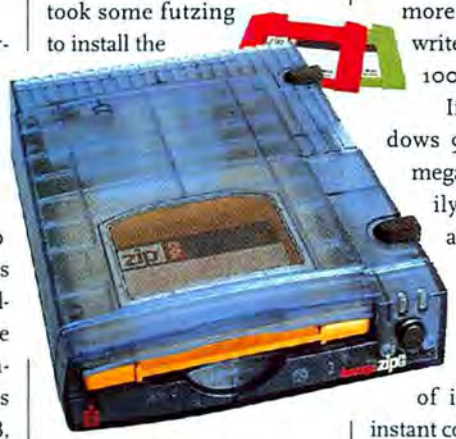
Iomega's New Zip Drive Holds 250MB

REMOVABLE STORAGE

IOMEGA IS weighing in with two third-generation models of its ubiquitous Zip drives: the 100MB **Zip USB** and the 250MB **Zip 250.** While they offer higher-capacity storage and faster performance, these new units—like the original Zip 100—are still incompatible with regular floppies.

I evaluated shipping versions of the Zip USB and the Zip 250 SCSI drives by installing each on a Gateway GX 450-XL desktop PC. Using the $150 Zip USB was as simple as plugging it into the PC's Universal Serial Bus port. Windows 98 automatically recognized the drive, the bundled utility software installed in minutes, and I was up and running. The Zip USB, with its hip, iMac-like translucent blue case, is a stunning performer, taking just over 2 minutes each way to copy about 80MB of files from the hard drive to the disk and back. By comparison, a standard 100MB parallel-port Zip took more than 9 minutes each way.

The $199 Zip 250 SCSI is targeted primarily for Macs, but it's also PC-compatible. It took some futzing to install the optional $50 Zip Zoom SCSI card adapter and drivers; the parallel-port version (available by the time you read this) will be easier to install but slower to use because of the parallel port's limitations. The Zip 250 reads 100MB disks as quickly as 250MB media, but because of its redesigned heads, it took more than 10 minutes to write 80MB to the older 100MB disk.



THE 100MB ZIP USB drive is ready instantly upon connecting.

If you are using Windows 98 and you need a megafloppy drive primarily to transfer large amounts of data from your desktop PC to a notebook, the Zip USB is an excellent choice for its ease of installation and its instant connectivity. For higher capacity and fast performance on a desktop PC, stick with the Zip 250 SCSI drive. But remember: With either device you will still need access to a floppy drive to read regular 1.44MB floppies.

—Rex Farrance

Zip 250

PRO: Cheap high-capacity storage, SCSI model is zippy.

CON: Incompatible with 1.44MB floppy disks.

VALUE: Uses the highest-capacity superfloppies available.

List price: $199 (parallel-port or SCSI version)

PC WORLD INFONET NO. 716

Zip USB

PRO: Ultraeasy installation, fast.

CON: Incompatible with 1.44MB floppy disks.

VALUE: Very easy to install and use, performs almost as fast as a SCSI model.

List price: $150

Iomega

800/697-8833

www.iomega.com

PC WORLD INFONET NO. 717

Rio: Internet Music on the Go

GADGET

WHEN I WANT to hear music I like, I turn to Rio. No, not the South American city, but Diamond Multimedia's new MP3 digital music player, the **Rio PMP300.** This $199 pager-size device functions as a sort of custom Walkman: I can download favorite music from various Internet sites or from CDs and listen to it anywhere.

MP3 is short for MPEG Layer 3, the compression technology that can create near-CD-quality music files that are small enough to send over the Internet. MP3 recordings are so faithful to the originals that the Record Industry Association of America sued to stop Diamond Multimedia from releasing the Rio, alleging that it encouraged music piracy. Diamond won, but the case is currently on appeal.

The Rio uses 32MB of onboard flash memory (think of it as a virtual hard disk) to hold music. Diamond says the device will hold up to an hour of music, but I maxed out the memory with 35 minutes' worth in my test of a shipping unit. Because the Rio has no moving parts, no skipping or flutter occurs as it does on tape, CD, or minidisc players. A single AA battery gave me 12 hours of play and record time.

The device comes with a small but robust program to load music from your PC to the Rio (through an included parallel-port cable), shuffle its playing order, and preview selections on your PC speakers. Another included program, MusicMatch, converts audio CD tracks to MP3 format. Using the software, I converted a 4-minute song from CD to MP3 in 48 seconds and saved it on my PC's hard drive; it then took me less than 30 seconds to transfer the song from my PC to the Rio.

Downloading music from the Net is appealing, as is the ability to create your own program mix of songs. But its relatively small capacity and high cost ($50 to $100 for external flash memory cards) make the Rio more of a promising first try than a worthwhile gadget.

—Michael S. Lasky ▶

Rio PMP300

PRO: Pocket-size device plays near-CD-quality customizable music.

CON: Holds just 35 minutes of music, extra memory is expensive.

VALUE: A pricey music player.

Street price: $199

Diamond Multimedia

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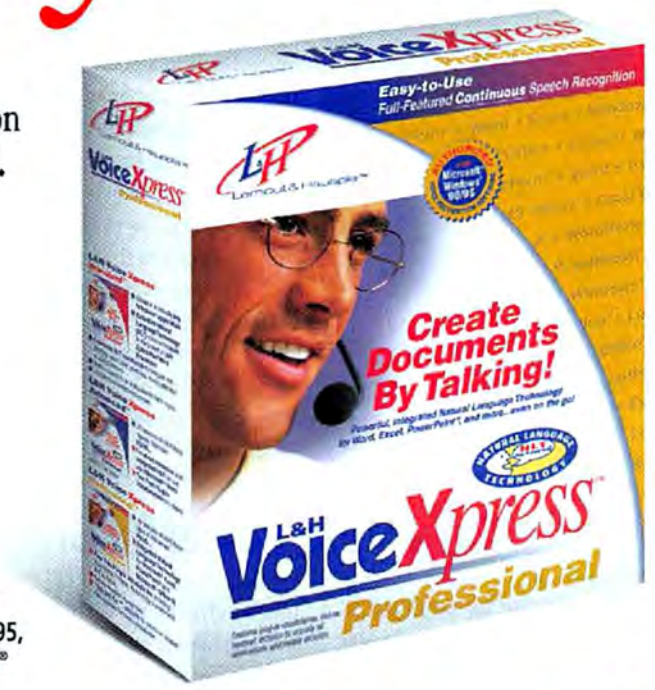

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ImageDeck Scanner: Look Ma, No PC Needed

SCANNER

JUST WHEN WE think we've seen every type of scanner design imaginable, along comes Microtek Lab's new **ImageDeck,** billed as the first stand-alone "scanning appliance." Unlike traditional scanners, the ImageDeck doesn't require a PC to make and store scans. Instead, you push a few buttons on the device's front panel to scan your documents and put them on removable disks using the unit's built-in floppy and Iomega Zip 100 drives.

NO PC REQUIRED: Microtek's stand-alone ImageDeck scanner features built-in Zip and floppy drives for saving its scans.

You can also connect the ImageDeck to a color printer and use the scanner as a color copier—again without a PC.

The 15-pound ImageDeck's footprint (13 inches wide by 4.8 inches high by 18.9 inches long) is similar to that of other flatbed scanners, but its slew of front-panel buttons and its built-in processor and storage drives distinguish it from other desktop models.

The buttons provide easy control over scan mode (36-bit color, 8-bit gray scale, or black-and-white), compression (high, medium, or low), resolution (up to 600 dots per inch), and scan area. The ImageDeck automatically saves your scanned images—in either JPEG or PCX format—on a standard 1.44MB floppy or on a 100MB Zip disk, depending on the size of the image you are scanning.

The preshipping version of the ImageDeck I reviewed was easy to set up and use for a variety of scanning and copying tasks. The final shipping version will bundle Ulead's PhotoImpact 4.0 image editor and two optical character recognition programs from Caere (PageKeeper Standard and OmniPage LE). If you plan to do a lot of OCR, the ImageDeck also can be used with an extra-cost ($149 street) automatic document feeder. One option I wish Microtek offered: some way of connecting the scanner to a PC, for times when you don't want to use it as a stand-alone device.

The ImageDeck might be a good solution for workgroups that want to share a scanner as they do the office photocopier. But this convenience doesn't come cheap: At $479, the ImageDeck costs about $230 more than an entry-level flatbed scanner ($100) and a Zip drive ($150) combined.

—Richard Jantz

ImageDeck

PRO: Simple installation, easy push buttons, good-looking scans.

CON: Expensive, lacks optional PC-to-scanner connection.

VALUE: Too pricey for no-sweat scanning.

Street price: $479

Microtek Lab

800/463-7766

www.microtek.com

PC WORLD INFONET NO. 719

Kai's More Powerful Graphics Tools

GRAPHICS

WITH VERSION 5, **Kai's Power Tools** from MetaCreations just got more powerful. The popular cross-platform (PC/Mac) Adobe Photoshop–compatible plug-in now comes with ten filters and offers special effects that can be applied to a bit map, imitate conventional photographic filters, or transform images in unusual ways.

KPT 5's collection of filters lets you distort photos and create bizarre images (to use as backgrounds, texture maps for special effects, or Web-page buttons) like no other graphics plug-in I've seen.

Geared for serious graphics artists and people who like to experiment with images, KPT 5 works with most image editing applications that support Photoshop plug-ins. The program offers fascinating new filters, preset effects, and patterns, all in a clean and modern interface. Unfortunately, that interface uses unconventional—albeit sleek and unique—menus, icons, and controls, all of which will take you some time to learn.

But Kai's on-screen slider controls for customizing effects and adjusting a broad range of graphical options—including light sources, colors, opacity, and size and density of shapes—are easy to use. Competing products such as Xaos Tools Paint Alchemy and Extensis PhotoTools don't give you similar improvisational control in real time.

Using a shipping copy of KPT 5, I found that each plug-in filter must be launched individually, a time-consuming task. It would be nicer if the KPT workspace remained loaded, allowing you to toggle between it and the host app (such as Photoshop).

—Grace Aquino ■

Kai's Power Tools 5

PRO: Good real-time controls.

CON: Unique interface takes time to learn.

VALUE: Great art effects for pros.

Street price: $129 (upgrade $99)

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www.metacreations.com

PC WORLD INFONET NO. 720

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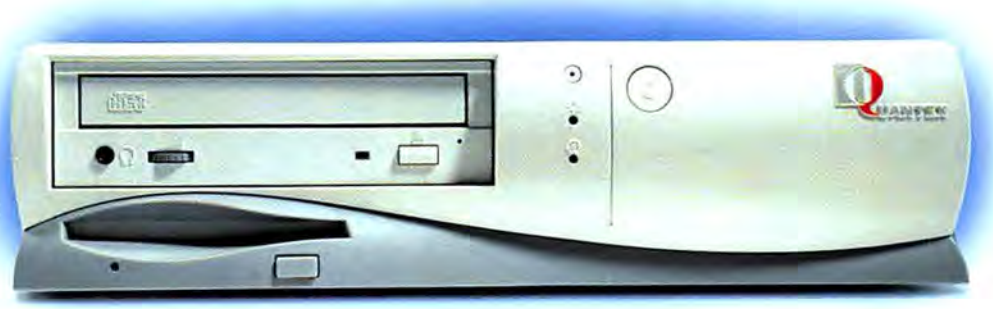

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intel inside pentium II

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SOFTWARE: MS Office 97 Small Business Edition v2.0 • MS Money '97 (pre-loaded only) • Office Mate • Day Planner Pro • Power Business Plans • Form Designer Pro • Project Manager Pro • Labels Unlimited • Compton's Reference Collection • Dr. Solomons Find-Virus (pre-loaded only) • MS Internet Explorer 4.0

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- 3rd Generation 4.8X DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec Lansing ACS-90 Speakers
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS Intelli Mouse
- MS Windows 98 - Power Multimedia Software Bundle
- Microsoft Office 97 SBE v2.0
- 3-year limited warranty with 1-year On-Site Service**
- Year 2000 Compliant
- *Upgrade to Altec Lansing ACS-45 1 PowerCube Speakers with Subwoofer, add $43*
- *Optional Internal Zip Drive w/one cartridge, add $79*

QP6/350 SM-2x(w/Pentium II processor 350MHz).....$1849

QP6/400 SM-3x $1999

Business lease: $70/Mo. Order Code #pcw0322

- Pentium II Processor 400MHz
- 128MB PC100 SDRAM Memory, 512KB Secondary Cache
- 13GB Ultra ATA HD, 3.5" 1.44MB Floppy Drive
- New 19" Monitor w/NEC CromaClear CRT (18.1" viewable), 1600x1200, 25dp
- New 3Dfx 128-bit Voodoo Banshee 3D AGP Video w/16MB Based on award-Winning Voodoo2 3D Technology
- 56K V.90 PCI Fax Modem* w/Voice Mail and Speakerphone
- 3rd-Generation 4.8X DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec Lansing ACS-45 1 PowerCube Speakers w/subwoofer
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS IntelliMouse
- MS Windows 98 - Power Multimedia Software Bundle
- Microsoft Office 97 SBE v2.0
- 3-year limited warranty with 1-year On-Site Service**
- Year 2000 Compliant
- Optional Internal Zip Drive w/one cartridge, add $79
- Upgrade from 13GB HD to 17.2GB HD, add $99

QP6/450 SM-3x(w/Pentium II processor 450MHz)...$2199

QP6/450 SM-4x $2399

Business lease: $84/Mo. Order Code #pcw0323

- Pentium II Processor 450MHz
- 128MB PC100 SDRAM Memory / 512KB Secondary Cache
- New 17.2GB Ultra ATA HD, 3.5" 1.44MB Floppy Drive
- New 19" Monitor w/NEC CromaClear CRT (18.1" viewable), 1600x1200, 25dp
- New 3Dfx 128-bit Voodoo Banshee 3D AGP Video w/16MB Based on award-Winning Voodoo2 3D Technology
- Internal 100MB Zip Drive with one cartridge
- 56K V.90 PCI Fax Modem* w/Voice Mail and Speakerphone
- 3rd-Generation 4.8X DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec Lansing ADA-305 Dolby Pro Logic Surround Sound Speakers with subwoofer
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS IntelliMouse
- MS Windows 98 / Power Multimedia Software Bundle
- Microsoft Office 97 SBE v2.0
- 3-year limited warranty with 1-year On-Site Service**
- Year 2000 Compliant
- *Add Sony CD-RW Drive for just $299 (24X CD/4X CD-R/2X CD-RW)*

SUPER MULTIMEDIA

QP6/450 M-4x SE $2199

Business lease: $77/Mo. Order Code #pcw0309

- Pentium II Processor 450MHz
- 128MB PC100 SDRAM Memory / 512KB Secondary Cache
- New 17.2GB Ultra ATA HD, 3.5" 1.44MB Floppy Drive
- 19" Monitor w/OSD (18.1" viewable), 1600x1200, 26dp
- Intel 740 3D 2X AGP Graphics with 8MB SDRAM
- Internal 100MB Zip Drive with one cartridge
- 56K V.90 PCI Fax Modem* w/Voice Mail and Speakerphone
- 3rd-Generation 4.8X DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec-Lansing ACS-90 Speakers
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS Mouse
- MS Windows 98
- Value Multimedia Software Bundle
- 3-year limited warranty with 1-year On-Site Service**
- Year 2000 Compliant
- *Optional Altec Lansing ACS-25 Subwoofer, add $39*
- *Add Sony CD-RW Drive for just $299 (24X CD/4X CD-R/2X CD-RW)*

QP6/400 M-4xSE(w/Pentium II processor 400MHz)...$1999

QP6/450 SM-4x SE $2799

Business lease: $98/Mo. Order Code #pcw0324

- Pentium II Processor 450MHz
- 128MB PC100 SDRAM Memory, 512KB Secondary Cache
- New 20GB (7200rpm) Ultra ATA HD, 3.5" 1.44MB Floppy Drive
- 21" Monitor w/OSD (20.0" viewable), 1600x1200
- New 3Dfx 128-bit Voodoo Banshee 3D AGP Video w/16MB Based on award-Winning Voodoo2 3D Technology
- Internal 100MB Zip Drive with one cartridge
- 56K V.90 PCI Fax Modem* w/Voice Mail and Speakerphone
- 3rd Generation 4.8X DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec-Lansing ADA-305 Dolby Pro Logic Surround Sound Speakers with subwoofer
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS IntelliMouse
- MS Windows 98 - Power Multimedia Software Bundle
- Microsoft Office 97 SBE v2.0
- 3-year limited warranty with 1-year On-Site Service**
- Year 2000 Compliant
- *Add Sony CD-RW Drive for just $299 (24X CD/4X CD-R/2X CD-RW)*

ULTIMATE GAMING PCS

QP6/400 GX-1c $1499

Business lease: $53/Mo. Order Code #pcw0340

- New Intel Celeron Processor 400MHz
- 96MB SDRAM Memory / 128KB Secondary Cache
- 13GB Ultra ATA HD, 3.5" 1.44MB Floppy Drive
- 17" Digital Monitor w/OSD (15.8" viewable)
- Intel 740 3D 2X AGP Graphics with 8MB SDRAM
- 56K V.90 PCI Fax Modem* w/Voice Mail and Speakerphone
- New 40X Max Variable Speed CD-ROM Drive
- Aureal A3D 3D Positional PCI Sound
- 32Mx Voodoo2 based 3D Game Accelerator w/12MB
- MS SideWinder Precision Pro Joystick
- Altec Lansing ACS-45 1 PowerCube Speakers w/subwoofer
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS Mouse
- MS Windows 98 - Value Multimedia Software Bundle
- Activision Game Titles: Battlezone, Heavy Gear Interstate 76 w/Nitro Pack
- 3-year limited warranty with 1-year On-Site Service**
- Year 2000 Compliant
- *Upgrade to 17" Monitor w/NEC CromaClear CRT for $79*

QP6/450 GX-2 $2399

Business lease: $84/Mo. Order Code #pcw0342

- Pentium II Processor 450MHz
- 128MB PC100 SDRAM Memory / 512KB Secondary Cache
- 13GB Ultra ATA HD, 3.5" 1.44MB Floppy Drive
- 19" Monitor w/OSD (18.1" viewable), 1600x1200, 26dp
- Intel 740 3D/3D 2X AGP Graphics with 8MB SDRAM
- Internal 100MB Zip Drive with one cartridge
- 56K V.90 PCI Fax Modem* w/Voice Mail and Speakerphone
- 3rd Generation 4.8X DVD-ROM Drive
- Aureal A3D 3D Positional PCI Sound
- New Dual 32Mx Voodoo2 SLI 3D Game Accelerators w/24MB (2X more powerful than single Voodoo2 accelerator)
- MS SideWinder Precision Pro Joystick
- Altec-Lansing ADA-305 Dolby Pro Logic Surround Sound Speakers & subwoofer
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS Mouse
- MS Windows 98 / Value Multimedia Software Bundle
- Activision Game Titles: Battlezone, Heavy Gear Interstate 76 w/Nitro Pack
- Year 2000 Compliant

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PC WORLD SPECIAL

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A guide to fast Net access—today, tomorrow, and beyond.

Bandwidth on Demand

BY HARRY McCRACKEN

Cable and DSL technology promise to break the Internet **bottleneck.** Do they deliver? Yes, but maybe **not to you.**

THOMAS EDISON said that genius is 1 percent inspiration and 99 percent perspiration. George Margolin, an inventor in Newport Beach, California, adds another ingredient to his own creative process: acceleration.

An early cable modem user, Margolin raves, "The cable modem speeds up my patent searches, technology investigations, and trademark lookups." But for Margolin, whose inventions include a folding computer keyboard and special-effects equipment for filmmaking, getting the service installed was like something out of *The Cable Guy*. Four months elapsed between the time Comcast, his cable provider, said service would be available in his neighborhood and the day he finally got up and running—and the company had to dig an 80-foot trench in his neighbor's lawn and chop through the concrete of Margolin's garage to string a cable to his home office. ►

Still, Margolin is lucky. If you surf the Web or receive e-mails with mammoth attachments, you probably often feel that the Net is stuck in first gear. True, some users luxuriate in speedy access at work, via fast and costly connections such as T1 or frame relay lines, while others have opted for a technology such as Integrated Services Digital Network or satellite-dish access that yields slightly swifter surfing.

But for most, the promise of speed lies in cable modems and Digital Subscriber Lines. Both cable and DSL are much faster than analog modems. Each provides a persistent connection that cancels the need to dial out, thus banishing busy signals and slow connect times. And with the new G.Lite standard, DSL may soon be easier to install. Best of all, both cable and DSL are priced affordably for small businesses and home users.

NICE WEB IF YOU CAN GET IT

OF THE TWO methods, cable modems are better for cheap, fast home access, while DSL is better for business users with more cash or a workplace that's not wired for cable. Sadly, however, "the decision will be based on what you can get," says Kevin Kahn of the Universal ADSL Working Group. "And today, most consumers can't get either."

At the end of 1998, the research firm Kinetic Strategies pegged the number of cable modems in use in North America at just 513,000; TeleChoice, a company that tracks the DSL industry, estimated the number of DSL lines in the United States at a piddling 39,000. In contrast, more than 27 million consumers around the world connect to the Net via dial-up modem, according to Internet market research firm Jupiter Communications. Thorny technical problems and a lack of standards continue to stand in the way of wider cable and DSL availability. But that should change soon. Analysts project up to 1000 percent growth for both technologies over the next few years. For now, though, Mach-speed broadband users remain the envy of the majority, who still lope along with a dial-up connection.

Cable Modems

MOVE OVER TV, HERE COMES THE INTERNET

IN MANY WAYS, cable modems offer a logical means of bringing fast access to home offices. While cable TV lines pass by more than 100 million North American homes, only 20 percent of those homes can now get cable modem service. That number will surge as cable companies roll out two-way fiber-optic networks that deliver more TV fare as well as high-speed Net connections.

Six Routes to the Internet

Dial-up connections are cheap but slow. Frame relay and T1/T3 lines are fast but cost a bundle. As alternatives, small offices could give speedy, affordable DSL services a try, while home-office users might do better with cable, which balances fast performance with even lower prices.

SERVICE[1]	Availability	Typical monthly cost[2]	Typical maximum performance (downstream/upstream)[3]	Pros	Cons	Recommended for...
Dial-up	universal	$20	56 kbps/ 33.6 kbps	Cheap, easy to install, and available everywhere.	Slow service that ties up a phone line while you surf the Web.	people who can't obtain or afford other options, and for notebook-toting travelers.
ISDN	widespread	$50–$130; may require extra per-minute and/or per-hour charges	128 kbps/ 128 kbps	Twice the speed of 56-kbps modems—plus fancy phone service features like call handling.	Costly, relatively slow, and prone to setup hassles; usually does not support always-on connection.	small-office and home users who need better-than-dial-up speed and can't get DSL or cable.
Satellite	widespread	$50 (for 100 hours)	400 kbps/ 33.6 kbps	Good downstream speed, available to anyone with a clear view of the southern sky.	Uses dial-up for upstream connections, installation is complex.	business and home users who can't get other high-speed connections, especially in rural areas.
Cable	limited	$30–$65	1–5 mbps/ 33.6 kbps–2.5 mbps	Where available, it's currently the cheapest way to get a continuous high-speed connection.	Most businesses aren't wired for cable, you can't choose your ISP, and shared-node system may lead to security and speed problems.	telecommuters, home-office types, and Web surfers, and for companies in areas where business-specific plans are offered.
DSL	very limited	$49–$1200	144 kbps–8 mbps/ 64 kbps–8 mbps	Turns your ordinary phone line into a fast connection that's always on.	Still very sparsely deployed and often costly, most versions require installation by a technician.	small offices that can't justify frame relay or T1, and for home users who can't get cable.
Frame relay and T1/T3	widespread	$300–$3000	56 kbps–45 mbps/ 56 kbps–45 mbps	Business-oriented high-speed services backed by speed guarantees and quick repair.	Too expensive for most small companies and residential users; requires costly, complex hardware.	medium-size to large businesses that can afford the cost—and can't afford service problems.

[1] From slowest to fastest.

[2] Includes ISP charges, but not installation charges. Dial-up and DSL costs do not include the cost of a phone line.

[3] According to service provider's claims. See "Battle of the Bandwidths," page 112, for our test results.

But cable modem access isn't a universal solution. Questions about service, security, and scalability keep it from being the best option for everyone. Even so, the two cable services we tested delivered an almost irresistible package: connection speeds at least ten times faster than a 56-kbps modem for about $40 a month—roughly twice the price of a typical dial-up account.

HEAD-SWIVELING SPEED

MARGOLIN'S experience aside, getting set up with a cable modem is usually clear-cut. Your PC needs an ethernet card, which the cable company can supply and install, and the company will likely lease you the modem as part of your monthly fee. Total installation costs range from $50 to $150.

Compared to its high-speed rivals, cable is a bargain. Depending on where you live, you'll pay between $30 and $65 a month, with most services around $40. Most cable systems offer always-on service that doesn't tie up a phone line. About 15 percent, however, are "telco return," which require a standard dial-up line to send data from your PC to the Internet.

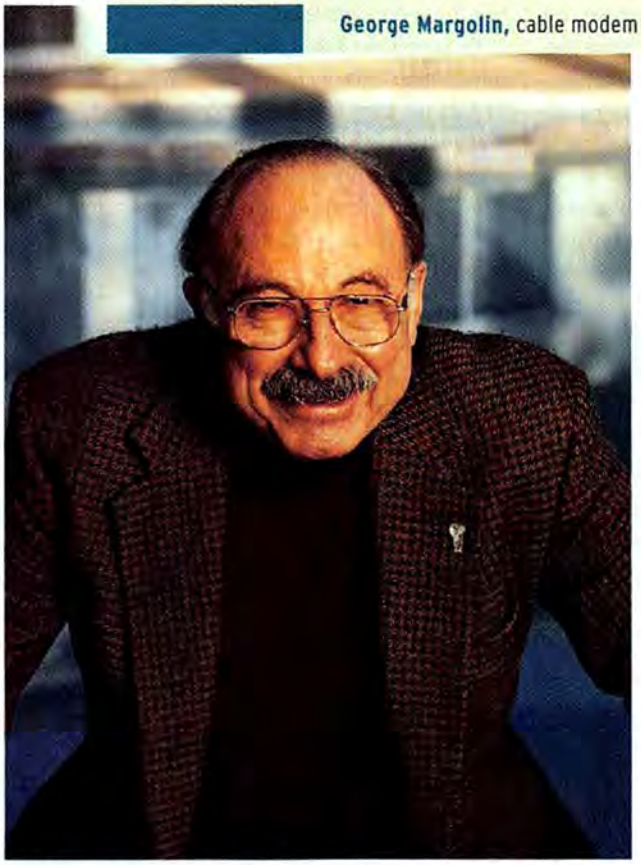
We sampled the two dominant cable modem services: @Home (www.home.net), via TCI in Antioch, California; and MediaOne Express (www.mediaoneexpress.com), via MediaOne cable in Arlington, Massachusetts. At their best, these services performed superbly: One graphics-heavy Web page that took over 4 minutes to download by 56-kbps dial-up popped up through @Home in under 5 seconds. More typically (but still impressively), cable modems sped up surfing and file transfers by 250 to 1000 percent. (See "Battle of the Bandwidths," next page, for complete results.) Users expecting more dramatic performance boosts of 50 or 100 times the dial-up speed may be disappointed; such claims refer to *maximum* increases and usually compare cable to a 28.8-kbps connection.

Of course, your mileage may vary. Your local cable system architecture could be faster or slower than the ones we tried. And like any fast connection, cable modem service can't relieve Net traffic that occurs outside its own network. That said, many services cache recently visited Web sites on their own servers, so popular pages and files download more quickly.

In our tests, cable performance—especially @Home's—often matched and sometimes beat that of *PC World*'s pricey T1 line. So why don't more companies switch from expensive T1 or frame relay to a cheaper cable connection? Because these consumer-oriented packages don't provide the level of guaranteed service quality and quick repairs that corporate users expect. That could change as @Home and Road Runner ramp up their fledgling business divisions.

Margolin's cable provider had to chop a 3-foot hole in the side of his garage.

George Margolin, cable modem user



PHOTOGRAPH: AMY ETRA

SHARING THE WEALTH

CABLE MODEM service can deliver cheap speed in part because it doesn't give you a dedicated fast connection to the Net. Instead, it divvies up an extremely fast pipe (capable of transfer rates up to 36 mbps) between you and other people on your "node." Depending on your service provider and your location, you might share your connection with 500 or 5000 people. If you and too many of your node-mates hit the Net simultaneously, your connection could bog down. And while most cable users seem delighted with their connection rates, some denizens of the cable modem newsgroup comp.dcom.modems.cable have reported incidents of truly glacial performance—as slow as 2 or 3 kbps.

No big whoop, say most cable modem reps; they'll simply add more capacity. "Cable modems are designed to handle bandwidth on demand," says Rouzbeh Yassini, consultant to industry research group CableLabs. "We have the architecture to allow higher capacity." For its part, @Home has acknowledged occasional problems in the Fremont, California, area, and has contracted with AT&T to increase its capacity.

Anyone who encounters lackluster cable modem service might take a cue from @Home customer Tim McArthur. Dismayed by repeated service outages—one of which lasted five days—he struck a deal with TCI cable in Pleasanton, California: He would pay his monthly bill only if the service stays up the whole time. Four months later, McArthur ▶

is still getting free access. At press time, TCI was unable to say whether other users can expect the same deal. In other words, don't hold your breath.

One more issue regarding cable's design deserves your attention: Since you share a node with other users, they could gain access to your PC. Reports of rampant cable modem hacking haven't yet surfaced, but the risk is real. Security software can help, and, as "Broadband Bob" Arick, the aptly nicknamed president of cable research firm Gecko Research says, so can common sense: "You don't need a firewall, but you do need to ensure that you have print and file sharing turned off." (For instructions, see "Top Net Access Tips," right.)

MONOPOLY MONEY

HAPPY WITH your current ISP and e-mail address? Tough. You'll have to leave both behind if you switch to cable modem service, because all cable service is sold as part of a package that includes a high-speed communications line and Internet access. While this may simplify setup, it also limits choice. The lack of competition could also lead to price hikes; witness the tendency of cable TV bills to mysteriously rise over time.

Cable operators contend that they'd simply like to recoup the millions of dollars they've poured into upgrading their systems for Net access. But America Online, which wants to bundle its service with cable modem service, is lobbying the federal government to give all ISPs access to cable companies' pipelines. Other ISPs want the same thing, as does the nonprofit Media Access Project, which would like to open the pipelines for reasons of freedom-of-choice rather than for profit. For now, anyone who wants to choose a broadband ISP should check out DSL. ▶

TIPS

TOP NET ACCESS

Set Up Two Gateways Ask your cable company for two gateway addresses, if your setup permits it. If the gateway you're using to access the Internet gets clogged, your cable modem can turn to another that may give you a faster connection.

Cable Security To keep your hard disk private while using a cable modem, turn off Windows 95/98's printer and file sharing: Click *Start•Settings•Control Panel.* Double-click the *Network* icon. Click the *File and Print Sharing* button. Uncheck the boxes *I want to be able to give others access to my files* and *I want to be able to allow others to print to my printer(s).* Click *OK,* then click *OK* in the Network dialog. ▶

TEST REPORT

Battle of the Bandwidths

Cable and DSL rival T1 for swiftness, while satellite is fast on downloads but poky on uploads.

CONNECTION TYPE (from fastest to slowest)	Web pages			File downloads			File uploads		
	PC World home page	Text-heavy page	Graphics-heavy page	Compressed .zip file	Word processing file	Mixed file types	Compressed .zip file	Word processing file	Mixed file types
T1 line Pacific Bell, San Francisco	3	3	18	28	22	40	20	16	27
Cable modem @Home, Antioch, Calif.	3	2	4	29	24	38	35	28	47
DSL[1] Pacific Bell, San Francisco	4	5	17	30	26	39	40	34	53
DSL[1] DNAI/Covad, San Francisco	4	6	25	35	30	49	47	40	62
Cable modem MediaOne Express, Arlington, Mass.	5	6	16	45	40	62	50	42	68
Satellite Hughes Electronics DirecPC, Alameda, Calif.	8	7	13	47	41	60	562[2]	192[2]	270[2]
ISDN Pacific Bell, San Francisco	11	19	121	160	133	211	156	129	207
56-kbps analog modem 3Com U.S. Robotics 56K Faxmodem Model 5687	18	29	243	364	163	230	547	161	211

All times in seconds

Faster — Slower

TEST PC WORLD CENTER **HOW WE TEST** We timed Web page loading and file transfer times under Windows 98 on a Quantex QP6/350 M-2x Pentium II-350 desktop PC with 64MB of RAM, a 512KB secondary cache, and a 8.6GB hard drive. The Web server used was a dedicated Sun Microsystems Ultra 2 running Solaris 2.6 and Apache Web server 1.3.1. Web hosting was provided by Value Net Internetwork Services (www.value.net). All tests were performed over the Internet, connecting to a private Web site; Web pages were downloaded using Netscape Navigator 4.07. Analog modem and satellite tests were performed via Netcom. Times reported represent averages of at least 18 passes performed over two days. File downloads and uploads were tested on a 1536KB compressed .zip file, a 2048KB mixed file type, and a 1280KB word processing file. Your performance may vary according to Net traffic and your service provider. Data based on tests designed and conducted by the PC World Test Center. All rights reserved. [1] 1.5 mbps downstream, 384 kbps upstream. [2] Satellite uploads were done using a 56-kbps analog modem.

What's the fun of sampling just one when you can score all of them?

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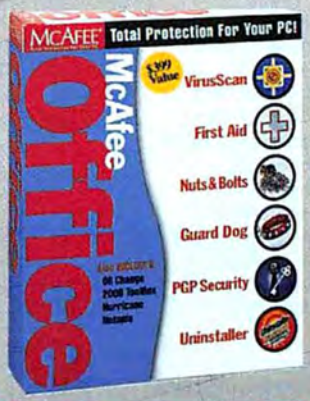

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Digital Subscriber Lines

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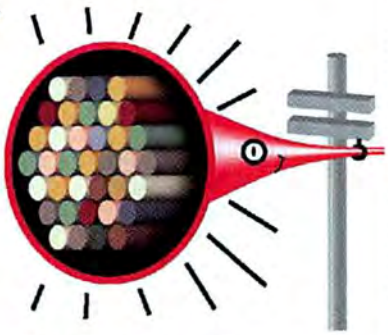


AWARD-WINNING pastry chef Ron Ben-Israel mixes new technology with his old-fashioned business: He connects his New York bakery to the Net via a DSL line, sending photos of cakes to clients and updating his mouthwatering site at www.weddingcakes.com. "The bottom line is that [DSL is] fast," he says. "This gives me more time to be creative."

The same copper wire that delivers phone service can transport DSL, and some DSL versions can run over 100 times faster than dial-up. The ubiquity of phone wires makes DSL a good choice for businesses that aren't wired for cable.

The drawback is that most folks can't get DSL yet. And even where it is available, DSL usually offers less than cable modems do. According to Bob Granadino at the ISP EarthLink, DSL "is so brand-new that [telephone companies] are still learning how to deploy it."

DSL'S MANY FACES

WHEREAS CABLE modem service looks similar from place to place, DSL is a chameleon. Flavors range from IDSL (ISDN DSL) to HDSL (High Bit-Rate DSL). Most variations are forms of ADSL; the *A* stands for "asymmetric," which means that the service sends data downstream to your PC faster than it sends data upstream to the Net, as with 56-kbps modems and most cable service. Because Web pages travel downstream for viewing, that direction is important to Web surfers. Telecommuters who routinely send big files upstream should consider a symmetrical form of DSL.

As you'd expect given its phone-line origin, DSL is being deployed by regional Bells such as Bell Atlantic, Pacific Bell, and US West, which will compete with local phone carriers such as Covad and NorthPoint. Both types of carriers usually offer several forms of DSL, all of which deliver a persistent connection that coexists with your phone service, so you can talk and surf simultaneously. ▶

But Can I Get It?

Cable modem and Digital Subscriber Line service are far from being universally available, but if you live in a major metropolitan area, there's a decent chance that you can obtain one, the other, or both. Here's a list of the 71 U.S. cities (among the 100 largest) in which one or both of these services is currently available.

ALABAMA
Birmingham: Cable, DSL
Mobile: Cable
Montgomery: Cable

ALASKA
Anchorage: Cable

ARIZONA
Mesa: Cable
Phoenix: Cable, DSL
Tucson: Cable

CALIFORNIA
Anaheim: DSL
Fremont: Cable, DSL
Glendale: DSL
Huntington Beach: DSL
Long Beach: DSL
Los Angeles: Cable, DSL
Oakland: DSL
Riverside: Cable
Sacramento: DSL
San Diego: Cable, DSL
San Francisco: DSL
San Jose: Cable, DSL
Santa Ana: DSL

COLORADO
Aurora: Cable
Colorado Springs: Cable
Denver: Cable, DSL

DISTRICT OF COLUMBIA
Washington: DSL

FLORIDA
Jacksonville: Cable, DSL
Miami: Cable
Tampa: Cable

GEORGIA
Atlanta: Cable, DSL
Columbus: Cable

HAWAII
Honolulu: DSL

ILLINOIS
Chicago: Cable, DSL

LOUISIANA
Baton Rouge: Cable
New Orleans: DSL

MARYLAND
Baltimore: Cable

MASSACHUSETTS
Boston: Cable, DSL

MICHIGAN
Detroit: Cable, DSL

MINNESOTA
Minneapolis: Cable, DSL
St. Paul: Cable, DSL

MISSISSIPPI
Jackson: Cable

MISSOURI
St. Louis: Cable

NEBRASKA
Omaha: Cable

NEVADA
Las Vegas: Cable

NEW JERSEY
Jersey City: DSL
Newark: DSL

NEW YORK
Buffalo: Cable
New York City: Cable, DSL
Rochester: Cable

NORTH CAROLINA
Charlotte: Cable, DSL
Raleigh: DSL

OHIO
Akron: Cable
Cincinnati: DSL
Columbus: Cable, DSL

OKLAHOMA
Oklahoma City: Cable, DSL
Tulsa: DSL

OREGON
Portland: Cable, DSL

PENNSYLVANIA
Philadelphia: Cable, DSL
Pittsburgh: Cable

TENNESSEE
Memphis: Cable
Nashville: Cable

TEXAS
Austin: Cable, DSL
Dallas: Cable, DSL
El Paso: Cable
Fort Worth: Cable
Garland: Cable
Houston: Cable, DSL
Lubbock: DSL

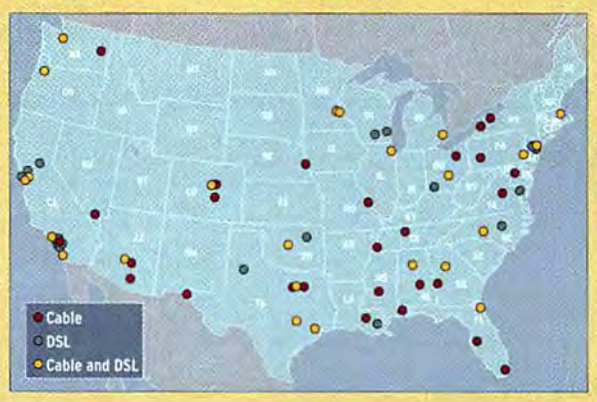
VIRGINIA
Richmond: Cable

WASHINGTON
Seattle: Cable, DSL
Spokane: Cable

WISCONSIN
Madison: DSL
Milwaukee: DSL

List takes into account 100 largest U.S. cities (by 1996 population) that had cable, DSL, or both as of December 1998. Availability may not be universal in listed cities and is subject to change. Check with your phone or cable company for availability in your area.

SOURCES: ADSL Forum, Cable Datacom News, Gecko Research, *PC World* research.



online For the latest availability list, updated as of late January 1999, see PC World Online (www.pcworld.com/mar99/cableaccess).

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Unlike cable companies, most DSL providers don't bundle the pipe and the access. Just as with dial-up, you can get DSL service from your phone company and Net access from an ISP. Today, only a few ISPs offer access through DSL, but more are expected to get on board. Chef Ben-Israel gets his DSL from Transwire. "I like working with a small company that knows me," he explains. "Everyone in New York has a story about the phone company, and don't get me started on Time Warner [a cable TV supplier]."

The DSL lines we tested performed 300 to 1000 percent faster than a 56-kbps connection.

PRICES ALL OVER THE MAP

SO FAR, THERE'S little logic governing regional DSL pricing. For instance, as we go to press, US West's 7-mbps DSL service, available in the Rocky Mountain area, costs $840 a month (without Net access), while Bell Atlantic charges just $190 each month for 7.1-mbps DSL *and* Net access in the Northeast. The lowest DSL monthly rates we found hovered around $50 (including ISP costs) for downstream speeds of 256 to 640 kbps, depending on the provider. Hardware and installation costs are inconsistent, too. You may find a DSL modem and installation under special promotion for just $99, or pay up to $600 for the modem, an ethernet card, and setup.

We tested DSL from Pacific Bell (www.pacbell.com) and DNAI (www.dnai.com), both in Northern California. (DNAI is an ISP that bundles Net access with Covad's DSL connection.) Each line offers rates of up to 1.5 mbps downstream and 384 kbps upstream. And both performed impressively in most of our tests, achieving speeds comparable to those of cable modems—from 300 to 1000 percent faster than a 56-kbps dial-up connection.

But unlike some forms of DSL, neither of these two services runs cheap enough for home use: Pacific Bell charges $159 a month; DNAI, $345. Still, for businesses contemplating T1 or frame relay, they're bargains. In fact, some industry wonks accuse phone companies of delaying DSL deployment to protect their high-profit frame relay and T1 line franchises. Not true, respond phone company reps, who argue that DSL appeals to different customers. "[DSL] pricing will be a great alternative for small and medium-size businesses," says Jeff Bolton, director of the ADSL program office at GTE.

SERVICE GOTCHAS

THOUGH DSL comes into your location through a phone line, it's not plug-and-play. Most forms require a technician to install a splitter. DSL can also react ▶

TIPS

TOP NET ACCESS

Buy a New PC With an Ethernet Adapter To use a cable modem or most flavors of DSL, you must have a PC equipped with an ethernet adapter. So if you're buying a new computer and either Internet connection method is on your horizon, be sure to choose a PC with an ethernet card or chip. Getting one preinstalled is simpler and cheaper than having someone install one later.

Keep ISDN Settings Nearby Hang on to a copy of the document from your phone company that lists ISDN settings such as phone number, SPID number (assigned by your telephone company), ISDN type, and so on, and tape it to your ISDN box. That way, if the ISDN goes down or you have to reset it (due to a power outage, for example), you'll have all the information you need close at hand.

Help for the Satellite Challenged Getting ready to scale the side of your house to install a DirecPC antenna? Befuddled by the complex installation instructions for your DirecPC software? Get help from the newsgroup alt.satellite.direcpc. (Cable modem subscribers can get assistance at comp.dcom.modems.cable, while DSL subscribers should try comp.dcom.xdsl.) –Judy Heim

Around the World in 19 Seconds

The cable modem and 1.5-mbps DSL services we tested ran nearly as fast as a costly T1 line. In 19 seconds, our T1 line downloaded an entire site, while cable and DSL delivered close to that. See "Battle of the Bandwidths," page 112, for complete test results.

56 kbps: 11 percent | ISDN: 17 percent | Satellite: 66 percent | Cable/DSL: 83 percent | T1: 100 percent

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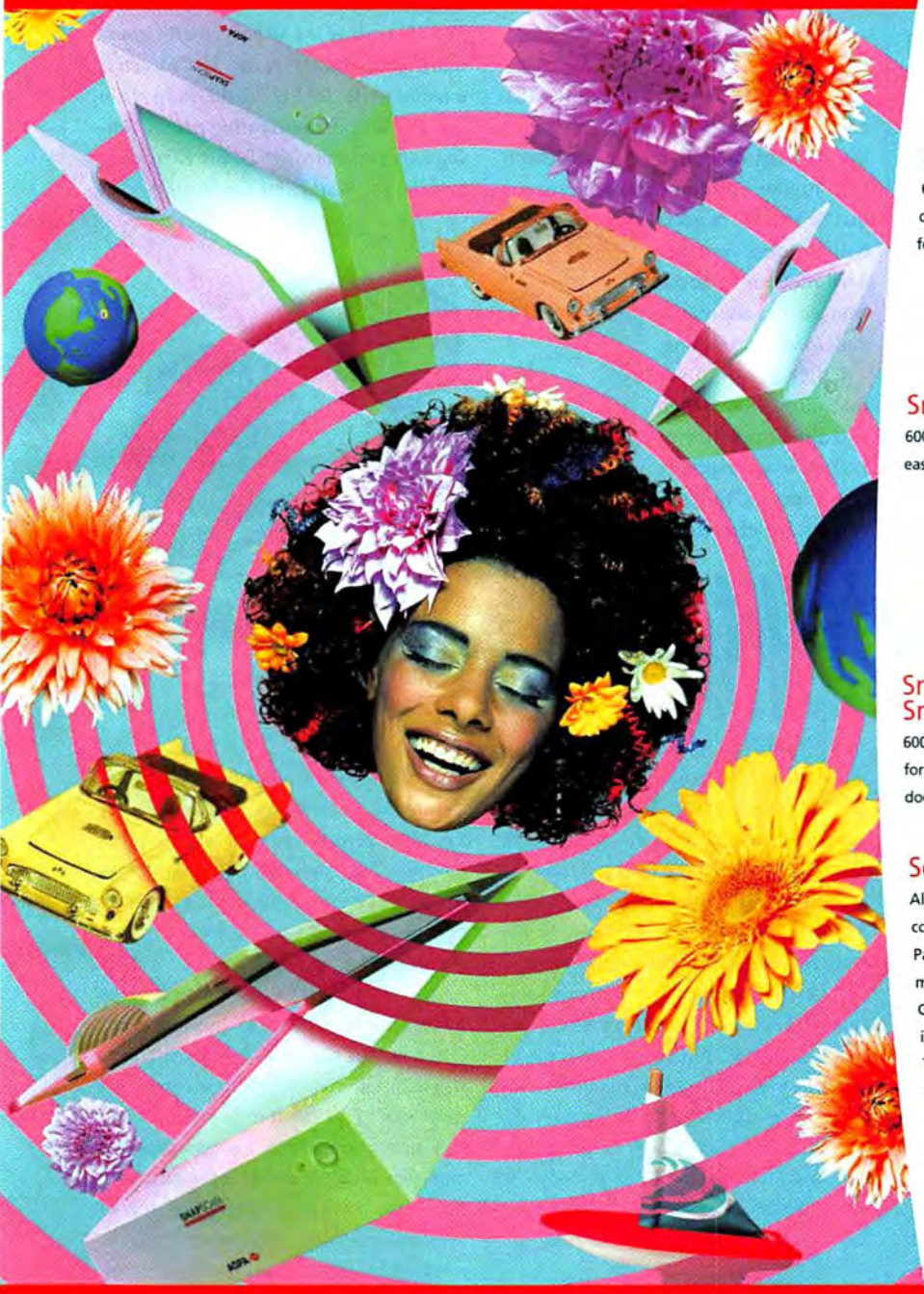

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fussily to your line quality, as Tim Scoff of Pittsburgh discovered when he signed up for Bell Atlantic's Infospeed service. His old house's wiring wasn't up to snuff, so the firm had to string a new line. "But once they did," he says, "it just worked."

The new G.Lite standard will eliminate the need for a splitter, theoretically making DSL modems easier to install. At maximum speed G.Lite will run at 1.5 mbps downstream and 384 kbps upstream. No provider offers it yet, but it may be cheaper than many forms of DSL. Analysts predict we'll see G.Lite modems costing $250 to $300 by the middle of this year, while Compaq is already shipping PCs with built-in 56-kbps G.Lite modems.

DSL has various technical problems that prevent providers from deploying it everywhere the phone network goes. For one thing, it's incompatible with some phone company equipment and can reach spots only within a certain distance (usually under 18,000 feet) of switching equipment. Thus, the service can't get to about 30 percent of lines in DSL-enabled areas.

DSL providers hope to reduce limitations. For now, talk to your phone company about availability. Luckily, analysts predict lower fees, and research firm TeleChoice forecasts growth in North American DSL lines from under 40,000 now to 904,000 at the end of 2000.

DON'T KILL YOUR MODEM

DESPITE THE HYPE, cable and DSL have glitches to resolve before they make the 56-kbps modem a relic. Research firm Jupiter Communications forecasts that 80 percent of users will connect via standard modem in 2002. And we may always use dial-up when traveling.

Which is not to say that those who switch to cable modems or DSL now will regret it. "As long as the on-ramps are crowded," Jupiter's Abhi Chaki notes, "there's going to be frustration." While most Net users are traffic-bound, cable modems and DSL put some in the express lane. How would you rather travel?

online *For an updated list of locations with cable modem and DSL service availability, visit PC World Online at www.pcworld.com/mar99/cableaccess. Harry McCracken is a senior writer for* PC World. *Judy Heim is a* PC World *contributing editor. Testing was performed by Elliott Kirschling and the PC World Test Center staff.* ■

ISDN and Satellite Still Kicking

Woody Allen once mused, "Eighty percent of success is showing up." And while most users are still waiting for cable and DSL to make an appearance, two other fast access methods—ISDN and satellite—deserve notice. Because they blanket the country, they might be just the ticket if you can't get cable or DSL.

ISDN: FALLING STAR?

Once hailed as the bearer of fast Net access for the masses, ISDN has never caught fire. Chugging along at up to 128 kbps, it provides a healthy boost over dial-up speeds but lags behind DSL and cable. (In our tests, using Pacific Bell's ISDN service in San Francisco, it beat our 56-kbps dial-up connection by 53 to 250 percent.) ISDN can be pricey, and it's usually not a flat-rate service: The more you use, the bigger your bill.

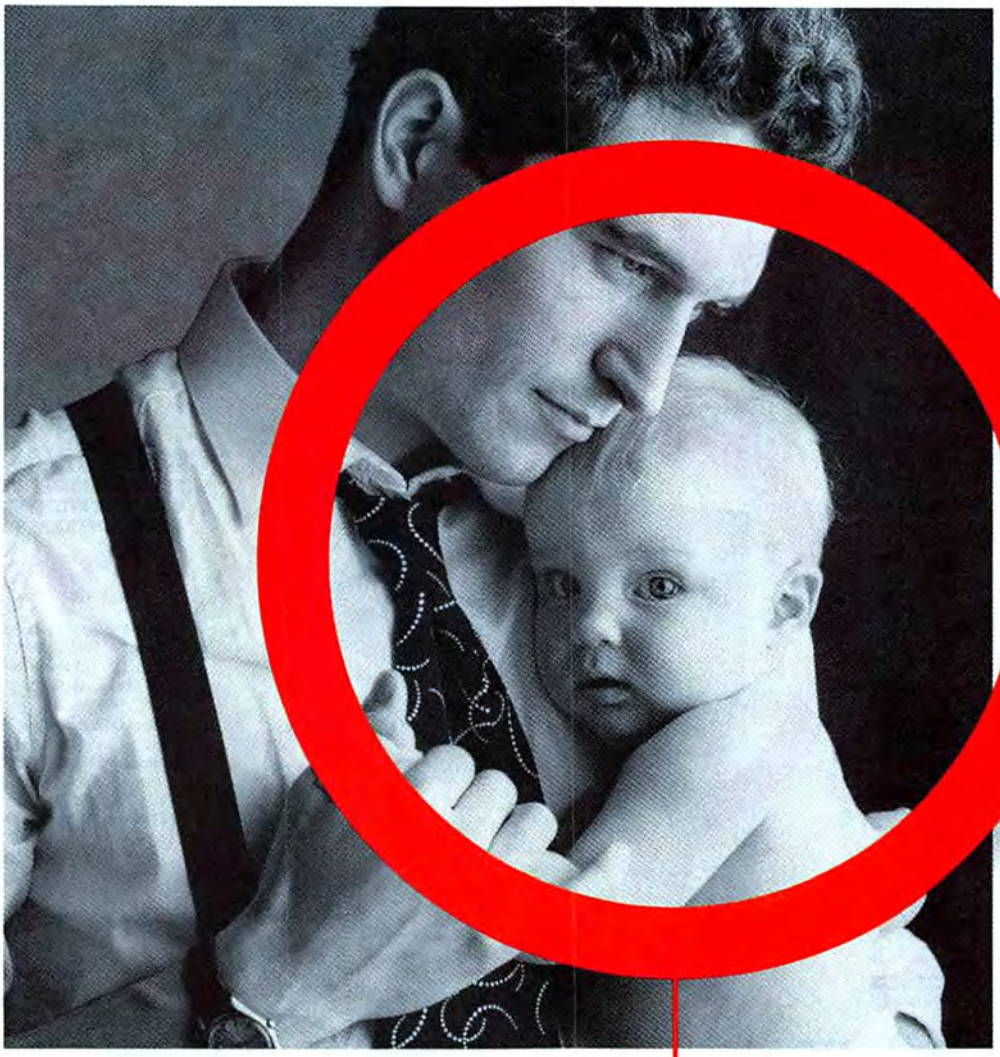
Still, about 90 percent of the country can get ISDN, a figure that cable and DSL may never match. Also, new standards have helped ISDN overcome its reputation for tough installs. And a new form of ISDN, AO/DI, offers always-on connectivity like cable and DSL, but it's not widely available.

ISDN also includes full-featured telephone service. But even the phone companies that supply ISDN concede that newer methods make more sense for surfers. "If people are using ISDN only for Internet access [as opposed to point-to-point connections, for example]," says US West spokesperson Jeremy Story, "DSL is a better service and will probably cost less."

THE DISH ON SATELLITES

Hughes' DirecPC satellite service (www.direcpc.com), meanwhile, is available to anyone who can mount a dish with a clear view of the southern sky. That's good news for folks in the boonies, where cable modems, DSL, and even ISDN may not be an option. DirecPC zaps data to your PC at speeds up to 400 kbps—quick enough for satisfying Web surfing.

Like ISDN, DirecPC doesn't offer unlimited access: 100 hours of service costs about $50 a month. Nor does it support a two-way path; information still crawls upstream from your PC to the Net via dial-up, tying up your phone line while you upload. On the plus side, Hughes recently introduced a Universal Serial Bus modem that should simplify installation. And though it makes no promises, Hughes says it may eventually release a faster version of DirecPC, and perhaps one with true two-way access, eliminating the need for the dial-up modem.



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RAM	64MB SDRAM	64MB 100MHz SDRAM	128MB 100MHz SDRAM	128MB 100MHz SDRAM	128MB 100MHz SDRAM
Hard Drive	8.4GB Ultra ATA hard drive*	13GB Ultra ATA hard drive*	13GB Ultra ATA hard drive*	13GB Ultra ATA hard drive*	25GB Ultra ATA hard drive*
Monitor	17" Micron 700Vx monitor (15.9" display)	17" Micron 700Vx monitor (15.9" display)	17" Micron 700Vx monitor (15.9" display)	17" Micron 700Vx monitor (15.9" display)	19" Micron 900Lx monitor (18" display)
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Modem	3Com US Robotics V.90 WinModem**	3Com US Robotics V.90 WinModem**	3Com US Robotics V.90 WinModem**	3Com US Robotics V.90 WinModem**	3Com US Robotics V.90 WinModem**
Graphics	nVidia Riva 128, 8MB SGRAM 3D 2X AGP graphics	nVidia Riva 128, 8MB SGRAM 3D 2X AGP graphics	16MB Diamond Viper 550 TnT 2X APG graphics	16MB Diamond Viper 550 TnT 2X APG graphics	16MB Diamond Viper 550 TnT 2X APG graphics
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PCWorld, "Best Buy," April '98"

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RAM	32MB SDRAM	32MB SDRAM	64MB SDRAM	64MB SDRAM	128MB SDRAM
Hard Drive	3.2GB hard disk drive (removable)*	4GB hard disk drive (removable)*	4GB hard disk drive (removable)*	4GB hard disk drive (removable)*	4GB hard disk drive (removable)*
Monitor	12.1" SVGA TFT display	13.3" XGA TFT display	14.1" XGA TFT display	14.1" XGA TFT display	14.1" XGA TFT display
CD-ROM	24X CD-ROM drive (dedicated bay)	24X CD-ROM (dedicated bay)	24X CD-ROM drive (dedicated bay)	24X CD-ROM drive (dedicated bay)	24X CD-ROM drive (dedicated bay)
Graphics	4MB AGP graphics accelerator	4MB AGP graphics accelerator	4MB AGP graphics accelerator	4MB AGP graphics accelerator	4MB AGP graphics accelerator
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Warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty
Operating System	Microsoft® Windows® 98	Microsoft Windows 98	Microsoft Windows 98	Microsoft Windows 98	Microsoft Windows NT® Workstation 4.0
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OPTIMIZED FOR WINDOWS NT

1. As the first direct PC manufacturer to ship Windows NT back in '94, Micron's knowledge and experience can help you maximize your Windows NT network, now and into the future.

HIGH-PERFORMANCE, RELIABLE NETWORKING

2. The Micron ClientPro desktop and NetFRAME server utilize industry-standard technology and are powered by Intel's latest chip set technology, including the Intel Pentium II and Pentium II Xeon™ processors.

MICRON MAKES IT EASY TO HARNESS THE POWER OF MICROSOFT WINDOWS 2000

CRITICS RAVE ABOUT THE MICRON CLIENTPRO

"The Micron ClientPro 400 succeeds in providing an optimized LANDesk Management Solution and combines it with top performance at a good price."

— PC Magazine
June 30, 1998

"Micron ClientPro provides "gracious plenty" for corporate IS and small-business buyers alike...This Windows NT 4.0 workhorse comes ready to network, with a preinstalled 3Com Etherlink LAN adapter card and Intel's remote control software for system monitoring."

— PC World
November 1998

As the industry looks ahead to Microsoft Windows 2000 (built on NT technology), Micron offers a way to get ahead of the game today. Whether you're looking to upgrade to Windows NT® 4.0 Workstation or preparing for a company-wide shift to Windows 2000, our ClientPro® managed PCs and Micron™ NetFRAME® servers will be among the first to support the full potential of Microsoft Windows 2000. Network-ready right out of the box, built on industry standards, and packing the power of the Intel® Pentium® II processor 450MHz, the ClientPro puts more manageable power in your office. And if you're looking for a reliable and expandable server, it would be tough to beat Micron's NetFRAME servers running with the powerful new Intel Pentium II Xeon™ processor. Nothing maximizes a network today and tomorrow like Windows NT technology – and no one delivers it better than Micron. And as the first PC company to ship Microsoft Windows NT in 1994, it's no surprise that Micron's **AdvanceDeploy** program gives Micron users early access to Windows 2000.

"MICRON'S NETFRAME 3100 GIVES YOUR WEB CUSTOMERS WHAT THEY WANT BEFORE THEY CLICK AWAY."
— PC Computing, A-List, Best Web Server, Nov. '98

"MICRON'S DUAL-PROCESSOR... SERVER RUNS FULL SPEED AHEAD."
— PC Computing, A-List, Editors' Choice

So when you're ready to put the power of the ultimate business operating system into your office network, look to the experience and affordability of Micron ClientPro managed PCs and Micron NetFRAME servers. Call today for more information or to order direct from the factory or visit www.micronpc.com/pcwd.

Micron University – The Ultimate Training Tool

In our continuing effort to build not only powerful systems, but powerful users, we are proud to introduce Micron University. Offering over one hundred free[§] online classes, seminars and self-paced tutorials on the hottest topics in computing and business today, Micron University will turn any Micron owner into a highly trained power-user. When you combine this powerful new tool with Micron's revolutionary MPower[SM] purchase program, offering qualified users no interest,[†††] no payments for six months and our PowerXchange trade-in options, you get more than a great machine at a great price, you get a deal you probably won't find anywhere else. Call today to order your system and to find out more about Micron University.

Micron NetFRAME 6200

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Micron Leasing arranged by an independent entity to qualified commercial customers. Above lease payments based on 36 month, FMV terms and do not include taxes, fees or shipping charges. Leasing subject to credit approval and availability. Above lease terms subject to change without notice or obligation.

PLANNED TECHNOLOGY MIGRATION

3. To simplify technology planning and implementation, Micron designs all ClientPro and NetFRAME systems to have long model lifecycles, consistent components and planned technology transitions including the upcoming industry shift to Microsoft Windows 2000.

HIGHLY MANAGED

4. Based on the Wired for Management specification and Desktop Management Interface compliant, ClientPro can be managed from a single point on the network. And every ClientPro desktop and NetFRAME server is backed by Micron's unmatched service and support programs.

3
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New Rules. New Tools.™

intel inside
pentium® II xeon™ PROCESSOR

ClientPro CS 450

The Highest Performing Managed PC[1]

- Intel® Pentium® II processor 450MHz
- 512KB internal L2 cache
- 128MB 100MHz SDRAM
- 8.4GB Ultra ATA hard drive*
- 17" Micron 700Vx (15.9" display)
- 32X max speed CD-ROM drive
- 8MB Real 3D Starfighter AGP graphics
- 64-voice PCI Wavetable sound
- 3Com 3C905 WOL 10/100 network card
- 5-year/3-year Micron Power™ limited warranty
- 1-year free[2] training at Micron U Online

Intel LANDesk® Client Manager
Microsoft® Windows NT® Workstation 4.0
Norton AntiVirus

SMART II hard drive monitoring
Chassis intrusion detection
Fan, temperature, and voltage problem reporting
Virus detection reporting
Remote Wake Up capability
MiniTower case
3.5" floppy drive
104-key enhanced keyboard
Microsoft IntelliMouse®

$2,049 $72/mo. Business Lease. 36 mos.[3]

NetFRAME 3101

The Perfect Small Business Server

- Intel Pentium II processor 400MHz
- 512KB internal L2 ECC cache
- 128MB ECC 100MHz SDRAM
- 9GB UltraWide SCSIU hard drive*
- 32X max speed CD-ROM drive
- 5-year/3-year Micron Power limited warranty
- Dedicated server technical support, 7x24
- 1-year next-business-day on-site service[4]

Intel LANDesk Server Manager
Emergency Management Port Console

Supports up to two Intel Pentium II processors
100MHz frontside bus and up to 1GB memory support
Integrated Ultra Wide SCSI-3 dual channel controller
Intel PRO/100+ Server Adapter
Integrated RAID upgrade support
5 expansion slots: 3 PCI, 1 ISA, 1 shared PCI/ISA
8 drive bays: 1 external 3.5", 2 external 5.25"
5 hot-swap redundant 1.0" hard drive bays

$2,499 $87/mo. Business Lease. 36 mos.[3]

NetFRAME 6200

High-Powered Server For Fast-Growing Businesses

- Intel Pentium II Xeon™ processor 450MHz
- 512KB integrated L2 ECC cache
- 128MB ECC EDO DRAM
- 9GB U2W LVDS SCA 1" hard drive*
- 32X SCSI CD-ROM drive
- 5-year/3-year Micron Power limited warranty
- Dedicated server technical support, 7x24
- 1-year next-business-day on-site service[4]
- NOS support (3 first-year incident resolutions)

Intel LANDesk Server Manager 6.0
Emergency Management Port Console
Microsoft Windows NT Server 4.0 (10-user license)

Supports up to four Intel Pentium Xeon processors
Options for 512KB, 1MB or 2MB L2 cache
4GB ECC EDO support (16 DIMM sockets)
Integrated Ultra-2 Wide LVDS dual channel & narrow SCSI controller
7 expansion slots: 6 PCI, 1 shared ISA/PCI
6 internal, hot-swappable hard drives bays
1 hot-swappable 400-watt power supply (upgradable to 3 w/redundancy)
3 external 5.25" media bays and floppy drive
Free-standing pedestal chassis standard (7u rack mount option available)

$6,999 $226/mo. Business Lease. 36 mos.[3]

NetFRAME 9200

The Mission-Critical Enterprise Server

- Intel Pentium II Xeon processor 450MHz
- 512KB internal L2 ECC cache
- 256MB ECC EDO DRAM
- 2 dedicated 4GB U2W LVDS redundant hot-swappable boot drives
- 32X max speed CD-ROM drive
- 5-year / 3-year Micron Power limited warranty
- Dedicated server technical support, 7x24
- 1-year next-business-day on-site service[4]
- NOS support (3 first-year incident resolutions)

Intel LANDesk Server Manager 6.0
Emergency Management Port Console
Microsoft Windows NT Server 4.0 (10-user license)

Supports up to four Intel Pentium Xeon processors
Options for 512KB, 1MB or 2MB L2 cache
8GB ECC EDO support (32 DIMM sockets)
Intel PRO/100+ Server Adapter w/Adaptive Load Balancing and Adatper Fault Tolerance software
Integrated Ultra-2 Wide LVDS dual channel controller
10 expansion slots: 4 hot-plug ready 64-bit PCI slots, five 32-bit PCI & 1 PCI/ISA slot shared
2 hot-swappable 750-watt 220-volt power supplies (upgradable to 3 w/redundancy)
7u rack mount chassis (cabinet and accessories sold seperately)

$14,199 $458/mo. Business Lease. 36 mos.[3]

DataFRAME 450

The Highly Scalable Mass Storage System

- Dual/Split SCSI bus disk sub-system w/8 drive bay capacity
- 1+1 (2 total) redundant hot-swappable power supplies (300 watts each)
- 9GB U2W LVDS SCA-2 hot swappable hard drive*
- 3u height rack mount chassis w/rails
- 3-year Micron Power limited warranty
- Dedicated server technical support, 7x24
- 1-year next-business-day on-site service[4]

Web Storage Manager (environmental monitoring system)
Supports up to 8 SCA-2 hot swappable hard drives
Supports 1" or 1.6" hard drives heights
Maximum storage capacity: 144GB per enclosure
Ultra-2 Wide 80MBps transfer rate
Low Voltage Differential SCSI interface (12 meter cable length)
Optional deskside/pedestal version available

$2,899 $101/mo. Business Lease. 36 mos.[3]

THERE'S NO BETTER TIME TO TRANSITION TO WINDOWS NT® TECHNOLOGY.

Micron systems, equipped with the easy to operate Microsoft Windows NT 4.0 Workstation operating system, allow your business to achieve immediate improvements in productivity. The power of a Micron system running Microsoft Windows NT Workstation offers the greatest return on investment and ensures that you own the best upgrade path to future technology such as Microsoft Windows 2000.

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Good Providers

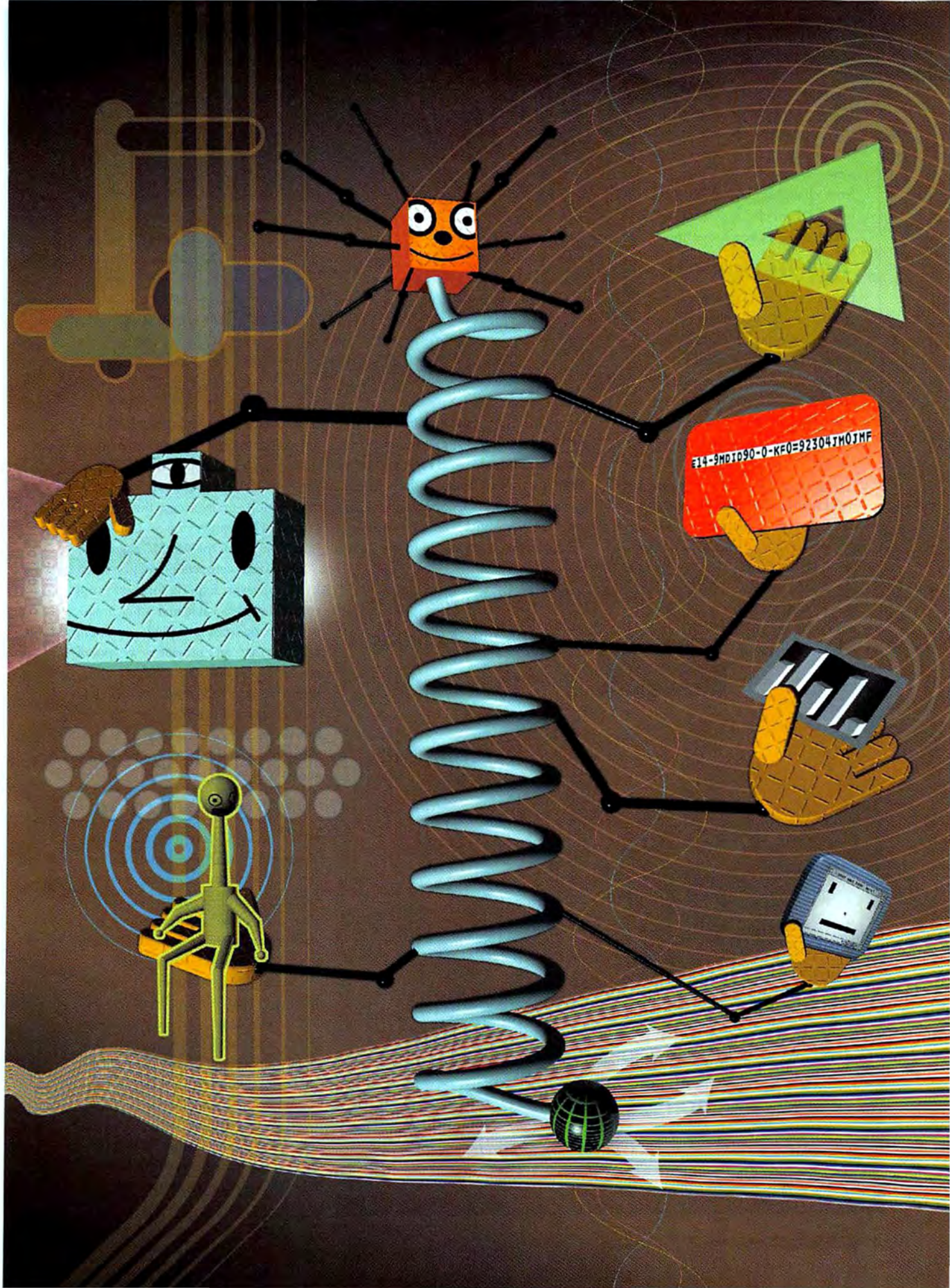
The Best National and Regional ISPs

BY ROBERTA FURGER

Still using AOL to get to the Net? ***Now's the perfect time to switch.*** *We rate 20 ISPs that are clamoring for your business.*

MIKE WINCKLER doesn't ask for much from US West, his Internet service provider. He would like to get online on his first try and have quick, reliable access to his e-mail. Oh, one more thing—he wants unlimited access for a reasonable price.

US West, however, hasn't quite met those modest expectations. "I try to log on and don't get an answer," explains the exasperated computer programmer from Omaha, Nebraska, who depends on the ISP for work and recreation. And there's the maddening problem of occasionally being unable to retrieve his e-mail. ▶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But as with many dissatisfied ISP users, the hassle of registering with another provider and informing friends and colleagues of the new e-mail address keeps him from changing providers. "Eventually, I'll switch," says Winckler.

Now couldn't be a better time.

A WILD AND WOOLLY MARKET

TODAY'S BUSTLING market of some 4500 ISPs—a bit larger than last year's—has one undisputed king: America Online, with its 14 million subscribers. No other ISP comes close to AOL's 13 percent market share worldwide, according to the market research firm DataQuest—but not for lack of trying.

Large national ISPs, local phone companies, and cable operators are consolidating to form global Goliaths—witness last year's merger of MCI and WorldCom, or the pending union of AT&T and TCI. Regional independent providers like Rocky Mountain Internet and CyberGate are gobbling up little ISPs in the quest to become nationals. And regional Baby Bells, hoping to leverage their brand recognition and telecommunications expertise, have quickly emerged as dominant players, particularly in the business market. Meanwhile, local ISPs keep springing up everywhere, providing users with a homespun touch. In fact, nearly half the respondents to our ISP satisfaction survey access the Internet through a local provider (see "Local ISPs: Living on Top of the World," page 132).

This market competition may be short-lived, however. Experts forecast rapid consolidation as cable and other broadband technologies take hold, squeezing out ISPs that can't provide new types of service or cut deals with cable companies. "We expect the market to shrink to well below 1000 providers over the next five years," says Zia Daniell, an analyst at Jupiter Communications' Bandwidth and Access Strategies Group.

YOU'RE IN THE DRIVER'S SEAT

BUT FOR NOW, consumers and businesses have the luxury of a buyer's market. So if you're running into busy signals, long waits for technical support, or other snags, don't just sit there—start looking for another provider (see "Finding an ISP That Works for You," page 134).

"Consumers have a huge number of options to choose from," says Daniell. "ISPs are looking to differentiate themselves, and they're just beginning to explore all the options they can offer."

To help you find the best ISP, we rank 20 competitors. In addition to evaluating the 10 leading national ISPs, as we have in the past, we've added 10 up-and-coming regional providers—including five Baby Bells—because of their growing

Best Buy

Whether you're logging on for work or fun, one Internet service provider stands above the rest: AT&T WorldNet.

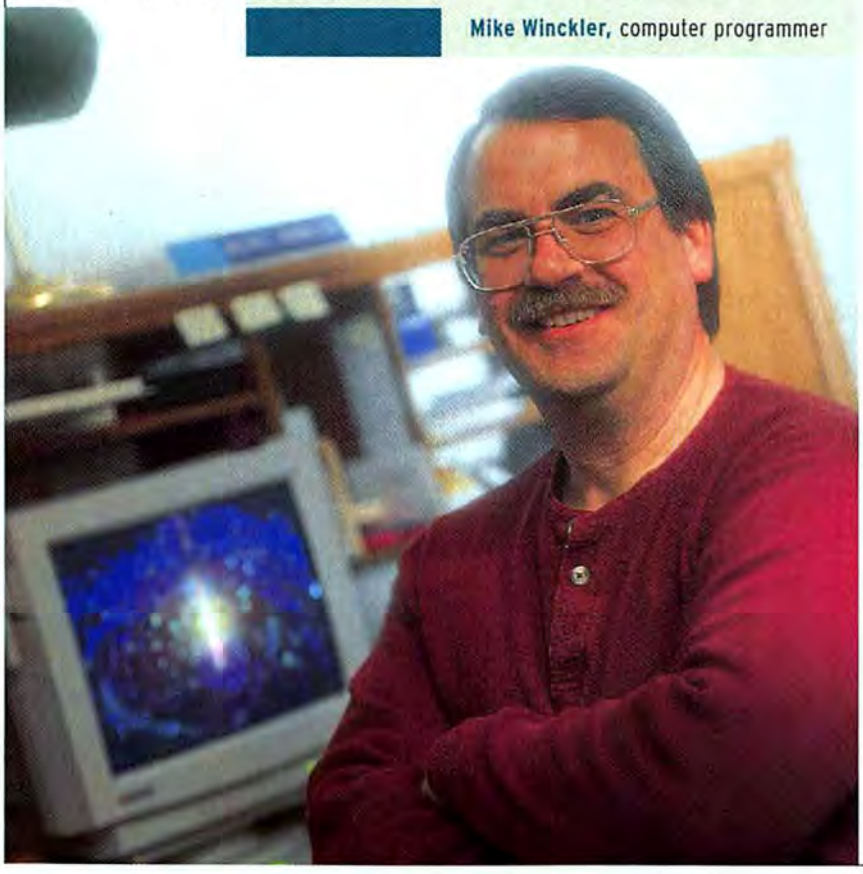
Backed by big investments in infrastructure and by partnerships with content providers, the huge phone company's aggressive push to become a leading ISP and challenge America Online for customers seems to have paid off. In a single year, AT&T has risen from the middle of the pack in our rankings to the top of the heap.

In addition to AT&T WorldNet's top-rated performance, users get easy installation, a free trial period, no start-up fee, up to six e-mail accounts (more than any other ISP we reviewed), national coverage, good V.90-modem access, a customized start page, and nonstop toll-free technical support.

AT&T WorldNet also offers business customers many extras, including custom Web site design and hosting, credit card processing, and the fullest range of options for high-speed access. The company charges a few dollars more for monthly service than many of the other ISPs here do, but we found that the extra cost is money well spent.

"I try to log on [to US West] and don't get an answer.... Eventually, I'll switch."

Mike Winckler, computer programmer



PHOTOGRAPH: PAULA FRIEDLAND

role in the market. In selecting regional ISPs for our review, we divided the United States into five regions (Midwest, Northeast, Rocky Mountain, South, and West) and chose two major providers in each area. (Erols, one of the regionals, took the name of its parent company, RCN, during the course of our review.)

We evaluated the 20 ISPs from almost every angle. To gauge speed and reliability, we contracted with Inverse Network Technology of Sunnyvale, California, a leader in ISP performance testing. We surveyed nearly 8000 *PC World* subscribers to assess their satisfaction with our 20 target ISPs as well as their competitors (for detailed results, see PC World Online at www.pcworld.com/mar99/isps). We signed up with each ISP to test the installation and start-up process (except with US West, which provides Internet service only to its local phone customers), and we researched each ISP's features and options, including business-oriented offerings (for details, see "Keeping Score: Rating the ISPs," page 138).

NATIONALS EDGE OUT REGIONALS

WHETHER YOU'RE in Fresno, California, or Bangor, Maine, and logging on for business or pleasure, you'll be hard-pressed to find a better all-around ISP than AT&T WorldNet, our Best Buy. ▶

Imitating AOL

ISPs Strive for Easy Web Access

Ask any of America Online's 14 million subscribers why they stick with the service—despite ongoing problems with busy signals, sluggish downloads, and abrupt disconnects—and you'll probably hear the same answer from all of them: content and chat. Where else can you so quickly and easily commiserate with other harried parents, get the scoop on hot Internet stocks, catch up on your magazine reading, or find the latest music tracks?

But AOL's reign as king of content is coming under siege. Recognizing the powerful pull of one-click access to news, weather, and chat rooms, more and more Internet service providers are following AOL's lead in hopes of sharing its market success.

BELLSOUTH, LIKE MOST ISPs, is trying to mimic AOL's success by providing links to news, entertainment, and more.

For Web newcomers, who often founder amid the sea of resources, easy access to information proves invaluable. That's true for Kevin Beekman, an economic consultant in Alexandria, Virginia. Using a custom feature on Bell Atlantic's Internet service, he formatted his opening page with his favorite information sources. The customized start page lets users tailor the first page they see when they log on so it displays only the type of content that interests them. "It's a nice feature when you first start using the Web," says Beekman, who left AOL because of its burdensome downloads.

AOL'S CLAIM TO FAME—a wealth of easy-to-access content—keeps users coming back, despite its performance.

Many ISPs—including national providers AT&T WorldNet, Concentric, and EarthLink/Sprint—offer highly customizable start pages and links to megasites, giving subscribers an array of daily news, stock and sports feeds, and local weather, traffic, and entertainment information. Though none of the ISPs whose representatives we spoke to plan to become content providers per se, all acknowledge the need to simplify the choices for their subscribers and to point them toward high-quality sites on the Web. Some providers, such as SBC/Pacific Bell Internet Services and MindSpring, go one step further, adding access to local information about everything from volunteer work to some area schools' daily lunch menu.

Although ISPs may be giving traditional content providers a run for their money, they still can't match the hundreds of forums and chats found on AOL and, to a lesser degree, on CompuServe. Voyager, a regional ISP serving consumers and businesses in the Midwest, is taking a stab at community building by providing a series of forums on the likes of local politics to the best sushi joints in town.

It's too soon to tell whether ISPs' recent content- and community-building efforts will make them stronger competitors with AOL. But for those who use AOL primarily as a gateway to content, these added services can offer the ease of AOL without the associated performance headaches.

AT&T has made big improvements since earning only a Fair rating from us last year. In addition to offering coverage in all 50 states, AT&T WorldNet boasts outstanding performance, easy installation, a comprehensive set of standard features and services, free start-up, and top-notch support policies. It also offers a full range of business-specific features, from six high-speed access options and Web-design services to credit card processing. But no ISP is perfect, and besides costing a few dollars more than most of its competitors, AT&T has been slow to respond to e-mail requests for help.

As a group, the national Internet service providers outscored the regional ISPs in most major categories such as installation and support, but not by much. Though AT&T, IBM Internet Connection, and MindSpring took the top three slots on our chart, the regionals (led by Ameritech, a Baby Bell) followed close behind, claiming fourth, seventh, eighth, ninth, and tenth positions.

Should you care whether an ISP's service coverage is national, regional, local, or even global when selecting a provider? If you travel a lot within the United States and need to stay connected to the Web,

SCORECARD AND FEATURES

Great Connections: Top ISPs for Home and Business

	INTERNET SERVICE PROVIDER	Overall rating	Coverage area	Start-up fee/ monthly fee [1]	Summary	Scorecard: Installation	Scorecard: Performance
1	AT&T WorldNet 800/967-5363 www.att.com	outstanding	national	none/$21.95	World-class competitor except for its slow responses to e-mail requests for help.	good	outstanding
2	IBM Internet Connection 800/821-4612 www.ibm.net	good	national	none/$19.95 [3]	All-around excellent provider is much easier to install than before. But monthly fee covers only 100 hours.	outstanding	outstanding
3	MindSpring 888/677-7464 www.mindspring.com	good	national	$25/$19.95	Fast, easy to set up, and backed by on-the-ball support. Our quibble: a $7.50-per-hour toll-free-access surcharge.	good	good
4	Ameritech 800/638-8775 www.ameritech.net	good	Midwest	none/$21.95	Nimble performer—the clear Midwest choice here—excels in everything but support quality and ease of installation.	fair	good
5	Concentric 800/939-4262 www.concentric.net	good	national	none/$19.95	Doesn't hold users' hands but offers good features, including plenty of overseas access points.	fair	fair
6	EarthLink/Sprint 800/395-8425 www.earthlink.net	good	national	none/$19.95	Earns good marks for support, but its Web speed is nothing to e-mail home about.	outstanding	fair
7	SBC/Pacific Bell Internet Services 888/708-4638 www.pacbell.net	good	West	$15/$22 [5]	Hard to set up, but its great performance—the best after AT&T's—makes it our choice in the West over GST.	poor	outstanding
8	BellSouth 800/436-8638 www.bellsouth.net	good	South	$10/$19.95	The clear choice over CyberGate down in Dixie—especially for Web page downloads.	fair	good
9	RCN [6] 800/746-4726 www.rcn.com	fair	Northeast	none/$19.95	Solid all-around service, especially for people who want to upgrade to new high-speed technologies.	fair	fair
10	Voyager 888/747-4638 www.voyager.net	fair	Midwest	$20/$19.95	Makes a decent showing in all categories, but Ameritech outperforms it.	fair	fair
11	Prodigy Internet 800/776-3446 www.prodigy.com	fair	national	none/$19.95	Sluggish performance and support offset by decent features.	fair	poor
12	Bell Atlantic Internet Solutions 800/638-2026 www.bellatlantic.net	fair	Northeast	none/$19.95	Not a bad choice, but regional competitor RCN offers cable and plenty of ISDN access points.	good	fair
13	GST Whole Earth Network 800/246-6587 www.wenet.net	fair	West	none/$25	Comes with free access to a cool online community (The Well), but Pacific Bell wins the West.	fair	good
14	Microsoft Network 800/373-3676 www.msn.com	fair	national	none/$19.95	Ho-hum at best; loses points for relatively short support hours and toll-only support line.	fair	fair
15	America Online 800/827-6364 aol.com	fair	national	none/$21.95	A cinch to set up—just pop in the disk—but poor performance and weak support still dog this behemoth.	outstanding	unacceptable
16	Rocky Mountain Internet 800/864-4344 www.rmi.net	poor	Rocky Mountain	$15/$19.95	Offers limited support hours, but reliable service give it the edge over US West in this coverage area.	fair	fair
17	CyberGate 800/638-4283 www.gate.net	poor	South	none/$17.95	Hard to install, and speed is just so-so; BellSouth easily outclasses it.	poor	poor
18	US West 800/244-1111 www.uswest.com	poor	Rocky Mountain	$5/$19.95	Performance problems, especially Web page download failures, make this provider hard to recommend.	fair	unacceptable
19	CompuServe 800/848-8990 www.compuserve.com	poor	national	none/$24.95	Once-dominant service is now long in the tooth. Can be a struggle to set up, and support needs improvement.	unacceptable	fair [7]
20	Netcom [8] 800/638-2661 www.netcom.com	poor	national	$25/$19.95	Suffers from uninspiring speed and support, and lacks a customizable start page and server space for Web sites.	fair	poor

Best Buy ● Yes ○ No

[1] Except where noted, fee is for basic flat-rate plan.

[2] For example, guaranteed uptimes for services, priority access to support.

[3] No flat-rate plan, 100-hour monthly limit.

[4] Also comes with ten Web-based e-mail accounts.

you probably should choose one of the national ISPs—they offer local access numbers in almost all major urban areas and many smaller cities.

Occasional travelers can also select from many local and regional ISPs that increasingly offer "roaming" services (which allow users to connect to another ISP's network) and toll-free lines (for a surcharge) to permit access on the road.

Traveling abroad anytime soon? Driven mostly by the needs of Fortune 500 companies with offices in several countries, large ISPs such as Concentric and IBM are going global. While the market for global access is tiny, these ISPs are beginning to offer it in Western Europe and Asia at no extra charge. Concentric, for example, has thousands of access points in 72 countries, and even offers technical support in many of them. IBM includes international access numbers in its dialing software—all preconfigured and ready to dial.

GETTING ONLINE—AND STAYING THERE

ANYONE WHO has encountered a busy signal when trying to access e-mail or waited forever for a download knows ▶

	All-purpose features					Business-specific features				Support	
Support policies/ satisfaction	Trial period (hours/ days)	Toll-free access charge (per hour)	Customized start page	Number of e-mail accounts	V.90 access	Web site design/ hosting	Credit card processing	Premium service/ support [2]	High-speed access	Weekday/Sat/ Sun support (hours)	Toll-free support
outstanding/ fair	unlimited/30	$6	●	6	good	●/●	●	●/●	ISDN/cable/DSL/T1/ frame relay/ATM	nonstop	●
outstanding/ good	30/30	$6	○	1	good	●/○	●	●/●	ISDN/cable/DSL/T1/ frame relay/ATM	nonstop	●
outstanding/ good	unlimited/30	$7.50	●	1 [4]	good	●/●	●	●/○	ISDN/cable/T1	nonstop	●
outstanding/ fair	none	not applicable	●	5	good	●/●	●	○/○	ISDN/DSL/T1/frame relay	nonstop	●
outstanding/ fair	unlimited/30	$5	●	5	good	●/●	●	●/●	DSL/T1/frame relay	nonstop	●
outstanding/ good	none	$5	●	1	good	○/●	●	○/●	ISDN/cable/DSL/T1/ frame relay	nonstop	●
outstanding/ fair	unlimited/10	not applicable	●	5	poor	○/●	○	○/○	ISDN/DSL/T1/ frame relay/ATM	nonstop	●
outstanding/ fair	none	$6	●	1	good	●/○	●	●/●	ISDN/DSL/T1/ frame relay/ATM	nonstop	●
outstanding/ fair	none	not applicable	●	1	good	○/●	●	●/●	ISDN/cable/T1/frame relay	nonstop	●
fair/fair	none	$6	●	3	good	○/●	●	●/●	ISDN/cable/DSL/T1/ frame relay	14/12/8	●
good/fair	none	$6	●	1	good	○/●	○	○/○	none	20/20/20	●
outstanding/ fair	none	not applicable	○	1	good	●/●	●	●/●	ISDN/DSL/T1/ frame relay/ATM	nonstop	●
outstanding/ fair	none	$6	○	1	poor	●/●	●	●/●	ISDN/DSL/frame relay/ATM	nonstop	●
poor/fair	unlimited/30	not applicable	●	1	good	○/○	○	○/○	ISDN/T1	16/16/16	○
outstanding/ poor	100/30	$6	○	5	fair	○/●	○	○/○	none	nonstop	●
fair/fair	none	$6	●	1	fair	●/●	●	●/●	ISDN/DSL/T1/ frame relay/ATM	12/8.5/none	●
poor/ fair	none	$7	●	1	good	○/●	●	○/●	ISDN/T1/frame relay/ATM	13/8/8	○
outstanding/ fair	unlimited/30	not applicable	○	2	good	●/●	●	○/●	ISDN/DSL/T1/ frame relay/ATM	nonstop	●
good/fair	100/30	$6	○	1	good	●/●	○	○/○	ISDN/T1	17/12/12	●
good/fair	150/30	$5	○	1	good	●/●	●	●/●	ISDN/T1/frame relay	nonstop	○ [9]

[4] No flat-rate plan, 150-hour monthly limit.

[2] The branch of RCN we tested was formerly known as Erols Internet.

[3] Based on our review of installation software and documentation.

[5] In January MindSpring announced acquisition of Netcom.

[9] Toll-free support for first 30 days.

the importance of fast, reliable performance. Our survey respondents count a reliable connection, a lack of busy signals, and fast e-mail among an ISP's key assets.

"Downloading patches sometimes takes a few hours. I want reliability and good performance—and I'm willing to pay extra for it," says William Robbins of the commercial real estate firm Cushman Wakefield in Dallas.

With this in mind, we turned to Inverse Network Technology to run our performance testing. Inverse put the 20 ISPs through a rigorous suite of tests, dialing in to each one at least 2864 times to test connection, log-in, and download times, and—for all but AOL, CompuServe, and Microsoft Network—e-mail send and receive times. The PC World Test Center performed the e-mail tests for those three providers because they

ISPs Get Down to Business

Luring companies with premium services, hosting, and more...

ISPs' pursuit of business users has changed the way the services themselves do business. Most of the 20 ISPs we've rated, the regional Baby Bell providers in particular, now offer a rapidly expanding list of business services and features in hopes of signing up your company.

"The business market is more lucrative for ISPs than the consumer business," says Jupiter Communications analyst Zia Daniell. Here's what to look for when choosing an ISP for your business:

■ **Design Assistance** Knowing you *should* have a company Web page doesn't mean you have the time or expertise in-house to make it happen. The majority of our 20 ISPs provide some form of Web-design assistance, but MindSpring and Rocky Mountain Internet offer the most robust consulting services for businesses. Both employ in-house design teams that will design a custom site based on the marketing and business needs of individual businesses. For do-it-yourselfers, several ISPs—including IBM Internet Connection and BellSouth—provide custom design tools that walk businesses through the process of creating their own Web site (in addition to offering some of the more popular off-the-shelf Web site development programs, such as Microsoft Front Page or SoftQuad's HotMetal Pro). Voyager and several other providers offer Web site tune-ups, where professional designers will review your site and offer tips for improving it.

■ **Hosting Service** ISP Web hosting is a booming business. But for companies without brand-name recognition, developing a presence online requires more than just some server space to house the company's site. Seek the advice of a service provider such as AT&T WorldNet, Concentric, or Rocky Mountain Internet that offers a full complement of hosting services, including credit card processing, site-analysis tools, and assistance with marketing strategies. Regional telephone companies like BellSouth and SBC/Pacific Bell aggressively promote their marketing services to businesses, offering deals to their business customers via their online yellow pages—a terrific advantage, considering the reach of this popular directory.

AT&T offers a full set of special services for businesses. AOL, MSN, and Prodigy do not.

■ **Premium Service Plans** Fortune 500 companies cut performance deals regularly with their ISPs: If uptimes or delivery times fall below an agreed-upon level, the ISP usually refunds the company some or all of its monthly service fee. BellSouth, Concentric, and IBM provide such a guarantee to small, Web-dependent businesses as well. It's a terrific option if your business requires unfettered Internet access. One word of caution: Don't be swayed by promises. Make sure the ISP guarantees a refund on your premiums if it doesn't meet the stated uptimes.

■ **Premium Support Plans** When your Internet connection is down, you don't want to languish on hold waiting for a support rep. Increasingly, Internet service providers are offering premium small-business support plans that include both dedicated high-speed access lines and more-traditional dial-up service. Among the ISPs reviewed here, AT&T, BellSouth, Concentric, IBM, and Voyager provide small-business support plans.

■ **High-Speed Access** Many smaller businesses shun expensive high-speed dedicated lines because their firm's small size and limited Web usage don't justify the cost. But thanks to the introduction of Digital Subscriber Lines, many small businesses can get dedicated high-speed access at only a fraction of the cost of a T1 connection (see "Bandwidth on Demand," page 108). Even if you don't need a high-speed connection today, as your business grows—along with your reliance on the Web—your needs may change. So think about choosing an Internet service provider that offers a full range of high-speed options. AT&T WorldNet leads the pack among the 20 ISPs we reviewed; America Online and Prodigy bring up the rear.

use proprietary e-mail systems. AT&T, IBM, and SBC/Pacific Bell are the only Outstanding performers; AOL (a perennial bottom-dweller in performance) and US West both receive an Unacceptable rating—the lowest we give.

By some measures, ISP performance in general has improved in the past year. Busy signals—the bane of every ISP customer's existence—have dropped to a fraction of last year's rate, says Chris Roeckl, research manager at Inverse. In January 1997, slightly more than a quarter of all calls to an ISP resulted in busy signals. By October of last year, that figure had dropped to just under 7 percent, thanks largely to major services' investment in additional capacity.

Still, don't expect ISP performance to match that of your telephone company anytime soon. The technology involved in connecting to the Web is more complex, and ISPs are having a hard time keeping up with their own phenomenal growth. "As providers try to deliver services to more places, something's always broken," says Lance Weatherby, an executive vice president at MindSpring. "When MindSpring served 3000 customers, we were small enough that we could yell across the room to fix problems. We can't do that anymore."

HIGH SPEEDS DOWN THE ROAD

ACCORDING TO our survey, roughly 50 percent of respondents now use a 56-kbps modem to connect to the Internet. But owning such a modem doesn't guarantee you'll actually connect at that rate.

First, your ISP must support your modem protocol—V.90, x2, or K56flex. V.90 became the global standard last fall, and ISPs began scrambling to implement it. Most providers claim to have achieved close to 100 percent V.90 compliance. Only SBC/Pacific Bell and GST Whole Earth Network earned a Poor rating in this category. Many providers expect to complete the transition to V.90 by the end of the first quarter this year.

But even if your provider supports V.90, antiquated phone lines make 56-kbps access a pipe dream for many users. "What's the use of having a 56K modem if you can't get on at that speed?" asks Ed Duran, who trades stocks and commodities online from his office in Inverness, Illinois. "I'm getting cable access as soon as it becomes available," he says matter-of-factly. "I want the speed, no matter what it costs."

AT&T, IBM, EarthLink/Sprint, MindSpring, RCN, and Voyager were the only ISPs we reviewed that currently offer limited cable connections, though availability will expand this year. In the meantime, many ISPs tout Digital Subscriber Line technology as the high-speed option of the future. All the Baby Bells offer some form of DSL, and MCI WorldCom has tapped EarthLink and America Online as partners in the telecommunication giant's 1999 rollout of DSL service.

Cherry Rose-Anderson, a research analyst with the Gartner Group in Stamford, Connecticut, believes cable will ultimately reign as the high-speed access option for consumers. "Right now, cable's strongly positioned for the consumer market," she says. And look for DSL to take hold in a big way in the business marketplace (see "Bandwidth on Demand," page 108).

A BOUNTY OF OPTIONS

NOT LONG AGO, ISPs gave you access to the Web and an e-mail account—period. But providers have begun to greatly expand their offerings in order to compete with feature-rich AOL for customers. They provide more Web space, pricing schemes, and extra e-mail accounts, among other enticements. ▶

"I want reliability and good performance, and I'm willing to pay extra for it."

William Robbins, office service coordinator

PHOTOGRAPH: DANNY TURNER

A year ago, $19.95 was the de facto rate for unlimited monthly Web access. Now pricing is beginning to vary, from the high teens to the mid-20s among ISPs we reviewed. At the high end, we find CompuServe and GST Whole Earth Network at around $25; midrange are America Online, Ameritech, and AT&T at $21.95. CyberGate, at $17.95, is the least expensive among the ISPs we reviewed.

More and more Internet service providers offer discounted rates in exchange for long-term commitments. EarthLink, for example, charges $19.95 for a basic month-to-month account, but subscribers who sign on for a year pay $18.40 monthly. Although making a long-term commitment with an unknown provider is risky, it can be a great way to save a few bucks with an ISP whose services you know and trust.

"My friends thought I was crazy," says Massachusetts software engineer Tom LaRoche, regarding his decision to sign with Erols (now RCN) for three years at a bargain monthly price of $9.95. Two years into the service, he's glad he did.

A year ago, multiple e-mail accounts (a necessity for households with several Web users) were rare. Seven of the ▶

Local ISPs

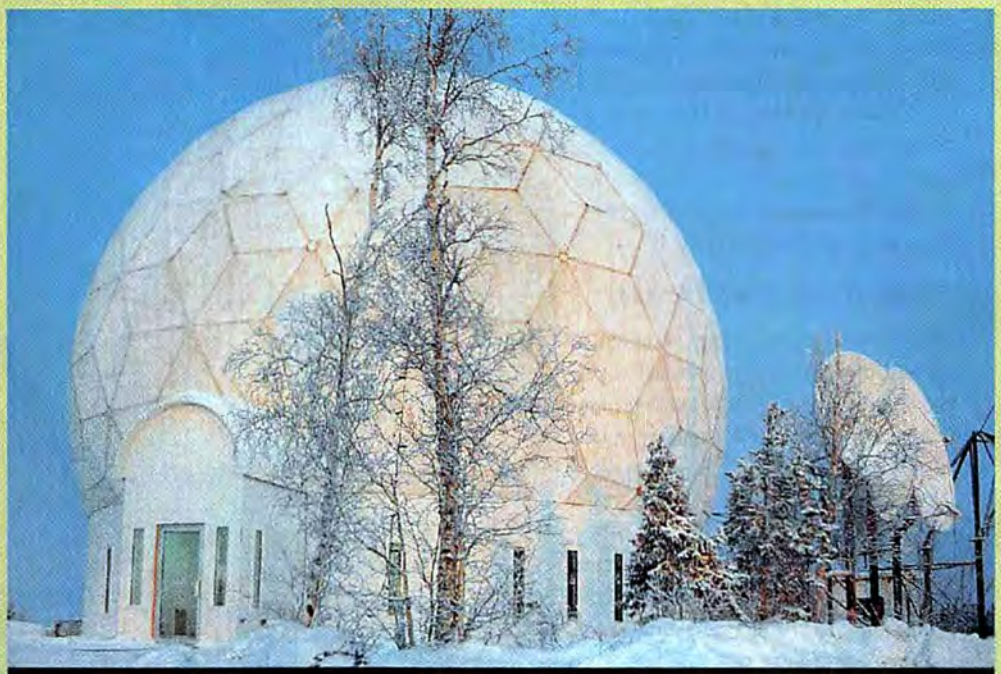
Living on Top of the World

Three hundred miles north of the Arctic Circle, where frost-stunted trees yield to barren tundra, sits the town of Inuvik, in Canada's Northwest Territories. Living well beyond the range of behemoths like AOL and AT&T, the 3000 residents of this remote mining settlement have only one place to turn for access to the World Wide Web: Inuvik TV, a local firm that supplies the town's cable TV and Internet service.

NORMAN ROCKWELL MEETS NORTHERN EXPOSURE

More ISP users should have it so good. Inuvik TV charges the equivalent of $20 per month for 33.6-kbps access. The company offers unlimited cable Internet service for the same fee—an option that none of the bigger providers makes available. The ISP's best feature, however, is the personal attention it provides customers—something national and regional ISPs can't begin to match.

All the subscribers live within a few miles of the 65-foot decommissioned radar dome that houses the company's main office. John Boudreau, who serves as the entire tech support department, knows at least half the subscribers personally, and even makes house calls from time to time. For instance, Boudreau recently visited a nursing home to install service for George "Buck" MacLeod, a pensioner who was looking for an inexpensive way to stay in touch with his family members living in Southern Canada and England. "I'm brand-new to computers," admits Buck. "I needed all the help I could get."



HIGH-SPEED ACCESS threatens the future of local ISPs. But remote operators, like Inuvik TV, will live on.

Given the personal touch local ISPs can offer users, it's little wonder that nearly half the respondents to our survey said they use a local provider. Forrester Research of Cambridge, Massachusetts, found a similar result—according to their research, one-third of all subscribers use local ISPs.

But in the not-too-distant future, says Bruce Kasrel, an ISP analyst at Forrester, the number of local providers will shrink as larger ISPs buy them, expand into their coverage areas, and offer high-speed access via cable and Digital Subscriber Lines. Many local ISPs simply won't be able to compete, and as connecting to the Web gets easier, the neighborly support offered by these mom-and-pop shops will gradually become less important for many customers.

Still, ISPs like Inuvik TV will have a role. "Local ISPs will dwindle, but they won't go away altogether because there will always be regions where larger ISPs won't reach," says Kasrel.

—Bryan Hastings

PHOTOGRAPH: BOB COOK

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Finding an ISP That Works for You

We evaluated 20 ISPs and identified our favorites, but no provider will suit everyone. Whether you're taking the plunge for the first time or giving your old provider the boot, these tips can help you find an ISP you can live with happily.

Cover Your World If you travel overseas, check out global ISPs such as IBM Internet Connection and CompuServe. If you travel frequently in the United States, go with a national ISP with free access in the areas you visit. Those who want access within a small region covering a state or two are safe selecting either a regional or a national ISP. Users who need to connect only from home and work can pick from national, regional, and local ISPs.

Ask Around Word of mouth from friends and colleagues is the easiest way to get valuable feedback about ISPs. Here are some questions to ask:

- Was the service easy to set up?
- Do you get a lot of busy signals when you're trying to connect?
- Does your e-mail arrive promptly?
- Can you get extra e-mail accounts for other household members who want separate addresses?
- Can you reach tech support quickly?

Use an ISP Finder There are some 4500 ISPs nationwide. Simplify your search by using an ISP finder to identify those that serve your area. The Ultimate Web ISP List (www.webisplist.com), BoardWatch's The List (www.boardwatch.com), and PC World Online's ISP Finder (www.pcworld.com/interactive/isps) provide a variety of basic information, such as monthly fees or high-speed access offerings. For in-depth information on topics like coverage area, click on the finders' links to the service providers' Web sites.

Surf the Web Although you have to spend some time browsing them, newsgroups are an excellent place to find unvarnished opinions about providers. Check out www.dejanews.com and dfw.internet.providers.

Call Your Phone Company Many local telephone companies, such as the Baby Bells, bundle Internet access with their telephone service, which can cost much less than if you purchase the two services separately.

Hello, Is Anyone There? Sign up with an ISP for a free trial period and call in during the busy times, such as in the evening and on weekends. Make sure that you can connect every time.

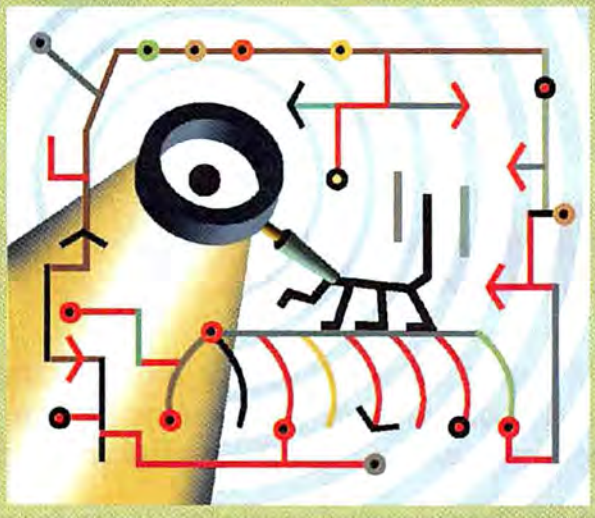
Am I Speeding? Once you're connected, click on the two small blinking computer screens on Windows' status bar to display your connect rate. The higher the rate, the faster you can download files and Web pages. Maximum rates are between 45,000 and 50,000 bps.

Time Your Mail You may be able to see how long messages take to reach you by noting the time stamps on incoming e-mail. E-mail should usually reach its destination within a few minutes.

Check the Offerings Because ISPs change and expand their options almost daily, visit the provider's Web site to hear about the latest offerings.

Ask About Hidden Charges Some providers impose extra charges when the number of Web site hits, e-mail messages sent and received, or amount of data that visitors pull from your site exceeds certain levels.

Ask About the Backbone Connection Make sure the ISP has at least one T1 connection to the Internet backbone, a prerequisite for 56-kbps speed. Also find out if the provider maintains a direct connection to the backbone. If the ISP connects through intermediaries, slowdowns are more likely.



Will You Be in the Loop? Ask if the ISP alerts subscribers to expected downtimes—a good thing to know if your business depends on ISP service.

Will You Be Backed Up? If you run a commercial Web site and change the site regularly, make sure your ISP performs daily backups of its mail and Web servers and stores those backups off-site. Otherwise you could lose valuable transactions, such as product orders.

—Judy Heim

ISPs in our review now offer them.

Internet service providers are even trying to challenge America Online's dominance as a content provider by offering subscribers customizable home pages and one-click access to Web-based content (see "Imitating AOL: ISPs Strive for Easy Web Access" page 127).

Capitalizing on the growing popularity of personal Web pages, more ISPs now include server space for Web hosting, dispensing from 1MB up to 20MB.

When we add up all the features that our 20 providers offer, AOL no longer stands alone as the best. AT&T WorldNet in particular matches AOL service for service and even surpasses the online giant in some areas.

WORKZ.com

(February 1999)

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improve their support, others grumble about the impracticality of the 24/7 toll-free standard. "A small percentage of customers use a large percentage of our technical support service," says Ed Callan, SBC/Pacific Bell's vice president of consumer marketing. "I expect that as the industry grows, we'll see the majority of ISPs introducing pay-for-support plans."

Three of the national service providers—IBM, MindSpring, and Netcom—have begun charging for premium service. For a few more dollars a month, subscribers receive upgraded technical support, along with convenient extras such as quarterly CD-ROM software upgrades. Concentric is considering whether to require customers with older operating systems to pay even for standard technical support.

Roughly 40 percent of the Web-goers we surveyed have received help via e-mail. Some 23 percent received a response in less than 3 hours (not bad), 17 percent heard back in 3 to 8 hours (not very good), and 23 percent waited 24 hours or more (yikes). Of the ISPs reviewed in this report, IBM proved the most responsive, answering nearly half of all e-mail queries within 8 hours. America Online, AT&T WorldNet, and Netcom were among the slowest at fielding e-mail inquiries.

Survey respondent Verne Cole, a retired newspaper editor from Fresno, California, has given up trying to use Netcom's e-mail support option. "Frankly, I have a great deal of difficulty trying to figure out who or what to ask. I've sent e-mail messages to them and much of the time don't get any response back," says Cole, who uses the Internet to stay in touch with his family and friends.

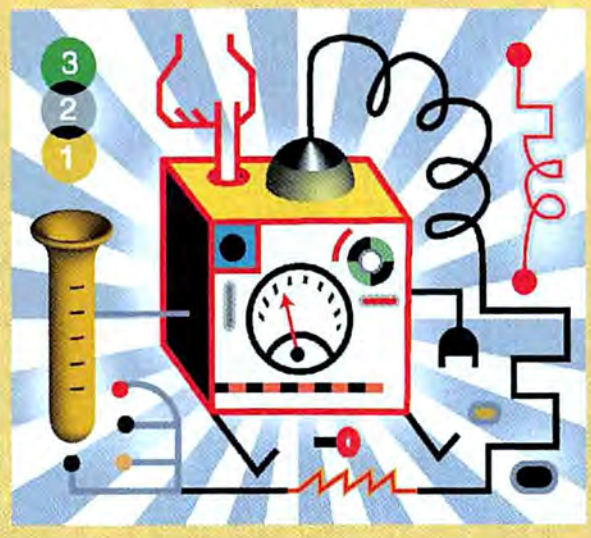
For now, e-mail support is really an option only for those individuals who can connect to the Web and who don't mind waiting for an answer. Companies will have to devote more resources to e-mail support—and respond to messages more quickly—before they'll see a noticeable drop in the number of phone calls they receive.

Keeping Score: Rating the ISPs

When it comes to rating Internet service providers, the fundamental criteria apply: cost, ease of setup, features, performance, and support. To determine how much each of these issues mattered to our readers, we asked them—lots of them. *PC World* ran an online survey last October, collecting and compiling nearly 8000 responses (7988, to be exact).

PC World readers say performance is the most important factor when choosing a service provider, so in our evaluation it counts for 35 percent of the overall rating. Our performance ratings also factor in the results of November 1998 dial-up tests performed by Inverse Network Technology and the subjective opinions of readers who responded to our online survey. Inverse dialed in to each provider at least 2864 times and tested for a wide range of performance measures, including percentage of successful connect rates and Web page download times.

PC World readers also care about features, including monthly fee, availability of 56-kbps connections, number of e-mail accounts per subscriber, and free server space for Web site hosting. Features make up 25 percent of the overall rating. Ease of installation and tech support quality contribute 15 percent each, and support policies make up the final 10 percent.



CHANGE FOR THE BETTER

ISPs WANT your business badly, and they're doing back flips to get it. They're adding capacity to improve performance, bolstering their list of standard features, and offering a smorgasbord of pricing and service options to fit the needs of just about any Web user. The leading national ISPs are sweetening their appeal with goodies like international roaming or extra space for Web hosting. Regionals, too, are offering an enticing mix of solid performance and broad-based services in aggressively priced packages.

Is switching providers a hassle? You bet. But the selection is terrific—at least for the time being. Come next year, who knows. As new bandwidth technologies hit the already tumultuous ISP market, the number of providers and their offerings may change substantially. Maybe for the better, maybe not.

online *Find details of our reader satisfaction survey on PC World Online at www.pcworld.com/mar99/isps. Roberta Furger and Judy Heim are contributing editors for* PC World. *Bryan Hastings is a senior associate editor for* PC World. ■

SIGNING UP WITH AN ISP

AFTER MANY YEARS of refinement, getting up and running with an ISP and properly configuring the software today should be a snap. Unfortunately, on many of the services it's more of a drag.

Our experience registering with these 20 ISPs ran the gamut. AT&T's automated phone-ordering system made registration a breeze, while a hyper-responsible Prodigy salesperson insisted on recording our lengthy phone conversation to document acceptance of the member agreement, turning registration into a pain.

Ease of installation also varied. We appreciated AOL's no-brainer procedure; CompuServe's unnecessarily complex and confusing process, with misleading instructions and confusing error messages, made us wonder how the company expects to attract new subscribers.

You can register with most ISPs online or by phone. If you switch ISPs, it's easiest to use your existing browser and register online. Many ISPs post step-by-step instructions for configuring a Windows dial-up connection; tech support can also walk you through the setup. Barring technical glitches, you should be online with most ISPs in a matter of minutes. The only downside: You'll miss out on any custom features the ISP has added to the commercial version of the browser.

First-timers are better off ordering the software by phone, even if their PC came with a browser preinstalled. You'll have to wait to get the CD—from a few days up to two weeks—but in most instances the simplified setup is worth the delay. And some ISPs offer ways to speed up delivery: RCN will expedite its start-up kit for an added cost; Prodigy expedites shipping if you sign up over the phone.

One word of caution: Although some ISPs, including AT&T, EarthLink, and IBM, give you a choice between Netscape Communicator and Microsoft Explorer, few supply and support both of these leading browsers.

SUPPORT: A PAPER TIGER

ON PAPER, just about all 20 ISPs have established customer-friendly support policies. All but six offer around-the-clock telephone support. CyberGate and Microsoft Network are the only providers in our review that skimp on both nonstop support hours and a toll-free support line. Netcom offers toll-free support, but only for the first 30 days.

But getting 24-hour service on a toll-free line doesn't guarantee that your questions will be answered satisfactorily when you call. Among our 20 ISPs, only EarthLink/Sprint, IBM, and MindSpring can boast even a Good satisfaction rating for support quality. Of the remaining service providers, all but one received a Fair score; AOL earned a Poor rating. A full 20 percent of all our survey respondents said their problems were not resolved by calling technical support. And even though 73 percent of respondents got through to a technician within 15 minutes, 27 percent of them said that they waited longer.

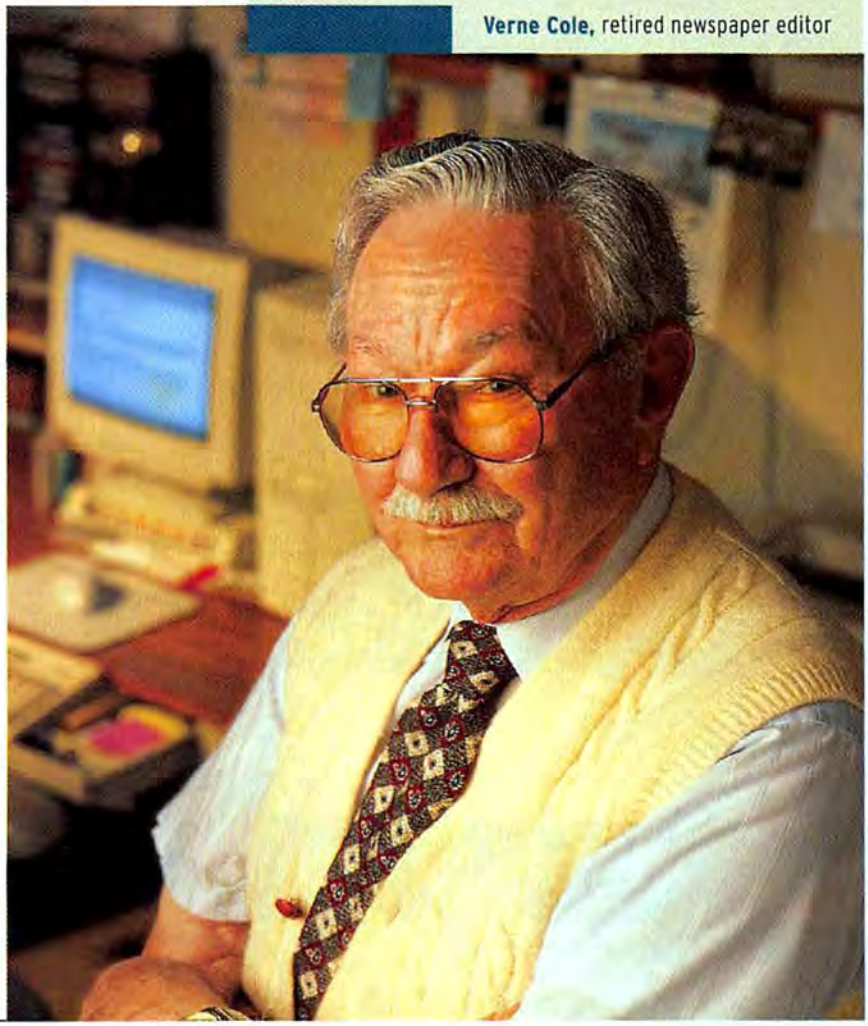
When you're thinking about signing on with an ISP, try this experiment: Call that provider's tech support line at roughly the time of day you expect to be using the service and see how long it takes you to get through to a rep. Although your experiment won't be scientific, it'll give you a first-hand glimpse of the service you might receive when trouble comes knocking.

AOL dominates the ISP market, but not because of its support practices. Less than two-thirds of AOL subscribers said they were "completely satisfied" or "satisfied" with the support they received, compared to 82 percent of AT&T users.

Whereas some ISPs struggle to ▶

"I've sent e-mail...to [Netcom] and much of the time don't get any response."

Verne Cole, retired newspaper editor



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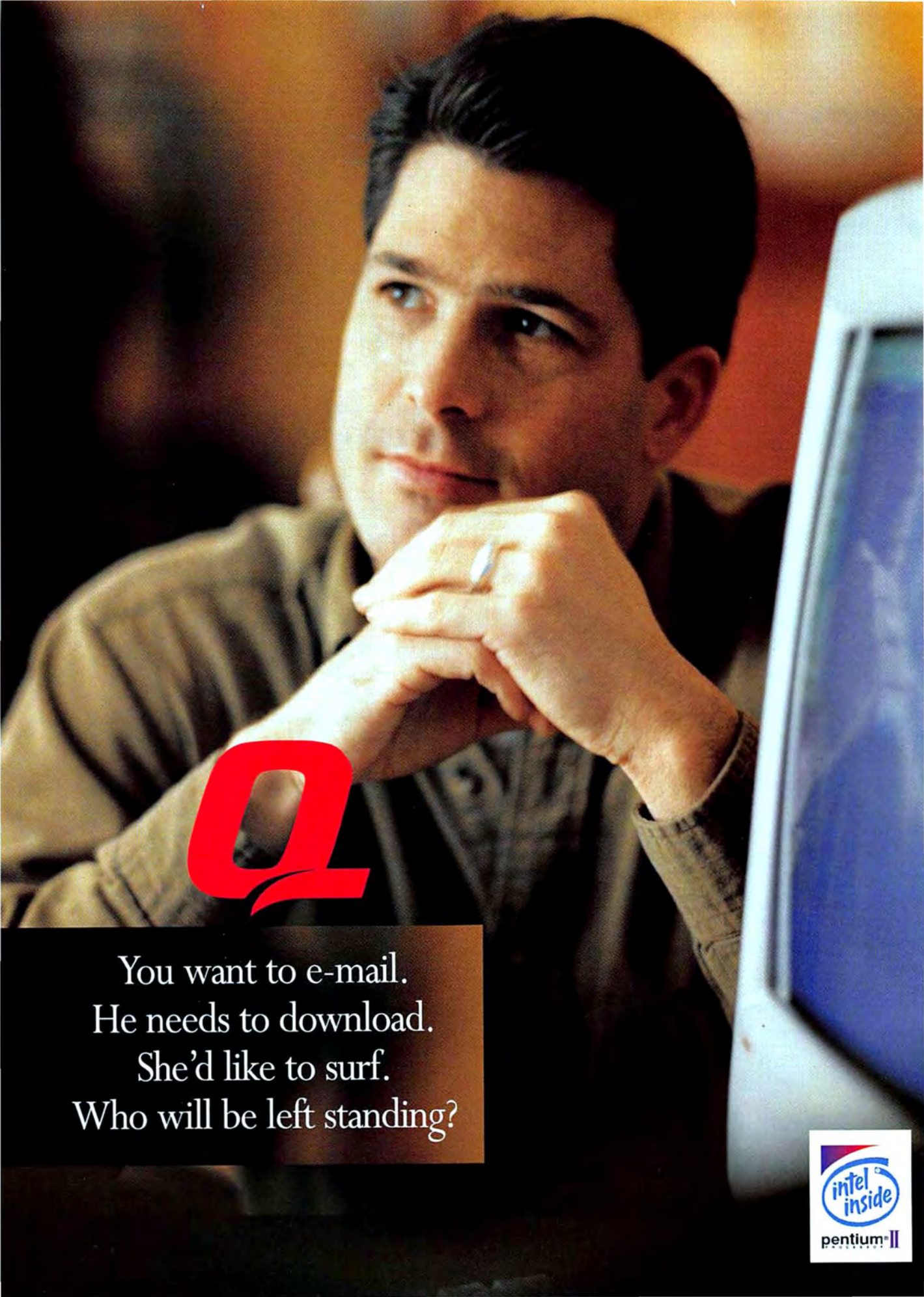
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- **PRESARIO 1600** – *October 1998*, **EQUIP MAGAZINE,** 5-Star Rating and Best Overall Notebook Award
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	16.8 GB UltraDMA Hard Drive	16.8 GB Ultra
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	1.5Mb Max Digital Modem[1]	1.5Mb Max D
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Fast Internet acc

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	2nd-Generation DVD-ROM Drive[9]	2nd-Generati
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	Smart LiIon Battery	Smart LiIon B
	256 KB Integrated "On-chip" cache	256 KB Integ
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	10.0 GB Ultra DMA Hard Drive. Add $350	Extra Smart L
	Port Replicator. Add $129	Tripp Lite Sup

All prices shown are Compaq Direct selling price. Prices shown do not include applicable sales tax and shipping. Products and prices valid in the U.S. only. Actual retail price may vary. Specifications and prices are subject to change or cancellation without notice. Not all Compaq Presario models are available in all retail stores. *50 free hours of Internet Access is chosen from Compaq Internet Setup. The 50 free hours must be used over a 30-day period from initial setup. A valid credit card is required to initiate service, although no charges will be incurred until the 50-hour trial has expired. **Card for 2nd computer requires open PCI slot. †Each additional PC must have a network adapter, sold separately. For hard drives, GB = billion bytes. [1]ITU V.90 modems are designed only to allow faster downloads from K56flex or V.90 compliant digital sources. Maximum achievable download transmission rates are currently unknown, may not reach 56 kilobits per second (Kbps), and will vary with line conditions. [2]24X Max CD-ROM data transfer rates may vary from 1500 to 3600 KB/s. [3]32X Max CD-ROM data transfer rates may vary from 1800 to 4800 KB/s. Works with most third party devices. [4]The 6X DVD-ROM Drive transfer rate is up to 8115 KB/s compared to 1352 KB/s for 1X DVD-ROM Drives. [5]2nd-Generation DVD-ROM Drives run at a higher maximum transfer rate of up to 2.76 MB/s compared to 1st-Generation DVD-ROM Drives which run at a maximum transfer rate of up to 1.348 MB/s. [6]One year parts and labor. [7]Lite 56K V.90 updates may be

RESARIO 5600i-450

Processor, 450 MHz
RAM expandable to 384 MB
MA Hard Drive
Drive
550 AGP w/16 MB SDRAM
ner Sound MX300 PCI Audio Card
gital Modem
um Speakers w/Subwoofer
y Imaging Center
net Port, Cable Modem Ready
ered Home Collection & MS Word
ows98
19" Monitor (18.0" VIA)

99

e Networking for 2 computers**
w/Dual Subwoofers (160 watts)
Flat Panel Monitor (15.0" VIA)

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32X Max CD-ROM Drive
2X AGP Graphics w/8 MB SGRAM
Aureal 8820 PCI Audio Card
56K ITU V.90 Modem
JBL Pro Speakers
Digital Creativity Imaging Center
10 Mbps Ethernet Port, Cable Modem Ready
Microsoft Office 97 Small Business Edition
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Compaq V910 19" Monitor (18.0" VIA)

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1.5Mb Max Digital Modem
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6X DVD-ROM Drive
2X AGP Graphics w/8 MB SGRAM
Aureal 8820 PCI Audio Card
56K ITU V.90 Modem
JBL Pro Speakers
Digital Creativity Imaging Center
10 Mbps Ethernet Port, Cable Modem Ready
Microsoft Featured Home Collection & MS Word
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& JBL Pro Premium w/Subwoofer Add $89
1.5Mb Max Digital Modem
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2X AGP Graphics w/8 MB SGRAM
Aureal 8820 PCI Audio Card
1.5Mb Max Digital Modem
JBL Pro Speakers
Home Phoneline Networking for 2 computers**
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Microsoft Office 97 Small Business Edition
Microsoft Windows98
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13.0 GB UltraDMA Hard Drive
6X DVD-ROM Drive
2X AGP Graphics w/8 MB SGRAM
Aureal 8820 PCI Audio Card
56K ITU V.90 Modem
JBL Pro Speakers
Home Phoneline Networking for 2 computers**
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Microsoft Windows98
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celerated Graphics w/2.5 MB VRAM
Modem
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Small Business Edition
ws98

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n Battery Add $129
Notebook Protector Add $14.95

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2nd-Generation DVD-ROM Drive
256-bit AGP Accelerated Graphics w/2.5 MB VRAM
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Smart Lilon Battery
256 KB Integrated "On-chip" cache
MS Featured Home Collection
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56K ITU V.90 Modem
Smart Lilon Battery
256 KB Integrated "On-chip" cache
MS Featured Home Collection
Microsoft Windows98

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24X Max CD-ROM Drive
256-bit AGP Accelerated Graphics w/2.5 MB VRAM
56K ITU V.90 Modem
Smart Lilon Battery
256 KB Integrated "On-chip" cache
MS Office 97 Small Business Edition
Microsoft Windows98

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192 MB SyncDRAM Add $250
2nd-Generation DVD-ROM Drive Add $149
Port Replicator Add $129

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Intel Pentium II Processor, 333 MHz
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6.4 GB UltraDMA Hard Drive
2nd-Generation DVD-ROM Drive
256-bit AGP Accelerated Graphics w/2.5 MB VRAM
56K ITU V.90 Modem
Smart Lilon Battery
256 Integrated "On-chip" cache
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It happens to the best of families. They get a computer or two (or three). They discover the Internet. And then they drive each other completely and utterly insane. "It's my turn to go online." "No, it's my turn." "Is not!" "Is too!" Was this what the Internet promised? The people at Compaq don't think so. Which is why we created these new Compaq Presario 5600i Series Internet PCs. They're the first computers to offer Home Phoneline Networking.[10] This amazing little innovation lets you plug your family's PCs into existing phone jacks, so you can all surf the Net at the same time, using the same phone line.[1] So while Dad e-mails his college roommate, the kids can visit their school's Web site. You can also share printers, transfer files, and even play games with each other. And there's more, like one-touch Internet access and

PRESARIO 5600i-450 with Home Phoneline Networking[10]

Intel Pentium II Processor, 450 MHz · 128 MB SyncDRAM expandable to 384 MB · 13.0 GB UltraDMA Hard Drive[1] · 6X DVD ROM Drive[1] · 2X AGP Graphics w/ 8MB SGRAM · Aureal 8820 PCI Audio Card · 1.5Mb Max Digital Modem[1] · JBL Pro Speakers · Digital Creativity Imaging Center[2] · 10 Mbps Ethernet Port, Cable Modem Ready · Home Phoneline Networking[10] for 2 computers** · Microsoft® Featured Home Collection + MS Word · Microsoft Windows®98 · Compaq V720 17" Monitor (15.9" VIA)

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50 free hours on the Net* Plus, these PCs are available with a 1.5Mb Max Digital Modem[1], which works with your 56K dial-up access sources for incredibly fast access right away. As an added bonus, it lets you talk on the phone while you surf. And since it's ADSL and cable modem ready[11], you can tap into those high-speed technologies as soon as they come to your area. Of course, these PCs are loaded with all the other features you'd expect from Compaq. Like Intel® Pentium® II processors, thrilling 3D graphics, DVD or CD-ROM drives, Dolby Digital Surround Sound, and more — all at an incredible value. So now, your family can e-mail, download, and surf in a whole new way: peacefully.

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32X Max CD-ROM Drive[4]	6X DVD-ROM Drive[4]
2X AGP Graphics w/8 MB SGRAM	Diamond Viper 550 AGP w/16 MB SDRAM
Aureal 8820 PCI Audio Card	Aureal 8820 PCI Audio Card
56K ITU V.90 Modem[2]	56K ITU V.90 Modem[2]
JBL Pro Speakers	JBL Pro Premium Speakers w/Subwoofer
10 Mbps Ethernet Port, Cable Modem Ready	10 Mbps Ethernet Port, Cable Modem Ready
Microsoft® Office 97 Small Business Edition	Microsoft Featured Home Collection & MS Word
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Compaq V720 17" Monitor (15.9" VIA)	Compaq V720 17" Monitor (15.9" VIA)
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64 MB SyncDRAM expandable to 128 MB	64 MB SyncDRAM expandable to 128 MB
4.0 GB UltraDMA Hard Drive[1]	4.0 GB UltraDMA Hard Drive[1]
2nd-Generation DVD-ROM Drive[3]	24X Max CD-ROM Drive[3]
256-bit Accelerated Graphics w/2.5 MB VRAM	256-bit Accelerated Graphics w/2.5 MB VRAM
56K ITU V.90 Modem[2]	56K ITU V.90 Modem[2]
Smart Lilon Battery	Smart Lilon Battery
256 KB Integrated "On-chip" cache	256 KB Integrated "On-chip" cache
MS Featured Home Collection & MS Windows98	MS Featured Home Collection
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- Diamond Monster Sound MX300 PCI Audio Card
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- JBL Pro Studio with Dual Subwoofers (160 watts total)
- Digital Creativity Imaging Center[5]
- Home Phoneline Networking[6] for 2 computers**
- 10 Mbps Ethernet Port, Cable Modem Ready
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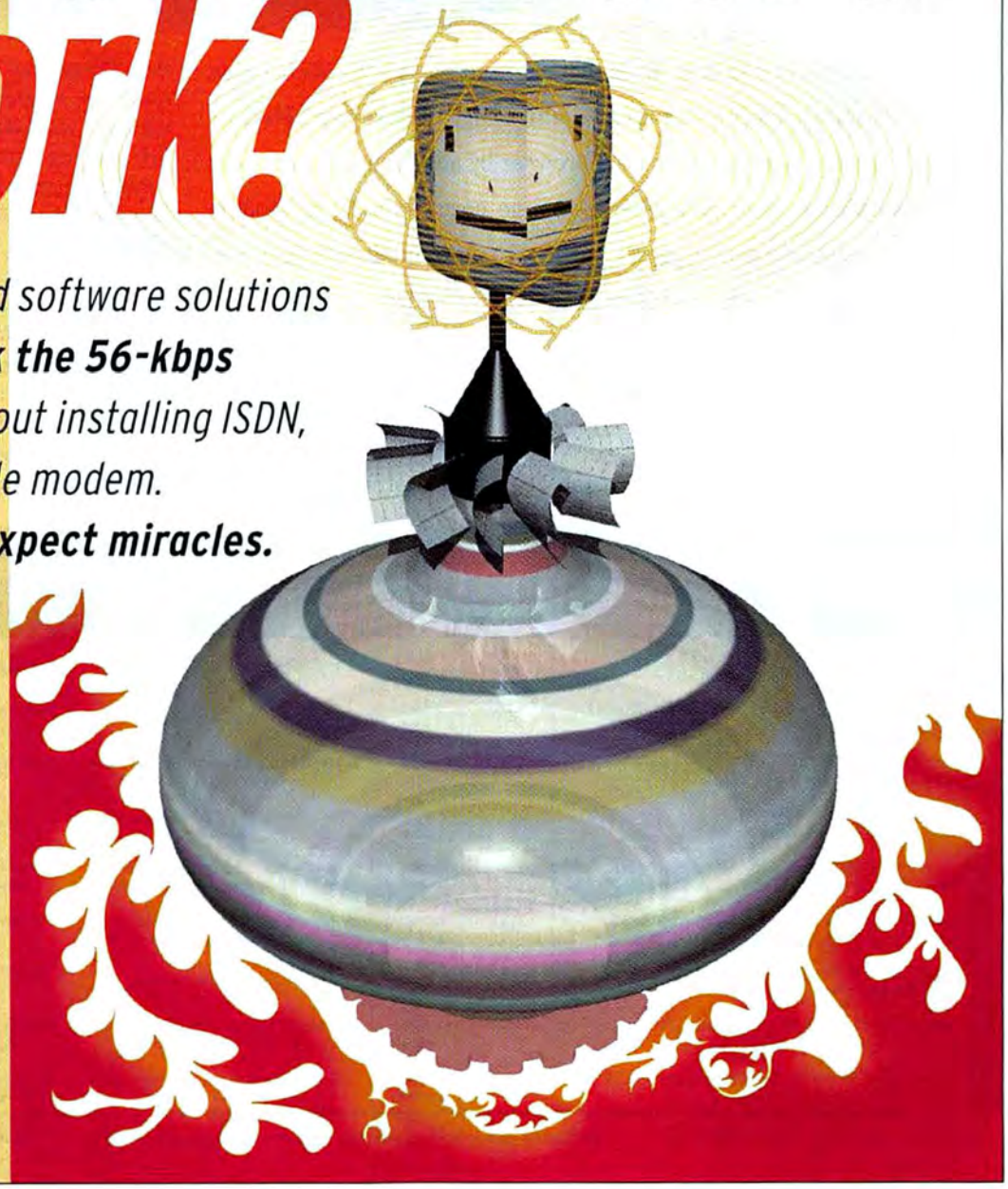
Do Web Accelerators Work?

BY GLENN McDONALD

Hardware and software solutions let you ***break the 56-kbps barrier*** *without installing ISDN, DSL, or a cable modem.* ***Just don't expect miracles.***



Recommended

IF YOUR ISP supports the multilink point-to-point protocol, your best bet for a modem bonder is **Diamond Multimedia's SupraSonic II**. Its $149 price tag includes the cost of two modems, making it an especially attractive package if you're planning to upgrade your current modem. The kit takes the pain out of setting up dual modems, and in our tests it provided excellent performance overall.

BROADBAND technologies such as Asymmetric Digital Subscriber Line, Integrated Services Digital Network, cable modem, and satellite promise superquick Internet access, lightning-fast downloads, and TV-like multimedia, as well as sunshine, flowers, and world peace. But if these aren't available where you live—or they're just too expensive for you—what are your options?

We examined two alternatives that claim to boost your Web access speed without costing you an arm and a leg. Browser accelerators attempt to turbocharge your Web browser by adding a smarter cache and by trying to anticipate where you'll go next on the Web. Modem bonders, as their name suggests, harness a pair of modems to give you a double-barrel pipe to your Internet service provider.

Of the two approaches, modem bonders yielded better results. At best, they may double your Internet access speed. They didn't do that in our tests, but they did improve the loading speed of a typical Web page markedly—in one case, by 67 percent. These gains come at a cost, however: The modem bonders we looked at require two separate modems and phone lines, and you'll also have to pay for two ISP accounts. Those demands generate cumulative costs that fall in the same range as DSL or even ISDN. (See "Bandwidth on Demand," page 108.)

Browser accelerators cost considerably less than modem bonders, because they require no financial investment beyond their modest sticker price; and they work with your existing modem setup. Unfortunately, reports of their efficiency have been greatly exaggerated. We saw far less improvement than we had hoped.

FEATURES COMPARISON

	WEB ACCELERATOR	Street price	Setup/ ease of use	Pros	Cons	PC World InfoNet number
Browser Accelerators	Connectix Surf Express Deluxe 1.5 800/950-5880 www.connectix.com	$39	good/ good	Efficient smart cache, easy setup.	Limits prefetching capabilities.	747
	Kiss Software Speed Surfer Internet Toolbox 4.0 888/768-5477 www.kissco.com	$50	fair/ poor	Adds security features.	Confusing setup, glitchy graphics performance.	748
	PeakSoft PeakJet 2000 2.0 888/377-7325 www.peak.com	$29	good/ good	Good customization features, nice combination of options.	Limits size of prefetched graphics by default.	749
	Web 3000 NetSonic 1.02 * 425/836-3000 www.web3000.com	free [1]	excellent/ excellent	Best combination of accelerator features, easy setup.	Does not prefetch graphics.	750
Modem Bonders	Amquest Modem Comsuite Software (Imass) 888/715-7444 www.amquestmodem.com	[2]	fair/ fair	Free with Amquest modem, quick downloads, doesn't require an ISP with MLPPP support.	Proxy-server problems, FTP support via browser only.	751
	Diamond Multimedia Systems SupraSonic II * 800/468-5846 www.diamondmm.com	$149	excellent/ excellent	Fine overall performance, includes two modems on one card.	Requires that your ISP support MLPPP.	752
	Microsoft Windows 98 Dial-Up Networking 800/426-9400 www.microsoft.com	free [3]	good/ good	Fast, free for Windows 9*x* users.	Requires that your ISP support MLPPP.	753
	MidCore Software MidPoint Teamer 3.11 800/673-6274 www.midcore.com	$49 [3]	fair/ good	Easy setup, quick downloads, doesn't require an ISP with MLPPP support.	No performance gains on standard and icon-heavy pages.	754
	Ragula FatPipe Internet Home Software 3.0 * 800/724-8521 www.ragula.com	$49 [3]	excellent/ excellent	Fine overall performance, doesn't require an ISP with MLPPP support.	Little performance gain on pages with heavy text and graphics.	755

* Recommended [1] $39 for Pro version 2.0. [2] Bundled with Amquest's $69 HyperModem. Requires second modem (not included). [3] Requires two modems (not included).

OF THE FOUR browser accelerators we tested, we liked Web 3000's NetSonic freeware version 1.02 best. In our informal tests, it learned which pages we visited most often and loaded them noticeably faster. Best of all, it's free.

IF YOUR ISP supports only the older point-to-point protocol standard, we think FatPipe Internet Home Software ($49) from Ragula Systems is the top choice. FatPipe is easy to set up, and it loaded our sample home page 67 percent faster than a comparable system using a single modem did.

Browser Accelerators

BOOSTS OR BLUNDERS?

WHEN THEY HIT on all cylinders, browser accelerators make Web pages pop up noticeably faster. But the magnitude of the speed boost you get depends on the accelerator you use and the way you surf the Web. In our formal lab tests involving a static Web site, none of the four accelerators we reviewed yielded any appreciable speed increase; and in some cases, they actually slowed us down. Only in our informal, hands-on tests, conducted over several days, did our surfing speed improve over what we obtained using no browser accelerator at all. The products we tested tended to increase our Web access speed only after learning which sites we repeatedly visited.

HOW THEY WORK

MOST BROWSER accelerators rely on one of two technologies: smart caching or read-ahead browsing. Smart caching first replaces your browser's existing cache and then pulls elements from your hard drive, the Internet, or both to accelerate Web surfing. The best products log the pages you frequent and keep them cached on your hard drive. Ideally, they draw only new content from the Web.

Read-ahead browsing works by prefetching text links (and sometimes graphics) while you're still reading a page. For the most part, read-ahead accelerators grab all the links on the current page, and then dump them into the cache in the background. When you finally get around to clicking a cached link, the destination page should pop up instantly from your hard drive.

How well the process works depends to a large extent on how the software is set up. At their default settings, most browser accelerators prefetch only text, and in some cases they limit the size of the text file. (PeakSoft's PeakJet 2000, for example, restricts prefetched files to 96KB, by default.) These limitations are necessary so that prefetching doesn't overwhelm your hard drive or your modem, especially when you download lots of graphics files. Every product uses a different set of defaults, however, and allows a wide variety of tweaks. Consequently, you'll probably have to tune the accelerator to your style of browsing.

NETSONIC LEADS THE PACK

IN OUR INFORMAL, hands-on testing, NetSonic 1.02 seemed to work fastest, effectively using both read-ahead browsing and smart caching. NetSonic's ▶

TIPS

TOP NET ACCESS

Surf Lean Shield your browser from gyrating french fries, singing bananas, and pop-up ads by turning off Java and JavaScript. In Netscape Navigator 4.*x*, select *Edit•Preferences•Advanced*. Uncheck *Enable Java* and *Enable JavaScript*, and click *OK*. In Internet Explorer 4.*x*, select *View•Internet Options•Advanced* and, under Multimedia, uncheck *Play animations, Play videos,* and *Play sounds,* as desired. Scroll to the Java VM category, uncheck all selections, and click *Apply*. Disabling these scripting languages may limit the interactivity of some Web sites, and you may receive annoying error messages when your browser refuses to run a script.

Skip the Pics Your browser spends most of its online time downloading graphics. For a speed boost, turn off the pictures. In IE 4.*x*, select *View•Internet Options•Advanced* and, under Multimedia, uncheck *Show pictures;* then click *Apply*. Or go to Microsoft's Web site (www.microsoft.com/ie/ie40/powertoys) and download the IE 4.0 PowerToys, which include an Image Toggler to turn images on and off. In Navigator 4.*x*, select *Edit•Preferences•Advanced,* uncheck *Automatically Load Images,* and click *OK*. (In Navigator and IE, you can always right-click on image boxes later to view particular pictures.)

Another option, WRQ's $30 @Guard, strips out banner ads and prevents your browser from opening extraneous windows to display pop-up images. Download a trial copy at www.wrq.com. Or consider using the $35 "low-overhead" Opera browser from Opera Software (www.operasoftware.com). It comes with a camera button so you can easily toggle between surfing with pictures and surfing without.

Clear Junk Off Your Desktop To ensure that your browser won't slow down when it is displaying graphics, close any unnecessary programs that may be running on your PC—especially graphics applications. This tip is particularly helpful if your PC uses an older-model graphics card. ▶

read-ahead browsing technique works best with text-heavy sites that contain relatively few links. We used this function when calling up the latest edition of the Onion (www.theonion.com), a weekly satirical online newspaper. NetSonic downloaded the initial page and then preloaded all of the main page's 15-odd article links. By the time we were ready to click over, the pages were all cached and appeared instantly. (Unlike its peers, NetSonic prefetches only text; there's no option to prefetch graphics.)

Browser accelerators require no financial investment beyond their sticker price.

Two other features recommend NetSonic: We found it by far the easiest browser accelerator to install, and it's the only one we looked at that costs nothing. (A $39 deluxe version, NetSonic Pro, adds a handful of useful improvements, such as graphics prefetching.)

Like NetSonic, Surf Express Deluxe version 1.5 ($39 from Connectix) has an efficient smart-cache system. It loaded pages noticeably faster when we used it to revisit pages it had already cached, and it can cache up to 10MB. But Surf Express lacks prefetching capabilities and can't cache graphics larger than 100KB.

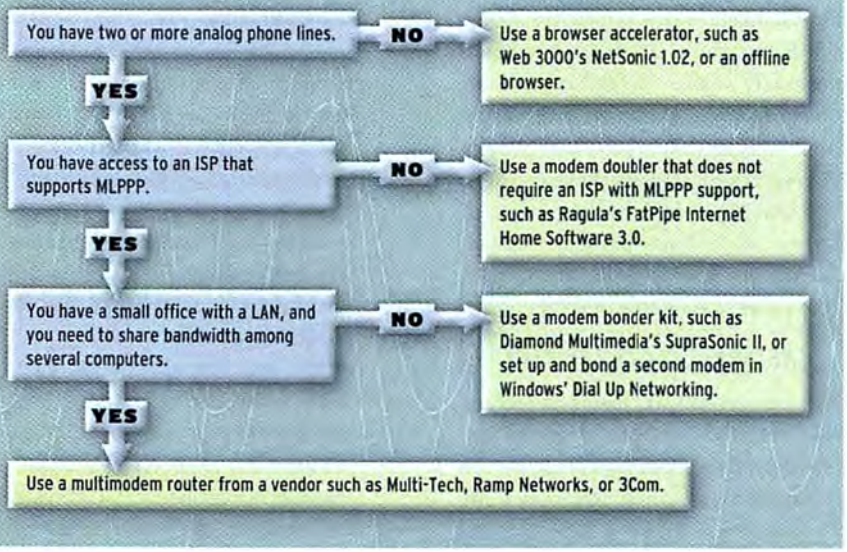
PeakSoft's $29 PeakJet 2000 version 2.0 showed occasional performance gains as well. Like NetSonic, it uses both caching and prefetching. To keep your modem from putting in too much overtime, it limits prefetched files to a default size of only 96KB. It does, however, give you a number of useful options for controlling what it caches.

Kiss Software's $50 Speed Surfer Internet Toolbox version 4.0 was the most difficult accelerator of the bunch to set up, for formal testing (with Navigator 4.5) and informal testing (with Navigator 4.06). In both kinds of testing, the program regularly stumbled over Web page graphics—once substituting a tiny icon for one of our large test graphics—and sometimes skipped them altogether. It hung up the browser on multiple occasions, too. On the other hand, Speed Surfer does offer such desirable Internet security features as anonymous cookies and e-mail encryption.

Our overall take? Browser accelerators work best on text-heavy Internet sites that you revisit frequently. If you go ahead and install one, though, don't plan on achieving huge speed gains. ▶

If You're Stuck With Dial-Up...

Here are four paths to faster browsing.



TOP NET ACCESS TIPS

The Older Browsers May Be Faster On a slower PC, try using an earlier version of your browser, such as a 3.*x* edition of Navigator or Internet Explorer. Older browsers require less memory, so they load (and surf) faster on geriatric PCs. Or download the $35 copy of Opera (see "Skip the Pics," previous page). It runs on PCs as old and weak as a 386SX with 6MB of RAM.

Don't Linger at Home If you're like most people, you use the default setting for your home (or start) page—and that's either Netscape's home page or Microsoft's, depending on which browser you're using. But why waste time loading a Web page you rarely want to visit? Instead, set your home page to a fast-loading site that you visit often. A good candidate: your favorite search engine. In Navigator, select *Edit•Preferences•Navigator.* In IE 4.*x*, select *View•Internet Options•General,* or simply drag and drop the icon next to a URL in the Address field on to IE's Home button.

Be Cache Savvy Your browser uses memory and disk caches to store images and other gewgaws from Web sites you've visited. If your Web surfing consists of going to the same sites day after day, give your browser a roomy disk cache of 12MB or more. If you tend to visit new sites, set up a smaller disk cache that's faster to search and access. Keep in mind, though, that an undersize cache will slow your Web access, since it forces your browser to download the same graphics repeatedly as you surf.

To speed things up, tell your browser to check its disk and memory caches for changes to a Web page only once per session. In Navigator 4.*x*, select *Edit•Preferences*, click the plus sign next to *Advanced*, click *Cache*, customize your caches, and then click *OK*. In Internet Explorer 4.*x*, select *View•Internet Options•General* and, in the Temporary Internet File section, click *Settings* to gain access to the cache settings. Click *OK* when you're done. ▶

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Modem Bonders

TWO IS BETTER THAN ONE

UNLIKE BROWSER accelerators, modem bonders harness the brute force of the modems themselves. They're pricier than browser accelerators because they require two modems, two phone lines, and two separate ISP accounts.

But at least the bonders deliver what you pay for. With two 56-kbps modems working together, you can realize combined throughput rates upwards of 90 kbps. (Despite marketing claims, the promised land of 112-kbps access is still a dream, since even 56-kbps modems seldom hit their maximum potential.)

Modem bonders require two modems, two phone lines, and two ISP accounts.

Two modem bonders we tested (Diamond Multimedia's $149 Suprasonic II software and hardware kit, and the free Windows 98 Dial-Up Networking) took advantage of the multilink point-to-point protocol, or MLPPP, the Multilink option built into Windows 98's Dial-Up Networking. Both delivered smooth, fast performance, loading a static version of PC World Online's home page up to 62 percent faster. Unfortunately, these modem bonders require that your ISP support MLPPP—a potential problem if you use a national provider. Among the few national ISPs that currently support MLPPP: Netcom (recently purchased by Mindspring) and A+Net. Several regional and local providers support it, however.

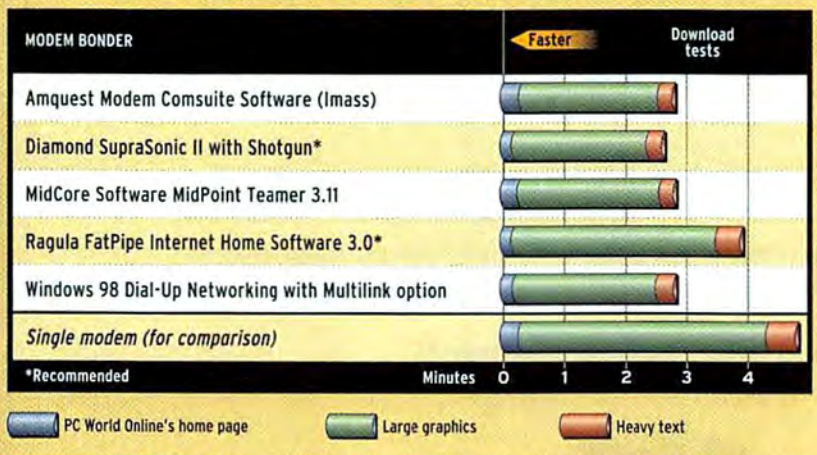
The second type of modem bonder relies on the older point-to-point protocol, which all ISPs support. PPP has one other advantage over MLPPP: Though you still need two accounts, they can be with different ISPs—very handy if one service temporarily goes down. We tested three PPP-based modem bonders for this review: the Imass portion of Amquest's $69 Comsuite Software, MidCore Software's $49 MidPoint Teamer version 3.11, and Ragula Software's $49 FatPipe Internet Home Software version 3.0.

In our tests, bonded modems using Imass and MidPoint Teamer showed virtually no speedup versus a single-modem connection when loading the static version of PC World Online's home page. But they accelerated downloads of big ▶

TEST REPORT

Modem Bonders Pick Up the Pace

Diamond SupraSonic II offers the best overall download time.



TEST PC WORLD CENTER **HOW WE TEST** Working with Netscape Navigator 4.5, we timed Web page loading and file transfers under Windows 98 on a Quantex QP6/350 M-2x Pentium II-350 desktop with 64MB of RAM, a 512KB secondary cache, and an 8.6GB hard drive. 3Com provided us with U.S. Robotics 56K V.90 Faxmodems (model 5687).

TIPS

TOP NET ACCESS

Incidentally, putting the cache into a virtual or compressed drive often forces the browser to run in low gear if you do not have enough memory, so avoid doing this unless you have a lot of spare memory (at least 32MB of total system memory). Defragmenting your hard drive every few weeks also helps speed up your browser's disk access.

Accept Cookies From Strangers As tempted as you may be to deploy a so-called cookie crusher to block Web sites from slipping cookies to your browser, forbear. Cookies aren't all bad. They allow Web sites to jump you past irrelevant material to areas you're interested in. And if you instruct your browser not to gulp down cookies as you surf, you may be bombarded by an annoying stream of messages whenever a Web site pops up with a cookie. Navigator 4.*x* permits you to 'Accept only cookies that get sent back to the originating server.' To set this option, select *Edit•Preferences•Advanced.* Thereafter, Navigator won't send any cookie from your machine to a server other than the one that originally sent it. Thus, for instance, if your ordering information for a Web shopping site happens to be stored in a cookie, Navigator will send it only to the original shopping site.

Upgrade to V.90 If your ISP supports the V.90 spec, you'll enjoy higher-speed connections after upgrading your K56flex or x2 modem to this new standard. Go to the modem manufacturer's Web site for information—and with luck, a free firmware upgrade, too. And while you're there, check to see whether you will need a new modem-initialization string. You can peruse a list of ISPs that support V.90 at www.k56flex.com/isprt.html.

Accelerate Your Port If you have an external modem, make sure your communications port is talking as fast as the modem can listen. In Windows 9*x*, select *Start•Settings•Control Panel•Modems.* Select your modem, select *Properties,* and use the drop-down box to adjust the maximum ▶

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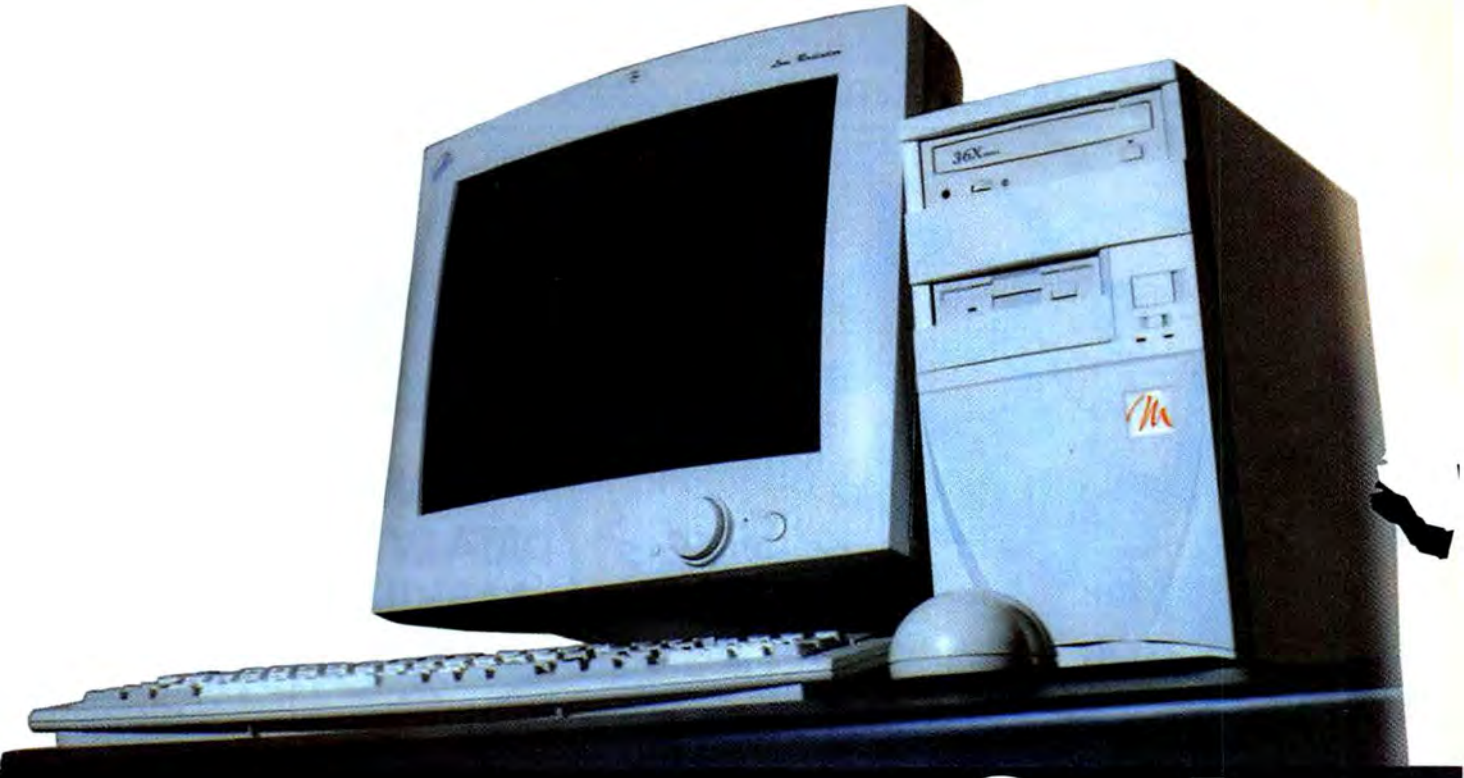

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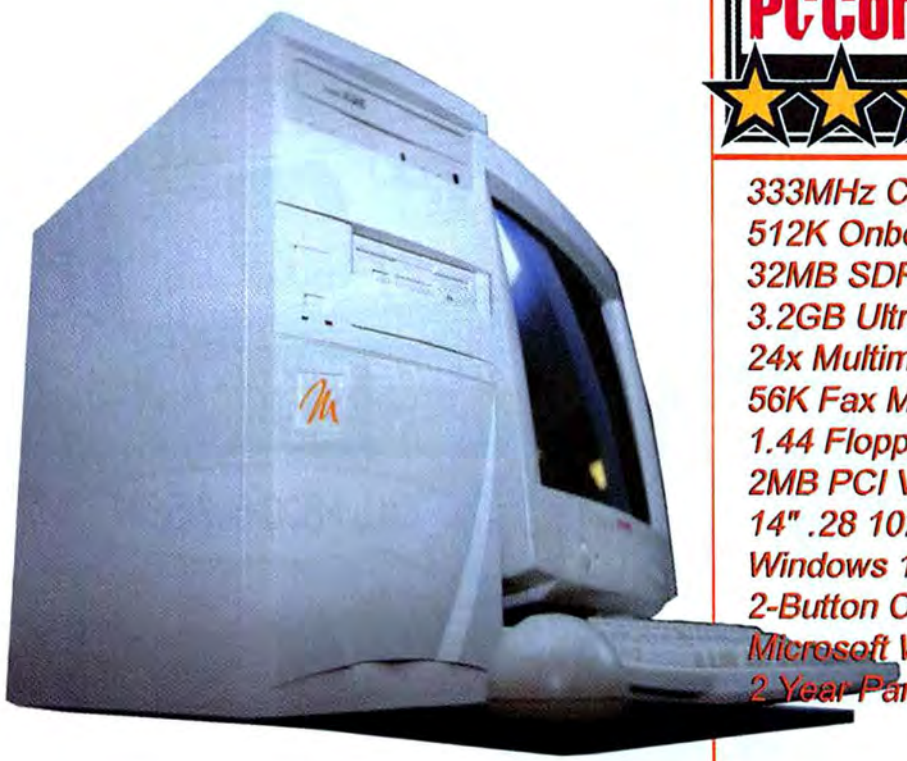

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graphics (four files totaling 1.1MB) and text (a 172KB file) by at least 70 percent.

FatPipe, on the other hand, produced healthy performance boosts across the board. Though less impressive than Imass or MidPoint on large graphics and text files (offering a modest 21 percent enhancement), FatPipe matched the MLPPP-based products' record of accelerating the download time of *PC World*'s Web site by 67 percent versus a single modem. And the configuration process was as painless as Diamond's setup.

THE MLPPP GOTCHA

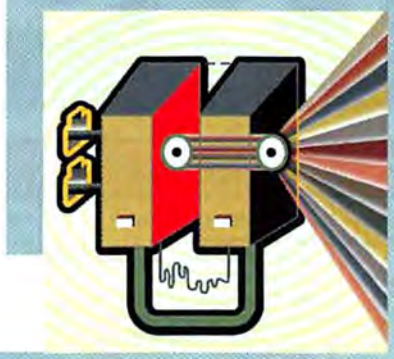
IF YOUR ISP does support MLPPP—and that's a big "if"—Diamond Multimedia's $149 SupraSonic II modem kit with Shotgun technology, or Windows 98's Multilink option, is the way to go. Windows 95 users can get into the act, too, by downloading the free Dial Up Networking 1.3 for Windows 95; to obtain a copy, go to www.microsoft.com and instruct the site's search engine to find "Dial Up Networking 1.3."

Diamond Multimedia's Web site (www.diamondmm.com/shotgun) lists ISPs that support MLPPP. Most of these providers are regional and local companies.

In our tests, both of these MLPPP-based bonders demonstrated significant performance boosts across the board compared with Web surfing on a single modem line. Most impressively, they increased the download speed of large graphics files by 70 to 80 percent.

Diamond's Shotgun Technology software, part of the SupraSonic II kit, is available as a free download to current users of any 56-kbps Diamond SupraExpress modem. (At least one of the two modems you're using must be a SupraExpress. We tested the SupraSonic II's performance using its pair of included modems.) The SupraSonic version of Shotgun adds a voice-priority feature that senses incoming telephone calls or fax transmissions and allows them to ring through on your second phone line.

With a free Windows option available, does it pay to buy the$149 Diamond kit? If you don't already have a 56-kbps modem or don't want to fuss with ▶



Faster for Free

Does the modem installed on your PC connect to an ISP that supports the multilink point-to-point protocol? If so, Windows 98's Dial-Up Networking lets you connect and bond a second modem:

1] Install the second modem according to the manufacturer's instructions. (Note: You can work with modems of different models, but installing modems that use identical chip sets yields better results.)

2] Go to Windows 98's My Computer, double-click *Dial-Up Networking*, right-click the icon for your ISP connection, and select *Properties*. (If Dial-Up Networking is missing, you may have to reinstall it from your Windows CD-ROM.)

3] From the Multilink tab, click *Use additional devices*, then click *Add*. In the Edit Extra Device dialog box, select the device you want to add to the connection, and then click *OK*.

4] Select *Multilink* tab again, and pick *Use additional devices*. At the bottom of the window, choose *Add*.

5] From the Device Name drop-down list in the Edit Extra Device Dialog Box, select your second modem. Once the ISP phone number appears, click *OK*.

6] Dial away. You can use the same icon that's located in Dial-Up Networking to access both modems, connecting each sequentially. –Michelle Campanale

TOP NET ACCESS TIPS

speed to 115200 (for a 56-kbps modem; you can set ISDN and faster modems to higher speeds). Next, go to the Connection tab, choose *Advanced*, make sure that hardware flow control is enabled, and then click *OK*. Click *Port Settings* and nudge the sliders up a bit to increase the send and receive ports' speed. Click *OK*.

Buy a Faster Port If you have an external 56-kbps or ISDN modem, consider buying a hot-rod serial card to replace your outmoded 16550-compatible UART chip (whose top speed is 115 kbps). High-speed serial cards with a 16650 or 16750 chip can attain speeds of up to 460 kbps–essential for optimal ISDN performance. Lava Computer (www.lavalink.com) and Pacific CommWare (www.pacificcommware.com) both sell a variety of such cards, which typically cost around $100.

Find Your Modem's Real Speed Want to know how your modem is *really* performing? Download a large compressed file from your Internet service provider's FTP (for File Transfer Protocol) server. Why from your ISP's server? Because the connection will be swifter than if your modem has to communicate with another server over the Net–and the protocol is faster, too. Use FTP software like the $35 CuteFTP (www.cuteftp.com).

FTP software will make a faster connection to your ISP than your browser will. If your FTP program displays the transfer rate in kilobytes per second, multiply that number by 10 to identify the kilobits-per-second rate that the modem is gauged at. Perform this test late at night or early in the morning, when your ISP is least likely to experience a slowdown on its server. For more detailed information about your modem's performance on the Net, get a copy of VitalSigns Software's $30 Net.Medic (www.vitalsigns.com, 888/984-8259). Net.Medic tells you where the slowdowns are occurring–whether the culprit is your modem, your ISP, or the Web sites you're visiting. ▶

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Windows' Dial-Up Networking, Diamond does the dirty work for you—and the $149 price tag also covers a matched pair of modems. Plus, the two modems on one board take up only one ISA slot. If you aren't daunted by Dial-Up Networking, buy one modem and use the built-in Windows 98 Multilink option.

Modem bonding won't answer all your prayers, but it offers a viable alternative to ISDN. And it beats waiting until cable or DSL come to your town.

Glenn McDonald is a freelance writer based in San Francisco. Michelle Campanale is an associate editor for PC World. Tom Yager is a freelance writer based in Texas. PC World Test Center analyst Elliott Kirschling was the test leader for this project, and PC World Test Center analysts Alex Jorge, Jeff Kuta, Mike Salayko, and Chris Patterson contributed to the testing. ■

Got LAN?

Multimodem routers—such as Multi-Tech Systems' ProxyServer, Ramp Networks' WebRamp 300e, and 3Com's OfficeConnect Remote Dual Analog Router—fill an important niche for computer users on a small LAN. These routers allow sharing of two or more bonded modems at close to double speed, for people who can't obtain or can't afford ISDN, cable, or other high-bandwidth technologies. In addition, they enable multiple users to share Internet access accounts.

MORE MODEMS, MORE SPEED

The Multi-Tech ProxyServer has three built-in K56flex modems; 3Com's OfficeConnect includes two built-in x2 units. The WebRamp 300e can support up to three external modems of your choice, though it doesn't come bundled with any. Of course, for each modem you plan to use in any of these systems, you'll need a corresponding phone line, as well as an ISP that has multimodem support—all of which will jack up your monthly costs.

Multi-Tech's $699 ProxyServer installed easily once we connected it to the PC's serial port. The software walked us through key configuration steps at installation time. The friendly interface should make implementing future changes fairly easy.

The WebRamp 300e, at a list price of $499, combines the functions of a router and a network hub, linking to up to four computers. With its external modem ports (modems are not included), the WebRamp is the only device we examined that has no preference for V.90, K56flex, or x2: Just make sure to buy modems that meet the standard your ISP uses. The WebRamp's capabilities roughly matched those of the ProxyServer—minus the dial-in support. But it added DNS (domain name service), which permits dynamic IP addressing, and it included browser-based configuration and automatic setup for Windows clients. Ramp Networks' COLT (Connection Optimated Link Technology) leverages the PPP protocol to allow users to employ different ISPs to connect each of the modems.

3COM'S OfficeConnect Remote Dual Analog Router (about $745) was also easy to configure. But unlike ProxyServer and WebRamp, it was short on built-in services.

We give our nod to the WebRamp 300e. It meets virtually all Internet routing requirements for small or home offices, and sets up in just a few minutes. Most important, it is simple to expand—so you won't pay for modems you don't use. The best course may be to get the WebRamp 300e with one modem now, and expand it later as you add more phone lines. **–Tom Yager**

TIPS

TOP NET ACCESS

@ Remove Unrelated Wires Does your modem share the jack with a fax or an answering machine? Noise from devices near your modem may be hobbling its connection. Plug the modem cord directly into the jack. If you use a double jack, disconnect any devices plugged into the second jack. Remove any cordless phones. Unplug the part of the phone that plugs into the jack.

@ Track Line Noise They sound good in a cereal bowl, but crackles or pops on your phone line interfere with your modem connection. To check this out, pick up the phone's handset, press a single number on the keypad, and then listen for noise pollution. If you hear static or other noise, plug the phone into another jack and repeat the test. If the phone sounds fine from that jack, the source of the noise is a bad phone cord, a loose connection in the first jack, a faulty wire between the first jack and your home's network connection box, or a loose connection at the network box. Try a new phone cord first, because this is the most common culprit and the solution is so simple.

If you hear noise when the phone is plugged into the second jack, too, the problem may be a bad connection between your house and the phone company. Try repeating the noise test at a neighbor's home or at your office before you call the phone company.

If you do have to call your phone company, ask to speak to a "data specialist." If the company uses a digital exchange, ask whether the automatic gain control is turned off, and request that the technician set your line setting to position 5. Also have the company trace your phone line's signal strength and quality through each of its central offices.

@ Multiplexed Phone Line If you have two phone lines (one for voice, and one for the modem), ask your phone company to connect two separate lines to your house, rather than splitting a single line in two. Splitting one line cuts its bandwidth in half, inviting modem connection problems. ■

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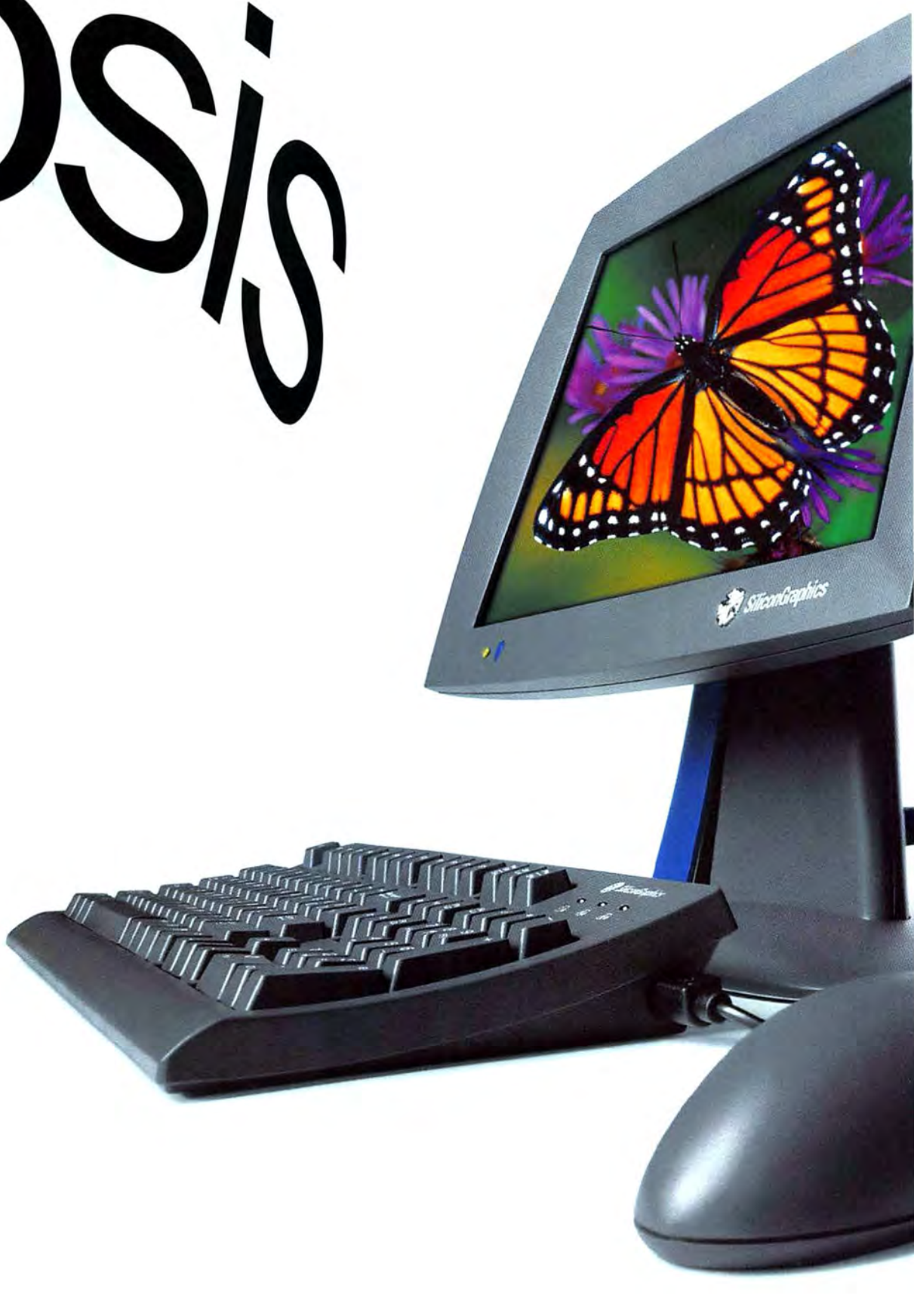

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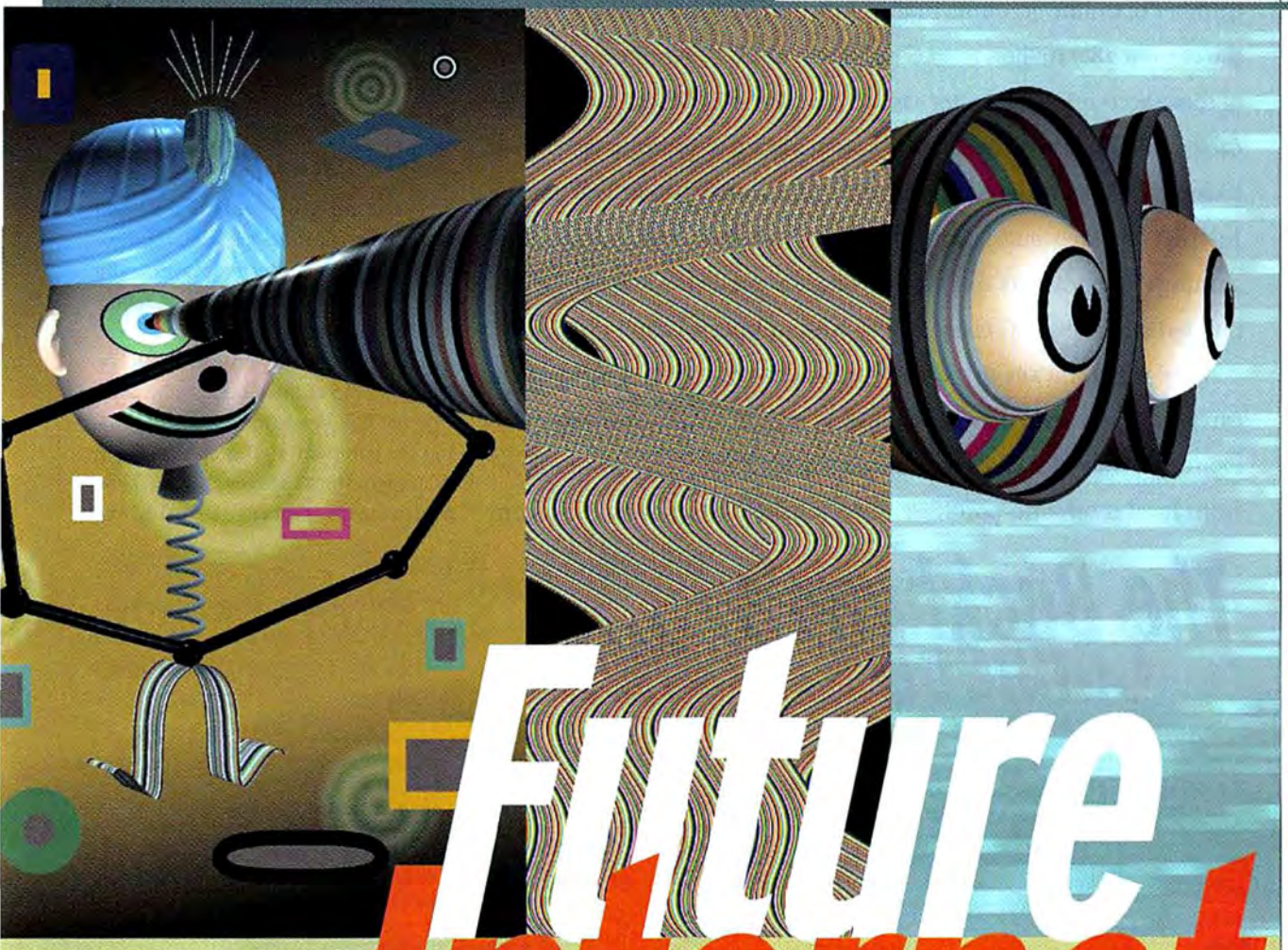


Future Internet

With millions *of new users going online, how will the Internet keep up? By building ultrafast digital backbones and deploying lightning-quick technologies to handle the crush.*

BY ANGELA NAVARRETE

THE INTERNET'S ABOUT TO CRASH.

Sure, you've heard that dire prediction before, and it didn't come true. But over the next three years, the Net could face a critical shortage of bandwidth. It all begins with millions of new users flocking to the Net. According to Forrester Research, the number of online accounts in the United States alone will grow from the current 28.7 million to 77.6 million in 2002. A significant number of those accounts—Forrester says 16 million—will access the Net over cable or DSL connections that are potentially up to 50 times faster than today's 56-kbps modems. At the same time, many people will use the Internet for videoconferencing, telephony, telecommuting, and online gaming—applications that not only are ravenous for raw bandwidth but demand a level of reliability the present Internet can't provide.

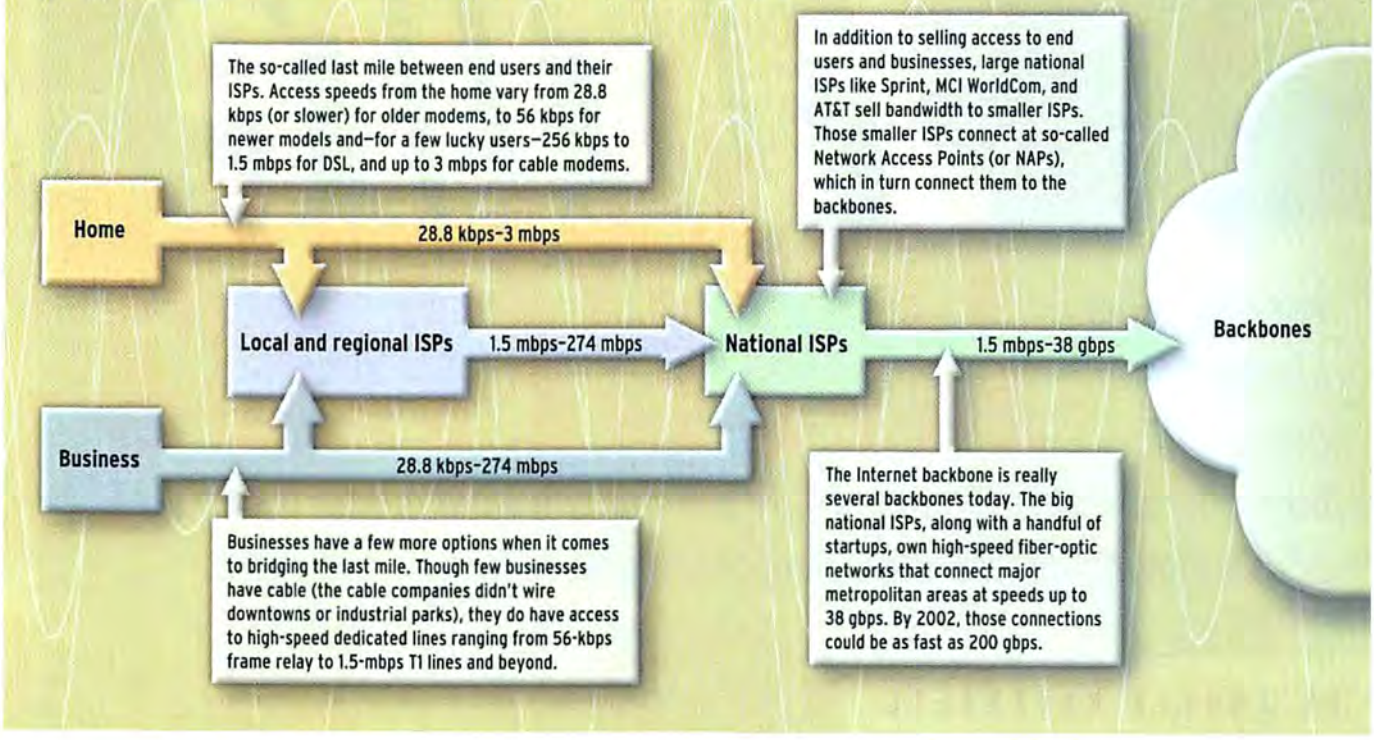
All of which means that three years from now the Net will have to carry way more data than it does today, and do so more reliably. This looming bandwidth crisis has the folks who run the Internet in a tizzy, from local mom-and-pop ISPs to established international telecom giants like Sprint. Players at every level of the Net are frantically scrambling to make the network, from the home desktop to the local ISP to the backbones that tie it all together, faster and more versatile. That costs money, and many of today's ISPs could be priced out of the game. Which is why three years from now, your Internet connection could be faster, your monthly Internet bills higher, and your choice of service providers more limited.

THE LAST MILE

SO WHAT DO YOU NEED all the bandwidth for? Ask ISPs, telephone companies, and other Internet players, and they'll describe a typical night at home, circa 2002: Pop's in the living room, videoconferencing via laptop with his broker; while the two of them discuss the latest Internet IPO, he's simultaneously browsing the company's 3D-graphics–laden Web page. Mom's telecommuting in the den, using her company's virtual private

The Backbone's Connected to the...

You dial in to your ISP...but what happens to your data then? More important, if you get DSL, will your ISP be able to keep up? Here's how the pieces of the Internet connect.



network and virtual Centrex. Upstairs, junior's playing Quake XXII online, complete with real-time audio heckling. And everyone else on their block is doing the same thing at the same time.

You can't very well do any of that today, largely because of the bottleneck between you and your ISP—the so-called last mile. While business users have a variety of broadband options, including T1 lines and other dedicated, high-speed connections, home users aren't so lucky: They're limited by the modem sitting on their desk. Not many home users have switched to ISDN (300,000 in the United States, according to Forrester), and at 56 kbps, today's modems are going about as fast as today's phone lines will let them.

Which is why everyone's so excited about cable and DSL, the two technologies vying to replace traditional modem connections for home users (see "Bandwidth on Demand," page 108). Current cable connections can manage speeds up to 3 mbps, and that's likely to still be the case three years from now. Most DSL implementations run between 256 kbps and 1.5 mbps—and analysts say that's what most users will get for the next three years as well.

THE NEXT STRETCH

BUT OTHER options are on the way. In mid-1999, for example, Sprint will start rolling out its Integrated On-demand Network, or ION, which will deliver voice, video, and data at speeds up to 620 mbps. By the end of the year, businesses and consumers alike should be able to purchase an ION Integrated Service Hub at a retail store for $200 to $300, about the cost of a DSL or cable modem today. The box will be wired into your phone jack and attached to an ethernet card in your PC. Then, for prices starting around $100 a month, you'll have a persistent high-speed Internet connection, videoconferencing, local calling with Caller ID, virtually unlimited long-distance calling, and service and support from Sprint. That's not to say you'll always get all the bandwidth you pay for: Sprint admits that whenever you leave the ION network—which means anytime you ask for data from a server that's not on Sprint's network—you'll slow down.

Two other companies, Virginia-based Teligent and New York–based Winstar, plan to traverse the last mile using wireless radio frequencies instead of congested copper lines. Voice or data would be transmitted from a dish on your roof the size of a dinner plate to a central office, which would then transmit the information to your ISP. Designed primarily for urban areas, this arrangement could be a lot cheaper than digging up the streets to lay fiber, and it would let businesses take full advantage of Net connection speeds of up to 622 mbps.

Winstar recently announced plans to expand from 30 to 60 U.S. markets between now and the end of 2000. Teligent, which will target small and midsize businesses in urban and suburban areas, entered its first 15 markets in 1998, including Chicago, Denver, Los Angeles, and Washington, D.C. The company expects to add 25 more before the end of this year.

"A meteor could hit this country and bounce right off, there's so much fiber under the ground."

Jim Southworth, Concentric Network

THE FUTURE OF ISPS

AS END USERS and businesses move up to faster connections, the bottleneck will shift from the desktop to the ISP.

The first problem is technical. If everyone with access to 1-mbps DSL signed up for the service, the Net infrastructure would probably be able to handle it, says Jim Southworth, director of advanced services and technology at Concentric Network. "But none of us today can sustain or support 7-megabit DSL to the home. And 20- to 25-megabit DSL will be available in a couple of years. The network will die, it will melt down, it won't handle it."

The second problem is economic. Let's say you get one of those superfast DSL services and want to view some full-motion video—which soaks up about 6 mbps—over the Net. Now let's say six of your neighbors decide to do the same thing. Right now, an ISP would have to pay $35,000 to $40,000 per month for a pipe big enough to handle all that data—hardly a viable business mod- ▶

PHOTOGRAPH: BOB HOLMGREN

el. Says Southworth, "DSL is going to kill the little ISP if he continues to function as he's functioning today."

As a result, it's likely we'll start seeing a hierarchy among ISPs. So-called tier-one ISPs—the Sprints, AT&Ts, and others who have direct access to their own backbones—will offer customers a performance advantage. "If you're connected through a tier-one ISP going to a tier-one server," says Sid Overbey, vice president of switched access and internet services at IBM, "you're going to see fantastic response time."

These same tier-one ISPs will likely position themselves as one-stop communications shops, bundling voice and data services in one handy package. For customers, the advantage would be a single monthly bill and a single number to call if any of their communications services went down. The downside: If that one company had a problem, customers could find themselves completely incommunicado.

Smaller ISPs that must rent backbone access from the tier-one companies could have a hard time keeping up. "There will certainly be a shakeout among ISPs that don't have their own backbones," says IBM's Overbey. Jim Southworth of Concentric agrees: "There are roughly 5000 ISPs in the U.S. Within the next 18 months, that number could drop by half." To survive, says Overbey, smaller ISPs will have to focus on selling value-added services such as superior customer support and Web hosting to businesses.

ACHING BACKBONE

SO WHAT HAPPENS when millions of users connected to thousands of ISPs start exchanging ever-larger streams of data? That prospect has the folks who own the Internet backbone more than a little worried.

Internet backbone is a bit of a misnomer—it's really *backbones* these days. Originally, there was just one backbone, administered by the National Science Foundation, connecting major research centers around the country at 56 kbps. But since 1995, that simple anatomy has given way to several separate backbones—thousands of miles of extremely-high-bandwidth fiber-optic cable owned by the likes of Sprint, GTE, IBM, and MCI WorldCom, connecting major metropolitan areas all over the country. These tier-one ISPs then sell backbone access to smaller ISPs, which then sell it to yet smaller ISPs, and so on down the Internet food chain.

Right now, there's plenty of fiber. "A meteor could hit this country and bounce right off, there's so much fiber under the ground," jokes Jim Southworth. And these backbones have so much bandwidth that a lot of it is currently "dark," or unused. But what will happen when those projected 16 million cable and DSL users start swapping as much data as their fat little pipes can carry? Suddenly the fiber will light up like a Christmas tree.

That's why the backbones' current proprietors are constantly upgrading, and working on ways to milk more bandwidth from their existing fiber. The fastest backbones in use today are OC-12 lines, which transmit data at 622 mbps, but Sprint recently announced plans to upgrade to OC-48—2.5 gigabits per second. "To be an Internet backbone player in a few years," says Dataquest analyst John Coons, "you'll have to run OC-48."

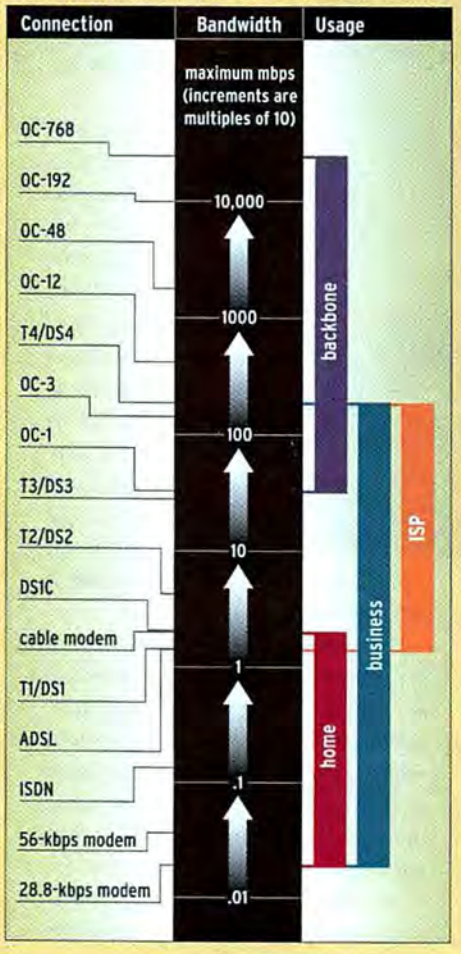
A bunch of aggressive new players want in on the backbone business. Take Qwest Communications. The Denver-based communications company is laying approximately 18,500 miles of Macro Capacity Fiber Network, an all-digital backbone that will connect over 130 cities by this March. Qwest plans to sell access to its network directly to businesses, offering them speedier Internet access, integrated phone and data service, and (it claims) lower costs.

But what about outlying parts of the country—and, for that matter, the rest of the world—that don't have easy access to this speedy fiber? The backbones connect major cities, bypassing rural areas altogether. And the undersea cables that connect continents can't keep up with today's network speeds.

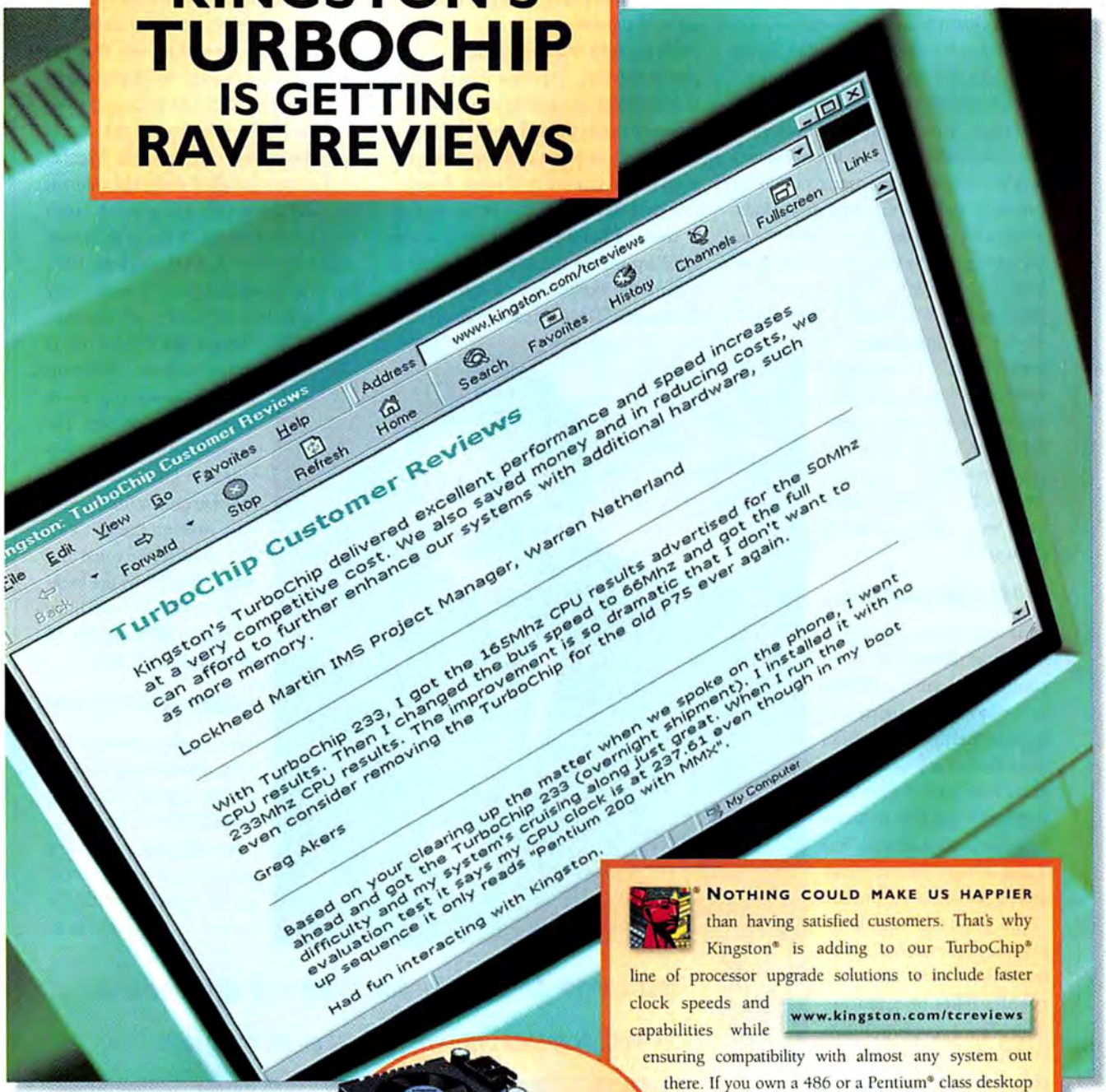
Again, the answer could be in the air. Washington, D.C.–based Teledesic, for example, is currently constructing a network of 288 satellites to connect remote ISPs that can't physically (or fiscally) connect to the fiber backbone. When the satellite network is completed in ▶

How Fast Is Your Pipe?

How fast is a cable modem compared to that old 28-kbps box? Here's how a number of different line types and connections stack up today and for the next few years.



KINGSTON'S TURBOCHIP IS GETTING RAVE REVIEWS



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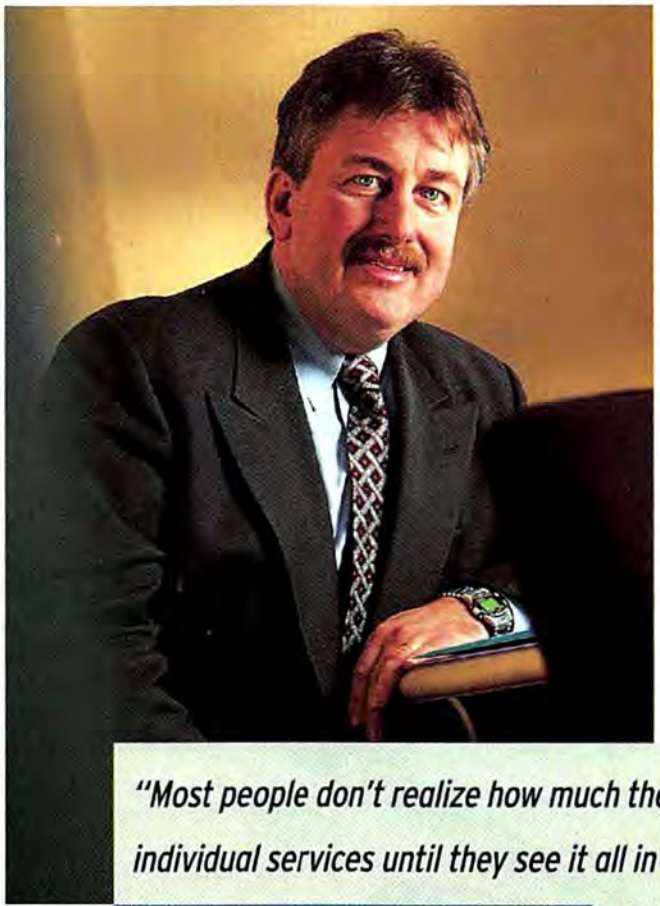
2003, an ISP in, say, Medicine Hat, Wyoming, that contracts with Teledesic could connect a small, externally mounted antenna to its servers. The dish would send the ISP's data up to one of the satellites (in low earth orbits to minimize signal delay), which would then relay the data back down to a backbone access point. Two-way connections should hit speeds of up to 64 mbps for downloads, 2 mbps for uploads. That may not be so hot compared to the rates of the U.S. backbone, but it would be a great improvement for an ISP in New Delhi whose maximum speed is now 8 mbps. "We're a niche technology—we're not looking to take away the market for fiber," says Teledesic president Russell Daggatt. "But we'll be the only broadband technology for most of the world."



ONE-STOP SHOPPING

YOU MAY HAVE noticed a common thread: All these companies, from the ISPs up to the backbone proprietors, assume that three years from now, the Net will carry more than just e-mail and Web pages; it'll regularly transmit voice and video as well. But doing so requires more than adding just lots of bandwidth.

The plain old telephone system that enables you to talk to Aunt Mabel across the country relies on a process called *circuit switching*. When you dial out, the phone company establishes a dedicated circuit between you and Aunt Mabel for the duration of the call, ensuring that the data—sounds translated into modulating electromagnetic waves—all reaches its destination in one piece and in the correct order, so that Mabel hears your sentences exactly as you speak them. But circuit switching is also an inefficient use of the wire, because the circuit is held open for the duration of the call whether you're talking or not.

By contrast, networks like the Internet use *packet switching*, which breaks data up into packets of various sizes and sends them by whichever route has available bandwidth. These packets are then reassembled at their destination. It's more efficient than circuit switching, because if no data's coming down the pipe, no circuits are held open. Because data packets traverse the Net by whatever route is handiest, an e-mail you're sending across the state could travel around the world before it arrived at its destination. The data packets don't have to travel the same route or arrive in the right order. As long as they all get there eventually, everyone's happy.

So what happens when you try to send voice and video over the Net? You can't very well watch a movie or hold an intelligible conversation unless the packets get back and forth quickly and in the right order. As Jim Southworth puts it, "In the classic Internet model, packets could bounce from server to server and nobody would care. Real-time apps like video and voice require fewer hops."

That's where Asynchronous Transfer Mode comes in handy. ATM technology helps real-time data like voice and video traverse a packet network. First, it cuts data into uniform, 53-byte cells. Specialized routers installed along the Internet can pass these cells along much faster than it can normal IP packets, whose sizes vary. Second, ATM alters the Net's hopping-from-computer-to-computer routing system. As Southworth explains, "Even if [an ATM route] is made of many different components, it appears to the system as one hop." The upshot: ATM enables providers to guarantee transmission quality from end to end, making the Net a viable vehicle for voice and video. That's why the backbones' owners are busy installing ATM routers all along their fiber lines.

FUTURE OF THE FUTURE

NEW CABLE, wireless, satellite, and routing technologies are only the beginning of the future for the Net.

For example, a select few universities and government agencies, with the help of 13 corporate partners (including Cisco, MCI, Nortel, and Qwest), are building a new Internet, dubbed (cleverly enough) Internet2. This second network will run over two backbones: Qwest's and the Very High Speed Backbone Network Service (or VBNS), a noncommercial backbone run by MCI WorldCom and the National Science Foundation—and connect to those universities and agencies at *gigapops*— ▶

> ***"Most people don't realize how much they pay for these individual services until they see it all in one place."***
>
> **Bob Hafner,** Gartner Group

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The catch: Internet2 will connect only academic and government users. The rest of us will benefit indirectly, though, as high-bandwidth Internet2 applications trickle down. "You'll see greatly improved multimedia and videoconferencing," says Vab Goel, Qwest's director of IP network engineering. For example, Internet2 engineers are developing techniques for tagging voice data packets so they get a higher priority as they pass over the network.

Another promising development is coming from a branch of physics called photonics. Right now, information travels down fiber-optic cables in the form of laser-generated light. Photonics studies ways of manipulating those light waves to increase fiber's transmission capabilities. One photonics scheme, Dense Wave Division Multiplexing (DWDM), sends multiple frequencies of light down the same fiber at the same time. Sprint's Mike Grubbs estimates that DWDM has already increased his company's fiber capacity by a factor of 32. "In the next few years," he says, "we hope to increase that to 100-fold or more." The cable ISP @Home recently signed a deal with AT&T to use the latter's DWDM-based backbone to carry its data traffic.

SilkRoad, a San Diego–based telecommunications and consulting company, has patented another photonics technology dubbed Refractive Synchronization Communication, which has demonstrated data transfer rates of 200 gbps over 200 miles, without signal amplification, on a single wavelength of light; the fastest fiber in use today maxes out at 40 gbps. SilkRoad says that it's negotiating with local telephone companies and large carriers that could roll out RSC technology by this summer. By fall it expects to offer local area network RSC-enabled hubs and switches for use by businesses and homes that have fiber connections. Some analysts predict that the entire Internet backbone will be using photonics of some sort within the next five years.

As one segment of the Internet accelerates, other segments must scramble to keep up.

PASS THE BOTTLENECK

WHAT YOU'VE GOT, then, is a game of musical bottlenecks: As one segment of the Net accelerates, the others must scramble to keep up. Right now, the bottleneck is at the desktop. As cable and DSL roll out, ISPs and backbone providers will have to speed up their segments to accommodate the new traffic. In the words of Technology Futures analyst Larry Vanston, "We'll be chasing around bottlenecks for the rest of our lives."

The question is, who's going to pay for the chase? Not surprisingly, the consensus among industry observers is that *you*, the end user, will—but nobody wants to say how much. Vendors will likely try a variety of price points for broadband connections before the market settles the issue. It's probably safe to say you won't get that multimegabit-per-second connection for $19.95 a month. If users start buying all their communications services from a single company, a national case of sticker shock could ensue. "Most people don't realize how much they pay for these individual services," says Bob Hafner, Gartner Group vice president and research director, "until they see it all in one place."

You may not mind paying the price if the Internet's taking care of all your communications needs. Just pray it doesn't crash.

Angela Navarrete is an associate editor for PC World. ■

Bandwidth Bestiary

Networking is rife with gobbledygook. Here are some of the key concepts, in plain English.

- **ATM:** Asynchronous Transfer Mode, a network technology supporting fast transfers of data, voice, and video.
- **Backbone:** The thousands of miles of extremely-high-bandwidth fiber-optic cable connecting major metropolitan areas.
- **Bandwidth:** The amount of data, usually expressed in megabits per second, an electronic line can transmit.
- **Broadband:** Describes high-bandwidth services such as DSL and cable.
- **Circuit switching:** How the plain old telephone system (POTS) works: The phone company establishes a dedicated circuit across its lines from caller to callee.
- **DSL:** Digital Subscriber Line, a technology that allows for high-speed data communications (starting at 144 kbps) over regular copper phone lines.
- **Internet2:** A new Internet, available only to government and academic users, optimized to carry multimedia as well as data.
- **IP:** Internet Protocol, the "IP" in TCP/IP. The set of rules and standards that govern how packets of data are sent and received over the Internet.
- **Packet switching:** How most data networks work. Data is divided into packets, with the destination computer's network address appended to each. Hardware along the network examines these addresses and forwards the packets accordingly.
- **Router:** The hardware that ties the Internet together, routers forward packets from one network to another.

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- *NEW* 17" (16.0" viewable, .26dp) M780 Monitor
- 8MB ATI 3D AGP Graphics
- 32X Max[Δ] Variable CD-ROM Drive
- Intel 10/100 Ethernet Controller

★ *3Com USRobotics V.90π PCI Telephony WinModem, add $49.*

★ *Iomega Zip 100MB Internal Drive with Two Cartridges, add $99.*

★ *Upgrade to MS® Windows NT® Workstation 4.0, add $99.*

$1299

Business Lease[◊]: $49/Mo., 36 Mos.

E•VALUE CODE: 03605-590212

COMMON FEATURES FOR ALL SYSTEMS SHOWN

Featured Systems Include:

- Microsoft® Office 97 Small Business Edition plus Bookshelf (Ask about Our *FREE* MS Office 2000 Upgrade Offer)
- McAfee VirusScan
- Microsoft Windows® 98
- Dell QuietKey® Keyboard
- 3-Year Limited Warranty†
- 1-Year NBD On-site[Δ] Service

POWER UPGRADES

- Iomega Zip 100MB Internal Drive, add $99.
- 3Com USRobotics V.90π PCI Telephony WinModem, add $49.
- 3Com 3C905B 10/100 NIC, add $50.
- Intuit QuickBooks v6.0 Pre-installed, add $118.
- 3-Year Next-Business-Day On-site[Δ] Service, add $99.

Prices valid with system purchase only.

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- **Add an HP DeskJet® 722C Color Printer for only**
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DELL DIMENSION AWARD INFO[‡‡]

- In 1998, Dell Dimension desktops won more than 90 product and service awards. See www.dell.com/awards98 for details.
- Winner of the 1998 *PC Computing* MVP "State-of-the-Art Desktop" (XPS R450) and "High-Performance PC" (XPS R400) awards.
- Three-time "A" rating in *PC Magazine's* Readers' Choice Awards for Service and Reliability (1996-1998).
- Received 32 "Best Buy" awards from *PC World* in its Power, Budget and Home categories.

Advertised configurations vary from award-winning configurations.

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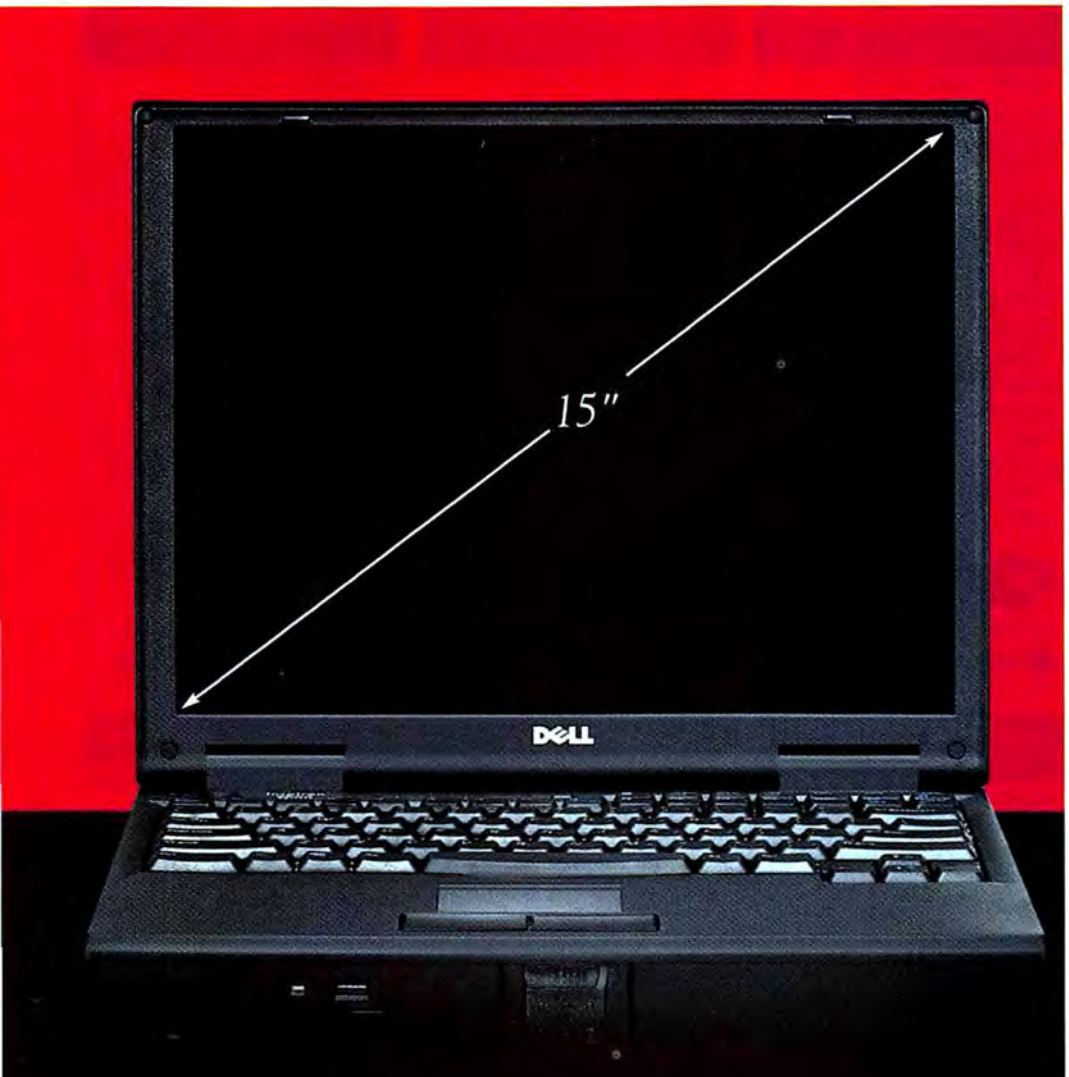

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Business Lease[◊]: $129/Mo., 36 Mos.

E•VALUE CODE: 03606-890233

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PENTIUM II PROCESSOR AT 333MHz

All-in-One Multimedia Performance

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- 64MB SDRAM (384MB Max[Θ])
- 4GB Ultra ATA Hard Drive
- Removable Combo 24X Max[^^] Variable CD-ROM and Floppy Drive
- 2X AGP 4MB ATI RAGE Pro 3D Video
- 3D Surround Sound
- 12-Cell Intelligent Lithium Ion Battery
- MS Office 97 SBE (Ask about Our *FREE* MS Office 2000 Upgrade Offer)
- Microsoft Windows 98/Touchpad
- 3-Year Limited Warranty[†]
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- ★ *3Com® Fast Ethernet Adapter, add $129.*

$2799

Business Lease[◊]: $106/Mo., 36 Mos.

E•VALUE CODE: 03606-890227

NEW DELL INSPIRON 7000 A333GT
PENTIUM II PROCESSOR AT 333MHz

All-in-One Multimedia Performance

- 14.1" XGA Active Matrix Display
- 64MB SDRAM (384MB Max[Θ])
- 4GB Ultra ATA Hard Drive
- Removable Combo 24X Max[^^] Variable CD-ROM and Floppy Drive
- 2X AGP 4MB ATI RAGE Pro 3D Video
- 3D Surround Sound
- 12-Cell Intelligent Lithium Ion Battery
- MS Office 97 SBE (Ask about Our *FREE* MS Office 2000 Upgrade Offer)
- Microsoft Windows 98/Touchpad
- 3-Year Limited Warranty[†]
- ★ *Upgrade to 96MB SDRAM, add $99.*
- ★ *Custom Leather Case, add $99.*
- ★ *Internal 56K Capable[π] V.90 Modem, add $59.*

$2599

Business Lease[◊]: $98/Mo., 36 Mos.

E•VALUE CODE: 03606-890225

NEW DELL INSPIRON 3500 A300GT
PENTIUM II PROCESSOR AT 300PE MHz

Light Weight, Light Price

- 14.1" XGA Active Matrix Display
- 32MB SDRAM (256MB Max)
- 3.2GB Ultra ATA Hard Drive
- Modular 24X Max[^^] Variable CD-ROM
- NeoMagic MediaMagic 256AV AGP Video
- 3D Surround Sound
- 9-Cell Intelligent Lithium Ion Battery
- APC SurgeArrest PNote 1 Pro
- Internal 56K Capable[π] V.90 Modem
- Trial Offer ConnectDirect Internet Access[4]
- MS Office 97 SBE (Ask about Our *FREE* MS Office 2000 Upgrade Offer)
- Microsoft Windows 98/Touchpad
- 3-Year Limited Warranty[†]

$2299

Business Lease[◊]: $87/Mo., 36 Mos.

E•VALUE CODE: 03606-890222

DELL INSPIRON 3500 D266XT
PENTIUM II PROCESSOR AT 266MHz

Light Weight, Light Price

- 13.3" XGA Active Matrix Display
- 32MB SDRAM (256MB Max)
- 3.2GB Ultra ATA Hard Drive
- Modular 24X Max[^^] Variable CD-ROM
- NeoMagic MediaMagic 256AV AGP Video
- 3D Surround Sound
- 9-Cell Intelligent Lithium Ion Battery
- MS Office 97 SBE (Ask about Our *FREE* MS Office 2000 Upgrade Offer)
- Microsoft Windows 98/Touchpad
- 3-Year Limited Warranty[†]

$1999

Business Lease[◊]: $76/Mo., 36 Mos.

E•VALUE CODE: 03606-890219

DELL LATITUDE® CPi D300XT
PENTIUM II PROCESSOR AT 300MHz

Network-Optimized Notebook

- 13.3" XGA Active Matrix Display
- 64MB EDO RAM (256MB Max)
- 4.3GB Ultra ATA Hard Drive
- Modular 24X Max[^^] Variable CD-ROM
- NeoMagic 128-bit Graphics Accelerator
- 3D Surround Sound
- Intelligent Lithium Ion Battery
- MS Windows NT® Workstation 4.0
- Touchpad
- 3-Year Limited Warranty[†]
- 1-Year NBD On-site[Δ] Service

$2899

Business Lease[◊]: $110/Mo., 36 Mos.

E•VALUE CODE: 03606-790228

DELL LATITUDE CPi D233ST
PENTIUM II PROCESSOR AT 233MHz

Network-Optimized Notebook

- 12.1" SVGA Active Matrix Display
- 64MB EDO RAM (256MB Max)
- 4.3GB Ultra ATA Hard Drive
- Modular 24X Max[^^] Variable CD-ROM
- NeoMagic 128-bit Graphics Accelerator
- 3D Surround Sound
- Intelligent Lithium Ion Battery
- MS Windows NT Workstation 4.0
- Touchpad
- 3-Year Limited Warranty[†]
- 1-Year NBD On-site[Δ] Service

$2399

Business Lease[◊]: $91/Mo., 36 Mos.

E•VALUE CODE: 03606-790223

DELL NOTEBOOK AWARD INFO

- Two-time "A" rating in *PC Magazine* Readers' Choice Awards for Service and Reliability, 7/98; 7/97.
- Latitude Line – *PC Computing*'s "Best Overall" Rating Three Years (1996-1998).
- Inspiron 7000 D300GT – *CNET* Editors' Choice, "Leading Edge Notebooks," 9/98.

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Business Lease◊: $416/Mo., 36 Mos.

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PENTIUM II PROCESSOR AT 450MHz
(DUAL PROCESSOR/RAID CAPABLE)

- 128MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- 18GB Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional)
- 32X Max^ Variable SCSI CD-ROM
- HP OpenView NNM Special Edition
- Intel® Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- Redundant Hot-Pluggable Power Supplies, Cooling Fans and Processor Fans
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 6-1.6" Hard Drive Bays
- 4 External 5.25" Drive Bays
- 3-Year NBD On-site^ Service
- 1-Year DirectLine NOS Support
- 7x24 Dedicated Server Hardware Telephone Technical Support

$5899

Business Lease◊: $217/Mo., 36 Mos.

E•VALUE CODE: 03607-290258

DELL POWEREDGE 2300 SERVER
PENTIUM II PROCESSOR AT 450MHz
(RAID 5 CONFIGURATION)

- 128MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- Three 9GB Ultra-2/LVD SCSI Hot Swap Hard Drives
- Ultra-2/LVD PowerEdge Expandable RAID Controller 2/SC
- 32X Max^ Variable SCSI CD-ROM
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 6-1" Hard Drive Bays
- 3 External 5.25" Drive Bays plus Floppy
- 3-Year NBD On-site^ Service
- 7x24 Dedicated Server Hardware Telephone Technical Support

$5249

Business Lease◊: $193/Mo., 36 Mos.

E•VALUE CODE: 03607-290252

DELL POWEREDGE 2300 SERVER
PENTIUM II PROCESSOR AT 400MHz
(DUAL PROCESSOR/RAID CAPABLE)

- 128MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- 9GB Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional)
- 32X Max^ Variable SCSI CD-ROM
- MS® Windows NT® Server 4.0
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 4-1.6" or 6-1" Hard Drive Bays
- 3 External 5.25" Drive Bays plus Floppy
- 3-Year NBD On-site^ Service
- 7x24 Dedicated Server Hardware Technical Telephone Support
- ★ *Upgrade to a Pentium II Processor at 450MHz, add $300.*

$3849

Business Lease◊: $146/Mo., 36 Mos.

E•VALUE CODE: 03607-290238

DELL POWEREDGE 2300 SERVER
PENTIUM II PROCESSOR AT 350MHz
(DUAL PROCESSOR/RAID CAPABLE)

- 64MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- 4GB Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional)
- 32X Max^ Variable SCSI CD-ROM
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 4-1.6" or 6-1" Hard Drive Bays
- 3 External 5.25" Drive Bays plus Floppy
- 3-Year NBD On-site^ Service
- 7x24 Dedicated Server Hardware Technical Telephone Support
- ★ *Upgrade to a Pentium II Processor at 400MHz, add $300.*

$2349

Business Lease◊: $89/Mo., 36 Mos.

E•VALUE CODE: 03607-290223

NEW DELL POWEREDGE 1300 SERVER
PENTIUM II PROCESSOR AT 350MHz
(DUAL PROCESSOR/RAID CAPABLE)

- 64MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- 4GB Ultra-2/LVD SCSI Hard Drive
- 32X Max^ Variable EIDE CD-ROM
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated PCI Ultra-2/LVD SCSI Controller
- 6 Expansion Slots: 5 PCI, 1 PCI/ISA
- 4 Hard Drive Bays: 2-1.6" and 2-1"
- 3 External 5.25" Drive Bays
- 3-Year NBD On-site^ Service
- 7x24 Dedicated Server Hardware Technical Telephone Support
- ★ *Add a Pentium II Processor at 350MHz, $399.*

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Business Lease◊: $70/Mo., 36 Mos.

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- Complete Network Cabling Installation
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Must purchase a PowerEdge server to be eligible for installations services.

DELL SERVER AWARD INFO

- *Network World* "World Class Award" for flexibility, serviceability and manageability – Dell PowerEdge 2300, 6/98.
- *Computer Shopper* "Top 100" – Dell PowerEdge 2300, 11/98.
- *PC Computing*'s "The 'A' List" – Dell PowerEdge 6300, 11/98.
- *Fortune* – 1998 Readers' Choice Award for Personal Service and Reliability, 11/98.
- *LANTIMES* "The Best of *LANTIMES* Over $25,000" – Dell PowerEdge 6300, 9/98.
- *ComputerWorld*'s "Leaders' Choice" Winner Workgroup Servers – Dell PowerEdge Family, 1/98.

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pentium® II xeon™ PROCESSOR

DELL PRECISION™ WORKSTATION 610
PENTIUM® II XEON™ PROCESSOR AT 450MHz
(Dual Processor/RAID Capable)

- 256MB 100MHz ECC SDRAM
- 512KB Full-Speed Integrated L2 Cache
- 9GB Ultra-2/LVD SCSI Hard Drive
- Adaptec RAIDPort Ultra-2/LVD Adapter
- 21" (19.8" vis) Trinitron® 1600HS Monitor
- 3D*labs* Oxygen GMX 2000 Graphics Card
- 40X Max™ Variable CD-ROM Drive
- Sound Blaster Pro Compatible Sound
- Integrated 3Com® 10/100 PCI NIC
- Remote Client Manageability Support via DMI 2.0; Wakeup on LAN Capable
- **MS® Windows NT® 4.0 and 1-Year NT Telephone Support**
- 3-Year NBD On-site^ Service
- 7x24 Dedicated Hardware Tech Support
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$6449

Business Lease◊: $237/Mo., 36 Mos.

E•VALUE CODE: 03608-490264

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(Dual Processor/RAID Capable)

- 128MB 100MHz ECC SDRAM
- 512KB Integrated L2 Cache
- 4GB Ultra-2/LVD SCSI Hard Drive
- 17" (15.9" vis) M780 Monitor
- Diamond 8MB AGP Graphics Card
- 40X Max™ Variable CD-ROM Drive
- Sound Blaster Pro Compatible Sound
- harman/kardon HK-195 Speakers
- Integrated 3Com 10/100 PCI NIC
- Remote Client Manageability Support via DMI 2.0; Wakeup on LAN Capable
- **MS Windows NT 4.0 and 1-Year NT Telephone Support**
- 3-Year NBD On-site^ Service
- 7x24 Dedicated Hardware Tech Support

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16MB STB nVidia TNT 3D AGP Graphics Card

Please review the following regarding your Video selection:
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4.8X DVD ROM Drive and Decoder Card

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  Add 3Dfx Voodoo2 3D Accelerator w/12MB.....'149
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- DVD-ROM III (32X CD-ROM)
- V.90 Standard 56K Voice/Fax Modem w/ Speakerphone
- Aureal A3D™ PCI Sound Card
- Altec Lansing ADA305 Digital Powercube Speakers w/ Subwoofer
- Corel WordPerfect Suite 8 & Max's Enthusiast Pack
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Pentium®II 400MHz .....'2149

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PC World Cover Story: Special Report on Reliability and Service— November 1998 — Good Rating, 4 Stars out of 5 for Overall Reliability and Service

PC WORLD

PC World Best Buy
Best Buy #2
Top 20 Budget Desktops
November 1998

PC World
Best Buy #1
Top 10 Home PCs
November 1998

PC World
1998 Reliability & Service Survey:

	Overall reliability score	Overall service score
Good		
CyberMax	★★★★	★★★★
Dell	★★★★★	★★★
IBM	★★★★	★★★
Fair		
Gateway 2000	★★★	★★★★
Compaq	★★★	★★★

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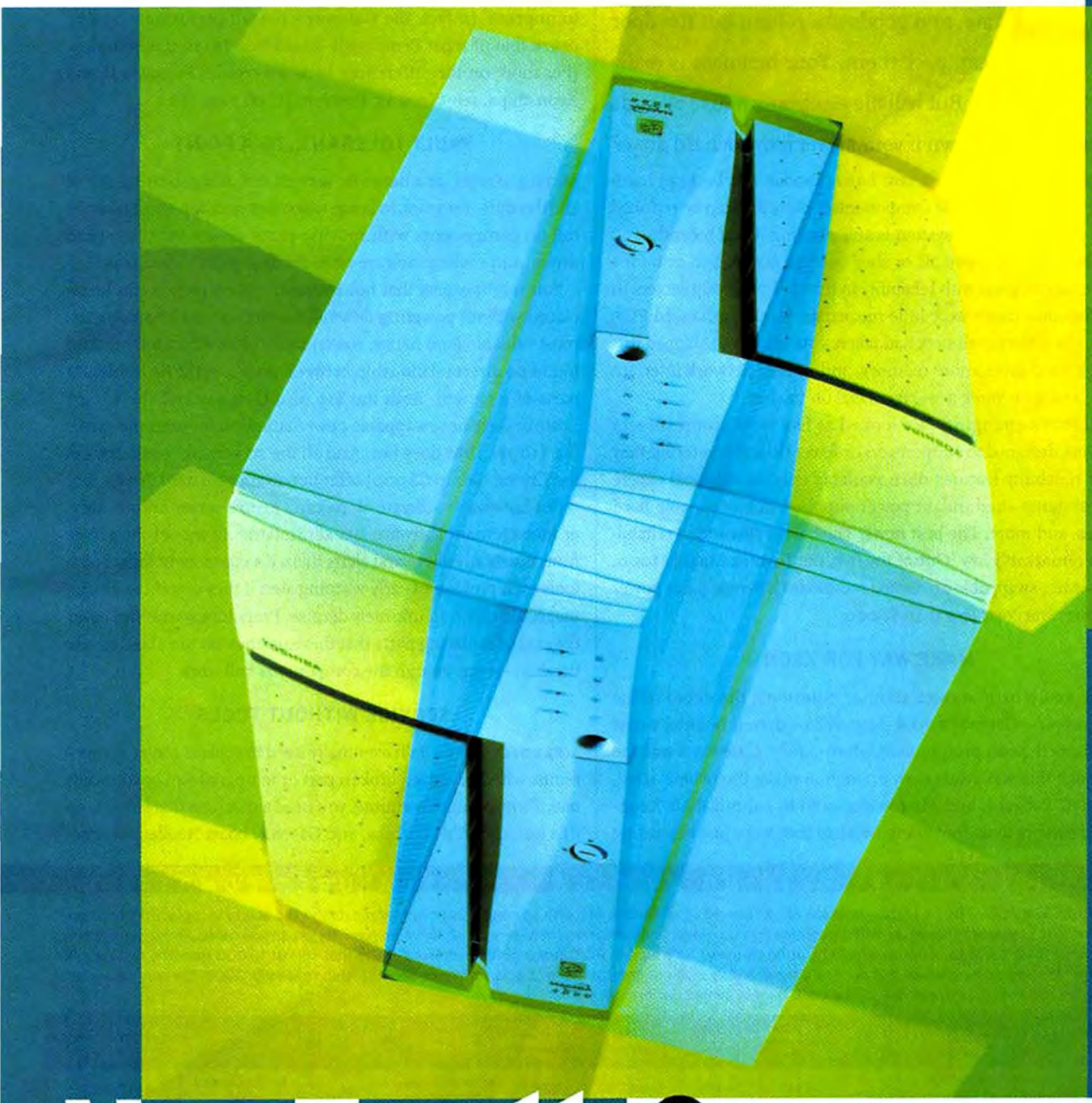
In a perfect world, your server would **never go down.** Yeah, right. Meanwhile, back here on planet Earth, we **tested** five servers with **redundant** hardware, **hot-swappable** hard drives, and more to identify the most **reliable** models in the bunch.



BY ROB HUMMEL & JOHN BASS

No-Fault Servers

PHOTOGRAPHS BY PIERRE-YVES GOAVEC

LIFE IS GOOD. Product inquiries are pouring into your Web server at a record rate, and goods are rolling out the door as fast as you can pack them. Your business is really starting to grow. But will the electronic house of cards come crashing down if your server blows a hard drive?

It might, unless your server has redundant (or backup) hardware and hot-swappable components—parts that can be replaced or repaired while the system is still running. Until recently, you had two choices: risk it all, or shell out $40,000 to $50,000 for a machine designed with reliability in mind. Workgroup servers in the $10,000 range were little more than feature-enhanced PCs. It was as if the developers had taken a standard PC; slapped in a bigger hard drive, more memory, and a faster network interface card; and then stuck a "server" label on the box.

All that's changing. We looked at five workgroup servers (servers designed to support 100 or fewer nodes) and found they offer reliability features once available only on the most expensive systems—redundant power supplies, hot-swappable hard drives, and more. The best news: The cost of this added reliability is remarkably low. One of the five, the Toshiba Magnia 3000, carries hot-swappable drives *and* redundant hot-swappable power supplies, yet costs less than $8000.

MAKE WAY FOR XEON

THIS ROUNDUP MARKS another milestone: the debut of the first server—Gateway's ALR 8300 NTS—driven by Intel's new Pentium II Xeon processors. Unfortunately, Gateway's was the only one that was ready early enough to make the review. (Dell, Hewlett-Packard, and Micron declined to submit their Xeon-based servers to us for testing because they were just beginning to produce them.) The four other workgroup server systems we tested use standard Pentium II processors.

Designed with servers in mind, the Xeon has a relatively low price (compared to mainframe RISC-based CPUs) and a huge secondary cache—features that may eventually usher in a new round of high-performance servers. But for now, the Xeon fails to impress. In fact, the Gateway's overall performance rated below that of most Pentium II–based systems in this roundup. (For more on the differences between regular Pentium II and Xeon chips, see "Xeon vs. Pentium II" on page 188.)

FAULT TOLERANT...TO A POINT

AS THE HEART of a network, servers tick along, beating day in and day out—for years, in some cases. But nonstop effort takes its toll on components with moving parts: power supplies, hard drives, and cooling fans are often the first parts to poop out.

You might expect that hot-swappable parts (which can be replaced without powering down the server) would be among the most valuable (and hence, costly) fault-tolerant features. But we found no direct relationship between price and the fault-tolerant parts of a system. Both the $10,649 Gateway and the $7649 Toshiba have hot-swappable power supplies, for example, while the $10,132 IBM does not. And all the servers we tested (except the Crystal Group CS900) offer hot-swappable hard drives, too.

But hot-swap hardware alone can't keep a server online. Server management software lets administrators reboot the server from nearly anywhere and alerts them if a component fails. Some tools even provide an early-warning alert if they detect conditions that could cause an untimely demise. Prefailure warranties cover the cost of replacing parts that these utilities say are about to bite the dust—even though the components still work.

SERVICE WITHOUT TOOLS

A PREDICTION: You'll eventually need to replace server components, whether to fix a broken part or to upgrade an obsolescent one. To minimize downtime, you need a machine that lets you do this quickly. IBM, Toshiba, and Gateway boast "toolless service-

RELIABILITY GAINING AN EDGE — FEATURES COMPARISON

MORE SERVERS TODAY feature backups of components that tend to fail, with an emphasis on hot-swappability—the ability to replace parts without having to shut down the server. With integrated disk controller and networking hardware, you have more room for expansion cards. And fewer machines rely on RAID cards to enhance reliability, using Windows NT's built-in RAID features instead. Hard drives that spin at 10,000 rpm—the fastest available—are now commonplace, but our tests showed they may not provide much of a performance boost. Toshiba's Magnia 3000, the only server here with 7200-rpm hard drives, finished a close third in overall performance.

SERVER	Street price (12/15/98)[1]	Dual CPUs	Memory type/ installed (MB)	Expansion slots (total/ open)	Integrated SCSI controller	RAID/RAID cache (MB)	Hard drives/ speed (rpm)	Max. total bays/max. hot-swap bays/ max. storage (GB)
Compaq ProLiant 1600 800/888-0220 www.compaq.com	$6347	PII-450	SDRAM/256	6/6	Symbios 876 Dual Wide-Ultra	n/a	Seagate Cheetah/ 10,000	9/7/45.5
Crystal Group CS900 800/378-1636 crystalpc.com	$16,500	PII-450	SDRAM/256	9/8	Adaptec AIC-7880 Wide-Ultra	n/a	Seagate Cheetah/ 10,000	2/0/18.2
Gateway ALR 8300 NTS 800/799-2000 www.gateway.com	$10,649	Xeon-450	SDRAM/512	7/6	Adaptec 7890 LVD	Gateway ADAC A-466/16	Seagate Cheetah/ 10,000	17/12/108
IBM Netfinity 5000 800/888-0220 www.pc.ibm.com	$10,132	PII-450	SDRAM/256	5/4	Adaptec 7895 Wide-Ultra	IBM ServRAID 3H/32	Seagate Cheetah/ 10,000	7/5/45.5
Toshiba Magnia 3000 800/867-4422 www.toshiba.com	$7649	PII-400	SDRAM/256	5/4	Symbios 876 Dual Wide-Ultra	n/a	IBM/7200	6/4/38

Best Buy n/a = not applicable [1] Street price includes Windows NT Server 4.0, with ten user licenses. Price excludes monitor.

ability," which generally means you can access the case interior—and even replace entire subassemblies—using nothing more complex than your fingers. In contrast, opening the Compaq ProLiant's case requires a special Torx driver (a screwdriver with an odd, star-shaped tip), ostensibly to provide greater security against tampering. But Murphy's Law dictates that, in a crunch, you won't be able to find your rarely used Torx driver.

Like the ProLiant, the Crystal Group CS900 doesn't lend itself to on-the-fly component swapping: Its case is secured with a dozen conventional screws. But the Crystal Group's box deviates from the traditional workgroup server in an important way: Its relatively cramped interior leaves no room for any redundant components. According to the vendor, that's because the entire server is one redundant component, designed to function in concert with a closely knit rack of other CS900s in an industrial setting. If a part fails, you're supposed to remove the disabled unit from the rack and fix it offline.

Other vendors in this roundup don't espouse Crystal's philosophy. Instead, they tout redundant components, though some implement the capability better than others. The dual power supplies on IBM's Netfinity, for example, come in two different shapes, so you have to stock replacement units of each one. In contrast, Toshiba's pair of hot-swappable power supplies (on the Magnia 3000) are identical.

SERVER KING: Our Best Buy, Compaq's ProLiant 1600.

Compaq Takes All

A LOW PRICE and impressive performance earned the **ProLiant 1600** our Best Buy award. It turned in an astonishingly high file-service speed, as reflected by a score more than twice as high as the competition's. Compaq's excellent software bundle makes configuring the server a snap, and while the ProLiant lacks redundancy in some key hardware components, its Insight Manager management tools can detect problematic components before they fail.

FAST APPS, FASTER FILES

ENTERPRISE SERVERS tend to do just one of three basic tasks: provide file and print services, serve Web pages, or run server-based apps such as databases. Workgroup servers usually do more (sometimes all three), like a server jack-of-all-trades—which is why Centennial Networking Labs, our server testing facility near Raleigh, North Carolina, tested them in all three categories.

As in our previous review ("Are You Being Served?" October 1998, www.pcworld.com/oct98/servers), Centennial used Bluecurve's Dynameasure File Professional 2.0 (for file service tests) and SQL Professional 2.0 (for database service tests), and Mercury Interactive's LoadRunner (for Web service tests). For the testing details, see "How We Test Server Performance" on page 188.

We asked for dual-processor workgroup systems with a minimum configuration of 256MB of memory, no less than 4GB of hard disk storage, a network card, and the Windows NT Server 4.0 OS. We left the rest of the feature set to the vendors' discretion. All except Toshiba's had 450-MHz processors; Toshiba submitted a PII-400 system. Each vendor also chose to supply a SCSI disk subsystem; but whereas all but one of the systems in the last roundup came with RAID (Redundant Array of Independent Disks) cards, only two of the five systems used RAID this time—and those that did used RAID level 0, which pro- ▶

Integrated network interface	Reliability features	NOS installation/server management software	Warranty and phone support	PC World InfoNet number
Netelligent TI TLAN	hot-swappable drives	Compaq SmartStart/Compaq Insight Manager	three-year on-site, prefailure warranty on hard drives, RAM, and processors; 24-hour free phone support	615
Digital 21143	none	none/QuickAlert Alarm Notification System	three-year on-site, next business day delivery of replacement parts; 24-hour free phone support	616
Intel 82558	hot-swappable drives, redundant hot-swappable power supplies	none/Gateway InforManager	three-year parts and labor on-site; 24-hour free phone support	617
AMD PCNet	hot-swappable drives, redundant power supplies	ServerGuide/Netfinity Manager	three-year parts and labor on-site, next business day delivery of replacement parts; free phone support, business hours only	–
Intel 82558	hot-swappable drives, redundant hot-swappable power supplies	Toshiba ServerSetup/Intel LANDesk Server Manager	three-year parts and labor on-site, next business day delivery of replacement parts; free phone support, business hours only	618

All products: 909

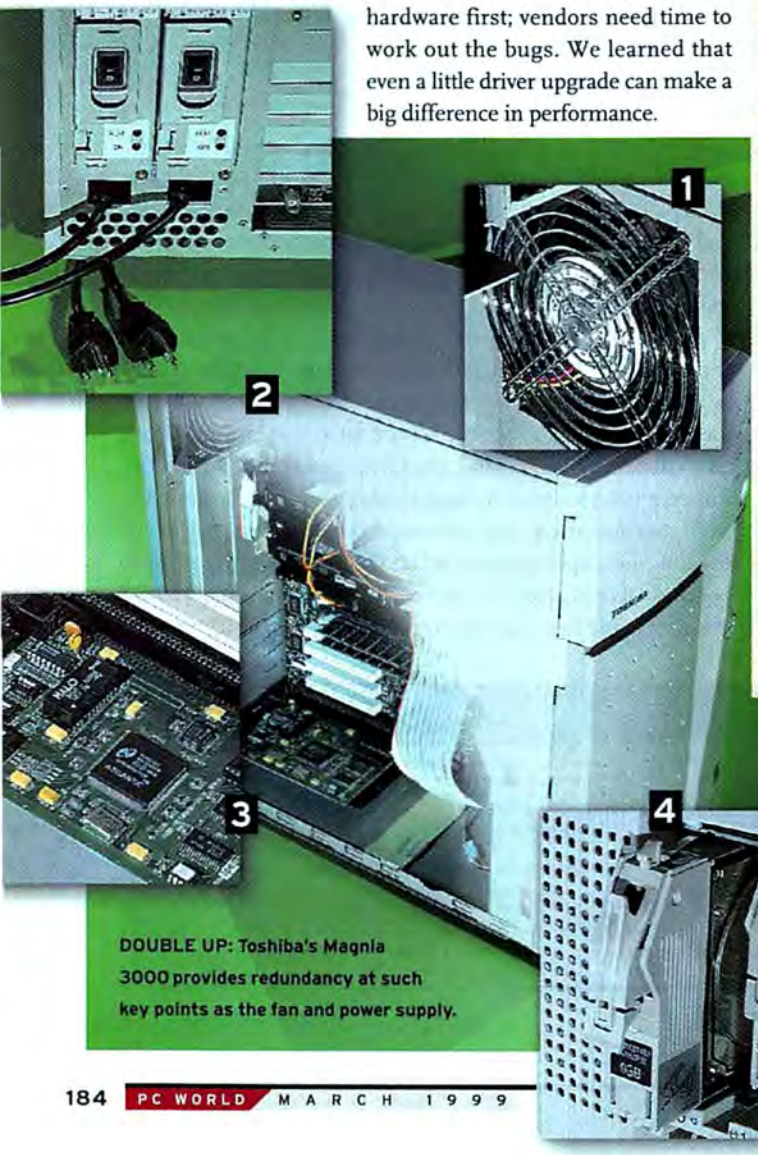
vides the highest data throughput (and the lowest redundancy).

As its 400-MHz sibling did last year, the Compaq ProLiant 1600 zipped past the competition in our file service tests, scoring 706 packets per second compared to the second-place Toshiba's 337. A finely tuned disk subsystem and efficient drivers helped the ProLiant achieve its substantial advantage. The machine then nearly completed a hat trick, taking first and second place, respectively, in our Web service and SQL tests.

The subpar performance of Gateway's Xeon-equipped ALR 8300 NTS shows that having the latest CPU doesn't guarantee a first-place finish. The Gateway product finished in next-to-last place in both our file and Web service tests, and managed third place in the SQL test. It may take some time to develop the efficient driver software this system needs; nonetheless, the ALR 8300 NTS has the makings of a very reliable server.

The Crystal Group CS900 flexed its muscles in the CPU-intensive SQL database tests, handily beating the competition. But this server also set itself apart—negatively—by falling to the back of the pack in the file and Web service tests.

As in the last roundup, newer servers didn't perform as well as the seasoned veterans, thereby proving one axiom of PC shopping that applies to servers, too: Never rush out to buy the newest hardware first; vendors need time to work out the bugs. We learned that even a little driver upgrade can make a big difference in performance.



DOUBLE UP: Toshiba's Magnia 3000 provides redundancy at such key points as the fan and power supply.

Compaq ProLiant 1600

PRO: Extremely fast storage for file and Web service tasks, good price

CON: Case design requires Torx drivers, unit lacks redundant components, some parts not easily accessible

Turning in the top scores in our file and Web tests and finishing a close second in the database test, the Compaq ProLiant 1600 was the clear overall performance champ. Essentially the same unit we reviewed in October (see "Are You Being Served?" www.pcworld.com/oct98/servers), the $6347 ProLiant is the least expensive server here. The differences from its predecessor are slight: The new unit had dual Pentium II-450 CPUs and 256MB of memory (versus PII-400 CPUs and 128MB).

The ProLiant 1600 is fairly easy to disassemble. Twisting a few thumbscrews lets you remove components quickly. The removable processor cage holds the two Pentium II processors and the memory. And you just take off the top cover (or slide a subassembly out the rear of the system) to access expansion cards.

Unfortunately, Compaq uses Torx screws to secure the case. To loosen these star-headed screws, you need a matching Torx driver. According to the manual, these screws are used for security, but they are reviled by every server technician who's ever mislaid a Torx driver. A lock and key would be more secure—and less trouble.

Compaq's SmartStart software, supplied on CD-ROM, makes setup easy. It configures hardware and assists with installing operating systems. And Compaq's Insight Manager server management software allows you to manage the server remotely over the network and alerts you to potential hardware failures ahead of time. A three-year prefailure warranty covers the server's hard drives, memory, and processors.

Parts must be replaced from the rear—difficult in a crowded server closet. But the ProLiant's weakest point is a lack of redundancy for critical items like power supplies and cooling fans. Ideally, a server should carry at least a pair of each, but the unit we tested had only some hot-swap hard drives. If other critical parts fail, you'll have to shut down the system.

With the top overall performance score and the lowest configured price of any unit we tested here, the Compaq ProLiant 1600 wins Best Buy honors among these workgroup servers. Compaq's decision to sacrifice redundancy for a low price—and to put all its reliability eggs in Insight Manager's

Servers Sport Tough Parts

LOW-COST servers now offer plenty of built-in reliability features. Any part listed below could be the weak link that brings down your server.

1 FANS tend to break first. Look for easy-to-remove fans that can be taken out while the server's running.

2 DUAL POWER SUPPLIES can keep a server alive if one fails, but you still might need to shut down the server to replace the bad unit.

3 NETWORK CARDS may share the network's traffic load, or one may stand by as a backup if the other fails.

4 HARD DRIVES with RAID keep copies of each other's data; some can be swapped out if they break down.

basket—may benefit customers, if the prefailure warranty indeed lets you correct problems before they happen.

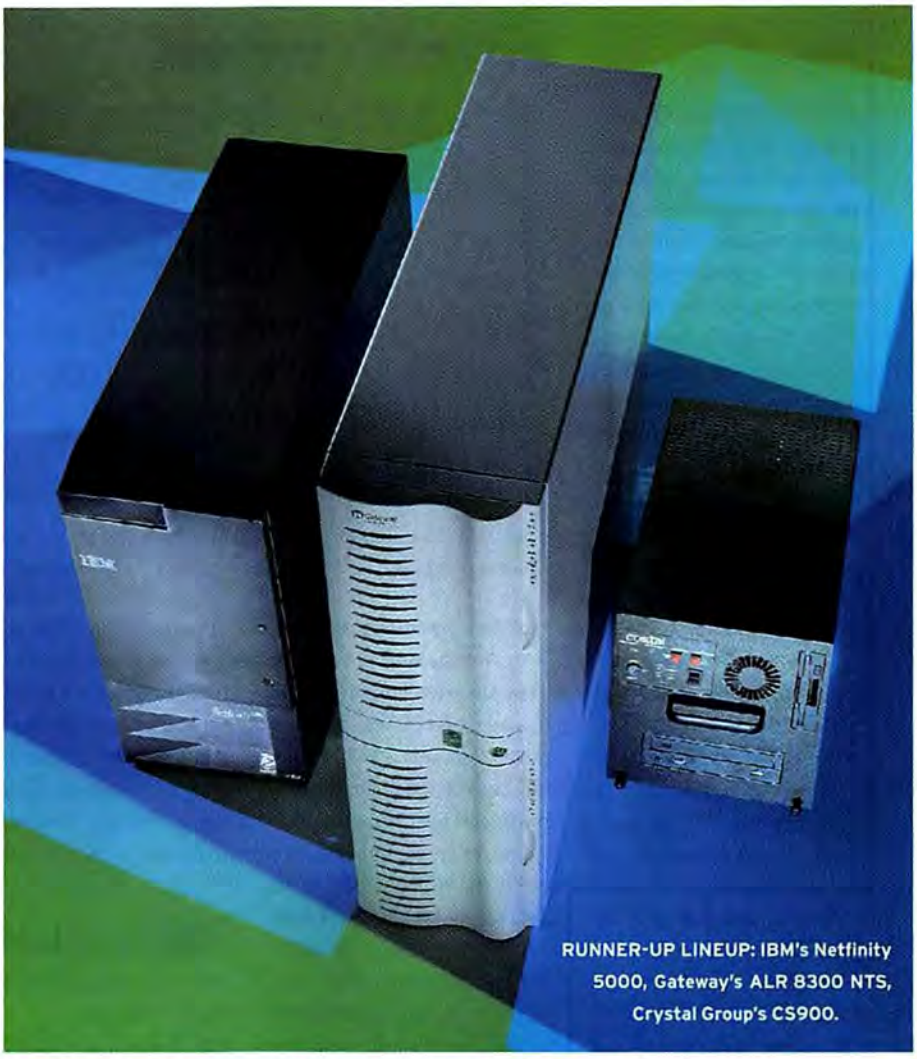
Crystal Group CS900

PRO: Top database performance in a slim, rack-mountable design

CON: Nonstandard server earned the poorest file and Web performance scores, most expensive unit in roundup

Do the best things come in small packages? If this model is any indication, Crystal Group seems to think so. But the CS900 is not a run-of-the-mill workgroup server: Its compact case is designed for high-density rack mounting, and its total lack of redundant or hot-swappable parts (it's the only system here that includes no hot-swappable drive support) means the CS900 fits a completely different server paradigm than all the others we tested.

The $16,500 CS900's last-place finishes on our file and Web performance tests reflect the server's low emphasis on storage. On the other hand, the machine finished first in the CPU-intensive SQL test. The CS900's dual 450-MHz Pentium IIs delivered plenty of database-crunching power.



RUNNER-UP LINEUP: IBM's Netfinity 5000, Gateway's ALR 8300 NTS, Crystal Group's CS900.

Crystal Group made some obvious trade-offs in the CS900's construction. The manufacturer clearly expects you to treat the entire server as a single, replaceable unit.

One of these tradeoffs came in serviceability. To access the interior you have to remove 12 tiny screws that secure the top panel to the case. But once you get inside, the unit's use of a single-board computer (with CPU, memory, video, sound, and disk controller integrated onto the motherboard) makes for a clean-looking interior. The only problem: If a single component fails, the entire motherboard is shot and must be replaced.

With a total of eight free PCI slots (one of which was occupied in the configuration we tested) and one ISA slot, the CS900 ought to accommodate plenty of expansion cards. Unfortunately, in our test unit, five of the PCI slots didn't leave room for full-length cards, and the second hard drive obscured a sixth PCI slot.

Crystal provides minimal documentation for the CS900 and includes no setup utilities or server management software. Evidently, the company expects users to add their own software, tweaked to work with customized applications, and then clone the optimal configuration onto lots of CS900s. But that's not how most businesses use a workgroup server; and at the CS900's steep price, some companies may balk at employing it in this way—unless space limitations (such as in telecommunications or a tight server closet) override other concerns.

If you need a high-density server for industrial or control applications, the CS900 is a good choice. As a general workgroup server, though, the CS900 has a lot working against it. Its high price, lackluster performance, and dearth of software and documentation make the CS900 a poor choice for typical workgroups.

Gateway ALR 8300 NTS

PRO: Lots of reliability features, good case design and setup software

CON: Sluggish performance, pricey, case screws not secured to server

Gateway is the only server vendor in this group to use Intel's latest processor, the Pentium II Xeon. Besides twin 450-MHz Xeons, the ALR 8300 NTS we looked at packs 512MB of memory, twice the amount on the other servers. To judge from its components, this $10,649 system should have been a powerhouse, but in our tests its performance was far from overwhelming.

With Gateway's combination of processor and memory, we expected the ALR 8300 NTS to excel in processor-intensive tasks, such as those in our SQL test. Instead, it finished a close third on this measure, behind the Compaq and Crystal servers. And despite its array of superfast SCSI drives spinning at 10,000 rpm, the server turned in the second-slowest scores in the file and ▶

Speed Demon

LAST OCTOBER, Compaq's ProLiant 1600 surprised us with a file service speed nearly double that of the next-fastest competitor. The latest round of tests proved that those results were no fluke. The ProLiant 1600 continues its reign as performance champ, posting top scores in both the Web and file tests. In the SQL/database test, the ProLiant trailed the Crystal Group CS900 by a scant 2 percent and finished narrowly ahead of the Xeon-powered Gateway.

Having the fastest hard drives and processors doesn't guarantee that a server will perform the fastest. Other elements—efficient hardware drivers, a well-designed system architecture, and a bug-free operating system—play important roles in helping a server outdo its rivals in performing real-world tasks.

The Toshiba Magnia 3000, for example, uses only 400-MHz Pentium II processors and hard drives that spin at 7200 rpm. But despite these limitations, the Magnia beat systems sporting faster processors and hard drives on two of our three tests. Gateway's ALR 8300 NTS, with a pair of the newest 450-MHz Xeons and twice as much system memory as any of the other servers, scored just shy of the second-place Compaq in the processor-intensive SQL test.

TEST REPORT

SERVER	Overall rating[1]	SQL (transactions/sec.) Faster	File service (packets/sec.) Faster	Web service (KB/sec.) Faster
Compaq ProLiant 1600*	92.1	403	706	389
Crystal Group CS900	73.3	410	261	349
Gateway ALR 8300 NTS	70.3	402	270	358
IBM Netfinity 5000	67.0	389	335	372
Toshiba Magnia 3000	72.2	395	337	374
*Best Buy		Test weighting 40 percent	Test weighting 30 percent	Test weighting 30 percent

TEST PC WORLD CENTER [1]For more information on overall ratings, go to PC World Online at www.pcworld.com/mar99/servers.

HOW WE TEST For a description of our server testing methods, see "How We Test Server Performance" on page 188.

Web tests, beating only the pokey Crystal Group CS900.

Reliability is the Gateway's strong suit. With six hot-swap–ready drive bays (more than any other system we tested) and five fixed hard-drive bays, the ALR 8300 NTS has plenty of disk capacity to run data-intensive applications and to accommodate various peripherals. Gateway also included a RAID disk controller card you can use to protect your data or speed up data retrieval. Its pair of hot-swappable, redundant power supplies can keep the server up and running even if one of them fails.

We also liked the status lamps Gateway built onto the front panel of the server. These lights report individual SCSI hard drive and processor activity, and they can warn the operator of power supply or memory problems.

The only fault we could find with the ALR 8300's case design was its use of noncaptivated (that is, not connected to the server) thumbscrews to attach the case covers. Most servers have a small plastic leash to hold them. Drop one of these screws, and—guaranteed—it will roll underneath the heaviest object in the room.

Gateway's InforManager server management package combines hardware sensors and software monitoring tools. The software watches vital server functions and broadcasts alerts if it detects problems. InforManager also communicates with IS management software from Hewlett-Packard, Novell, and SCO. The client component of InforManager permits you to monitor or manage the server from any desktop PC on your network.

As you might expect, the ALR 8300's use of leading-edge technology comes at a price. Adding this server to your network will set you back nearly $11,000—considerably more than the Compaq ProLiant, the least expensive server in this review. But the ALR 8300's forward-looking features—including Xeon processors, a RAID controller, and top-notch reliability hardware—may make the higher cost more palatable.

IBM Netfinity 5000

PRO: Easy access to interior, helpful front-panel status monitor, simplified problem diagnosis

CON: Some components difficult to replace, lackluster database performance

With a sleek black case that's 25 percent wider and 50 percent deeper than a conventional tower, the IBM Netfinity 5000 has haute couture looks to match its $10,132 price tag. And with some innovative monitoring technology and a wide array of status lights on board, the Netfinity unquestionably ranks as the easiest server to diagnose and repair, a factor that could reduce downtime.

Maintaining a server is hard enough without having to search for manuals. Recognizing this, IBM attached clear and detailed diagrams to the inside cover that describe just about every aspect of system service. Another label inside the box lists the replaceable parts and their part numbers, as well as Web addresses for online support and documentation.

IBM has gone out of its way to make the Netfinity easy to troubleshoot. The server's front-panel display shows the status of various devices at a glance. You can quickly check on system power, individual processor activity, system error, 100MB LAN activity, ethernet link status, and LAN transmit/receive activity. And despite the case's monolithic appearance, you can access the Netfinity's interior surprisingly easily. We had no difficulty locating the tool-free levers that open the side panel.

When you open the case, an LED panel (built into the system board) displays status reports on the cooling fans, power supplies, and PCI bus. Warning lights alert you to dangerous sys- ▶

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tem temperatures and hot-swappable disk failures. In addition, IBM placed small red LEDs on the system board (adjacent to critical devices) to help server administrators pinpoint failures of specific memory modules and processors.

But the Netfinity can be time-consuming to repair. Though it has a redundant power supply, to replace a faulty one you must shut down the server and pull out your toolbox—and do the job from inside the unit body. You have to remove screws, disconnect hooks, and unplug discrete cables—there are no quick-connect sockets or slide-in rails as in Gateway's and Toshiba's servers. And to replace the lower power supply, you must remove both units. Worse, they are different sizes, which forces you to stock spares of each type.

Despite a top-notch collection of processors and peripherals, the Netfinity's performance was just middling, ranking third on our Web and file tests and dead last on the SQL test. Other servers here turn in better performance—and are more serviceable—for far less money. Still, its quick-diagnosis features make the Netfinity 5000 worth a look.

XUPER XEON: The Pentium II Xeon (left) dwarfs a Pentium II cartridge.

Xeon vs. Pentium II

INTEL'S NEW family of chips is designed to suit the needs of high-end servers and specialized workstations. The first processor in that family to be released, the Xeon, looks impressive—on paper.

The new chip is more reliable and more tractable. Many of the PII's server weaknesses are addressed in the Xeon.

But the Xeon may not live up to its potential for some time. It can't fulfill its promised 64GB of memory, for example, until new motherboard chips come out. Once the growing pains subside, Xeon will likely challenge the dominance of Digital's Alpha chip, which is used to run the biggest mainframe servers.

THE XEON DIVIDEND

- The Slot 2 connector is closer to plug and play than PII's Slot 1.
- You can obtain up to 2MB of level-2 cache memory—versus 512KB in a Pentium II—and the Xeon's cache runs twice as fast.
- Cluster support lets you join several four-way Xeon servers.
- You can plug in more Xeons as your needs expand; PII servers are limited to two CPUs.

Toshiba Magnia 3000

PRO: Inexpensive system gives speedy file and Web service performance scores, tool-free maintenance, lots of redundant components

CON: Slightly older components run a bit slower than others here

The most distinguishing features of Toshiba's Magnia 3000 lie under the hood: a pair of Pentium IIs clocked at a leisurely 400 MHz, and disks that spin at only 7200 rpm. The slower CPU speed hurt the Magnia's performance in the processor-intensive SQL test. But in the file and Web tests, where disk and network subsystem performance is a key factor, the Magnia redeemed itself, beating out three more powerful servers for second place despite having slower drives. Its low price doesn't hurt, either.

Forgoing faster hard disks and CPUs kept the Magnia's price relatively low; at $7649, it costs only about $1300 more than Compaq's ProLiant. But this is no stripped-down system. Toshiba includes some desirable (and often pricey) extras, such as hot-swappable redundant power supplies.

Anyone can access the Magnia's interior in seconds. Simply turn a front-panel knob, and the side panels slide right off. Expansion slots, too, are tool-free, with cards held in place by spring-loaded clips.

The Magnia's fault-monitoring capabilities are functionally identical to the IBM and the Compaq servers' abilities. Intel's LANDesk Server Manager, modified to coordinate with the Magnia's internal fault monitoring, helps run the show.

Our Magnia came with a 4GB fixed disk and two 9GB hot-swappable SCSI drives, giving it the largest storage capacity of any server in this group. Two additional hot-swap–ready bays are available for future expansion. This unit also included an optional PCI RAID controller, which may have contributed to its high Web and file scores despite its disks' slower spindle speed.

By hanging back from the leading edge on processor and drive speed, the Magnia makes a small concession on performance that translates into big cost savings. For $7649, you get the fault-tolerant features you want at a price you can afford.

How We Test Server Performance

RELIABILITY, features, and price tag can help you gauge the value of a server. But to determine whether these systems can deliver in the real world, we tested how well they performed three important functions: file serving, database serving, and Web serving.

The file service test, Dynameasure File Professional 2.0, measures the ability to perform standard file serving. The database test, Dynameasure SQL Professional 2.0, evaluates a system's suitability for tasks requiring raw processing power. The Web test uses Mercury Interactive's LoadRunner to simulate users' attempts to download HTML text and graphics files from a Web site.

online

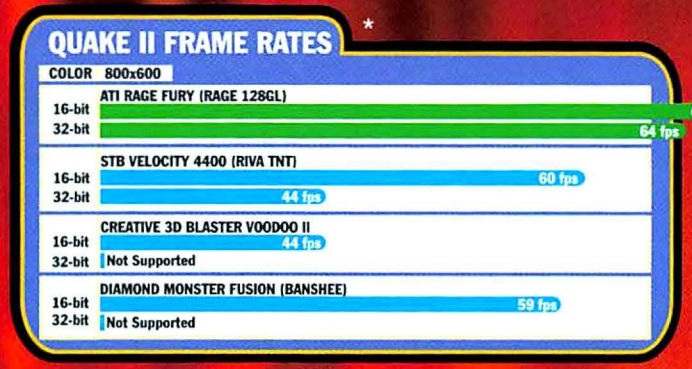
For detailed information about our testing methodology and techniques, check out PC World Online at www.pcworld.com/mar99/servers.

Rob Hummel is a New Hampshire–based computer programmer, author, and commentator. John Bass is a senior technical staff member at Centennial Networking Labs, a networking testing center in North Carolina. ■

It's the fastest true color graphics technology ever. It's the new breed of speed.

Introducing ATI RAGE 128 graphics technology. From the world leader in PC graphics. Its heart is the new ATI RAGE 128 next-generation 3D accelerator, the revolutionary new graphics chip with the fastest performance, no matter what the measure – 3D, 2D or DVD video. It combines a true 128-bit graphics engine and up to 32MB of memory with 32-bit true color and ATI's new SuperScalar Rendering. So you get blistering true color (16.7 million colors) 3D that's even faster than the competition's 16-bit (64,000 colors) performance.

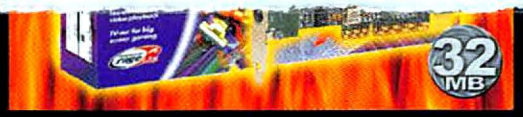
And it's the only graphics chip you can buy that delivers exquisite DVD video from hardware DVD decoding. Look for new ATI RAGE 128 technology in the newest systems from the world's top PC makers, and in the new ATI RAGE 128 graphics upgrades available at computer retailers everywhere. Nothing is faster.



True 128-Bit Graphics • 32-Bit Color • Up To 32MB • SuperScalar Rendering • Hardware DVD

ATI RAGE 128 Is Born.
Graphics Scream.

GRAPHICS BY

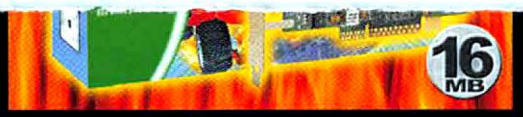


RAGE FURY

The Ultimate 3D Game Card

More advanced features. True color 3D graphics. More speed, realism and heart-pounding 3D excitement than you get from any other graphics board.

- Fast 16-bit and 32-bit true color rendering
- RAGE 128 GL 128-bit graphics engine and 128-bit memory interface for incredibly fast 3D and 2D graphics
- 32MB of memory to handle massive graphics textures and deliver outstanding performance
- Advanced 3D architecture with Single Pass Multi-Texturing
- Full 3D acceleration in all modes, all color depths, and all resolutions up to 1920x1200
- Full OpenGL, DirectX 6.0 and Direct 3D acceleration
- Hardware DVD for full-frame, full-screen DVD playback
- TV-Out for a big-screen gaming experience

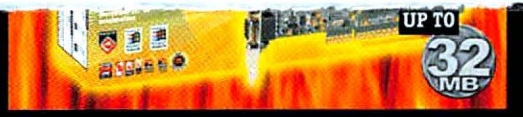


XPERT 128

The Graphics and DVD Powerhouse

ATI brings striking graphics performance and DVD video to home, small office and home-based business PCs. It's the best all-round graphics upgrade you can buy.

- RAGE 128 GL 128-bit graphics engine and 128-bit memory interface for incredibly fast 3D and 2D graphics
- 16MB of memory radically improves visual quality
- Hardware DVD for full-frame, full-screen DVD playback to save the added expense and hassle of installing a separate MPEG-2 decoder
- Full OpenGL, DirectX and Direct 3D acceleration
- Advanced 3D architecture with Single Pass Multi-Texturing
- Full 3D acceleration in all modes, all color depths, and all resolutions up to 1600x1200



All-IN-WONDER 128

The Ultimate Multimedia Upgrade

It's the RAGE 128-based addition to the number one all-in-one TV, graphics and video upgrade. In fact, there's practically nothing you can't do – from running the very latest games and applications, to watching TV and capturing and replaying video.

- A 128-bit graphics engine and 128-bit memory interface for incredibly fast 3D and 2D graphics
- Up to 32MB of memory to handle massive graphics textures and deliver outstanding performance
- Advanced TV tuner functions including instant replay, digital VCR with video compression and video capture
- Enables Web TV for Windows 98
- TV-Out for a big-screen gaming experience
- Hardware DVD for full-frame, full-screen DVD playback

For complete product specifications, industry reviews and where-to-buy, check out www.atitech.com.

GRAPHICS BY ATi rage 128

The New Breed of Speed.

ATi®

© Copyright 1999, ATI Technologies Inc. ATI, RAGE 128 VR, RAGE 128 GL, RAGE FURY, All-in-Wonder and XPERT 128 are trademarks and/or registered trademarks of ATI Technologies Inc. Features, performance, and specifications may vary by operating environment and are subject to change without notice. Products may not be exactly as shown. * All tests were done running Quake II v3.19 on a P2-450MHz system with 64MB RAM, Windows 98, DirectX 6.0. ATI RAGE FURY, STB Velocity 4400, Creative 3D Blaster Voodoo II and Diamond Monster Fusion were tested using drivers 4.11.6031, 4.10.01.2104-01.37, 4.10.01.0094 (2.16), 4.10.01.0206 respectively.

A monthly update of the best desktop PCs, notebooks, printers, monitors, graphics boards, and modems

PC WORLD

TOP 100

196 Power Desktops

204 Budget Desktops

220 Notebooks

224 Home PCs

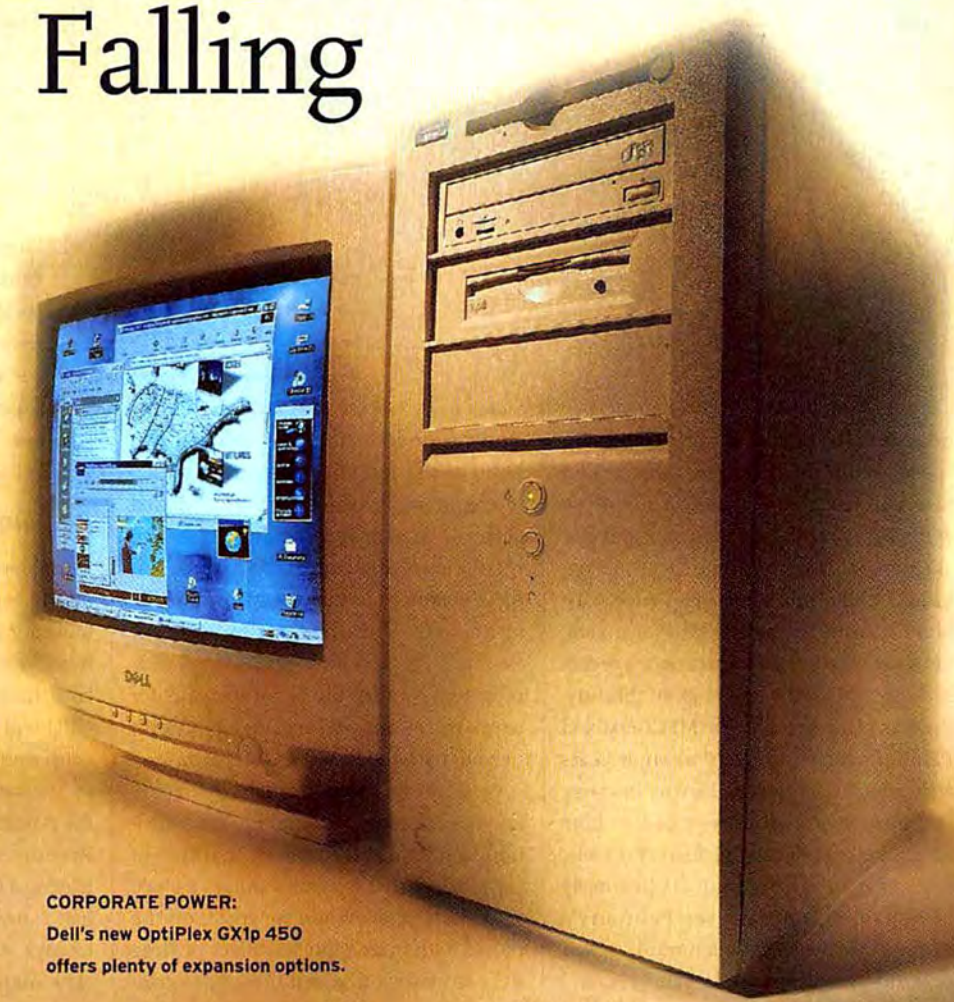
227 Printers

231 Monitors

233 Graphics Boards

235 Modems

Pentium III Rising, Prices Falling



CORPORATE POWER:
Dell's new OptiPlex GX1p 450 offers plenty of expansion options.

Edited by Cameron Heffernan

PHOTOGRAPHS: MARC SIMON ICONS: JEFFREY PELO

WHAT? No new chip this month? Afraid not. Those of you whose ear hair tingles at the mere mention of Intel's latest offering, the Pentium III, will just have to wait another month for our first look at systems based on those CPUs. But the $3500 question is, should you wait? The answer: It depends.

When a new technology arrives, we tend to wait and see how worthwhile it is before plunking down the big bucks. The new Pentium III–based PCs, which will clock in at 450 and 500 MHz, are no exception. In addition to faster processing speed, Pentium III's 70 new instruction sets will, in theory, provide real-time MPEG-2 encoding and decoding, faster 3D graphics, more accurate speech recognition, and improved imaging effects. To benefit from the new instruction sets, however, you'll need applications specially developed for the new chip. In this way, Pentium III resembles the MMX-enabled Pentium chips introduced a couple years ago, which disappointed many because few apps had been developed to take advantage of their unique instruction sets. For more on the Pentium III (formerly code-named Katmai), see February's "Your PC in the New Millennium," www.pcworld.com/feb99/futurepcs.

The arrival of Pentium III will affect the entire PC marketplace, as systems equipped with Pentium II-450 chips lose command. Although Intel plans to target its Pentium III chips at the entry-point workstation level, the company will also likely be aiming at the mass-market desktop segment. Prices of Pentium II–based systems may drop dramatically in the retail channel as stores try to clear out their inventory to make way for the new technology. Thus the older but still fast Pentium IIs (and their equivalents) may represent some of the better bargains for users who want performance but don't need to have the fastest PC on earth.

Vendors that specialize in the direct-to-end-user channel are handling the transition to Pentium III systems in different ways, compared to retail vendors as well as to each other. When we spoke off the record with three representatives of large PC companies that sell directly to consumers, we uncovered a wide range of strategies. A spokesperson from the first vendor said the company expects to move completely to the new systems soon—within four to six weeks of the new chips' introduction—and that the price difference between Pentium II– and Pentium III–based systems would be minimal. The second company said it anticipates that Pentium II computers will coexist with the new systems for about three to six months before being phased out completely, and that Pentium III–equipped machines will cost $200 to $300 more than those without the new instruction sets. The third company said it plans to continue offering Pentium II–based PCs for no more than three months and that Pentium III systems will cost about $90 more than their similarly configured predecessors.

XEROX'S CORPORATE-minded DocuPrint N17b delivers high print quality at a good price. See *Top 10 Printers*, page 227, for details.

What does all this mean to you? That now, more than ever, you have to shop carefully. Do your homework and get prices from lots of different manufacturers. Some companies will advertise their new Pentium III PCs with the heftiest configurations: huge hard disks, large monitors, expensive graphics cards, and costly bundled extras you might not need. In some cases, it may be the configuration rather than the CPU that drives the price up. Figure out exactly what you want in your new PC *before* you buy, then have the vendor configure it to meet your needs.

NOT A ONE-CHIP TOWN

PENTIUM III–BASED PCS are expected to be the top performers for a while, but their dominance could prove to be short-lived. With AMD's K7 chip slated to arrive later this year, it's possible that a non-Intel CPU will be the new speed king. Such a coup would be unprecedented, according to Michael Slater, principal analyst with the processor-research firm MicroDesign Resources. "For the first time, AMD is playing a game of leapfrog [with Intel], not just running two to three years behind," he says. As will be the case with Pentium III's instruction sets, applications will

have to be specially optimized in order to take advantage of AMD's 3DNow technology, which enhances 3D texturing as well as 3DNow-aware games or those developed with DirectX 6.0.

If the K7 turns out to be faster than Intel's Pentium III, it's unclear how long AMD's dominance will last. That's because Intel's next chip, codenamed Coppermine, will likely start appearing in systems by midyear to challenge AMD's K7 in the high-stakes performance race.

The arrival of AMD's K7 chip later this year could mean a non-Intel chip will be the fastest on the block—at least until Intel responds.

Slater also says (unsurprisingly) that performance will continue to improve, and predicts that low-end PCs with 3D graphics and DVD-ROM players will sell for as little as $900 before the year's end. Systems on our Budget Desktops chart will likely remain the better bargains as Intel's Celeron-366 and -400 and AMD's K6-2-400 chips make their presence felt in the midrange.

BUDGET BONANZA

WE RECENTLY TESTED three Celeron-366–based PCs and two equipped with AMD's K6-2-400 (see February's "On Target! $1499 PCs Hit the Mark," www.pcworld.com/feb99/newchips). In PC WorldBench 98 tests, two of the Celeron-366 systems—Hewlett-Packard's Vectra VE Series 8 and Micron's Millennia C366—outperformed the average PII-350 system with 64MB of RAM, as did the CyberMax Enthusiast KII 400. We'll take a further look at those and other midrange budget systems in next month's *Top 100*.

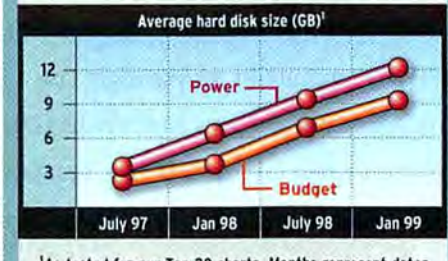
This month's Budget Desktops chart features great bargains on systems at the lower end of the price scale. Two new competitively priced offerings, the $1399 Dell Dimension V350 and the $1899 Gateway GP6-400, take first and fourth place, respectively. Although the Dell's configuration, including a Pentium II-350 chip, may now be commonplace, the low price is anything but, and you get the added bonus of Dell's strong service and reliability record. Gateway's GP6-400, based on the Pentium II-400, goes a bit further, with extras like an Iomega Zip drive and an integrated ethernet connection. Axis Systems' Metropolis NX5-333c debuts at the bottom of the price scale, at just $1054 (including a network card). This speedy Celeron-333 system has a small 4.3GB hard disk and lacks software, but its price is hard to beat.

On the mobile front, Intel has just released a slew of new processors: This month we focus on the first notebooks equipped with Intel's Pentium II-366 and -333, Pentium II-300 Performance Enhanced, and Celeron-266 (see *Top of the News*, page 52). We'll review them for next month's *Top 10 Notebooks*.

Cameron Heffernan is an associate editor for PC World. *Senior Associate Editors Vince Bielski, Bryan Hastings, and Karen Silver; Staff Editors Grace Aquino and Mick Lockey; Editorial Assistant Kalai Murugesan; and freelance writers Gordon Meyer and JoAnne Robb contributed to the* Top 100. *Testing was performed by Ulrike Diehlmann, Robert James, Elliott Kirschling, Jeff Kuta, Nancy Miller, and Mike Salayko of the PC World Test Center. See page 14 for contact information.*

Hard Disk Growth Spurt

SURE, PCS ARE getting faster and cheaper, but vendors are also equipping them with dramatically larger hard disk drives.



[1]As tested for our Top 20 charts. Months represent dates systems were tested, not magazine issue dates.

YOUR GUIDE TO THE TOP 100

QUESTIONS ABOUT OUR CHARTS? The following section should answer most of them.

How do the charts work? The Top 20 and Top 10 charts are evolving lists of the best PCs, printers, monitors, graphics boards, and modems we've tested. System charts are divided by price. Power desktops cost $2000 or more; power notebooks cost $2750 or more. We compare new products to previously reviewed hardware, updating the charts to reflect price cuts and other changes.

Where do you get your prices? We estimate street prices based on vendor information and our own research, including surveys of retail outlets. We recheck all prices every month.

What does the overall rating mean? This 100-point scale reflects results from our hands-on evaluations and performance tests. A score in the 90s is exceptional, while one in the 80s is among the best and one in the 70s above average.

What does the PC WorldBench 98 score mean? It's a measure of how fast a PC is in relation to our baseline machine, a Gateway PMMX-200 configured with 32MB of RAM, a 2GB hard drive, and 512KB of secondary cache. A PC that scores 200, for instance, is twice as fast as the baseline system.

Where do the scores for reliability, support quality, and support policies come from? Reliability and support quality scores are based on surveys of *PC World* readers and anonymous support calls made by *PC World* staff. The policies score is based on vendor support policies.

What do all those word scores mean? Word scores for performance and price are based on a product's rating in relation to other products in its category. For instance, we score the performance of Windows NT PCs separately from that of Windows 95 machines. (Based on our PC WorldBench 98 tests, Windows NT machines are faster on average than Win 95 PCs.)

Check out *PC World*'s Top 400 reviews online. Point your browser to PC World Online (www.pcworld.com/top400) to explore our Top 400, which provides comprehensive reviews and ratings for products in 16 different categories. You'll also find reviews not available in print.

PC WORLD

TOP 20 POWER DESKTOPS

	SYSTEM	Last month	Month tested	Street price (12/18/98)	CPU	Comments
1	Dell OptiPlex GX1p 450 800/388-8542 www.dell.com	n/a	NEW	$2499	Pentium II-450	Great performance, management features, and a 14.4GB hard disk for a fair price.
2	Dell Dimension XPS R450 800/388-8542 www.dell.com	4	Nov 98	$2319	Pentium II-450	Good features; now includes STB NVidia 3D graphics card with 16MB of SGRAM.
3	Gateway GP6-450 800/846-2000 www.gateway.com	3	Jan 99	$2293	Pentium II-450	Nice general-business PC with management options; now has 16MB of SDRAM.
4	Polywell Poly 8450 B5 800/999-1278 www.polywell.com	7	Jan 99	$2038	Pentium II-450	After $157 cut, fastest Win 98 system is a great value; powerful multimedia.
5	Micron Millennia 450 Max 888/634-8799 www.micronpc.com	n/a	Nov 98	$2385	Pentium II-450	Impressive speed and graphics, plus DVD-ROM drive and 14.4GB hard disk.
6	Sys Performance Pro 450 800/613-9963 www.sys.com	10	Dec 98	$2399	Pentium II-450	General-business PC with LS-120 drive sheds $100; good service and support.
7	Axis Systems Metropolis GX7-S PII-400 800/378-9014 www.axissys.com	n/a	NEW	$2185	Pentium II-400	Great performance and feature set for manageable midtower with network card.
8	Gateway E-4200 450 800/779-2000 www.gateway.com	5	Feb 99	$2429	Pentium II-450	Managed PC with network card and strong warranty; slow for a PII-450.
9	Compaq Deskpro EP 6450 800/345-1518 www.compaq.com	18	Nov 98	$2148	Pentium II-450	Corporate PC with Zip drive sheds $195; video RAM doubled to 8MB from last month.
10	MidWest Micro Business Solutions 400 800/728-8582 www.mwmicro.com	6	Dec 98	$2014	Pentium II-400	Network-ready PC with LS-120 drive; graphics card upgraded to STB Velocity 4400.
11	Compaq Prosignia Desktop 330 800/345-1518 www.compaq.com	17	Feb 99	$2124	Pentium II-450	Big $305 drop moves small-business PC with network card and modem up chart.
12	IDot.com 450 BX 3 888/388-4368 www.idot.com	n/a	Jan 99	$2131	Pentium II-450	Debuts on chart after $151 price cut; good warranty and performance.
13	Acma ZPower 7450 PII-450 800/786-6888 www.acma.com	n/a	NEW	$2598	Pentium II-450	Quick PC with network card, DVD-ROM and Zip drives; limited expandability.
14	HP Vectra VL Series 8 HE 800/322-4772 www.hp.com/desktops	14	Nov 98	$2370	Pentium II-450	High-end, multimedia-savvy corporate system has plenty of management options.
15	IBM PC 300 PL 800/426-2968 www.ibm.com	16	Jan 99	$2549	Pentium II-450	Quick, network-ready PC is available via retail only (model number is 6862fxj).
16	Quantex QP6/450 SB-4 800/896-4898 www.quantex.com	n/a	NEW	$2549	Pentium II-450	Small-business PC offers decent NT performance, massive hard disk, network card.
17	Aberdeen Inverness D27 PII-450 888/300-5545 www.aberdeeninc.com	n/a	Feb 99	$2499	Pentium II-450	Price of network-ready PC with LS-120 drive falls $100; poor support policies.
18	HP Brio 8500 PII-450 800/752-0900 www.hp.com/desktops	11	Dec 98	$2344	Pentium II-450	Fast network-ready system with CD-RW drive; Brio tech support hours shortened.
19	Quantex QP6/450 SM-4x SE 800/896-4898 www.quantex.com	15	Feb 99	$2469	Pentium II-450	Multimedia-friendly PC has 4.8X DVD-ROM drive, good business software bundle.
20	NEC PowerMate 8100 888/863-2669 www.neccomputers.com	9	Jan 99	$2988	Pentium II-450	Pricey corporate PC has network card and USB monitor but no software bundle.

Best Buy See features chart, page 198; test report, page 200.

n/a = not applicable

[1]A system's performance word score is relative to scores of other PCs running the same operating system. For more details see "Your Guide to the Top 100" on page 195.

[2]For more information about all products in this table, select PC World InfoNet no. 904 or visit www.pcworld.com/infonet.

FOUR NEW SYSTEMS land on the power chart this month, led by the number one Best Buy, Dell's OptiPlex GX1p 450. This corporate PC is blazingly fast, feature laden, network ready, and moderately priced at $2499. Axis Systems' new Metropolis GX7-S PII-400, a cheaper corporate option, comes in at number seven. One of only two Pentium II-400 systems on the chart, it delivers strong performance and comes with an integrated network card. The Desktop 330 from Compaq's new Prosignia line dropped a whopping $305 from last month, moving it up several notches to 11th place. Just off the chart is NEC's new Direction SPB 450, a fast and loaded machine hurt mostly by its high $3051 sticker price.

SCORECARD

★ Overall rating	PC WorldBench 98/operating system	Performance [1]	Features and design	Vendor's system reliability	Price	Vendor's support quality/policies	PC World InfoNet number [2]
92	257/Win NT 4.0	very good	very good	good	average	good/outstanding	649
89	212/Win 98	good	very good	good	average	good/good	650
87	213/Win 98	good	very good	good	average	fair/outstanding	651
87	224/Win 98	outstanding	very good	[3]	inexpensive	fair [4]/fair	652
86	218/Win 98	very good	very good	good	average	good/good	653
84	222/Win 98	outstanding	very good	[3]	average	good [4]/good	654
83	256/Win NT 4.0	very good	very good	[3]	average	good [4]/good	655
82	204/Win 98	good	outstanding	good	average	fair/outstanding	656
81	214/Win 98	very good	good	good	inexpensive	fair/outstanding	657
81	233/Win NT 4.0	good	outstanding	[3]	inexpensive	good [4]/good	658
81	210/Win 98	good	very good	good	inexpensive	fair/good	659
80	219/Win 98	very good	good	[3]	inexpensive	good [4]/good	660
79	218/Win 98	very good	very good	[3]	expensive	good [4]/good	661
78	216/Win 98	very good	very good	good	average	good/poor	662
78	219/Win 98	very good	good	fair	expensive	good/good	–
78	250/Win NT 4.0	very good	outstanding	[3]	expensive	fair [4]/good	663
77	223/Win 98	outstanding	outstanding	[3]	average	fair [4]/unacceptable	664
77	263/Win NT 4.0	outstanding	satisfactory	good	average	good/poor	665
77	213/Win 98	good	outstanding	[3]	average	fair [4]/good	666
77	218/Win 95	very good	very good	outstanding	very expensive	good [4]/good	667
Scorecard weightings ▶		Performance 25 percent	Features 25 percent	Reliability 15 percent	Price 15 percent	Quality/policies 10 percent each	

[3] Insufficient data to give a rating.

[4] Scores were derived from anonymous support-quality calls due to insufficient data from survey.

This Month's Best Buys

1 DELL OPTIPLEX GX1P 450

PRO: Large hard drive, plenty of expansion slots

CON: Few open bays, RAM sockets hard to access

For about the price of an average Pentium II-450 PC, you get a terrific NT machine with Dell's fast new OptiPlex GX1p 450. While most PII-450s come equipped with a 10GB or smaller hard drive, the $2499 OptiPlex ships with a spacious 14.4GB drive.

To maximize expandability, the system features a separate motherboard and expansion slot circuit boards, connected to each other at a right angle. Thanks to this unusual design and the extrawide midtower case, the OptiPlex can handle up to seven expansion cards, and ships with a phenomenal six open slots (three PCI, two ISA, and one shared ISA/PCI).

The OptiPlex comes with excellent documentation (including a setup booklet and poster), color-coded connectors, a three-year warranty on both parts and labor, and around-the-clock support. In addition to the 3Com Fast EtherLink XL network interface card, Dell provides its own Open Manage Client Administrator, a feature that IS professionals will appreciate. The OptiPlex reverts to PCI graphics technology—it uses an STB NVidia TNT adapter with its D1028L 17-inch monitor, which delivers good picture quality at resolutions up to 1280 by 1028.

Dell OptiPlex GX1p 450

Although the OptiPlex has plenty of expansion slots, it's a bit short on open drive bays, with only one 5.25-inch bay and one hidden bay. Despite the large hard disk and preinstalled Zip drive, we'd prefer to see room for additional drives and at least one large-capacity backup device.

Adding RAM to this machine might be somewhat of a hassle, as the processor and power supply partially block access to the DIMM sockets. We ordered our test system without speakers; you can add them for $49 or $105, depending on the models you choose.

2 DELL DIMENSION XPS R450

PRO: Extensive features including high-quality 4.8X DVD-ROM drive and MPEG-2 playback

CON: None significant

If you're venturing away from the corporate fold, Dell's latest Win 98 midtower is a fine choice. After a $210 price cut, this PII-450 now costs $2319. Good performance, impressive multimedia features, and strong reliability and support ratings combine to make the XPS R450 one of our top picks for power-hungry small or home businesses.

Although the Dimension's PC WorldBench 98 score of 212 is among the lowest on the power chart, this PC is plenty fast for most users, loading Microsoft Word and Internet Explorer on the screen almost instantly. File junkies and pack ▶

PHOTOGRAPHS: KEN SMITH

TOP 20 POWER DESKTOPS

STANDARD FEATURES

	SYSTEM [1]	CPU	Operating system	RAM (MB)	Second-ary cache (KB)	Hard drive (GB)	Graphics adapter (AGP unless noted)	Video RAM (MB/type)	Monitor tube/ viewable diag-onal (inches)	56-kbps modem protocol
1	Dell OptiPlex GX1p 450*	Pentium II-450	Windows NT 4.0	128	512	14.4	integrated STB NVidia TNT [3]	16/SDRAM	17/15.9	not included
2	Dell Dimension XPS R450*	Pentium II-450	Windows 98	128	512	10	STB Velocity 128zx	8/SGRAM	17/16	V.90
3	Gateway GP6-450*	Pentium II-450	Windows 98	64	512	10	ATI Xpert98	8/SDRAM	19/18	x2
4	Polywell Poly 8450 B5*	Pentium II-450	Windows 98	128	512	10	Matrox Millennium G200	8/SGRAM	17/16	V.90
5	Micron Millennia 450 Max*	Pentium II-450	Windows 98	64	512	14.4	Diamond Viper V550	16/SGRAM	17/15.9	V.90
6	Sys Performance Pro 450	Pentium II-450	Windows 98	128	512	10.1	Matrox Millennium G200	8/SGRAM	17/15.8	V.90
7	Axis Systems Metropolis GX7-S PII-400	Pentium II-400	Windows NT 4.0	128	512	9.1	Diamond Viper V550	16/SDRAM	19/17.9	not included
8	Gateway E-4200 450	Pentium II-450	Windows 98	128	512	10	ATI Rage Pro Turbo	8/SGRAM	19/18	not included
9	Compaq Deskpro EP 6450	Pentium II-450	Windows 98	64	512	10	Matrox Millennium G200	8/SGRAM	17/16	K56flex
10	MidWest Micro Business Solutions 400	Pentium II-400	Windows NT 4.0	128	512	12.7	Matrox Millennium G200	8/SDRAM	17/15.8	not included
11	Compaq Prosignia Desktop 330	Pentium II-450	Windows 98	128	512	16.8	STB Velocity 4400	16/SDRAM	17/16	V.90
12	IDot.com 450 BX 3	Pentium II-450	Windows 98	128	512	14.4	Matrox Millennium G200	8/SGRAM	17/16.1	V.90
13	Acma ZPower 7450 PII-450	Pentium II-450	Windows 98	128	512	14.4	Number Nine Revolution IV	16/SDRAM	17/16.1	V.90
14	HP Vectra VL Series 8 HE	Pentium II-450	Windows 98	64	512	10.1	integrated Matrox G200	8/SGRAM	17/16	not included
15	IBM PC 300 PL	Pentium II-450	Windows 98	64	512	9.1	Matrox Millennium G200	8/SGRAM	17/16	not included
16	Quantex QP6/450 SB-4	Pentium II-450	Windows NT 4.0	128	512	16.8	Number Nine Revolution IV	32/SDRAM	19/18	not included
17	Aberdeen Inverness D27 PII-450	Pentium II-450	Windows 98	128	512	10.1	Matrox Millennium G200	8/SGRAM	17/16	not included
18	HP Brio 8500 PII-450	Pentium II-450	Windows NT 4.0	64	512	10.1	integrated ATI 3D Rage Pro	4/SGRAM	17/16	not included
19	Quantex QP6/450 SM-4x SE	Pentium II-450	Windows 98	128	512	16.8	STB Velocity 4400	16/SDRAM	19/18	V.90
20	NEC PowerMate 8100	Pentium II-450	Windows 95	64	512	14.4	Accel Graphics AccelStar 3D II	8/SDRAM	17/15	not included

* Best Buy

[1] Configuration as tested. Vendor may have since changed components.

[2] *PC World* defines towers as taller than 20 inches, midtowers as 15.5 inches to 20 inches, and minitowers as shorter than 15.5 inches.

[3] PCI-based graphics.

Dell Dimension XPS R450

rats will like the big 10GB hard drive.

Multimedia capability is one of this system's strengths. Its DVD video output is supersmooth, thanks to effective MPEG-2 playback, 128MB of RAM, and a 17-inch Trinitron monitor. Even with half a dozen apps churning away in the background, playback remained flawless. Our test PC came with an STB Velocity 128zx graphics card with 8MB of video RAM, but Dell now ships this Dimension with an STB NVidia TNT 3D that packs 16MB of video RAM.

The included Turtle Beach Montego sound card and Altec Lansing ACS295 speaker-subwoofer combination produce powerful, crystal-clear sound. Just make sure you have enough space for the subwoofer, which is the size of a small microwave oven. Dell backs the well-built, well-documented XPS R450 with phone support around the clock, and our readers rate Dell's system reliability as good.

3 GATEWAY GP6-450

PRO: Price includes 19-inch monitor, network card, and modem; easy setup

CON: Comes with just 64MB of RAM

With a price of $2293 and a respectable PC WorldBench 98 score of 213, the GP6-450 balances affordability with solid performance. Ultimately, this PC is built for business, featuring both a 56-kbps modem and an ethernet card that's ready to plug into a cable modem or small-business network. It also ships with a 19-inch monitor—great for large spreadsheets—but lacks a DVD-ROM drive; our test system included a 13X–32X CD-ROM drive instead. Most business users won't mind, though. And while our test unit came with 8MB of video RAM, the PC now ships with 16MB.

Three open slots ensure trouble-free expandability, and if the 10GB hard drive ever begins to fill up, you can use one of the three free externally accessible bays to add a second hard disk, a Zip drive, or a tape backup unit.

Gateway GP6-450

When the system is configured with just 64MB of RAM, the tall midtower's

CD/DVD-ROM drive speed	Sound board	EXPANDABILITY: Case style [2]	Max. RAM (MB)	Open RAM sockets	Open drive bays (ext./int.)	Open slots	CUSTOMER SUPPORT: Warranty for parts/labor (years)	Weekday toll-free support (hours)	Weekend support	Online support
17X-40X	Integrated Crystal PnP	midtower	384	2	1/1	6	3/3	24	Sat, Sun	AOL, BBS, CIS, MSN, WWW
4.8X DVD-ROM	Turtle Beach Montego	midtower	768	2	2/1	2	3/1	24	Sat, Sun	AOL, BBS, CIS, MSN, WWW
13X-32X	Creative Ensoniq AudioPCI	midtower	384	2	3/2	3	3/3	24	Sat, Sun	AOL, BBS, CIS, MSN, WWW
2X DVD-ROM	Aztech PCI 338-A3D	midtower	1024	3	3/1	3	1/5	[4]	[4]	WWW
2X DVD-ROM	Integrated Crystal PnP	midtower	384	1	3/1	4	varies [5]/1	24	Sat, Sun	BBS, CIS, WWW
17X-40X	Sound Blaster AWE64	midtower	1024	3	3/2	4	varies [6]/5	24	Sat, Sun	WWW
14X-32X	Creative Ensoniq AudioPCI	midtower	512	3	3/0	3	3/3	24	Sat, Sun	WWW
13X-32X	Sound Blaster Audio PCI 64V	midtower	384	2	3/2	3	3/3	24	Sat, Sun	AOL, BBS, CIS, MSN, WWW
12X-32X	Integrated ESS 1869	desktop	384	2	0/1	3	3/1	24	Sat, Sun	AOL, BBS, CIS, WWW
14X-40X	Sound Blaster PCI128	midtower	384	2	3/1	3	varies [5]/3	24	Sat, Sun	BBS, WWW
12X-40X	Creative Ensoniq AudioPCI	midtower	384	2	1/1	2	3/1	24	Sat, Sun	AOL, BBS, CIS, Prodigy, WWW
17X-40X	Aztech PCI 338-A3D	midtower	384	2	3/0	3	varies [5]/1	24	Sat, Sun	WWW
4.8X DVD-ROM	Sound Blaster Live	midtower	384	2	1/0	1	3/1	24	Sat, Sun	BBS, WWW
12X-32X	Aztech AZT2320	minitower	384	2	2/1	4	3/1 [7]	11	none	AOL, BBS, CIS, WWW
14X-32X	Integrated Crystal PnP	desktop	384	2	1/0	4	3/1	24	Sat, Sun	AOL, BBS, CIS, WWW
14X-32X	Creative Ensoniq AudioPCI	midtower	768	1	3/3	4	3/1	24	Sat, Sun	BBS, WWW
14X-32X	Creative Ensoniq AudioPCI	midtower	768	2	4/1	4	1/1	9	none	WWW
12X-24X	Aztech AZT2320	midtower	384	2	3/0	3	3/90 days	16	none	AOL, CIS, WWW
4.8X DVD-ROM	Creative Audio PCI 64V	midtower	768	1	2/3	4	3/1	24	Sat, Sun	BBS, WWW
12X-32X	Integrated Crystal PnP	midtower	384	2	2/1	5	3/3	24	Sat, Sun	AOL, BBS, CIS, MSN, WWW

[4] Around-the-clock support for one year, then 10 hours weekdays, 4 hours Saturday.

[5] Five years on CPU and main RAM, three years on other parts.

[6] Six years on CPU and main RAM, three years on other parts.

[7] Tech support is free for one year, then $99 per year. On-site service is free for 90 days.

roomy interior includes two free memory sockets. But you might want to order yours with 128MB, since doubling the RAM costs less than $100.

Bundled with the GP6-450 are three extremely useful software titles for small-office/home-office use: Microsoft's Office 97 Small Business Edition, Expedia Streets 98, and Bookshelf 98. In our recent reliability and service survey, *PC World* subscribers rated the reliability of Gateway's business systems as above average, but the company earned only fair marks for service, as readers reported long waits for technical support. In our anonymous calls to Gateway's 24-hour support line, however, our average wait was between 5 and 10 minutes, and the courteous representatives gave good advice.

4 POLYWELL POLY 8450 B5

PRO: Fastest PII-450 we've tested on Windows 98, solid graphics board, crisp display

CON: Unimpressive software bundle, speaker controls are on subwoofer

A $157 price drop puts the Polywell Poly 8450 B5 in Best Buy territory this month. With a PC WorldBench 98 score of 224, it's the fastest Windows 98 system we've ever reviewed. But beyond sheer speed, does this midtower deserve your attention? If efficient performance for office productivity applications tops your wish list, yes.

The 8450 B5 brings notable assets to multimedia and graphics, including a Matrox Millennium G200 AGP graphics adapter—one of the best for handling fast image display and maintaining 3D graphics quality. Our system shipped with a high-quality 17-inch Decaview V387 monitor with easy-to-use controls and an on-screen display control menu. The PC's audio card, an Aztech PCI 338-A3D, generates above-average 3D sound with the help of a Juster multimedia speaker system and a subwoofer. But because the power, volume, and bass controls are located on the subwoofer, you have to place the bulky unit on or near your desk to get at those controls.

Polywell Poly 8450 B5

The Polywell comes with a software bundle of dubious value. It was a shock, for instance, to find the 1995 edition ▶

of Microsoft Encarta among the offerings. Checking under the PC's hood requires using a screwdriver to loosen one screw, but the side panel pops off and on easily, and you've got free and clear access to the open memory sockets and card slots. Toll-free tech support is available around the clock for the first year only; after that it drops to 10 hours on weekdays and 4 hours on Saturday. The warranty covers parts for one year and labor for five, but Polywell charges $75 for on-site service.

5 MICRON MILLENNIA 450 MAX

PRO: Excellent performance, DVD-ROM drive, good track record on reliability and service

CON: Audio subsystem is only average

When it debuted on the power chart last November, Micron's Millennia 450 Max was the fastest Windows 9x system we'd ever tested. Quicker PCs have since taken over that title, but this $2385 midtower, with its PC WorldBench score of 218, still outperforms many of its similarly configured peers.

Micron Millennia 450 Max

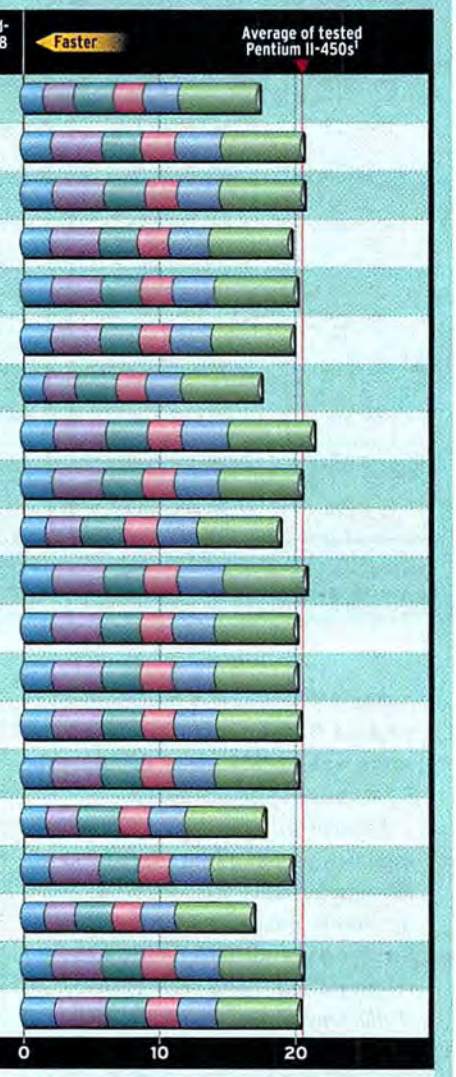
This Millennia should please most business multimedia users, although if you're doing serious graphics work you'll want to upgrade the fine 17-inch Micron 700VX monitor to a 19- or 21-inch model.

The 450 Max's sleek, curved front bezel is an appealing departure from the dreaded Beige Box Syndrome. A removable ▶

TOP 20 POWER DESKTOPS

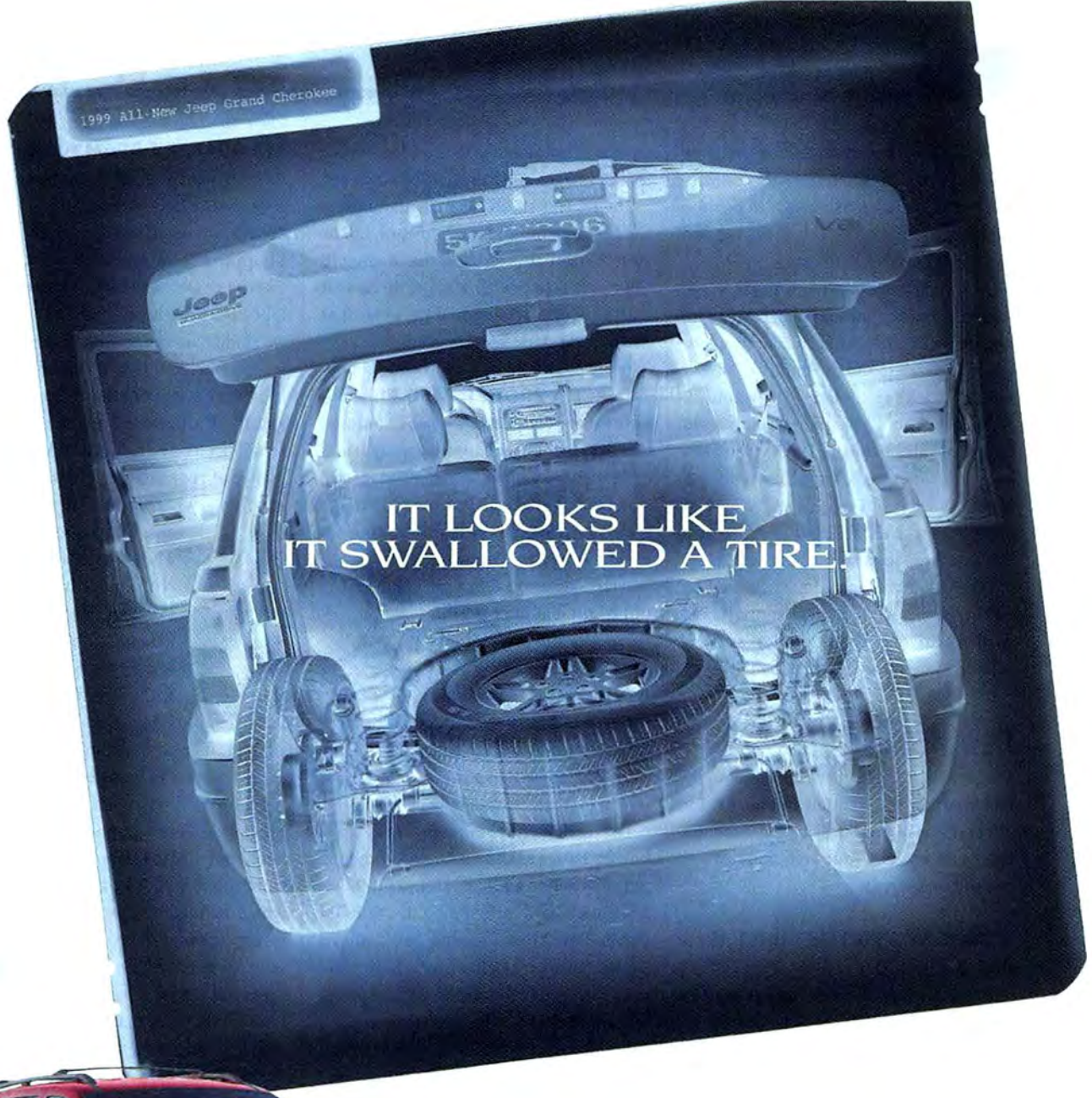
TEST REPORT

	SYSTEM	CPU	Operating system	RAM (MB)	Secondary cache (KB)	PC WorldBench 98 score
1	Dell OptiPlex GX1p 450*	Pentium II-450	Win NT 4.0	128	512	257
2	Dell Dimension XPS R450*	Pentium II-450	Win 98	128	512	212
3	Gateway GP6-450*	Pentium II-450	Win 98	64	512	213
4	Polywell Poly 8450 B5*	Pentium II-450	Win 98	128	512	224
5	Micron Millennia 450 Max*	Pentium II-450	Win 98	64	512	218
6	Sys Performance Pro 450	Pentium II-450	Win 98	128	512	222
7	Axis Systems Metropolis GX7-S PII-400	Pentium II-400	Win NT 4.0	128	512	256
8	Gateway E-4200 450	Pentium II-450	Win 98	128	512	204
9	Compaq Deskpro EP 6450	Pentium II-450	Win 98	64	512	214
10	MidWest Micro Business Solutions 400	Pentium II-400	Win NT 4.0	128	512	233
11	Compaq Prosignia Desktop 330	Pentium II-450	Win 98	128	512	210
12	IDot.com 450 BX 3	Pentium II-450	Win 98	128	512	219
13	Acma ZPower 7450 PII-450	Pentium II-450	Win 98	128	512	218
14	HP Vectra VL Series 8 HE	Pentium II-450	Win 98	64	512	216
15	IBM PC 300 PL	Pentium II-450	Win 98	64	512	219
16	Quantex QP6/450 SB-4	Pentium II-450	Win NT 4.0	128	512	250
17	Aberdeen Inverness D27 PII-450	Pentium II-450	Win 98	128	512	223
18	HP Brio 8500 PII-450	Pentium II-450	Win NT 4.0	64	512	263
19	Quantex QP6/450 SM-4x SE	Pentium II-450	Win 98	128	512	213
20	NEC PowerMate 8100	Pentium II-450	Win 95	64	512	218



*Best Buy

TEST PC WORLD CENTER **HOW WE TEST** All systems are tested with PC WorldBench 98, *PC World*'s application-based benchmark. A higher PC WorldBench score is better. All PCs are tested with Windows 95, Windows 98, or Windows NT 4.0, and video resolution is set to 800 by 600 in 65,536 colors. We run automated scripts on six popular business applications, performing common tasks such as spelling checks, scrolls, saves, sorts, and recalculations. The PC WorldBench 98 score is a sum of the weighted, normalized result of each script: Word 97 (10 percent), Word Pro 97 (10 percent), Excel 97 (20 percent), 1-2-3 97 (20 percent), Paradox 8.0 (20 percent), and Picture Publisher 7.0 (20 percent). For more details on our benchmark and how we run it, see PC World Online (www.pcworld.com/testing). [1]Under Windows 98 with 128MB of RAM.



See? There it is. Right under the cargo area. The spare tire that used to be out in the open is now carefully tucked inside a well underneath the cargo floor. That leaves more room for your gear and provides easy access to a clean tire, should you ever need it.

That's just one of the many interior refinements we've made to the all-new 1999 Jeep® Grand Cherokee. There's also an available all-new overhead console with 13 programmable features to help make this one of the most user-friendly sport utility vehicles around.

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cover artfully conceals the three available external drive bays. On the back, thumbscrew and latches make it easy to pop the side cover, get inside the box, and add memory and expansion cards.

On the downside, Micron made some trade-offs in the audio subsystem. The integrated Crystal sound chip lacks an onboard wavetable, and the bundled Advent AV009 speakers deliver tinny sound. Also, the monitor's picture was simply too dark in our tests during DVD video playback, even after we boosted the brightness setting. The system includes a DVD-ROM drive but lacks an MPEG-2 decoder card (Micron supplies a software decoder).

The Millennia 450 Max is backed by around-the-clock technical support. According to our latest reader survey, Micron systems tend to be reliable.

New This Month

The following systems made our Power Desktops chart for the first time this month. For brief reviews of previously tested machines on the chart, visit our Web page (www.pcworld.com/top400).

7 AXIS SYSTEMS METROPOLIS GX7-S PII-400

PRO: Impressive performance, strong warranty

CON: Poor picture quality, no system manual

Axis Systems' Metropolis GX7-S won't win any beauty contests with its standard beige case and lackluster display quality. But if you're in the market for a high-performance networkable NT workstation with good support policies, the $2185 Metropolis might suit you.

Metropolis GX7-S PII-400

With a PC WorldBench score of 256—the highest of any PII-400 system we've tested—the GX7-S is faster than some PII-450 NT machines with the same 128MB of RAM. Too bad this one comes with only a 9.1GB hard disk and no Zip drive (though you can add one for under $100).

The quick processor is combined with a Diamond Viper V550 graphics card—a consistent contender on our *Top 10 Graphics Boards* chart—but these strengths are effectively canceled out by the system's 19-inch Optiquest V95 monitor, which makes images and icons look washed out.

The PC ships with separate manuals for the components and motherboard, but no system manual. Axis backs the Metropolis GX7-S PII-400 with a solid three-year warranty on parts and labor, as well as around-the-clock telephone support.

13 ACMA ZPOWER 7450 PII-450

PRO: Extras include a Zip drive and both a network card and modem; good business graphics card

CON: Pricey, no software, limited upgrade options

At $2598, the Acma ZPower 7450 PII-450 costs a good $200 more than most PII-450 machines in its class. And you don't get out-of-the-ballpark performance for the price, either: The ZPower's PC WorldBench score of 218 is average for its CPU class. But you do get some fancy components as well as 24-hour tech support—both of which go a long way toward making up for the extra bucks you'll spend.

ZPower 7450 PII-450

The ZPower's beige-and-gray case houses basics such as a 56-kbps modem, plus extras like a Microsoft IntelliMouse, a network card, and a 4.8X DVD-ROM drive. The Altec Lansing Multimedia ACS52 speakers deliver nice highs and lows, but music becomes staticky when you crank up the volume. Business users will be pleased with the graphics card, a Number Nine Revolution IV (which isn't the best for indulging in alien takeovers, however). The ZPower also comes with a Zip drive and a 14.4GB hard disk. Acma bundles no software with the system.

Expansion is limited to one free PCI slot, one free external drive bay, and two free DIMM sockets. Need more card slots? You could probably lose either the modem or the network card.

The ZPower's system manual falls short. For example, it includes a whole section on system upgrades but doesn't tell you how to remove the chassis. If you do run into trouble, Acma offers toll-free technical support around the clock, and the company's reps delivered good service during our anonymous calls.

16 QUANTEX QP6/450 SB-4

PRO: Very good performance, generous hard drive capacity, large monitor

CON: Expensive, support quality is only fair

Shopping for a graphics workstation? Check out Quantex's latest office PC. The QP6/450 SB-4 is pricey at $2549, but this well-built midtower comes ideally equipped for the task. Its PC WorldBench 98 score of 250 befits its Pentium II-450 processor and its Windows NT 4.0 operating system. The 16.8GB hard disk gives you plenty of room to store high-resolution graphics, which you can view on the spacious 19-inch monitor. The system also houses a Number Nine Revolution IV graphics board with a whopping 32MB of RAM—some PCs have less *system* RAM. Considering all these features, plus a 10/100-mbps ethernet adapter, this workstation would be a welcome addition to many office LANs.

Trouble is, more isn't always better. Most users, even graphics mavens, don't need more than 8MB of video RAM. The extra memory goes mainly to texturing, which no business programs—and even very few games—take advantage of. The huge hard disk, too, is overkill for most people. With a cheaper 8MB or 16MB graphics card and a smaller hard disk, this PC would be more affordable. Also, although Quantex offers good support policies—a three-year parts/one-year labor warranty and 24-hour phone support—readers rate the company's support as only fair. In our anonymous calls to tech support, Quantex reps tended to falter on our tougher questions. ▶

Quantex QP6/450 SB-4

BEYOND THE TOP 20

online

We evaluated the following systems along with the others, but they didn't score high enough to reach the *Top 20 Power Desktops* chart. For write-ups, visit PC World Online (www.pcworld.com/t20pcs).

- **NEC Direction SPB 450**
- **Quantex QP6/400 SM-4x SE**

We could tell you lots of nice things about CANVAS™ 6.

"The program's best features spring directly from Canvas's signature strength - the marriage of bitmap and vector technology... Deneba's SpriteLayers technology lets you create some interesting transparency effects that would be difficult if not impossible to make in a dedicated drawing program... We were also impressed by Canvas's new face lift, which helps your workspace stay better organized and perform more efficiently... In the competition of the graphics titans, Canvas 6 is fighting with a unique set of weapons."

Macworld – Feb., 1999

"With it's elegant interface, Canvas is a compelling alternative to suite-based solutions that require separate illustration and image editing programs to perform the same functions... Canvas has always performed well with technical illustrations, featuring extraordinary dimensioning capabilities and numerous precision drawing aids... The program warrants serious consideration from newcomers seeking an elegant and relatively inexpensive tool."

PC Magazine – Jan., 1999

"SpriteLayer technology represents an industry breakthrough because it allows users to apply an unlimited variety of compositing effects to any type of object or group of objects... [SpriteLayer] technology is an excellent piece of programming wizardry. With it, designers can easily experiment with complex graphic ideas that would have been prohibitive or impossible in any other program... Deneba has given designers a creative tool that makes it more convenient than ever to play around with any and all of their graphic elements in one place."

Digital Design & Production – Jan./Feb., 1999

But everyone else beat us to it.

"Canvas 6 is sure to please faithful users... My favorite feature is Canvas's new SpriteLayer technology, which allowed me to control the transparency of any graphical object, text, photo, or vector illustration... Canvas continues to deliver a vast scope of graphics tools in one convenient application, and does a remarkable job of breaking down barriers between bitmap and vector graphics."

PC World Online – Dec. 28, 1998

"Version 6 has dramatically improved the software's interface, significantly increased user customization and added lots of useful features... Canvas 6 delivers power and versatility at a competitive price."

eMediaweekly – Jan., 1999

"Deneba has done what Adobe has refused to do: unify graphics apps... The vector abilities are very robust. Canvas has all the tools you'd expect of an illustration app, with bonus widgets thrown in... Canvas 6.0's unique ability to combine disciplines will lead the designer down previously inaccessible creative paths... SpriteLayers composite like no other program can."

Maximum PC – Jan., 1999

Find out for yourself why everyone's talking about Canvas 6 and the revolutionary new SpriteLayer technology. Visit **www.deneba.com/pcworld/** to download a **FREE** fully functional 30-day evaluation kit. The graphics revolution is here, and it begins with Canvas 6.

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This ad was created using nothing but Canvas 6.

*Estimated street pricing in US dollars. Pricing does not include shipping and handling. Sixty-day money back guarantee excludes shipping and handling costs. © Copyright 1999 Deneba Software. Limited time offer valid only in North America. All other trademarks or registered trademarks are the property of their respective owners.

PC WORLD

TOP 20 BUDGET DESKTOPS

	SYSTEM	Last month	Month tested	Street price (12/18/98)	CPU	Comments
1	Dell Dimension V350 800/388-8542 www.dell.com	n/a	NEW	$1399	Pentium II-350	Quick small-business PC backed by Dell's good reliability and service record.
2	Micro Express MicroFlex C400B 800/989-9900 www.microexpress.net	2	Jan 99	$1499	Pentium II-400	Price falls $200 on PII-400 with plenty of RAM, DVD-ROM drive, mediocre monitor.
3	Micron Millennia 400 Max 888/634-8799 www.micronpc.com	n/a	July 98	$1878	Pentium II-400	Multimedia PC with DVD-ROM and Zip drives sheds $150, moves to budget chart.
4	Gateway GP6-400 800/846-2000 www.gateway.com	n/a	NEW	$1899	Pentium II-400	Quick, expandable small-business PC offers network card and sharp monitor.
5	Dell OptiPlex GX1 400 800/388-8542 www.dell.com	n/a	Aug 98	$1937	Pentium II-400	Former Power Desktops champ drops $208; fast corporate PC with easy service design.
6	Micro Express MicroFlex-35B 800/989-9900 www.microexpress.net	3	Dec 98	$1149	AMD K6-2-350	PC formerly known as MicroFlex-35A has decent speed and robust multimedia components.
7	Dell Dimension V333c 800/388-8542 www.dell.com	4	Nov 98	$1559	Celeron-333	Price falls $70; decent Celeron-333 performance; Zip drive and 4.8X DVD-ROM drive.
8	Xi Computer 333A Mtower 800/432-0486 www.xicomputer.com	n/a	NEW	$1399	Celeron-333	Fastest Celeron-based Win 98 PC we've tested has good price and management features.
9	Axis Systems Orion 100R PII400 800/378-9014 www.axissys.com	8	Jan 99	$1699	Pentium II-400	Fast PC from Axis Systems' small-business line has 4.8X DVD-ROM drive, $100 price cut.
10	Quantex QP6/400 M-4x SE 800/896-4898 www.quantex.com	n/a	NEW	$1949	Pentium II-400	Loaded PC from Quantex's value multimedia line features DVD-ROM drive, 19-inch monitor.
11	Gateway E-3200 450 800/779-2000 www.gateway.com	n/a	NEW	$1999	Pentium II-450	Well-designed corporate PC performs like many PII-400s; has just two open drive bays.
12	CyberMax Enthusiast KII 350 800/437-4596 www.cybermaxpc.com	7	Feb 99	$1099	AMD K6-2-350	Price drops $50 and DVD-ROM drive upgraded to 4.8X, but monitor quality is poor.
13	Sys TaskMaster 350K2 800/613-9963 www.sys.com	9	Jan 99	$1559	AMD K6-2-350	Speedy PC equipped with 17X-40X CD-ROM drive has lots of expansion options inside.
14	Micron ClientPro 400 888/634-8799 www.micronpc.com	6	Oct 98	$1999	Pentium II-400	Network-ready PC with built-in management; CD-ROM drive upgraded to 17X-40X.
15	Axis Systems Metropolis NX5-333C 800/378-9014 www.axissys.com	n/a	NEW	$1054	Celeron-333	Network card offsets puny hard disk and lack of software bundle on cheap corporate PC.
16	Acma ZPower 6400 PII-400 800/786-6888 www.acma.com	n/a	Oct 98	$1888	Pentium II-400	Network-ready corporate PC with modem gets $310 price cut.
17	Quantex QP6/400 SM-1x 800/896-4898 www.quantex.com	11	Sept 98	$1950	Pentium II-400	PC tested with Win 95 but now offered only with Win 98; good support policies.
18	MidWest Micro Office Pro 350 800/728-8582 www.mwmicro.com	10	Feb 99	$1499	Pentium II-350	Average-priced PC benefits from DVD-ROM drive and strong warranty.
19	Acma ZPower 6450 PII-450 800/786-6888 www.acma.com	n/a	Nov 98	$1998	Pentium II-450	Acma takes $200 off PC with 128MB of RAM, Zip drive, and improved support policies.
20	NEC Direction SP B350 888/863-2669 www.neccomputers.com	13	Feb 99	$1408	Pentium II-350	Price rises $109 due to increase in RAM to 64MB and hard disk upgrade to 6.4GB.

Best Buy See features chart, page 206; test report, page 210.

n/a = not applicable

[1] A system's performance word score is relative to scores of other PCs running the same operating system. For more details see "Your Guide to the Top 100" on page 195.

[2] For more information about all products in this table, select PC World InfoNet no. 903 or visit www.pcworld.com/infonet.

WITH COMPETITION FORCING the prices of more Pentium II-400 PCs below $2000 (the most a PC can cost and still qualify for the budget chart), the average price of all the systems on the chart has risen slightly, to just over $1600. But while Pentium II-400s dominate the top five, a new $1399 Pentium II-350 system from Dell tops them all: The Dimension V350, our number one Best Buy, offers a superb mix of price and performance. Of the six new PCs making the chart this month, Gateway's corporate-centric E-3200 450 is the most powerful. The most intriguing new system, however, might be the Axis Systems Metropolis NX5-333C, a Celeron-333–based PC that costs just $1054 and delivers acceptable performance.

SCORECARD

★ Overall rating	PC WorldBench 98/operating system	Features and design	Price	Performance [1]	Vendor's system reliability	Vendor's support quality/policies	PC World InfoNet number [2]
90	179/Win 98	very good	average	good	good	good/good	629
88	204/Win 98	very good	average	very good	[3]	fair [4]/outstanding	630
88	210/Win 95	very good	expensive	very good	good	good/good	631
87	203/Win 98	very good	expensive	very good	good	fair/outstanding	632
87	244/Win NT 4.0	good	expensive	very good	good	good/outstanding	633
85	179/Win 98	good	inexpensive	good	[3]	fair [4]/outstanding	634
83	170/Win 98	good	average	good	good	good/good	635
83	182/Win 98	very good	average	good	[3]	good [4]/good	636
83	201/Win 98	very good	average	very good	[3]	good [4]/good	637
82	203/Win 98	outstanding	expensive	very good	[3]	fair [4]/good	638
82	208/Win 98	good	expensive	very good	good	fair/outstanding	639
81	161/Win 98	very good	inexpensive	satisfactory	[3]	fair [4]/good	640
81	181/Win 98	very good	average	good	[3]	good [4]/good	641
81	228/Win NT 4.0	very good	expensive	good	good	good/good	642
80	198/Win NT 4.0	good	inexpensive	satisfactory	[3]	good [4]/good	643
79	198/Win 95	very good	expensive	very good	[3]	good [4]/good	644
79	199/Win 95	very good	expensive	very good	[3]	fair [4]/good	645
79	181/Win 98	very good	average	good	[3]	good [4]/good	646
78	217/Win 98	good	expensive	outstanding	[3]	good [4]/good	647
77	170/Win 98	satisfactory	average	good	outstanding	good [4]/good	648
Scorecard weightings ▶		Features 25 percent	Price 22 percent	Performance 18 percent	Reliability 15 percent	Quality/policies 10 percent each	

[3] Insufficient data to give a rating.

[4] Scores were derived from anonymous support-quality calls due to insufficient data from survey.

This Month's Best Buys

1 DELL DIMENSION V350

PRO: Inexpensive for a PII-350, good support and warranty, color-coded connectors

CON: So-so monitor, case is difficult to open

Dell continues its tradition of highly competitive pricing with this addition to its Dimension V small-business line. The V350 isn't the cheapest system available, but its $1399 price falls near the low end for machines equipped with that processor. The V350's PC WorldBench 98 score of 179 hovers close to the average score for a PII-350 machine with its configuration.

Rather than providing separate cards for graphics and sound, Dell integrated those functions into chips on the motherboard. This setup frees up valuable expansion slots. The machine teams ATI's increasingly popular 3D Rage Pro graphics chip set with Yamaha's superior XG MIDI sound system; together they make a good audio-video workhorse combination.

Dell Dimension V350

Dell's 17-inch 1000HS monitor provides a clear picture all the way up to 1024 by 768 resolution. At higher settings, image quality gets a little fuzzy, even though the 3D Rage Pro supports resolutions up to 1280 by 1024. For $277, you can upgrade to Dell's 19-inch UltraScan P990, a Best Buy on last month's *Top 10 Monitors* chart. As for sound quality, the Harman/Kardon HK195 speakers perform well for this price class, offering wide dynamic range.

When it comes to expandability, the Dimension V350 lands squarely in the middle of the pack with two open DIMM sockets, three available expansion slots, and four free drive bays. To open the case, you simply remove some thumbscrews and access panels; but in our experience, taking these stiff panels off requires a fair amount of brute strength. An easy-to-follow setup poster and color-coded rear ports help you get the system up and running, and Dell includes a very useful system manual and troubleshooting guide.

Dell enjoys one of the better service track records. The Dimension V350 is backed by a fairly standard three-year parts/one-year labor warranty, and we received excellent advice in our anonymous calls to the company's tech support department. In our recent subscriber survey, Dell's work PCs received good reliability and service ratings.

2 MICRO EXPRESS MICROFLEX C400B

PRO: Generous amount of memory, 5X DVD-ROM drive, good tech support policies

CON: Cover is difficult to remove, mediocre monitor, outdated documentation

After dropping $200 this month to come in at $1499, the Micro Express MicroFlex C400B ▶

PHOTOGRAPHS: KEN SMITH

TOP 20 BUDGET DESKTOPS

STANDARD FEATURES

	SYSTEM [1]	CPU	Operating system	RAM (MB)	Secondary cache (KB)	Hard drive (GB)	Graphics adapter (AGP)	Video RAM (MB/type)	Monitor tube/ viewable diagonal (inches)	56-kbps modem protocol
1	Dell Dimension V350*	Pentium II-350	Windows 98	64	512	8.4	integrated ATI 3D Rage Pro	8/SDRAM	17/15.9	V.90
2	Micro Express MicroFlex C400B*	Pentium II-400	Windows 98	128	512	10	ATI Xpert@Work	8/WRAM	17/16.1	V.90
3	Micron Millennia 400 Max*	Pentium II-400	Windows 95	64	512	10	Diamond Fire GL 1000 Pro	8/SGRAM	17/16	V.90
4	Gateway GP6-400*	Pentium II-400	Windows 98	64	512	10.1	Ensoniq 3D Blaster Banshee	16/SGRAM	17/16	not included
5	Dell OptiPlex GX1 400*	Pentium II-400	Windows NT 4.0	64	512	6.4	integrated ATI 3D Rage Pro	8/SGRAM	17/15.9	not included
6	Micro Express MicroFlex-35B	AMD K6-2-350	Windows 98	64	1024	8	Diamond Viper V330	4/SGRAM	17/15.9	V.90
7	Dell Dimension V333c	Celeron-333	Windows 98	64	128	8.4	integrated ATI 3D Rage Pro	8/SDRAM	17/15.9	V.90
8	Xi Computer 333A Mtower	Celeron-333	Windows 98	64	128	14	Matrox Millennium G200	8/SGRAM	17/16	V.90
9	Axis Systems Orion 100R PII400	Pentium II-400	Windows 98	64	512	10	Matrox Millennium G200	8/SGRAM	17/16	V.90
10	Quantex QP6/400 M-4x SE	Pentium II-400	Windows 98	128	512	13.6	Diamond Stealth II G460	8/SDRAM	19/18	V.90
11	Gateway E-3200 450	Pentium II-450	Windows 98	128	512	10	integrated ATI 3D Rage Pro	4/SGRAM	17/16	not included
12	CyberMax Enthusiast KII 350	AMD K6-2-350	Windows 98	64	512	8.4	Mpact II AGP	8/RDRAM	17/15.8	V.90
13	Sys TaskMaster 350K2	AMD K6-2-350	Windows 98	64	512	10.1	Matrox Millennium G200	8/SGRAM	17/15.8	V.90
14	Micron ClientPro 400	Pentium II-400	Windows NT 4.0	128	512	6.4	Diamond Viper V330	4/SGRAM	17/16	not included
15	Axis Systems Metropolis NX5-333C	Celeron-333	Windows NT 4.0	64	128	4.3	Intel740	8/SDRAM	17/15.7	not included
16	Acma ZPower 6400 PII-400	Pentium II-400	Windows 95	64	512	14.4	Real 3D StarFighter AGP	8/SGRAM	17/16.1	V.90
17	Quantex QP6/400 SM-1x	Pentium II-400	Windows 95	64	512	11	Real 3D StarFighter AGP	8/SGRAM	19/18	V.90
18	MidWest Micro Office Pro 350	Pentium II-350	Windows 98	64	512	6.4	ATI Xpert@Play 98	8/SGRAM	17/15.8	V.90
19	Acma ZPower 6450 PII-450	Pentium II-450	Windows 98	128	512	10.1	Real 3D StarFighter AGP	8/SGRAM	17/16.1	V.90
20	NEC Direction SP B350	Pentium II-350	Windows 98	64	512	6.4	ATI Xpert98	8/SGRAM	15/13.9	V.90

* Best Buy

[1] Configuration as tested. Vendor may have since changed components.

[2] *PC World* defines towers as taller than 20 inches, midtowers as 15.5 inches to 20 inches, and minitowers as shorter than 15.5 inches.

[3] Five years on CPU and main RAM, three years on other parts.

looks like a bargain. This Pentium II-400–based system offers solid multimedia features, good upgrade options, a generous warranty, and strong tech support policies.

The MicroFlex earned a PC WorldBench score of 204, about average for its processor and price class. But it packs 128MB of memory—double that of most comparably priced units—and such multimedia perks as a 5X DVD-ROM drive, S-video, and RCA cables. It also boasts a MIDI port, along with a set of Altec Lansing PowerCube speakers that are backed by a robust subwoofer and powered by a superior Creative Labs Sound Blaster PCI128 sound card. The 17-inch Impression 7 Plus monitor can be adjusted easily, thanks to straightforward hardware controls and a helpful on-screen menu. But the display itself leaves something to be desired. In our tests, text and graphics looked sharp, but the corners of the screen tended to be fuzzy.

MicroFlex C400B

You'll find it easy to perform upgrades on this system, but as with most MicroFlex midtowers, getting inside means you have to remove four screws and then lift off an awkward three-sided cover. Once you've opened the case, you'll find plenty of room to move around in—and no nasty cable clutter. Unfortunately, putting the cover back on proves to be just as inconvenient as removing it.

You get numerous component manuals with the MicroFlex C400B, but the seriously outdated owner's guide—designed for Windows 3.1 users—contains nary a word about Windows 98.

Micro Express backs the MicroFlex C400B with an exceptionally long four-year warranty on both parts and labor, and provides free around-the-clock telephone tech support every day of the week.

3 MICRON MILLENNIA 400 MAX

PRO: Fast Windows 95 PII-400, 4X DVD-ROM drive, Zip drive, good reliability

CON: Merely adequate speakers and monitor, sparse documentation

One chart's loss is another chart's gain. After a long run at or near the top of our Power Desktops

		EXPANDABILITY					CUSTOMER SUPPORT			
CD/DVD-ROM drive speed	Sound board	Case style [2]	Max. RAM (MB)	Open RAM sockets	Open drive bays (ext./int.)	Open slots	Warranty for parts/labor (years)	Weekday toll-free support (hours)	Weekend support	Online support
14X-32X	Integrated Yamaha XG	midtower	384	2	3/1	3	3/1	24	Sat, Sun	AOL, BBS, CIS, MSN, WWW
5X DVD-ROM	Sound Blaster PCI128	midtower	384	1	3/0	4	4/4	24	Sat, Sun	WWW
4X DVD-ROM	Integrated Crystal PnP	midtower	384	2	2/1	4	varies [3]/1	24	Sat, Sun	BBS, CIS, WWW
13X-32X	Integrated Sound Blaster Audio	midtower	384	2	2/2	4	3/3	24	Sat, Sun	AOL, BBS, CIS, MSN, WWW
14X-32X	Integrated Yamaha OPL3	midtower	384	2	2/1	7	3/3	24	Sat, Sun	AOL, BBS, CIS, MSN, WWW
12X-32X	Sound Blaster PCI128	midtower	384	4	3/0	4	4/4	24	Sat, Sun	WWW
4.8X DVD-ROM	Turtle Beach Montego	minitower	384	2	2/1	1	3/1	24	Sat, Sun	AOL, BBS, CIS, MSN, WWW
20X-40X	Creative Ensoniq AudioPCI	midtower	768	2	3/2	4	3/3	24	Sat, Sun	WWW
4.8X DVD-ROM	Sound Blaster PCI128	midtower	384	2	2/0	4	3/3	24	Sat, Sun	WWW
2X DVD-ROM	Creative Ensoniq Audio PCI 64V	midtower	384	1	2/3	4	3/1	24	Sat, Sun	BBS, WWW
13X-32X	Integrated Crystal PnP	desktop	384	2	1/1	3	3/3	24	Sat, Sun	AOL, BBS, CIS, MSN, WWW
4.8X DVD-ROM	Sound Blaster AWE64	midtower	256	1	3/3	4	3/1	24	Sat, Sun	BBS, WWW
17X-40X	Sound Blaster AWE64	midtower	768	2	3/2	4	varies [4]/5	24	Sat, Sun	WWW
17X-40X	Integrated Crystal PnP	midtower	384	2	3/1	4	varies [3]/1	24	Sat, Sun	BBS, CIS, WWW
14X-32X	Creative Ensoniq AudioPCI	midtower	384	2	3/0	4	3/3 [5]	24	Sat, Sun	WWW
12X-32X	Integrated Crystal PnP	midtower	384	2	0/1	3	3/1	24	Sat, Sun	BBS, WWW
12X-32X	Creative Ensoniq AudioPCI	midtower	384	2	3/3	3	3/1	24	Sat, Sun	BBS, WWW
4.8X DVD-ROM	Sound Blaster AWE64D	midtower	768	2	3/1	4	varies [3]/3	24	Sat, Sun	BBS, WWW
12X-32X	Integrated Crystal PnP	midtower	384	2	0/1	3	3/1	24	Sat, Sun	BBS, WWW
14X-32X	Integrated Crystal PnP	midtower	384	2	3/0	4	3/3	24	Sat, Sun	AOL, BBS, CIS, MSN, WWW

[4] Six years on CPU and main RAM, three years on other parts.

[5] Free on-site service for one year only.

chart—including a second-place showing last month—a $150 price cut to $1878 moves the Millennia 400 Max over to a Best Buy slot on the budget chart.

A full eight months after it was originally tested, the system's PC WorldBench 98 score of 210 still stands as the highest we've seen for a Pentium II-400 system running Windows 95. The Millennia 400 Max comes loaded with attractive features, and our readers tell us that Micron's work systems are among the most reliable.

This PC even looks fast, with chiseled curves and molded slots for its external storage bays. The system comes equipped with floppy, Zip, and DVD-ROM drives, along with helpfully color-coded rear ports to ease setup. Its midtower case opens easily to reveal a tidily arranged interior with plenty of open drive bays, card slots, and DIMM sockets.

Micron Millennia 400 Max

The Millennia 400 Max's Diamond Fire GL 1000 Pro AGP card delivers snappy graphics, but its less-impressive 17-inch monitor produced images that appeared washed out and a bit fuzzy at the edges. The bundled Advent AV390PL speakers and subwoofer are sufficient for common business use, but you have to crank up the volume to get any bass out of the subwoofer.

Micron provides sparse documentation for the 400 Max. Fortunately, the company's telephone support operates nonstop, and you get a five-year warranty on the Millennia's CPU and main RAM. Unfortunately, the labor warranty is good for one year only.

4 GATEWAY GP6-400

PRO: Outstanding support policies, Zip drive and ethernet adapter, good expandability, excellent system documentation

CON: One of the more expensive systems on the budget chart this month

If expandability is more important to you in a network computer than raw horsepower, the new Gateway GP6-400 makes an excellent choice. The easily upgradable GP6-400 hails from Gateway's small-business line, and benefits from a 3Com Fast EtherLink adapter, a three-year warranty on parts and labor, and the company's strong support ▶

PROSIGNIA NOTEBOOK 122	PROSIGNIA NOTEBOOK 144	PROSIGNIA NOTEBOOK 162	PROSIGNIA DESKTOP 310
Mobile Intel® Pentium® II Processor 266 MHz	Mobile Intel Pentium II Processor 333 MHz	Mobile Intel Pentium II Processor 366 MHz	Intel Celeron® Processor 366 MHz
4.0 GB SMART Hard Drive[1]	4.0 GB SMART Hard Drive[1]	6.4 GB SMART Hard Drive[1]	8.4 GB Ultra ATA Hard Drive[1]
64 MB SDRAM (expandable to 160 MB)	64 MB SDRAM (expandable to 192 MB)	64 MB SDRAM (expandable to 192 MB)	32 MB SDRAM (expandable to 256 MB)
12.1" CTFT (800 x 600) Display	13.3" CTFT (1024 x 768) Display	14.1" CTFT (1024 x 768) Display	Compaq S700 17" Monitor (15.7" viewable)
24X Max CD-ROM[2]	24X Max CD-ROM[2]	24X Max CD-ROM[2]	40X Max CD-ROM[2]
Integrated K56flex Modem[3]	Integrated K56flex Modem[3]	Integrated K56flex Modem[3]	Compaq 56K V.90 PCI Modem[4]
Compaq PremierSound	Compaq PremierSound	Compaq PremierSound	Creative Labs SBS50 Speakers
Integrated AC Adapter; 1 Li-Ion Battery	Integrated AC Adapter; 1 Li-Ion Battery	Integrated AC Adapter; 2 Li-Ion Batteries	Matrox Millennium G200 AGP
Microsoft® Windows®98	Microsoft Windows98	Microsoft Windows98	Microsoft Windows98
Microsoft Office 97 Small Business Edition	Microsoft Office 97 Small Business Edition	Microsoft Office 97 Small Business Edition	Microsoft Office 97 Small Business Edition
Free[4] Trial of Compaq Online Services	Free[4] Trial of Compaq Online Services	Free[4] Trial of Compaq Online Services	Free[4] Trial of Compaq Online Services
3-year Worldwide Limited Warranty[5]	3-year Worldwide Limited Warranty[5]	3-year Worldwide Limited Warranty[5]	3-year Limited Warranty[5]
$2,149*	**$2,699***	**$3,199***	**$1,299***
Leasing Price: $73/month[6]	**Leasing Price: $92/month[6]**	**Leasing Price: $109/month[6]**	**Leasing Price: $44/month[6]**
Customize with these options:	**Customize with these options:**	**Customize with these options:**	**Customize with these options:**
Ethernet Convenience Base: $279	Additional Li-Ion Battery: $199	Microsoft Office Professional Upgrade: $199	Upgrade to S900 19" Monitor (18" viewable): $200
MultiBay Zip® Drive Upgrade: $229	Compaq Value Case: $129	Compaq Global Case: $129	Upgrade to Altec Lansing ACS44 Speakers: $50
Compaq Workstation Case: $59	DVD-ROM Drive Upgrade: $49	Additional Li-Ion Battery: $89	Iomega® Zip Drive: $99

intel inside
pentium® II

*All prices shown are Compaq DirectPlus prices and are subject to change. Prices do not include applicable state and local sales tax or shipping to recipient's destination. [1]For hard drives, GB = billion bytes. [2]24X Max CD-ROM data transfer rates may vary from 150 KB/s to 3600 KB/s; 32X Max CD-ROM data transfer rates may vary from 150 KB/s to 4800 KB/s; 40X Max CD-ROM data transfer rates may vary from 150 KB/s to 4800 KB/s. [3]Designed only to allow faster downloads from K56flex-compliant sources. Maximum achievable download transmission rates currently do not reach 56 Kilobits per second (Kbps), and will vary with certain line conditions. [4]Compaq Online Services: Free 30-day trial requires Internet access capability. [5]Some restrictions and exclusions apply. Call (800) OK COMPAQ for warranty details. [6]ITU V.90 modems are designed only to allow faster downloads from K56flex- or V.90-compliant digital sources. Maximum achievable download transmission rates are currently unknown, may not reach 56 Kbps, and will vary with line conditions. [7]For storage, GB=billion bytes. [8]Compaq Server Pre-Failure Warranty: Pre-Failure Warranty is available on all Compaq Prosignia servers using Compaq Insight Manager 2.1 or higher, also covers ECC memory, and server hard drives (except the 535MB Fast-SCSI-2 hard drives) using Compaq IDA, IDA-2, Compaq SMART SCSI Array Controllers, Compaq SMART-2 SCSI Array Controllers, or SMART Array 3100ES Controllers. [9]Leasing: Available through Compaq Capital Corporation to qualified businesses for a term of 36 months with a Fair Market Value purchase option, and is subject to approved credit and certain terms and conditions. Does not include taxes, fees, or shipping charges. ©1999 Compaq Computer Corporation. All rights reserved. Compaq, the Compaq Logo, and Prosignia are registered trademarks and DirectPlus is a registered service mark of Compaq Computer Corporation. Intel, the Intel Inside Logo, Pentium, and Celeron are registered trademarks of Intel Corporation. Microsoft and Windows are registered trademarks of Microsoft Corporation. Other products mentioned herein may be trademarks or registered trademarks of their respective companies. Operating system pre-installed on all portable products. Compaq is not liable for editorial, pictorial, or typographical errors in this advertisement.

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PROSIGNIA DESKTOP 330

Intel Pentium II Processor 400 MHz
16.8 GB Ultra ATA Hard Drive[1]
64 MB (expandable to 256 MB)
Compaq S700 17" Monitor (15.7" viewable)
40X Max CD-ROM[2]
Compaq 56K V.90 PCI Modem[3]
Creative Labs SBS50 Speakers
Matrox Millennium G200 AGP
Microsoft Windows98
Microsoft Office 97 Small Business Edition
Free[4] Trial of Compaq Online Services
3-year Limited Warranty[5]

$1,739*
Leasing Price: $59/month[9]

Customize with these options:

Upgrade to S900 19" Monitor (18" viewable): $200
Upgrade to Altec Lansing ACS44 Speakers: $50
DVD-ROM: $65

PROSIGNIA DESKTOP 330

Intel Pentium II Processor 450 MHz
25.5 GB Ultra ATA Hard Drive[1]
128 MB (expandable to 256 MB)
Compaq S700 17" Monitor (15.7" viewable)
DVD-ROM G3
Compaq 56K V.90 PCI Modem[3]
Creative Labs SBS50 Speakers
Matrox Millennium G200 AGP
Microsoft Windows98
Microsoft Office 97 Small Business Edition
Free[4] Trial of Compaq Online Services
3-year Limited Warranty[5]

$2,399*
Leasing Price: $82/month[9]

Customize with these options:

Upgrade to S900 19" Monitor (18" viewable): $200
Upgrade to Altec Lansing ACS44 Speakers: $50
Iomega Zip Drive: $99

PROSIGNIA SERVER 740

Intel Pentium II Processor 400 MHz
Dual Processor Capable
64 MB SDRAM (expandable to 1 GB)
4.3 GB SCSI Hard Drive[1]
Max Internal Storage of 54.6 GB[7]
8 Bays: 4 Removable, 4 Hard Drive
32X Max CD-ROM[2]
10/100 TX UTP NIC
Compaq V55 15" Monitor (13.7" viewable)
Server Management Software
Pre-Failure Warranty:[8] Memory, Drives, Processors
3-year Limited Warranty[5]

$2,659*
Leasing Price: $91/month[9]

Customize with these options:

450 MHz Processor Upgrade: $349
64 MB Memory Addition: $229
9.1 GB Hard Drive[1] Upgrade: $289

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policies. In our PC WorldBench 98 tests, the $1899 GP6-400 exceeded the average score for a Pentium II-400–based system. In fact, the GP6-400's score of 203 isn't far off the 213 turned in by the company's GP6-450, which places third on this month's power chart.

Gateway GP6-400

The GP6-400 is easy to set up and use, thanks in part to a helpful installation poster, excellent system documentation, and color-coded connectors. The midtower case can be opened easily by removing two thumbscrews; inside you'll find four open expansion slots (three PCI, one shared ISA/PCI) and four open drive bays. Even with the included Zip drive, two of the four available bays can support devices that use externally accessible media, such as a tape backup unit or a CD-Rewritable drive.

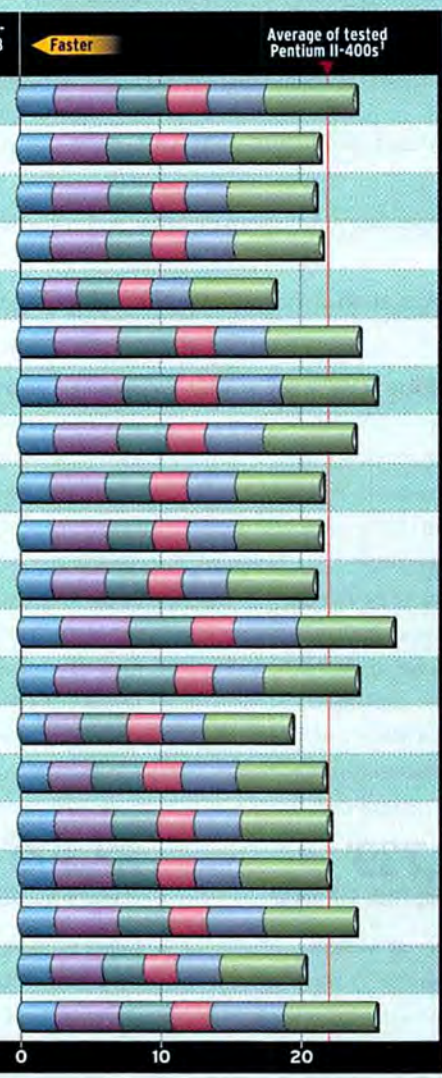
Although the GP6-400's Ensoniq 3D Blaster Banshee graphics adapter doesn't support resolutions as high as those of the ATI 3D Rage Pro, its top setting of 1280 by 1024 looks very good on Gateway's EV700 monitor (we wouldn't recommend choosing a higher resolution on a 17-inch monitor anyway).

The GP6-400 ships with a decent-sized 10.1 GB hard drive as well as Microsoft's Office 97 Small Business Edition with Bookshelf, and McAfee Anti-Virus, a ▶

TOP 20 BUDGET DESKTOPS

TEST REPORT

	SYSTEM	CPU	Operating system	RAM (MB)	Secondary cache (KB)	PC WorldBench 98 score
1	Dell Dimension V350*	Pentium II-350	Win 98	64	512	179
2	Micro Express MicroFlex C400B*	Pentium II-400	Win 98	128	512	204
3	Micron Millennia 400 Max*	Pentium II-400	Win 95	64	512	210
4	Gateway GP6-400*	Pentium II-400	Win 98	64	512	203
5	Dell OptiPlex GX1 400*	Pentium II-400	Win NT 4.0	64	512	244
6	Micro Express MicroFlex-35B	AMD K6-2-350	Win 98	64	1024	179
7	Dell Dimension V333c	Celeron-333	Win 98	64	128	170
8	Xi Computer 333A Mtower	Celeron-333	Win 98	64	128	182
9	Axis Systems Orion 100R PII400	Pentium II-400	Win 98	64	512	201
10	Quantex QP6/400 M-4x SE	Pentium II-400	Win 98	128	512	203
11	Gateway E-3200 450	Pentium II-450	Win 98	128	512	208
12	CyberMax Enthusiast KII 350	AMD K6-2-350	Win 98	64	512	161
13	Sys TaskMaster 350K2	AMD K6-2-350	Win 98	64	512	181
14	Micron ClientPro 400	Pentium II-400	Win NT 4.0	128	512	228
15	Axis Systems Metropolis NX5-333C	Celeron-333	Win NT 4.0	64	128	198
16	Acma ZPower 6400 PII-400	Pentium II-400	Win 95	64	512	198
17	Quantex QP6/400 SM-1x	Pentium II-400	Win 95	64	512	199
18	MidWest Micro Office Pro 350	Pentium II-350	Win 98	64	512	181
19	Acma ZPower 6450 PII-450	Pentium II-450	Win 98	128	512	217
20	NEC Direction SP B350	Pentium II-350	Win 98	64	512	170



*Best Buy

TEST PC WORLD CENTER **HOW WE TEST** All systems are tested with PC WorldBench 98, *PC World*'s application-based benchmark. A higher PC WorldBench score is better. All PCs are tested with Windows 95, Windows 98, or Windows NT 4.0, and video resolution is set to 800 by 600 in 65,536 colors. We run automated scripts on six popular business applications, performing common tasks such as spelling checks, scrolls, saves, sorts, and recalculations. The PC WorldBench 98 score is a sum of the weighted, normalized result of each script: Word 97 (10 percent), Word Pro 97 (10 percent), Excel 97 (20 percent), 1-2-3 97 (20 percent), Paradox 8.0 (20 percent), and Picture Publisher 7.0 (20 percent). For more details on our benchmark and how we run it, see PC World Online (www.pcworld.com/testing). [1]Under Windows 98 with 64MB of RAM.

Mobile Computing Solutions

LifeBook L Series

Fujitsu PC Corporation Has One For Every Notebook User

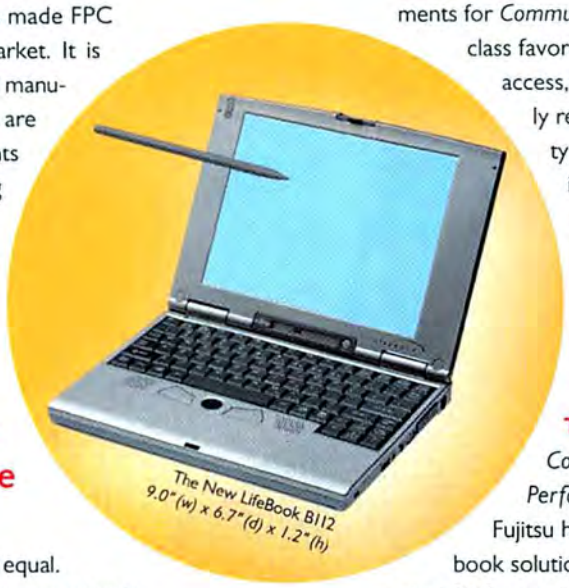
The need for simple, unconstrained mobility is a fact of life in business today. Because of e-mail and online resources—and the accompanying proliferation of tools such as notebooks, handhelds and cellular phones—the desire and need to have constant access to information and the ability to communicate anytime and from anywhere has become universal and critical. Not just for sales people, but for anybody who ever finds themselves working on the road, telecommuting occasionally, or shopping and doing online banking at home after hours. The question facing professionals of all stripes is no longer if, but rather, how to fulfill the need to stay in touch and be productive away from the office.

A Heritage of Mobile Computing Solutions

Fujitsu PC Corporation (FPC) understands the need for unfettered mobility in the modern business environment. To support its philosophy of developing truly differentiated mobile LifeBook™ solutions, FPC has drawn on the 64-year track record for innovation in computing, networking and microelectronics of its $37 billion global parent company, Fujitsu Ltd. The experience and technical know-how of Fujitsu Ltd., coupled with a $3 billion annual R&D budget, have propelled FPC to become one of the leading notebook providers in the U.S. since its debut in North America in 1996. To further increase its market presence, FPC

has recently introduced a variety of new, highly reliable notebook computers backed by comprehensive warranties and service plans and aggressively priced to offer small business and corporate users exceptional value.

But it's more than strong backing, a well-known name, reliability and value that has made FPC a major player in the domestic market. It is the company's ability to design and manufacture notebook solutions that are easily deployed by IT departments and take into account the varying requirements of different users that has led many to think of FPC as the mobile computing solutions company.



There's a LifeBook to Meet the Specific Needs of Every Mobile Professional

Not all notebook users are created equal. Depending on their business function and mobility patterns, what users require from a notebook computer can vary significantly. FPC has identified three user classes to guide its approach to LifeBook product development: the *Communicator*, the *Producer* and the *Hybrid* user.

The *Communicator*

Consisting primarily of mobile professionals, field workers and commuters, *Communicators* have a paramount need to be connected while traveling. E-mail, access to the Internet, simple presentations and data access and collection are key requirements for *Communicators*. Consequently, this user class favors solutions that simplify remote access, are light-weight in design and highly reliable. Since *Communicators* are typically not involved in "producing" information, they are willing to forgo certain functionality and features in favor of ease of use, speedy access and lighter weight.

The LifeBook Solution for *Communicators*

THE LIFEBOOK B112

Compact Convenience. Maximized Performance.

Fujitsu has a brand-new, light-weight notebook solution for *Communicators*: weighing in at just 2.65 pounds, the just-released LifeBook B112 is a *Communicator's* dream. This mini-notebook computer provides the power of a full-fledged notebook in a sleek and stylish, compact package. The strong performance and small design of the LifeBook B112 make it a highly efficient mobile

A Reliable, Cost-Saving LifeBook Solution for CCC Information Services, Inc.

Chicago's CCC Information Services, Inc., the leading provider of solutions for the automotive claims industry, relies on a fleet of 3,000 Fujitsu LifeBook notebook computers to give claims adjusters and collision repairers the ability to access and analyze up-to-the-minute claims information. CCC's innovative solutions include collision damage appraisal software, digital imaging applications and network communications to streamline business processes. This competitive advantage ensures that the right information is available to quickly make the right business decision.

Since the majority of appraisal work is done in the field, fully mobile, rugged and reliable notebooks are essential. By migrating a large part of it claims solutions to LifeBook notebooks, CCC approximates that it has been able to reduce its overall downtime rate by more than half, when compared with notebooks the company formerly utilized. This high reliability, plus FPC's dedicated and responsive technical support staff, have made LifeBooks a critical element in expediting claims and reducing costs for CCC customers.

"Appraiser efficiency is improved with CCC's technology solutions. For instance, instead of writing a scope sheet at the car and walking inside to develop the estimate on the computer, the entire estimate can be completed at the car," notes Kevin Ronan, CCC's Manager of Business Services. "Claims are settled faster, customers receive their checks quicker, and rental cars are required for less time." For these reasons and more, CCC expects its fleet of LifeBook notebooks to grow to more than 7,000 in the coming years as it replaces other notebooks already in the field.

solution for e-mail, reviewing documents on the road, conducting presentations through an external projector or accessing the Internet. And, the latest addition to the LifeBook family does it with plenty of innovation, including touchscreen capabilities through the use of a stylus for easy navigation on the go and a convenient 56K v.90* internal modem.

For *Communicators* requiring more firepower for producing documents when they're back in the office, Fujitsu's LifeBook L Series is a smart solution (see *Hybrid* user, below).

The *Producer*

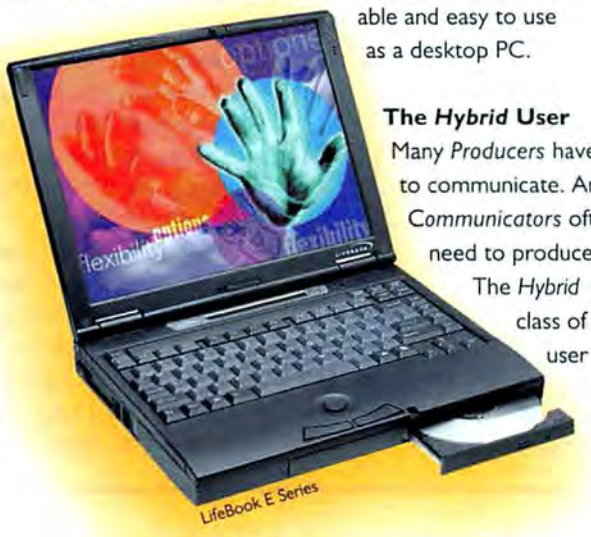
This class of user consists largely of small business professionals, telecommuters and salespeople. While requiring mobility and top-notch communication functionality, *Producers* also have the need for extra power and features that enable the production of information—be it spreadsheets, presentations, reports or other complex documents. For this reason, *Producers* are willing to sacrifice some weight and size benefits in favor of notebook solutions that offer higher processor speeds, increased functionality and a wider array of configuration options for increased flexibility.

The LifeBook Solution for *Producers*

LIFEBOOK E SERIES

The Power and Choices You Demand.

The Fujitsu LifeBook E Series was designed with the needs of *Producers* in mind. With the fastest mobile processors—including a model with a 366MHz Intel® Pentium® II—the LifeBook E Series delivers mobile computing solutions that let *Producers* do what they do best. Featuring FPC's signature dual Multi-function Bay design for on-the-fly changes in configuration with a number of options such as a DVD drive or an Iomega® Zip® drive, the LifeBook E Series packs just the right combination of power, performance and flexibility for tackling just about any productive task. What's more, their large, easy-to-read screens, full-size keyboards and spacious palmrests make the LifeBook E Series as comfortable and easy to use as a desktop PC.



The *Hybrid* User

Many *Producers* have to communicate. And *Communicators* often need to produce. The *Hybrid* class of user requires the best of all worlds: ultimate portability, flexibility and functionality. As the name implies, the solution for this user brings it all together.

The LifeBook Solution for *Hybrid* Users

LIFEBOOK L SERIES

Truly Innovative for the Way You Work.

The Fujitsu LifeBook L Series gives *Hybrid* users the means to communicate and the power to produce in a sleek, highly portable light-weight design. Weighing less than 4.5 pounds and only 1.1 inches thick, LifeBook L Series notebooks are remarkably versatile machines. For *Hybrid* users seeking the compact convenience and communications prowess of the LifeBook B112 as well as the power and flexibility of the LifeBook E Series, this is one happy medium. The LifeBook L Series provides simple remote access and a detachable bay design for increased flexibility. This big technology in a slim and light package is loaded with options like a mobile LAN dock and innovations that eliminate any compromise between the desire to communicate and the need to produce for today's *Hybrid* users.

What Kind of User are You?

Regardless of the kind of notebook user you are, there's a LifeBook notebook solution for you. At FPC's *LifeBook for You* web page, the choice is yours. *LifeBook for You* can help you determine your needs and tailor a product configuration to meet them exactly. So log on today to see which LifeBook is best suited for your unique style of mobile computing.

Find a Mobile Computing Solution Designed for the Way You Live: Visit www.fujitsu-pc.com/pcw or call 888-4-ON-THE-GO for more information.

Circle 89 on card or go to www.pcworld.com/infonet

*Actual speeds over U.S. telephone lines vary and are less than 56Kbps due to current FCC regulations and line conditions. The internal modems on all Fujitsu notebooks from Fujitsu PC Corporation are not qualified for use with telephone systems outside the United States and Canada and may not operate in other countries.

welcome addition to any corporate environment. Our research indicates that Gateway's business systems tend to be reliable. In our anonymous calls to Gateway technical support, we experienced short hold times and encountered fairly helpful representatives.

5 DELL OPTIPLEX GX1 400

PRO: Attractively designed corporate system, easy access to interior, excellent monitor

CON: Relatively small hard drive, no AGP slot

Moving over from the top spot on the power chart thanks to a $208 price cut, the Dell OptiPlex GX1 400 is a formidable budget PC. This $1937 corporate-oriented midtower features integrated remote management hardware and an easy-access interior.

The OptiPlex GX1 400 logged an impressive PC WorldBench 98 score of 244 on Windows NT 4.0. That score makes it the second-fastest system we've tested for this configuration, trailing only the Sys Performance Pro 400BA.

Dell's high reliability and service ratings should clinch the OptiPlex GX1 400 a spot on any corporate IS manager's shopping list. The price drop from last month is due partly to the fact that our test machine lacked speakers this time. If you want to add them, Dell offers speaker options priced at $105 (shown at left) and $49.

Dell OptiPlex GX1 400

The OptiPlex's modular case design allows every part of the system to swivel, glide, or swing open for easy access. Removing the cover could hardly be easier: Just press a button on the front and flick the case-lock switch at the back, and the cover swings up and out of the way. Expansion cards mounted on a separate chassis conveniently slide out as you press a lever. The power supply pivots upward and provides easy access to RAM slots and the motherboard. There is, however, no AGP slot, so you can't upgrade the integrated AGP graphics with an AGP graphics board in the future.

But in general, upgrades shouldn't enter into the picture for some time, thanks to the hardware Dell already includes. The 6.4GB hard disk suffices for most uses, though it's on the small side compared to those of other PCs on the chart. Dell's bundled UltraScan 1000HS monitor, one of the best 17-inch Trinitron displays currently available, delivers excellent image quality. The vendor covers the machine with a three-year warranty on parts and labor. Telephone support lines operate around the clock. In our recent survey, readers rated Dell's work PCs as among the most reliable.

Xi Computer 333A Mtower

New This Month

The following systems made our Budget Desktops chart for the first time this month. For brief reviews of previously tested machines on the chart, visit our Web page (www.pcworld.com/top400).

8 XI COMPUTER 333A MTOWER

PRO: Speedy Celeron-based system with exceptionally large hard drive

CON: Poor access to upper drive bays, mediocre keyboard, no system manual

Xi Computer's $1399 333A Mtower takes the prize as the best overall Celeron-based system we've reviewed. This new midtower earned an impressive PC WorldBench 98 score of 182—higher than that of any similarly configured system we've seen in this processor class, and a full 10 points above average.

The 333A Mtower also excels in storage. Most Celeron-333 and Pentium II-350 systems sport hard drives of 8GB or smaller, and many include a mere 4GB to 6GB of drive space, so the 333A Mtower's 14GB hard drive really stands out. The system comes equipped with Microsoft's popular Office 97 Small Business Edition.

Xi Computer offers an above-average three-year warranty on both parts and labor. In our recent anonymous calls to the company's tech support line, which operates 24 hours a day, Xi's representatives provided helpful advice.

Matrox's popular Millennium G200 graphics adapter and a 17-inch Optiquest V773 monitor combine to provide pleasing, crystal-clear pictures. The monitor easily supports the G200's maximum resolution of 1280 by 1024. Xi also includes a handy combination microphone/headset for use with the voice-mail/speakerphone capabilities of the bundled Lucent modem. Although we liked the layout of the 333A's Keytronic keyboard—especially the enlarged L-shaped <Enter> key—it seemed a bit noisy and felt flimsy.

Since you never know when you may want to add components to your PC, it pays to purchase a system that opens easily, allowing you to perform surgery on the innards. It takes only a few seconds to remove the 333A's two thumbscrews and get inside. With two open DIMM sockets, four available slots, and five free drive bays, the 333A Mtower offers slightly above average expandability.

However, a wide bar runs the entire length of the computer, hampering access to either of the upper two 5.25-inch drive bays. Two other minor grievances: The Xi 333A comes with no system documentation, just individual component manuals (for the motherboard, modem, graphics card, and the like). And despite the LAN-ready network utilities that come with the system—including LANDesk and a DMI wizard—it doesn't ship with any kind of network adapter.

10 QUANTEX QP6/400 M-4X SE

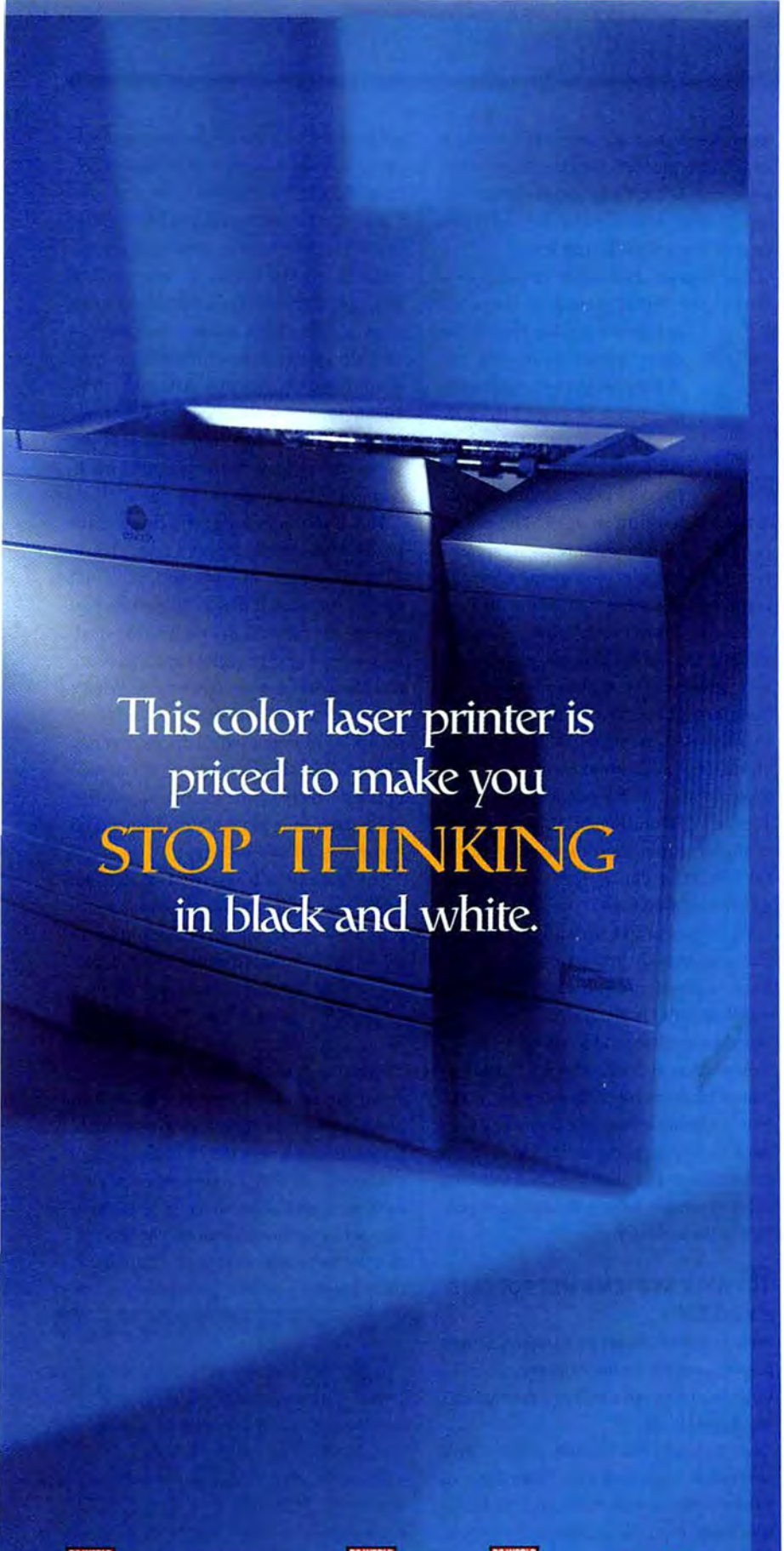
PRO: Great expandability, good feature set

CON: Performance is only average for processor class, fairly expensive

In our tests, the newly revamped Quantex QP6/400 M-4x SE earned a PC WorldBench score of 203—average among the nine similarly configured PII-400 PCs we've tested to date.

QP6/400 M-4x SE

A good choice for any user with multimedia needs, this $1949 Quantex is outfitted with an Iomega Zip drive, a 19-inch monitor, a 2X DVD-ROM drive, and management features. However, it's a bit pricey compared with some of the higher- ▶



COLOR PAGEWORKS™ L
$1,699

Every monitor in your company is in color. The Web is in color. PowerPoint® presentations are in color. But for some reason, every laser printer on your network is black and white. Why? Probably that pesky little barrier: price.

Well, say hello to the color laser printer that shatters the price barrier, the new Minolta Color PageWorks™ L.

The CPW L printer gives you dazzling, 2400 dpi, just-like-a-photograph color for an estimated street price of just $1,699. That makes it the most affordable color laser printer in its category.

And you won't have to wait by the printer to be impressed since Minolta's Advanced Processing Technology gives the CPW L amazing first print speed.

So start doing your printing the same way you do everything else. In color. Call 1-888-264-6658 for a free CD-ROM, or visit us at: **www.minoltaprinters.com**

MINOLTA

PC World Top 10 — PageWorks 8L, 1/99

PC Computing ★★★★★ — Color PageWorks PS, 5/98

PC World Top 10 — Color PageWorks PS, 5/98

PC World Top 10 — Color PageWorks, 3/98

PCTODAY Top Pick — Color PageWorks, 1/98

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ranking units on the chart this month, even though the M-4x is part of Quantex's Value Multimedia line.

The system's Altec Lansing ACS 45 speakers offer impressive sound quality, with wide-ranging highs and lows. The PC also includes a Desktop Management Interface—but that's a difficult feature to take advantage of without an integrated ethernet card; our test PC came with a V.90 modem instead. Quantex has added the business-savvy 8MB Diamond Stealth II G460 graphics card, which features control tools that enable users to create customized desktops. For example, you can use the tools to customize shortcut keys or bring up the Start menu by clicking anywhere on the desktop.

Gateway E-3200 450

A look inside the M-4x SE's case reveals a well-organized interior with lots of room to grow, including two free externally accessible bays, three available internal bays, and four open slots—generous considering that the system includes a preinstalled Zip drive. The software bundled with the system includes Corel's WordPerfect Suite 8.

Quantex covers its desktop systems for three years on parts and one year on labor, and provides around-the-clock toll-free technical support. Our anonymous tech support calls were answered by representatives who usually—but not always—nailed our questions. Unfortunately, hold times averaged 20 minutes.

We also tested a similar PII-400 system from Quantex, the QP6/400 SM-4x SE, that failed to make the power chart. The M-4x SE, at $550 cheaper, is the better value of the two. In fact, aside from the amount of graphics memory (8MB in the M-4x versus 16MB in the SM-4x) we couldn't find any dramatically different performance factors.

11 GATEWAY E-3200 450

PRO: Inexpensive for a Pentium II-450, outstanding support policies, excellent monitor

CON: Limited expandability, subpar performance for a Pentium II-450

With most PII-450s hovering around $2400 these days, Gateway's $1999 networkable E-3200 450 is one of the cheapest on the market. Among those we've seen, only Micron's $1699 Millennia PII-450, which didn't make the chart this month, costs significantly less.

The E-3200 450's slim desktop case doesn't overwhelm your desk. If space is at a premium, the E-3200 can even operate on its side as a skinny minitower. Gateway's 17-inch ATI Rage Pro–powered EV700 monitor, which supports resolutions of up to 1600 by 1200, produces great-looking images. The digital controls on the monitor remain pleasantly out of sight until you swing down the control panel on the front of the display.

You will have to make some concessions if you opt for this low-priced Gateway, however. The system offers only two open drive bays, and its mere two open PCI slots and one shared PCI/ISA slot put significant additional limits on future expandability. As for performance, the E-3200's PC WorldBench 98 score of 208 is slightly lower than the average rating for similarly configured Pentium II-450–based systems.

To help you get up and running quickly and painlessly, Gateway provides an excellent setup poster, color-coded connectors, and a very well-written and illustrated pair of manuals covering setup and maintenance/troubleshooting. Gateway's standard three-year parts and labor warranty and unlimited around-the-clock technical support remain among the strongest policies in the industry.

15 AXIS SYSTEMS METROPOLIS NX5-333C

PRO: Low price, decent performance, network adapter, good monitor for the money

CON: Small hard drive, outdated graphics chip, slightly flimsy case

Your company has to cut expenses, but it also needs some new PCs. Enter the Axis Systems Metropolis NX5-333C. At $1054, it's cheap, even for a Celeron-333 system. If you want to pay much less for a new PC, you'll probably find yourself buying it off the back of a truck. The Metropolis is pretty fast, too: Loaded with Windows NT, it earned a PC WorldBench score of 198.

But don't expect miracles for so little cash. The Metropolis comes equipped with office basics like an ethernet card but lacks any software, and its hard drive is a puny 4.3GB. Other subpar components include a soon-to-be-outdated Intel740 graphics chip, wimpy Altec Lansing speakers, and a flimsy case. When we removed the cables, we could feel the metal on the back of the machine buckling under the pressure.

Still, if you're looking for a cheap office PC, this Metropolis makes a good choice. After all, with an ethernet card, you don't need a huge hard drive—hopefully you can use the network drives. And top-quality speakers and graphics capabilities are rarely crucial for most office work. What's more, our test PC was equipped with a 17-inch KDS monitor, which displays a crisp picture. You also have plenty of upgrade options: The machine includes three free drive bays, four available card slots, and two empty DIMM sockets.

Metropolis NX5-333C

The Metropolis NX5-333C doesn't come with an overall system manual, but Axis Systems provides lifetime around-the-clock technical support on a toll-free line. The company's phone reps, judging from our anonymous calls to that line, have improved over the past several months. We experienced an average hold time of about 8 minutes in recent calls.

Axis offers a three-year warranty on both parts and labor, which is better than you get from many vendors. On-site service is free for the first year; extending it costs $75 per year for up to two years. ▶

BEYOND THE TOP 20

online

We evaluated the following systems along with the others, but they didn't score high enough to reach the *Top 20 Budget Desktops* chart. For write-ups, go to PC World Online (www.pcworld.com/t20pcs).

- **Cyberdyne Micro Centron CC333+**
- **Micron Millennia PII-450**
- **Racer 2000RS PII-350**

< AWARDS SPEAK LOUDER THAN WORDS. >

Experience award-winning quality with Acer's 79g.

Acer's 79g is being hailed as the highest performing and most reliable monitor in the industry. After receiving numerous awards from PC World, BusinessWeek, PC gaming and a dozen other major PC magazines, the 79g is clearly setting the benchmark for superior image and text quality.

- **Superfine .25 mm Stripe Pitch**
- **Aperture Grille 17" CRT (16" Viewable)**
- **1600 x 1200 NI Resolution at 76Hz**
- **PC/Mac Compatible**

HOT SWAP Acer Peripherals

It also comes with a full three-year warranty and one-year "Hot Swap" program. Because we are so confident in our monitor's reliability, the "Hot Swap" program allows customers to receive a replacement monitor within 48 hours.*

The choice is simple, this impressive monitor is second to none in quality, performance and reliability. But don't take our word for it. View the monitor yourself and see why awards do speak louder than words. For more information, please call 1-800-379-2237 ext.124 or visit us at www.acerperipherals.com.

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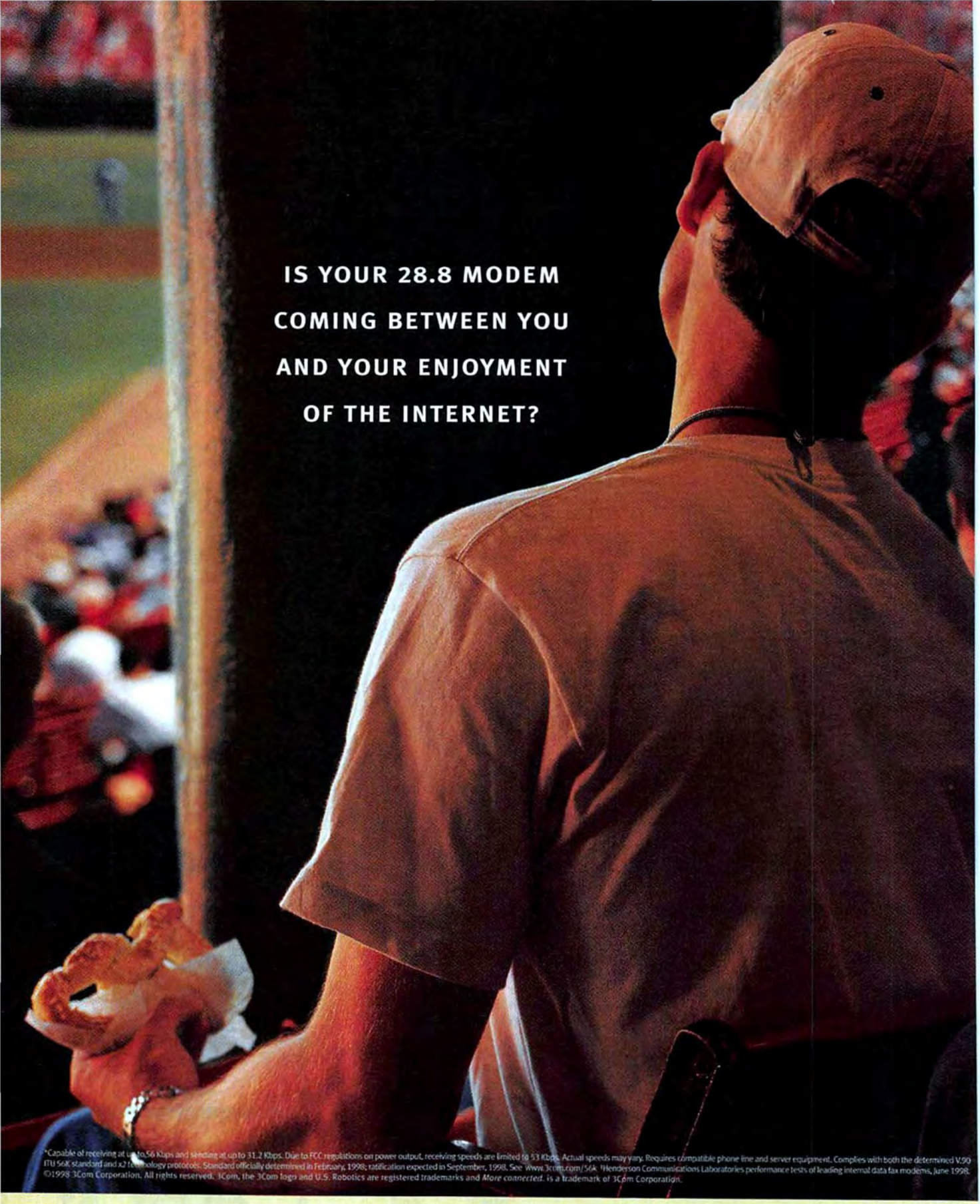

*Capable of receiving at up to 56 Kbps and sending at up to 31.2 Kbps. Due to FCC regulations on power output, receiving speeds are limited to 53 Kbps. Actual speeds may vary. Requires compatible phone line and server equipment. Complies with both the determined V.90 ITU 56K standard and x2 technology protocols. Standard officially determined in February, 1998; ratification expected in September, 1998. See www.3com.com/56k. †Henderson Communications Laboratories performance tests of leading internal data fax modems, June 1998.
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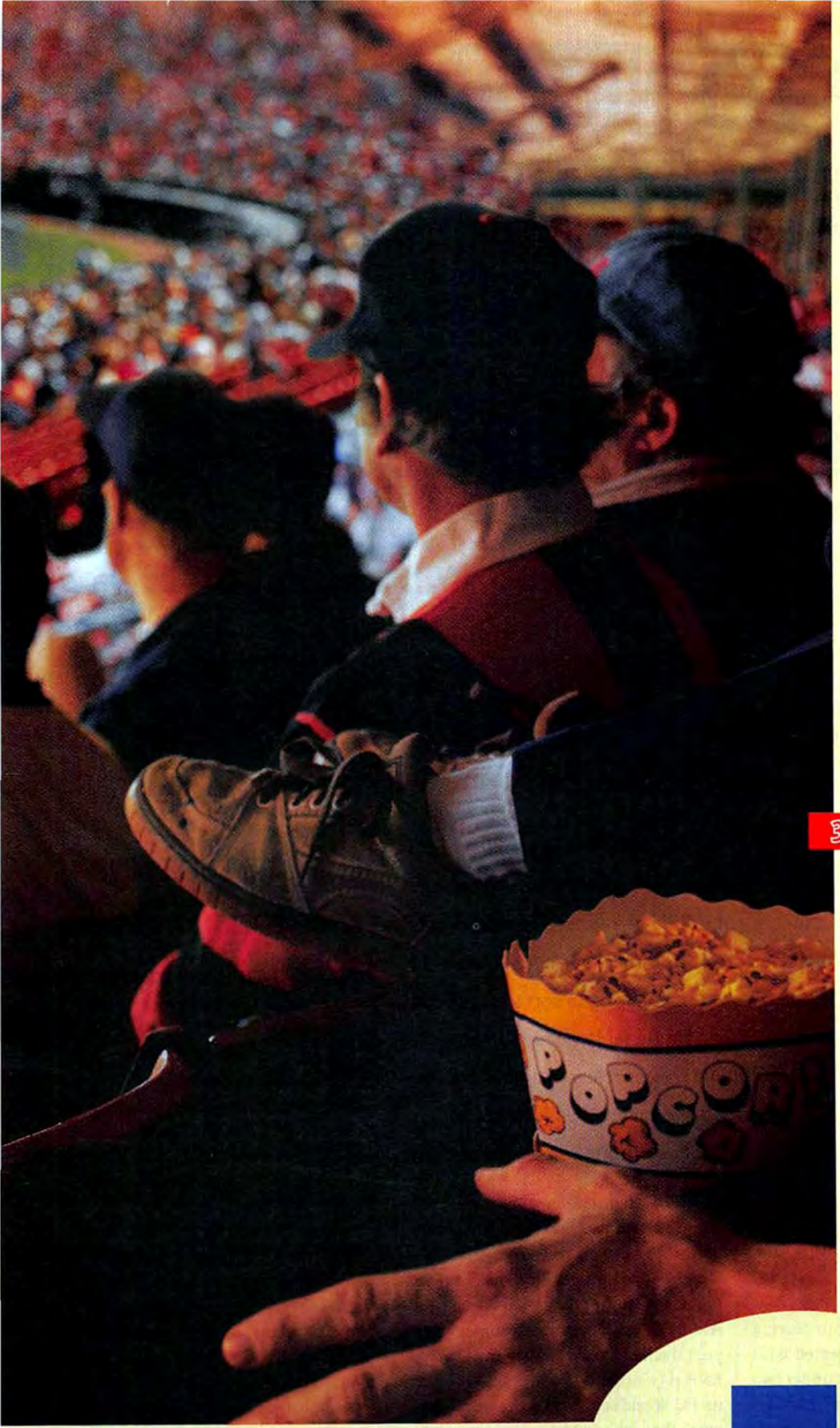


The World's Best-Selling 56K Modem.

If your modem's not in a hurry, it's just in the way. That's why it's time to move to V.90 U.S. Robotics® 56K* desktop modems from 3Com. They deliver significantly greater overall performance† than other V.90 56K modems for high speed downloads and real-time online games.

3Com U.S. Robotics

So get over to your nearest 3Com retailer or find us at www.3com.com/56k for additional information. Because, when it comes to getting the most out of the Internet, the modem makes the difference.

3Com® More connected.™

PC WORLD TOP 10 NOTEBOOK PCs

	POWER NOTEBOOK	Last month	Month tested	Street price (12/18/98)	CPU	Comments
1	Dell Latitude CPi D300XT 800/388-8542 www.dell.com	1	Nov 98	$3143	Pentium II-300	Thin laptop for desktop work and travel is Best Buy for fifth straight month.
2	Gateway Solo 2500LS 800/315-2526 www.gateway.com	2	Nov 98	$2924	Pentium II-300	Notebook with strong battery, fixed CD-ROM and floppy drives sheds $150.
3	WinBook XL2 800/965-9349 www.winbook.com	3	Jan 99	$3199	Pentium II-300	Presentation unit stuffed with multimedia features: big screen, AGP, DVD-ROM.
4	Toshiba Tecra 8000 888/867-4422 www.toshiba.com	5	Nov 98	$3099	Pentium II-266	Price falls $400 on light, durable portable that is ideal for travel.
5	NEC Versa SX 888/863-2669 www.nec-computers.com	n/a	Dec 98	$3699	Pentium II-300	Very light and slim travel unit with multipurpose bay and upgrade options.
	BUDGET NOTEBOOK					
1	Gateway Solo 2500SE 800/315-2526 www.gateway.com	2	Sept 98	$1849	Pentium II-233	Fast notebook with built-in drives drops $150; great for desktop use or travel.
2	Unicent Voyager 1212 800/308-3614 www.unicent.com	1	Feb 99	$1799	Pentium II-266	Price of bargain notebook with great performance and light weight falls $100.
3	Gateway Solo 3100SE 800/315-2526 www.gateway.com	3	Jan 99	$2499	Pentium II-233	You pay a premium for this thin, very light notebook designed for the road.
4	AMS Tech Roadster 15CTA 800/886-2671 www.amstech.com	5	Jan 99	$1395	AMD K6-2-300	Affordable portable for first-time buyers has bright screen, good performance.
5	WinBook XL 233 DSTN 800/965-9349 www.winbook.com	n/a	Oct 98	$1299	Pentium MMX-233	Least expensive notebook here offers fixed drives and dual-scan screen.

Best Buy See features chart, page 222.

n/a = not applicable [1]Includes computer; adapter; power cord; and floppy, DVD-ROM, or CD-ROM drive. [2]For more about products here, select the number on the product information card or visit www.pcworld.com/infonet. [3]Insufficient data to give a rating.

INTEL'S RECENT DEPLOYMENT of a small army of mobile processors—six in all—deviates from the company's tradition of launching one CPU at a time. The selection of chips available to notebook buyers has probably never been greater. In fact, you may find yourself a bit overwhelmed trying to sort them all out.

Here are a few highlights. Intel has predictably goosed its mobile Pentium II line all the way up to 366 MHz, and released a new low-cost line of Celeron chips for portables. All the new CPUs have secondary cache integrated onto the chip, a design that improves performance by enabling data to move between the processor and the cache more quickly.

We tested four notebooks with new chips for our story in *Top of the News*, page 52. A new Pentium II-366 notebook broke the laptop speed record in our tests; a Celeron-266 notebook we tested isn't nearly as fast, but it sells for under two grand. Tune in next month to see how laptops with the new chips fare in the Top 10.

This month, none of the new notebooks that we tested hit the chart, but the NEC Versa SX, a light and slim Pentium II-300 that we tested back in December, debuts at number five on the power chart. We also reviewed our first notebook based on the AMD K6-2-333 CPU, a desktop chip. Although disappointing technical support dashed the Enpower Innovation ENP 313+'s chances of making the chart, its PC WorldBench 98 score of 133 suggests that other notebooks powered by this chip may make fine, inexpensive alternatives to Pentium II-233 portables.

This Month's Best Buys

POWER NOTEBOOKS

1 DELL LATITUDE CPI D300XT

PRO: Very fast, excellent keyboard

CON: Modem not included

Number one on our power chart for five straight months, this notebook with corporate aspirations appears headed for a record. The Latitude CPi D300XT deserves its long run: It's a pleasure to use, not too heavy, and fast. Its PC WorldBench score of 159 makes it one of the quickest notebooks we've ever tested.

The D300XT's pleasing charcoal-gray case measures 1.75 inches thick (a little thinner than the current notebook standard of 2 inches) and includes one modular bay on the side. Weighing in at 7.4 pounds and offering slightly more than 3 hours of battery life, the D300XT proves more than adequate away from the office. You can double its travel life by purchasing the optional $169 second battery. Just

SCORECARD

★ Overall rating	PC WorldBench 98 score/performance	Price	Vendor's system reliability	Features and design	Vendor's support quality/policies	Battery life (hours:min)/rating	Traveling weight [1]	PC World InfoNet number [2]
90	159/outstanding	average	good	very good	good/good	3:05/good	average	619
88	158/outstanding	inexpensive	good	very good	good/fair	4:09/very good	heavy	620
87	164/outstanding	average	fair	outstanding	good/poor	2:22/satisfactory	heavy	621
87	154/very good	average	good	very good	good/fair	2:42/satisfactory	light	622
85	157/very good	expensive	good	very good	fair/best	1:25/poor	very light	623
Power scorecard weightings ▶	**Performance 22 percent**	**Price 14 percent**	**Reliability 22 percent**	**Features 16 percent**	**Support 10 percent**	**Battery life 8 percent**	**Weight 8 percent**	
87	125/good	good	good	good	good/fair	3:15/good	light	624
87	149/outstanding	inexpensive	[3]	very good	adequate [4]/poor	3:22/good	light	625
84	138/very good	expensive	good	very good	good/fair	2:47/satisfactory	very light	626
84	122/good	very inexpensive	[3]	good	good [4]/fair	2:35/satisfactory	average	627
83	109/satisfactory	very inexpensive	fair	good	good/poor	1:33/poor	very heavy	628
Budget scorecard weightings ▶	**Performance 14 percent**	**Price 22 percent**	**Reliability 22 percent**	**Features 16 percent**	**Support 10 percent**	**Battery life 8 percent**	**Weight 8 percent**	**All products: 902**

[4] Due to insufficient data from survey, score was derived from anonymous support-quality calls.

keep in mind that the second battery weighs almost a pound. (But if you leave the CD-ROM or floppy drive at the office, traveling with both batteries increases the notebook's total weight by only a fraction of a pound.)

Dell Latitude CPi D300XT

The Latitude CPi D300XT comes with a responsive, accurate touchpad and an excellent keyboard. Adequately sized keys offer crisp action and occupy the expected locations, so adapting from a desktop keyboard to the D300XT's is a breeze. You shouldn't have to upgrade this notebook's generous 6.4GB hard drive any time soon.

The CPi D300XT's brilliant screen produces a sharp image from edge to edge. We do have one gripe with the casing around the display, though: Because it's wider at the top of the screen, when the lid is closed it protrudes slightly over the edge of the notebook's case. As a result, if the portable ever falls on its side, the fragile screen would absorb much of the shock.

As with most laptops, the system's built-in stereo speakers yield tinny sound. But MIDI music has a fuller sound, thanks to a software wavetable synthesizer.

Dell generally earns high support and reliability marks from *PC World* readers, and in our recent anonymous calls to the company's technical support phone line, we encountered shorter wait times and better advice than we have in the past.

BUDGET NOTEBOOKS

1 GATEWAY SOLO 2500SE

PRO: Inexpensive for a PII-233, light

CON: Poor speaker placement, flimsy keyboard

The Gateway Solo 2500SE returns to the top spot on our budget chart after being nudged out by the Unicent Voyager 1212 last month.

At $1849, it's one of the least expensive Pentium II-233 notebooks that we've seen, but its basic features and PC WorldBench score of 125 compare well with those of notebooks that cost hundreds of dollars more. (For a review of the new version of the Solo 2500SE, which features Intel's new Celeron-266 processor, again see this month's *Top of the News*.)

This gray, boxy portable is particularly well suited to the road. At 7.1 pounds, it's among the lightest Pentium II models we've tested—about half a pound lighter than the average laptop. The Solo 2500SE's 3.3-hour battery life is typical for a Pentium II portable, but you can't use two batteries at once to extend the unit's life when you're away from an outlet. The Solo also lacks a modem, an essential component for almost any traveler. (You can order one from Gateway for $100.)

Back at the office, you can connect the 2500SE to a docking station—even while the computer is running—and save yourself the hassle of connection cables. For backup and storage, the floppy drive bay accepts an optional $75 LS-120 drive, which can also read and write to standard 3.5-inch floppies. The CD-ROM drive is fixed. ▶

PHOTOGRAPHS: KEN SMITH

TOP 10 NOTEBOOK PCs

STANDARD FEATURES

	POWER NOTEBOOK [1]	CPU	Traveling weight (pounds) [2]	RAM (MB)	Hard drive (GB)	Color screen type	Screen diagonal (inches)	Screen resolution	Maximum screen colors	Battery type	Pointing device
1	Dell Latitude CPi D300XT*	Pentium II-300	7.4	64	6.4	active	13.3	1024 x 768	262,144	lithium ion	touchpad
2	Gateway Solo 2500LS	Pentium II-300	8.3	64	4	active	13.3	1024 x 768	65,536	lithium ion	touchpad
3	WinBook XL2	Pentium II-300	8.0	128	6	active	14.1	1024 x 768	16.8 million	lithium ion	touchpad, eraserhead
4	Toshiba Tecra 8000	Pentium II-266	7.2	64	6.4	active	13.3	1024 x 768	262,144	lithium ion	eraserhead
5	NEC Versa SX	Pentium II-300	6.4	64	3.2	active	14.1	1024 x 768	65,536	lithium ion	touchpad
	BUDGET NOTEBOOK [1]										
1	Gateway Solo 2500SE*	Pentium II-233	7.1	32	2.1	active	12.1	800 x 600	262,144	lithium ion	touchpad
2	Unicent Voyager 1212	Pentium II-266	7.3	64	4	active	12.1	800 x 600	16.8 million	lithium ion	touchpad
3	Gateway Solo 3100SE	Pentium II-233	6.1	64	4	active	12.1	800 x 600	16.8 million	lithium ion	eraserhead
4	AMS Tech Roadster 15CTA	AMD K6-2-300	7.9	32	2.1	active	12.1	800 x 600	16.8 million	NiMH	touchpad
5	WinBook XL 233 DSTN	Pentium MMX-233	8.7	64	2.1	dual-scan	12.1	800 x 600	262,144	NiMH	touchpad

*Best Buy ● Yes ○ No [1] Configuration as tested. Vendor may have since changed components. [2] Includes computer; adapter; power cord; and floppy, DVD-ROM, or CD-ROM drive.

Using the Solo 2500SE is comfortable and easy. It comes with a vibrant active-matrix screen, and its Logitech touchpad incorporates an unusual feature that lets you simulate left and right mouse clicks by tapping on the touchpad with one or two fingers, respectively.

However, the notebook's keyboard is just run-of-the-mill. Typists who tend to pound on the keys will notice excessive flex under the keyboard. In addition, the speakers are located in the wrist rest, so your hands may muffle the sound when you type.

Gateway Solo 2500SE

Near Misses

Eight of the notebooks we tested this month failed to make our chart. Four that came close are highlighted below; the other four are listed in the "Beyond the Top 10" box on page 223.

HAS A CERTAIN netherworldly inferno frozen over? You might think so after taking a look at the low prices in IBM's first notebook line for consumers, the ThinkPad I Series. A ThinkPad for under two grand seems unthinkable, but the standard ThinkPad 1450 I sells for $1799.

Still, we found the Pentium MMX-266 notebook a bit too expensive to make the chart. You can get the ThinkPad 1450 I's performance for hundreds of dollars less in a non-Intel notebook like AMS Tech's $1395 Roadster 15CTA, which rises a spot on the budget chart this month. But then you'd lose the ThinkPad's comfortable keyboard and some nifty enhancements specific to the I series.

The 1450 I comes with built-in floppy and CD-ROM drives. It's too heavy—8.6 pounds with adapter—but it's generously configured with a 3-hour battery, a 4.3GB hard drive, an internal V.90 modem, and a 13.3-inch screen. And thanks to audio controls on the case, this ThinkPad can even double as a very expensive CD player. You can play music, change tracks via a small LCD window, and pause or eject a CD, all without opening the notebook or even turning it on. The 1450's speakers, which run along the sides of the screen, sound great with the lid closed. In fact, with the notebook open, the audio becomes grating and a little distorted.

The 1450's third mouse button, another feature introduced with the I series, can be set to scroll through or magnify documents—not an innovation to die for, but an interesting addition. Shortcut fiends will prefer the four programmable keys. As with other models in the I series, the 1450 carries IBM's venerable eraserhead pointing device. IBM also packs in a generous number of business- and home-oriented programs: Lotus SmartSuite, IBM AntiVirus, Quicken 98, Tom Lehman Golf Pro 98, World Book Encyclopedia, and Rand McNally TripMaker.

SKIMPY SUPPORT?

IN THE PAST, *PC World* readers have praised IBM notebooks' reliability but complained about the company's service. Based on our recent anonymous calls to IBM's technical support line, however, the quality of the company's service seems to be picking up: We have received some especially helpful advice lately from IBM representatives.

All told, IBM did a nice job with the ThinkPad 1450 I, but a few changes would make it an even better notebook for consumers. The company could be more generous with support: Few notebook companies limit free help to the first year, as IBM does (it charges $99 annually after the first year). And while this model comes with an 8X–20X CD-ROM drive, faster devices are available on newer units. The ThinkPad 1450 I doesn't have a modular

		EXPANDABILITY					CUSTOMER SUPPORT			
CD/DVD-ROM drive speed	56-kbps modem protocol	Maximum RAM (MB)	Modular expansion bays	Bay for second battery	Optional docking station	Infrared port	Warranty for parts/labor (years)	Weekday toll-free support (hours)	Weekend support	Online support
12X-24X	not included	128	1	●	●	●	3/1	24	Sat, Sun	BBS, WWW
8X-20X	V.90	128	0	○	●	●	1/1	24	Sat, Sun	AOL, BBS, CIS, WWW
2X DVD	V.90	128	0	○	○	●	1/1	13	Sat	BBS, WWW
12X-24X	V.90	256	1	○	●	●	3 [1]/3	24	Sat, Sun	BBS, CIS, WWW
10X-24X	x2	256	1	●	●	●	3/3	24	Sat, Sun	AOL, BBS, CIS, MSN, WWW
8X-20X	not included	160	0	○	●	●	1/1	24	Sat, Sun	AOL, BBS, CIS, WWW
12X-24X	K56flex	128	0	○	○	●	1/1	12	Sat	BBS, WWW
8X-20X	K56flex	160	0	○	○	●	1/1	24	Sat, Sun	AOL, BBS, CIS, WWW
10X-24X	K56flex	96	0	○	○	●	3/3	11	none	BBS, CIS, WWW
8X-20X	V.90	128	0	○	○	●	1/1	13	Sat	BBS, WWW

[1] One year on battery.

multipurpose bay that accepts a second hard drive or battery. But you can get one in the new top-of-the-line ThinkPad 1721 I.

ENPOWER'S SMALL SPLASH

"REASONABLY priced performance" is about the most extravagant praise we can lavish on Enpower Innovation's ENP 313+, the first notebook we've tested with the new AMD K6-2-333 chip. With a PC WorldBench score of 133, the $1799 ENP 313+ gives you Pentium II-233 speed for $50 to $100 less than you pay for most PII-233 notebooks. Had Enpower scaled down the notebook's hard drive (a monstrous 6.4GB model), the ENP 313+ could have been a better deal by several hundred dollars.

Otherwise, this dapper, gray 8.1-pound notebook is largely unremarkable. It comes with 96MB of RAM, a 13.3-inch active-matrix screen, a touchpad, a V.90 PC Card modem, and fixed floppy and 10X–24X CD-ROM drives. (The first ENP 313+ we looked at had a broken CD-ROM drive; a replacement worked fine.) You also get typical notebook-anemic sound.

Enpower's small manuals don't approach the thoroughness of HP's or Gateway's user guides. Tech support proved even more off-putting: Condescending staffers gave us wrong information or told us to call other vendors with even the simplest questions.

DVD DUKE-OUT

SCEPTRE'S SOUNDX S6500 and ARM Computer's ArmNote TS3012 are twin Pentium II-300 notebooks that have serious entertainment possibilities thanks to their fast processors, DVD-ROM drives, 14.1-inch active-matrix screens, 8MB of video RAM, and television jacks. DVD videos look so good on these machines, you might be willing to ignore the heft factor: These 9.5-pound multimedia behemoths outweigh most other portables by at least a pound. The two notebooks' beefiness was largely responsible for their failure to make our chart.

Outwardly, the SoundX and ArmNote are nearly identical. Each comes with a 2X DVD-ROM drive stacked atop the floppy drive in a front-mounted modular bay, a touchpad, an internal V.90 modem, and an inexpensive carrying case.The modular bay can also accommodate a second battery or an LS-120 drive, both of which are extra-cost options.

Each notebook lasts longer than average on a single battery—approximately 3 hours and 15 minutes. A little extra width makes the keyboards comfortable, and the Synaptics utility included with both the SoundX and the ArmNote enables you to program mouse buttons to conveniently launch applications and files.

The choice between these two notebooks comes down to a handful of differences, with the $2599 ArmNote holding a slight edge. Not only is it $400 cheaper than the $2995 SoundX, but its 6.4GB hard drive is half again as large. The ArmNote disappoints only in performance: Despite its 96MB of RAM—32MB more than the SoundX has—the ArmNote's PC WorldBench score of 148 lags behind the SoundX's score by 8 percent. However, most users won't notice such a minor difference in performance.

Both portables come with skimpy support plans. Sceptre and ARM Computer both offer free telephone help but limit support hours mostly to weekdays. ARM Computer doesn't guarantee a specific turnaround time for repairs. Finally, the generic manuals accompanying the two notebooks offer just the basics. ■

BEYOND THE TOP 10

online

Other models we evaluated this month (listed below) did not score high enough to make the *Top 10 Notebook PCs* chart. For reviews, visit PC World Online (www.pcworld.com/top400).

- **Compaq Presario 1235**
- **CTX EZBook FC3A300A**
- **Kiwi Computer OpenNote 820MPR**
- **Transmonde Vivanté SE 2233**

PC WORLD

TOP 10 HOME PCs

	POWER SYSTEM	Last month	Month tested	Street price (12/18/98)	Comments
1	Dell Dimension XPS R450 800/388-8542 www.dell.com	1	Dec 98	$2179	**PRO:** Super performance, especially with business apps and graphics; recent $380 price drop. **CON:** Limited software package, so-so service rating.
2	Micron Millennia 450 Max 800/642-7667 www.micronpc.com	2	Dec 98	$2699	**PRO:** Fastest home system to date, joystick and gamepad, 19-inch monitor. **CON:** Still expensive despite $200 price drop.
3	Compaq Presario 5600 800/345-1518 www.compaq.com	3	Dec 98	$2499	**PRO:** Great speed, built-in ethernet, DSL capability, 19-inch monitor, FireWire, $100 price cut. **CON:** Mediocre reliability and service ratings.
4	Sony VAIO PCV-E308DS 800/315-7669 www.sony.com/pc	5	Jan 99	$2500	**PRO:** Easy setup, tons of digital imaging software, FireWire, huge $400 price cut. **CON:** Slowest performer on power chart, poor upgradability.
5	Gateway G6-450 800/315-2536 www.gateway.com	4	Feb 99	$2588	**PRO:** Fast, terrific sound system, CD-Rewritable drive. **CON:** On the pricey side, subpar software documentation.
	BUDGET SYSTEM				
1	IBM Aptiva D1N 800/426-7235 www.pc.ibm.com	n/a	NEW	$798	**PRO:** Incredibly low price backed by Big Blue's solid reliability rating. **CON:** Slow, only 32MB of RAM, limited expandability, scanty documentation and software.
2	Quantex QP6/333 M-1c 800/896-4898 www.quantex.com	1	Feb 99	$1049	**PRO:** Great price for great performance. **CON:** Limited software bundle, so-so setup, keyboard not very sturdy.
3	Dell Dimension V333c 800/388-8542 www.dell.com	2	Dec 98	$1416	**PRO:** Very fast and easy to use, first-class reliability rating. **CON:** Somewhat pricey, not a lot of software.
4	Compaq Presario 2266 800/345-1518 www.compaq.com	4	Jan 99	$848	**PRO:** Supercheap computer, respectable speed for the price, $100 off. **CON:** Very slow graphics performance, unsuitable for games.
5	Micron Millennia 350 800/642-7667 www.micronpc.com	5	Dec 98	$1649	**PRO:** Excellent performance, solid reliability and service ratings. **CON:** Most expensive budget PC on chart.

Best Buy n/a = not applicable [1] For more about products here, select the number on the product information card or visit www.pcworld.com/infonet.

FAST IS GOOD. FASTER IS BETTER. So when you buy a home computer you should spend a few extra dollars to get the fastest system you can afford, right? Not always. Whether you want a cutting-edge power system or a less advanced PC that's easier on your wallet, you'll find a range of price-performance combinations that offer what you want without straining your budget.

Take the new ultracheap IBM Aptiva D1N, this month's budget Best Buy. It may not have all the whiz-bang features of today's multimedia systems, but it provides Pentium II–level performance for $798. So ask yourself how much PC you really need—you might save some cash.

If you're flying an F-16 in Falcon 4.0 (a flight simulation game) or creating a director's cut of your latest cinema project, you need the fastest PC you can find. All five power systems scorch the carpet with Pentium II-450 processors, and all cost over $2000. But you still have some wiggle room to find the right PC at the right price.

For the second month in a row, Dell's Dimension XPS R450 and Micron's Millennia 450 Max run neck-and-neck for a Best Buy. Both systems are blisteringly fast, though the 450 Max holds a slight edge. The differences? The Micron system comes loaded with gaming goodies (including a joystick, a game pad, and scads of software) and has a $2699 price tag. The Dell PC is easier to use and costs $520 less, but it packs fewer hardware features and a skimpier software bundle.

If you're not a gaming gremlin or graphics guru, you can save a bundle on a power system by buying a PC with a slightly slower (and cheaper) CPU than what you'll find on our power list—without feeling a pinch in performance. We tested two such PCs this month: CyberMax's $1699 Enthusiast KII 300 and Quantex's $1749 QP6/350 SM-2x. Both just missed making the chart, but they're a good bet if you want something between the penthouse and the bargain basement.

PENNY-PINCHING PERFORMERS

ON THE BUDGET SIDE, too, you can save big bucks. Until now, our budget chart has generally been dominated by $1200 to $1600 PCs equipped with older Pentium II or non-Intel chips. We're finally seeing some real sub-$1000 systems—PCs from manufacturers like IBM that include a monitor in the price. Even the slowest of these offer decent performance to satisfy your basic computing needs.

In fact, the slowest system this month is our brand-new Best Buy budget system, IBM's Aptiva D1N. It steals the top spot from last month's winner, Quantex's QP6/333 M-1c, thanks to an incredible price of $798 (including a 15-inch monitor) and IBM's solid reliability rating.

The compact, no-frills D1N is a real space-saver, too. Its desktop case isn't

SCORECARD

★ Overall rating	PC WorldBench 98 score/rating	Price	Setup/ ease of use	Graphics	Reliability/ support	Features	PC World InfoNet number [1]
85	218/outstanding	inexpensive	good/ outstanding	outstanding	outstanding/ fair	Pentium II-450, 128MB of SDRAM, 10GB hard drive, 2X DVD-ROM drive, V.90 56-kbps modem, 17-inch monitor, Turtle Beach Montego sound card.	604
85	221/outstanding	expensive	very good/ good	outstanding	good/ good	Pentium II-450, 128MB of SDRAM, 14.4GB hard drive, 2X DVD-ROM drive, x2 56-kbps modem, 19-inch monitor, Iomega Zip drive, Sidewinder joystick.	605
82	216/outstanding	expensive	outstanding/ good	outstanding	fair/ fair	Pentium II-450, 128MB of SDRAM, 12.9GB hard drive, 2X DVD-ROM drive, V.90 56-kbps modem, 19-inch monitor, built-in ethernet.	606
82	201/good	expensive	outstanding/ good	outstanding	good/ good	Pentium II-450, 128MB of SDRAM, 10GB hard disk, 2X DVD-ROM drive, x2 56-kbps modem, 17-inch monitor.	607
81	212/outstanding	expensive	outstanding/ outstanding	outstanding	fair/ good	Pentium II-450, 64MB of RAM, 14GB hard drive, 2X DVD-ROM drive, V.90 56-kbps modem, 19-inch monitor, Boston Acoustics BA635 speakers.	608
Power scorecard weightings ▶	Performance 20 percent	Price 10 percent	Setup/ease 5 percent	Graphics 10 percent	R & S 40 percent	Features 15 percent	
79	128/good	very inexpensive	good/ good	poor	good/ fair	IBM 6x86MX-PR300, 32MB of SDRAM, 3.2GB hard drive, 14X-32X CD-ROM drive, V.90 56-kbps modem, 15-inch monitor.	–
78	169/outstanding	inexpensive	good/ fair	good	good/ good	Celeron-333, 64MB of SDRAM, 4GB hard drive, 12X-32X CD-ROM drive, V.90 56-kbps modem, 15-inch monitor.	609
74	169/outstanding	expensive	outstanding/ very good	good	outstanding/ fair	Celeron-333, 64MB of SDRAM, 8.4GB hard disk, 17X-40X CD-ROM drive, x2 56-kbps modem, 17-inch monitor, Harman/Kardon HK195 speakers.	610
74	130/good	very inexpensive	good/ fair	poor	fair/ fair	IBM 6x86MX-PR300, 64MB of SDRAM, 3GB hard drive, 12X-32X CD-ROM drive, V.90 56-kbps modem, 15-inch monitor.	611
72	178/outstanding	expensive	very good/ good	good	good/ good	Pentium II-350, 64MB of SDRAM, 10GB hard drive, 24X-32X CD-ROM drive, x2 56-kbps modem, 17-inch monitor.	612
Budget scorecard weightings ▶	Performance 15 percent	Price 25 percent	Setup/ease 10 percent	Graphics 5 percent	R & S 40 percent	Features 5 percent	All products: 906

Dimension XPS R450

much bigger than a deep-dish pizza box. Setup is a snap—connectors are clearly marked and labeled on the back of the case, and the speakers are built into it for easy audio.

Like the fourth-place Compaq Presario 2266, the D1N uses IBM's 6x86MX-PR300 processor, which matches the PC WorldBench 98 performance of a Pentium II-233. So you have plenty of power for spreadsheet activity, zipping off e-mails, and browsing the Web. The D1N also carries a full version of Lotus SmartSuite 97—but that's about it for software.

At this low price you can forget about high-quality multimedia: The built-in speakers sound gravelly at best, and the D1N's graphics test scores were very low—4MB of the system's 32MB of RAM are shared with the video card.

Unfortunately, you may have a hard time finding a D1N at your local superstore. At this writing, they were selling fast, and IBM built only a limited number of them. However, Big Blue says it will release a new sub-$1000 Aptiva with similar specs by the middle of this year. As we went to press, no further information was available.

IBM Aptiva D1N

COMPAQ: OFF THE CHART

ON THE HIGH END of the budget spectrum is one of the first PCs we've tested that uses AMD's K6-2-400 CPU: Compaq's new $1548 Presario 5240. This distinctive-looking minitower (which, if you squint, vaguely resembles a space-age image of Buddha) just missed the list because of its slightly inferior graphics scores. Still, with 128MB of RAM, the 5240 posted a PC WorldBench score on a par with Celeron-333 PCs, and within shouting distance of PII-350s.

Hooking up peripherals to the system's case is easy. Home-office PC buyers will like some of the 5240's extras, which include a built-in ethernet port as well as a handy port on the front of the case with both a USB and a FireWire connector.

But adding things internally is another matter. If you want to install an expansion card, you'll have to fight your way through a nest of cables and clutter. And to add memory or remove the CPU, you'll need double-jointed wrists to reach around the poorly located power supply.

Kirk Steers is a contributing editor for PC World. *Testing was performed by Ulrike Diehlmann of the PC World Test Center.* ■

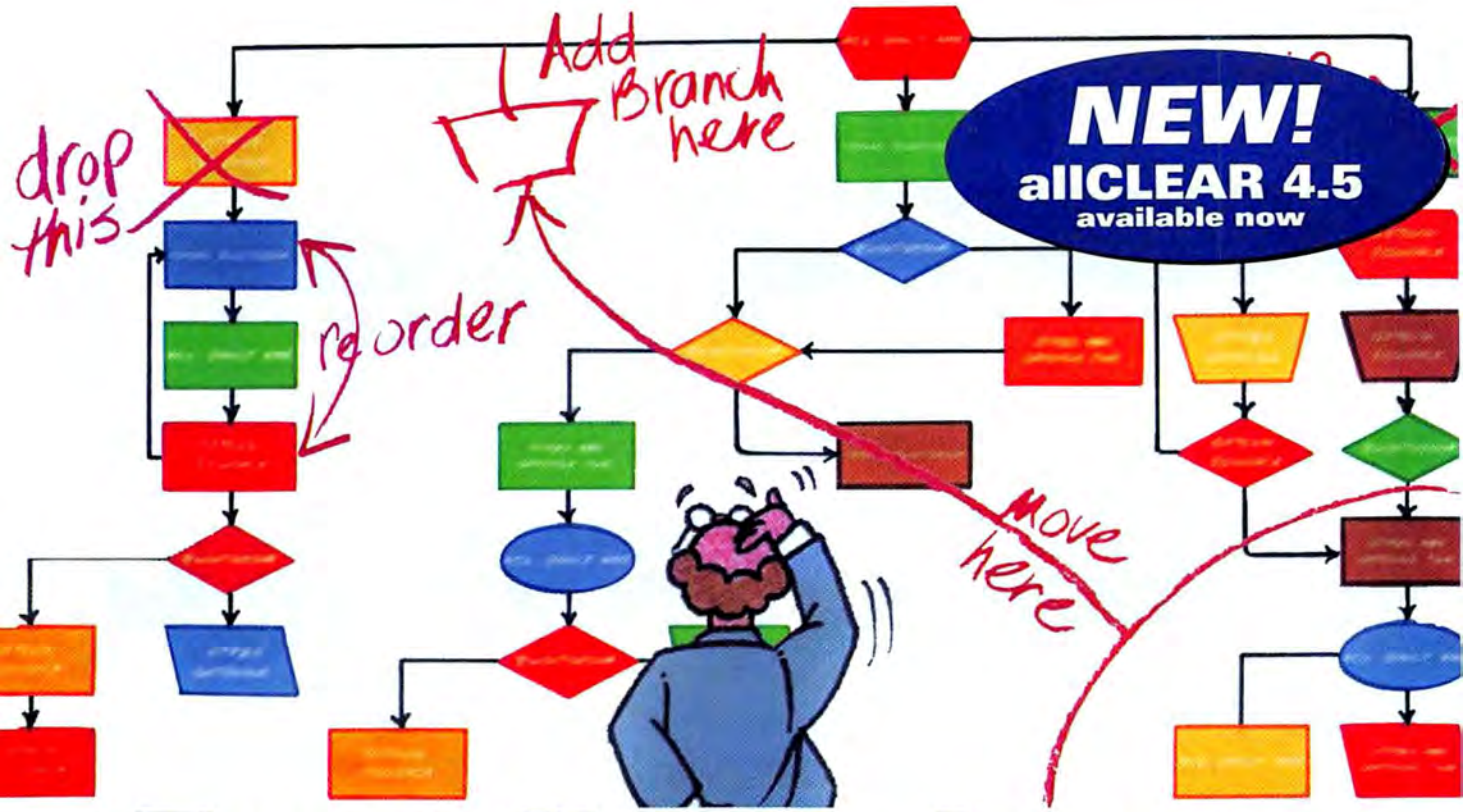
BEYOND THE TOP 10

online

We also evaluated the below systems this month, but they didn't score high enough to make the *Top 10 Home PCs* chart. For reviews, see PC World Online (www.pcworld.com/t10homepcs).

- **Compaq Presario 5240**
- **CyberMax Enthusiast KII 300**
- **HP Pavilion 6355**
- **HP Pavilion 8395**
- **IBM Aptiva E2U**
- **Quantex QP6/350 SM-2x**

PHOTOGRAPHS: KEN SMITH



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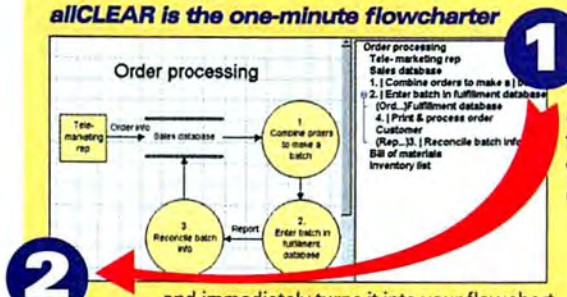

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PC WORLD

TOP 10 PRINTERS

	SMALL-BUSINESS/HOME MONOCHROME	Street price (12/8/98)	Overall rating	Speed for plain text/full-page graphics (ppm)	Print quality for text/gray-scale graphics	Comments	PC World InfoNet number
1	Okidata OkiPage 10i 800/654-3282 www.okidata.com	$499	83	8.5/3.4	very good/ adequate	FEATURES: LED, rated 10 ppm. Standard 2MB of RAM, 1200-by-600-dpi maximum resolution, 250 sheets input, 150 output. SUMMARY: Small-business model produces handsome text at an impressive rate and holds a lot of paper. Gray-scale graphic images are too dark for our taste, however.	668
2	Okidata OkiPage 6e 800/654-3282 www.okidata.com	$249	82	5.2/3.2	good/ adequate	FEATURES: LED, rated 6 ppm. Standard 2MB of RAM, 1200-by-300-dpi maximum resolution, 100 sheets input and output. SUMMARY: Good print quality, a modest footprint, a simple and functional control panel design, and a low price help keep this unit high on the chart, despite its slow text and graphics production.	669
3	Minolta PageWorks 8L 888/264-6658 www.minoltaprinters.com	$379	82	6.5/3.4	very good/ adequate	FEATURES: Laser, rated 8 ppm. Standard 2MB of RAM, 1200-by-1200-dpi maximum resolution, 150 sheets input, 100 output. SUMMARY: This quiet, easy-to-use monochrome model has great documentation, but it's a bit pricey considering its somewhat pedestrian text printing speed. Text output looks handsome, but graphics are dark.	670
4	Xerox DocuPrint P12 800/832-6979 www.xerox.com	$699	82	9.2/3.9	excellent/ good	FEATURES: Laser, rated 12 ppm. Standard 2MB of RAM, 600-by-600-dpi maximum resolution, 330 sheets input, 250 output. SUMMARY: Our former corporate Best Buy, this somewhat pricey ship-jumper lands on the small-office chart with a three-year warranty and outstanding text print quality.	671
5	Brother HL-1040 800/276-7746 www.brother.com	$300	80	8.4/3.6	very good/ adequate	FEATURES: Laser, rated 10 ppm. Standard 2MB of RAM, 600-by-600-dpi maximum resolution, 200 sheets input, 100 output. SUMMARY: This inexpensive unit offers impressive text and graphics speeds, good text output, and a convenient design. But graphics are dark, and the printer's paper trays seem flimsy.	672
	CORPORATE MONOCHROME						
1	Lexmark Optra S 1855 800/539-6275 www.lexmark.com	$1129	86	13.8/4.1	very good/ very good	FEATURES: Laser, rated 18 ppm. Standard 4MB of RAM, 1200-by-1200-dpi maximum resolution, 350 sheets input, 250 output. SUMMARY: Fastest text printing on the chart, extensive paper-handling options. But its usually strong gray-scale graphics print quality can be inconsistent, and it's the costliest printer on the chart.	673
2	Lexmark Optra S 1625 800/539-6275 www.lexmark.com	$999	85	11.6/2.5	very good/ very good	FEATURES: Laser, rated 16 ppm. Standard 4MB of RAM, 1200-by-1200-dpi maximum resolution, 350 sheets input, 250 output. SUMMARY: Low price for its class, strong performance, and good overall print quality. Except for its print speed and price, specifications are identical to those of the Best Buy Optra S 1855.	674
3	HP LaserJet 4000 800/752-0900 www.hp.com	$1099	82	12.4/4.4	very good/ adequate	FEATURES: Laser, rated 17 ppm. Standard 8MB of RAM, 1200-by-600-dpi maximum resolution, 600 sheets input, 300 output. SUMMARY: Offers fast text and graphics printing, very good text quality, and extensive features for the price. However, you need to use special settings to achieve optimal graphics quality.	675
4	Xerox DocuPrint N17b (NEW) 800/832-6979 www.xerox.com	$999	80	10.7/1.4	very good/ adequate	FEATURES: Laser, rated 17 ppm. Standard 16MB of RAM, 1200-by-600-dpi maximum resolution, 350 sheets input, 250 output. SUMMARY: Feature-rich model is the only one on our chart to come standard with Adobe PostScript. It also has comprehensive paper-handling options and lots of memory, but it's a bit slow for a corporate printer.	676
5	Samsung QwikLaser-7000 (NEW) 888/987-4357 www.samsungtelecom.com	$999	78	10.4/3.8	good/ adequate	FEATURES: Laser, rated 17 ppm. Standard 4MB of RAM, 1200-by-1200-dpi maximum resolution, 500 sheets input, 250 output. SUMMARY: The first Samsung printer we've tested grabs a spot on the corporate chart with sharp, dark text output and a handy built-in duplex feature (rare at this price point). We only wish it could print text "qwiker."	677

Best Buy Windows 95-certified Plug and Play All products: 905

TEST PC WORLD CENTER **HOW WE TEST** The overall rating for both monochrome small-business/home printers and corporate printers is based on print quality (25 percent), price (25 percent), features (15 percent), speed (10 percent), service and support (10 percent), and ease of use (15 percent). For all ratings, higher is better. Data based on tests designed and conducted by the PC World Test Center. All rights reserved.

SPEED IS THE WORD when it comes to monochrome lasers this month. As printer makers use faster processors, both small and large offices can find great deals on brisk black-and-white models. But as printers get faster, low-end models drop out of the mix—forcing us to shift our scoring scales upward—and printers rated at 12 pages per minute move from the corporate chart to the small-business/home section. ▶

Of the four new corporate printers vying for chart spots this month, two succeed. Xerox's $999 DocuPrint N17b, which prints high-quality text and graphics, takes fourth place, while Samsung's $999 QwikLaser-7000 nabs the number five slot thanks to its slick features. Both the Brother HL-2060 and the GCC Technologies Elite XL 20/1200 missed the chart, though the Elite offers notable connectivity options that could make it a must-buy.

In our December printer review ("All Color, All the Time," www.pcworld.com/dec98/printers), we noted that NEC alone had failed our informal tech support test. This month, we called the company 12 more times. Its reps were more accurate and courteous than before, but we still had to wait up to 21 minutes to reach them.

A SMALL-OFFICE AFFAIR

THE ARRIVAL OF 12-ppm climbers raised the average price on our SOHO chart, giving costlier models a chance to rise. For example, Okidata's speedy $499 OkiPage 10i earns a Best Buy on the strength of great paper-handling features and text quality.

Xerox's $699 DocuPrint P12 survived the move to the small-office chart. Its good performance, great print quality, and three-year warranty helped it clinch first place on the January corporate chart; in the company of more economical SOHO machines, it finishes fourth. The lone new small-business model tested this month, Hewlett-Packard's DeskJet 2100, comes up short due to mediocre performance for its $699 price. It costs the same as the DocuPrint P12 but runs slower, with fuzzier output. It does, however, have an infrared port—handy for notebook users.

CORPORATE HEADQUARTERS

THIS MONTH, Lexmark's $1129 Optra S 1855 and $999 Optra S 1625 switch places. Both print handsome text, but the deemphasis on price for corporate buyers allows the Optra S 1855's superior speed and expandability to nose it ahead of its sibling and into first place while the 1625 settles in at number two.

Xerox's new DocuPrint N17b prints relatively slowly (10.7 ppm on text), but other qualities earn it fourth place. It prints clean, crisp text, and unlike most models in its class, the N17b comes standard with Adobe PostScript and 16MB of memory. We do wish its grays were smoother, however. Xerox sells a full line of paper-handling equipment for the N17b, including a 2000-sheet feeder ($1060), a duplexer for two-sided prints ($295), and an output tray for multiple collated copies ($375).

Meanwhile, Samsung makes its Top 10 debut with a new model from its year-old printer line. The QwikLaser-7000 offers one particularly outstanding feature: With its built-in duplexer, you just select *Duplex* in the driver and—presto!—it prints on both sides of the page with no further intervention. The duplexer alone makes the Samsung's price of $999 a bargain, although at 10.4 ppm it plods compared to the top-ranked Lexmark Optras. We also found the QwikLaser's graphics a bit dark and posterized—with rough transitions—but we liked its sharp, clean text.

THE $999 QWIKLASER-7000's built-in duplexer and good text quality give the Samsung printer line its first chartmaker.

CLOSE CALLS

THERE'S NO DOUBT about it: Brother's HL-2060 prints fast. Tested at 14.8 ppm for text, it outputs a full page more per minute than our Best Buy, the Lexmark Optra S 1855. It's $30 cheaper than the Lexmark, too. But ultimately, the Brother's fuzzy print quality kept it off the chart.

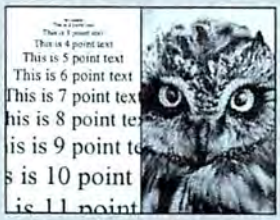
GCC's Elite XL 20/1200 presents a mixed bag, too. It offers numerous forms of connectivity: parallel and SCSI ports, 10Base-T and AAUI ethernet ports, a Mac LocalTalk port, and even an unused port (silly, but true). These ports, which can be used simultaneously, are ideal for offices that have systems running on numerous platforms. The XL 20/1200 also prints on 13-by-19-inch paper and includes a huge 64MB of memory.

Alas, the $2199 XL 20/1200 costs about twice as much as other corporate monochromes we've seen. And its graphics speed of 1.3 ppm on standard-size paper means that oversize CAD drawings will take ages to emerge. Finally, though the Elite prints crisp text pages, its gray-scale graphics look washed out.

—Dan Littman ■

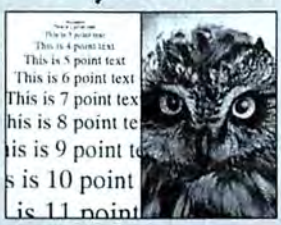
PRINT QUALITY SAMPLES

A Good Gray Is Hard to Find



LEXMARK OPTRA S 1855

Its sharp text, particularly on small type, impressed us, but the Lexmark Optra S 1855's gray-scale graphics can sometimes look less smooth than we prefer.



SAMSUNG QWIKLASER-7000

The QwikLaser-7000 is the first Samsung to make our printer chart. It generates sharp and clear text, though gray-scale images appear a bit too dark and blocky.

XEROX DOCUPRINT N17B

Xerox's newest corporate printer, the DocuPrint N17b, produces light but clean text output and adequate, albeit somewhat streaky, gray-scale images.

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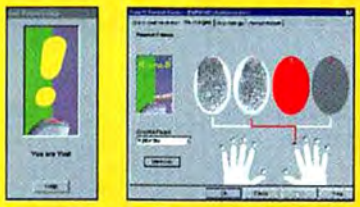

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PC WORLD

TOP 10 MONITORS

	15-INCH MONITOR	Month tested	Street price (12/4/98)	Overall rating	Quality of text/graphics	Comments	PC World InfoNet number
1	Princeton EO500 800/747-6249 www.prgr.com	Nov 98	$187	80	very good/ very good	**FEATURES:** 13.6-inch viewable area, .28mm dot pitch tube, up to 110-Hz refresh rate,[1] Plug and Play ready,[2] TCO'95 compliant, three-year warranty, 24-hour weekday toll-free support. **SUMMARY:** $10 price cut, even color saturation, sharp text, and generous support are highlights. On-screen controls require tedious button pressing.	678
2	CLR VisionPro 15 800/611-1555 www.clrusa.com	Nov 98	$159	80	very good/ very good	**FEATURES:** 13.4-inch viewable area, .28mm dot pitch tube, up to 85-Hz refresh rate,[1] Plug and Play ready,[2] TCO'92 compliant, three-year warranty, 12-hour weekday toll-free support. **SUMMARY:** Sharp text, realistic graphics, and $20 price cut negate small viewable area and on-screen icons that lack numeric adjustment gauges.	679
3	Samsung SyncMaster 500b 800/933-4110 www.sosimple.com	Nov 98	$199	79	very good/ very good	**FEATURES:** 13.6-inch viewable area, .28mm dot pitch tube, up to 85-Hz refresh rate,[1] Plug and Play ready,[2] three-year warranty, 24-hour toll-free support. **SUMMARY:** Sleek design with blue-gray inlays; picture quality nearly equals the Best Buy EO500's. Icons for on-screen controls are cryptic; control buttons are hard to press.	680
4	ViewSonic P655 800/888-8583 www.viewsonic.com	Nov 98	$245	78	very good/ excellent	**FEATURES:** 14-inch viewable area, .27mm dot pitch tube, up to 110-Hz refresh rate,[1] Plug and Play ready,[2] TCO'95 compliant, three-year warranty, 11-hour weekday toll-free support. **SUMMARY:** Large viewable area, deep colors, and terrific text are pluses, but a high price tag and limited support hours hurt its overall ranking.	681
5	MAG InnoVision XJ500T 800/827-3998 www.maginnovision.com	Nov 98	$189	78	good/ very good	**FEATURES:** 13.9-inch viewable area, .25mm stripe pitch Trinitron tube, up to 85-Hz refresh rate,[1] Plug and Play ready,[2] TCO'92 compliant, three-year warranty, 24-hour toll-free support. **SUMMARY:** Competitive price, enticing graphics, and easy-to-adjust on-screen controls win praise. Text isn't as sharp as on higher-ranking models.	682
6	Panasonic PanaSync Pro 50 800/742-8086 www.panasonic.com/alive	NEW	$199	78	good/ very good	**FEATURES:** 14-inch viewable area, .27mm dot pitch tube, up to 85-Hz refresh rate,[1] Plug and Play ready,[2] TCO'92 compliant, three-year warranty, 24-hour toll-free support. **SUMMARY:** Crisply rendered graphics and large viewable area compensate for lackluster text display and control buttons that take some time to master.	683
7	CTX PL5+ 800/888-9052 www.ctxintl.com	Nov 98	$179	78	very good/ good	**FEATURES:** 14-inch viewable area, .28mm dot pitch tube, up to 85-Hz refresh rate,[1] Plug and Play ready,[2] TCO'92 compliant, three-year warranty, 12-hour weekday toll-free support. **SUMMARY:** Text looks fine and viewable area is large, but higher-ranked rivals display colors better. Readily accessible controls span the front bezel.	684
8	AcerView 56c 800/733-2237 www.acerperipherals.com	Nov 98	$209	78	very good/ very good	**FEATURES:** 13.8-inch viewable area, .28mm dot pitch tube, up to 100-Hz refresh rate,[1] Plug and Play ready,[2] TCO'92 compliant, three-year warranty, 12-hour weekday toll-free support. **SUMMARY:** Classy shape and fine image quality overcome enigmatic on-screen menu icons. You must press Save before settings take effect.	685
9	Sampo AlphaScan 511 800/467-2676 www.sampotech.com	NEW	$169	77	very good/ good	**FEATURES:** 13.9-inch viewable area, .28mm dot pitch tube, up to 75-Hz refresh rate,[1] Plug and Play ready,[2] three-year warranty, 10-hour weekday toll-free support. **SUMMARY:** Good price and clear, focused text compensate for somewhat weak graphics, short tech support hours, and a relatively low refresh rate.	686
10	MaxTech XT-5862 800/936-7629 www.maxtech.com	Nov 98	$139	77	good/ very good	**FEATURES:** 13.9-inch viewable area, .28mm dot pitch tube, up to 100-Hz refresh rate,[1] Plug and Play ready,[2] three-year warranty, 8-hour weekday toll-free support. **SUMMARY:** Cheapest monitor here has unimpressive text, limited support hours, and poorly defined on-screen controls. Still, a good deal if price is top priority.	687

Best Buy For reviews of products that didn't make the chart, visit www.pcworld.com/t10monitors. All products: 906

TEST PC WORLD CENTER

HOW WE TEST Ten judges rate a monitor's text and graphics quality. We evaluate each unit on how well it displays typical business letters, a newsletter, spreadsheets, Web pages, and scanned images. The overall rating is based on text and graphics quality (25 percent each), features and ease of use (25 percent), price (20 percent), and service and support (5 percent). The best possible overall rating is 100. Data based on tests designed and conducted by the PC World Test Center. All rights reserved.

[1] Highest refresh rate at 800 by 600 resolution. [2] Plug and Play monitors and graphics cards can communicate bidirectionally. However, Windows 95 does not fully utilize monitor Plug and Play.

PRICES FOR TYPICAL 15-INCH monitors now hover at around $200—about half what you'd have paid a year ago. Princeton's EO500, priced at $187, retains its first-place status while similarly affordable models from Panasonic and Sampo debut. Not for penny-pinchers, ViewSonic's $245 P655 displays colors with gusto; it's your best bet for small-screen Web surfing or graphics-intensive work. Next month we review 17-inch models. ■

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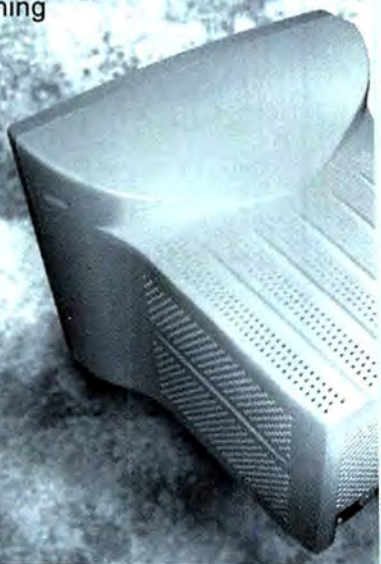

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PC WORLD

TOP 10 GRAPHICS BOARDS

	PCI BOARD	Month tested	Street price (1/5/99)	Overall rating	Mixed-media business rating	3D rating	Features rating	Comments	PC World InfoNet number
1	STB Velocity 4400 PCI 800/234-4334 www.stb.com	Feb 99	$149	89	good	average	excellent	**FEATURES:** 16MB of SDRAM, 250-MHz RAMDAC, NVidia RIVA TNT chip, bundled graphics plug-ins, video editing tool, and 3D game. **SUMMARY:** Excellent features, pleasing performance, and top-notch support policies justify the Velocity's high price.	696
2	Creative Labs 3D Blaster Banshee 800/998-5227 www.soundblaster.com	NEW	$130	88	good	excellent	good	**FEATURES:** 16MB of SDRAM, 250-MHz RAMDAC, 3Dfx Voodoo Banshee chip, no bundled apps. **SUMMARY:** Excellent 3D performance and useful utilities such as color calibration tools make this card a good choice for gaming and standard graphics tasks.	697
3	Matrox Millennium G200 SD PCI 800/844-8305 www.matrox.com/mga	Feb 99	$129	86	good	good	good	**FEATURES:** 8MB of SGRAM, 250-MHz RAMDAC, MGA-G200 chip, bundled 3D modeling and image editing tools and 3D game. **SUMMARY:** Affordable board performs well in graphics-heavy apps—a fine upgrade for business users and casual gamers.	698
4	Diamond Monster Fusion 800/468-5846 www.diamondmm.com	Jan 99	$150	85	average	excellent	average	**FEATURES:** 16MB of SDRAM, 250-MHz RAMDAC, 3Dfx Voodoo Banshee chip, bundled 3D games. **SUMMARY:** Terrific 3D rating suits this board for gaming and standard graphics jobs, but it costs more than other PCI boards here. AGP version also $150.	699
5	Metabyte Wicked3D Vengeance 510/494-9700 www.wicked3d.com	Feb 99	$99	84	good	excellent	average	**FEATURES:** 16MB of SGRAM, 250-MHz RAMDAC, 3Dfx Voodoo Banshee chip, bundled 3D game. **SUMMARY:** Remarkable 3D speed qualifies card for hot gaming, and $20 off makes it the cheapest PCI card here, but it's short on useful utilities.	700
	AGP BOARD								
1	Matrox Millennium G200 800/844-8305 www.matrox.com/mga	Oct 98	$129	93	excellent	good	excellent	**FEATURES:** 8MB of SGRAM, 250-MHz RAMDAC, MGA-G200 chip, bundled 3D modeling and image editing tools. **SUMMARY:** Top-notch features and performance at a good price. To view games on a TV, try the $129 Mystique G200 or $299 Marvel G200-TV.	701
2	STB Velocity 4400 AGP 800/234-4334 www.stb.com	Dec 98	$149	92	good	good	excellent	**FEATURES:** 16MB of SDRAM, 250-MHz RAMDAC, NVidia RIVA TNT chip, bundled 3D games, video editing tool, and graphics plug-ins. **SUMMARY:** Good all-around performance and bundled software suits this board for games and standard graphics tasks.	702
3	Diamond Viper V550 800/468-5846 www.diamondmm.com	Feb 99	$169	91	excellent	good	good	**FEATURES:** 16MB of SDRAM, 250-MHz RAMDAC, NVidia RIVA TNT chip, bundled graphics plug-ins, 3D game, and tools for VRML authoring, 3D visualization, and photo editing. **SUMMARY:** Great mixed-media rating and software. PCI version is also $169.	703
4	Hercules Terminator Beast 800/532-0600 www.hercules.com	Dec 98	$80	90	good	good	good	**FEATURES:** 8MB of SDRAM, 250-MHz RAMDAC, S3 Savage3D chip, no bundled software. **SUMMARY:** Good 3D performance and $15 price drop make the Terminator Beast a fine, low-cost upgrade for gaming fanatics, but it's backed by skimpy support.	704
5	Creative Labs Graphics Blaster RIVA TNT 800/998-5227 www.soundblaster.com	Feb 99	$170	89	good	good	good	**FEATURES:** 16MB of SDRAM, 250-MHz RAMDAC, NVidia RIVA TNT chip, no bundled software. **SUMMARY:** Graphics Blaster comes with weekend support—a nice perk for home users. But this middle-of-the-road board is on the pricey side.	705

Best Buy ONLINE For reviews of products that didn't make the chart, visit www.pcworld.com/t10graphics. All products: 908

TEST PC WORLD CENTER **HOW WE TEST** We test boards under Windows 95. Business tests include PC WorldBench 98, a PowerPoint test, and a Macromedia Director script. Our 3D score is based on four games, each evaluated on frame rate and image quality. For AGP cards we add a texturing test using Caligari's TrueSpace3. We tested PCI boards in a Micron Millennia Mme PC with a Pentium MMX-233 and 32MB of RAM. AGP boards were tested in an NEC Direction 333 with a PII-333 and 64MB of RAM. Overall rating is based on performance (PCI 50 percent, AGP 55 percent), features (25 percent), price (PCI 15 percent, AGP 10 percent), and support policies (10 percent). For all scores, higher is better. Data based on tests designed and conducted by the PC World Test Center. All rights reserved.

ZIPPY PERFORMANCE and useful software bundles keep STB's Velocity 4400 PCI and Matrox's Millennium G200 in the top spots. Alternatively, Creative Labs' new 3D Blaster Banshee PCI card offers top 3D speeds, good graphics quality, and Sonnetech's easy-to-use color calibration tool. Newly tested boards from Asus, CardExpert, Elsa, and Hercules missed our list because of so-so performance and subpar support policies. ■

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What makes the stars twinkle?

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PC WORLD

TOP 10 MODEMS

	INTERNAL V.90 MODEM	Month tested	Street price (12/23/98)	Overall rating	56-kbps downloads/ 33.6-kbps transfers (min:sec per MB)	Comments (all modems listed support V.90)	PC World InfoNet number
1	IBM 56K Modem Internet Kit 800/772-2227 www.ibm.com/pc/us/accessories	Jan 99	$91	80	3:33/5:57	**FEATURES:** Supports x2, 16-bit ISA card, V.80 videoconferencing, USR/TI chip set, distinctive ring, voice mail, speakerphone, DSVD, Caller ID, QuickLink Message Center software. **SUMMARY:** This great SOHO modem is inexpensive and comes with voice features, excellent 56-kbps performance, and nonstop support.	–
2	Zoom FaxModem 56K PCI Dualmode 800/631-3116 www.zoomtel.com	Jan 99	$64	79	4:16/5:40	**FEATURES:** Supports K56flex, PCI card, Rockwell chip set, MNP-10EC error control, V.80 videoconferencing, voice mail, distinctive ring, Communicate software. **SUMMARY:** Top choice for SOHO on a strict budget; low-cost modem has voice features and is backed with long support hours. But it runs a little slow on 56-kbps downloads.	688
3	Diamond Multimedia SupraExpress 56i 800/468-5846 www.diamondmm.com	Jan 99	$100	78	3:41/5:41	**FEATURES:** Supports K56flex, 16-bit ISA card, Rockwell chip set, V.80 videoconferencing, distinctive ring, voice mail, speakerphone, Caller ID, FaxTalk Communicator software. **SUMMARY:** Excellent candidate for home offices performs well and offers lots of features. Support is available 14 hours per weekday and on Saturdays.	689
4	Viking V.90 56K ISA Modem 800/338-2361 www.vikingcomponents.com	Feb 99	$60	78	3:23/5:41	**FEATURES:** Supports K56flex, 16-bit ISA card, Rockwell chip set, voice mail, speakerphone, QuickLink III software. **SUMMARY:** This ISA modem drops $35 this month and sports great 56-kbps performance. Viking backs it with 24-hour support, but the skimpy manual it provides isn't very helpful.	690
5	Amquest Host PCI 56K Dual Mode Voice/Speakerphone 877/663-3648 www.amquestmodem.com	Feb 99	$49	78	3:35/5:39	**FEATURES:** Supports K56flex, PCI card, Rockwell chip set, MNP-10EC error control, V.80 videoconferencing, speakerphone, ASVD, DSVD, VoiceView, Caller ID, voice mail, Amquest @fax.com software. **SUMMARY:** Ultralow-cost, performs well, numerous voice features; but it's hard to install and uses only one port assignment (COM2).	691
6	Apache Micro Peripherals NetExpress 56K 800/330-1328 www.apache-micro.com	Jan 99	$88	76	3:46/5:42	**FEATURES:** Supports K56flex, 16-bit ISA card, Rockwell chip set, distinctive ring, voice mail, speakerphone, ASVD, Caller ID, MegaConnect Lite software. **SUMMARY:** This affordable modem comes with voice features, but the company limits tech support to just 8 hours per day, weekdays only.	692
7	3Com U.S. Robotics 56K Faxmodem 800/342-5877 www.3com.com	Jan 99	$130	76	3:42/5:51	**FEATURES:** Supports x2, 16-bit ISA card, USR/TI chip set, distinctive ring, Caller ID, RapidComm software. **SUMMARY:** Good choice if you're willing to pay extra for hand-holding. The pricey Faxmodem is fast at 56-kbps downloads, and its thorough manuals will appeal to novices and experts alike.	693
	PC CARD V.90 MODEM						
1	3Com Megahertz 56K Cellular Modem PC Card 800/638-3266 www.3com.com/mobile	retested this month	$199	83	3:38/5:54	**FEATURES:** Supports x2, 3Com/TI chip set, cellular connectivity, voice mail, speakerphone, Caller ID, digital line voltage protection, Xjack pop-out phone jack, RapidComm software. **SUMMARY:** Costs plenty, but it's fast and comes with crystal-clear setup instructions; a retractable phone jack eliminates the need for a special cable.	694
2	TDK CyberExpress 5600 56K 800/999-4835 www.tdksystems.com	NEW	$99	83	3:36/5:41	**FEATURES:** Supports K56flex, Rockwell chip set, MNP-10EC, distinctive ring, Caller ID, digital line voltage protection and alert, QuickLink III software. **SUMMARY:** Lacks a handy pop-out phone jack, but installs easily and costs considerably less than the other two PC Card modems on the chart.	695
3	IBM 56K PC Card Modem 800/772-2227 www.ibm.com/pc/us/accessories	NEW	$160	82	4:01/6:06	**FEATURES:** Supports x2, USR/TI chip set, direct cellular connections, Caller ID, digital line voltage protection and alert, Xjack pop-out phone jack, QuickLink III software. **SUMMARY:** A little poky at 56-kbps downloads, but comes with both a built-in phone jack and digital voltage protection. Users can call tech support anytime.	–

Best Buy For reviews of products that didn't make the chart, visit www.pcworld.com/t10modems. All products: 907

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NO LONGER DOES BUYING a PC Card modem mean you'll have to max out your credit card. Our Best Buy, 3Com's Megahertz 56K Cellular, sells for $199, though that's not cheap. If you don't need all the extras that the Megahertz offers—such as a direct cellular connection and a built-in internal phone jack—check out TDK's $99 CyberExpress 5600 56K. It costs little more than most internal modems, and it outruns most of them. ■

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AD# W03

HERE'S HOW

WINDOWS TIPS SCOTT DUNN

Control Your Out-of-Sorts Start Menu

IF YOU'RE ACCUSTOMED to using Windows 95, you know that the Start menu is arranged into submenus (folders) that contain shortcut icons, all of which appear in alphabetical order. But Internet Explorer 4 and Windows 98 trash this convenient alphabetical scheme. This is progress?

Not to worry. Unlike Windows 95, Windows 98 and IE 4 (with the Windows Desktop Update feature installed) let you arrange Start menu items in any order you want. When you install new software, it's usually added to the bottom of the Programs menu unless the installer lets you specify otherwise. The fix is easy. Just click *Start•Programs*, position the pointer over an item you want to move, and then drag it to a new location—either on the same menu, on any menu in the Programs menu hierarchy, or above the first line in the Start menu. When you see a black bar where you want to place your submenu folder or shortcut, release the mouse button (see **FIGURE 1**).

If your Programs menu is stuffed with dozens of items, you might want to edit the Registry to alphabetize it automatically. As a precaution, you should first make a backup of the following files in your Windows folder: user.dat, system.dat, user.dao, and system.dao.

Now launch the Registry Editor by choosing *Start•Run*, typing **regedit**, and clicking *OK*. In the left-hand pane, navigate to HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Explorer\MenuOrder. Click the + next to MenuOrder to see its two folders (called keys)—Favorites and Start Menu. To alphabetize your Programs menu, continue navigating down the tree to the Start Menu\&Programs\Menu key. In the right pane, you should see the binary Order icon, which stores sorting information. To reset the sort order, select that icon, , shown here, and press **<Delete>**. Then click *Yes* to confirm the deletion.

To clean up other menus, delete the Order icon from within the appropriate MenuOrder keys—that is, from the Favorites\Menu key, the Start Menu\Menu key, or the Menu key of any submenu key. Then exit the Registry Editor and select *Start•Log Off <your user name>*. Log on to Windows again, click the *Start* button, and go to a menu you've just cleaned to see the result. Items should appear in alphabetical order with submenus first. In my experience, this technique works better with Favorites, Programs, and other menus than with items you've added to the Start Menu itself.

FIGURE 1: DRAG AND DROP Win 98 or IE 4 Start menus into place.

ILLUSTRATION: HARRY CAMPBELL

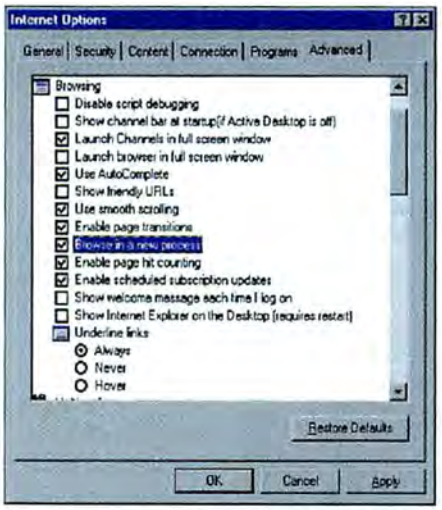

FIGURE 2: WHEN BROWSERS go bad, protect the Active Desktop with this simple setting.

Unfortunately, neither dragging Start menu items around nor editing the Registry tidies up out-of-order items permanently. Drag an item out of place, install new software, or let other people use your computer, and your Programs menu can gradually lapse into disorder again. The same holds true for any menu that you can customize, such as the Favorites menu in Internet Explorer. To force Windows to alphabetize a given menu each time you start your computer, you need to create stand-alone Registry sections. Here's what to do.

First, use the Registry Editor to make a backup of the Menu key of a particular menu: Select the key in the left pane and choose *Registry•Export Registry File*. Specify a location for your backup and type a name. Make sure 'Selected branch' is highlighted and click *Save*. Now locate the backup file you just created, right-click it, and choose *Edit* to open it in Notepad. Save a copy under a new name to preserve your original backup: Choose *File•Save As*, type a name like **"alphatiz.reg"** (be sure to include the quotation marks so Notepad gives it the .reg extension), and save the file in the folder of your choice—for example, the Windows folder.

Now to make some changes. If you successfully exported only a Menu key branch, the third line of your file containing text should begin with '"Order"=hex:'. Select and delete everything after the colon so that '"Order"=hex:' is the only thing on the line and that line is the last one in your file. At the end of the line, press **<Enter>** to insert a carriage return. Now choose *File•Save* and then *File•Exit*. This creates a Registry key backup with a blank Order icon, eliminating the information about icon arrangement.

This little text file includes a complete path to the section of the Registry that determines the order of a given menu. By merging this file with the Registry, you can delete whatever order info is stored for a given menu. To make Windows import this Registry key every time you restart your computer, choose *Start•Run*, type **notepad c:\autoexec.bat**, and click *OK*. Now add the following line to the last line of your autoexec.bat file: **c:\windows\regedit c:\windows\alphatiz.reg** (your path may differ). To change the order info on multiple menus, create a modified .reg file for each menu and create a line for each .reg file in autoexec.bat. Save the file; exit; and rest assured your menus will be a little cleaner each time you reboot.

THE SEVEN-MEGABYTE SOLUTION

YOU'VE ALWAYS suspected that Win 95 took up more disk space than it needed to, and you may be right. Launch Explorer, and navigate to the Help folder in the Windows folder. Choose *View•Arrange Icons•by Type*. Then scroll through the folder and look for video clip icons. Chances are you'll find 7MB of AVI files demonstrating such procedures as scrolling in a window. Take a look at these files to make sure you don't need them; then press **<Delete>** and enjoy a bit more breathing room.

PROTECT YOUR ACTIVE DESKTOP

IF YOU USE Internet Explorer as your browser and have the Active Desktop feature enabled, you may have noticed an unhappy connection: When your browser crashes, the Active Desktop often shuts down and Windows itself may freeze. To keep your browser from taking your desktop down with it when it crashes, try this: In IE, choose *View•Internet Options*. Click the *Advanced* tab and check *Browse in a new process* (see **FIGURE 2**). Click *OK*, exit, and restart IE. Besides reducing screen redraw distortions, this option lets you exit your browser the next time it crashes without having to restart Windows or log off and on.

Note: When IE runs in a separate process, it consumes more resources and may reduce overall performance. So try this setup for a few weeks, then decide which benefit you need more: quick crash recovery or improved performance.

BRING BACK MY RECYCLE BIN

NORTON UTILITIES may be the best-selling utilities package, but its diagnostic, recovery, and maintenance tools can be a little pre- ▶

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sumptuous. For instance, when you install Norton Utilities 3.0, your trusty Recycle Bin changes into the "Norton Protected Recycle Bin," and you lose the ability to view deleted files by double-clicking the bin icon; instead, the utility forces you to step through the Norton UnErase Wizard. To return your Recycle Bin to its normal behavior, right-click the *Norton Protected Recycle Bin* icon and choose *Properties*. Click the *Desktop Item* tab. In the 'Double-clicking item opens' section, select *Standard Recycle Bin*.

You can also customize the bin while you're at it. Use the Title box to type in a new name for the Recycle Bin. And if you want, make the desktop icon show whether the bin contains any files protected by the Norton Protection feature, which stores deleted files that would otherwise not appear in the Recycle Bin (these include files deleted from within an application or from a DOS box): Just check *Show Norton Protection status*. If this option is unavailable, you'll need to click the *Norton Protection* tab, check *Enable Protection*, click *Apply*, and then return to the *Desktop Item* tab.

WINDOWS SIZED TO ORDER

MOST OF MY Windows 95 applications "remember" the size and position they last occupied on my desktop. Other applications, however, such as Calculator and Cardfile (which I kept when I upgraded from Win 3.1), return to their default position when launched. Is there a way to get those programs to remember, or to change their default size and position?

Mark Wuggazer
Northville, Michigan

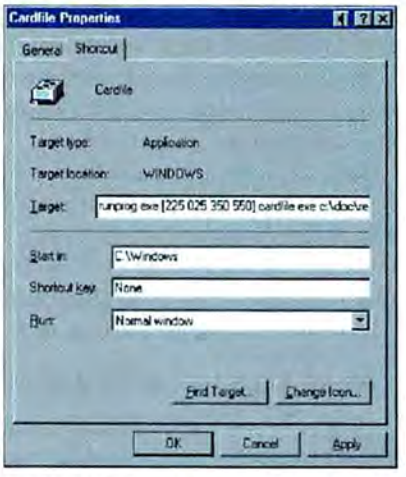

FIGURE 3: PICK THE start-up size of any app using RunProg and the proper coordinates.

MANY OLDER apps do not store their window size and position, and fewer still let you customize these attributes. Windows 9*x* provides partial control in this department: Right-click an application shortcut and choose *Properties*. Click the *Shortcut* tab and select *Normal window*, *Minimized*, or *Maximized*. Unfortunately, the Normal window option provides no control over window size and position, and the Maximized option does not apply to small-window applets like Calculator and Cardfile. Your best bet is to find an application that gives you the control you want. You could use a utility that stores the size and location of each window when it closes, but it would have to run all the time and would invariably hog system resources.

A better solution is to use a tiny application like RunProg, an old Windows 3.*x* utility that lets you specify the desired coordinates and dimensions of any window in a shortcut command line. As soon as it launches and positions your application, RunProg exits, freeing resources. RunProg can also open a file of your choice or set a program's default start-up directory (the directory you see when you first choose *File•Open*).

Here's how the routine works: Say your system uses a screen resolution of 800 by 600. You want Cardfile to open your recipe cards with the window about the size of one card but tall enough to see the titles of several cards. After adding RunProg to the folder of your choice, open Cardfile's shortcut Properties sheet, click the *Shortcut* tab, and enter something like **runprog.exe [225 025 350 550] cardfile.exe c:\doc\recipes.crd** in the Target box. Add complete paths for the .exe files if needed (see **FIGURE 3**).

The first two numbers in brackets are the horizontal and vertical pixel coordinates of Cardfile's upper left corner. So our example window starts 225 pixels from the left edge and 25 pixels from the top. The second two numbers define the width and height of the Cardfile window in pixels. Experiment with these numbers until you get the size and window position you want. RunProg comes with complete instructions in a text file. Although RunProg is no longer supported and is difficult to find, you can get a copy from PC World Online. It's a great little time-saver.

Find files from this article on PC World Online at www.fileworld.com/magazine, and find more tips at www.pcworld.com/heres_how. Windows Tips *pays $50 for published tips and questions. Scott Dunn is a contributing editor for* PC World *and a principal author of* The PC Bible, 2nd Edition *(Peachpit Press, 1995).* *See page 14 for contact information.* ■

WINDOWS TOOLBOX

A Stimulant for Your CD-ROM

AS USEFUL AS CD-ROM drives are, the sad fact is that they are dog slow. The average hard disk is ten times quicker at finding data than a CD-ROM drive is. A CD-ROM cache utility can help put some hustle into that sluggish optical drive by storing recently retrieved data on a fast hard disk or even in RAM. For a measly $29, CD-Quick Cache lets you designate a portion of RAM or any local hard disk as a cache to boost the speed of your CD-ROM drive. It's easy to install and use and includes a utility for before-and-after speed tests. CD-Quick Cache works in Windows 9*x* and requires a CD-ROM using a 32-bit driver. A trial version, cdq95.exe, is available from PC World Online or from its creators at Circuit Systems. • CD-Quick Cache; $29 download; Circuit Systems; ourworld.compuserve.com/homepages/circuitsys

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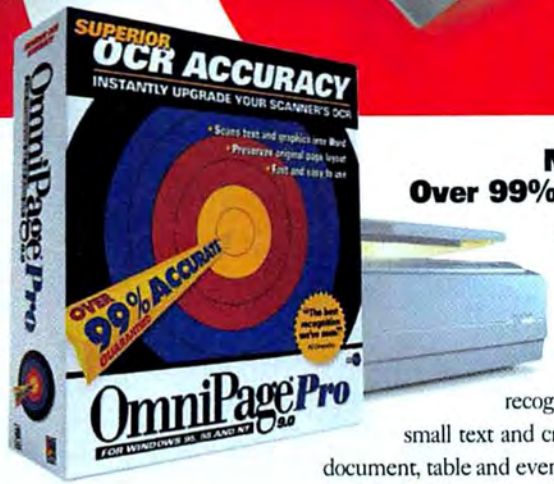

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Track Down Trouble With Event Viewer

YOU KNOW NT is stable. That's probably why you got it in the first place. But remember that this operating system isn't entirely crash-proof and may still trash your data. The difference between NT and its predecessors is that a crashed application won't bring your entire system down.

Fortunately, the Event Viewer and Task Manager applets can help you diagnose and troubleshoot after a crash. Event Viewer logs critical system activity, including application crashes, device hiccups, and OS updates. You launch it by selecting *Start•Programs•Administrative Tools•Event Viewer*. Once you're there, a window displays a series of events, each with a color-coded icon to its left identifying it by type—blue for information, yellow for warning, and red for error. To see detailed information about an event, double-click the listed item (see **FIGURE 1**).

Event Viewer tracks events that affect system security, application operation, and the OS or hardware. Click the *Log* menu item, and select from among *System*, *Security*, and *Application* to view the different reports. You may be able to spot interesting trends—a particular application or driver that frequently fails, for instance, or unexpected log-ons that may point to a security problem. To view events sorted by a criterion, select *View•Filter* and use the Filter dialog box to display events by time, type, category, or other criterion.

At its default settings, Event Viewer won't catch every problem your system encounters. If you worry about people trying to break into your PC, make some adjustments in the User Manager. Open this tool by selecting *Start•Programs•Administrative Tools•User Manager for Domains*. Choose *Policies•Audit*, and click the *Audit These Events* radio button (see **FIGURE 2**). Check the boxes next to the listed event types and then click *OK*.

POST-CRASH CLEANUP

A CRASHED PROGRAM may not take down your system, but its vestiges, which often linger in memory, can lock up memory and resources. Task Manager can help you tidy up the mess. Right-click the *Taskbar*, select *Task Manager*, and click the *Applications* tab. You'll see a list of apps—including the crippled one, which should be labeled 'Not responding'—in the Status field. Highlight the offending program and click *End Task*.

If you can't restart an app after a crash, launch *Task Manager* and click the *Processes* tab to see a list of currently running programs. If the crashed app is among those listed, select it and click *End Process* to close it. You may need to repeat these steps to end multiple processes of the same program.

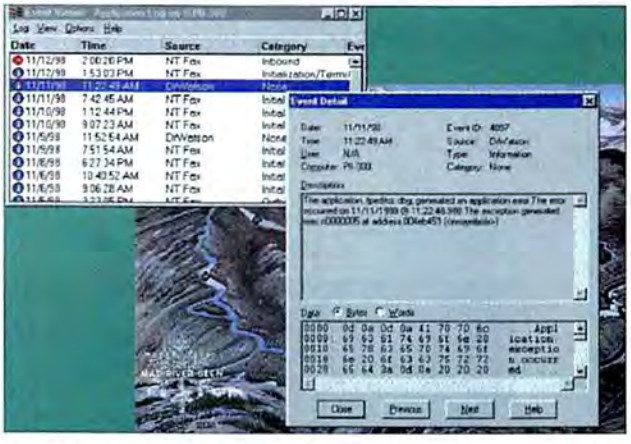

FIGURE 1: DOUBLE-CLICK an item in Event Viewer and get a detailed description that may help shed light on your system woes.

System Tray Utilities

ADD A COLLECTION of handy tools to your desktop and access them quickly through the System Tray. William Eckles' Tray Widget 98 is a shareware utility available on FileWorld (www.fileworld.com/magazine). You get instant access to your screen saver (for disabling during resource-intensive operations, for example), a command prompt window, and even a quick and dirty macro generator for automating common tasks. Tray Widget 98 works with Windows 9*x* or NT. Single-user registration costs a mere $10.

CREATE NEW SETUP DISKS

NT COMES WITH three setup disks that you must use to start the installation. But what if you have lost or damaged a disk and need to reinstall NT? Fortunately, you can create duplicate setup disks. Gather three formatted 1.44MB floppy disks and your NT CD. Put the CD into your CD-ROM drive, select *Start•Run*, and type **d:\i386\winnt32.exe /ox**, where *d:* is the correct letter for your CD-ROM drive. The file winnt32.exe is NT's setup program, and the /ox switch instructs this program to limit itself to creating new setup disks. To make these disks on a Windows 3.*x* or 9*x* system or on a DOS system, use the command line **d:\i386\winnt.exe /ox**.

FIGURE 2: WATCH OUT FOR security problems with the Audit Policy dialog box in User Manager.

Find files mentioned in this article on PC World Online's FileWorld at www.fileworld.com/magazine. We welcome tips and questions from readers and pay $50 for published items. Michael Desmond is a Vermont-based freelance writer. See page 14 for contact information. ■

ILLUSTRATION: JEFFREY PELO

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$2799 or $77/month for 48 mos. lease**
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9100LS
the powerful desktop replacement

- 14.1" XGA TFT Color Display
- Intel Pentium II Processor 333MHz with 512K Cache
- 64MB SDRAM (expandable to 384MB)
- 4MB SGRAM 3D Graphics Accelerator
- Combination DVD Drive/120MB SuperDisk™ Drive
- 6GB Ultra ATA Hard Drive
- Lithium Ion Battery
- Deluxe Leather Carrying Case
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YOUR QUESTIONS ON: PCI modems • **Downloading IE 4's Active Desktop**

Back Up Your Crucial Windows Files

JUST WHAT FILES should a Windows 9*x* user back up? The conventional answer—"all of them"—doesn't help if you're using Zip, SuperDisk, HiFD, SparQ, or CD-RW storage media; they're all too small to back up today's multigigabyte hard disks. But they can hold your most important files.

Key file protection is no substitute for full tape backup, of course. If your entire drive is trashed, you'll still have to jump through hoops to reinstall your operating system and applications (see *Hardware Tips*, page 269). The point is, armed with a carefully planned backup of your key files, you'll be able to restore your PC to its familiar basic contours and minimize downtime. And if you accidentally destroy a data or configuration file, you can easily reinstate it from the removable media.

ROUND UP YOUR FILES

THE HARDEST PART is finding your data files, since apps tend to strew them all over the drive. For example, most Office 97 apps put data in C:\My Documents, but Outlook prefers the Windows folder for your e-mail, contact info, and appointments. To make your job a little easier, I've provided a list of files and folders to back up for default installations of several popular programs (see **FIGURE 1**). Of course, if you've changed where they store their files, alter the list accordingly.

How do you figure out what files to back up and where to find them? With data, it's usually easy. Just head for the folder specified in the Save As dialog box. But since configuration files are spread all over, they are more elusive, even though Windows 9*x* has a central repository for them in the Registry. But not all apps—not even Microsoft's own—store their settings exclusively in the Registry. If you don't know where to look, try this: Open a program, change a lot of the settings, and exit. Then select *Start•Find•Files or Folders*. Click the *Date* tab, click *during the previous 1 day(s)*, and click *Find Now* (see **FIGURE 2**). Maximize the window so you can see the Modified column; when the search is done, click that column heading to bring the most recently modified files to the top of the list (after the folders). Among these files, you'll find one or more that contain configuration information for the application in question.

Now that you know what to back up, how should you go about it? If you've got a decent backup program (did one come with your removable-storage drive?), use it. As an example, here's how to use Iomega's One-Step Backup: From the ▶

ILLUSTRATION: JEFFREY PELO

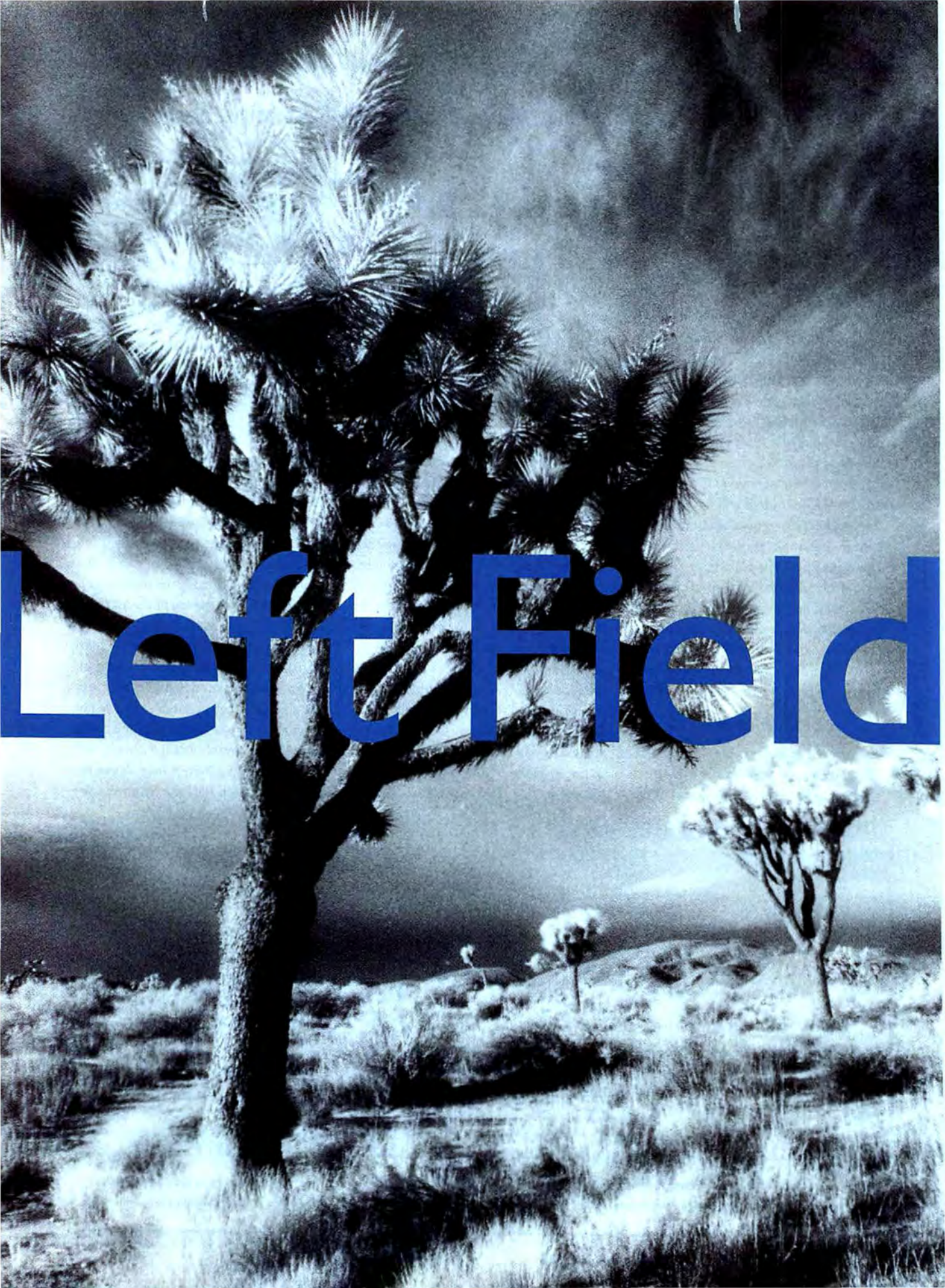
Other Ways to the Desktop

THE OCTOBER COLUMN offered a two-click trick to get to the desktop quickly. It still works, but Windows keyboard users can also hold down the <Windows> key and press M. If you have IE 4 or IE 5 with Active Desktop, you can use the Show Desktop button on the Quick Launch toolbar. If you don't have IE or Active Desktop, download QuickDesk from PC World Online's FileWorld (www.fileworld.com/magazine). This tool puts the desktop where you're most likely to look for it—on the <Alt>-<Tab> cycle of running programs.

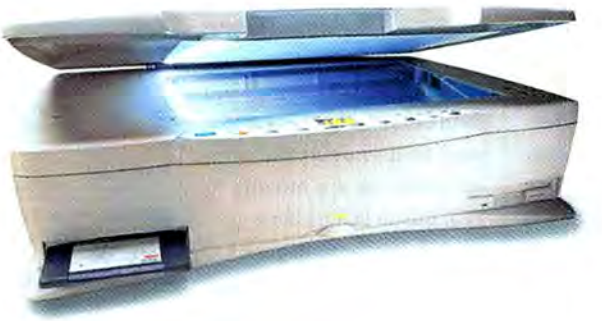
SAFETY SINE QUA NON: FILES AND FOLDERS YOU MUST COPY

PROGRAM	Folders and files	Notes
Internet Explorer 4.*x*	c:\windows\favorites, c:\windows\application data, c:\windows\web	If you're using IE 4.0, you may have files in 'c:\program files\outlookexpress\mail' and 'c:\program files\outlook express\news' that you need to back up.
Navigator	c:\program files\netscape\users*yourname*	Replace *yourname* with your actual name, the way it appears as a folder name under c:\program files\netscape. After restoring, create a user profile with the same name you used before.
Office 97	c:\my documents, c:\windows\user.acl, c:*.pst, c:\program files\microsoft office\templates, c:\program files\microsoft office*.dic, c:\windows*.xlb, c:\windows*.cag	It's best to back up .pst files across your drive because Outlook stores these files in different places, depending on what version(s) you're using now and have used in the past.
SmartSuite Millennium	c:\lotus\work, c:\lotus\smasters, c:\lotus\123\auto, c:\lotus\compnent\spell, c:\lotus\wordpro*.gls, c:\lotus\wordpro\scripts, c:\lotus\wordpro\menus, c:\lotus\123\icons, c:\lotus\approach\icons, c:\lotus\flg\icons, c:\lotus\organize\icons, c:\lotus\word	none
Windows 95	c:\windows\start menu, c:\windows\desktop, c:\windows\sendto, c:\windows*.ini, c:\windows*.inf, c:\autoexec.bat, c:\config.sys	You might also want to back up your wallpaper (c:\windows\something.bmp), sounds (c:\windows\media), and cursors (c:\windows\cursors).
Windows 98	Combine the files listed for Windows 95 and Internet Explorer 4.x.	none
Windows Registry	c:\windows\system.dat, c:\windows\user.dat, c:\windows\system.da0, c:\windows\user.da0	If you use backup software, these files are copied automatically. If you back up manually or with a batch file, copy these files into a separate folder.

FIGURE 1: IF YOU CAN'T COPY everything, at least protect your data and config files. Here are the essential files and folders to back up for various programs. This list assumes that you're running the default configuration of each program. Be sure to back up all subfolders within these folders.


Left Field

Way out yonder. Far, far away. Nowheresville. You can now scan and store images anywhere your heart desires with ImageDeck™—Microtek's new Stand-Alone Scanning Appliance™. All you need is a wall socket and something to scan. ImageDeck is a 36-bit, 600 x 600 dpi desktop scanning appliance that features a 100 MB Iomega Zip® Built-in™ drive, as well as a 3.5" floppy drive. Images can easily be transferred to a PC or a Mac. And if you attach your ImageDeck to a color printer, it doubles as a high-resolution color copier. So no matter where you go, there you are—scanning images and making color copies. For more, see us at www.imagedeck.com.



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MICROTEK
Better Images Through Innovation.
www.imagedeck.com

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PKZip 2.50 Command Line for Windows 95/NT
$29 direct price; PKWare; 414/354-8699;
www.pkware.com
PC WORLD INFONET NO. 706
WinZip 7.0 or 7.1
$29 registration fee; Nico Mak Computing;
www.winzip.com

opening screen, click *Customize* and the *File Selection* tab. Check off the files and folders you want to save. Unfortunately, One-Step won't let you select files by type—for instance, you can't specify *.ini. Instead, you have to sort the file display by type, then go to the Windows folder and manually click each 'Configuration file'.

Or you can copy the files directly, preferably with software that compresses them into .zip archives. This way, you can use any zip utility to restore the files. I've put two programs for automating .zip archiving onto PC World Online's FileWorld (www.fileworld.com\magazine). One requires PKZip Command Line for Windows 95/NT; the other, WinZip 7.*x* with its command line interpreter. At press time, WinZip's command line interpreter was in beta form. When the final version is available, it'll be either a free add-on to 7.0 or part of a free upgrade to 7.1. To set up one of my programs, download the one you want, unzip it, and run setup.bat.

BACK UP THE REGISTRY

YOU NEED TO back up four Registry files: user.dat, user.dao, system.dat, and system.dao. If you use a backup program, it'll copy them for you. If not, remember that these hidden files don't copy under all conditions. My programs first unhide them, then copy and rehide them.

Restoring them is also a pain—and restoring them while in Windows is either dangerous or impossible. My programs restore them to C:\Regback; you then boot up MS-DOS to copy them to C:\Windows.

FIGURE 2: SEEK CONFIGURATION files by changing an app's settings and using Find.

If, heaven forbid, you lose everything on your hard drive, you may not want to restore the precrash Registry. After all, reinstalling Windows and your apps creates a new, working Registry. True, your new Registry won't contain the customized configuration information stored in the old one. For instance, it won't know how to dial your ISP. But over time, the Registry collects a lot of garbage, too, much of which can cause system errors. I recommend that you occasionally wipe out your Windows installation and start from scratch. And what better time to do it than when you've just lost everything?

MODEMS: PCI VS. ISA

I'VE NOTICED PC manufacturers putting PCI-based modems in their systems. Do these have any advantages over standard ISA internal modems?

Victor Heimur
Rutherford, New Jersey

PCI IS REPLACING ISA, and soon new PCs won't have ISA slots. So it's no surprise internal modems are moving to PCI. But do PCI modems possess any real advantages?

Performance, PCI's most obvious benefit, is irrelevant here; the ISA bus has no trouble keeping up with modems. But that's not the only attraction. A PCI card doesn't need its own IRQ, and that means fewer hardware conflicts. PCI also is more versatile at energy management. Among other benefits, this allows the rest of the bus to sleep while the modem stays on to receive faxes.

The most nettlesome problem with PCI modems has nothing to do with PCI. As I write this, every PCI modem *PC World* has tested has been a controllerless modem, or WinModem. To keep costs down, these units use software to do much of the work that built-in chips handle in conventional modems. As a result, yet another driver gets loaded, further straining the CPU. In fact, in *PC World*'s most recent modem roundup, devices with controllers *consistently* outperformed those lacking them (see "V.90: The Last Great Standard?" January, www.pcworld.com/jan99).

Let's hope PCI modems with controllers arrive on the scene soon.

WHERE IS ACTIVE DESKTOP?

I DOWNLOADED and installed Internet Explorer 4.01 mainly because I wanted the Active Desktop, but it's nowhere to be found. How do I get it?

Lee Hook, Detroit

THE DOWNLOADABLE version of IE 4 doesn't come with Active Desktop, so you'll have to download and install it separately. To get it, enter www.microsoft.com/ie/ie40/download/rtw/x86/en/download/addon95.htm in the Address bar (see **FIGURE 3**), which will take you to a page that bears the peremptory instruction, "Please wait..." Obey. If nothing happens after a minute or so, close IE and try again. Eventually a dialog box will pop up and ask for permission to check your system. Click *Yes*. Next you'll see a list of IE components, together with their installation status. Check *Windows Desktop Update* and click *Next*. Wait until the next page has finished downloading; then select a download site and select *Install Now*.

FIGURE 3: ACTIVE DESKTOP doesn't come with the downloadable version of IE 4. You have to find it elsewhere on Microsoft's site.

Find files from this article at www.fileworld.com/magazine. We welcome questions and tips and pay $50 for published items. Humor columnist Lincoln Spector is a PC World contributing editor. *See page 14 for contact information.* ■

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The catch is "concurrency"

Vega Technologies™ introduces ***concurrency***, a revolutionary new technology that for $149 allows you to expand your existing Windows® 95/98 computer by adding our Buddy System™, an additional monitor, keyboard and mouse, creating two separate computers in your home or office. This second system can be as far as 50 feet away. It will access the internet, printer, hard disk, work with all your software on your main computer independently and without slowing down or impeding the use of the main computer.

The Buddy System™ includes an external module and an add-in card

Consider this:

ONE phone line, modem, printer, hard disc, one set of software applications, one computer but TWO USERS, operating independently. You can upgrade the main computer and get a faster PC with a bigger hard drive, a faster modem, a better printer, or more software—and let your second user enjoy the same benefits without paying twice.

Concurrency uses the incredible power of today's computers to distribute resources without impacting speed or creating user conflicts. Isn't it time to save money by not buying needless hardware and software, let alone the energy and time wasted in installing and configuring two PCs rather than one? We think it is.

Extremely easy to install, the total cost of this second PC is: the Buddy System™ ($149), and if you don't have one, a keyboard and mouse ($25) and a SVGA color monitor ($130) are all available from Vega.

VEGA technologies

For ordering and information:
Call 1.888.654.5415 or visit our website: www.vegatechnologies.com
Circle 248 on card or go to www.pcworld.com/infonet

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When a Browser Upgrade Goes Awry

THEORETICALLY, a software upgrade replaces an older version while maintaining your preferences and custom configurations. In reality, some upgrades turn on you and make your life miserable. Consider the following question:

I RECENTLY installed Communicator 4.5 and spent an entire weekend getting it to work. I followed the instructions on Netscape's site, but still my address book was cruelly disfigured: Entries got shuffled out of alphabetical order, and I kept getting 'illegal operation' errors. Later, I read on Netscape's tech support site, help.netscape.com (see FIGURE 1), that the best way to install 4.5 is first to save your Bookmarks and addresses and then to uninstall the old version, restart the system, and install 4.5. Belatedly, I discovered that the Readme file presented at the end of the installation also recommends uninstalling older versions first. Are there any general rules for installing browser upgrades that might save users similar aggravation?

Randall Carlson, via the Internet

THE BEST RULE for upgrading a browser is to check the Readme file first (few people do, though I'm sure you'll find little solace in that fact now). If you're running a version of Communicator prior to 4.5, it's a good idea to uninstall the old version before upgrading—in certain instances: if you're running CoolTalk Watchdog, or if you prefer that multiple uninstall lines for Communicator not appear in your Add/Remove Programs dialog box in the Control Panel. If you download Communicator and can't get it to work, the best solution is to uninstall it, along with any old versions you still have, restart your PC, and then reinstall the browser.

In general, it's a good idea to back up all Bookmarks, mail, and personal configuration files before attempting to install a new version of *any* browser. In Communicator, head to the c:\Program Files\Netscape\Users*yourname* directory, make a copy of the contents of your namesake subdirectory, and place it somewhere else on your drive as a backup of your address book (abook.nab), Bookmarks (bookmark.htm), and Mail and News folders, as well as of the prefs.js file that stores your personal configuration settings. You should also disable any virus checkers and close all running applications. To ensure that you're installing the new version onto a "clean" hard disk, run ScanDisk and Disk Defragmenter. To uninstall an older version, select *Start•Settings•Control Panel•Add/Remove Programs*, and then select *Netscape Communicator*. Restart your computer and delete any files still in the Communicator directories.

You risk disaster if you install a new version of Communicator in a new directory and then try to uninstall the old version. I've done this and ended up destroying both copies. If you intend to plant Communicator in a new folder, first uninstall the old version; create a new directory structure; and then copy your Bookmarks, address book files, and mail and news directories into the new folders. Then install the new version, and specify that new folder name in the Custom options of the Install wizard.

Importing an older address book into a new version of Communicator can be a dicey proposition, too. In theory, you simply head to *Communicator•Address Book•File•Import*, select *Communicator Address Book*, and navigate to the location of your old address book. If you still can't open the address book, close Communicator and open prefs.js in a text editor such as Notepad. If the file contains the following line, delete it: user_pref("ldap_1.directory1.isOffline", true). Resave the file.

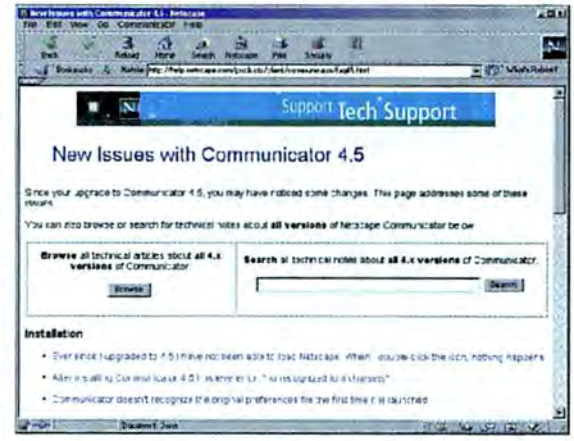


FIGURE 1: BROWSER UPGRADE HEADACHES? Consult Netscape's site for upgrade tips and news about gotchas.

ILLUSTRATIONS: JEFFREY PELO (TOP); HARRY CAMPBELL (BOTTOM)

Get Real Help on AOL

TECH SUPPORT for America Online is hard to find, unless you know whom to ask. Often, the most knowledgeable and helpful advice comes from users who hang out at the Members Helping Members forum. To get there, type members helping members in the keyword bar and click *Go*.

Once there, browse existing message threads related to your particular problem, or just post your question. Don't forget to revisit the forum periodically to check the replies to your post.

You may need to reinstall some of your plug-ins, but first try copying the existing plug-ins' DLL files from their old directory to the new one and then restarting Communicator. If the plug-ins still don't work, you'll have to reinstall them.

UPGRADING IE

SOME OF THE same rules apply to upgrading Internet Explorer. Before you start, run ScanDisk, defrag your drive, and shut down all running applications, particularly virus monitors. Consider performing a full system backup before installing any new IE versions, especially if you're using Active Desktop.

It's generally *not* a good idea to uninstall a previous version of IE, unless the installation wizard shoots back an error message saying it can't install over a prior version. You may run into that problem if you use apps that include IE—which these days means most Microsoft packages.

For more Internet Explorer troubleshooting tips, go to support.microsoft.com/support/tshoot/default.asp.

PRINT WEB PAGE FRAMES

I OFTEN HAVE problems printing Web pages with frames. How can I get the browser to print the portion of the page that I want to print?

Elliot Lax, Montreal, Quebec

IN NAVIGATOR 4.5, click the frame you want to print (be careful not to click any links), then move your pointer to the Print button on the toolbar. You'll notice that it now says 'Print the selected frame', so click it. If you're not sure whether the frame you're printing is the right one (the confusing design of some sites makes it hard to tell where one frame ends and another begins), right-click anywhere inside the frame and select *Open Frame in New Window* (see **FIGURE 2**). Then view the new page that opens and (if it's the right one) print it. In IE 5, click the frame in question, select *File•Print*, and click next to the option 'Only the selected frame'. As with Navigator, if you're not sure which frame you're selecting, right-click within that frame and select *Open Frame in New Window.*

FIGURE 2: BEFORE YOU PRINT a frame, see what you're getting into by opening it in a separate window.

E-MAIL BACKUPS

ALEXANDER KARRER, of Pembroke Pines, Florida, offers these tips for backing up e-mail files in several of the most popular packages:

Outlook Express: You'll find your mail stored in the directory c:\windows\profiles*yourname*\Application Data\Microsoft\Outlook Express\Mail. Each mailbox is stored in a file that carries an .mbx extension—for example, inbox.mbx. You need to back up all the .mbx files. Outlook stores your address book in a file called *yourname*.wab in the folder c:\windows\profiles*yourname*\Application Data\Microsoft\Address Book.

Netscape Messenger: Your mail is stored in the directory c:\program files\netscape\users*yourname*\mail, and your address book is a file called abook.nab in c:\programfiles\netscape\users*yourname*. Back up everything in the *yourname* folder because that's where Communicator stores all your stuff.

You might also consider moving this directory to a spot on your hard drive that's easier for you to locate when you're trying to run one of those quickie backups at 3 a.m. From Navigator's Edit menu, select *Preferences*. In version 4.0*x*, do the following: In the treelike display in the left pane, click the plus sign next to *Mail & Groups* to expand that "branch." Click *Messages* and then the *More Options* button. After 'Local mail directory', the name of the mail directory will appear. Change it to a location that's easier to find (such as c:\mail) by clicking *Choose* and then scrolling to the directory of your choice. Click *OK*. In version 4.5, find and click the *Copies and Folders* entry inside the Mail & Groups branch, and look for those locations in the right pane.

Eudora Light: Eudora stores Mailbox files in c:\eudora, in files with .toc and .mbx extensions. It stores folders in subdirectories with a .fol extension and attachments in the Attach subdirectory. To make things easy on yourself, back up the entire contents of Eudora's directory—including files and subdirectories.

Find files from this article at www.fileworld.com/magazine. We welcome questions and tips from readers and pay $50 for published items. Contributing Editor Judy Heim is coauthor of The Quilter's Computer Companion: Hundreds of Easy Ways to Turn the Cyber-Revolution Into Your Artistic Revolution *(No Starch Press, 1997).* *See page 14 for contact information.* ■

HOT DOWNLOAD

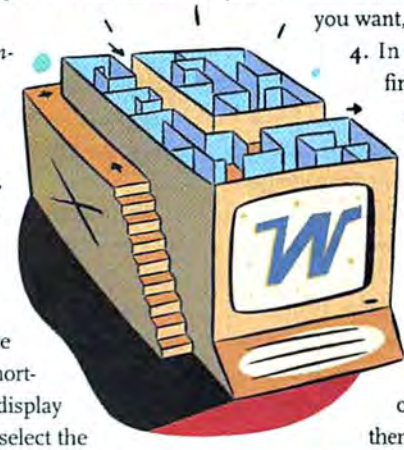
OneSeek's ActiveCaption

PUT HOT BUTTONS at the top of your browser window with ActiveCaption, a free add-on from OneSeek that's available from PC World Online's FileWorld. You may program the buttons with favorite URLs, or type keywords into the caption bar to search the Web. And ActiveCaption's Bookmark Manager is transportable between IE and Navigator. If you use both browsers, ActiveCaption will pop up at the top of both, and you can access your Bookmarks/Favorites with either browser. It works with versions 3.*x* or later of Navigator and IE.

Concoct your own menus ◆ Use Word's Style Gallery ◆ **Align numbered lists**

Customize Shortcut Menus in Word

WORD'S RIGHT-CLICK shortcut menus can save you gobs of time by instantly displaying often-used commands for a specific task. Still, many shortcut menus lack the exact commands you may need. For example, if you right-click a word in a document, the Thesaurus command doesn't pop up. You can add it, however, by using a method that isn't very well documented.



Word 97:

1. Select *Tools•Customize*; then click the *Toolbars* tab in the Customize dialog box.
2. In the Toolbars list, check the box beside *Shortcut Menus* to display the toolbar for Shortcut Menus.
3. Click the appropriate category within the Shortcut Menus toolbar to display a list of menus; then select the particular menu you want to modify.
4. In the Customize dialog box, click the *Commands* tab. Select the appropriate item from the Categories list. For example, the Thesaurus command is in the Tools category, corresponding to its location in Word's menus. Click the command you want to add to the menu; then drag and drop it onto the displayed shortcut menu. The new command will be on the displayed shortcut menu when you release the mouse button (see **FIGURE 1**). Click *Close*. **Note**: You can remove any command from the shortcut menu by dragging it off the menu and dropping it anywhere in the document window during this process.

Word 6 and 7:

1. Select *Tools•Customize*; then click the *Menus* tab in the Customize dialog box.
2. In the *Change What Menu* list, locate and choose the menu you want to customize.
3. You'll obtain a list of categories with names like 'File' and 'Format.' Select the category for the command you want to add. If you can't find the one you want, select *All Commands*.
4. In the Commands list, find and select the command that you want to add. If you want to place the command in a particular position on the shortcut menu, open the *Position on Menu* list and choose one of the first three position options. Click *Add* and then click *Close*. **Note:** To remove an item from the selected shortcut menu, select the command from the Position on Menu list, and then click *Remove*.

CLEAN UP E-MAIL TEXT

IT HAPPENS ALL the time: You paste text from an e-mail message or load a text file in Word, and you get funny line breaks. The problem is that Word inserts a hard return at the end of every line that you paste. (Click the paragraph mark icon on the main toolbar to see line breaks and other hidden characters.) Although selecting *Format•AutoFormat* in Word 97 may clean this up a bit, it may also add unwanted heading styles to formatted text. To translate those choppy e-mail messages into basic text (sans gratuitous formatting), I've created macros for Word 97 and for Word 6 and 7. Follow the steps provided to create the macro for your version of Word. Or download it from PC World's FileWorld if you don't feel like typing all this gobbledygook.

Word 97:

1. Select *Tools•Macro•Macros*.
2. Type **fixmail** in the 'Macro name' field of the Macros dialog box, and click *Create*.
3. In the macro editor, carefully type the macro text listed at the top of the following page, including all punctuation characters, between the 'Sub fixmail()' and 'End ▶

Word's Full Screen View

WORD'S Full Screen view *(View•Full Screen)* reduces clutter and leaves more room for text. To format text, select the text you want to change; right-click to launch the shortcut menus, or use a keyboard shortcut such as <Ctrl>-I for italics or <Ctrl>-B for boldface. To access Word's menus, hold down the <Alt> key and press the appropriate letter—<Alt>-F for the File menu, say, or <Alt>-E for the Edit menu. To restore the normal interface, press <Esc> in Word 6 or later, or click *Close* on the Full Screen toolbar in Word 7 and 97.

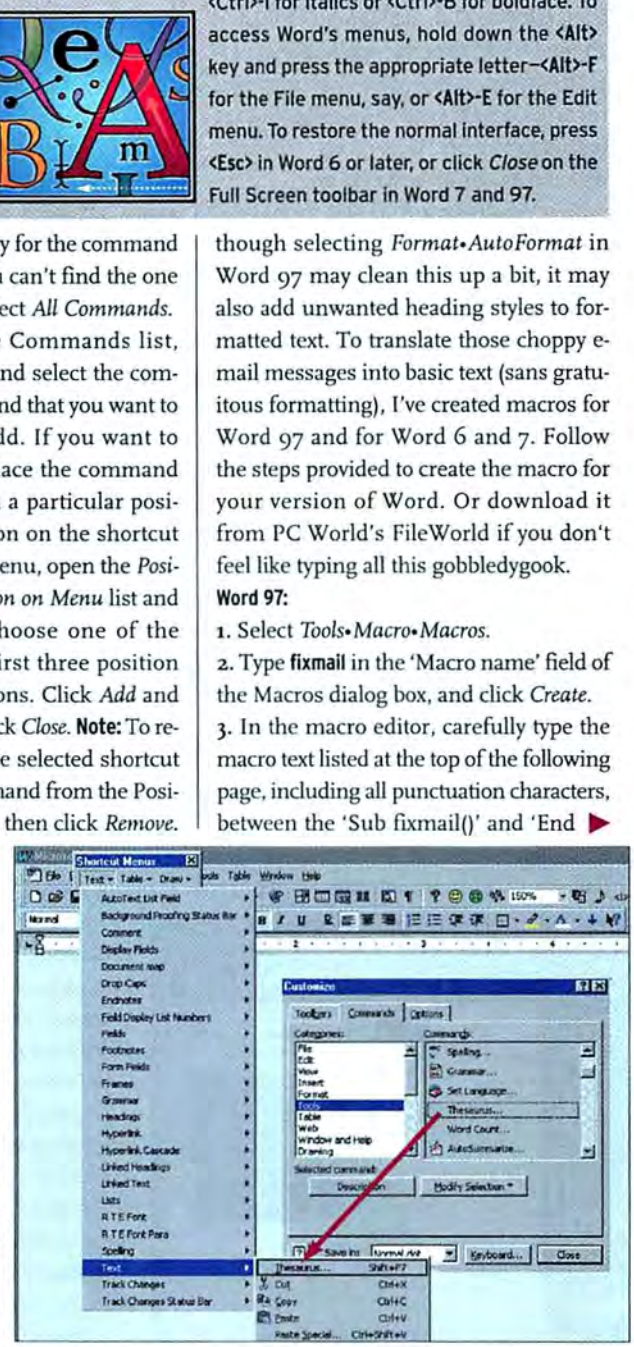


FIGURE 1: DO THE RIGHT CLICK by editing Word's context-sensitive shortcut menus to reflect your work habits and preferences.

ILLUSTRATION: JEFFREY PELO (TOP); HARRY CAMPBELL (BOTTOM)

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Card 102

```
Sub fixmail()
dowhat = wdFindStop
If Selection.Type = wdSelectionIP Then
 Selection.HomeKey Unit:=wdStory
 dowhat = wdFindContinue
End If
Selection.Find.ClearFormatting
Selection.Find.Replacement.ClearFormatting
With Selection.Find
 .Text = "^p"
 .Replacement.Text = "@@@"
 .Forward = True
 .Wrap = dowhat
End With
Selection.Find.Execute Replace:=wdReplaceAll
With Selection.Find
 .Text = "@@@@@@"
 .Replacement.Text = "^p^p"
 .Forward = True
 .Wrap = dowhat
End With
Selection.Find.Execute Replace:=wdReplaceAll
With Selection.Find
 .Text = "@@@"
 .Replacement.Text ="##"
 .Forward = True
 .Wrap = dowhat
End With
Selection.Find.Execute Replace:=wdReplaceAll
End Sub
```

Sub' lines. **Note:** Where the text reads '##', press the spacebar once. Do not type ##.

4. Select *File•Save Normal*, and then *File•Close* and *File•Return to Microsoft Word*.

Word 6 and 7:

1. Select *Tools•Macro*.
2. Type **fixmail** in the Macro Name field of the Macro dialog box, and click *Create*.
3. Carefully type the macro text below, including all punctuation characters, between the 'Sub MAIN' and 'End Sub' lines. **Note:** Type the lines beginning with 'EditReplace' and ending with '.Wrap = dowhat' fully, before pressing **<Enter>**. Where the text says '##', just press the spacebar once. Do not type ##.
4. Select *File•Close*, and click *Yes* when you are prompted to save the changes.

```
Sub MAIN
dowhat = 1
If SelType() = 2 Then
        dowhat = 0
End If
EditReplace .Find = "^p", .Replace = "@@@", .Direction = 0, .ReplaceAll, .Wrap = dowhat
EditReplace .Find = "@@@@@@", .Replace = "^p^p", .Direction = 0, .ReplaceAll, .Wrap = dowhat
EditReplace .Find = "@@@", .Replace ="##".Direction = 0, .ReplaceAll, .Wrap = dowhat
End Sub
```

With this macro, you can reformat an entire document or a highlighted section. Select *Tools•Macro•Macros* in Word 97, or *Tools•Macro* in Word 6 or 7; select *fixmail* from the Macro Name list and click *Run*.

Note: These macros work best on text made up of paragraphs separated by blank lines—the format used for most e-mail messages. If your text also includes sections of short lines in a list format, select only the parts of the text in normal format and run the macro for each selection.

STYLISH REFORMATS

TO PREVIEW THE EFFECTS of different styles on an existing Word document, you need Word's Style Gallery. Unlike simple text formatting, Style Gallery lets you preview the ways different formatting alternatives would make your letter, memo, or résumé look, based on Word's built-in templates. Here's how it works:

1. Open a document in Word, and select *Format•Style Gallery*.
2. Click the *Document* option button, and choose a template from those in the Template list. The preview window will show your document as it would appear if you adopted that template.
3. When you've found the style you like, click *OK* to apply that look to your document and return to the editing window.

Hint: You can use Style Gallery before creating a document, selecting the *Example* or *Style Samples* options to get an idea of what a document in that style looks like. Click *OK* to attach the desired template and create the document using that template's styles.

REALIGN NUMBERED LISTS

WHEN I USE the numbered list feature in Word, the numbers line up at the left. This looks wrong to me when the list exceeds nine items, since the 1 in the tens column of 10 aligns with the 9 in the ones column of the line above. Isn't there some way to right-align these numbers?

Nestor Mendiola, San Diego

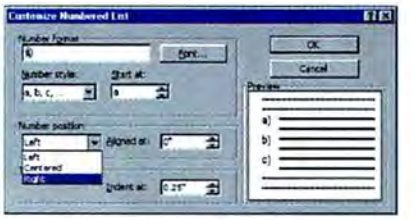

FIGURE 2: USE THIS (or a similar) dialog box to control alignment of Word's numbered lists.

A LOT OF PEOPLE share your irritation at Word's default number alignment style. Fortunately, there is a way to make the numbers line up in the manner you prefer, though it's by no means an obvious one. Here's what to do:

Word 97:

1. Before creating a numbered list or after selecting an existing numbered list, select *Format•Bullets and Numbering*.
2. If necessary, click the *Numbered* tab in the Bullets and Numbering dialog box, and select one of the numbering option samples featured in that dialog.
3. Click *Customize*.
4. Open the *Number position* list in the Customize Numbered List dialog box, and choose *Right* (see **FIGURE 2**).

Word 6 and 7:

1. Before creating a numbered list or after selecting an existing numbered list, select *Format•Bullets and Numbering*.
2. If necessary, click the *Numbered* tab in the Bullets and Numbering dialog box, and select one of the numbering option samples featured in that dialog.
3. Click *Modify*.
4. Open the *Alignment of List Text* list in the Number Position frame of the Modify Numbered List dialog box, and choose *Right* to align the numbers the way you want. Click *OK* to finish the job.

Find files mentioned in this article at www.fileworld.com/magazine. We welcome your questions and tips and pay $50 for published items. You can reach Contributing Editor George Campbell on his Web page at www.osomin.com, or see page 14 for contact information. ■

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waiting?"

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Price of Service Plan (Without ISP)	$19.99/Month	$34.99/Month	$109.99/Month
Hours of Service (Availability)	24 Hours a Day	24 Hours a Day	24 Hours a Day
On-Line Time (Hours of usage for Turbo Internet)	25 Hours /Month	100 Hours/Month	200 Hours/Month
Additional Hourly Rate (Including ISP) Additional Hourly Rate (Without ISP)	$1.99/Hour $.99/Hour	$1.99/Hour $.99/Hour	$1.99/Hour $.99/Hour
DirecPC Services			
Turbo Webcast: Broadcast delivery of popular Websites to your PC's hard drive	Included	Included	Included
Turbo Newscast: Broadcast delivery of up to 30,000 Usenet Newsgroups to your PC's hard drive	Included	Included	Included
Turbo Internet: Fully interactive access to the Internet at speeds up to 400Kbps	Included in Online Time	Included in Online Time	Included in Online Time
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Networking (Number of Seats)	N/A	N/A	4

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How to Duplicate Values in an Excel List

HOW OFTEN HAVE you seen an Excel worksheet like the one on the left-hand side of **FIGURE 1**, where a single entry in column A applies to several rows of data? Sort this list by name, and those blank cells make it impossible to tell who sold what in February and March.

When a list is small, you can enter the missing names manually. But if your database is huge, you need a better way of filling in those names. Here's how:

1. Select the range (A3:A14 in Figure 1).
2. Press **<F5>** to get the Go To dialog box.
3. In the Go To dialog box, click *Special*.
4. Select the *Blanks* option.
5. Type **=** followed by the address of the first cell with an entry in the column (=A3 in our example), and press **<Ctrl>-<Enter>**.
6. Reselect the range and choose *Edit•Copy*. Then select *Edit•Paste Special*, choose the *Values* option, and click *OK*.

SHARING SHORTCUTS

I'VE SET UP approximately 200 Excel AutoCorrect shortcuts that represent various products and services offered by my company. What's the best way to transfer these shortcuts to other systems so that my coworkers can use them?

Steve Edery, Gibraltar

AUTOCORRECT, which debuted in Excel 95, can correct common spelling errors on the fly. As many users of Excel have discovered, you can also assign "shorthand shortcuts" that expand to a longer sequence of characters. For example, you may define "awc" as an AutoCorrect shortcut for "Amalgamated Widget Corporation of America." When you type **awc** into a cell, Excel will then replace it with the associated text string. You define and manage your shortcuts by using the Tools•AutoCorrect command.

Excel and all other Microsoft Office applications store AutoCorrect shortcuts in a single *.acl file in your Windows folder (the exact file name will vary). So changes you make from Excel, say, will be available in Word. However, there's no tool for manually editing the binary *.acl file, and moving such a file from one system to another will invalidate your existing entries. The solution is to use a VBA macro to create the shortcuts.

Start Excel with a new workbook with one sheet, and then enter your shortcuts and their associated text into columns A and B, respectively. Enter as many as you like, beginning in row 1, and don't include any blank rows between the entries. (See **FIGURE 2** for an example of a worksheet containing AutoCorrect shortcuts.) Save and name this worksheet.

In Excel 97, select *Tools•Macro•Macros* to display the Macros dialog box. Type **CreateShortcuts** in the Macro Name field and click *Create*. Then enter the following macro into the VBA module, and press **<Alt>-<F11>** to return to Excel. (Note that in earlier versions of Excel, you have to select *Insert•Module* to insert a new VBA module sheet that will hold the code.)

```
Sub CreateShortcuts()
    ItemCount = Application. _
       CountA(Range("Sheet1!A:A"))
    For Row = 1 To ItemCount
       ShortText = Cells(Row, 1)
       LongText = Cells(Row, 2)
       Application.AutoCorrect. _
          AddReplacement ShortText, LongText
    Next Row
End Sub
```

Save the workbook and distribute it to your coworkers. To add the AutoCorrect shortcuts, open the workbook, select *Tool•Macro•Macros*, and then execute the CreateShortcuts macro. Be aware that existing shortcuts with the same name will be overwritten without warning.

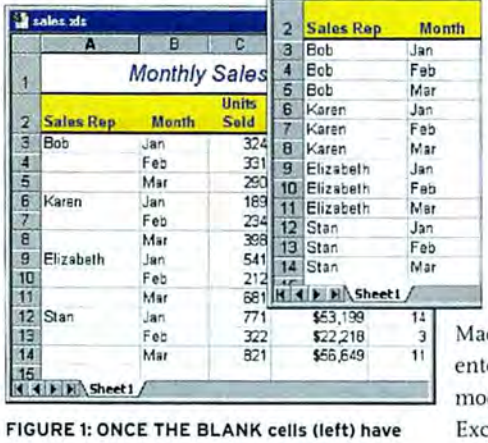


FIGURE 1: ONCE THE BLANK cells (left) have been filled in (right), the list can be sorted.

FIGURE 2: TO SHARE YOUR AutoCorrect entries with colleagues, first create a shortcut worksheet.

Spreadsheets *welcomes your questions and tips and pays $50 for published items. Contributing Editor John Walkenbach is author of the* Excel 2000 Bible. *Visit his Web site at www.j-walk.com.* *See page 14 for contact information.* ■

Copy Page Setup

EACH EXCEL SHEET has its own setup options (orientation, margins, headers and footers, and so on), which you set using the File•Page Setup command. But when you add a new sheet to a workbook, it contains the default page setup. Bibi Ali of Briarwood, New York, has come up with an easy way to transfer the settings: Activate the sheet that contains the desired setup info. Hold down **<Ctrl>** and click the sheet tabs of the additional sheets you want to update. Then select *File•Page Setup* and click *OK*.

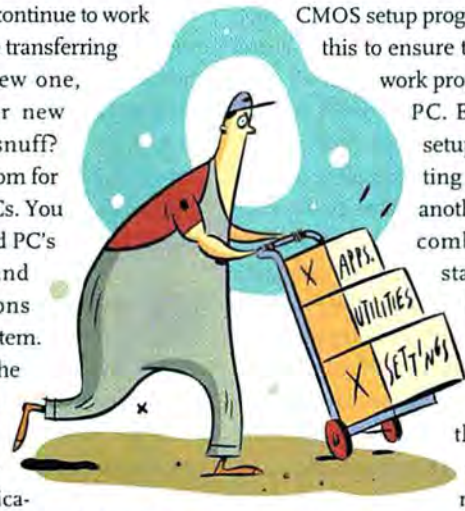
ILLUSTRATION: JEFFREY PELO

Old hard disks, new PCs ◆ Fun with drive mirroring ◆ **Partition tricks**

Migration Migraines and How to Avoid Them

MOVING FROM an old PC to a new one is a time-consuming chore. Sure, you can reinstall your word processor and spreadsheet in less than an hour—if you still have all your original disks. But making your new PC as useful as your old one means finding or downloading old shareware utilities, reentering countless application tweaks, and transferring a passel of passwords for Web sites, dial-up settings, and the like. Add the time spent resolving the inevitable hardware glitches and compatibility problems, and you're looking at hours or even days of downtime.

What if you could continue to work on your old PC while transferring your data to the new one, ensuring that your new hardware is up to snuff? So you don't have room for two space-hungry PCs. You can still copy your old PC's operating system and installed applications over to your new system. Then, with both of the OSes coexisting on the same hard disk, use a multiboot utility like V Communications' System Commander Deluxe ($50) or PowerQuest's PartitionMagic ($70) to choose, each time you boot, which OS you want to work with. The overall process has two steps: installing the old hard disk into the new PC, and configuring your old copy of Windows 95 or Windows 98 to work with the hardware on your new PC.



You'll need two utilities in addition to the multiboot program: one to adjust disk partitions, and one to move data from disk to disk. Several worthy programs perform one or both of these tasks. I recommend the $50 Partition Commander from V Communications. Products such as PartitionMagic, DriveImage ($70), and DriveCopy ($30), all from PowerQuest, also contain terrific sets of tools that can help you accomplish these tasks.

IN WITH THE OLD

INSTALLING AN IDE drive in your new PC isn't hard. First, get the hard disk setup information from your old PC's CMOS setup program—you'll need this to ensure that the drive will work properly in your new PC. Enter the CMOS setup program by hitting **<Delete>**, **<F1>**, or another indicated key combination during start-up. Go to the hard disk setup menu and write down the setup parameters for the disk. These should include numbers for Cylinders, Heads, and Sectors. Your new PC will likely detect these settings when you install the drive, but there's an outside chance you may have to enter this data manually. Also uninstall any antivirus software on the new PC, since it may be confused by your new settings and give you a bogus virus alert.

Now copy the setup directory from your old system's Windows CD-ROM to your hard disk. That way, if things go wrong with CD-ROM drivers on the new PC, you can still access setup files and update components. For Windows 95 it's the 34MB Win95 directory. For Window 98 it's the Win98 directory; you only need to copy the 105MB of files in the directory, not anything else within that folder. Also have your new PC's driver disks handy in case Windows asks for them.

Remove the old hard disk. Before unplugging the power cord or touching any components or wires, ground yourself by touching the metal frame of the case. Disconnect the drive's power cable and the flat IDE connector cable. Then look carefully at how the hard disk attaches to your computer. It's often easier to remove the entire drive bay assembly than it is to remove the drive itself.

Prepare for transplant. Most Pentium and later motherboards have two built-in EIDE connectors, one for the primary channel and one for the secondary. Each channel supports two hard drives or other devices. One device is designated the "master" and the other the "slave," distinguishing between the two devices installed on a single channel. The hard disk that came inside the new computer is almost certainly the master device on the primary channel. If you intend to attach the old drive to the primary channel—provided a CD-ROM or other drive isn't already installed there—you must set the jumpers on the outside of the old drive for slave operation. A diagram on the hard drive case should illustrate the proper jumper settings.

Install hard disk in new system. Now attach the hard disk and mount it inside the ▶

Put More Zip in Your Zip

IF YOU OFTEN save files onto removable drives, you can boost performance by enabling write-behind caching in Windows 98. Say you need to save changes to an existing file; Windows normally writes the file onto the removable disk. Write-behind caching lets it store outbound data in RAM and write it to the disk later. Select *Start•Settings• Control Panel*, open the *System* icon, and click the *Performance* tab. Click *File System• Removable Disk* and check *Enable write-behind caching on all removable disk drives.*

ILLUSTRATIONS: JEFFREY PELO (TOP); HARRY CAMPBELL (BOTTOM)

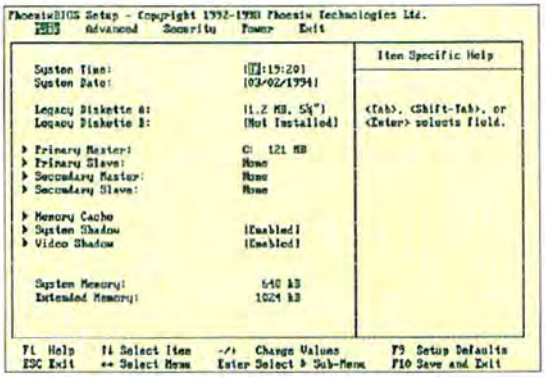


FIGURE 1: INSTALL YOUR hard disk in the CMOS setup program. Select the configuration that matches your system.

appropriate internal bay. Power up the system and reenter the CMOS setup program. Go to the EIDE hard disk autoinstall or autodetect menu, select the hard disk you just installed, and configure it.

The look of these menus varies depending on the BIOS manufacturer, but using them to do the configuration should not be difficult. Typically, autodetect looks for four drives—a master and a slave on both the primary and secondary channels. For the just-attached drive, toggle selections until you come to the proper channel designation, and select the drive. **FIGURE 1** shows a typical CMOS hard disk setup menu. When in doubt, check your system's documentation.

Next, prepare the new disk to accept data from the old. For this task, you must create a separate partition on your new hard disk so that it can hold the contents of the old drive. Your new drive probably has one big partition, usually C:. You need to shrink this partition, using a utility such as Partition Commander (see **FIGURE 2**), so that there is room for a second partition that will be dedicated to the contents of the old drive. After you have created this second partition, you can mirror the contents of the old drive over to the dedicated partition of the new drive by using a disk copy utility such as DriveCopy 2.0.

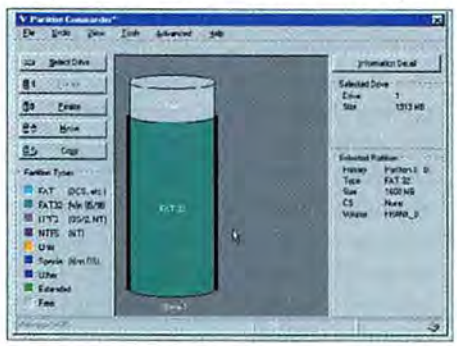


FIGURE 2: PARTITION COMMANDER'S graphic interface makes changing hard disk partitions easy.

OLD WINDOWS IN A NEW HOME

NEXT, INSTALL System Commander. A multiboot menu will then let you select from your installed operating system choices when you boot the new PC.

Now comes the tricky part. The Windows setup you moved onto that new partition is configured for your old system's motherboard, BIOS, and components. The first time you boot to Windows 98 in the new system, Windows will start reconfiguring itself. Windows 98 is very good at this; Window 95 is less so.

Once Windows completes its first boot, check Device Manager (select *Control Panel•System*) and make sure all your hardware is working. If a device is missing from the list or a yellow circle appears next to a device name, that piece of hardware is not properly installed. In this case, try rebooting again once or twice. If the trouble persists, run Windows' setup program; it will perform a complete reinstallation while keeping your installed programs intact. And if that tactic doesn't work, manually install the driver for the device in question with the Add/Remove hardware wizard in Control Panel.

TWO SHORTCUTS

IF YOU ARE LUCKY enough to have large compatible removable storage drives—such as Jaz drives—on both your new and your old systems, you can simply use the removable media to transfer data. If all your data won't fit on a single removable disk, you'll need the compression and disk-spanning capabilities of a disk-imaging program like DriveImage. This utility creates compressed images of the hard disk—at about half the original size—that can be copied to one of your removable drives and then restored on another machine. DriveImage provides sufficient partitioning ability to set up your target drive.

Finally, if you have the space, you can run both of your systems side by side. Shell out about $50 for cables and another $20 for a data switch box, and you'll be able to run your two PCs using a single keyboard, mouse, and monitor.

KEEP YOUR MONITOR AWAKE

I'VE JUST PURCHASED a new Pentium II-400 PC running Windows 98, and the monitor keeps going to sleep after about 5 minutes of nonuse. I called the shop where I purchased the system, and they walked me through the process of disabling the power savings mode in the BIOS setup. That didn't help. The monitor still goes blank. Should I return my new system?

Howard Oldroad, Miami

DON'T. If your motherboard supports the Advanced Power Management specification, Windows 98 can control power settings for different components in your system even when power management has been disabled in CMOS. Select *Start•Settings•Control Panel•Power Management* and review the settings that appear in the Power Schemes sheet. In the *Turn off monitor* drop-down list, select *Never* to disable monitor shutoff.

For other hardware tips, see www.pcworld.com/heres_how. Kirk Steers is a PC World *contributing editor.* Hardware Tips *welcomes your tips and questions and pays $50 for published items. See page 14 for contact information.* ■

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Install a Faster Processor

IF YOUR once-screaming computer seems to be showing you more of that hourglass cursor, perhaps it's time for a CPU transplant, one of the easiest and most beneficial do-it-yourself PC projects. But first consider whether a CPU upgrade is worth the money and effort. Contrary to what you might think, doubling your computer's CPU speed won't necessarily double its performance. Other system bottlenecks, such as slow hard drives, leisurely graphics cards, and small amounts of RAM, aren't eliminated when you get a faster processor. A new CPU in an old system often yields no more than a 25 percent difference in performance, though your mileage may vary depending on the relative improvement in clock speed and the degree to which you upgrade other components. Our rule of thumb: A gain of less than, say, 100 MHz in processing speed generally doesn't repay the investment.

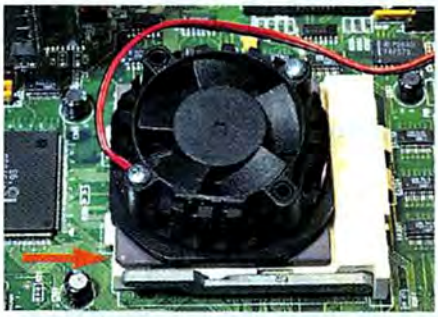
You also need to consider the cost of the upgrade. If the total upgrade (including more RAM, a new hard disk, and so on)

UPGRADING A PENTIUM-BASED PC

1 Remove the old CPU. After you've done a complete backup, turn off your PC (but leave it plugged into a grounded outlet), remove the cover, and find the CPU. Usually, it's easy to locate, but you may have to unplug some cables or remove add-in cards to access it. If so, first note where everything is connected.

If your old CPU has a heat sink held on top by a spring clip, you may need a small screwdriver to remove the clip. If your CPU has a fan, disconnect the fan's power cable.

Very important: Before you remove the CPU, observe the corner that has a small diagonal cut indicating pin 1 (photo) and the



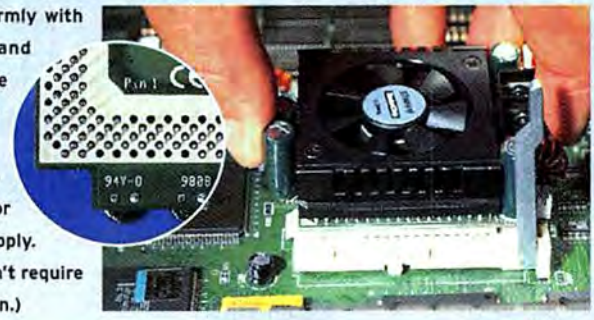
corresponding pinhole 1 in the socket. Take careful note of the cut's position relative to the rest of the motherboard. You'll need to know where pin 1 goes when you put in the new CPU. (Hint: Use masking tape to mark the pin 1 location on the motherboard.)

The vast majority of computers made over the past three to five years have ZIF (Zero Insertion Force) CPU sockets. Touch a metal part of your PC's case to ground yourself, and with your other hand lift the lever that releases the CPU and carefully pull the chip straight out of the socket.

2 Install the new CPU. Remove it from its protective packaging and carefully insert it into the socket (photo). Don't force it; it should drop right in. Make absolutely sure that you have pin 1 of the CPU aligned with pinhole 1 (inset) of the socket. If it's not clearly marked on the new CPU, double-check the installation manual that accompanied the new chip. If you didn't mark pin 1 on the motherboard in step 1, check your system or motherboard manual. (If you don't plug in the CPU correctly, it's likely to be destroyed as soon as you turn on the power.)

Hold down the CPU firmly with your finger or thumb and carefully push down the ZIF lever to lock the CPU into the socket.

Connect the CPU fan to a free power connector from your PC's power supply. (Some CPU upgrades don't require separate power for the fan.)



3 Set the motherboard jumpers. To get the maximum performance out of your CPU upgrade, you must ensure that your motherboard's bus speed is set to 66 MHz and that its clock multiplier is set to the maximum value (usually 3.5X). Check the manual that came with your CPU upgrade for details on how to do this.

Some motherboards come with the required setting clearly marked, but most don't. Check the motherboard manual to make sure you're setting the right jumpers (photo). Setting jumpers incorrectly can result in a (temporarily) dead PC.

Some newer motherboards don't have jumpers. In this case, the PC should automatically detect the speed of the new processor and reset itself accordingly.

Some older motherboards (three to five years old) won't allow you to set the clock multiplier as high as the new CPU requires. In this situation the new CPU will still work, but not at its maximum speed.

Don't put the PC's cover back on until you're sure the system is working. Turn on your PC. If nothing happens, double-check that you've inserted the new chip correctly. If it still won't work, call the upgrade maker's tech support. If your PC does start up, run your applications to make sure everything is working correctly.

PHOTOGRAPHS: KEVIN CANDLAND

costs more than 60 to 75 percent of a new system of comparable speed, you're probably better off donating your old system and purchasing an entirely new one. You can upgrade a 486-33 or 486-66 CPU to a 486-120 or 486-133 CPU for about $100, rev up the speed of a Pentium-75 or P-90 to 200 MHz for $100 to $150, and boost a Pentium-133 to 233 MHz for about $200.

Intel no longer manufactures its own OverDrive chips for standard Pentiums, but several companies do make plug-and-play upgrade kits. These producers include Evergreen (www.evertech.com), Kingston (www.kingston.com), and Trinity Works (www.trinityworks.com).

If you're not in a hurry, here's something to look forward to: Evergreen recently announced a radical new upgrade product—due out in the first quarter of this year—that puts the processor on a PCI add-in card. The company claims that this card will upgrade virtually any system (even a 486) by using Intel's Celeron and Advanced Micro Devices' K6-2 chips to achieve speeds beyond 400 MHz.

If your current PC has an early, "slower" Pentium II CPU, you can replace it with a faster version such as the Pentium II-333. But figure on paying a steep $450 to $475 for that chip. (Note: You can't upgrade an older PII PC to a 350-, 400-, or 450-MHz machine without installing a new motherboard.)

If your system uses a Pentium Pro chip, you can replace the CPU with an Intel OverDrive for Pentium II, boosting processing speed to 300 or 333 MHz. But at $549, this upgrade may not make economic sense for many systems.

Don't be tempted to purchase in the so-called "gray market" (through unauthorized resellers) an Intel, AMD, or Cyrix CPU. Even if you find a reliable source, these bare chips are difficult to install, and a wrong setting could destroy them instantly. Instead, opt for a complete plug-and-play upgrade package.

One final caveat: If your computer is more than about three years old, it may need a BIOS upgrade to handle a new CPU. Before you buy, check an upgrade chip maker's Web site for a list of compatible systems. Alternatively, some upgrade chips come with utilities that check your system for compatibility before you attempt the installation. All companies offer a money-back guarantee if the upgrade doesn't work.

Here's how to upgrade your processor.

Stan Miastkowski is a PC World *contributing editor.* ■

UPGRADING A PENTIUM II-BASED PC

1 Remove the old Pentium II CPU. After doing a backup, turn off your PC (but leave it plugged into a grounded outlet) and remove the cover. If your existing PII cartridge has a built-in fan, remove its power connector from the motherboard, noting where it connects.

If your PII uses a large heat sink instead of a fan, the heat sink may be held to the motherboard by a pair of screws. Remove them carefully. Other PII-based PCs may use different schemes, such as a bar that holds down the PII assembly. If in doubt, check your system or motherboard manual.

A tiny lever on the top of each side of the PII cartridge (photo) unlocks it from the frame that holds it in. Press both levers in with your fingers until the levers click into their open positions. Then, grasping the CPU cartridge firmly, carefully rock it from side to side until it starts to loosen. Gently pull the cartridge upward from the frame.

2 Install the new Pentium II. Remove the new processor from its protective packaging and carefully slide the cartridge into the frame, making sure the fan is on the correct side. Press it firmly into its socket until the levers on each side click into the frame. Make sure the new CPU is seated securely. It shouldn't wobble.

Connect the fan power connector to the motherboard.

3 Set the speed. Most Pentium II motherboards have jumpers (photo) that must be set to match the speed of the new PII. If the appropriate jumper positions aren't marked clearly on the motherboard, check the manual that came with your PC for the charts and diagrams that indicate the correct positions.

Some PII motherboards don't have jumpers. In certain instances, you need to enter your PC's system setup utility (procedures vary) to alter the speed. In others, the manufacturer has provided a utility on floppy disk for CPU setup. Again, check your PC manual for the proper procedure.

Don't put the PC's cover back on until you're confident that everything is working properly. If your PC won't start, turn off the power switch, make sure the PII cartridge is firmly seated, and try again. If it still doesn't work, verify that the jumpers or other settings are correct. If all else fails, try Intel's tech support. (You'll find the information in the CPU's box.)

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400 Celeron 64MB 6.4GB 10/100	1269.23
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400/PII 32MB 6.4GB	1360.22
400/PII 64MB 6.4GB 24X 10/100	1693.55
400/PII 64MB 4.3GB 24X 10/100	1998.75
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333 Celeron 32MB 6.4GB 32X 10/100	1258.64
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350/PII 64MB 4.3GB 24X 10/100	1898.45
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Cyrix 333 MMX 32MB 4GB 32X 56K	596.00
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350/PII 128MB 10GB 32X 10Mbps 32X	1296.00
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IBM

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333 Celeron 32MB 3.2GB	899.75
350/PII 64 3.2GB NT	1119.80
350/PII 32MB 3.2GB	1015.99
400/PII 64MB 6.4GB NT	1249.05
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3500 300/PII 64MB 6.4GB 13.3" AM	3597.36
3500 300/PII 64MB 6.4GB 13.3" AM NT	3697.12
6500 300/PII 64MB 6.4GB 14.1" AM 24X	4087.35
6500 300/PII 64MB 6.4GB 14.1" AM 24X WNT	4167.28
7400 300/PII 64MB 6.4GB 13.3" AM 24X	4067.97
7800 266/PII 64MB 5GB 13.3" AM 20X	3497.44
7800 266/PII 64MB 5GB 13.3" AM NT	3697.12
7800 266/PII 64MB 5GB 13.3" AM 33.6K	3697.12
7800 266/PII 64MB 8GB 14.1" AM 20X	3997.56
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7800 300/PII 64MB 8GB 14.1" AM 33.6K	4267.23
7800 266/PII 64MB 8GB 14.1" AM DVD	4657.31
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600 233/PII 32MB 3.2GB 24X 12.1" AM	2047.37
600 300/PII 64MB 5.1GB 24X 13.3" AM	3188.68
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1010CXNT 300/PII 64MB 4GB DVD 13.3"	2679.59
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AM = active-matrix display; DS = dual-scan display

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PC MAGAZINE EDITORS' CHOICE 11/3/98

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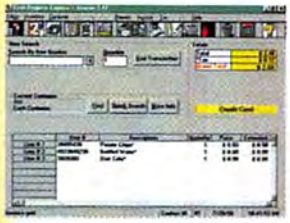

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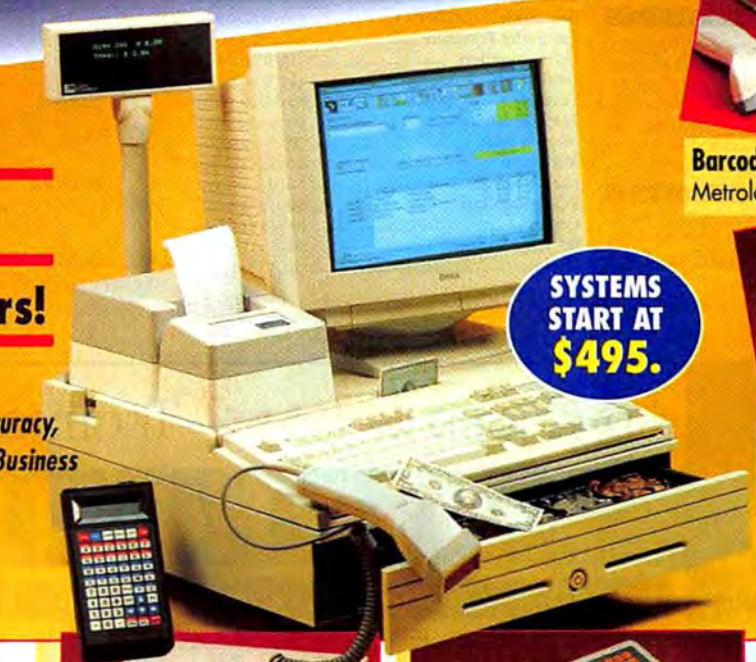

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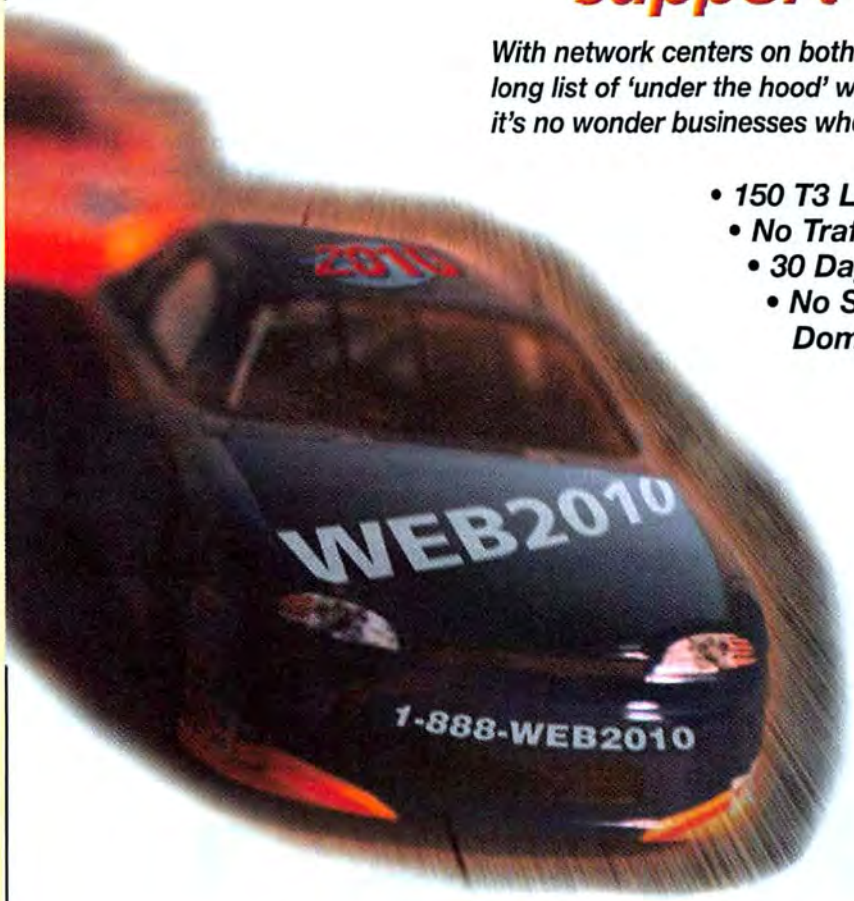

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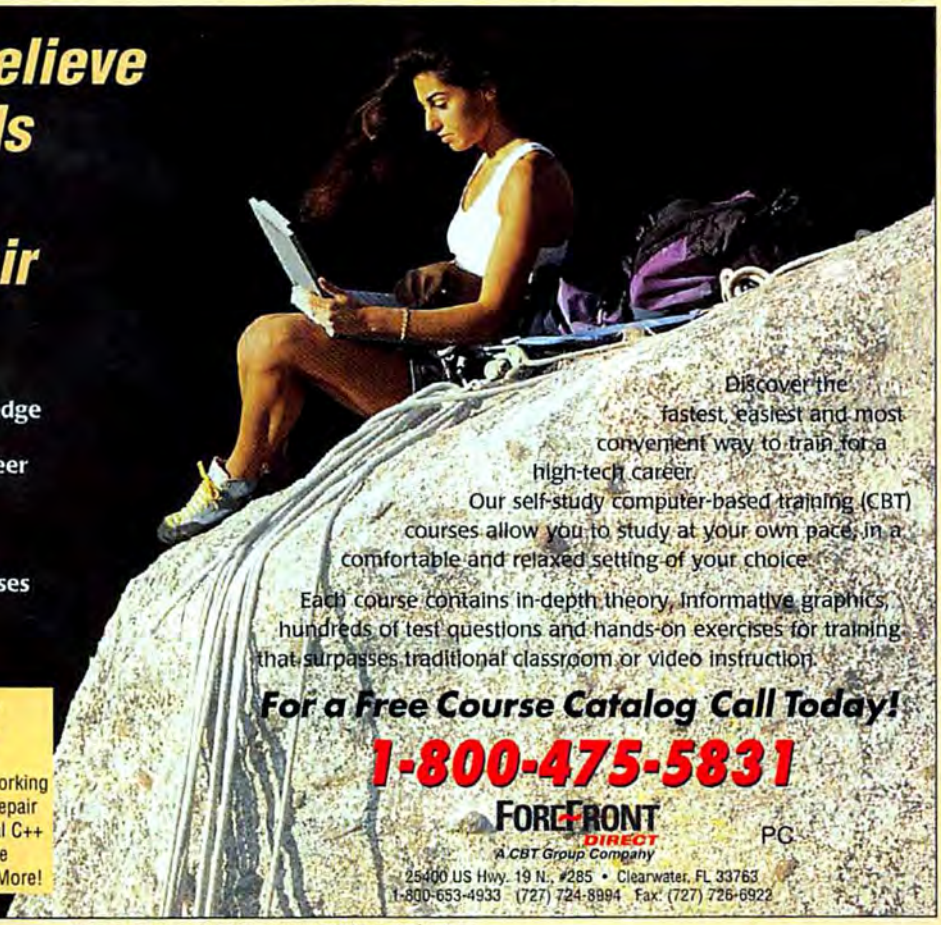

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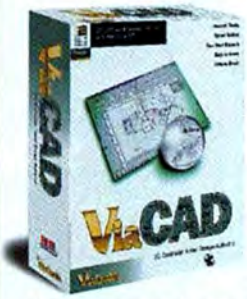

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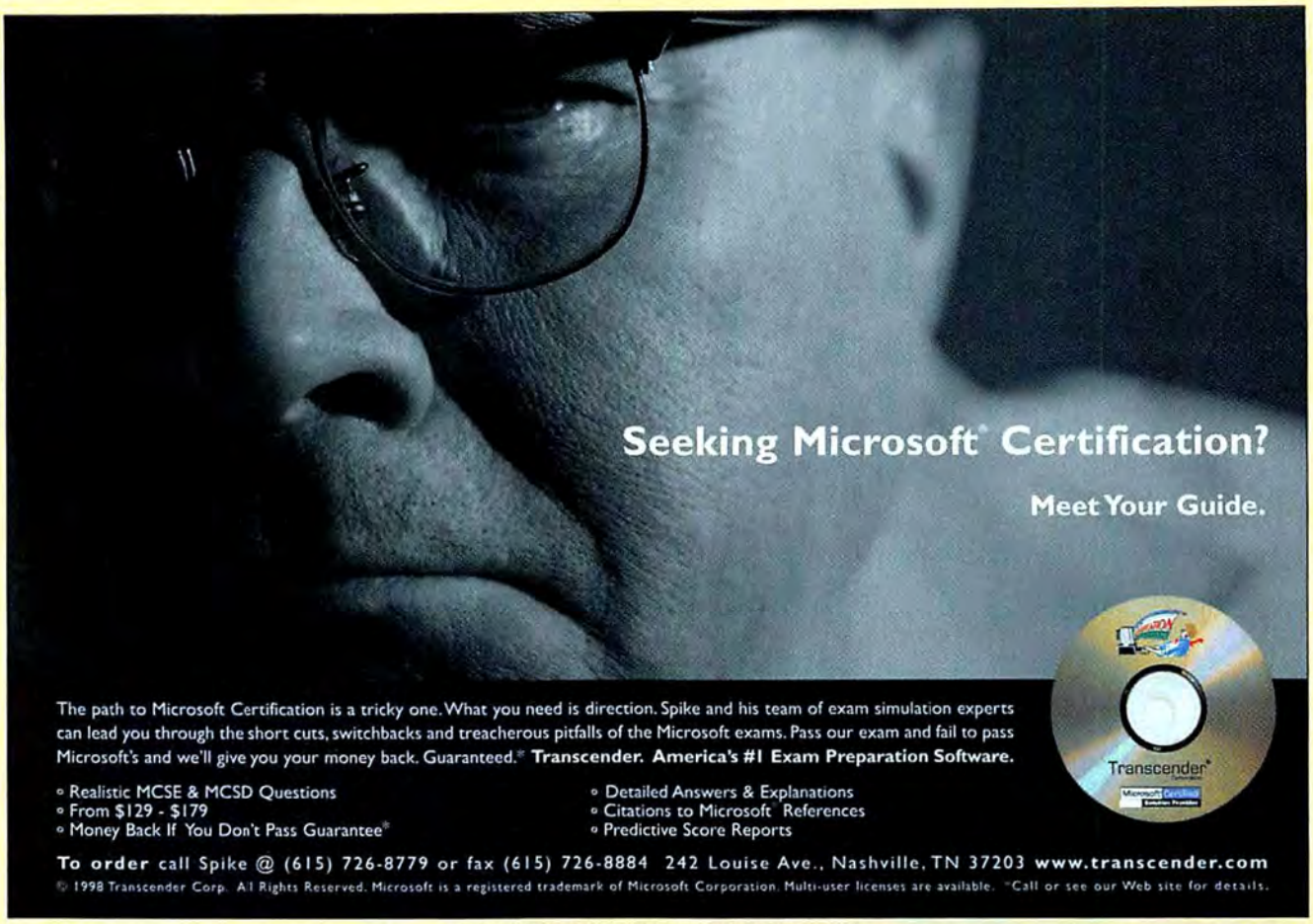

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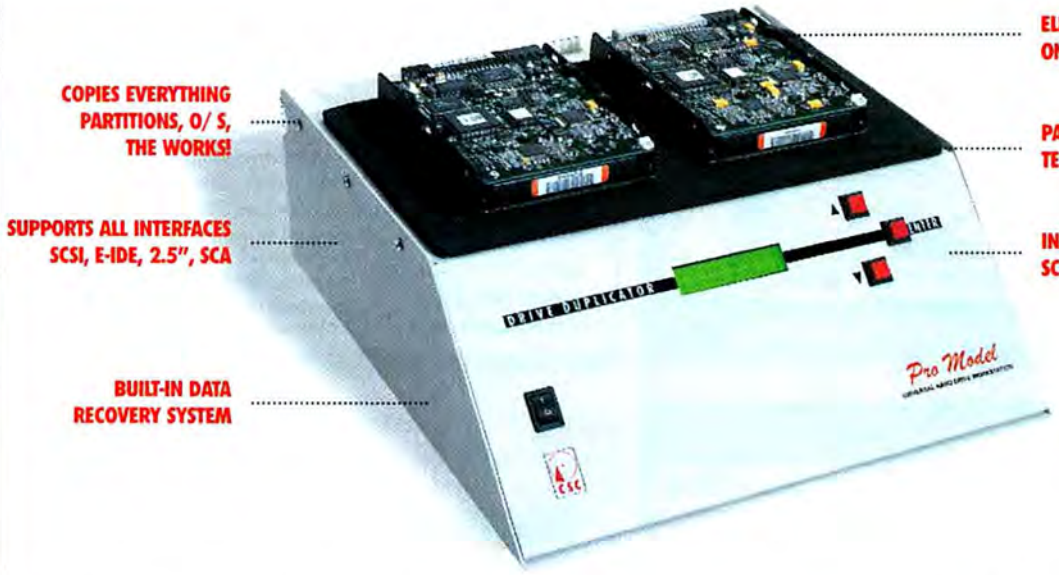

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- Diagnostic Indicators • Large Ferrite Filters
- Triple Shielding (Unique Design)
- Double Gold 20u" Plated Connectors
- Extra Heavy 26 Gauge Wire • 100 Styles in Stock

From: $39

Teflon® 90 Ohm External Cables

Benefits :
- Ultra SCSI 40 MB/s operation
- Fixes Ultra SCSI Cable Problems

Features :
- Perfect 90 Ohm Impedance Match
- Triple Pronged Connector With Gold contacts

From: $159

Active 2-1 SCSI Switch / Repeater

Benefits :
- Up to 14 Devices to 1 Computer
- Share Devices Between 2 Computers

Features :
- 2-1 Active Digital Switch/Repeater
- Regenerates SCSI Signal for Long Runs

$599

Gold .8mm Ultra SCSI Cables

Benefits :
- Faster Performance
- Test Cable Integrity
- No Loss Of Important Data

Features :
- New .8mm Ultra SCSI Connector
- Triple Shielding (Unique Design)
- Double Gold 20u" Plated Connectors
- Diagnostic Indicators • Large Ferrite Filters

From: $109

Gold Diagnostic Adapters

Styles : Gender Changers
- Both 50 pin and 68 pin (all combinations)

Gender Changer

Drive Bus Changer (run 68 pin on 50 pin bus)

Styles : 68 pin Drive to 50 Bus
- 68 Pin Drive to 50 Pin IDC (runs wide drive as narrow)

$49

Styles : 68 Pin Adapter Wide to 50 Pin Narrow
- 68 Pin External Adapter to 50 Pin (converts Host Adapter)

68 Pin to 50 Pin Centronics or 50 Pin MicroD Adapters

Styles : For Adaptec Ultra Wide Cards
- Adapters with partial termination built in for 68 to 50 converters (converts Host Adapter)

Gender Changer

68 Pin Male to Male or 25 Pin Female to Female

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Styles : Custom Adapters and Connectors that match most needs. If we don't have it we can make it.

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$39

Styles : Converts the 68 pin connector on a 68 pin cable to a 50 IDC female connector so that a 50 pin drive can be used on the 68 cable.

Styles : Converts the 80 pin SCA type drives to be used with either 50 or 68 pin SCSI Buses. Three models available.

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Drive Bracket Kits- 3.5" to 5.25"

From: $10

We carry a variety of Brackets that allow you to mount a 3.5" drive into a 5.25" bay. They include all screw and hardware necessary. Face panels are also available. Also see our Bay Cooler Fan and Bracket Kits.

Hot Swap Powered Terminator

$69

Now you can safely remove any SCSI device from a SCSI chain by simply clicking a switch. The Hot Swap Powered Terminator also has an optional Power Supply so that it can supply termination power to portable setups or when termination power is not being supplied.

Ultra 2 (LVD) Wide Terminator

This is the ultimate terminator on the market. It offers both Ultra 2 (LVD) operation and standard Ultra Wide or Fast Wide operation, all in one unit. Automatically senses which type of bus you are using and configures itself to that bus.

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Converts an 80 pin SCA LVD (Ultra 2) drive into a standard 68 pin LVD. Has a Power Connector and SCSI ID.

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- Ultra SCSI Custom Teflon Cable Available
- Custom Enclosures in 1 Day for Raid & Arrays

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- Slide Out (400lbs rated) Rails

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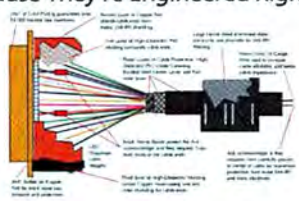

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This is the fastest SCSI available! Twice as fast as Ultra 1 SCSI and without any of its limitations. If you want true horsepower this is the Ultra SCSI system to buy. Completely backwards compatible with Ultra 1 SCSI, Fast SCSI, and SCSI 1& 2! The key to this new SCSI Standard is the use of Low Voltage Differential Technology. Also known as (LVD) and Ultra 2 SCSI, we can now achieve speeds that far exceed even the fastest computers data thruput capabilities.

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Now you can take all your SCSI devices and run them any distance you want, (up to 75 feet) while sharing the Ultra 2 SCSI bus. This revolutionary Repeater / Converter will give you, not only long cable distance, but also complete compatibility with the new Ultra 2 standard. There is no need to have two SCSI Adapters taking up precious PCI slots. Two models are available, the internal model that mounts into your enclosure, Raid/Array case, and the external that can be used anywhere.

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Benefits :
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- Silver Wire Improves Signal Quality

Features :
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- Triple Pronged Connector - Gold contacts Silver Wire

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68 Pin Replacement Cable for External Drive Cases

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68 Pin Internal Cables, custom or stock, from 1 to 15 SCSI devices per cable . We can also make Custom 68 pin and 50 pin Combination Cables that allow you to use narrow drives on a wide cable.

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From: $99

Benefits :
- Models for all SCSI types
- Fixes SCSI Cable Problems
- Doubles Cable Length (up to 18')

PS Included

Features :
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- Ultra Fast Performance for Added Capabilities
- Diagnostic Capabilities • 30u" Gold Contacts

Internal Repeater

If you integrate SCSI Raids or Arrays and are having problems making it work, the Granite SCSI Repeater will make it work. Designed to fit inside any computer or external case. These repeaters will double the cable length of any scsi bus allowing you to achieve the needed distance to make your system operate. Up to 2 repeater can be used per channel.

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- **50** pin Centronics
- **68** pin MicroD

From: $29

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Features :
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- Triple Pronged Connector - Gold contacts Silver Wire

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68 Pin Internal Cable

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SIZE	SDRAM x64	SDRAM x72 ECC	SDRAM PC-100	SDRAM PC-100 ECC	CAS LATENCY 2 PC-100	CAS LATENCY 2 PC-100
8Meg	—	—	—	—	64 Bit	72 Bit ECC
16Meg	35	35	39	44	Non-Reg./	Non-Reg./
32Meg	55	68	59	69	Registered	Registered
64Meg	109	119	119	134	119 / 137	135 / 149
128Meg	204	229	229	249	229 / 275	258 / 289
256Meg	549	599	669	699	— / 568	— / 699

INDUSTRY STANDARD DIMMS

	16Mg	32Mg	64Mg	128Mg	256Mg
Unbuffered					
3.3V ECC, EDO	49	69	129	239	559
3.3V EDO	35	78	119	199	—
Buffered					
3.3V ECC, EDO	49	79	129	249	519

72 PIN SIMMS (FPM, EDO)

	60NS	70NS	80NS
1 x 32 4 mg	10	10	10
2 x 32 8 mg	19	19	19
4 x 32 16 mg	49	49	–
8 x 32 32 mg	89	89	–
16 x 32 64 mg	159	159	–
1 x 32 4 mg EDO	10	10	–
2 x 32 8 mg EDO	17	17	–
4 x 32 16 mg EDO	45	45	–
8 x 32 32 mg EDO	89	89	–
16x32 64 mg EDO	119	119	–

	60NS	70NS	80NS
256 x 36	–	14	14
512 x 36	–	3	–
256 x 32	–	3	–
512 x 32	–	4	–
1 x 36 4 mg	14	14	14
2 x 36 8 mg	29	29	29
4 x 36 16 mg	59	59	–
8 x 36 32 mg	98	98	–
16 x 36 64 mg	175	175	–

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Pentium II, BX Chipset, PC-100 109.00

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	60NS	70NS	80NS
1Meg x 3 (3 chip)	4.00	4.00	4.00
1Meg x 9 (9 chip)	4.00	4.00	4.00
4Meg x 3 (3 chip)	17.00	17.00	–
4Meg x 9 (9 chip)	19.00	19.00	19.00
16Meg x 9 (9 chip)	74.00	74.00	–

CPU CHIPS

NTEL		Pentium II 233/MMX 139	Pentium 75/90/100 39/49/49
Pentium II Xeon	3949	Pro 200 256K/512K 395/595	486 DX2-66/DX4/100 25/45
Pentium II 400/450 MHZ	299/379	Pro 150/180 99/129	Celeron 333/300A 125/119
Pentium II 350 MHZ	279	Pentium 233/MMX 109	Celeron 300/266 99/98
Pentium II 333 MHZ	279	Pentium 200/200 MMX 295/98	AMD
Pentium II 300 MHZ	279	Pentium 166/166MMX 89/79	K6-2-400/-350MHZ 339/159
Pentium II 266B MHz	234	Pentium 133/150 59/79	K6-2-333-300-266Mhz 129/109/89

DELL MEMORY

Dimension XPS D233, D266, D300, D333 (SDRAM)	32/64/128Meg 59/99/199
Dimension XPS D233, D266, D300, D333 (ECC)	32/64/128Meg 83/119/229
Dimension XPS 1335, 1660, 2005, P133V, P200V (SDRAM)	16/32Meg 32/59
Dimension XPS R253, R400, R450 (PC-100)	64/128Meg 119/229
Dimension XPS V333, V333C, V350 (PC-100)	32/64/128Meg 119/229
Dimension XPS M166A, M200A, M200S (SDRAM)	16/32Meg 32/59
Dimension XPS Pent II H233, H266 (EDO pairs)	8/16/32Meg 19/36/79
Dimension XPS P100C, 120C, 133C, 166C (EDO pairs	4/8/16/32Meg 11/19/36/79
Dimension XPS P60, P75, P90, P100 (FPM pairs)	4/8/16/32Meg 10/19/39/79
Optiplex GM, GMT P75, P90, P100, P120, P133, P166 (EDO pairs)	4/8/16/32Meg 11/19/36/79
Optiplex GNT, N Series (EDO Dimm)	32/64/128Meg 49/99/199
Optiplex GX Pro 180, 200 (SDRAM)	32/64/128Meg 59/99/199
Optiplex GXi (EDO ECC)	32/64/128Meg 84/119/229
Optiplex GXi (ECC P/100)	32/64/128Meg 59/119/224
Optiplex GN/GNT 166, 200, 233 (EDO Dimm)	32/64/128Meg 49/99/199
Optiplex XL, XM, XMT (FPM pairs)	8/16/32Meg 19/44/79
PowerEdge 2100, 2200, 4100, 4200 (EDO, ECC)	32/64/128/256Meg 84/119/229/529
PowerEdge 6L, SP, SP2 (FPM pairs)	8/16/32Meg 25/49/98

IBM APTIVA, PC

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Aptiva 2137, 2142, 2142 (SDRAM)	16/32/64/128Meg	39/59/109/209
Aptiva M, M 500, 700 Series	4/8/16/32Meg	6/19/49/89
Aptiva C, S,L Series (EDO pairs)	4/8/16/32Meg	6/19/49/89
Intellistation Models E88, E89	32/64/128/256Meg	84/139/279/549
Netfinity		Please Call
PC 300 XPM/PC330 EDO	4/8/16/32Meg	6/19/49/89
PC 300 DL (SDRAM) / PC 330 PL	16/32/128/256Meg	39/89/109/229/519
PC 330 Model 6577 (EDO pairs)	4/8/16/32Meg	6/19/49/89
PC 350 Models 6581-6585	4/8/16/32Meg	6/19/49/89
PC 350 Model 6586 (pairs)	4/8/16/32Meg	6/19/49/89
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PC 750 Model 6887 (EDO, pairs)	4/8/16/32Meg	6/19/49/89
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Thinkpad 340, 345, 355, C, CS	4/8/16Meg	44/54/79	119/—
Thinkpad 360C, DE, DSE, P, PE	4/8/16Meg	44/54/79	105/—
Thinkpad 360X, 365XD	8/16/32Meg	29/44/79	105/—
Thinkpad 380, 380D, 380E, 385ED, 385XD	16/32/64Meg	49/79/139	119/238
Thinkpad 560, 560E, 560X	8/16/32/64Meg	29/49/79/139	241/—
Thinkpad 600, 770, ED (SDRAM)	16/32/64/128Meg	39/79/139/539	
Thinkpad 700, 730, CL/S75X	4/8/16/32Meg	54/79/90/199	140/175
Thinkpad 701, 701C, 701CS	4/8/16/32Meg	18/29/49/89	119/—
Thinkpad 755C,CE,CD,CS,CSN,CSE,CV	4/8/16Meg	44/54/79	140/271
Thinkpad 760C, CD, L, LD	8/16/32Meg	29/49/99	140/271
Thinkpad 760E, ED, ELD	8/16/32Meg	29/44/79	140/271
Thinkpad 760XD, 780XD	8/16/32Meg	29/44/79	140/271
Thinkpad 765D, 765L	8/16/32/64Meg	29/44/79/139	140/271

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G5-166, 200 Prof. System – SDRAM	16/32/64Meg	29/69/109
G5-166M, 200M MMedia System – SDRAM	16/32/64Meg	29/69/109
G6-200 Prof. System – SDRAM	16/32Meg	29/59
G6-Prof. M MMedia System – EDO	4/8/16/32Meg	6/19/45/89
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Canon LBP 430	–	9	–	–	–	14	–	39	59	99
Canon LBP 860, 1260	–	–	–	–	–	14	–	39	59	99
Epson Action Laser 1100, 1500	–	–	–	–	–	14	–	39	59	–
Epson Action Laser II	–	59	–	89	–	–	119	–	–	–
Epson 8000, 1800, 4000, 4100, 4300	–	59	–	89	–	–	119	–	–	–
Epson 1000, 1500, 5300, 5200	–	–	59	–	–	60	–	–	–	–
HP 5, 5D	–	29	–	–	–	79	–	–	–	–
HP 5 SI, SP, 5Px	–	–	54	–	–	79	–	–	–	–
HP 4, 4M, 4Si, 4SiMX	–	9	–	–	–	19	–	39	–	–
HP 4L	–	–	–	–	–	–	–	–	–	–
HP 4MP, 5P	–	29	–	–	–	19	–	–	–	–
HP 4+, 4M+, 4L, 4ML	–	–	–	–	–	19	29	–	59	99
HP 5, 5M, 5MP, 5N, 5P, 5Si, 5MX	–	9	14	–	–	19	29	–	59	99
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IBM Laser 4029, 4029	–	–	–	–	–	49	–	–	–	–
IBM Laser 4039, 4079	–	–	–	–	–	29	–	–	–	–
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Lexmark Optra Laser 300 600	–	29	–	39	–	49	–	–	–	–
Lexmark Optra Plus 200, 400, 600	–	29	–	39	–	49	–	–	–	–
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NEC 95, 97	–	–	59	–	–	–	–	–	–	–
Oki 400, 400E, 410E, 413EX	–	–	59	–	105	119	–	–	–	–
Oki 810E	–	75	79	–	–	69	–	89	99	149
Oki 5000	–	–	–	–	–	–	97	–	119	–
Oki 5100	–	233	279	87	–	–	97	–	119	–
Panasonic 4420/4450	–	–	59	–	–	99	–	–	–	–
Panasonic 4413/4430	–	–	59	–	–	99	–	–	–	–
Panasonic 4400	–	49	69	–	–	99	–	–	–	–
Panasonic 4400/5400	–	49	69	–	–	99	–	–	–	–
Panasonic 4440, 5410	–	69	–	–	–	99	–	–	–	–
Panasonic 6500	–	14	14	–	–	49	–	–	–	–
Sharp 9400, 9450, 9600, 9700E	–	49	59	–	–	99	–	–	–	–
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Deskpro 2000, 4000, 6000 Series (EDO, pairs)	4/8/16/32Meg	6/19/49/89
Deskpro 2000, 4000, MMX	16/32/64/128Meg	29/49/99/199
Deskpro 6000	16/32/64/128Meg	34/59/109/229
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Deskpro XL 6150, 6200 (ECC, pairs)	8/16/32/64/128Meg	Call
Presario 510, 520, 524, 660, 720, 724, 860	4/8/16/32Meg	6/19/49/89
Presario 920, 924, 954, 974, 978, 992	4/8/16/32Meg	6/19/49/89
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Presario 4112, 4122, 4150, 4402 (EDO pairs)	4/8/16/32Meg	6/19/49/89
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Presario 4704, 4706, 4710, 4712, 4714, 4716 (EDO pairs)	4/8/16/32Meg	6/19/49/89
Presario 4764, 4770, 4784, 4786 (SDRAM)	16/32Meg	34/69
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Prolinea 575, 590, 5100, 5120, 5133 (pairs)	4/8/16/32Meg	6/19/49/89
Prolinea 5120, 5120, 5133, 5150, 5166 (EDO pairs)	4/8/16/32Meg	6/19/49/89
Prolinea 5150, 5150, 5166, 5200MX (pairs)	4/8/16/32Meg	6/19/49/89
Prolinea 590MX, 5120MX (pairs)	8/16/32Meg	14/29/59/98
Prolinea 6150E, 6180E (pairs)	8/16/32Meg	29/49/99
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Prosignia 500 5/90, 5/120, 5/150 (pairs)	4/8/16/32Meg	14/29/59/98

COMPAQ NOTEBOOK/LAPTOP MEMORY

MODEL	AMT. UPGRADED	MEMORY PRICE	BATTERY Nimh/Li-on
Armada 1100, 1110, 1120T, 1120, 1125	8/16/32/64Meg	24/44/79/139	194/—
Armada 1136, 1130T	8/16/32/64Meg	24/44/79/139	194/—
Armada AA 1500 Series	8/16/32/64Meg	24/44/79/139	139/229
Armada 1500, 1520, 1540C	16/32/64/128Meg	39/79/149/319	—/219
Armada 4100, 4120, 4120T, 4125D (Kit)	8/16/32/64/128Meg Kit	29/49/99/139/279	—/219
Armada 4130T, 4131T, 4150, 4150T (Kit)	8/16/32/64/128Meg Kit	29/49/99/139/279	
Armada 4210T, 4230T Solo Series (pairs)	8/16/32/64/128Meg	29/49/99/139/279	
Armada 6500	32/64/128Meg	79/139/519	
Armada 7300, 7330, 7360, 7360, 7362, 7372, 7380, 7800	16/32/64Meg	44/79/139	—/221
Armada 7730 Series	16/32/64Meg	44/79/139	—/229
Armada 58 Series 5200, 5231, 5233, 5256	16/32/64Meg	44/79/139	
Armada 58 Series 6233/127	16/32/64/128Meg	39/79/149/519	
Contura 4/25, 4/25C, 4/25CX	4/8/16Meg	34/44/79	119/—
Contura 400C, 400CX, 410C, 410CX	4/8/16Meg	5/44/74	104/—
Contura 420C, 425CD, 430C, 430CX	4/8/16/24Meg	31/44/74/89	104/—
LTE 5000, 5100, 5200, 5300, 5400 (Kit)	8/16/32/64Meg Kit	3/10/49/119/229	138/258
Presario 1000, 1010, 1020, 1030, 1072, 1080	8/16/32Meg	19/54/109	119/217
Presario AP 1230, 1602, 1800 Series	16/32/64Meg	29/74/139	112/236

TOSHIBA NOTEBOOK MEMORY

MODEL	AMT. UPGRADED	MEMORY PRICE	BATTERY Nimh/Li-on
Libretto 50CT, 70CT, 100CT	8/16/32Meg	39/59/89	—/161
Tecra 500CDT, CS, 510CDS, CDT, 520CDT, 530CDT	8/16/32/48/64/128Meg	22/44/79/119/139/289	231/239
Tecra 540, 550, 550CDT	8/16/32/64/128Meg	22/44/79/139/289	259/—
Tecra 700CS, 700CT (SDRAM)	16/32/64/128Meg	39/59/149	279/259
Tecra 710CDT, 720CDT, 730CDT, 730CSDT, 740CDT	8/16/32/64/128Meg	39/49/89/149/289	279/258
Tecra 750CDT, CDM, DVD, 780 Series	8/16/32/64Meg	22/44/79/129	
Tecra 8000 Series	32/64/128Meg	79/149/539	
72100 Series	4/8/16/24Meg	4/29/49/79	104/—
7100S, 7450S, 7460C, 7470S, 7490S All Models	4/8/16/32Meg	33/49/69/119	104/—
7440C, 7450C, 7460C	16Meg	59	
Satellite 1130CS, 1135CS, 1110CS, 1110CT, 1115CS	8/16/32Meg	29/56/89	104/—
Satellite 2000CDS, 2050DS, 2120CS, CT Series	8/16/32Meg	29/56/89	104/—
Satellite 2200CDS, 2250DS, 2300CX	8/16/32/48/64/128Meg	24/44/79/119/139/289	196/258
Satellite 310, 320, 310, 315, 320, 325, 330, 335 Series	8/16/32/64/128Meg	22/44/79/119/289	196/258
Satellite 2595CDS	16/32/64Meg	44/94/149	
Satellite 4000 Series	32/64/128Meg	79/149/539	
Satellite 400, 405, 410, 415, 420, 425, 430, 435 Series	8/16/32/64Meg	29/56/89	
Satellite Pro 440CDT, 440CDX, 445, 460CDT	8/16/32/48/64/128Meg	24/44/79/119/289	196/258
Satellite Pro 465, 470, 480	8/16/32/48/64/128Meg	24/44/79/119/289	196/258
Satellite Pro 490	16/32/64/128Meg	44/79/139/289	
Portege 610CT, 620CT	8/16/32Meg	39/59/99	
Portege 650CT, 660CT	16/32/64Meg	59/69/149	—/218
Portege 7000, 7010	64/128Meg	149/539	

PC CARDS (PCMCIA) Version 2.0

DIGITAL CAMERA & STORAGE CARDS

ATA FLASH	8/16/32/48/64/96/128/160/224Meg	69/94/159/209/259/359/476/595/799	
ATA Compact Flash	8/16/24/32/48Meg	55/79/99/139/199	
S-Ram Cards	1/2/4/8Meg	79/139/259/Call	
Smart Media	2/4/8/16Meg	25/29/39/99	
Compact Flash Adapter	15	Smart Medial Adapter	65

DATA/FAX MODEMS

56.6/14.4	89.00	56.6/14.4 & Ethernet	169.00

PC CARDS

Ethernet Combo (10 BT & 10 B2)	59.00
Kingmax 100 Base-TX	109.00
Kingmax 10/Mbps	129.00
Kingmax Video Conference	299.00
Calluna Tech Type III Hard Drive, 260 Meg	399.00
Calluna Tech Type III Hard Drive, 520 Meg	499.00
PCMCIA Card Reader (Internal)	119.00
PCMCIA Card Reader (External)	119.00
CD Rom Kit (Cards, Drive, Cables) 20X	299.00
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NOTEBOOK, LAPTOP MEMORY

MODEL	AMT. UPGRADED	MEMORY PRICE	BATTERY Nimh/Li-on
ACER Extensa 336/367/366/368	16/32/64Meg	49/89/149	
ACER Extensa 390, 391, 392, 393, 394, 395	16/32/64Meg	49/89/149	
ACERNote 763, 765, 782, 784, 786	4/8/16Meg	19/29/49	
ACERNote Light 356, 358, 358 SE, 361 (pairs) edo	4/8/16/32Meg	19/29/49/89	147/—
ACERNote Extensa 371, 972, 372, 372, 373, 374	8/16/32Meg	29/49/79	
ACERNote Pro 950, 954, 955, 957, 959 (pairs)	4/8/16Meg	19/29/64 ea	
ACER Travelmate		8Meg	
AST Ascona A Series and M Series	8/16/32/64Meg	29/49/79/139	154/219
AST Ascentia P30, P50	8/16/32Meg	49/69/109	—/299
AST Ascentia J10, J30,J50 (pairs)	4/8/16/32Meg	19/29/49/89	119/158
AST Ascentia 800N, 810N, 900N, 910N	4/8/16Meg	44/56/79	105, 147/187
AST Ascentia 950N	8/16Meg	59/79	—/187
AST Ascentia M6230 ,J/M 5260X	16/32/64Meg	49/89/149	
AT&T Globalyst 130	4/8/16/32Meg	19/29/69	103/—
Canon Innova Book 350CD, 360, 475 (pairs)	8/16Meg	29/69 ea	119/—
Canon Innova Book 480, 490 EDO (pairs)	8/16Meg	29/69 ea	119/—
CTX EZ book 300 EDO (pairs)	8/16/32Meg	39/69/109 ea	138/—
CTX EZ Book 500, 600 Series	4/8/16Meg	19/29/69	138/—
CTX EZ Book 700, 760, 772 (EDO) (pairs)	4/8/16/32Meg	19/29/69/109 ea	138/—
CTX EZ Book 780MT, 785MT (EDO) (pairs)	8/16/32Meg	29/69/109 ea	138/—
DEC HiNote Ultra 2000	16/32/64Meg	49/79/139	
DEC HiNote VP 320,525,535,545/150MM (pairs)	4/8/16Meg	19/29/69 ea	119/259
DEC HiNote VP 510, 5120	8/16/32/64Meg	29/49/79/149	119/—
DEC HiNote VP, CSS, LSS, CTS, LTS	8/16/32/64Meg	29/49/79/149	119/—
DEC HiNote VP700, 733	16/32/64Meg	49/79/149	
Dell Inspiron 3000, 3200, 7000	16/32/64Meg	49/79/149	—/229
Dell Latitude CP & CPi Series	16/32/64Meg	49/89/149	
Dell Latitude LM, LM P166MMX (pairs)	4/8/16/32Meg	19/29/99/109 ea	—/243
Dell Latitude XPi, CP	4/16Meg	49/79	119/—
Dell Latitude LX, M	4/8/16Meg	49/59/89	105/—
Dell Latitude XP, XPi, XPi CD M166ST (pairs)	4/8/16/32Meg	19/29/69/109 ea	
Epson Action Note 850, 855c, 860, 866Dx	4/8/16Meg	34/44/69	119/—
Epson ActionNote 880, 886c, 890, 910	4/8/16/32Meg	19/29/69/99	119/—
Fujitsu Lifebook 400, 530, 600 Series	8/16/32/64Meg	29/59/79/149	103/203
Fujitsu Lifebook 500, 600, 700, 800 Series	8/16/32/64Meg	49/79/149/319	103/253
Fujitsu Monte Carlo, Montego, Milan	8/16/32/64Meg	29/49/79/149	—/203
Gateway 2000 Colorbook 4/33	4/16Meg	89/179	112/—
Gateway 2000 Solo Series (pairs)	4/8/16Meg	19/29/49/89	
Gateway Solo Series 2100, 2200 edo	8/16/32Meg	49/79/179	—/219
Gateway Solo 2300, 2500, 3100, 5100, 9100	16/32/64Meg	49/79/139	
Hitachi Flora Series	8/16/32Meg	29/44/69	
Hitachi E-Series, MMX Series	8/16/32Meg	49/69/129	119/218
Hitachi M-Series	8/16/32Meg	49/69/129	104/—
Hitachi Prime Notebook Elite, Plus, Pro	8/16/32/64Meg	29/49/79/149	154/217
HP Omnibook 800	8/16/32/64Meg	49/79/129/169	—/145
HP Omnibook 2100 Pii, 4100	32/64/128Meg	89/139/299	
HP Omnibook 4000C, CT, C	4/8/16Meg	49/54/79	126/—
HP Omnibook 5000CT, CTS, C, 5500CS	8/16/32Meg	54/79/129	126/—
Micron Go Book 233 Lite, 233, 266	16/32/64Meg	49/89/169	
Micron Millenia Transport Portable (pairs), MRX	8/16Meg	29/69 ea	
Micron Millenia Transport VLX P133 (pairs)	4/8/16Meg	19/29/69 ea	
Micron Millenia Transport XKE P166MMX	16/32/64Meg	49/79/149	
Midwest Micro Elite or Soundbook Plus or Sidbk II, VP	4/8/16Meg	19/49/109	119/—
Midwest Micro Elite or Soundbook CD	4/8/16Meg	19/29/69	
NEC Ready Notebook 2207, 330T	16/32/64/128Meg	49/89/169/239	133/—
NEC Ultralite Versa, E, V, MP	4/8/16/32Meg	9/44/79/129	133/—
NEC Versa 2600 Series (pairs)	4/8/16Meg	19/29/69 ea	
NEC Versa 4000, 4050/4080, 4200, 4230	8/16/32/64Meg	39/49/79/129	—/219
NEC Versa 6000, 6050, 6030	16/32/64Meg	49/79/149/319	
NEC Versa 6200MX edo	8/16/32/64Meg	29/59/79/149	
Packard Bell Statesman	8Meg	69	168/—
Panasonic CF-141, 142	4/8/16/32Meg	49/59/79/139	126/—
Panasonic CF-62 P100, P133	8/16/32/64Meg	39/59/79/149	
Panasonic Toughbook 25, 35, 45	16/32/64Meg	49/89/149	
Sager Modern, all Models	8/16/32/64Meg	19/29/59/109	Call
Samsung Sen 810, 900	8/16/32/64Meg	49/79/109	—/219
Sharp 3090, 3040, 3070	8/16/32Meg	49/69/109	
Sharp 3012, 3020, 3050, 3060	4/8/16/32Meg	19/29/59/119	133/—
Sharp 9700, 9800, 9900	8/16/32/64Meg	49/79/149/279	124/—
Sharp 9080, 9030, 9020, 9050, 9300CD, T edo	8/16/32/64Meg	49/69/109	298/252
Sharp 904C, 9C70 (pairs)	4/8/16/32Meg	19/29/69/119 ea	—/298
Sharp 9700, 9800, 9900	8/16/32/64Meg	49/79/149/279	
Sharp Widenote 100T	8/16/32Meg	29/69/99	
Sony 505J, 505GX, 505FX	32/64Meg	79/149	
Sony V&C PCG-750C, 707C, 719	16/32/64Meg	49/79/139	
TI 4000, TI 4000E, TI 4000M	4/16Meg	49/340	88, 110/—
TI 5000, 4100, 5200, 5300	8/16Meg	39/89	—/188
TI 8000, 8030, 8050, 8160	8/16Meg	29/69	—/215
TI Extensa 450, 450T, 455, 455T	4/8/16Meg	19/29/69	147/—
TI Extensa 510, 515 (pairs) edo	4/8/16/32Meg	19/29/69 ea	161/—
TI Extensa 550, 555, 560, 565, 570 (pairs)	4/8/16Meg	19/29/69 ea	161/—
TI Extensa 600, 605, 650, 900, T, CDT edo	8/16/32Meg	29/59/99	147/—
TI Extensa 700 Series	16/32/64/128Meg	49/89/179/359	147/—
Toshiba Hi 710, 720, P133, P150	8/16/32Meg	49/79/119	—/329
Winbook XL, XLi, XL2	16/32/64Meg	49/79/149	139/219
Winbook XPC, XP	16/32Meg	69/119	112/217
Sony V&C	8/16Meg	119	112/217
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Pro 950-959	199	259	299	339	419	699
Nuvo 971, 972	199	259	299	339	419	699
AST Ascentia	**2.1G**	**3.2G**	**4.0G**	**5.1G**	**6.4G**	**8.0G**
800 & 900	199	259	299	339	419	699
COMPAQ	**2.1G**	**3.2G**	**4.0G**	**5.1G**	**6.4G**	**8.0G**
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Contura 400-430	199	259	299	339	419	699
Lte 5000-5400	199	259	299	339	419	699
FUJITSU	**2.1G**	**3.2G**	**4.0G**	**5.1G**	**6.4G**	**8.0G**
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Monte Carlo	199	259	299	339	419	699
Lifebk 500 Series	199	259	299	339	419	699
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NEC VERSA	**2.1G**	**3.2G**	**4.0G**	**5.1G**	**6.4G**	**8.0G**
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Stop Buying Bugs!

HOW WE CAN GET SOFTWARE WITHOUT BUGS.

by Glenn Welt, CEO, Mega World, Inc.

"Software Bugs Run Rampant" was the headline in *PC World,* Jan. '99, page 47. The article blames software companies. It says 64% of consumers would pay more for bug-free software. So what's the problem?

TRADE SECRETS

The real problem is retailers. Keep reading. Discover the truth and what you can do to get bug-free software.

RISKING IT ALL

I'm risking my company by revealing what you're about to read. I'm hoping retailers will wise up or you will force them to do so. Speak up or we might have crappy software forever. I've spent 4 years developing ChecksNet Software to make it BUG-FREE. You can't buy it today at some major retailers because they choose to sell you crap with known bugs.

Between May and October of 1998 I visited the buyers at 4 of the largest software retailers in the USA. They all sell VersaCheck, my competitor. Only one buyer gave the impression that he'd ever tested it. I presented a stack of letters from consumers who complained about numerous bugs in VersaCheck. Not one buyer cared. I explained how ChecksNet is bug-free, faster and has more features. Not one buyer cared or asked to see a demo of my software. I discovered they care about 1 thing ... MONEY. Retailers call it Advertising Allowances, Promotional Funds, or Free Goods. I call it bribery. One software buyer made it clear that unless I gave him much more than my competitor, he wasn't going to put ChecksNet on his store shelves. **Software companies are getting shelf space by delivering dollars instead of quality products. You get bugs in pretty boxes instead of what you really want and expect. It's that simple.**

YOU CAN STOP IT

The January '99 *PC World* article said to complain but didn't say how. Here are my suggestions:

1. Stop Buying Crap! Refuse software until retailers provide written assurance that they have tested it.

2. Deliver a copy of this ad to local store managers. Tell them you want quality software ... not pretty boxes offering the most ad money.

3. Contact retailer CEO's. Go to www.checksnet.com and click SPEAK OUT. You'll find email addresses, street addresses and phone numbers of major retailers.

4. Insist on a demo. If a store can't run software on a display computer, go to the website of the software company. If they don't offer a demo that you can download and test, DON'T BUY IT!

MORE BUG CLUES

If you want the best software in a category, here are more things you can do to avoid the wrong one:

1. Look for comparisons. If you can't find magazine reviews, look on software packages or go to their websites. If a software is afraid to compare itself to competitors, you can guess why.

2. Support. Does the software include free phone support? Does it have website tech support that anyone can view? If not, it's probably difficult to use or full of bugs.

THE "NEW VERSION" GAME

Aside from bugs, here's a trick some software makers use that bugs me: **Having to buy an entire new package to get a few new features.** Example: ChecksNet Standard makes business and wallet-size checks. VersaCheck Personal only makes wallet-size. Instead of offering the business-size function as a free update or upgrade, VersaCheck recently released a new $29.95 package with the business-size features. In fact, MIPS now offers 8 versions of VersaCheck. Instead of offering updates or upgrades, they slap on a new version label and expect you to pay again and again. Put all 8 VersaCheck versions together and you still won't have the speed, ease-of-use or features that you get in ChecksNet Professional.

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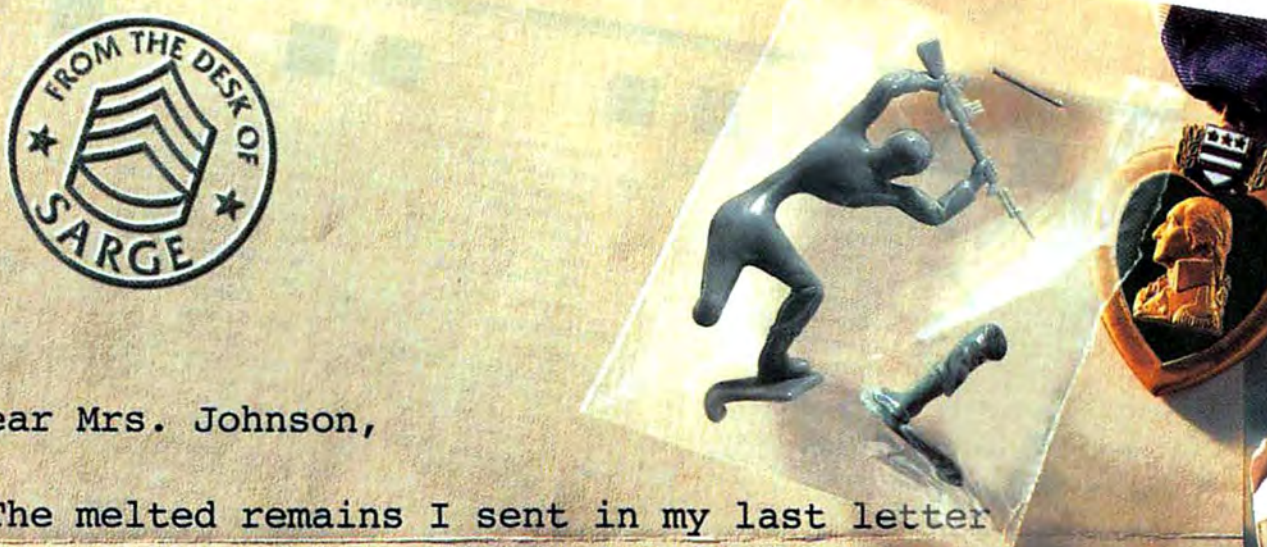


Dear Mrs. Johnson,

The melted remains I sent in my last letter were not those of your son. Our condolences. Your son, Joe, is attached above in this little baggie.

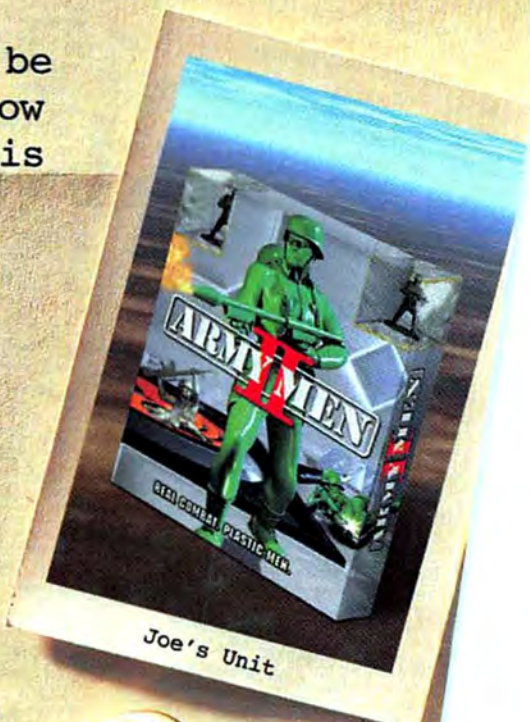
Please return the previously sent melted Private at your earliest convenience.

Deepest regrets,

Sarge

Sarge

P.S. Although there will never be another Joe, you'll be glad to know we're already molding others in his likeness.



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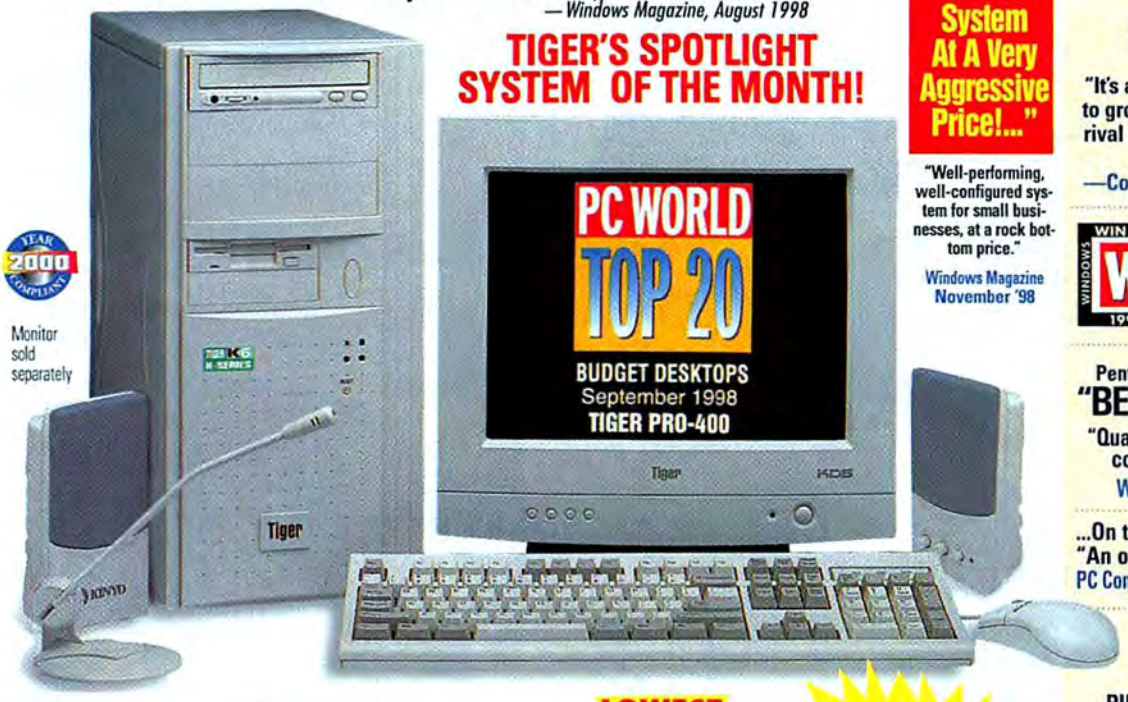

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Form Factor: **ATX** • CPU: **Socket 7** • Bus Speed: **Up to 100 MHz** • AGP Slots: **1** • PCI Slots: **5** • ISA Slots: **2** • Memory: **3 DIMM Sockets** • Max Memory: **384 MB**

Tiger 767 AT, 760 ATX Slot 1

Motherboard & Case: Motherboard mounted in dual-cooling fan case; cables & manual

Pre-Assembled Kits: Motherboard in dual-cooling fan case; keyboard, speakers, mouse, 3D AGP video, 56KFlex faxmodem, 1.44MB floppy drive, 24X CD-ROM, Wave Table sound.

Tiger 767 Form Factor: **AT** • CPU: **Slot 1** • Bus Speed: **Up to 100 MHz** • On Board Video: **8MB AGP** • On Board Audio: **YES** • PCI Slots: **4** • ISA Slots: **1** • Memory: **DIMM** • Max Memory: **768 MB**

Tiger 760 Form Factor: **Micro AT X** • CPU: **Slot 1** • Bus Speed: **Up to 100MHz** • On Board Video: **8MB AGP** • On Board Audio: **YES** • PCI Slots: **3** • ISA Slots: **1** • Memory: **DIMM** • Max Memory: **768 MB**

Motherboard Design	Processors Supported	MOTHERBOARD ONLY Item No.	1-2 units	3+ units	MOTHERBOARD & CASE Item No.	1-2 units	3+ units	PRE-ASSEMBLED KITS Item No.	1-2 units	3+ units
Tiger 571 AT including Wave Table sound and PCI video	**AMD** Up to K6-300 & K62-266 **Intel** Pentium up to 233 MMX **IBM/Cyrix** Up to PR300	MB1-C-1B	$77.99	$69.99	BB1-C-1B Mid-tower AT case with 200-Watt power supply	$124.99	$114.99	KT1-C-1B	$219.99	$202.99
Tiger S7-MVP3 ATX Super Socket 7 1MB cache	All **AMD** Up to K62-400; **Intel** Pentium up to 233 MMX **IBM/Cyrix** up to MII 350	MB1-C-2B	$57.99	$49.99	BB1-C-2B ATX case with 235-Watt power supply	$139.99	$128.99	KT1-C-2B	$269.99	$248.99
Tiger 767 AT Slot 1 with Sound & AGP video	**Celeron** up to 333MHz **Intel** Pentium II up to 500MHz	MB1-E-5A	$99.99	$91.99	BB1-E-5A AT Case 200 W Power Supply	$154.99	$142.99	KT1-E-5A	$249.99	$229.99
Tiger 760 Micro-ATX Slot 1 w/Sound & AGP video	**Celeron** up to 333MHz **Intel** Pentium II up to 500MHz	MB1-E-6A	$99.99	$91.99	BB1-E-6A Micro ATX Case 140W Supply	$139.99	$128.99	KT1-E-6A	$239.99	$220.99
Tiger 6KE LX ATX Slot 1	**Celeron** up to 333MHz **Intel** Pentium II up to 333MHz	MB1-T-10A	$49.99	$39.99	BB1-T-10A ATX Case 235W Supply	$114.99	$99.99	Not Available		
Tiger 6BE+ BX ATX Slot 1	**Celeron** up to 500MHz **Intel** Pentium II up to 500MHz	MB1-T-9A	$89.99	$79.99	BB1-T-9A ATX Case 235W Supply	$149.99	$134.99	Not Available		

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CZF

Bandwidth Myths: Beneath the Hype

GIVEN SOME OF THE THINGS we've heard lately about bandwidth, the term might be better dubbed *bandmyth*. In no other area of the PC industry is there quite as much hype or misinformation. Here are a few of the more dubious concepts about fast Net access:

Bandwidth is free. Thanks to advances in fiber optics and chip technology, bandwidth is definitely getting cheaper. But some industry pundits will try to tell you that bandwidth is essentially free. Not likely. At the Association for Computing Machinery's 1997 conference, digital pioneer Gordon Bell warned us to be wary of just such bandwidth claims, noting the unsurprising reality that "you just can't get any of it at that price."

You can't get a fast connection. The bitter truth about bandwidth is summed up in the title of an old Jimmy Cliff song: "You Can Get It If You Really Want." Operators are standing by to lease you a T1 line that delivers data at a whopping 1.5 megabits per second—if you really want it badly enough to cough up more than $1000 a month.

You can get a fast, affordable connection. Different story. In my Seattle neighborhood, fast Digital Subscriber Line service is available in my phone exchange, but not at my house; I'm too far from the switch. Cable modems? Offered in other parts of town, but not in mine; I'm on a waiting list. If I desperately needed a faster connection, I could probably get ISDN. But it hardly seems worth paying elevated tariffs to both my local phone company and my ISP.

Wireless? Sorry, but the price/performance ratio's too low. Metricom has been promising 128-kbps service for its Ricochet system, but it hasn't arrived, and 128 kbps doesn't seem all that fast anymore anyway. Other wireless data schemes have astronomical costs, glacial speeds, and other complications.

That leaves some variant of T1—if I win the lottery.

People are clamoring for more bandwidth. Those of us who truly need greater Web speed may be the exceptions. When adequate, not-quite-56-kbps service is available at $20 a month, and a sizable fraction of Web surfers find AOL acceptable, getting most customers to fork over twice that price or more for faster Net links could be a hard sell. Sure, downloads will be lots faster, banner ads will pop up quicker, and always-on connections will be a boon. But they won't help you plow through e-mail any faster.

Those of us who truly need greater Web speed may be the exceptions.

You get what you pay for. You probably don't, because you're sharing bandwidth with thousands of users across the Net. The dial-up connection to your ISP is the only place bandwidth isn't pooled; that 45 or 50 kbps is dedicated to you, and nobody can snag a piece of it.

But no law says an ISP has to use a big pipe to connect to the Net, so service providers can save money by using small ones. One way ISPs increase apparent speed is by caching popular pages on local proxy servers. That trade-off of storage for bandwidth may work fine for some; it won't do you much good if you frequent obscure sites or download a lot of software.

In these and many other ways, the effective speed of your connection can be severely compromised. A few weeks ago, I was stunned when a neighbor dropped by and expressed his delight at the speed of my sort-of 56-kbps connection. Turns out he does most of his surfing from a college campus where the communal T1 line is evidently in heavy use. Sharing isn't always a good thing.

Fast connections will soon be the norm. Not on the evidence we've seen so far. When you look at the percentages of people who have high-speed Internet access, cable modems are just barely on the charts and DSL is barely a blip. Blame the combination of high prices and limited availability. As Gordon Bell pointed out, "Network bandwidth becomes available more slowly than anyone can ever predict," alluding to an AT&T vice president's 1981 forecast that "ISDN will be ubiquitous by 1985."

Besides the handful of people who will pay almost any price for faster Net access, what most of us really want is simple: a high-bandwidth connection for slightly more than what we're paying now for dial-up, an easy upgrade path from dial-up systems to faster ones, and widespread availability. In keeping with the wisdom of Gordon Bell, I'm skeptical that any of it will happen in any hurry.

PC World *Contributing Editor Stephen Manes has been writing about computers and their frustrations for more than 15 years. He is coauthor of* Gates, *a biography of Microsoft's chairman.* ■

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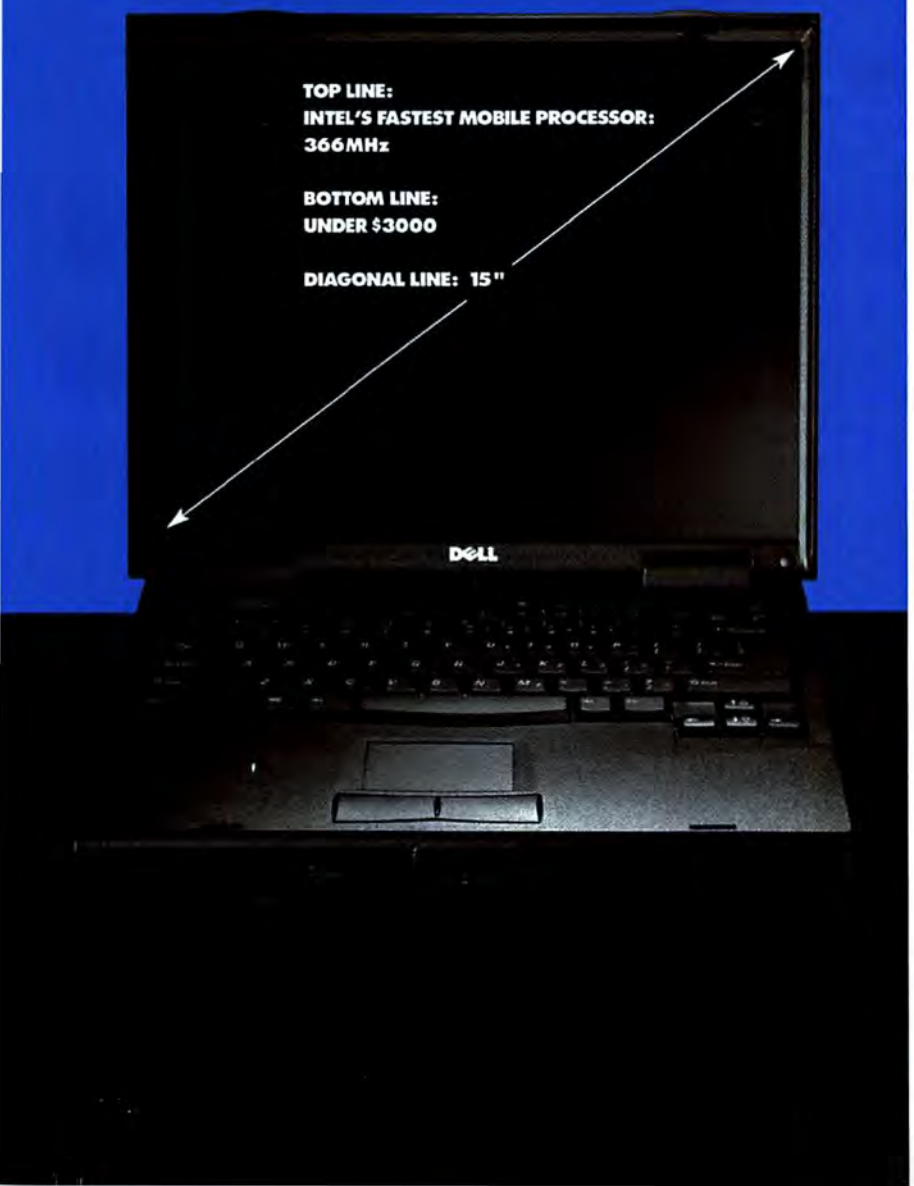

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DELL® DIMENSION® DESKTOPS FOR BUSINESS

Common features: Mini-Tower Model ◆ 3.5" Floppy Disk Drive ◆ Two USB Ports ◆ MS® Office 97 Small Business Edition plus Bookshelf (Ask about Our *FREE* MS Office 2000 Upgrade Offer) ◆ McAfee VirusScan ◆ MS Windows® 98 ◆ Dell QuietKey® Keyboard ◆ 3-Year Limited Warranty[1] ◆ 1-Year On-site[A] Service ◆ 24-Hour Toll-free Telephone and Online Technical Support **Upgrade:** 3-Year Next-Business-Day On-site[A] Service, add $99

DELL DIMENSION XPS R450
PENTIUM® II PROCESSOR AT 450MHz

- 256MB 100MHz SDRAM
- 512KB Integrated L2 Cache
- *NEW* 17.2GB Ultra ATA Hard Drive
- *NEW* 17" (17.0" viewable) Flat Panel 1700FP Display
- 16MB STB nVidia TNT 3D AGP Graphics Card
- 40X Max™ Variable CD-ROM Drive
- Turtle Beach Montego A3D Sound
- ACS-295 Speakers with Subwoofer
- 3Com® 3C905B 10/100 NIC

★ *3Com USR V.90™ PCI Telephony WinModem, add $49.*

★ *Intuit QuickBooks v6.0, add $118.*

$3999

Business Lease[B]: $151/Mo., 36 Mos.

E•VALUE CODE: 03602-590239

DELL DIMENSION XPS R450
PENTIUM II PROCESSOR AT 450MHz

- 128MB 100MHz SDRAM
- 512KB Integrated L2 Cache
- 12.9GB Ultra ATA Hard Drive
- 19" (17.9" viewable, .26dp) 1200HS Monitor
- 8MB STB nVidia 3D AGP Graphics Card
- 40X Max™ Variable CD-ROM Drive
- Crystal 3D 64V Wavetable Sound
- harman/kardon HK-195 Speakers
- 3Com USRobotics V.90™ PCI Telephony WinModem
- Trial Offer ConnectDirect℠ Internet Access[1]
- APC SurgeStation Pro8T2

$2179

Business Lease[B]: $83/Mo., 36 Mos.

E•VALUE CODE: 03602-590221A

DELL DIMENSION XPS R400
PENTIUM II PROCESSOR AT 400MHz

- 96MB 100MHz SDRAM
- 512KB Integrated L2 Cache
- 12.9GB Ultra ATA Hard Drive
- *NEW* 17" (16.0" viewable, .26dp) M780 Monitor
- 8MB ATI XPERT 98D 3D AGP Graphics Card
- 40X Max™ Variable CD-ROM Drive
- Crystal 3D 64V Wavetable Sound
- harman/kardon HK-195 Speakers
- Iomega Zip 100MB Internal Drive
- APC SurgeStation Pro8T2

★ *Upgrade to 128MB 100MHz SDRAM, add $69.*

$1779

Business Lease[B]: $67/Mo., 36 Mos.

E•VALUE CODE: 03602-590217

DELL DIMENSION V333c
INTEL® CELERON™ PROCESSOR AT 333MHz

Network-Designed Desktop

- 64MB SDRAM
- 128KB Integrated L2 Cache
- 8.4GB Ultra ATA Hard Drive
- *NEW* 17" (16.0" viewable, .26dp) M780 Monitor
- 8MB ATI 3D AGP Graphics
- 32X Max[C] Variable CD-ROM Drive
- Intel 10/100 Ethernet Controller

★ *Upgrade to 96MB SDRAM, add $69.*

★ *Upgrade to a NEW 12.9GB Ultra ATA Hard Drive, add $79.*

★ *Upgrade to a 17" (16.0" viewable, .26dp) Trinitron® 1000HS Monitor, add $109.*

$1299

Business Lease[B]: $49/Mo., 36 Mos.

E•VALUE CODE: 03602-590212

DELL DIMENSION DESKTOPS FOR HOME

Common features: Mini-Tower Model ◆ 512KB Integrated L2 Cache (128KB on Intel Celeron Processor-based Systems) ◆ *NEW* 3Com USR V.90™ PCI Telephony WinModem with Trial Offer ConnectDirect Internet Access[1] ◆ 3.5" Floppy Disk Drive ◆ Two USB Ports ◆ *NEW* MS Works Suite 99 with Money 99 Basic ◆ McAfee VirusScan ◆ MS Windows 98 ◆ 3-Year Limited Warranty[1] ◆ 1-Year At-home[A] Service **Upgrades:** Premier 3-Year At-home[A] Service, add $99 ◆ HP DeskJet® 722c, add $249 ◆ HP OfficeJet 710, add $499

DELL DIMENSION XPS R450
PENTIUM II PROCESSOR AT 450MHz

- 128MB 100MHz SDRAM
- *NEW* 17.2GB Ultra ATA Hard Drive
- *NEW* 19" (18.0" viewable, .26dp) Trinitron P990 Monitor
- 16MB STB nVidia TNT 3D AGP Graphics Card with STB PCI TV/FM Tuner
- 4.8X DVD-ROM Drive and Decoder Card with TV Out
- Turtle Beach Montego II A3D 320V Sound Card
- *NEW* ADA880 Dolby Digital Speakers with Subwoofer
- Iomega Zip 100MB Internal Drive
- Dell Comfort Key Keyboard

$2899

Personal Lease[B]: $108/Mo., 36 Mos.[E]

E•VALUE CODE: 03602-500228B

DELL DIMENSION XPS R450
PENTIUM II PROCESSOR AT 450MHz

- 128MB 100MHz SDRAM
- *NEW* 12.9GB Ultra ATA Hard Drive
- 17" (16.0" viewable) Trinitron 1000HS Monitor
- 8MB ATI XPERT 98D 3D AGP Graphics Card
- 4.8X DVD-ROM Drive
- Turtle Beach Montego II A3D 320V Sound Card
- ACS-495 Dolby Surround Sound Speakers with Subwoofer
- Iomega Zip 100MB Internal Drive
- Dell Comfort Key Keyboard

$2299

Personal Lease[B]: $86/Mo., 36 Mos.

E•VALUE CODE: 03602-500222

DELL DIMENSION XPS R450
PENTIUM II PROCESSOR AT 450MHz

- 128MB 100MHz SDRAM
- *NEW* 12.9GB Ultra ATA Hard Drive
- 17" (16.0" viewable, .26dp) M780 Monitor
- 8MB ATI XPERT 98D 3D AGP Graphics Card
- 4.8X DVD-ROM Drive
- Turtle Beach Montego A3D 64V Sound Card
- ACS-295 Speakers with Subwoofer
- Dell Comfort Key Keyboard

★ *Upgrade to a 17" (16.0" viewable, .26dp) Trinitron 1000HS Monitor, add $109.*

$1999

Personal Lease[B]: $75/Mo., 36 Mos.

E•VALUE CODE: 03602-500219

DELL DIMENSION V333c
INTEL CELERON PROCESSOR AT 333MHz

- 64MB SDRAM
- 8.4GB Ultra ATA Hard Drive
- 17" (16.0" viewable, .26dp) M780 Monitor
- ATI 8MB 3D AGP Graphics
- 32X Max[C] Variable CD-ROM Drive
- Yamaha XG 64V Wavetable Sound
- harman/kardon HK-195 Speakers
- Dell QuietKey Keyboard

★ *Iomega Zip 100MB Internal Drive, add $99.*

★ *Upgrade to 128MB SDRAM, add $139.*

★ *Upgrade to a NEW 12.9GB Ultra ATA Hard Drive, add $79.*

$1299

Personal Lease[B]: $50/Mo., 36 Mos.

E•VALUE CODE: 03602-500212

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Microsoft® Office 97 Small Business Edition includes:

- Word 97
- Excel 97
- Publisher 98
- Outlook 98
- Small Business Financial Manager 98
- Direct Mail Manager
- Expedia Streets 98

Microsoft Works Suite 99 includes:

- Word 97
- Encarta Encyclopedia 99
- Money Basic 99
- Works 4.5a
- Works Calendar
- Graphics Studio Greetings
- Expedia Streets 98

Software Upgrades:

- Intuit QuickBooks v6.0, add $118.
- MS Windows NT® Workstation 4.0, add $99.

DELL WORKSTATION

DELL PRECISION™ WORKSTATION 410
PENTIUM II PROCESSOR AT 450MHz
(DUAL PROCESSOR/RAID CAPABLE)

- 128MB 100MHz ECC SDRAM
- 9GB Ultra-2/LVD SCSI Hard Drive
- *NEW* 19" (18.0" viewable, .26dp) Trinitron P990 Monitor
- Diamond 8MB AGP Graphics Card
- 40X Max^ Variable CD-ROM Drive
- Sound Blaster Pro Compatible Sound
- Integrated 3Com 10/100 PCI NIC
- Remote Client Manageability Support via DMI 2.0; Wakeup on LAN Capable
- **MS Windows NT Workstation 4.0 and 1-Year NT Telephone Support**
- 3-Year NBD On-site§ Service
- 7x24 Dedicated Workstation Hardware Telephone and Online Technical Support

$3579

Business Lease◊: $136/Mo., 36 Mos.

E•VALUE CODE: 03602-490235

DELL POWEREDGE® SERVERS

Common features: 512KB Integrated L2 ECC Cache ◆ Intel Pro/100+ PCI Ethernet Adapter ◆ HP® OpenView™ NNM Special Edition ◆ 7x24 Dedicated Server Hardware Technical Telephone Support ◆ 3-Year Next-Business-Day On-site§ Service **Upgrades:** APC Smart-UPS 700W Power Supply, add $369 ◆ 800F 15" (13.8" viewable) Monitor, add $199

DELL POWEREDGE 2300 SERVER
PENTIUM II PROCESSOR AT 450MHz
(RAID 5 CONFIGURATION)

- 128MB 100MHz ECC SDRAM
- Three 9GB Ultra-2/LVD SCSI Hot-Swap Hard Drives
- Ultra-2/LVD PowerEdge Expandable RAID Controller 2/SC
- 32X Max^ Variable SCSI CD-ROM
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 6-1" Hard Drive Bays
- 4 External Bays: 3-5.25" and 1-3.5"

$5249

Business Lease◊: $193/Mo., 36 Mos.

E•VALUE CODE: 03602-290252

NEW DELL POWEREDGE 1300 SERVER
PENTIUM II PROCESSOR AT 350MHz
(DUAL PROCESSOR/RAID CAPABLE)

- 64MB 100MHz ECC SDRAM
- 4GB Ultra-2/LVD SCSI Hard Drive
- 32X Max^ Variable EIDE CD-ROM
- Integrated PCI Ultra-2/LVD Controller
- 6 Expansion Slots: 5 PCI, 1 PCI/ISA
- 4 Hard Drive Bays: 2-1.6" and 2-1.0"
- 3-5.25" External Bays
- ★ *Microsoft Windows NT Server 4.0 (10 Client Access Licenses), add $799.*
- ★ *12/24GB Variable SCSI DAT Tape Backup Unit, add $749.*

$1849

Business Lease◊: $70/Mo., 36 Mos.

E•VALUE CODE: 03602-290218

DELL INSPIRON™ NOTEBOOKS

Common features for the Inspiron 7000: 3D Surround Sound and Hardware Wavetable ◆ 12-Cell Intelligent Lithium Ion Battery ◆ Microsoft Office 97 Small Business Edition (Call about Our *FREE* MS Office 2000 Upgrade Offer) ◆ MS Windows 98 ◆ S-Video Port ◆ Touchpad ◆ 3-Year Limited Warranty† **Common features for the Inspiron 3500:** 3D Surround Sound and Software Wavetable ◆ Modular Floppy Drive ◆ Modular 24X Max^^ Variable CD-ROM ◆ 9-Cell Intelligent Lithium Ion Battery ◆ MS Office 97 Small Business Edition (Call about Our *FREE* MS Office 2000 Upgrade Offer) ◆ MS Windows 98 ◆ Touchpad ◆ 3-Year Limited Warranty†

NEW DELL INSPIRON 7000 A366LT
PENTIUM II PROCESSOR AT 366MHz

All-in-One Multimedia Performance

- 15" XGA Active Matrix Display
- 64MB SDRAM (384MB Max**)
- 4GB Ultra ATA Hard Drive
- *NEW* Removable Combo 4X DVD-ROM and Floppy Drive
- 2X AGP 8MB ATI RAGE Pro 3D Video
- Deluxe Nylon Case
- Internal 56K Capable™ V.90 Fax Modem
- Trial Offer ConnectDirect Internet Access‡
- ★ *Upgrade to 128MB SDRAM, add $199.*

$3399

Business Lease◊: $129/Mo., 36 Mos.

E•VALUE CODE: 03602-890233

NEW DELL INSPIRON 7000 A366GT
PENTIUM II PROCESSOR AT 366MHz

All-in-One Multimedia Performance

- 14.1" XGA Active Matrix Display
- 32MB SDRAM (384MB Max**)
- 4GB Ultra ATA Hard Drive
- Removable Combo 24X Max^^ Variable CD-ROM and Floppy Drive
- 2X AGP 4MB ATI RAGE Pro 3D Video
- ★ *Upgrade to 64MB SDRAM, add $99.*
- ★ *Upgrade to a 6.4GB Ultra ATA Hard Drive, add $149.*
- ★ *Deluxe Nylon Case, add $49.*

$2699

Business Lease◊: $102/Mo., 36 Mos.

E•VALUE CODE: 03602-890226

NEW DELL INSPIRON 3500 A300GT
PENTIUM II PROCESSOR AT 300PE MHz

Light Weight, Light Price

- 14.1" XGA Active Matrix Display
- 32MB SDRAM (256MB Max)
- 3.2GB Ultra ATA Hard Drive
- NeoMagic MediaMagic 256AV AGP Video
- APC SurgeArrest PNote 1 Pro
- Internal 56K Capable™ V.90 Fax Modem
- Trial Offer ConnectDirect Internet Access‡
- ★ *Upgrade to 96MB SDRAM, add $199.*

$2299

Business Lease◊: $87/Mo., 36 Mos.

E•VALUE CODE: 03602-890222

DELL INSPIRON 3500 D266XT
PENTIUM II PROCESSOR AT 266MHz

Light Weight, Light Price

- 13.3" XGA Active Matrix Display
- 32MB SDRAM (256MB Max)
- 3.2GB Ultra ATA Hard Drive
- NeoMagic MediaMagic 256AV AGP Video
- ★ *Upgrade to 64MB SDRAM, add $99.*
- ★ *Upgrade to a 4.3GB Ultra ATA Hard Drive, add $99.*
- ★ *Deluxe Nylon Case, add $49.*
- ★ *Internal 56K Capable™ V.90 Fax Modem, add $59.*

$1999

Business Lease◊: $76/Mo., 36 Mos.

E•VALUE CODE: 03602-890219

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DELL® DIMENSION® XPS R450
PENTIUM® II PROCESSOR AT 450MHz

- 128MB 100MHz SDRAM
- 512KB Integrated L2 Cache
- 12.9GB Ultra ATA Hard Drive
- 17" (16.0" viewable, .26dp) Trinitron® 1000HS Monitor
- 16MB STB nVidia TNT 3D AGP Graphics Card
- 40X Max™ Variable CD-ROM Drive
- Turtle Beach Montego II A3D 320V Sound Card
- ACS-295 Speakers with Subwoofer
- 3Com® USR V.90™ PCI Telephony WinModem
- Trial Offer ConnectDirect℠ Internet Access[λ]
- Microsoft® Office 97 Small Business Edition plus Bookshelf (Ask about Our *FREE* MS® Office 2000 Upgrade Offer); McAfee VirusScan
- Microsoft Windows® 98
- Dell QuietKey® Keyboard
- Logitech MouseMan® Wheel (PS/2v)
- 3-Year Limited Warranty[†]
- 1-Year On-site[Δ] Service

$2199

Business Lease[◇]: $83/Mo., 36 Mos.

E•VALUE CODE: 03600-590221

UPGRADE TO THE MVP "STATE-OF-THE-ART"[μ] SYSTEM

- ★ *14.4GB Ultra ATA Hard Drive (7200 rpm)*
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- ★ *3Com 3C905B 10/100 NIC*
- ★ *Iomega Zip 100MB Internal Drive*

ADD $379

Add to Business Lease[◇]: $15/Mo., 36 Mos.

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