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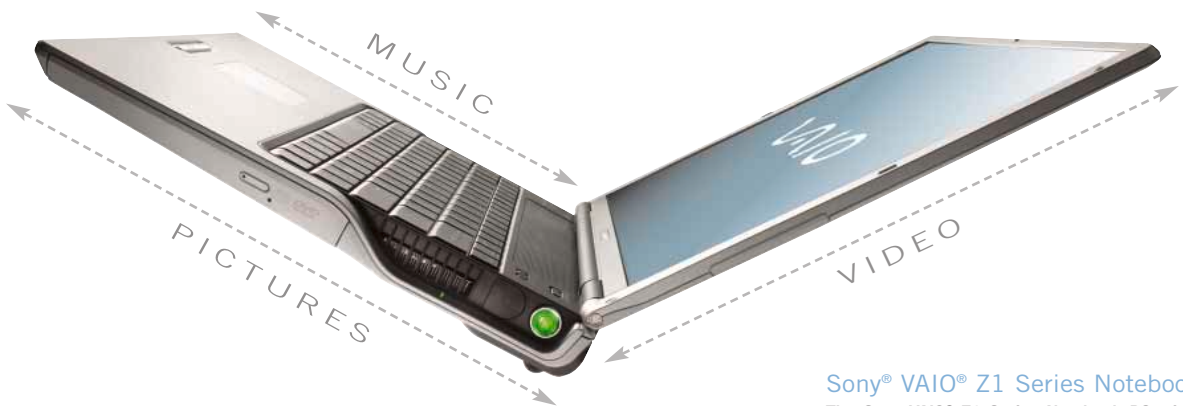


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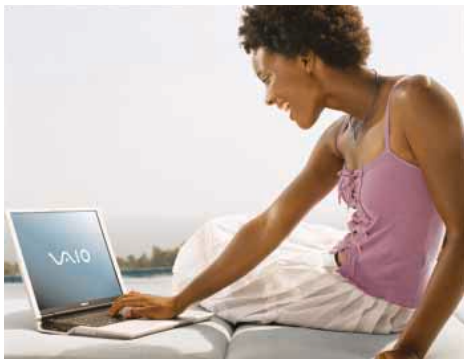
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- Intel® 855 Chipset
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- 14" SXGA+ TFT display
- 512MB DDR SDRAM
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- 256MB RAM
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- Intel® 855 Chipset
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- 512MB DDR at 333MHz
- DVD-RW Drive⁴
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- Wireless keyboard and wireless mouse
- Built-in stereo speakers
- Convert VHS to DVD with Giga Pocket® Personal Video Recorder
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- 128MB ATI® RADEON™ 9200 Graphics Card
- Sony VAIO® Creation Suite Standard software package
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The number of months you will pay and the amount of your total minimum monthly payment will depend on additional purchases and your Account balances. Minimum Finance Charge, \$2.00. Certain rules apply to the allocation of payments and Finance Charges on your promotional purchase if you make more than one purchase on your Sony Card. Call 1-888-367-4310 or review your cardholder agreement for information. 11. Purchase must be made by 8/31/04. For rebate mail-in coupon and Terms and Conditions, please visit www.sonystyle.com. 12. Requires compatible 802.11b or 802.11g wireless access point, some of which may require a fee and/or ISP. 13. Requires compatible 802.11b wireless access point, some of which may require a fee and/or ISP. This wireless LAN product has been designed to permit legal operation worldwide in regions in which it is approved. Operation on channels 12-14 is not permitted in all regulatory regions of the world. The wireless LAN feature is limited to operate on channels 1-11 and will not support channels 12, 13 and 14. This product has been tested and certified to be interoperable by the Wireless Ethernet Compatibility Alliance and is authorized to carry the Wi-Fi logo. 14. Offer valid with purchase of PC-VZ006 direct from www.sonystyle.com. While supplies last. 15. Purchase must be made by 5/31/04. For rebate mail-in coupon and Terms and Conditions, please visit www.sonystyle.com. 16. MP3 music playback requires Memory Stick media. Sold separately. 17. Purchase an eligible notebook from www.sonystyle.com plus sign up for a T-Mobile HotSpot annual subscription plan before 6/30/04 and receive a 30-day free trial of the T-Mobile HotSpot service. Verified major consumer credit card required. Cancel before 30 days of service and you will not be billed. Any credit card pre-authorizations will be cancelled. Twelve-month service obligation begins after the 30-day free-trial period expires. 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"The biggest advance in computing in recent years." — Peter Lewis, Fortune

"One thing that's for sure is that the G5 is the biggest advance in computing in recent years, and not just because it is the first personal computer to use a 64-bit desktop processor."

— Peter Lewis, Fortune, 10/27/03

"To say that the latest and greatest G5 screams does a disservice to the word. I can say flatly that if you have been waiting for the G5 to update your aging Power Macs, you need wait no longer. It will chew through any processor-intensive task you throw its way."

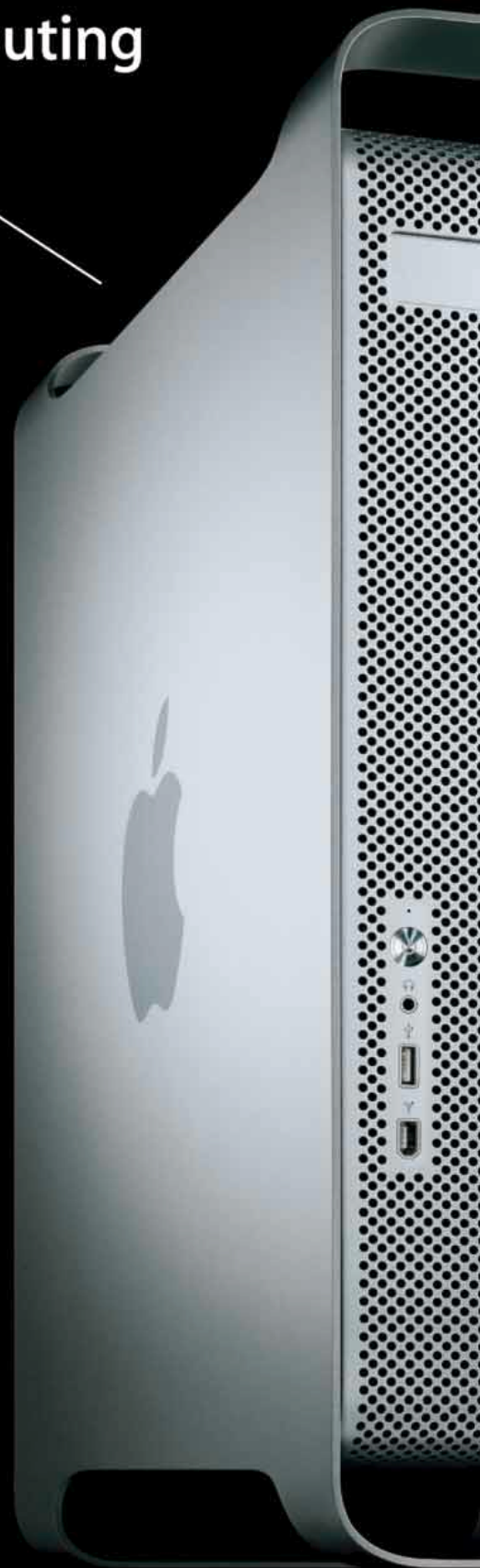
— Ken Mingis, Computerworld

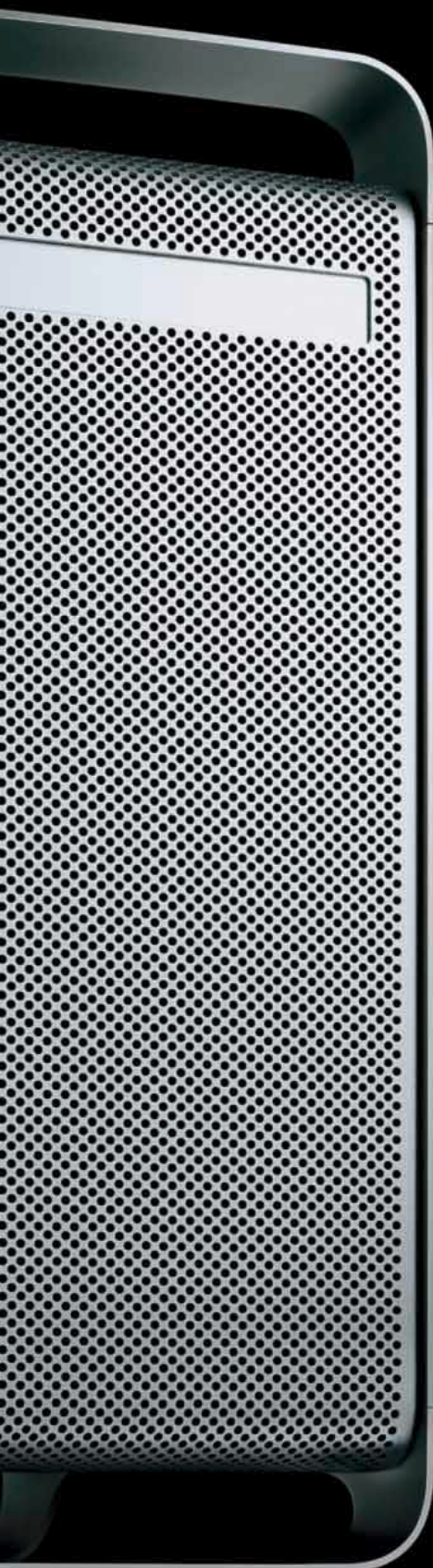
"After two weeks with a dual processor 2GHz Power Mac G5, it's the fastest Mac I've ever used in my entire life, and not by a small margin, either. I'd call it wicked fast, but that wouldn't even come close to doing it justice. It was astonishing."

— Bob Levitus, in the Houston Chronicle

"The Power Mac G5 shatters the long-standing limits of expectation imposed by Intel and Microsoft."

— Tom Yager, InfoWorld





"With the Power Mac G5, the increase in speed is three-fold over the old machine. Especially in my line of work, this means more rendered scenes in the same amount of time, more freedom to try different versions, or simply a chance to go home before midnight."

— **Thomas Tannenberger**, Look Effects

"I wasn't prepared for the truly overwhelming performance of my new dual 2 GHz G5. The combo of this amazing hardware and OS 10.3 [Panther] adds up to a work platform that is not only astounding in its power but also in the joy that it brings to the user—just for the quality of work life that it offers those of us who spend hours and hours in front of our machines."

— **Pat Metheny**, Musician

"It is a leap of not only faith, but over tall buildings in a single bound. The G5 is so revolutionary, it almost cannot be thought of as simply a better Macintosh, or as a trump card over the hand dealt to us by the Wintel world. This changes everything; the Power Mac G5 is really in a class by itself."

— **George Tomlin**, Digital Output

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— **Jon Fortt**, San Jose Mercury News



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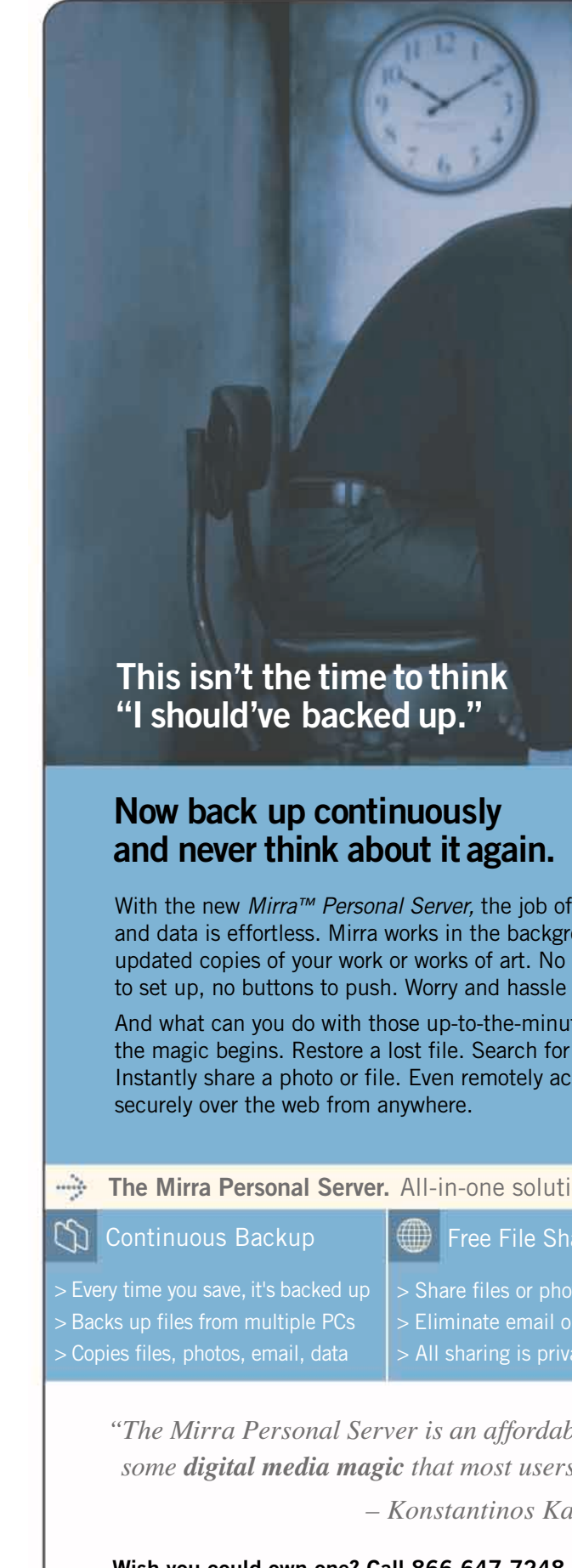
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— Konstantinos Karagiannis, PC Magazine

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Forward Thinking

The Benefits of Offshore Outsourcing

As more companies transfer programming and call-center jobs offshore, the topic of offshore outsourcing is raging throughout the information technology industry. I understand the frustration of workers whose jobs have moved and of customers who fail to get their technical-support questions answered. But the backlash may be overblown. One of the latest studies indicates that the trend may actually be creating more jobs. At least that's the conclusion of a recent study by Global Insight, sponsored by the Information Technology Association of America (ITAA).

Given our global economy, the globalization of the IT industry is inevitable. Most big IT companies do much of their business overseas and naturally want to have some of their employees in those markets. Lower wages in some countries are also a huge incentive to move operations, especially since high-speed communication removes many of the barriers to dealing with U.S.-based colleagues and customers.

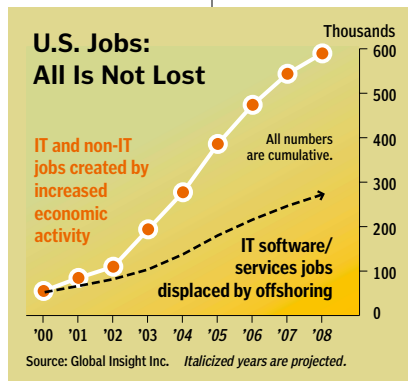
I think that some of the criticism of offshore outsourcing is misplaced. According to the Global Insight study, from 1998 through 2003 offshore IT software and services spending increased from \$2.5 billion to \$10 billion; the figure could reach \$31 billion by 2008.

It also estimates that as of 2003 nearly 104,000 IT software and services jobs were displaced. The same study says that 372,000 IT jobs have been lost in this country since 2000, accounting for about 10 percent of the total number of such jobs in the U.S. The main reasons for the loss: the dot-com bust, the recession, and the growth in productivity.

Interestingly, Global Insight says that rather than reducing the number of jobs in the U.S., offshoring is lowering costs for everyone and actually creating jobs, thanks to a more efficient economy. It says that about 194,000 new jobs—both IT and non-IT—were created in 2003 thanks to offshore IT outsourcing, and by 2008 the number will reach over 589,000.

According to a study by Gartner, fewer than 5 percent of U.S. IT jobs have moved offshore. But analysts predict that by 2010 25 percent will be in developing countries. They urge companies to proceed carefully, as such moves could result in the loss of future talent, intellectual assets, and organizational performance.

Of course, the creation of new jobs isn't much consolation for people who have lost their jobs. Still, moving some jobs offshore seems inevitable. There is no good alternative.



Rather than reducing the number of jobs in the U.S., offshoring is lowering costs for everyone and actually creating jobs, thanks to a more efficient economy.

The New IT Job Scene

All the emphasis on offshore jobs is obscuring an important trend: Information technology jobs are changing dramatically. Though many IT jobs are still out there, you won't find the huge demand—or the huge salaries and generous options—that we saw in the dot-com era. During that period, many companies had trouble filling open positions, which led to higher wages. Now that we're back to normal, wages have retreated too.

Increased productivity also plays a key role in the new IT job scene: IT



support requires fewer people than it once did. Windows 2000, Windows XP, and Mac OS X are far from perfect, but there's no question that they are more stable than Windows 95 or 98, or Mac OS 8 or 9. As a result, companies need fewer people to support them. (And if we can ever get spam and viruses under control, we'll need even fewer support personnel.)

Meanwhile, server consolidation and better desktop management have been significant trends for a long time, result-

Forward Thinking

MICHAEL J. MILLER

ing in the need for fewer IT jobs. These trends are also reflected in job statistics. IT jobs won't disappear altogether, but we may need fewer of them.

Perhaps the biggest transformation taking place is in programming. The number of computer science majors has dropped significantly, a big concern because these are the people who would have their names on the next great innovations in software. In many cases, the best computer science graduate students are going into finance or biotechnology, because programming has now reached many industries outside traditional IT.

More important, programming has gotten much easier. Although a limited number of people can program in C, a lot more people can program in JavaScript, Perl, or Visual Basic.

In large businesses, the nature of programming is

on the verge of change. Given the emergence of reusable objects and Web services, programming is often a matter of linking things together. We still need experts to build the underlying components and the basic infrastructure, but I suspect that managers will be able to take these components and create applications that match their business processes without going through the traditional IT process.

This new way of working changes IT. For an extreme example, consider what happened to typists and keypunch operators three decades ago. Their jobs disappeared as everyone adopted their skills. The same thing won't happen in IT, because we still need component creation, management, and innovation. But it won't surprise me if the future holds fewer traditional IT jobs and a lot more jobs in other fields that require IT and programming skills.

Adobe CEO on Open-Source Software and Competition



Recently I had the opportunity to talk with Adobe Systems CEO Bruce Chizen about open-source software, the Macintosh, and the software scene. You can read the entire interview at www.pcmag.com/interviews. Here's an excerpt.

MM: *What do you think about the progress open-source and Linux are making?*

BC: The server side clearly has momentum. The real question is on the Linux desktop, and I think it can happen. If Microsoft doesn't do anything, then I think Linux on the desktop has an opportunity to take off. If Microsoft does take action, especially on pricing and business models, it might stall the corporate adoption of Linux. Until the

environment is stable enough, people are going to continue to pay a premium for Windows.

MM: *What about Adobe making Linux apps?*

BC: We do Reader today, but the experiment with FrameMaker a couple of years ago was a total failure. The only people who wanted to use it were people who wanted it for free or very inexpensively. There was no real market. The first application that we'll probably do will be a full version of Acrobat. And that's something that we're already experimenting with. The question becomes, should we port our traditional graphics apps, like Photoshop and Imaging, to Linux? Right now we're taking a wait-and-see approach.

MM: *So if you, the second-largest desktop applications vendor, are not going to produce Linux apps for the desktop, who will?*

BC: In this environment, where everybody is connected, it's not just about a confined desktop system that can run your applications. It has to work within the entire enterprise workflow. Until that infrastructure is in place, I don't envision many corpora-

tions switching to Linux on the desktop.

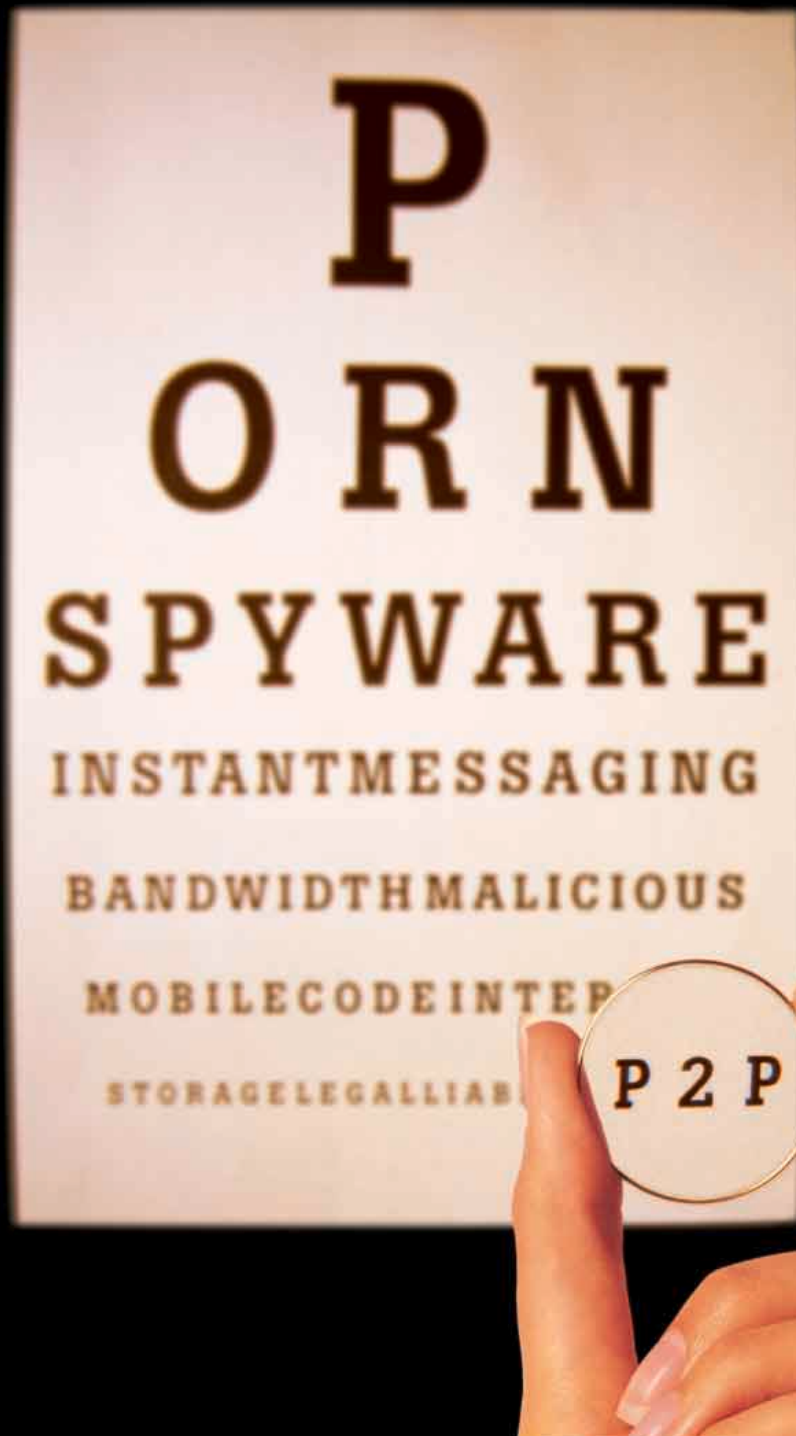
MM: *How is the Mac platform doing in the corporate space, from your perspective?*

BC: When you look at our overall revenue, we get somewhere between 22 and 25 percent of our business from Macintosh customers or software that runs on the Mac. If you factor out Acrobat and the server products, our Mac business has stayed relatively strong, which is good news. And I believe that those loyal Macintosh users continue to be loyal to the Mac. At least that's what our customers are telling us and what our revenue is telling us. What we don't see are a lot of graphics professionals moving over from Windows to Macintosh. But because of all the great things that Steve [Jobs] has done, those who are on the Mac are sticking with the Mac. Most of our customers are telling us they have plans to move to G5 this year, which is good news for the industry.

MM: *On the Windows side of the world, there were a whole bunch of desktop application companies ten years ago, but there aren't many very large ones left. You're an exception. So what's your secret?*

BC: We've learned that if we stay close to what we do well—which is build software that helps people in organizations communicate better—and if *good enough* is not acceptable, then we've competed successfully. Our focus is so clear. What's helped us a lot is that the environment has moved in our direction: The machines are more capable, people want more visually rich information, they want information that's reliable, and they want to work across multiple operating systems. All that plays into Adobe's strategy.

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A comprehensive list of our current picks in nearly 100 categories.

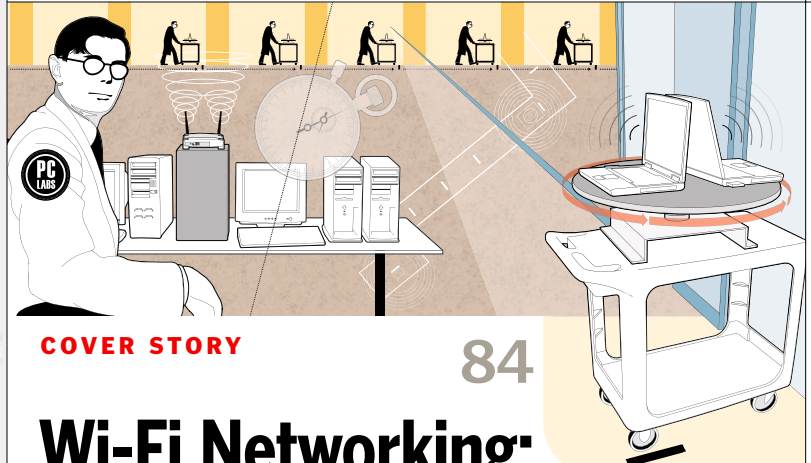
34 First Looks

- 34 Canon PowerShot ProI
- 35 Konica Minolta DiMAGE A2
- 35 Nikon CoolPix 8700
- 36 Olympus C-8080 Wide Zoom ▶
- 36 Sony Cyber-shot DSC-F828
- 37 Sun Java Studio Enterprise 6
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- 45 Xcelcius Professional Edition 3.0
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- 50 3M Bravo S10
- 52 BorderWare MXtreme Mail Firewall MX-200 v3.1
- 52 Proofpoint Protection Server 2.0



ALSO IN THIS ISSUE

- 55 Feedback
- 152 Backspace



COVER STORY

84

Wi-Fi Networking: Rated "G" for Everyone

Wireless networking is finally coming into its own, with faster and cheaper products than ever before. The popular 802.11g standard has pushed throughput to a new level, and enhanced-performance modes of some products are boosting transmission rates even higher. Here's a look at 19 of the latest wireless routers and client cards—all, of course, tested at PC Magazine Labs.

MEDIA HUBS

104 Entertainment Central



Digital music and videos are the future of fun, but playing them on your PC's speakers and display might feel a bit cramped. Being able to play these files in the right place—namely on your TV and stereo—can really expand your entertainment world. Our reviews of ten media hubs make connecting the dots easy.

ON THE COVER

Special Report: Go Wireless page 84

The Essential Personal Printer Buying Guide page 114



GPSs: 6 New Choices page 148

8-Megapixel Cameras page 34

Send Large Files Without E-Mail page 68

New Ways to Play Music Around Your House page 104

PRINTERS

114 The Essential Buying Guide: Personal Printers

Figuring out which kind of printer to buy is becoming a bigger headache every day with all the excellent options on the market. We help you sort through the different technologies and features to figure out which type best fits your needs.



MOBILE DEVELOPMENT

124 Code for the Road

The mobile workforce is growing fast, keeping pace with ever more powerful phones and PDAs. The dilemma for developers is: Which language is best for handheld apps: Java 2 Micro Edition or Microsoft .NET Compact Framework? We review the latest tools from both camps.

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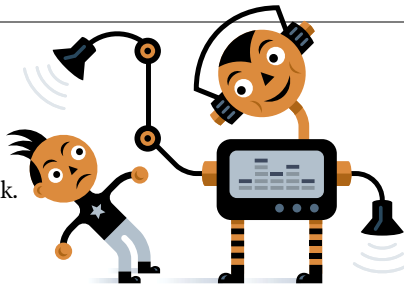
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25 Pipeline

- 25 Search square-off: Microsoft vs. Google.
- 25 The mightiest micro air vehicle.
- 25 IBM's muscular new Power5 chip.
- 26 The first commercial digital paper e-book.
- 26 Welcome to Wi-Fi city.
- 26 New directions for MP3, from its creator.
- 28 **COMING ATTRACTIONS:** HP Pavilion a500 Desktop PC Series, Casio Exilim EX-Z40 camera, Adobe Video Collection, VMware Workstation 4.5



68 Solutions

- 68 **Sending Large Files:** What do you do when your files are too big to e-mail? We explore several ways to send them safely and easily.
- 70 **Hardware:** Dual-layer DVDs will hold nearly twice as much data as standard discs.
- 72 **Security Watch:** Worried that your instant messages will be read by snoops? Here's how to protect yourself.
- 76 **Internet Business:** Here's how online grocer FreshDirect takes the hassle out of city shopping.
- 78 **Internet Professional:** Web services interoperability hasn't proved easy, but help is on the way.
- 81 **User to User:** How to highlight Excel formulas, format text as you replace it, eject a stuck CD, and more.

Opinions

- 9 Michael J. Miller: Forward Thinking
- 59 Bill Machrone
- 61 John C. Dvorak
- 63 John C. Dvorak's Inside Track
- 65 Bill Howard

148 After Hours

- 148 **O Brother, Where Am I?** We review several relatively inexpensive GPS devices for in-car and outdoor navigation. You'll never get lost again.
- 150 **Gear & Games** Judge Dredd: Dredd vs. Death; for gamers, the Logitech MX510 Performance Optical Mouse; three ways to play classic video-arcade games at home.

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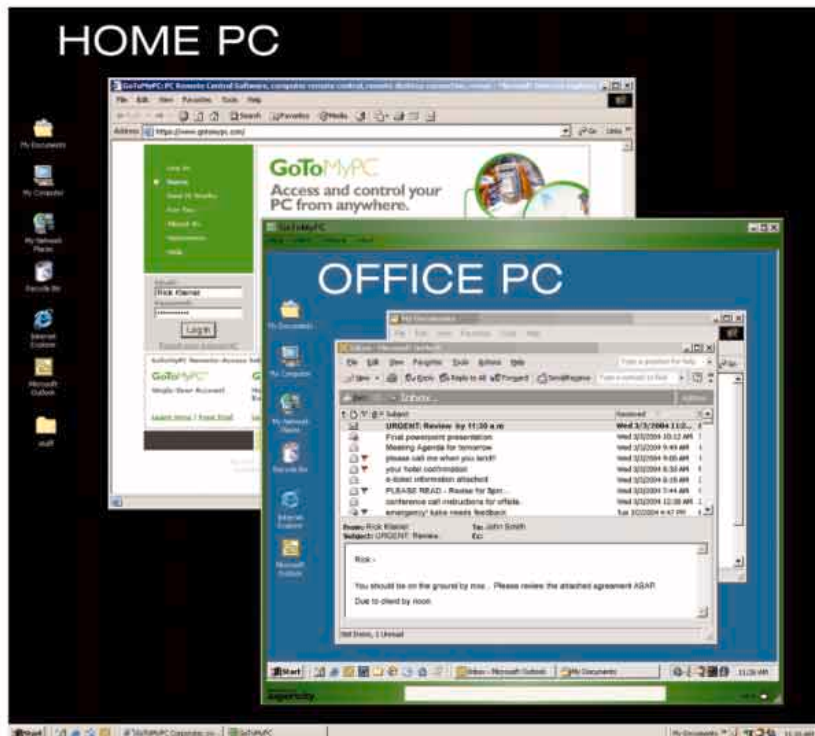
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1-800-555-2094 gateway.com Gateway® stores

AOL Keyword: Gateway

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PIPELINE

TECHNOLOGY TRENDS & NEWS ANALYSIS

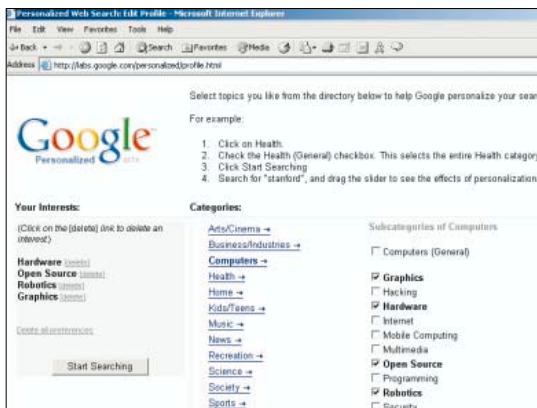
Found What You're Looking For?

Microsoft will deliver a search engine, while Google and Yahoo! move forward.

THE WEB-SEARCH FACE-OFF IS turning into one of 2004's high-profile duke-outs. New details have emerged about Microsoft's Google competitor due later this year, and Google recently added robust search personalization features. Also, since dropping its use of Google for search results, Yahoo! has expanded its index of news content to thousands of new sources.

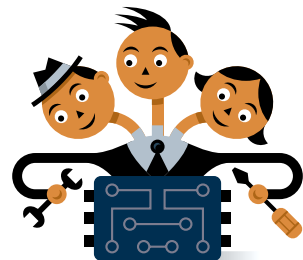
Microsoft's search tools will launch on a piecemeal basis. MSN Newsbot and MSN Blogbot will both launch by June, and Microsoft's algorithmic search engine will follow in the second half of the year. Newsbot and Blogbot will scour aggregated collections of news and Weblogs, provided by partner Moreover Technologies, to deliver personalized news links.

Microsoft CEO Steve Ballmer conceded in March that not investing in search technology earlier was a mistake, but the company has given a glimpse of what it sees as a future ace in the hole: Answerbot. Slated to show up as a search service in two years, it's based on Microsoft's natural language research. If you type "What is the tallest mountain in Washington State?" into Answerbot, it will return "Mount Rainier at 26,800 feet." At least



that's what the researchers hope. "Users don't want 40 pages of search results—they want answers," says Karen Redezki, MSN product manager.

You can try Google's search personalization features at <http://labs.google.com/>. One useful feature is a slider bar that dynamically personalizes search results. "For example," says Jen Fitzpatrick, Google's engineering director, "one person might search for 'jaguar' and get cat-related results, while another gets results for Apple's Jaguar operating system." The goal is to make Web search results more relevant. Who doesn't wish for that?—*Sebastian Rupley*



Chip Co-Op

IBM's chip-making arm is reaching out with its Power5 microprocessor, which will replace its Power4 chip found in many of the company's high-end servers and storage devices. The company is also courting more partners and codevelopers for its PowerPC processors. Sony has licensed Power Architecture chips for use in many future consumer electronics devices.

"Chip makers have pursued their own processor architectures, slowing innovation," says IBM spokesperson Chris Andrews. "There should be freedom for chip development partners to modify designs for different kinds of products [along the lines of open-source software development]." Can more cooks in the kitchen serve up better chips?—SR

MAIL WARS Searching isn't the only competitive sport for Google and Microsoft. Google is preparing a free Web e-mail service, Gmail, to compete directly with Hotmail. Gmail has advanced e-mail searching and—we'll believe it when we see it—1GB of free storage.

Tiny Eyes in the Sky



GET A LOAD OF CALIFORNIA-BASED AeroVironment's Wasp Micro Air Vehicle, which has set endurance records for pint-size planes, flying as long as two hours. The lilliputian, battery- and propeller-powered airplane has a wingspan of 13 inches and weighs 6 ounces. It, or other planes like it, could carry color digital video cameras and stream video to the ground. That application has drawn financial backing for micro-air vehicles from DARPA, the Defense Department's research arm. DARPA researchers foresee swarms of tough-to-shoot-down microplanes delivering ground surveillance above future battlefields.—SR

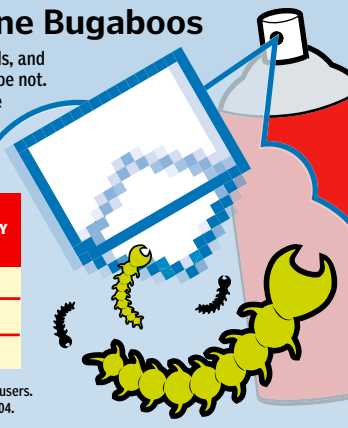
ILLUSTRATION BY BOB DALY

Beating Back Online Bugaboos

Is all the hubbub about spam, pop-up ads, and other online intrusions overblown? Maybe not. Net users seem to be paying much more attention to tools that can help them overcome online pests than they were a few months ago.

Home Internet users who block online annoyances	JULY 2003	JANUARY 2004
Banner advertising	16%	33%
Pop-up advertising	25%	42%
E-mail (spam)	34%	50%

Based on 2,290 phone interviews with U.S. Internet users. Source: Arbitron/Edison Media Research, March 2004.



Digital Paper Display



Yes, those are Japanese characters on Sony's LIBRle e-book reader (\$380 street), the first commercial product using Philips' and E Ink's electronic ink display technology. Shipping in April only in Japan, the LIBRle is the fruit of a three-year collaboration between Sony, Philips, Toppan Printing, and E Ink.

Electronic ink technology allows light, low-power displays with newsprint-like contrast ratios and viewing angles. Here's the key: The display requires only intermittent battery power—when the displayed image changes—so four triple-A batteries in the LIBRle can deliver 10,000 pages. Sony claims that it stores 500 books.

At each pixel on the LIBRle's display are a few negatively charged black beads and positively charged white beads. Electrodes cause the beads to turn to form characters and images.

E-books have not succeeded as expected "because of poor display quality on cumbersome devices," claims Yoshitaka Ukita, general manager of Sony's e-book business. With E Ink's display technology, and other digital paper efforts now viable, some analysts predict the time may be ripe for gadgets that display electronic newspapers and magazines.—SR

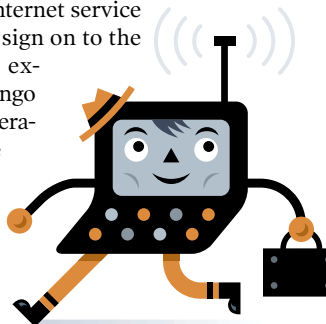
Welcome to Wi-Fi City

YOUR PHONE WORKS ALMOST EVERYWHERE THERE'S cellular service, and you get one monthly bill, right? Why, ask roving Wi-Fi users, can't we get the same deal? Answer: Slowly but surely you may, as the Wi-Fi (wireless Ethernet) providers sign cooperative deals and cellular carriers offer access to more hot spots and cellular/Wi-Fi data handoffs.

Wificom Technologies has reached an agreement allowing its Wificom SAB Server wireless Internet service provider (WISP) customers to sign on to the Boingo roaming system and exchange billing information. Boingo already integrates 70 hot spot operators worldwide. And T-Mobile announced it will offer integrated 3G cellular and Wi-Fi service, dynamically switching to whichever service is available, faster, or cheaper.

Dan Lowden, a VP at Wi-Fi provider Wayport, envisions two to four major players controlling access at hotels, airports, and restaurants, and they'll cut deals with cellular, DSL, and cable companies. Lowden says a business traveler might pay up to \$10 daily (or \$20 to \$30 monthly in company-wide deals) for good service.

"Ten dollars a day is a no-brainer for a traveler like me who has to sync Outlook over a VPN," agrees Phil Belanger of mobile networker BelAir Networks, "but the pricing is too high for mass adoption." Belanger believes the major cellular carriers hold the key to expanded Wi-Fi access, since they have the billing infrastructure and can provide future cellular-plus-Wi-Fi combinations. Until deals are struck, the waiting game is on.—Bill Howard



LOFTY IDEAS

Could plummeting hardware prices lead to an era of free hardware? So claimed Microsoft chairman Bill Gates, at a March symposium hosted by market research firm Gartner: "Ten years out, I'm not saying it will be absolutely free, but in terms of the power of servers, desktop machines, and wireless technologies, it will be [almost free]." Gates also predicted that "speech will be in every device" by then, but panelists were skeptical. Gates maintained that speech-recognition error rates are quickly approaching human error rates.

MP3 Grows Up—But Do We Want It To?



YOU CAN RIP, COPY, OR PLAY an MP3 file, but one thing you can't do is get more than two channels of sound out of it. Soon, you will be able to, although you may have more trouble copying the file. The Fraunhofer Institute, originator of the file format that brought the music industry to its knees, is adding surround sound and

copyright protection.

Expected this summer, the MP3 Surround format is based on Agere Systems' technology. "What we do is take the original surround-sound signal," explains Peter Kroon, Agere's chief multimedia architect, "and we down-mix that from 5.1 channels to stereo." Rather than capturing all the additional channel information, however, the encoding uses psychoacoustic techniques to capture only spatial and speed information for additional channels, thus preserving compact file size. The MP3 Surround files are backward-compatible, so they

play back as stereo tracks on existing players; updated hardware and software will play the files back as surround sound for 5.1 speakers.

The Fraunhofer Institute is also adding copyright protection. Dubbed Light Weight Digital Rights Management (LWDRM), when added to MP3 files it allows copying files, provided the user is willing to mark files with a digital signature—and register it. So when a file appears on Kazaa, the culprit could be swiftly found. Some will surely contend, though, that the whole appeal of MP3 files has been their flexibility—and lack of restrictions.—John R. Quain

TRACKING YOU Human rights groups have sent an open letter to the International Civil Aviation Organization, protesting plans to require radio (RFID) tracking chips in more than 1 billion passports by 2015. Privacyinternational.org has details.

Microsoft
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Flip the screen
and it's a
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It's a notebook PC, and with a flip of the screen it's as simple to use as a pad and pen. It's a Tablet PC. Now you can write ideas down or sketch them out, right on a spreadsheet* or right on an instant message. Plus it runs the full range of Windows® XP compatible applications, including the new Microsoft® Office System, so they can be at your command wherever you go. See it in action at microsoft.com/tabletpc

Microsoft
Windows xp
Tablet PC Edition

*Excel software not included with the Tablet PC and must be purchased separately. © 2004 Microsoft Corporation. All rights reserved. Microsoft, MSN, the MSN logo, Windows, the Windows logo, the Windows Start logo, and "Your potential. Our passion." are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries. The names of actual companies and products mentioned herein may be the trademarks of their respective owners.

COMING ATTRACTIONS



HP's New Consumer Desktop

Looking for a digital camera-friendly home PC that won't break the bank? Consider the new **HP Pavilion a500 Desktop PC Series**. The front-mounted FireWire port, USB 2.0 ports, and 9-in-1 media card reader make it easy to move pictures from your digital camera to the PC. Then the included HP Image Zone Plus software lets you download, manage, edit, share, print, and archive photos from within one easy-to-use application. Buyers can choose from a range of Athlon, Celeron, or Pentium 4 processors to suit their computing needs.—*Jamie M. Bsales*

\$529.99 direct and up.
Hewlett-Packard
Development Co.,
www.hpshopping.com.



First eMachines PCs from Gateway

The **eMachines M6805** and **M6809** are wide-screen notebooks built around AMD's powerful Mobile Athlon 64 processor. The Pentium 4-based **M2105**, meanwhile, is the first wide-screen portable priced below \$1,000. The 7.5-pound notebooks are relatively svelte and should deliver about two and half hours of runtime, depending on the configuration.—*JMB*

\$999 list and up. Gateway Inc.,
www.gateway.com.

Casio's Longer-Lasting Camera

The downfall of most ultraslim digital cameras has been poor battery life. The new **Casio Exilim EX-Z40** camera delivers more than twice the shots per charge of the company's outgoing Z4U

model, Casio says. The 4-megapixel Z40 features a 3X optical zoom lens. Photographers can view their subjects via either an optical viewfinder or a 2-inch LCD. In addition to fully automatic modes, shooters can choose from a variety of programmed and manual modes. The camera has 10MB of built-in memory and can accept either SD or MMC memory cards.—*Sean Carroll*
\$399.99 list. Casio Inc., www.casio.com.



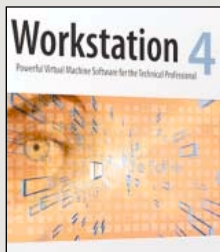
Adobe's Updated DV Suite

Adobe has updated its professional digital-video tools, available separately or in the **Adobe Video Collection**. The collection includes **Premiere Pro 1.5** for video editing, **Encore DVD 1.5** for DVD authoring, **After Effects 6.5** for adding special effects to video projects, and **Audition 1.5** for audio editing.—*JMB*
Adobe Video Collection Standard Edition: \$999 direct. Professional Edition: \$1,499. Adobe Systems Inc., www.adobe.com.



Improved Virtual Desktop

VMware Workstation 4.5 brings new power to the popular virtual-machine software for IT personnel and developers. Available for both Windows and Linux host operating systems, the new build's improvements include plug-and-play support for USB devices and support for more memory for virtual machines.—*JMB*
\$189 direct. VMware, www.vmware.com.



Make Web Photo Albums

BrilliantPhoto 1.2 lets users easily create multi-page Web-based photo albums for friends and family. Other new features in the photo management utility let you straighten crooked photos, add music to slide shows, and search your collection more easily.—*JMB*
\$29 direct. Brilliant Labs Inc., www.brilliantlabs.com.



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to read this magazine... yet still pay
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EDITORS' CHOICES

MAY 18–JUNE 7, 2004



In the market to buy? Here are our latest Editors' Choices in the leading technology categories—the products we've picked as the best from the hundreds that PC Magazine Labs has been testing. For links to the complete reviews, including dates of publication, visit www.pcmag.com/editorschoice.

DESKTOP PCs

GAMING DESKTOPS

- Dell Dimension XPS—3.4-GHz Extreme Edition
- Falcon Northwest FragBox Pro
- Velocity Micro Vision FX

MULTIMEDIA DESKTOPS

- Apple Power Mac G5 Dual 2 GHz
- Velocity Micro ProMagix

MEDIA CENTER PCs

- Gateway Media Center FMC-901X
- Sony VAIO Digital Studio PCV-RZ46G

VALUE PC

- eMachines T2865

HOME PC

- Sony VAIO PCV-W500GN1

CORPORATE PC

- IBM ThinkCentre S50

PORTABLE PCs

BUSINESS NOTEBOOK

- IBM ThinkPad T40

GAMING NOTEBOOK

- Dell Inspiron XPS

MULTIMEDIA NOTEBOOK

- NEW** HP Pavilion zd7000

ULTRAPORTABLE

- IBM ThinkPad X40

TABLET PCs

- HP Compaq TC1100
- Toshiba Portégé M205-S809



IBM ThinkCentre S50



HP Pavilion zd7000

MOBILE DEVICES

PDA's

- HP iPaq Pocket PC h4350
- Sony Clié PEG-UX50

PDA/PHONE COMBO

- Handspring Treo 600

PHONE

- Motorola MPx200

GPS DEVICE

- TomTom Bluetooth GPS Receiver



Creative Labs SoundBlaster Wireless

HOME ENTERTAINMENT

MEDIA CENTER PCs

- Gateway Media Center FMC-901X
- Sony VAIO Digital Studio PCV-RZ46G

MEDIA HUBS

- NEW** Creative Labs SoundBlaster Wireless (music)
- Prismiq MediaPlayer (multimedia)



Konica Minolta DiMage A2

- NEW** Turtle Beach Audiotron AT-100 (music)

DIGITAL VIDEO RECORDER

- SnapStream Beyond TV 3

HDTV

- Sharp Aquos 37-inch LCD TV

CAMERAS

COMPACT CAMERAS

- Kodak EasyShare LS743
- Sony Cyber-shot DSC-T1

MIDRANGE CAMERA

- Olympus C-5060 Wide Zoom

PROSUMER CAMERAS

- NEW** Konica Minolta DiMage A2

NEW Olympus C-8080

- Wide Zoom

DIGITAL SLR CAMERA

- Olympus E-1

ENTRY-LEVEL DV CAMCORDER

- Sony DCR-HC40 MiniDV Handycam

DIGITAL IMAGING

CONSUMER PHOTO PRINTER

- HP Photosmart 7960

PROFESSIONAL PHOTO PRINTER

- Epson Stylus Pro 4000

CONSUMER IMAGE EDITOR

- Adobe Photoshop Elements 2.0

PROFESSIONAL IMAGE EDITOR

- Adobe Photoshop CS

PHOTO ALBUM SOFTWARE

- Adobe Photoshop Album 2.0

PHOTO SHARING

- OurPictures

- Smugmug

PHOTO-PRINTING SERVICE

- Shutterfly

DIGITAL AUDIO & VIDEO

ANALOG CAPTURE DEVICE

- HP DVD Movie Writer dc3000

CONSUMER VIDEO EDITOR

- Pinnacle Studio 8

PROFESSIONAL VIDEO EDITOR

- Adobe Premiere Pro CD/DVD-BURNING SUITE

DVD AUTHORIZING

- Roxio Easy Media Creator 7
- NEW** Ulead DVD WorkShop 2 (professional)

PORTABLE AUDIO PLAYERS

- Apple iPod
- Apple iPod Mini
- iRiver iFP-390

SOUND CARD

- Creative Labs Sound Blaster Audigy 2 ZS



iRiver iFP-390

SPEAKERS

- Creative Labs Gigaworks S750
- Klipsch ProMedia GMX D-5.1

PC JUKEBOX

- MusicMatch Jukebox 8.2

MUSIC STORE

- Napster 2.0

WEBCAM

- Logitech QuickCam Pro

Sony DCR-HC40 MiniDV Handycam



PRINTERS

PERSONAL PRINTERS

- Brother HL-5040 (laser)
- HP Deskjet 5150 (ink jet)

NEW Lexmark C510n

- (color laser)

PERSONAL MFP's

- Brother MFC-8420 (laser)
- Canon MultiPass MP730 (ink jet)
- Dell A940 (ink jet)

EDITORS' CHOICES

MAY 18-JUNE 7, 2004

PHOTO PRINTERS

- Epson Stylus Pro 4000 (pro)
- HP Photosmart 7960 (consumer)

NETWORK PRINTERS

- HP LaserJet 9000dn (monochrome laser)
- Xerox Phaser 4500DT (monochrome laser)
- Xerox Phaser 7750DN (color laser)

DISPLAYS & STORAGE

BUSINESS DISPLAYS

- Dell UltraSharp 1901FP
- Samsung SyncMaster 171N

BUSINESS PROJECTOR

- NEC VT460

GAMING GRAPHICS CARD

- ATI Radeon 9800 XT

MAINSTREAM GRAPHICS CARD

- PNY Verto GeForce 5700 FX Ultra

HDTV

- Sharp Aquos 37-inch LCD TV

DVD BURNERS

- HP DVD Movie Writer dc3000

HP DVD Movie Writer dc3000



- Plextor PX-708UF
- TDK 8X Indi

EXTERNAL DRIVE

- Maxtor OneTouch

PRODUCTIVITY SOFTWARE

OFFICE SUITE

- Microsoft Office 2003

OCR

- ScanSoft OmniPage Pro 14 Office

PDF CREATION

- Adobe Acrobat 6.0
- FinePrint pdfFactory PRO 1.57
- Jaws PDF Creator 3.0

DOCUMENT MANAGEMENT

- ScanSoft PaperPort Pro 9 Office

DESKTOP PUBLISHING

- Adobe InDesign CS

FINANCE & ACCOUNTING

- Microsoft Money 2004 Premium

- QuickBooks Premier 2004
- Quicken 2004 Premier

WEB SITE CREATION

- NeoVerve StoreSense

MEDIA CREATION SUITE

- Roxio Easy Media Creator 7

E-MAIL CLIENT

- Microsoft Outlook 2003

VIDEOCONFERENCING

- SightSpeed Video Messenger
- VidiTel

DATABASE

- FileMaker Pro 7

UTILITIES

SECURITY

- Norton AntiVirus 2004 (antivirus)
- Norton Internet Security 2004 (suite)
- Norton Personal Firewall 2004 (firewall)
- SpySweeper 2.2 (antispyware)
- ZoneAlarm 4.5 (firewall)
- ANTISPAM
- Norton AntiSpam 2004
- Qurb

POP-UP BLOCKER

- PopUp Cop

INSTANT MESSAGING

- MSN Messenger 6.1

ARCHIVING

- PKZIP for Windows

PARTITIONING

- PartitionMagic 8.0

REMOTE CONTROL

- GoToMyPC 4.0

VIRTUAL PC

- VMWare Workstation 5

BLOG/WIKI TOOLS

- EditMe
- Socialtext Workplace 1.0
- TypePad

SEARCH TOOL

- Google Toolbar

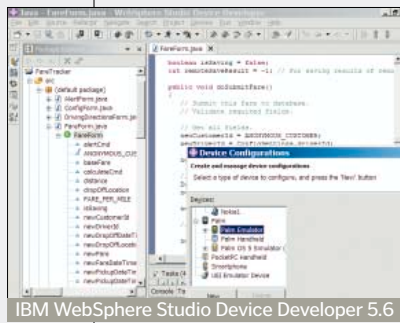
ENTERPRISE SOFTWARE & DEVELOPMENT

NETWORK ANTIVIRUS

- Trend Micro Enterprise Protection Strategy

ENTERPRISE ANTISPAM

- BrightMail Anti-Spam 5.1
- Postini Perimeter Manager



IBM WebSphere Studio Device Developer 5.6

E-MAIL SERVER PLATFORM

- IBM Lotus Notes and Domino 6.5

WIRELESS PLATFORM

- NEW GoodLink 3.0

WEB FILTERING

- Websense Enterprise 5.1

CRM

- Salesforce.com

DATABASE

- Oracle 9i Database

WEB CONFERENCING

- WebEx Meeting Center

ENTERPRISE DEVELOPMENT

- Borland JBuilder 9
- NEW IBM WebSphere Studio Device Developer 5.6 (mobile)
- SQL Anywhere Studio 9 (mobile)

Netgear ProSafeFWAG114



WEB SITE DEVELOPMENT

- Macromedia Contribute
- Macromedia Studio MX 2004

WEB SITE ANALYSIS

- WebTrends Live Enterprise Edition

VULNERABILITY SCANNER

- Retina Network Security Scanner

NETWORKING

SERVER HARDWARE

- Dell PowerEdge 1750

SERVER OS

- Microsoft Windows Server 2003 Enterprise Edition

WIRELESS INFRASTRUCTURE

- NEW Linksys Wireless-G WRT54GS (802.11g)

- NEW Netgear ProSafeFWAG114 (802.11a/g)

SECURITY APPLIANCE

- ServGate EdgeForce (small-business)

REMOTE-ACCESS APPLIANCE

- Neoteris Access 1000

NETWORK PRINTERS

- HP LaserJet 9000dn (monochrome laser)
- Xerox Phaser 4500DT (monochrome laser)
- Xerox Phaser 7750DN (color laser)



Linksys Wireless-G WRT54GS

GAMES & EDUCATIONAL SOFTWARE

SIMULATION

- Microsoft Flight Simulator 2004

ACTION/COMBAT

- Halo: Combat Evolved
- Orbz 2
- Savage: The Battle for Newerth

SPORTS

- Madden NFL 2003

VIRTUAL WORLD

- Second Life

ONLINE

- EverQuest: Evolution

EDUCATION

- Math Mission: The Race to Spectacle City Arcade, The Amazing Arcade Adventure
- Zoombinis Island Odyssey

MOBILE GAME

- Bejeweled

REFERENCE

- Microsoft Encarta 2004
- Visual Thesaurus

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Branch Office



Back Office



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Road-Warrior Office

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Color Laser Solutions



Network Printer Solutions



Multi-Function Solutions



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* Purchase Influence in Larger American Businesses (Erdos & Morgan, 2001).



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37 Sun Java Studio Enterprise 6
37 GoodLink 3.0
38 WordPerfect Office 12 Standard Edition
40 Sony VAIO Digital Studio PCV-RS520

40 Gateway 710G Gamer
40 Polywell Poly 900NF3-FX53
40 Falcon Northwest Mach V FX-53
40 eMachines T2742

43 Toshiba Tecra M2-S630
43 Toshiba Satellite P15-S420
43 Eurocom Mirage D870P
43 Twinhead N15RN
43 Dell Latitude D505

44 HP Pavilion zd7000
44 Dell Inspiron 9100
44 HP Compaq nc8000
44 Resco Explorer 2003 for Pocket PC
44 Motorola V600

Super Eight Shooters

THE MAGAZINE
WORLD'S LARGEST
COMPUTER-TESTING
FACILITY



BY DANIEL GROTTA & SALLY WIENER GROTTA

In June of last year, Sony announced the industry's first 8-megapixel CCD. It hasn't taken long for this powerhouse to show up in a host of cameras. For the prosumer shooter, 8MP images translate into crisp, razor-sharp 14-by-17 prints. Even better, fine details are maintained when you crop in on and blow up small sections of an image. • We tested five of the latest 8MP cameras, priced from \$999 to \$1,100. They share many features, including 3,264-by-2,448 maximum resolution,

metal bodies, extended (but noninterchangeable) zoom lenses, electronic eye-level viewfinders, intelligent hot shoes for strobes, pop-up flashes, autofocus assist beams, and RAW file capabilities (RAW is a lossless file format that preserves images in an unprocessed state for later manipulation).

If image quality is your paramount concern and you have around \$1,000 to spend on a camera, we still recommend a true digital SLR (such as the Canon Digital Rebel or Olympus E1). But for those who want the ease of a point-and-shoot but the image quality of a higher-end model, these new models might be just right.

Canon PowerShot Pro1

The Canon PowerShot Pro1 represents a big step forward versus the former top of the PowerShot line, the 5MP G5. The Pro1 is smaller, rounder,

and more user friendly than the G5. This design, combined with the 8MP CCD and the new, more powerful zoom lens, give it the ability to take razor-sharp pictures—the sharpest on our resolution tests.

The Pro1's heft and sculpted body, coupled with convenient clusters of easy-to-operate controls, give it an all-business look and feel and allow easy one-handed shooting. On the camera's top is an oversized, very legible control panel. Directly behind is the select dial, which,

in addition to the usual modes, offers two user-defined settings.

The Pro1's 2-inch LCD display is fully articulated for viewing from almost any position, but its eye-level electronic viewfinder isn't as detailed as that of the Konica Mi-



THE KONICA MINOLTA

DiMAGE A2 (above) is the only camera here with image stabilization. The Canon PowerShot Pro1 is a solid entry.

nolta DiMAGE A2. There's no antishake capability, and zooming the 7X zoom lens (a 28- to 200-mm equivalent) is power-assisted rather than mechanical (though you can control zoom speed by the speed with which you twist the zoom collar). Manual focus is kludgy: You must hold a button and turn the lens collar (so you can't zoom while manually focusing).

Though a bit crowded, the menus are extensive, legible, and intelligently organized. They can be displayed on either the LCD or the eye-level viewfinder. On playback, magnifying an image is as easy as turning the lens collar. The camera can record 640-by-480 video, but its top frame rate is only 15 fps for 30 seconds.

Although the Pro1 is no speed demon, its performance is good, and it shoots bursts of 2.5 images per second for up to six shots. Images are among the sharpest we've seen in this class, with excellent detail and supercrisp edges (which bodes well for enlargements). Our simulated daylight still life exhibited good exposure and accurate colors, but the flash shot was overexposed and too warm.

Still, the Canon PowerShot Pro1's combination of compact design, excellent ergonomics, relatively easy operation, and supersharp resolution add up to a first-class camera.

Canon PowerShot Pro1

\$999 list. Canon U.S.A. Inc., www.usa.canon.com. OVERALL ●●●●●
Ease of use ●●●●●
Power ●●●●●
Performance ●●●●●
Image quality ●●●●●

PHOTOGRAPHY BY THOMAS CONNOR

LOOKS

WHAT THE RATINGS MEAN: ●●●● EXCELLENT | ●●●○ VERY GOOD | ●●○○ GOOD | ●○○○ FAIR | ○○○○ POOR

- 45 X1 Search 3.0
- 45 Xcelsius Professional Edition 3.0
- 46 Ulead DVD MovieFactory 3 Disc Creator
- 46 Ulead DVD Workshop 2

- 47 Philips KEY019 Key Ring Camcorder
- 48 Lexmark C510n
- 48 Lexmark C752Ldn
- 48 HP LaserJet 3015 All-in-One
- 48 HP LaserJet 3030 All-in-One

- 48 Canon imageProGraf W6200
- 50 Samsung SyncMaster 192MP
- 50 Envision EN-7220
- 50 Sony SDM-HS73P
- 50 Xerox XL795D

- 50 3M Bravo S10
 - 52 BorderWare MXtreme Mail Firewall MX-200 v3.1
 - 52 Proofpoint Protection Server 2.0
- Red type denotes Editors' Choice

Konica Minolta DiMage A2



The Konica Minolta DiMage A2 offers exceptional functions and excellent handling characteristics. While it can't quite match the Olympus model's image quality, it outzooms the Olympus and is the only camera in our roundup that's equipped with antishake technology. These features make the DiMage A2 ideal for rock-solid handheld telephoto shots and worthy of an Editors' Choice.

The unit's oversize, sculpted grip makes for easy operation, even one-handed. Most controls are accessible to the right hand, with the remainder along the left side. By default, antishake is on, though it's easy to turn off when not required, such as when you're shooting in wide angle or with a tripod.

The DiMage A2 is the only camera here with a movable eye-level viewfinder. Its electronic viewfinder has the highest resolution in this roundup, and it's the only camera here that can switch from the 1.8-inch LCD on the back of the unit to the eye-level viewfinder when it senses you've brought the camera up to your eye.

Manual focus is done via focus-by-wire rather than a mechanism like Sony's superior mechanical focus. But not only is the 7X zoom lens (28- to 200-mm equivalent) the only one we tested with an optical stabilizer (the CCD actually moves to offset camera motion), it's the only true apochromatic digital lens (cor-

rected for all three primary colors) on the market.

This camera can shoot JPEG, RAW, and TIFF images; pros will appreciate its ability to save both RAW and JPEG files simultaneously. You can shoot 544-by-408 video clips up to 15 minutes long at 30 fps. Menus



Nikon CoolPix 8700

The smallest and lightest camera in our roundup, the Nikon CoolPix 8700 offers the greatest optical zoom ratio and the most program modes. It's the only model with a best-shot selector—a feature that lets the camera take a series of shots, determine which is the best exposed, and discard the rest. But despite excellent ergonomics and novice assists, the CoolPix 8700 isn't easy to operate.

The CoolPix 8700 is a beautifully balanced camera that fits most hands perfectly. It's designed for easy two-handed operation, with clusters of controls along the side of the lens and to the right of the LCD viewfinder.

The CoolPix 8700 has a fully articulated 1.8-inch LCD viewfinder that can swivel towards the shooter for self-portraits. The LCD viewfinder is bright, but in Setup mode the white-on-grey text can be hard to read. Settings displayed on the minuscule control panel can also be hard to read. But

the 15 program modes are easy to set, and the best-shot selector helps ensure optimum image quality.

Nikon's 8X zoom lens (a 35- to 280-mm equivalent) favors extreme telephoto over wide angle—all the more reason why we wish it came equipped with image stabilization like the DiMage A2, so that zoomed-in shots at slow shutter speeds wouldn't be blurred. Unlike the Sony unit, which offers precise manual zoom and focus, the CoolPix 8700's motorized zoom works at one speed only, and its zone-type manual focus is awkward and difficult to use.

The CoolPix 8700 can save JPEG, RAW, and TIFF files. It can also record 640-by-480 videos at 30 fps, but with a maximum length of only 35 seconds. Shooting is a mixed bag. The camera handles well, and although it can shoot a five-shot burst mode at 2.5 images per second, its boot and recycle speeds are somewhat sluggish. Image quality is very good to excellent, with good flash illumination and simulated daylight exposure, and colors that are pleasing.

The CoolPix 8700 may not be the easiest camera in this roundup to operate (though its best-shot mode helps), but it's still a solid choice, especially for those who always find themselves wanting to zoom just a little bit closer.

THE OLYMPUS C-8080 delivered the best images. Nikon CoolPix 8700 (top) offers the greatest optical zoom ratio here.

are bright, legible, and intuitive.

Performance is a mixed bag. While boot time is average, the DiMage A2 has the fastest click-to-click speed and a three-shot burst mode, at 2.7 images per second. Image quality and exposure are very good, though the colors in both of our still life shots tended to be slightly yellowish.

The DiMage A2 offers a good combination of quality, features, and performance.

Konica Minolta DiMage A2

\$1,100 street. Konica Minolta Photo Imaging U.S.A. Inc., www.konicaminolta.com. OVERALL ●●●●○ Ease of use ●●●●○ Power ●●●●○ Performance ●●●●○ Image quality ●●●●○

Nikon CoolPix 8700

\$999 list. Nikon USA, www.nikon.usa.com. OVERALL ●●●●○ Ease of use ●●●●○ Power ●●●●○ Performance ●●●●○ Image quality ●●●●○

Olympus C-8080 Wide Zoom



This solid workhorse of a camera doesn't have the longest zoom, and its menus take some getting used to. But unless you need to zoom in closer, the time it'll take you to learn its ins and outs will be amply rewarded. Five-star image quality and an impressive set of features make the Olympus C-8080 Wide Zoom an Editors' Choice.

The C-8080 is designed to be operated with both hands for maximum stability, with lots of nonslip material on the body and lens barrel. The camera's bevy of analog controls are scattered but conveniently placed and well marked, and although the camera offers only five program modes, they're instantly available on the Select dial.

Like the Konica Minolta unit, the C-8080's 1.8-inch LCD viewfinder isn't fully articulated, but it can be flipped 180 degrees along the back of the camera. One other complaint: To focus the camera manually you have to use the jog buttons. These work well, but ease of use takes a hit here.

In addition, its motorized 5X zoom lens (a 28- to 140-mm equivalent) is activated by a lever above the shutter button. Zoom speed can't be altered. The C-8080 has dual media slots for CompactFlash and xD-Picture Cards. To protect the memory cards, an interlock stops activity when the media door is inadvertently opened.

Image files may be saved as JPEGs with three compression levels or as uncompressed RAW or TIFF files. Top video resolution is 640 by 480 pixels at 15 fps, until the memory card is filled. Although it has controls for adjusting hue and color saturation, the C-8080 is limited to sRGB, not multiple color spaces like the DiMage A2. The C-8080's menu structure is extensive and several levels deep,

reflecting the camera's many options and features.

The C-8080 is a reasonably fast shooter, with quick bootup time and fair recycle time, though slow button and menu navigation may bog things down. It has a burst mode of five images at 1.6 images per second. You also get an impressive eight user-defined setups and the ability to assign a button for one frequent function.

Our flash still life had rich colors and great illumination, and the simulated daylight shot was well exposed, with good color. All the cameras in this roundup shot good images, but the C-8080's were noticeably better at its factory default settings.

Excellent picture quality, good depth of features, and a body built like a tank make the C-8080 a top choice for serious shooters.

Olympus C-8080 Wide Zoom

\$1,000 street. Olympus America Inc., www.olympusamerica.com.
OVERALL ●●●●○ Ease of use ●●●●○ Power ●●●●● Performance ●●●●○ Image quality ●●●●●

Sony Cyber-shot DSC-F828

The Sony Cyber-shot DSC-F828 was the first 8MP camera out of the gate last autumn, and it's the only one to use a four-color version of the Sony CCD. But the early version we tested ("Digital Photography for Everyone," March 16, page 72) didn't fare well on image-quality tests. Sony has since upgraded its

firmware (available as a free download), so we gave it another look. Not only has sharpness and resolution dramatically improved, but the DSC-F828 has proved to be the easiest 8MP camera to operate.

The DSC-F828 is the biggest and heaviest camera in our roundup, with a huge 7X zoom lens (a 28- to 200-



NOT A SHIRT-POCKET SHOOTER, the Sony Cyber-shot DSC-F828 is large but well-balanced. It delivers a host of features as well as very good image quality.

mm equivalent) as large as the body itself. Rather than using an articulated LCD, the camera's lens/body can rotate 140 degrees. A well-balanced, two-handed camera, the DSC-F828 is the only one here with manual mechanical focus and zoom capability for more precise control. Also, its tripod screw socket is directly beneath the lens for easier, more accurate panoramas. At f2, it has the fastest lens in our roundup, for better available-light photography. In addition, the DSC-F828 is equipped with Sony's Nightshot and Nightframing, for viewing and shooting in total darkness.

Controls are scattered but well marked, and the short-throw four-way jog button is one of the best we've tried. In aperture or shutter priority mode, rotating the secondary select dial actually lightens or darkens the viewfinder, so users can preview how their selection affects depth of field.

DSC-F828 images can be saved as JPEGs, with two levels of compression, or as uncompressed RAW or TIFF files. It records 640-by-480 videos at 30 fps until memory fills. The

DSC-F828's menus are simple, logical, and legible, using clear and unambiguous words and phrases. The command structure is complicated, however, and some modes will display only select menus, with additional options available only through analog controls.

With the fastest bootup, second-fastest click-to-click, and fast throughput, the DSC-F828 is peppy. Burst mode is seven shots in less than 3 seconds. Our test still-life photos are crisply defined, with superb sharpness. However, the flash shot was too warm and bright, while the simulated daylight shot was slightly underexposed, with a significant shift to cyan.

A fun camera for serious amateurs, the DSC-F828 produces sharp pictures, though not perfect color.

Sony Cyber-shot DSC-F828

\$999 list. Sony Electronics Inc., www.sonystyle.com. **OVERALL** ●●●●○ Ease of use ●●●●○ Power ●●●●● Performance ●●●●○ Image quality ●●●●○

8-MEGAPIXEL DIGITAL-CAMERA TESTS

	PERFORMANCE TESTS ▼		RESOLUTION ▲		TRANSITION PIXELS ▼	
	Boot time (seconds)	Recycle time (seconds)	Horizontal (lines)	Vertical (lines)	Horizontal	Vertical
Canon PowerShot Pro1	3.6	1.9	1,800	1,800	1.3%	1.0%
Konica Minolta DiMage A2	2.1	1.1	1,600	1,600	2.0%	1.9%
Nikon CoolPix 8700	3.8	2.4	1,650	1,650	1.3%	1.6%
Olympus C-8080 Wide Zoom	1.5	1.9	1,750	1,800	2.1%	1.7%
Sony Cyber-shot DSC-F828	1.2	1.3	1,700	1,750	1.7%	1.4%

RED denotes Editors' Choice.

Sun Debuts a New Developer's Suite

BY RICHARD V. DRAGAN

Aimed at enterprise developers running Sun's server platform, **Sun Java Studio Enterprise 6** offers a welcome redesign of its compiler and tools for Java. With

impressive new technology, a brand-new application framework, and a number of J2EE wizards, this suite can be instrumental in your next large development project.

Java Studio includes helpful

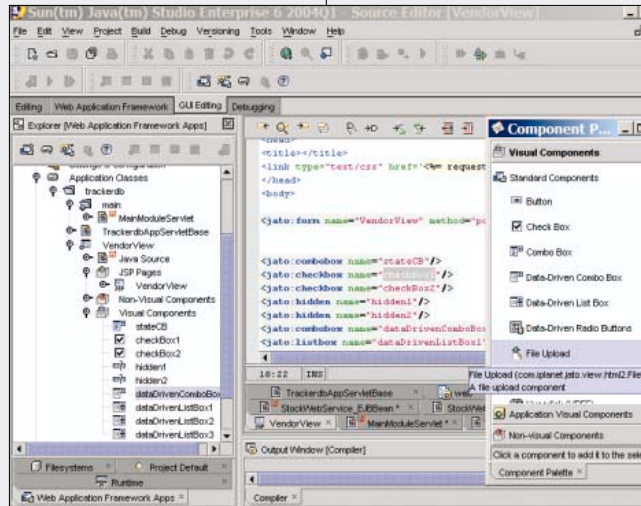
wizards for creating common J2EE applications and objects, including an EJB wizard. There's also step-by-step support for consuming or creating Web services. We created a Web service for accessing customer information and an EJB to model customers and orders against an Oracle database. By default, the wizard generates an EJB to power the Web service, which is an innovative option.

A significant reason to choose Java Studio is its new version of Sun's Web Application Framework, a set of components, classes, and wizards designed to take on Struts as the industry standard method for building Web applications. This framework relies on Model-View-Controller classes to split up presentation and business logic. Struts does the same, but Java Studio incorporates the latest in software patterns from industry and in-house experts.

We liked that you could design JSPs and underlying Java code with several dozen visual and nonvisual components and that you could add WAF support to existing projects. This approach to programming is easier than with Struts, though not as intuitive as BEA's WebLogic Workshop component model.

Java Studio is a natural fit for any enterprise that runs Sun's application server platform. And if you want to stay current with the best recommended practices for designing scalable enterprise software on J2EE, Sun's new application framework technology is a powerful solution. It's less intuitive to learn than the competing IDEs from Borland and IBM, but it imposes few limitations on productivity.

Sun Java Studio Enterprise 6
\$1,895 direct. Sun Microsystems Inc., www.sun.com. ●●●●○



SUN JAVA STUDIO ENTERPRISE 6 offers the latest software patterns for enterprise applications.

Good Gets Even Better

BY RICHARD V. DRAGAN

PC MAGAZINE EDITORS' CHOICE With its innovative cradle-less synchronization of Exchange data and newfound support for Treo 600 Palm OS devices, Good's new **GoodLink 3.0** wireless platform delivers excellent reach in enterprise mobile software. The latest version adds some nicely improved administration abilities and more deployment and carrier options.

With this release, the company moves beyond its support for a limited number of end-user devices (namely its own G100 unit plus RIM 950 and 957 handhelds) and lets enterprises deploy Treo 600 phone/PDA combo devices. Good has also announced support for Pocket PC, with clients due out later this year.

As in previous releases, IT control over password and security options is excellent. Unlike the competing BlackBerry Enterprise Server, GoodLink now allows you to designate additional administrators with policy-based control over additional provisioning. This release also adds Web administration support for registering and checking the status of devices and servers via the GoodLink portal through a browser.

On the client side, GoodLink Server's claim to fame is clearly still its over-the-air approach to synchronizing Exchange data, including e-mail, contacts, calendars, and tasks. With GoodLink, you don't need to connect the PDA to stay current with data.

On the Treo 600 we tested, GoodLink's client applet mim-

icked previous releases, with a well-thought-out mobile interface. Features such as automatic capitalization, auto-selection of e-mail addresses, and wider support for attachments are welcome improvements here. You can now view rich attachments, as long as the corre-

sponding viewer is installed on your device.

Good's open-minded approach to syncing up mobile users deserves a serious look from any organization that runs Exchange and wants to bring connectivity to its workforce.

GoodLink 3.0
\$330 direct per user (volume discounts available). Good Technology Inc., www.good.com. ●●●●○



NEW IN VERSION 3.0, the Good Portal Monitor lets IT personnel check and manage GoodLink mobile devices via the Web.

WordPerfect Office Fits a Microsoft-Centric World

BY EDWARD MENDELSON

Corel designed its **WordPerfect Office 12** productivity suite for two kinds of users: WordPerfect loyalists looking for smoother integration with a Microsoft Office-centric universe, and anyone who wants a powerful alternative to MS Office. Almost all the improvements in WP Office contribute to making this sleek-looking suite exchange data seamlessly with Microsoft products and provide an easy transition for anyone switching from MS Office.

When you first launch the WordPerfect word processor, Quattro Pro spreadsheet, or Presentations application, a dialog asks if you want to work in the program's native interface or an interface that closely resembles the corresponding Microsoft program. Slick. If you choose Microsoft Word mode for WordPerfect, the menus, toolbars, and keyboard layout almost exactly match their Microsoft equivalents—and your documents are saved in Microsoft Word format instead of WordPerfect's native format.

The dialog boxes brought up by the menus and toolbars are the standard WordPerfect dialogs, however. These provide features not offered by Microsoft, such as built-in export to PDF format (complete with hyperlinks).

The Microsoft compatibility

features are impressive but incomplete; they can have unsettling consequences if you aren't careful. The Word-compatible keyboard layout mistakenly uses Ctrl-Del to delete everything from the cursor to the end of the line (the WordPerfect default) instead of deleting only one word, as in Microsoft's keyboard layout. (This will reportedly be fixed in a forthcoming service pack.)

"Don't add space between paragraphs of the same style," and the left margin of the document's footnotes shifted to the main page margin.

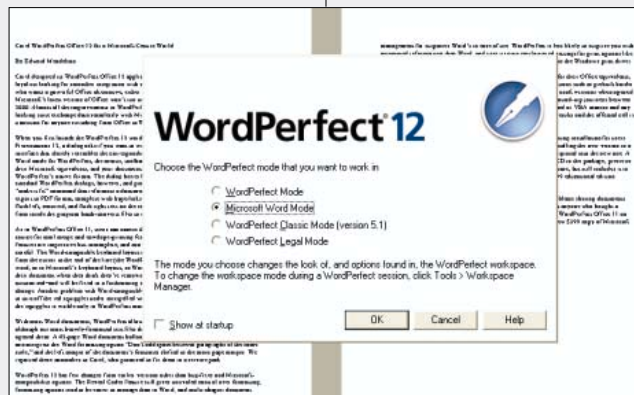
Aside from the new compatibility options, WordPerfect has few changes from earlier versions. The Reveal Codes feature still gives unrivaled control over formatting. These options tend to be easier to manage than in Word, and

Macromedia Flash SWF format.

New layout options, such as prebuilt border patterns, allow Excel and PowerPoint files to look more like their Microsoft versions when opened in Corel's programs, but the programs are otherwise unchanged from earlier versions. Our relatively simple test spreadsheets made round-trip journeys between Excel and Quattro Pro with no difficulty. But note that Quattro Pro won't convert Excel or VBA macros; any cells with functions that aren't duplicated in Quattro Pro are highlighted in red.

The installation program now offers the option of upgrading an existing installation for users who don't want to follow the traditional WordPerfect method of installing the new version in a separate folder. Settings from the earlier version are successfully migrated into the new one. Corel no longer upgrades the Paradox database but still includes it in WordPerfect Office 12 Professional (\$349 direct, upgrade \$199). A \$99 educational edition of the suite is slated for June.

Those using earlier WordPerfect versions who haven't experienced problems sharing documents with MS Office users won't find much reason to upgrade to WordPerfect Office 12. But those who need an MS Office-compatible suite but can't swing the purchase price for MS Office proper (currently \$499 direct for the Professional Edition, \$399 for the Standard Edition, and \$149 for the Student and Teacher Edition) should take a look—especially if they qualify as an upgrade or education buyer and can get the lower price.

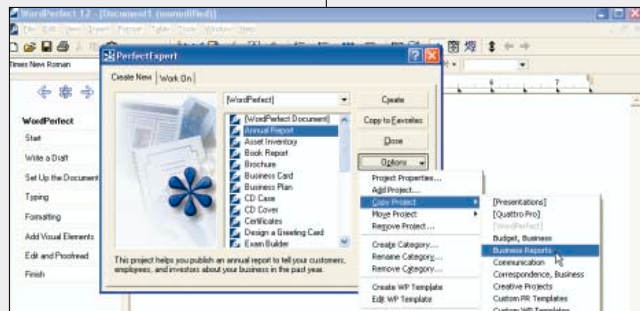


UPON OPENING A DOCUMENT, the WordPerfect Office 12 applications will prompt you to select which mode you prefer to work in: the program's native mode or the equivalent Microsoft offering.

With most Word documents, WordPerfect allows almost perfect back-and-forth compatibility, although our most heavily formatted test files displayed some anomalies when WordPerfect opened them. A 42-page Word document ballooned to 46 pages because WordPerfect misinterpreted the Word formatting option

multichapter document management far surpasses Word's in ease of use. WordPerfect is less likely to surprise you with automated reformatting than Word, and it uses its own easily stored settings for print options like booklets and duplexing rather than making you set them each time in the Windows print driver. A special-purpose legal interface mode displays WordPerfect's traditionally strong tools for pleadings and other legal formats, and a "classic" interface mode makes a half-hearted effort to reproduce the blue-screen environment of WordPerfect 5.1 for DOS.

Quattro Pro and Presentations remain adequate replacements for their MS Office equivalents and add direct-to-PDF export. Presentations also features direct export to the



AS BEFORE, THE SUITE includes a welcome selection of document templates to get you started. The interface is well-thought-out and inviting, which should help those transitioning from Microsoft apps.

WordPerfect Office 12 Standard Edition
 \$299 direct; upgrade, \$149. Corel Corp., www.wordperfect.com.
 ●●●●○

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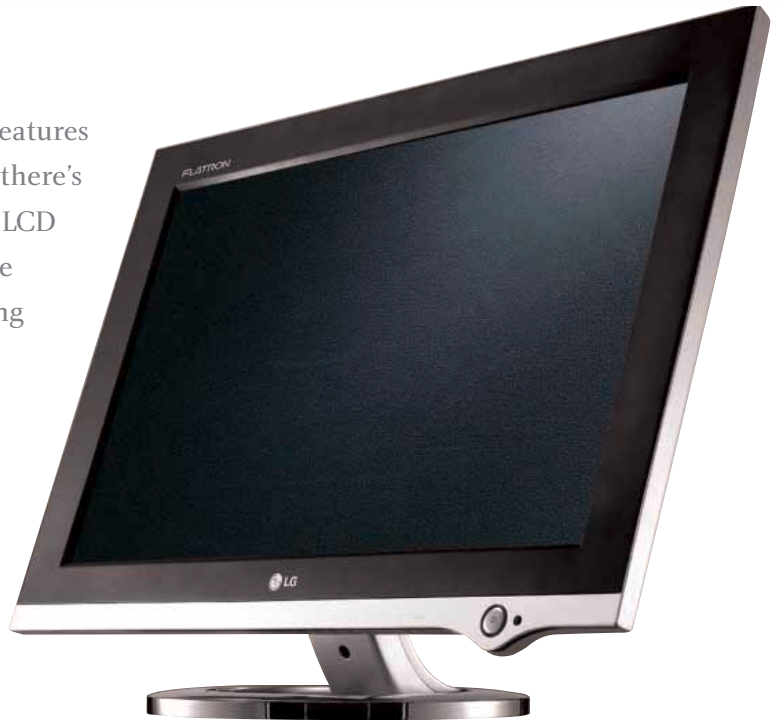
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A Well-Priced Sony Desktop

BY JOEL SANTO DOMINGO

The Sony VAIO Digital Studio PCV-RS520 is a solid desktop entry with a sleek facade. With an ATI Radeon 9200 graphics card, this system is not at the upper end of the performance spectrum—but neither is its price.

The 17-inch flat-panel Sony SDM-HS73 LCD that came with our test system is attractively designed, and its Xbrite technology means that you can quickly increase the brightness to help “punch up” video viewing. The panel’s 16-ms pixel response rate means the video you view will be free of much of the smearing and blurring common in older LCD panels.

As Sony’s value model, the PCV-RS520 lacks some of the components we’ve seen in other VAIO PCs, like the GigaPocket (Sony’s TV/PVR add-on),



Memory Stick readers, and a PC Card slot. But it does have a multiformat DVD burner, which is a bonus at this price. The large 160GB, 7,200-rpm hard drive is plenty for music and photos. Inside the case, the PCV-RS520 has space for two more PCI cards and another hard drive.

The PCV-RS520 is plenty fast enough for 2D tasks like photo editing, word processing, and Web browsing. It scored 19.5 on

SONY'S ENTRY-LEVEL PC is multimedia-friendly and includes a DVD burner.

our Business Winstone 2004 test and 26.4 on our Multimedia Content Creation Winstone, which compares favorably to more costly PCs we’ve tested. But it should not be your first choice for playing 3D games: The PCV-RS520’s performance on our gaming test makes it a nonstarter there.

Sony VAIO Digital Studio PCV-RS520

With 3.0-GHz Intel Pentium 4 with SSE3 (Prescott) processor, 512MB DDR SDRAM, 160GB hard drive, DVD+/-RW drive, DVD-ROM drive, 128MB ATI Radeon 9200 graphics card, 17-inch LCD monitor, Microsoft Windows XP Home Edition, \$1,760 street. Sony Corp., www.sony.com. OVERALL ●●●●● ● 86 ● 78 ● 73

IN SHORT

Gateway 710G Gamer

Pros: Relatively inexpensive gaming system.

Cons: Memory (512MB) and hard drive (single 7,200-rpm) trade-offs for price.

Bottom line: With its 3.2-GHz P4 processor, the Gateway 710G Gamer is a good starting point for a gaming system.

\$1,800 direct. Gateway Inc., www.gateway.com. OVERALL ●●●●● ● 93 ● 82 ● 65 ● 86



Polywell Poly 900NF3-FX53

Pros: Strong performance, thanks to the AMD Athlon 64 FX-53 processor and dual 10,000-rpm 74GB SATA hard drives in a RAID 0 array.

Cons: Could use more hard drive space, and the DVD and combo drives are poorly airbrushed to match the case color.

Bottom line: This sensible high-end desktop will

handle most if not all of your business, gaming, and multimedia needs for hundreds less than the boutique shops. Just don't look for a lot of frills. \$3,399 direct. Polywell Computers Inc., www.polywell.com. OVERALL ●●●●● ● 88 ● 66 ● 88 ● 91



Falcon Northwest Mach V FX-53

Pros: High-end hard drives plus 8X multiformat DVD burner.

Cons: Performance seems low for an overclocked Athlon 64 FX-53 machine.

Bottom line: Its anomalous performance and high price may make it hard for the Mach V FX-53 to draw a crowd.

\$4,795 direct. Falcon Northwest, www.falcon-nw.com. OVERALL ●●●●● ● 80 ● 63 ● 83 ● 100



Basic Computing for Less Than \$700

BY JOEL SANTO DOMINGO

Just as you wouldn't buy a Bentley to go grocery shopping, you don't need a tricked-out, high-end desktop for day-to-day computing. Enter the eMachines T2742. At \$700 street, it's an affordable PC for Web surfing, e-mail, and basic productivity chores.

The Spartan yet functional metallic-grey case looks the part of a value computer. The matching 17-inch CRT won't win any awards, but image quality is passable. The relatively small 40GB drive means that you will have enough room to load Microsoft Office and a few other programs. Just don't plan on doing any video editing on the T2742, and plan on external storage if you have a lot of digital music and photo files. The T2742's case has room for an additional hard drive and memory, as well as a couple of PCI cards, and there's a manual bundled with the system that lists directions for installing both.

The T2742 is adequate if you want to play 2D educational games. But if you plan to play any recent 3D games,

you should buy a PC with more horsepower. With its Intel 845GV integrated graphics, the T2742 is nigh unusable for any DirectX 8 or 9 games. Predictably, its score on our Serious Sam gaming test (6 fps) was one of the lowest we've ever seen. The 845GV chipset doesn't support AGP, so any upgrade card you install will have to be a PCI card, most of which are also quite weak at 3D performance.

When it comes to everyday computing needs, it will get the job done.

eMachines T2742

With 2.7-GHz Intel Celeron, 256MB DDR333 SDRAM, 40GB hard drive, DVD/CD-RW combo drive, integrated Intel 845GV integrated graphics, 17-inch CRT, Intel integrated sound card, eMachines stereo speakers, Microsoft Windows XP Home Edition, \$658 direct. eMachines Inc., www.emachines.com. OVERALL ●●●●● ● 40 ● 30 ● 13 ● 16



FOR BUYERS ON A BUDGET, the eMachines T2742 delivers a good mix of features, including a CD burner.

EasyWireless

Two words you normally don't see together



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* AOSS functions between Buffalo AOSS enabled devices only. Buffalo client devices are AOSS enabled by using Buffalo's updated client manager software (Windows clients only).

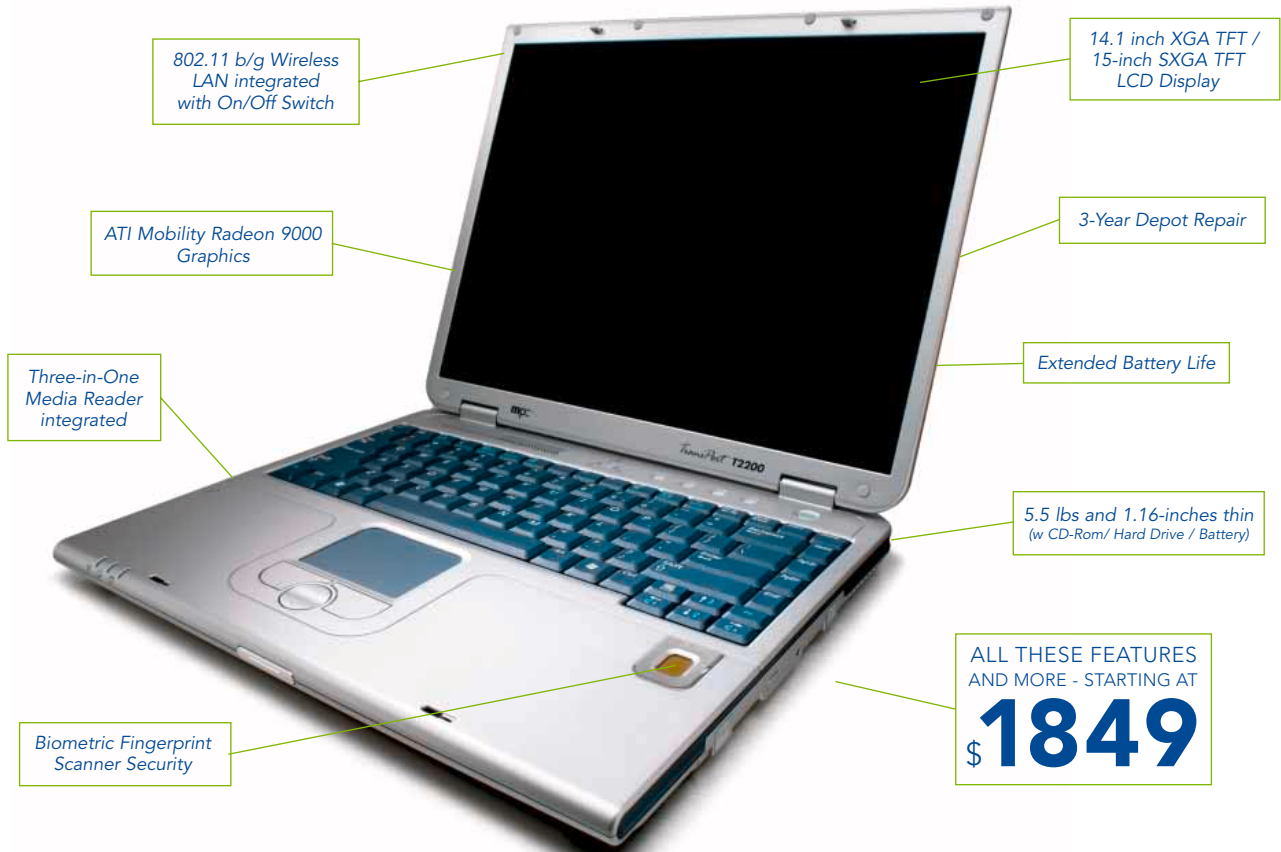
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Bread-and-Butter Business Notebook

BY BILL HOWARD

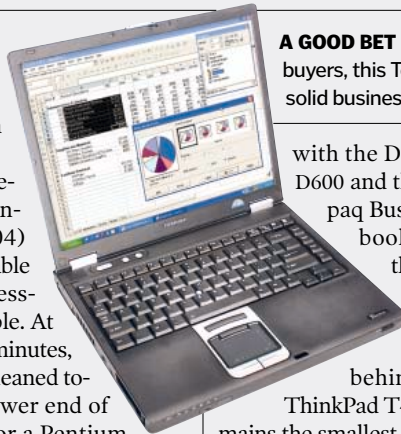
The Toshiba Tecra M2-S630 is one of the better choices out there if you need a versatile two-drive notebook for business use. This mainstream thin-and-light model delivers good wireless throughput and lots of battery and optical drive options.

Measuring 1.2 by 12.3 by 10.1 inches (HWD) and weighing 4.9 pounds (5.8 with the AC adapter), the unit is easy to tote. The designers moved most connectors off the rear to accommodate an optional double-capacity battery that sticks out an extra inch. I/O is top-notch: two USB ports, a printer port, wired and wireless Ethernet, Bluetooth, FireWire, two PC Card slots, and an SD IO slot. The port replicator (\$199 direct) and optical bay modules work across a wide range of Toshiba notebooks.

The unit's performance (20.2

on Business Winstone 2004 and 22.3 on Multimedia Content Creation Winstone 2004) was reasonable for a business-class portable. At 3 hours 32 minutes, battery life leaned toward the lower end of the norm for a Pentium M system with a six-cell battery, although you could approach 10 hours of runtime using the extended battery and the optical bay battery (each \$169). Wireless performance was excellent, with virtually no falloff through 120 feet when connected via 802.11b, and reasonable throughput out to 160 feet under 802.11g.

With this notebook, Toshiba comes closer to reaching parity



A GOOD BET for corporate buyers, this Tecra is a solid business notebook.

with the Dell Latitude D600 and the HP Compaq Business Notebook nc6000 than surpassing them. And it's still a step behind the IBM ThinkPad T41, which remains the smallest and sleekest of the group. But you won't go wrong specifying the Tecra M2-S630 for a business of any size, especially with Toshiba's reputation and the common docking and optical bay modules.

Toshiba Tecra M2-S630

With 1.7-GHz Pentium M, 512MB RAM, 60GB hard drive, DVD/CD-RW drive, 14.1-inch LCD, nVidia GeForce GX Go5200 graphics, 802.11b/g wireless, Windows XP Pro, \$1,899 direct. Toshiba America Information Systems Inc., www.shoptoshiba.com. ●●●●○

Toshiba Satellite P15-S420

Pros: Fine design and excellent display.

Cons: Graphics solution not great for 3-D gaming.

Bottom line: If you create a lot of home movies or just like watching DVDs and need a desktop replacement portable, this system is for you. It delivers good performance, decent battery life, and ample multimedia features.

\$1,899 direct. Toshiba America Information Systems Inc., www.csd.toshiba.com. OVERALL ●●●●○ 40 44 71 62



Eurocom Mirage D870P

Pros: Top-of-the-line core components.

Cons: High-end parts come at a high price.

Bottom line: It comes down to price: If you're willing to pay \$4,192 for a high-end desktop replacement notebook, then the Eurocom Mirage D870P is in your league. For everyone else, there are other lower-priced systems that are comparable in performance but don't give you all the latest and greatest that the Mirage does.

\$4,192 direct. Eurocom Corp., www.eurocom.com. OVERALL ●●●●○ 51 90 90 84



Twinhead N15RN

Pros: Design is somewhat forgiving of spills and drops.

Cons: Subpar speed, wireless throughput, and battery life.

Bottom line: The best aspect of this notebook is that you can drop it and it will still work. Unfortunately, most everything else is unimpressive.

\$1,499 direct. Twinhead Corp., www.twinhead.com. ●●●●○



www.pcmag.com/notebooks

Dell's Budget Business Notebook

BY CISCO CHENG

While the Pentium M mobile processor debuted last year with the huge amount of fanfare that surrounded the Centrino rollout, the new Celeron M processor has slipped into the market all but unnoticed. One of the first to use the new chip is the **Dell Latitude D505**, designed to give budget-minded business users the performance and features they need.

The Celeron M chip is based on the Pentium M, but with half the L2 cache (512K) and lower clock speeds (a

maximum of 1.3 GHz). The D505's benchmark test scores weren't earth-shattering, but the system held its own: 14.0 on Business Winstone 2004 and 14.2 on Multimedia Content Creation Winstone 2004.

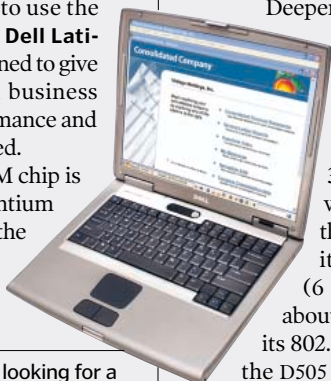
The Celeron M doesn't offer Enhanced SpeedStep or the Deeper Sleep features of its mobile sibling, hence the D505's BatteryMark score (4 hours 37 minutes) was less than that of others in its weight class (6 pounds) by about an hour. With its 802.11g technology, the D505 scored solidly on wireless throughput. The full-size keyboard is

comfortable, but you won't find many extra keys, such as a wireless on/off switch or volume control buttons. The D505 has two USB 2.0 ports on the back; we'd prefer to see at least one on the side, for easier use of a USB memory key. But there's a FireWire port—surprising for a value notebook. There's also a swappable bay, which can accommodate either a second battery (\$99 direct) or optical drive.

Business users on a budget—or even college students—would be hard-pressed to find a better value than the D505.

Dell Latitude D505

With 1.2-GHz Intel Celeron M, 256MB DDR SDRAM, 40GB hard drive, 15-inch XGA display, Intel 82855 GME graphics, DVD/CD-RW combo drive, 802.11g wireless, Windows XP Professional, \$1,357 direct. Dell Inc., www.dell.com. ●●●●○



BUDGET BUYERS looking for a full-featured PC for productivity chores will like the D505.

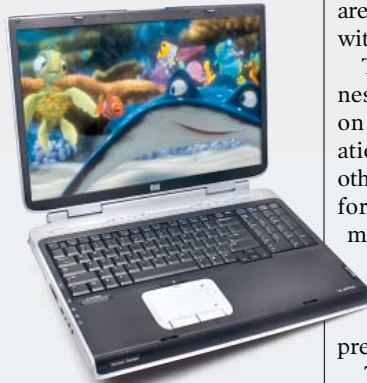
HP's Faster Wide-Screen Portable

BY CISCO CHENG



We loved previous iterations of HP's wide-screen multimedia portable ("The Coolest Home PCs: Desktop Replacement Notebooks," November 25, 2003, page 116), and we like the new build of the **HP Pavilion zd7000** desktop replacement just as much. HP has stepped up the processing power with a desktop-spec 3.2-GHz Pentium 4 Extreme Edition chip and boosted the hard drive capacity (to 80GB) and RAM (to 1GB). These improvements are reflected in the price, but they also make the zd7000 a top contender among multimedia notebooks.

Sure, at 9.3 pounds (11.2 pounds with AC adapter) the zd7000 is heavy. But features abound. The full-size keyboard includes a number pad. There are four USB ports, one FireWire port, a 5-in-1 memory



A PERSONAL THEATER can be yours with the HP Pavilion zd7000.

card reader, a DVD+RW drive, and top-notch (for a notebook) Harman Kardon speakers supported by 16-bit Creative Labs Sound Blaster Pro circuitry. Driving the 17-inch wide-screen display is the nVidia GeForce FX Go5600 graphics card. It isn't as swift in 3D graphics performance as the top-end mobile ATI Radeon solutions

are, but it does a reasonable job with games.

The unit scored 20.3 on Business Winstone 2004 and 26.0 on Multimedia Content Creation Winstone 2004. As with others in this class, battery performance is poor: 1 hour 46 minutes. But on our wireless tests, the system's Broadcom 802.11g wireless solution yielded very impressive results.

The upgraded components of the zd7000 make it a winner for most users looking for a multimedia-centric desktop replacement.

HP Pavilion zd7000

With 3.2-GHz Pentium 4 Extreme Edition, 1GB DDR SDRAM, 80GB hard drive, 128MB nVidia GeForce FX Go5600 graphics card, 802.11g wireless, DVD+RW drive, 17-inch WXGA wide-screen LCD, Microsoft Windows XP Professional, \$3,172 direct. Hewlett-Packard Co., www.hp.com. **OVERALL** ●●●●●
 ● 73 ● 65 ● 72 ● 82

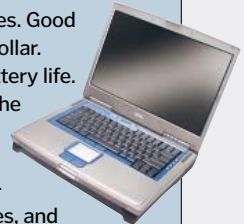
Dell Inspiron 9100

Pros: Superior graphics and 15.4-inch screen. Dual pointing devices. Good value for the dollar.

Cons: Poor battery life.

Bottom line: The Dell Inspiron 9100 ranks high on performance, features, and core components (which include the 3.2-GHz desktop Pentium 4, 1GB of RAM, and a powerful ATI Radeon 9700 graphics solution). This high-end multimedia desktop replacement notebook is worth a look.

\$2,786 direct. Dell Inc., www.dell.com. **OVERALL** ●●●●●
 ● 73 ● 65 ● 73 ● 83



HP Compaq nc8000

Pros: Good performance. Nice 15-inch SXGA display.

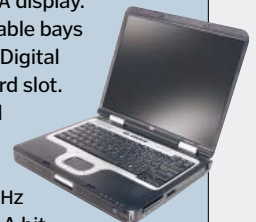
Two swappable bays and Secure Digital memory-card slot.

Cons: Bland design and a bit bulky.

Only a 1.6-GHz Pentium M. A bit pricey.

Bottom line: The nc8000 comes loaded with features, such as two hot-swap media bays and an excellent display. Add a top-of-the-line graphics solution and you have yourself a very fine machine, though it may offer more features than a typical corporate user needs.

\$2,399 direct. Hewlett-Packard Co., www.hp.com. ●●●●●



V600 Reaches Mere Mortals

BY JONATHAN ROUBINI

First debuting at the Academy Awards in those decadent goodie bags the stars get, the **Motorola V600** is finally ready to meet the masses. With a sleek design, easy-to-use interface, and Bluetooth capability, it is indeed a classic beauty.

The V600 is a slimmed-down version of the popular Motorola V300/V400. The black-and-silver flip phone has an external monochrome screen that displays the time and Caller ID info. For a touch of flash when a call comes in, the external Motorola logo lights up in your choice of colors (like Nocturne, Solar, or Passion) to suit your tastes.

The 4-directional keypad inside is more comfortable to use: The round pad surround-

ing the center button is not as prominent and the center button is larger. The number pad is a tad uncomfortable: The keys are not raised enough, there are no gaps between them, and they are a bit slippery.

The V600 is a worldwide quad-band GSM phone. And when it comes to staying connected sans voice, the phone also supports SMS, EMS, and MMS as well as POP3, IMAP4, and SMTP e-mail.

The audio quality of phone calls we placed in testing was fine. The look and feel of the menus is very similar to

the already easy-to-use V400. The V600 does add some spice, though, such as the ability to play short video clips.

However, don't expect to record any video even though there's a VGA (640-by-480) camera. The pictures taken with the camera looked okay, but there's no flash.

Overall, the Motorola V600 is a nicely designed phone ideal for both personal and business use.

Motorola V600

\$299.99 direct (with 2-year contract). AT&T Wireless, www.attwireless.com. ●●●●●

TALK LIKE A STAR with the Hollywood-approved V600.



Resco Explorer 2003 for Pocket PC

Pros: Network mapping capability and ZIP file support. Familiar tree file structure.

Cons: Expensive for a PDA file organizer.

Bottom line: If you are looking for more control over the files stored in your Pocket PC device than the native OS supplies, then this is a good choice.

\$24.95 direct. Resco Ltd., www.resco-net.com. ●●●●●

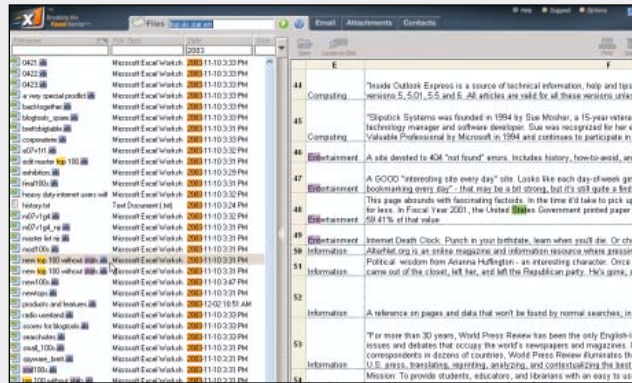
Search at the Speed of Typing

BY NEIL J. RUBENKING

As we become more dependent on e-mail and information in the files on our PCs, being able to locate messages and documents becomes ever more important. Unfortunately, the search tools built into Windows and most e-mail programs are extremely slow and often lack many useful features. That's where **X1 Search 3.0** comes in.

To accomplish its magic, X1 creates an index of all the words in your files and e-mail. This index lets the utility display search results as fast as you type search terms.

X1's main window features four category tabs that list all indexed files, e-mail messages, attachments, and contacts. Built-in viewers for dozens of file types power a preview pane of selected items. To search, simply type a keyword into the tab's search field. All



AS YOU TYPE the term you're looking for, X1 Search 3.0 is finding it.

words starting with that string are highlighted in the detail list and preview; items not containing the keyword disappear.

The program does have some shortcomings. One is that X1 treats each term independently. Searching on "PC Magazine," for instance, would show you every document where both words appear, not just those where the two words

appear together. Also, Boolean OR searches are not available. And X1 will not index files inside a ZIP archive. It indexes e-mail from Outlook (including archive PST files), Outlook Express, Eudora, and Netscape Mail, but only Outlook users can actually reply or forward mail directly from within X1.

We found that the initial indexing went quickly. On an 833-

MHz Pentium III system with 512MB of RAM, X1 needed 15 minutes to index about 50,000 files, 5,000 e-mail messages, and 1,000 contacts (this yielded a 140MB index file). Subsequent index updates occur in the background at scheduled intervals.

X1 sends a daily log to X1 Technologies, including a user-specific ID code to prevent piracy, debug information after a crash, and give information about what features were used. Registered users concerned about privacy can limit the log to the ID code and debug data.

In the time it takes to type a query in Windows or Outlook, X1 Search 3.0 already has the results. Sure, the program has some limitations. But once you've grown accustomed to X1's speed, you'll never want to wait for search results again.

X1 Search 3.0

\$99 direct. X1 Technologies Inc., www.x1.com. ●●●●●

Add Flash to Excel Data with Xcelsius

BY ROBYN PETERSON

Microsoft Excel is an indispensable tool when it comes to maintaining and organizing data in spreadsheets. But Excel falls short when it comes to presenting data. This is where Incommersion's **Xcelsius Professional 3.0** comes in.

Xcelsius takes your spreadsheet (or database) and turns it into an interactive Flash-based application, complete with engaging graphs and maps, interactive dials, buttons, and menus. Xcelsius is very easy to use and gives you a lot of control over how your files look and operate. Best of all, you don't need to know anything about authoring Flash files to use it.

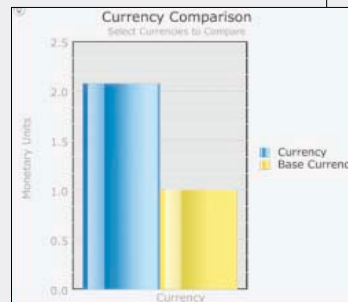
The files you create are very flexible. For example, you can embed them into PowerPoint

presentations and show your audience how changing certain values will affect results. Or you can put the Flash files onto Web pages so that your visitors can manipulate the data themselves. And since all they need is the freely available Macromedia Flash Player, visitors can view your file whether they're on a Mac or Windows system. They don't need Xcelsius or even Excel loaded.

To get started, you first import the spreadsheet on which you want to work into Xcelsius, then select the type of components you'll use to represent your data. These include charts, maps, gauges, buttons, knobs, and sliders. With simple point-and-click actions, you link data to the components, which then graphically represent the data.

You can create simple pre-

sentations quite easily, though the process of linking dials and sliders to spreadsheet cells so that you can manipulate the underlying data can take a little practice. The more advanced features, such as XML mapping, will require more technical know-how and proficiency with Excel. One shortcoming we encountered was that Xcel-



TURN STATIC DATA into a Flash-based animation easily with Xcelsius.

sus lacks good debugging tools. When creating complex projects, it can be difficult to diagnose and resolve problems.

The Professional edition we tested lets users collect dynamic XML data from the Web or database servers. If you don't need that advanced feature, the \$195 Xcelsius Standard edition will serve you well. Either way,

we recommend Xcelsius for anyone who wants to create interactive applications out of Excel files, or for people who frequently present what-if analysis based on numerical data.

Xcelsius Professional Edition 3.0

\$495 list. Requires: Microsoft Windows 2000 or XP, Office 2000 or later. Incommersion Inc., www.incommersion.com. ●●●●●

Passable Entry-Level DVD Authoring

BY JAN OZER

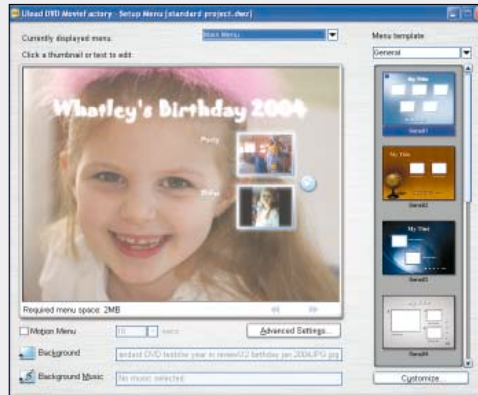
With digital video cameras and DVD burners finally becoming affordable to mainstream consumers, it's not surprising that the entry-level DVD authoring market has suddenly exploded. One of the latest entries is Ulead's **DVD MovieFactory 3 Disc Creator**. While Ulead has added some good features, we found problems with the program's interface.

MovieFactory now boasts premastering functions—such as disc copying and CD audio production—in addition to the DVD-authoring and tape-conversion functions the program already had. The program also includes a DVD Player applet that you can burn onto your DVD discs, ensuring that users can play the video on their PCs.

We were glad to see that MovieFactory now includes background splitting and trimming controls

for audio and video. We love the multitrack tool that lets you select multiple in and out points for your video. Unfortunately, the manual trim controls are a mess. After you split a video, it inexplicably turns into three clips: the original presplit file and the two postsplit segments. And we hate that you trim your videos in one screen and insert transitions in another, complicating precise edits. Also, DVDs you create are limited to sequential and chapter menus.

Ulead has significantly enhanced MovieFactory's slide show capabilities, adding transitions, rotation, automatic brightness and color enhancement, and the ability to match slide duration to background



MovieFactory 3's fixed 800-by-730 creation area felt cramped on our 1,280-by-1,024 monitor.

audio. But there's no pan and zoom effects or cropping controls as in competing programs.

To test performance, we burned a 60-minute project to DVD in real time. The video quality was good and audio synchronization was perfect. We then produced a two-menu DVD with a 12-minute

video and 4-minute slide show with synchronized background audio. MovieFactory took 14 minutes 15 seconds to render and burn the project (on an HP x4100 workstation with a 3.2 GHz Pentium 4 processor). Its competitors' times were all slower, with MyDVD closest (14:20), Roxio next (16:59), and Pinnacle Studio a distant 32:00.

So while speed is a strong point, Ulead has a tough bar to clear, thanks to Sonic's MyDVD. If MovieFactory 3 comes preloaded on a new PC, give it a try. If you're buying it yourself, Sonic's entry is the stronger choice.

Ulead DVD MovieFactory
3 Disc Creator

\$99.95 direct. Ulead Systems Inc.,
www.ulead.com. ●●●○○

Outstanding Pro-Level DVD Authoring

BY JAN OZER

Ulead DVD Workshop 2 is an impressive DVD-authoring program that is well suited for everything from simple projects to producing commercial DVD titles. Even pros that are used to other authoring applications should consider switching to DVD Workshop 2 for its efficient workflow and high-end options.

What most impresses us about the program is its wealth of menu-design tools and options. Newcomers can follow a wizard to choose a menu style and then link buttons to assets, such as video clips. Another option is to select a customizable template and then modify it to your needs. Expert users can begin with a blank menu and import Photoshop files for

custom menu graphics.

Workshop's fixed interface is dominated by a large preview window that doubles as the menu-creation palette. The program's alignment and resizing controls—which are complemented by a design grid—make it easy to place and size text and buttons. You can add overlays to menus and buttons, skew buttons, and place video and

animated sprites in menu backgrounds. To get even more creative, you can create invisible and autoactivated buttons.

Ulead has also enhanced the navigation options. Most notably, Workshop now includes playlists, which can be used to string multiple movies together in various ways so that playback can be customized with a button or menu option. This is



DVD Workshop 2 features an uncluttered interface, showing a playlist on the upper left and the excellent menu-design controls.

the first time this type of feature has been available in a program in this price range.

The new version also adds support for a spate of features that make it a competent choice for commercial DVD authoring. It includes a decent subtitle editor and lets you create projects that include multiple audio and text tracks. It also supports dual-layer (DVD-9) discs, CSS and Macrovision, Region Coding, 16:9 videos and menus, and DLT output.

Our only real complaint is that we would have liked a *fit to disc* setting that automatically encoded the project to match disc capacity. Otherwise, DVD Workshop 2 seems to do it all—and do it well.

Ulead DVD Workshop 2

\$495 direct. Ulead Systems Inc.,
www.ulead.com. ●●●●●

Miniature Marvel Plays Music, Captures Images

BY DANIEL S. EVANS

Last year Philips launched its highly successful Key Ring line, which included lipstick-size USB devices that integrated an MP3 player or a 1-megapixel digital camera. We fell hard for them, calling the products “paragons of simplicity and style.” So you can imagine how excited we were to hear about the **Philips KEY019 Key Ring Camcorder**. It’s an MP3 player and 2MP digital camera the same size and shape as the earlier devices, with one great addition: It’s also a camcorder. You can use the 128MB of internal memory for still shots, digital videos, MP3 files, and documents.

The KEY019 looks and feels like a slightly oversized USB key drive with a lens. That design makes file transfer very easy: Just drag and drop files on and off the device. And it recharges while plugged into your PC’s USB port. A remote attaches to the headphone cord, and when you plug the cord into the KEY019, the viewfinder becomes a microdisplay, allowing for easy navigation of your pictures, songs, and clips.

The KEY019 is a decent little music player, supporting MP3 and WMA (but not AAC) files. Sound quality is good, but advanced features are light. For example, there is no playlist feature. And with no external display, there’s no way to glance at track info quickly.

During testing in PC Magazine Labs, we were impressed by the quality of still images shot under daylight conditions. Dynamic range and resolution were both very good, although color fidelity was merely fair: Images were decidedly blue. With no flash, you’ll be less than pleased with the results in dim light, however.

Also, the camcorder features are best thought of as a convenience for grabbing video notes: Colors were off, and images were uncapturable in low-light conditions. Also, our labs found that the video shot by the KEY019 has a resolution of about 320-by-240 at 30 frames per second. This is fine to e-mail to friends, but to convert it to a usable format (such as VCD for sharing on-disc) will require a third-party conversion tool, and the results are likely to look somewhat blocky.

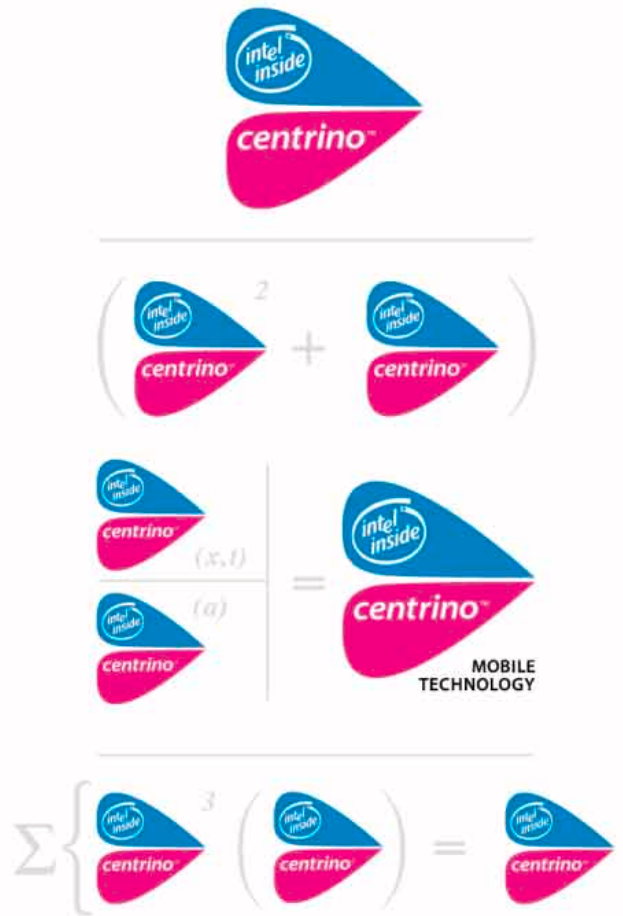
If you are looking for a full-featured MP3 player, camcorder, or camera, the KEY019 isn’t for you. But we are willing to look beyond its shortcomings for the convenience that the KEY019 affords. It offers the basic fun of all of these gadgets: You can take snapshots, record spontaneous moments on video, and carry along a few of your favorite tunes, to boot.



A JACK OF ALL TRADES, the KEY019 is an okay MP3 player and camera but a subpar camcorder. The trick is that it’s all three in a tiny package.

Philips KEY019 Key Ring Camcorder

\$249 direct. Koninklijke Philips Electronics N.V., www.usa.philips.com.



Secret formula for extreme mobility.

Stay connected in thousands of places around the world. Get a wireless laptop powered by Intel® Centrino™ mobile technology. Find out more at intel.com/unwire.



A Color Laser for Your Home, Office

BY M. DAVID STONE

The Lexmark C510n manages the difficult feat of being both a personal color laser printer and a full-fledged network printer. It earns the right to be called personal thanks to both a relatively small footprint (16.5 by 19.5 inches) and a price that squeaks in at \$1,000. And for \$300 less, you can get this printer without a network card, putting it solidly in personal color laser territory.

Network setup takes advantage of Lexmark's new setup routine, which is a big step forward for Lexmark, even though it's still not quite state of the art. For example, you have to tell it to create a network port, something the installation routines



THE BEST COLOR LASER for personal use is the Lexmark C510n.

from HP and Xerox do automatically. Still, even if you've never set up a network printer before, you should be able to find your way through the setup.

The four-pass C510n boasts a monochrome engine speed of 30 pages per minute and a

color speed of 8 ppm. And indeed, on almost every test it turned in faster times than every four-pass printer we've tested. Count this as impressively fast for personal use and usable by a small office or workgroup.

Output quality is also among the best for this class of color laser. Text is readable at 4 points. Graphics offer brilliant colors, and photos on laser paper approach near-photo quality. The C510n offers very good speed and good-looking output at an attractive price. For now, it's the personal color laser printer to beat.

Lexmark C510n
 \$1,000 street. Lexmark International Inc., www.lexmark.com.
 OVERALL ●●●●● ●●●●● ●●●●●
 ●●●●● ●●●●●

TEXT | GRAPHICS | PHOTO

Lexmark C752Ldn

Pros: Network setup routine is improved, and the color laser delivered good print quality across the board.

Cons: Shiny text output.

Bottom line: Aimed at workgroups and small offices, the Lexmark C752Ldn is a more than reasonable choice in its class.

\$2,059 direct. Lexmark International Inc., www.lexmark.com.
 OVERALL ●●●●● ●●●●● ●●●●●
 ●●●●● ●●●●●



HP LaserJet 3015 All-in-One

Pros: Excellent text output. Very good scanning, faxing, and copying capabilities.

Cons: Sheet-fed scanner only, not flatbed. Graphics output is merely acceptable.

Bottom line: The HP LaserJet 3015 All-in-One offers the speed and text quality of a laser printer along with a basic sheet-fed scanner.

\$299 direct. Hewlett-Packard Development Co., www.hp.com.
 OVERALL ●●●●● ●●●●● ●●●●●
 ●●●●● ●●●●●



HP LaserJet 3030 All-in-One

Pros: Good to excellent text output. Excellent scanning, faxing, and copying capabilities.

Cons: Graphics output shows obvious dithering. Paper handling is relatively limited.

Bottom line: If you want the speed and text quality a laser printer provides but require more versatility—for scanning, faxing, and copying—the HP LaserJet 3030 with its flatbed scanner and automatic document feeder is a good choice where printing demands are light to moderate.

\$499 direct. Hewlett-Packard Development Co., www.hp.com.
 OVERALL ●●●●● ●●●●● ●●●●●
 ●●●●● ●●●●●



Mega Quality for Mega-Size Prints

BY M. DAVID STONE

Wide-format printers can be lifesavers for offices and institutions that create banners or posters on a regular basis. So if you find yourself running to the nearest quick-print shop more than once a month because your printer can't handle anything larger than 11-by-17, you may be able to justify the \$3,495 (list) price of the **Canon imageProGraf W6200**. It prints on 24-inch-wide rolls of paper and gives you gorgeous output at breathtaking speeds.

Need some hard numbers as ammo for your accounting department? Canon estimates that printing a large (about 6-square-foot) glossy poster with the W6200 costs \$3.86. Our local Kinko's charges \$72 for the same size print.

Physical setup isn't hard, but it is tedious. This is a large printer, and you have

to assemble the stand and output catcher. But the print engine setup is standard fare for ink jets. The only complaint we have is the need for manual printhead alignment. Setting up on a network is also more cumbersome than it should be. In particular, although the setup program can find the printer on the network, the feature is



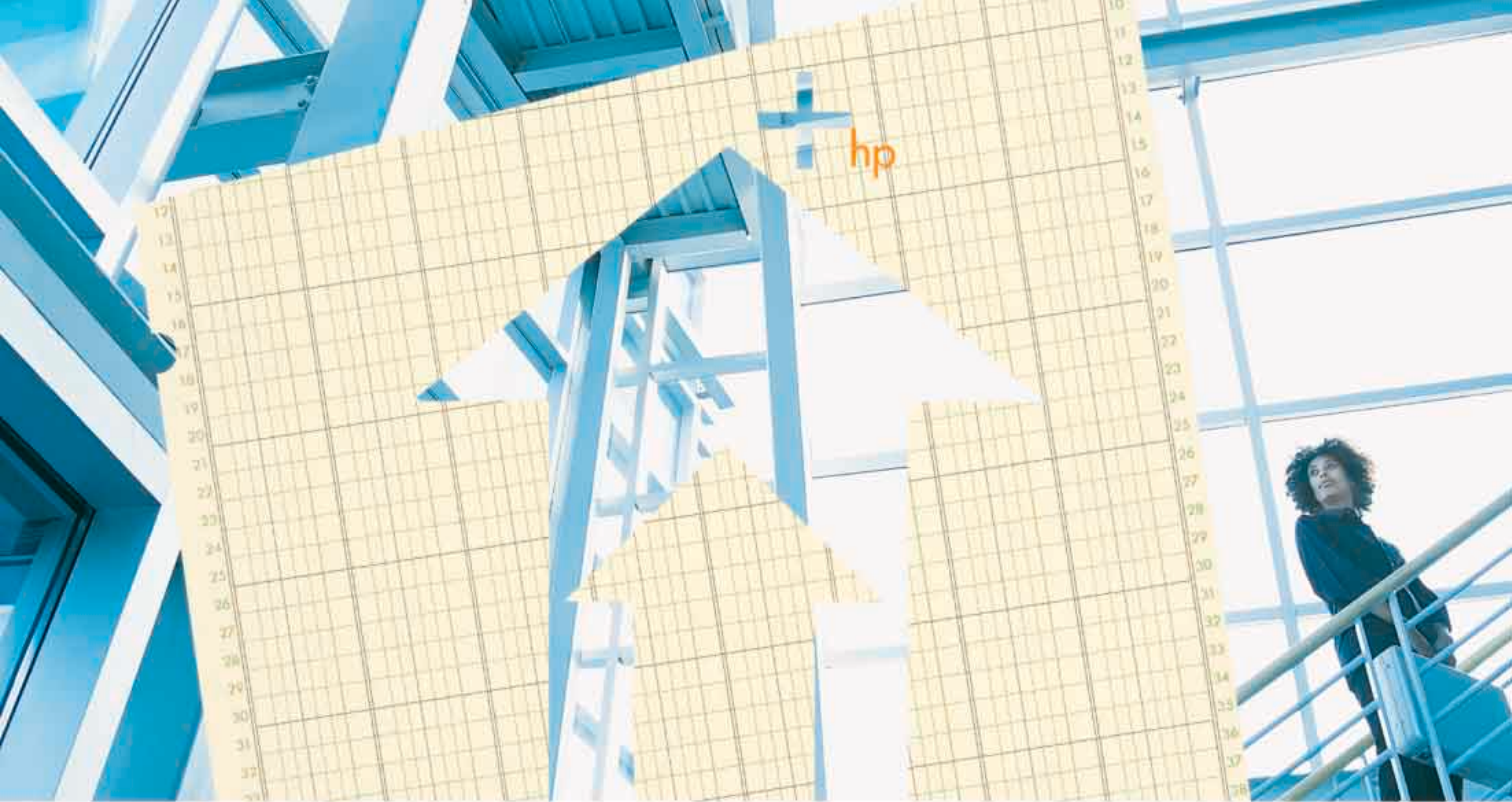
THE W6200 can pay for itself in just three years of light use.

turned off by default, so you have to enter information manually or know to turn it on.

The W6200's speed and output quality are outstanding, thanks in large part to a printhead with 7,680 nozzles. Printing an A1-size image at standard quality (600 by 1,200-dpi) took just 3 minutes 25 seconds. Printing at high quality (1,200 by 1,200 dpi) took 6:04, complete with the automatic cutter slicing the image off the roll.

Output qualifies as true photo quality when viewing poster-size output from an appropriate distance. Assuming you can justify the price, the W6200 is easy to recommend.

Canon imageProGraf W6200
 \$3,495 list. Canon U.S.A. Inc., www.usa.canon.com. ●●●●●



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Samsung's Monitor/TV Combo

BY ALFRED POOR

The Samsung SyncMaster 192MP lets you watch TV while you work on your word processing and spreadsheets. The 19-inch LCD commands a premium price (\$830 street), but its picture quality and extra features are strong incentives.

The monitor has both analog and digital connections for your computer, and it comes with both cables. A coax connector for an antenna or cable TV signal is included, as are composite, component, and S-Video connectors.

The on-screen menu system is fairly easy to use, and you can quickly access volume, channel selection, autosync, and signal source with the control buttons. And the handy remote control is even easier to

use. Television can be viewed as full screen or picture-in-picture on top of a computing signal. (Computer images can't be PIP.) The monitor features Samsung's MagicBright technology—a series of preset brightness and contrast settings for different applications.

Test images generated with Displaymate software (www.displaymate.com) showed excellent color



tracking, good gray-level response from white to black, and little distortion even at extreme viewing angles. The color ramps with an analog signal were very smooth, though there was faint banding with digital signals.

Brightness was uniformly good, with only a faint glow in the lower-right corner on an all-black screen. For video, however, the pixel response time is not suitable for fast-moving images: There was noticeable smearing.

The SyncMaster 192MP is clearly a monitor first and a television second, since the image smearing makes it less attractive as a TV. But it serves very well as a monitor, with a large image and generally outstanding image quality.

Samsung SyncMaster 192MP

\$830 street. Samsung Electronics America Inc., www.samsungusa.com/monitor. ●●●●○

WATCH ANIMAL PLANET or do e-mail or both with the 192MP.

Envision EN-7220

Pros: Good image quality. Portrait mode feature.

Cons: Hard-to-see icons on control buttons.

Bottom line: The Envision EN-7220 is a happy surprise: A 17-inch monitor at a competitive price that delivers some useful features along with good image quality. The combination makes for a bargain that deserves careful consideration. \$480 street. Envision Inc., www.ensonmonitor.com. ●●●●○



Sony SDM-HS73P

Pros: Exciting case design, front and back. Preset backlight settings.

Cons: Flawed image quality. No quick access to features from front panel.

Bottom line: The 17-inch SDM-HS73P shows off Sony's flair for making stylish products, but it does not deliver the top-notch image quality that most buyers expect from the brand.

The limited viewing angle and other flaws are not fatal, but better choices are available at a similar price or lower.

\$610 direct (before \$50 rebate). Sony Electronics Inc., www.sony.com/displays. ●●●●○



A Projector with an Italian Flair

BY ALFRED POOR

What does the 3M Bravo S10 have in common with a Ferrari 575 M Maranello? Both owe their stylish appearance to the legendary Italian design firm, Pininfarina. But it's not just another pretty face: The SVGA-resolution LCD projector aggressively competes in the entry-level market.

There's more to the innova-

tive design than the curvilinear case. One of the most impressive features is a circular base that makes aligning an image properly on a screen incredibly easy—no more fumbling with screw-type feet adjustments.

The S10 supports both data and video functions, but it's targeted primarily for office use. Though it's a little bulky for long sales trips, at 6.4 pounds it's light enough to be carried easily from room to room. A single RGB connector handles computer connections. A serial port allows remote control of the projector, but its use is not documented in the manual. The S10 also features a full comple-

ment of video connectors.

On our tests using images generated with Displaymate (www.displaymate.com), the S10 performed very well. It maintained excellent focus throughout the screen and excellent gray shade response at both ends of the spectrum. Convergence was very good. There were faint, fine bars in the color ramps, but colors were good. The S10 delivered only 813 lumens on our tests—sufficient for a moderate-size image in a room without too much ambient light.

All told, the Bravo S10 has attractive styling, innovative design features, excellent image quality, and a competitive price.

3M Bravo S10

\$1,100 street. 3M, www.3m.com/meetings. ●●●●○



ONE LOOK tells you the 3M Bravo S10 projector is different.

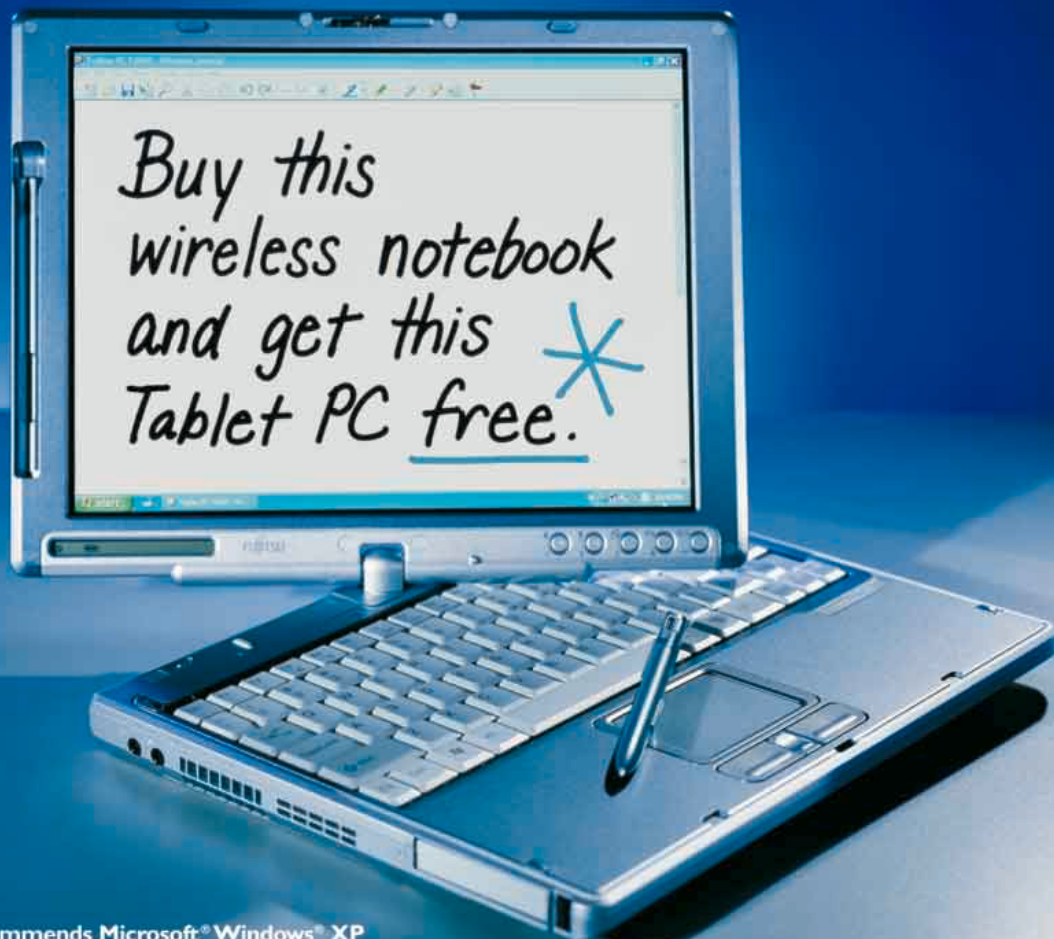
Xerox XL795D

Pros: Generally good image quality. Analog and digital connections.

Cons: Less-than-competitive price. No signal-source select switch.

Bottom line: If the Xerox XL795D were priced lower, it would be a good deal. But it fails to deliver sufficient extras to justify its premium price. \$835 direct. Proview Technology Inc., www.xerox-displays.com. ●●●●○





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MOBILE
TECHNOLOGY

All-In-One E-Mail Security

BY ROBERT P. LIPSCHUTZ

Considering the increasing onslaught of spam messages and viruses that propagate through e-mail systems, it's a given that businesses now need to run an e-mail firewall to protect their employees and e-mail servers from these evils. Here we evaluate two of the newest products—the BorderWare MX-treme Mail Firewall MX-200 3.1 and the Proofpoint Protection Server 2.0—which work with any mail server to address security and privacy concerns.

BORDERWARE MXTREME MAIL FIREWALL MX-200 3.1

The BorderWare MX-treme Mail Firewall MX-200 3.1 has a host of e-mail perimeter security features, including anti-virus protection, various mail encryption features, and everything but the kitchen sink to combat spam. Spam-combating tools include pattern matching, real-time black hole lists (RBLs), distributed checksum clearinghouses (DCC), and statistical token analysis (STA). RBL and DCC rely on outside services to identify spam by matching known mail server offenders or by identifying bulk messages based on how often the messages have been seen by mail servers. These techniques work but can often lead to false positives. STA works by identifying spam based on certain words within the message.

We don't think these three semi-effective antispam measures lead to an effective solution, so we recommend the Brightmail option the company offers. It fared best in our previous roundup (First Looks, November 11, 2003, page 34) and provided good protection

SPAM CLASSIFICATION rules catch potential spam, which can then be quarantined.

in the BorderWare box.

To stop viruses, the MX-treme uses the Kaspersky anti-virus engine and attachment filtering. With attachment filtering, an administrator can stop or block often-problematic files such as scripts, PIFs, or executables.

E-mail travels in plain text, plainly readable to any potential snooper. To combat this, BorderWare includes Transport Layer Security, which can be configured to work with any other mail server that supports it, such as Microsoft Exchange.

Sitting at the perimeter of the network, the MX-treme protects your internal mail server from hacks, denial-of-service attacks, directory harvesting, and buffer overflow attacks. With its hardened operating system, the MX-treme is designed to take these abuses without incident while it protects mail from spam and viruses.

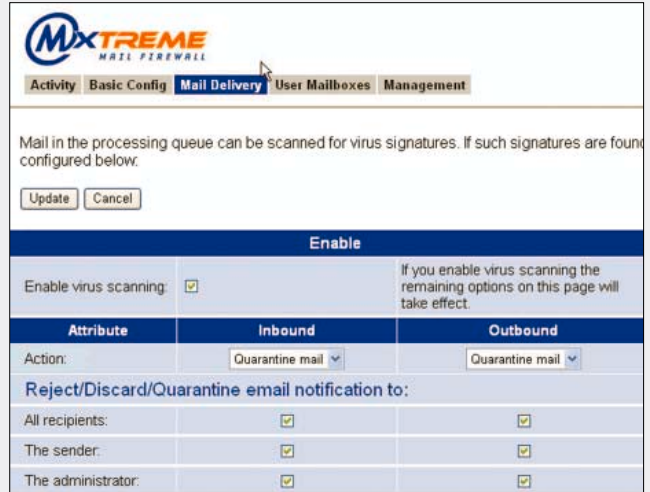
BorderWare MX-treme Mail Firewall MX-200 3.1

\$7,995 direct (plus \$3,700 for Brightmail antispam service for 2 years).
BorderWare Technologies Inc.,
www.borderware.com. ●●●○

PROOFPOINT PROTECTION SERVER 2.0

The Proofpoint Protection Server 2.0 gives larger companies the flexibility to address a full set of e-mail protection issues. The product handles spam well by default. With its content filtering, reporting, and optional antivirus module (provided by Network Associates), companies can enforce confi-

Enabled	Classification	Description	Condition	Action	Edit
<input checked="" type="checkbox"/>	spam	Spam	Spam score between 100 and 50	• Send to quarantine. • Add header X-Proofpoint-Spam-Details=# SpamDetails	Edit
<input type="checkbox"/>	adult spam category	Adult Spam	Rule Disabled	• Discard the message.	Edit
<input checked="" type="checkbox"/>	probablespam	Probable Spam	Spam score between 79 and 50	• Continue to process the message. • Add header X-Proofpoint-Spam-Details=# SpamDetails	Edit
<input type="checkbox"/>	adult spam category	Adult Spam	Rule not defined		Define
<input checked="" type="checkbox"/>	notspam	Not Spam	Spam score between 49 and 0	• Continue to process the message. • Add header X-Proofpoint-Spam-Details=# SpamDetails	Edit



THE MXTREME USES the Kaspersky antivirus engine to check inbound and outbound messages for malicious attachments.

dentiality, compliance, and security policies.

The Proofpoint Server acts as a relay between your mail server and the outside world. You reroute mail to the Proofpoint server with a DNS MX record (instead of pointing to your internal mail server), and the Proofpoint Server inspects all messages for spam, content violations, and viruses (if you buy that option). The Proofpoint Server uses rules configured by the administrator to quarantine or pass along e-mail.

At the heart of the product is Proofpoint's MLX engine, which evaluates e-mail messages for spam and other problem content. The Proofpoint Server contains more than 50,000 rules that serve to separate spam from good e-mail, and the company updates the rules weekly to address the lat-

est spam trends. Customers can add custom rules to ensure that important e-mails are not quarantined. In this new version, individuals can create their personal safe lists and block lists using a clever e-mail interface to override any corporate spam rules.

For companies concerned about confidentiality and regulatory compliance, the Proofpoint Server contains extensive reports and content filtering. Administrators can display, schedule, publish, and e-mail numerous reports concerning spam, viruses, or e-mail content. They can also catch specific phrases, such as patient names, using simple text checks or even regular expressions.

Another welcome touch: IT personnel at large enterprises can deploy multiple Proofpoint units installed on either Red Hat Linux or Solaris systems and manage them from a single Web-based interface. All in all, it's a solid implementation that should suit the needs of most businesses.

Proofpoint Protection Server 2.0

Starts at \$5,400 a year for 300 users (plus \$4,320 for antivirus).
Proofpoint Inc., www.proofpoint.com.
●●●○



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Reduce noise with Bose technology.

David Carnoy reports on *CNET* that our original noise-reducing headphones "set the gold standard." And according to respected columnist Rich Warren, our newest headphones "improve on perfection." They electronically identify and reduce noise while faithfully preserving the music, speech or silence that you desire. As Jonathan Takiff reports in the *Philadelphia Daily News*, "Even in the noisiest environment, wearing these phones creates a calming,

quiet zone for easy listening or just snoozing."



Enjoy your music with our best headphone sound quality ever.

After trying QuietComfort® 2 headphones, audio critic Wayne Thompson reports that "Bose engineers have made major improvements." The sound is so clear, you may find yourself discovering new subtleties in your music. *CNET* says "All sorts of music – classical, rock, and jazz – sounded refined and natural."



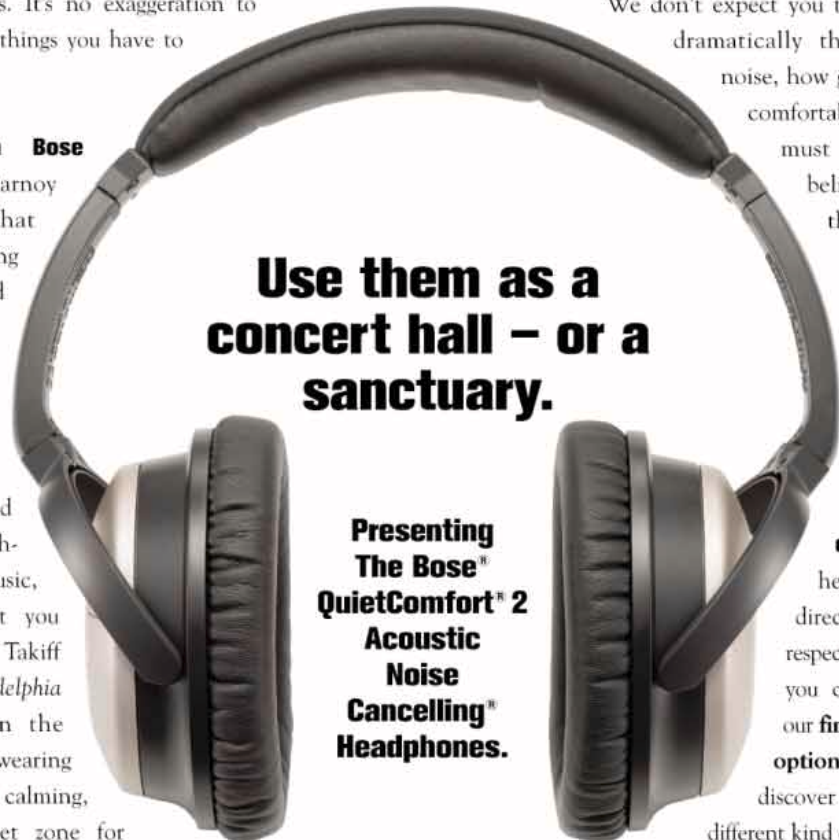
"The QuietComfort 2 lives up to its name, enveloping you in blissful sound in the utmost comfort. It's easy to forget they're on your head." That's what columnist Rich Warren says. And as Ivan Berger reports in *The New York Times*, the "QuietComfort 2

offers more conveniences than the original model." You can wear them without the audio cord to reduce noise. Or, attach the cord and connect them to a portable CD/DVD/MP3 player, home stereo, computer or in-flight entertainment system. When you're done, their convenient fold-flat design allows for easy storage in the slim carrying case.



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FEEDBACK

“He gave the full denial of cancellation pitch, despite my insisting that my brother was dead.”

AOL CONTRACTS: WITH DEATH, DO YOU PART?

MY BROTHER recently died after a skiing accident. He was my business partner, and the month after his death involved canceling many contracts. I saved the most feared cancellation (based on previous experience) for last: his AOL account. I explained the situation to the service representative. After a few minutes of the most insensitive comments (obviously scripted), I asked where he was located. “India,” he said. He insisted on giving the full AOL denial of cancellation pitch, despite my insisting that my brother was dead. He offered lower monthly rates, retaining his AOL e-mail address, transferring his account to someone else in our company, etc. He would not give me the cancellation number until I had listened to his complete pitch. (He said it was an FCC requirement.) I then wrote a letter to AOL, suggesting that a more sensitive method be used for death cancellations—like faxing a death certificate. No one at AOL has responded. I can’t believe that we, here in the U.S., sit quietly while this trespassing on our personal lives grows and grows. Every bit of personal information about us is on the servers in Bangalore. This really worries me.

ED MAXWELL

THE NETWORKED HOME

AFTER READING “From the Ground Up” (April 6, page 91), I thought about my home network troubles. After purchasing about \$200-worth of wireless networking gear, I realized it was all useless, because my 2Wire HomePortal is already a wireless router. All it requires is a \$30 USB adapter for any other computer. The DSL gateway includes two ports (an Ethernet and a USB) that plug right into the modem. Also, it supports HPNA and is a wireless router. It isn’t the biggest or the best, with my current throughput at about 1.4 megabits per second, but those speeds are absolutely fine. My wireless is just as fast as my wired Ethernet connection on the other computer. And the two computers are 20 to 30 feet away from each other, separated by an L-shaped hallway. SBC Yahoo! may not have the best service, but 2Wire has things down pat for ease of use.

PIERCE BAUMANN



IT'S THE GAMES, AND THE SOFTWARE WE'VE COLLECTED

ONCE AGAIN John C. Dvorak (April 6) hit the nail on the head: Were it not for games, I would’ve bought an Apple a long, long time ago. I love their design, I can do everything I need on that platform, except playing the latest games. A bit ironic, as games on an Apple

I were the first I ever played. Linux seems to me all about setting the system up and tuning it to the max—it reminds me of people planning their model-train tracks for evenings and evenings but never playing with the trains.

ROLAND AUSTINAT

IN HIS ANALYSIS of the factors that supposedly prevent people from switching computer platforms, John C. Dvorak missed the biggest factor of all: perceived investment in the current platform. Even though we only regularly use perhaps 5 percent of the software that we’ve ever purchased, all of it sits in our drawer taunting us, laughing at the notion that we’d ever convert to a Mac. We look at it and think: How could I possibly start over? If we were to start over and dump every disc except for the five or six programs that we actually use, the thought of switching platforms wouldn’t be quite so frightening.

RICHARD HUFFMAN

HEAVENS!

I NEED TO KEEP UP with the current issue of your magazine. Not only would I have saved myself a bunch of grief caused by the worm in my new Compaq Presario 2100, but I would have been aware of the AT&T spam scam that John C. Dvorak’s “Inside Track” uncovered. For the Compaq, I wound up reformatting and buying Norton’s Internet Security Suite, but I did not read your comment of how it slows down the system until after I bought it. On the other hand, RoadRunner defused the W32.Beagle bug in an AT&T e-mail before they passed it to me. If it had gotten by RoadRunner, Norton AntiVirus/Firewall, and SpyBot, I probably would have opened the attachment. You can’t imagine how relieved I am to have these mysteries finally solved. Thank heaven for *PC Magazine!*

DALE HEINDEL

How to Contact Us

We welcome your comments and suggestions. When sending e-mail to Letters, please state in the subject line of your message which article or column prompted your response.
E-MAIL pcmag@ziffdavis.com
MAIL Letters, *PC Magazine*, 28 East 28th Street, New York, NY 10016-7940. All letters become the property of *PC Magazine* and are subject to editing. We regret that we cannot answer letters individually.

Corrections and Amplifications

- In our April 20 story on monochrome laser printers, we omitted a byline for contributing editor/lead analyst Alfred Poor in the review of the Kyocera FS-9520DN.
- In our April 6 “First Looks” review of the Fujitsu LifeBook N5010, we stated that CyberLink makes WinDVD 4 and WinDVD Creator 2. They are made by InterVideo; CyberLink makes PowerDVD.



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AUTOMATIC VS. MANUAL DEFRAGMENTATION

	Diskeeper® 8.0	Built-in defragmenter
Completely automatic – requires no user or IT staff intervention	Yes	No
Automatically schedules defragmentation as needed	Yes	No
Runs in the background; allows users to work during defragmentation	Yes	No
Addresses critical reliability issues	Yes	No
Server-specific edition designed for large servers	Yes	No

Automatic defragmentation is essential!

Disk fragmentation is a cancer that eats away at speed and reliability—and the defragmenter built into Windows is simply too slow, too obtrusive, and too labor-intensive to solve the problem. In fact, most IT departments that rely on the built-in defragmenter wind up never defragmenting at all.

New Diskeeper® 8.0 is the automatic “Set It and Forget It”® defragmenter that permanently eliminates fragmentation-related problems on your servers, desktops and laptops. Diskeeper runs as a background process, so your users will hardly know when its active—and it’s so affordable that it quickly pays for itself in saved labor costs.

Disk fragmentation causes crashes, slowdowns and freeze-ups. Get Diskeeper 8.0 for your workstations and servers, and put an end to fragmentation-related problems for good!

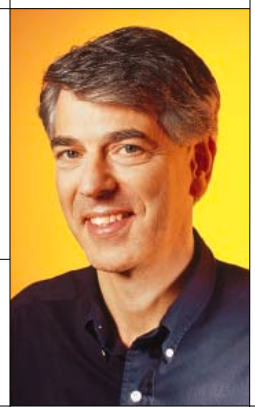


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Bill Machrone



Your Next PC: A Survey

You've read plenty of my opinions in these columns, and now I want *your* input. As a reader of *PC Magazine*, you are part of the most influential group of people in the computer industry: You're the opinion leaders who stay abreast of emerging technologies, the people who others ask when they need a new PC or software, the ones who do all the research. But that's where the similarities among you end. That's why I've put together an online survey, so you can tell me what your next move will likely be.

The PC market, despite consolidation, has become incredibly diverse. PCs come in more shapes and sizes than ever. Hitherto undreamed-of power is at your fingertips. Hardware that not so long ago would have filled a climate-controlled room now fits in a standard tower. An unprecedented range of equipment exists to meet users' needs, from the simplest to the most demanding. On shelves, \$300 machines sit side by side with \$5,000 machines. Laptops rival many desktop machines in power and storage, and even in screen size and resolution.

Confusing? You bet. Taken as a whole, the PC market is a morass of clamoring, contradictory approaches. But each of us has a laser-like, individual viewpoint that cuts through the clutter and focuses on the machine that's right for us.

My hope is to gain a greater understanding of the market as seen through your eyes, not the manufacturers' offerings. My questions are about options and configurations, not about brands and prices. Go to www.pcmag.com/nextpc to participate.

We know, for instance, that Media Center PCs are off to a very slow start. People have been clamoring for convergence products for a long time, but now that they're here, they have yet to catch on. I wonder if the physical hardware is wrong: Does it make sense to have a Media Center PC that isn't next to your TV and audio gear? And if it is, does it look stupid beside the black and brushed chrome of your home entertainment equipment? Noise, of course, is another problem. The machine whose fans and drives were inaudible in the store whines insistently when installed in the quiet of your home.

People are increasingly choosing notebooks as their only PC. Are you one of them? If so, I'd like to know what direction you'll likely take when you buy your next notebook. The ultraportables are lighter than ever, but with no optical drive, loading new soft-

ware is inconvenient when you're on the go.

Then there's the vast middle ground of machines with a built-in optical drive. Many can burn CDs, but you pay a weight and size penalty. I've always carried an ultraportable, but lately I've been using a couple of laptops with optical drives. I can't say I'm thrilled with the extra bulk, but the convenience of ripping music on my IBM ThinkPad or burning CDs with my Toshiba Portégé M100 is undeniable. Do you feel the same way?

In this multimedia age, though, notebooks may limit you in some surprising ways. We normally don't test their audio performance, but I've sampled a few with severely limited frequency response or unacceptable amounts of harmonic distortion. I've recommended that this become part of PC Magazine Labs' standard testing; I know it'll be part of my screening as I look at new machines.

On the other hand, some new notebooks are being built specifically as Media Center machines. They're big and brawny, some with 17-inch conventional screens, others with wide screens. They have built-in stereo speakers that actually sound halfway decent; some even have built-in "subwoofers," if you stretch the term to its breaking point. (Most so-called subwoofers are just woofers; real subwoofers address subsonic and very low bass frequencies, so you can feel them in the pit of your stomach.)

The question is, will you buy such a machine for its ability to record and edit video? Will you actually watch movies on it? Will it become your music repository, and will it live more easily in your television/home entertainment space than a desktop or tower machine?

I'd also like to get a better sense of the degree to which you'll specify the components and their performance level in your next system. Do you trust the manufacturer to integrate the right bits and pieces, or do you want to determine the kind and speed of your hard drives, the front-side bus speed, and so on? I'm also interested in where you'll buy your next machine, and why. Does walk-in service at your local store outweigh the ability of a boutique manufacturer to build a custom system? Does price outweigh everything else? It's all in the survey.

Tower, notebook, Media Center PC—what is your next computer purchase likely to be?

MORE ON THE WEB: You can contact Bill Machrone at Bill_Machrone@ziffdavis.com. For more *Extreme Tech* columns, go to www.pcmag.com/machrone.



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John C. Dvorak



Scams, Lies, Deceit, and Offshoring

Someone has to take the jobs that, as President Bush and others say, “Americans don’t want.” There appear to be a large number of these jobs. In fact, it seems that our fastest-growing business segment is the creation of more and more jobs that Americans don’t want. Often, American companies will lay people off, only to train newcomers to replace them.

Here is how the real scam works. You are a programmer at one of the big IT or computer companies. You’re 55 and nearing a retirement plateau; in fact, you’re a liability. You’re making, say, \$80,000 as a program designer. You have various responsibilities. The company eliminates your position in the process of downsizing.

To be fair to you, it creates a new position, Associate Program Designer, that pays \$35,000 a year. Its responsibilities coincidentally match those of your old job. You can take this job, doing what you did before but at a huge cut in pay, or look elsewhere. If the latter, it’s apparent that this new job is one that “Americans don’t want.” The company can then hire a “body shop” to drop in a foreign H-1B or L1 visa holder, who will not be quite as good but will work for a lot less.

This is a bait-and-switch scheme that is designed to screw older and more experienced workers out of their retirement benefits, plain and simple. This sort of thing, unfortunately, is nothing new to corporate America: Every time I write about it, I get hundreds of e-mails from people who have been abused by such practices.

More horrendous still is the sudden emergence of offshoring, whereby we send the money as well as the jobs overseas, mostly to India, where labor is even cheaper. The proponents of offshoring have a rumored \$100 million PR budget; anyone who speaks out against this trend is bombarded by hate mail. Just mentioning the problem here will result in numerous requests to my editors that I be fired. Few of the senders will be traceable.

The sinister nature of offshoring jobs has corrupted the highest levels of our nation. Hillary Rodham Clinton, for example, is directly involved with one of the big body shops, Mumbai-based Tata Consultancy Services. Bush is actively promoting the replacement of American workers. Colin Powell recently promised India that the administration

would continue to promote offshoring. Which country does he represent, anyway?

In an economic argument that is floating around, people cook numbers to show that every job lost to offshoring is a ridiculously large net benefit to the U.S. economy; we are making money on the deal. One math genius claimed that although we export around \$10 billion in outsourcing fees, the economy somehow recovers over \$300 billion in savings. It’s a bonanza. Taking this logic to an extreme, if we offshored all American jobs and nobody here worked, we’d be filthy rich. Let’s just do that! Where do I get my check?

I hear all the time that coders in India are cheaper *and* better. What makes them better? Have there been some blockbuster Indian software programs that I somehow missed? Maybe they are good at patching spaghetti code or doing well-defined C++ modules, but who knows? You’d think that some killer apps would have come out of India by now, as they have from Europe, the U.S., Japan, and even Russia.

Even more irksome than this notion of “better” is the fact that companies are trying to hide their offshoring operations, a deceptive practice at best. Help desks, bill collectors, and telemarketers are in India. All the AT&T staffers I have talked to seem to be in India, but ask them where they are and they won’t say. They are trained to fake American accents. They say their name is Bill or Dave or Patty; it is clearly not. They never tell you where they are, because Americans don’t like having their American Express records (yes, AmEx uses India) in Bangalore, where our privacy laws aren’t in force.

One company told my wife that its reps don’t say where they are from because of terrorism. Terrorism? My wife is going to fly to Bangalore? We are lied to by the companies we do business with; plain dishonesty is at work here.

Although I appreciate some aspects of globalization, I can’t excuse the cavalier attitude toward fellow Americans that we see among large corporations who benefit from the free-enterprise system and American infrastructure. It will come back to haunt them all.

It seems that our fastest-growing business segment is the creation of more and more jobs that Americans don’t want.

MORE ON THE WEB: Read John C. Dvorak’s column every Monday at www.pcmag.com/dvorak. You can reach him directly at pcmag@dvorak.org.



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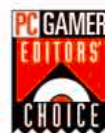
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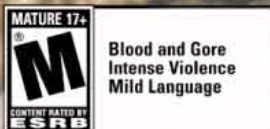


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Inside Track

Disc Watch Dept.: New developments in the Blu-ray disc scene are highlighted by some **new disc-coating** technologies promoted by TDK. The coating makes a disc's surface scratch-resistant, so it doesn't need a cartridge for protection. Sony, meanwhile, appears to be first out of the gate with a DVD/R/RW drive that complies with DVD-9 characteristics, meaning it has **two layers on one side**, offering about 9 gigabytes of storage capacity using the +RW methodology. Burning two different layers of a rewriteable disc is **amazing to me**. Look for the drive this summer.

And when exactly are we going to resolve the **spelling conflict** between *disc* and *disk*? I suspect it will happen as soon as the spelling conflict between **catsup** and **ketchup** gets resolved.

Wireless Everywhere Dept.: During my recent trip to the CeBIT fair in Hannover, Germany, I spent 12 days on the road, traveling to London, the Netherlands, Germany, Austria, and Croatia. This was the **first trip** I have ever taken where I never made a dial-up or even a hard-wired connection; I used my laptop with built-in wireless networking to remain in near-constant contact. Everywhere I went, I managed to find some sort of 802.11b wireless connection. London, for example, is **loaded** with wireless. In Germany it's spotty, and too often available only for hefty fees. Lots of hotels are offering wireless in the rooms for a small fee or, in many cases, for free.

This phenomenon is **mind-boggling**. I found connections in the street (**often open relays**), airports, hotels, and business centers. The speed varied, but was never slower than dial-up. I'd advise all business travelers to consider wireless. The latest version of the Toshiba Portégé R100 laptop (my current fave) has improved connectivity and seems to get signals from an **extended range**.

While on the Subject of Wireless Dept.: Ultrawideband, the nifty technology known as pulse radio, is getting bogged down in bureaucratic squabbles. Looks like the military may have its way after all, meaning this technology will remain unexploited.

Weird-but-True Stories Dept.: Here's one of those odd stories that makes you wonder how any business ever gets done. Back in 1983, Sony and Philips were working on a joint standard for the CD audio disc that was about to take the world by storm. There was **one last decision** to be made: The sampling rate was going to be either 44.1 kHz or 36 kHz for the audio tracks. They had just determined that the disc **needed to hold 72 minutes** of audio, because **Beethoven's Ninth Symphony** was that long. Philips proposed the 36-kHz standard, because it made a



The only good thing about the EU that I can see is the invention of the nifty Euro currency.

smaller, more compact disc and matched a telecom standard that would make downloading and transferring music easier—which I find rather ironic. Sony preferred the 44.1-kHz sampling rate, because it matched the upper reaches of audible sound at 20,000 cycles.

The final decision was made in a **meeting in Hawaii**, according to Richard Bruno, who was a Philips executive and one of the company's CD project managers. With final arguments running into recreational time, Bjorn Blutgen of Philips and Toshi Doi of Sony took to surfboards **still bickering**. One of them had the bright idea of challenging the other to a **surfing match**: Whoever fell off the board first would lose. The Dutchman lost. Hence we have a 44.1-kHz sampling rate on today's CDs. Now you know.

Screwing Microsoft Dept.: Maybe it's just me, but does anyone else think it's a little weird that the European Union **jammed Microsoft** with a fine of over half a billion dollars for business practices that have little to do with Europe and involve companies that are not European? Sounds like a money grab to me. A tax. Nobody seems to be defending Microsoft, but now is the obvious time to do so.

Nobody is a fan of Microsoft's **random abuses** of its position in the market, but what is the point of the EU action? Did these folks think that our failed attempt to reign in the company needed a savior? Is Europe trying to prove something? Although I don't think it would be right, it would be funny if Microsoft said, "OK, we're through with Europe. We're revoking all licenses." And then **remotely pulled the plug** on every copy of Windows running in Europe. That would be rich. Well, except for triggering a worldwide depression!

This **plug-pulling scenario** is where computing is headed, thanks to European initiatives that protect intellectual property, copyrights, and licenses. Meanwhile, this sort of world court run by Brussels-based bureaucrats is going to get worse. American companies will be easy targets.

Within the EU, control of agriculture and industry rests with Brussels. Apparently, you can't even plant new vineyards in certain countries without permission from the Eurocrats. Many EU citizens are **moaning** about how they're establishing a centralized **Soviet-style controlled** economic system, especially for farmers. Like that has ever worked. The only beneficiaries will be the Eastern European countries that have learned how to manipulate such a system.

As far as I can tell, **the only good thing about the EU** is the invention of the nifty Euro currency. It works great and makes travel on the continent much easier. If you can afford it, that is.

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Bill Howard



Media Hubs: Not Ready for Prime Time

The digital living room has no iPod: no killer convergence product with near-flawless design and execution that legitimizes and expands the category. Instead, welcome to the world of not-ready-for-prime-time media hubs.

We all know—okay, hope—that the next TV we buy will be a high-definition flat-panel. But you probably have a hazier picture of the devices that are converging the worlds of PC-based MP3s, digital photos, and digitized home videos onto TV sets and audio receivers. These are the *digital media hubs*, also known as *digital media/music receivers* or *streaming media players*. After testing nearly 20 of them in the past year, I've reached these conclusions: Cool and affordable as they are compared with good CD or CD/DVD changers of several years ago, they're unfinished products, missing features and short on ease of use. There's not an iPod-class hub among them.

The market remains gawky and adolescent (only the Turtle Beach AudioTron is as much as 18 months old), as the portable MP3 player market was two years ago. Most digital media hubs still handle only music, not photos or videos. Interfaces are clunky. Some products don't work with WMA or WMV (movie) files. Many don't show album art—even some that use TV *on-screen displays* for the artist and track information. Some OSDs time out quickly to an unchangeable screen saver: the company logo.

We're now in the caterpillar-not-yet-a-butterfly phase with media hubs. The transformation may result in creations of function and style, perhaps devices integrated into your next audio receiver (as Integra and Onkyo have attempted) or DVD player (as Apex and Gateway do). Hewlett-Packard, one of the early media hub entrants, has opted not to update its standalone HP en5000; perhaps it senses little future for a single-purpose device.

If you're thinking of buying, consider these issues.

Upgradability. All hubs play MP3, some also play WMA, a few (especially Mac) play AAC, and a very few others play FLAC (for original CD quality using half the space). In many cases, WMA compatibility will be a firmware upgrade; Omnifi promises an upgrade allowing photo displays. But you're buying promises, not guarantees.

DRM. You say you've cleaned up your act and are now buying rather than stealing music online? Sucker! Home media hubs can't play music with digital rights

management (DRM), which most paid downloads have now. (Ripped CDs play fine.)

A Microsoft technology dubbed Janus should solve that problem in late 2004: A revision of Windows Media Player in Windows XP Service Pack 2 will allow playing a media file with DRM on a media hub. Microsoft claims other players (Musicmatch, Winamp) will be able to implement the DRM function. It would be nice if buyers could get advice such as "Look for a UPnP (Universal Plug and Play) media hub that is forward-compatible with Janus DRM," but the hub makers aren't sure whether this first Janus version will work with their products.

Ethernet disks. Ideally, you'd off-load your media files to cheap (sub-\$250) Ethernet hard drives rather than keeping them on your PC. The problem is, most media hubs require a software applet running on a PC, regardless of whether the files are on a network disk. (The AudioTron is an exception, and the Slim Devices Squeezebox is a partial one, but they're both audio-only with no OSD.) It may be as easy to get a PC (with a TV-out card) just for media services. Dell, Gateway, HP, Samsung, and others will come out with Media Center Extenders—essentially media hubs that talk only to MCE PCs—in the second half of the year.

Mood matching. Once you have thousands of songs, you'll wish for categorization beyond the standard rock versus rap versus jazz. To create media hub playlists, try standalone software such as MoodLogic or MusicMagic for \$30 to \$50. MoodLogic's forte is finding songs similar in mood to those you like: If you listen to "Come Away with Me," by Norah Jones, MoodLogic will queue up similar works performed by Ella Fitzgerald and Charlie Hunter, if you have them. This works better with bigger music libraries—and best when you can stream the entire Internet of (legal) music. Mood matching will be available in future versions of Musicmatch and Windows Media Player.

The future of entertainment media could well be online. I'm not sure I like this, but you may have to set aside \$10 a month in perpetuity for Napster, Rhapsody and their siblings. DRM plus streaming means you will always have fresh music for portable devices, even car players, at whatever bit rate you desire, as long as you continue tithing.

The market for media hubs remains gawky and adolescent, as the portable MP3 player market was two years ago.

MORE ON THE WEB: You can contact Bill Howard directly at bill_howard@ziffdavis.com. For more On Technology columns, go to www.pcmag.com/howard.



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*Based on DDS-4 tape comparison. Compressed capacity assuming 2.6:1 data compression with "high" compression on Iomega Automatic Backup Pro software. This capacity may vary since

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Sending Large Files

What do you do when you need to share a file but it's too big to e-mail? **BY JAY MUNRO**

You've worked for weeks on that multimedia PowerPoint presentation that will mean a promotion for sure. However, the boss just called from the San Diego office and needs it today, rather than tomorrow. At 15MB, the file exceeds your ISP's e-mail limit. What do you do?

FTP AND HTTP

You can transfer files using two of the basic Internet protocols, FTP and HTTP. Both can easily send large files, but as neither is particularly secure, you should investigate some of the other options.

File Transfer Protocol (FTP) is the classic way to move large files online. Using a public or private Web site, you put your

files using a third-party FTP client, such as CuteFTP or WS_FTP, or by configuring a Windows XP or Windows 2000 Network Place. With a broadband connection, you can host an FTP server. CoolSoft's **PowerFTP** client includes an easy-to-use server. Turn it on, add users and home folders, and tell your friends your IP address. They can connect using an FTP client or Internet Explorer. PowerFTP costs \$29.95; a trial version is available. (CoolSoft, www.coolsoft.com/powerftp.htm. ●●●●○)

Windows XP Professional includes an FTP server (FTP Publishing Service). It isn't a default feature, but you can install it easily by following the instructions. It's not as easy to use as PowerFTP, but it's free.

Setting up an HTTP file transfer is easy: Create a simple Web page with a link (such as `click here`) to the file. It should be private enough for most purposes, but if it is up for long, a search engine may catalog and even cache it. HTTP is problematic over poor connections because you need to start over if the download is interrupted.

PEER-TO-PEER

For a more private transfer, peer-to-peer (P2P), a direct connection between your own and your friend's computers, is an option. It's the technology that drives file sharing services like Kazaa and Gnutella. A central server

indexes the available files and facilitates P2P connections between users. Using this kind of network for private sharing is possible if you use files with unusual names, such as XG2aU15.b2v, and then let your friend know the filename. (A public search would not turn it up unless someone

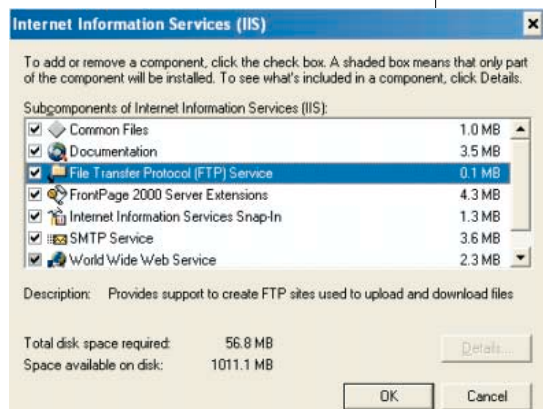


FIGURE 1: Setting up an FTP server in Windows XP Professional requires you to first install it through the Control Panel | Add/Remove Programs selection.

files in an easily accessible place for your recipients. There are two basic types of FTP access: anonymous and private. *Anonymous* FTP on a public site is risky, as anyone can access the files, but *private* FTP requires you to configure users.

If you have a Web site, you can transfer

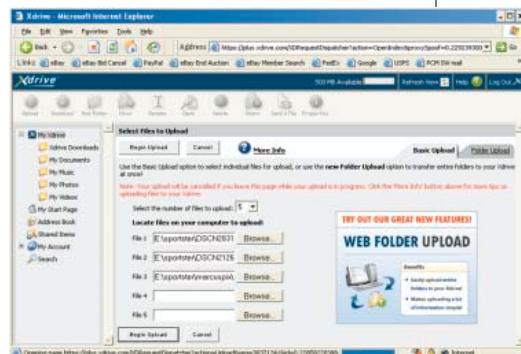


FIGURE 2: The online storage site Xdrive lets you easily upload up to five files at once into your virtual hard drive.

searched on that exact filename.)

RazorPop's **TrustyFiles 2.0** is an interesting alternative to public-network file sharing. It offers private P2P transfers, along with public music and video searching and downloading, using the Gnutella network. When you install TrustyFiles, you can specify whether you want your shared files to be public (open to anyone), personal (private and public sharing), or private (friends only). If you're behind a firewall or router, you must set up port forwarding for TrustyFiles to work. (RazorPop Inc., www.trustyfiles.com. ●●●○●)

Creo Tokens is like a P2P system on steroids. A secure and easy way to transfer files directly from your machine, the application requires two components: Token Creator and Token Redeemer. The sender uses the Creator application to compress and encrypt a file into a *bundle*, which is stored in a shared folder while a companion *token* file is created. The sender e-mails the token to the recipient, who can request, download, and unpack the bundle using Token Redeemer.

If you're behind a router or firewall, Creo Tokens automatically uses its relay service for the transfer, letting you avoid setting up port forwarding. Unlike in TrustyFiles, you can't set the IP address that Creo Tokens uses, so you must use either your PC's real address or the relay service. The relay service is automatic, but there is a monthly transfer limit (though you can purchase more through-

70 **HARDWARE:**
Dual-layer DVDs.

72 **SECURITY WATCH:**
Personal IM security.

76 **INTERNET BUSINESS:**
Online grocery shopping.

78 **INTERNET PROFESSIONAL:**
Interoperable Web services.

81 **USER TO USER:**
Tips and tricks.

put). Corporate clients should look to the Creo Server, which lets users save shared files to a corporate server; all tokens point back to that address rather than to the sender's desktop. (Creo Inc., www.creo.com/tokens. ●●●●○)

STORE IT ONLINE

If you don't have a Web site and don't want to create a peer-to-peer connection, an Internet-hosted "hard drive" is a good way to go. Such services, like Xdrive, provide a simple interface and a set amount of disk space, based on your purchase plan, for you to upload and store files. To share

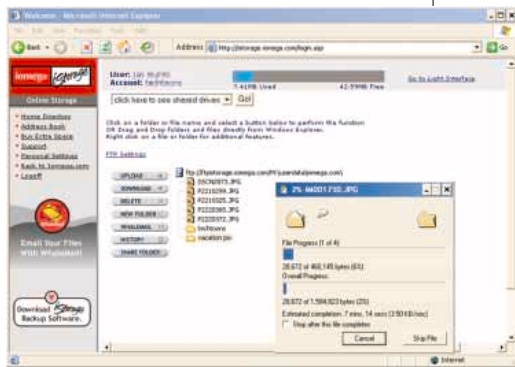


FIGURE 3: iomega iStorage's desktop interface makes file transfers a snap with drag and drop, file tree display, and menu items at your disposal.

them with your friends, let the service know who should have access to your account. It will then e-mail a link to your friends. Files are encrypted on the site, and users need a password for access and decryption.

Xdrive lets users share entire folders or individual files. With shared folders, recipients can upload their own files, depending on the permissions you grant. You can use the service's Web interface or install Xdrive's Desktop application. With Desktop, users have access to Xdrive through Windows Explorer for drag-and-drop file management and can schedule automatic backups. Business clients should check out Xdrive's workgroup capabilities. (Xdrive Inc., www.xdrive.com. ●●●●○)

Yahoo! Briefcase is a 30MB freebie, with the option to buy more space. The free account, like other Yahoo! functions, is ad-driven. You can upload five files at a time. To share content, select the files and click to e-mail them; you can add up to ten addresses to each file. Recipients get an e-mail from Yahoo! with links to your files. (Yahoo! Inc., <http://briefcase.yahoo.com>. ●●●●○)

iomega iStorage is similar to Xdrive. Start with the 30-day trial; paid plans start at \$2.49 a month for 50MB of storage. With the iStorage desktop application, an ActiveX-based page, you can drag and drop files from Windows Explorer or MyComputer. Files are encrypted online.

iomega WhaleMail makes it easy to e-mail stored files. Choose one or more files from



FIGURE 4: The MagicVortex interface, with a visual indicator of where files are in transit, gets extra points for design.

your online folder and add recipients and comments; your friends get an e-mail with a link to your iStorage file. WhaleMail links are good for 14 days or five downloads. (iomega Corp., www.iomega.com/istorage. ●●●●○)

MagicVortex is a service just for moving large files. With its "facilitated streaming," you can transfer files of up to 2GB, depending on your pricing plan. Files are saved temporarily at MagicVortex's site, so you can upload even when your recipient isn't online.

With the 30-day trial, you can transfer up to 30MB at a time. You can either use the MagicVortex client software or do a Web-based transfer. Paid plans start at \$9.95 a month for up to 100MB of transfers. When you upload a file, MagicVortex sends the recipient a link to retrieve it. The recipient can click a link to send you a confirmation of the download. The recipient doesn't need MagicVortex to receive files. (Sage Analytic Technologies LLC, <http://magicvortex.com>. ●●●●○)

If you are armed with the right info, transferring large files isn't difficult. You can send that PowerPoint file with ease, and that promotion should be in the bag.

Jay Munro is a freelance writer and consultant based in Connecticut.

Tools for Transferring Large Files

●●●●-EXCELLENT ●●●-VERY GOOD ●●-GOOD ●-FAIR ●-POOR

	Price	Architecture	Client required	Interface	Security	OVERALL
Creo Tokens	\$49	P2P	Token Redeemer (free)	●●●●	●●●●	●●●●
iomega iStorage, WhaleMail	30-day trial, then \$2.49 a month (50MB)	FTP, SSL/FTP	Any browser, any FTP client	●●●●	●●●●●	●●●●
MagicVortex	30-day trial, then \$9.95 a month (100MB)	HTTP	Any e-mail client	●●●●	●●●●●	●●●●
PowerFTP	\$29.95	FTP	Any FTP client	●●●●	●●●	●●●●
TrustyFiles 2.0	Free	P2P	RazorPop (free)	●●●	●●●	●●●
Xdrive	30-day trial, then \$9.95 a month (500MB)	FTP	Any browser, any FTP client	●●●●○	●●●●●	●●●●○
Yahoo! Briefcase	Free (30MB)	HTTP	Any browser, any e-mail client	●●●	●●●	●●●

HARDWARE

New DVDs Hold More

You'll be able to record almost twice as much data on a dual-layer DVD. **BY DON LABRIOLA**

If you thought the current crop of multiformat DVD±R/RW drives had finally resolved the long-standing rivalry between the DVD-Plus and DVD-Dash camps, guess again. The DVD+RW Alliance and DVD Forum may now both support high-performance 8X write-once and 4X rewritable media, but the battlefield has simply shifted to another front: dual-layer (DL) recording.

Unlike currently available single-layer media, which hold 4.37GB (about 4.7 billion bytes) of data, DL write-once discs can store a whopping 7.95GB (about 8.5 billion bytes)—matching the capacity of the dual-layer read-only discs used to distribute Hollywood movies. They provide nearly twice as much room for video productions and computer data, and make it possible to back up any dual-layer DVD-Video disc on a single piece of media.

Until a few years ago, most analysts considered it impossible to manufacture DL-recordable media that would work reliably with consumer DVD players. But as has been the case with most advances in DVD recording, the DVD Forum and DVD+RW Alliance now both plan to release proprietary versions of such a technology. Building on research at Philips and MKM (Mitsubishi Kagaku Media, the parent company of Verbatim), the Alliance has already launched its DVD+R DL format. A similar format developed at Pioneer Electronics promises to become the basis of the DVD Forum's imminent (but not yet named) dual-layer version of DVD-R. Although it's too early to know for sure, it's likely that both formats will be equally compatible with most late-model DVD players.

The two specifications have many minor technical differences, and use dissimilar mechanisms for addressing and locating data on the disc. But from an end-user perspective, the only obvious difference is likely to be their write speed. DVD+R DL will initially support 2.4X recording, but the Forum's dual-layer spec will probably run at 2X. Media prices are

not yet set, but they're likely to be similar for both Plus and Dash blanks, though dual-layer discs initially will cost much more than single-layer DVDs of equivalent speed. 4X versions of both formats are already in development.

To comprehend how dual-layer recording works, you first need to understand how DVD players access data on mass-produced single-layer discs. Read-only DVDs store information as billions of microscopic pits stamped in a spiral groove on the surface of a polycarbonate disc. The grooved side of the disc is coated with a reflective material like aluminum, which is then bonded to a protective plastic layer and label. When a laser is swept along the groove, a sensor monitors the amount of light bouncing off the reflective layer behind the pitted surface. Alterations in the beam that occur when it passes through a pit enable the drive to interpret the stamped pattern as a sequence of ones and zeros.

Blank recordable DVDs replace the pits with a blank stamped groove covered by a layer of heat-sensitive organic dye. A virtual pit is recorded by heating a tiny pinpoint of dye with a tightly focused laser.

This permanently changes the dye's physical characteristics at that point, giving it optical properties similar to those of a stamped pit.

Dual-layer media add a second recordable layer behind the first. The metallic coating of *Layer 0*, which is closer to the laser, is altered to become translucent, allowing the laser beam to pass through it when focused on the deeper *Layer 1*.

Producing such a disc may sound like a straightforward task, but ensuring that both recordable layers have the same optical properties as stamped pits was a monumental feat. Even after carefully tweaking parameters like the precise depth and shape of the recorded "pits," the thickness and chemical composition of each dye layer, and the ability of the metallic coatings to reflect or transmit light, first-generation DL media are still subject to constraints. Both formats, for example, require that data on *Layer 0* must be recorded before the corresponding position on *Layer 1* can be burnt.

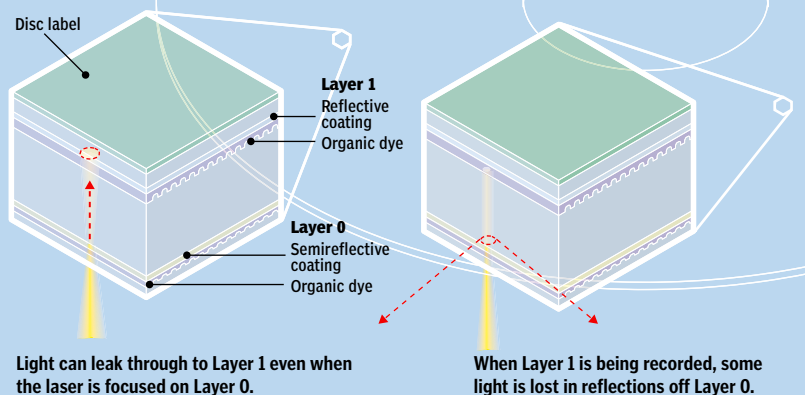
Recordable dual-layer media won't single-handedly revolutionize the DVD industry. But the technology is a giant leap in the continuing effort to make personal DVD recording flexible enough to handle any DVD application.

For an expanded version of this story, please visit www.pcmag.com.

Don Labriola is a contributing editor and lead analyst in DVD technology for PC Magazine.

Recording Two-Layer DVDs

Producing a dual-layer disc may sound like a straightforward task, but ensuring that both recordable layers have the same optical properties is tricky indeed.





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SECURITY WATCH

Secure Instant Messaging

Here's how to keep IM conversations safe. **BY BILL MACHRONE**

Everyone talks about protecting the corporation from intruders—including, perhaps, its own employees. But who's protecting your instant messages from snoops? Most companies tolerate some personal calls, e-mails, and IMs, as long as the privilege isn't abused. But don't forget—they can legally monitor conversations on their equipment, whether phone or computer. So not only are your e-mails fair game, but so are your IM sessions.

also protects against buffer overflow IM exploits. AIM, MSN, or Yahoo! will all work with the freeware version. The Pro version encrypts multiple accounts and provides additional security features. Your correspondent must be running IMSecure as well; messages to recipients without the program are not encrypted.

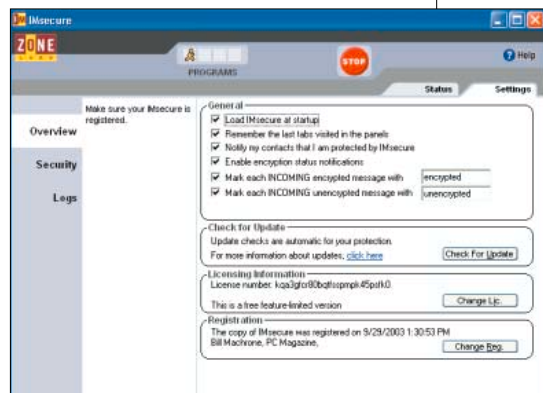
IMSecure encrypts third-party, universal clients such as GAIM and Trillian, too. You can also find proprietary end-to-end encryption add-ons for MSN Messenger and Yahoo! Messenger. These function like IMSecure, but only for one product.

Another route to securing IM is to get a digital certificate. A Class 1 or personal digital certificate is issued by a certificate authority, which maintains a unique public key for your identity. We tested VeriSign's certificate system for AOL Instant Messenger, which costs \$14.95 a year. The VeriSign solution is not actually integrated

with AIM, but there are clear directions for acquiring and installing the certificate. You can also use the certificate to secure and encrypt e-mail.

You start by going to www.verisign.com/products/class1/aim/index.html. You can choose the 60-day free trial option or pay \$14.95 a year with a credit card. After you fill out your name, billing information, and e-mail address, VeriSign sends an e-mail with a PIN number that allows you to pick up the digital certificate from its site with your browser. Once you have done so, your browser stores the ID. Next you export the ID to a file, following the instructions on VeriSign's site. You then import the certificate into AIM.

When you restart AIM, you will be asked for the security password, and AIM will start normally. Others who see your name on their buddy lists will see a lock icon next to your name, but there is no



YOU CAN KEEP your IM sessions private with IMSecure.

While we're sure your messages are entirely wholesome and aboveboard, we're equally sure there are some you'd rather not have bandied around the department or forwarded to everyone. Fortunately, you can secure your personal IM messages without too much difficulty. Bear in mind, however, that no encryption scheme prevents keystroke capturing or copying unencrypted text from the screen by spyware and monitoring software; the messages are encrypted only while in transit, on your network, or on the Internet.

AOL, Microsoft, and Yahoo! include encryption in the enterprise versions of their software, but the easiest way to encrypt personal IM sessions is to download IMSecure, from Zone Labs (www.zonelabs.com). The freeware version of this program will encrypt one IM account, and it

THE LOOKOUT

WEB-BASED E-MAIL AT RISK

Israeli security vendor GreyMagic has discovered a security vulnerability in Microsoft's and Yahoo!'s Web-based e-mail services. The vulnerability results from the technology the companies use to filter e-mail in order to thwart potentially unsafe HTML. According to GreyMagic (www.greymagic.com/security/advisories/gm005-mc/), the flaw could have severe consequences, such as the theft of log-ons and passwords—or distribution of a Web-based e-mail worm.

The problem arises from functions in Internet Explorer designed to add timing and media synchronization support to HTML pages. Features of this technology make it possible to inject any HTML content into a document, including a script.

GreyMagic noted that Microsoft fixed Hotmail shortly after the company was notified of the vulnerability, but attempts to inform Yahoo! failed. GreyMagic also pointed out that other Web-based services may also be at risk.

—Sharon Terdeman

change in AIM's operation. When you initiate a session with another user who has a certificate, you will see a message at the bottom of the window that says "Encrypted conversation" and cites the user's name and certificate authority. If you use AIM from another machine, your buddies will not see the lock icon and messages will not be encrypted.

You can also get a free "personal e-mail certificate" from the VeriSign subsidiary Thawte (www.thawte.com/email/index.html). The certificate works with IM as well and interoperates with VeriSign certificates. To install and use it, follow the instructions on the AIM and VeriSign sites. MSN, Yahoo!, GAIM, and Trillian do not currently support Class 1 certificates.

Digital certificates use public-key encryption. Your public key is on the vendor's servers, and the other user's secure AIM session retrieves your key, encrypts the message, and sends it to you, where your session uses your stored private key to decrypt it. While publicly vetted encryption, as used by AIM, is generally preferable, the proprietary algorithms used by IMSecure and other add-ons are probably sufficient for most users' needs.

Bill Machrone is a contributing editor of PC Magazine.



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INTERNET BUSINESS

Web Grocer Hits Refresh

Online grocer FreshDirect takes the hassle out of city shopping. **BY JENNIFER HARSANY**

If you've ever gone grocery shopping in Manhattan, you know how expensive—and frustrating—a weekly food run can be. Fruit costs twice as much as it should, the heavy plastic bags dig into your palms, and eventually you begin to wonder if that gallon of milk really is necessary for your cereal.

Now 150,000 New York City dwellers have registered for FreshDirect, a more convenient online alternative that's often nicer to their wallets and as personalized as a neighborhood grocer. When it comes to filling 230,000 orders every week, Dean Furbush, COO of FreshDirect, says the plant operates like “a huge Willy Wonka chocolate factory.” Since shipping its first order in July 2002, FreshDirect has been out to prove that its business model can be a profitable one.

The privately owned company doesn't release sales figures, but Furbush says it has recently been gaining 25 percent in revenue every month. FreshDirect attributes its success to giving customers less expensive food and more flexibility in arranging deliveries. The company buys directly from farms, fisheries, and dairies, and, as long as a customer places his order by midnight, he can get it the next evening during a 2-hour delivery slot he chooses.

At www.FreshDirect.com, you can browse through the food departments and sort products by price or brand. Items are accompanied by photographs, ingredients, recipes, and nutrition facts. FreshDirect prides itself on having over 500 kinds of cheese, deli meats, and farm-fresh produce, but it also stocks brand-name goods such as Kraft cheese slices, Cocoa Puffs, and Chef Boyardee canned pasta. You can even order paper towels, laundry detergent, and 14-pound bags of kitty litter.

The heart of the operation is a fully refrigerated plant the size of five football fields, located just across the river from Manhattan. The plant is equipped with 30 Wi-Fi 802.11b access points to keep the multitude of technical equipment and hand scanners in constant communication. “We

have quite a bit of complexity in this environment,” says CTO Myles Trachtenberg.

FreshDirect uses a combination of tools from SAP for inventory control and order processing. As customers are placing orders, it tracks product availability in real time so the inventory system can mark an item as unavailable if the supply falls too low. The FreshDirect technical team of almost 50 people has written extensions to the SAP applications to help with product replenishment and has developed the J2EE app for the Web storefront.

Orders are sent through the SAP system to be aggregated according to delivery time and location. The orders are then sent to the production floor, where food specialists prepare them and label them with bar code stickers.

Bins of products then travel on a conveyor belt past a worker. A light shows the

worker how many of a certain product to grab to fill an order and which bin the product is in. After all the items in an order are placed in a packing box, they are repacked and sorted into one of ten delivery bays, where they board a temperature-controlled FreshDirect truck. The company employs about 400 manufacturing workers and 300 delivery drivers.

FreshDirect's Web servers run Apache on a Solaris operating system and are housed on about 40 Unix machines. Another 40 Windows machines run back-office applications. At peak times, the Web servers handle 18,000 simultaneous shopping sessions. An Oracle 9i database system powers Quick Shop, a feature that takes the hassle out of repeat orders. Customers can view the details of their previous orders and, for example, reorder the same kind of fresh tortellini or another 2 pounds of kosher ground turkey.

As for expansion plans, FreshDirect is focusing first on creating a world-class and replicable facility in New York. Judging by the number of those brightly colored trucks on the city streets, it has already made it easier for a lot of people to replace that empty milk carton.

Special Delivery

Here's how FreshDirect delivers food orders within 24 hours.

2 All orders are cut off at midnight and sent through an SAP system to be sorted according to delivery time and location.

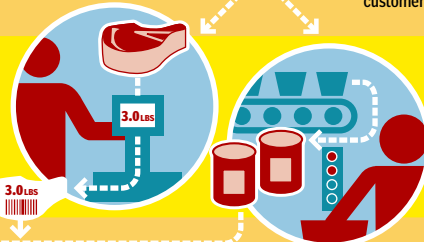


1 The FreshDirect Web site displays everything from fresh vegetables to customizable meat cuts.



The QuickShop feature lets return customers reorder their favorites.

3 Food specialists prepare fresh food orders and weigh each for the final invoice.



4 Dry goods are pulled from bins moving along conveyor belts. Lights show workers how many of which items to take for an order.

5 Orders are packed in delivery boxes and loaded into a climate-controlled truck.



6 The order is delivered within a 2-hour time window chosen by the customer.



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INTERNET PROFESSIONAL

Crafting Interoperable Web Services

Interoperability has been a rather elusive goal. Now an organization dedicated to it provides help. **BY ROBERT P. LIPSCHUTZ**

Web services arrived on the scene promising not only to eliminate the difficulties of enterprise application integration—one of the costliest technology problems for large companies—but also to serve as an on-ramp to a new breed of distributed services that would revolutionize the Internet. Although seemingly every company or software vendor has implemented Web services, or plans to implement them, nagging interoperability problems remain.

Marketing and sales people throw the term *interoperability* around very loosely, but developers and other poor souls working in the trenches agonize over the idea. Industry veterans know that standards alone do not guarantee interoperability, because the specifications usually fail to spell out crucial implementation details. Moreover, rival vendors apply the standards in different and often incompatible ways.

Unfortunately, this holds true for Web services. Basic Web services must comply with the XML, SOAP, and WSDL specifications, but these specifications have not been tight enough to ensure interoperability. SOAP 1.1, for example, defines four different ways to represent data in the envelope, leaving a lot of wiggle room. And true to form, tool vendors like Microsoft, IBM, BEA, Sun, and others have wiggled in different directions.

Even more problematic, when developers choose to encode the SOAP envelope—completely in accord with the SOAP specification—the developer of a consuming application needs special knowledge of the encoding used, beyond just the WSDL and XML definitions. Encoding serializes the underlying data structure and circumvents the self-describing nature of XML.

The Web Services Interoperability Organization (or WS-I, www.ws-i.org), launched in February 2002, plans to make interoperability viable by creating profiles, sample applications, and testing tools to guide soft-

ware makers and developers. The recently released WS-I Basic Profile 1.1 delivers a set of rules that programmers can follow when using XML, SOAP, and WSDL. Compliant tool vendors will build support for these rules into their products.

The Basic Profile is not a brand new standard. Instead, it takes the options and choices available within the existing standards and tightens them to a level that ensures interoperability. For example, to address the SOAP encoding issue mentioned above, the Basic Profile includes statements like those shown in Figure 1.

As a further aid for developers, the WS-I

The `soap:encodingStyle` attribute is used to indicate the use of a particular scheme in the encoding of data into XML. However, this introduces complexity, as this function can also be served by the use of XML Namespaces. As a result, the Profile prefers the use of literal, non-encoded XML.

R1005 An ENVELOPE MUST NOT contain `soap:encodingStyle` attributes on any of the elements whose namespace name is "http://schemas.xmlsoap.org/soap/envelope/".

R1006 An ENVELOPE MUST NOT contain `soap:encodingStyle` attributes on any element that is a child of `soap:Body`.

R1007 An ENVELOPE described in an `rpc-literal` binding MUST NOT contain `soap:encodingStyle` attribute on any elements are grandchildren of `soap:Body`.

FIGURE 1: As this example illustrates, WS-I Basic Profile 1.1 sets out stricter requirements for Web services.

has created a sample supply chain management application to illustrate how the Basic Profile can be used, and to give a working, real-world example from which users can gain insight into the profile's mechanics. Ten WS-I members, including BEA, IBM, Oracle, and Sun, produced implementations of the WS-I supply chain scenario, using varying platforms (Microsoft .NET or Java). Each implementation conforms to the Basic Profile; therefore, the components should be interoperable. The ten implementations are available to developers.

Finally, the WS-I has created a set of testing tools to help developers ensure that their own Web services conform to the Basic Profile. The tools include the Web

Service Communication Monitor, which captures the messages Web services exchange, and the Web Service Profile Analyzer, which evaluates the messages and also validates items such as a Web service's WSDL documents and XML schema files. The analyzer then produces a report that indicates whether the service corresponds to the Basic Profile's interoperability rules.

Another major obstacle hindering the widespread acceptance of Web services is security—or its lack—in their basic protocols, and that's become the focus of the WS-I's latest efforts. Under development is a Basic Security Profile, an extension of the Basic Profile that is intended to allow developers to build secure Web services without diminishing interoperability.

The WS-I published a draft of its security scenarios in February (www.wsi.org/Profiles/BasicSecurity/2004-02/SecurityScenarios-0.15-WGD.pdf) that identifies threats and challenges relating to authentication, data integrity, and confidentiality, and sets out a number of candidate technologies for tackling these security

needs. The forthcoming security profile will build on the definitions in that document and provide clear direction and recommendations to developers and tool makers.

"If the standards were perfectly clear and unambiguous," said a spokesperson for WS-I, "the Basic

Profile would have one sentence that read, 'Use the standards.'" We'd like to add that developers would be happier if they did not have to read a Basic Profile either. We'd leave that to the software companies and reap the interoperability benefits inherent in the tools.

We can look forward to that scenario. Expect development tools to have Basic Profile support and built-in validation later this year. But for now, developing interoperable Web services still requires programmers to have a deeper understanding of the rules.

Robert P. Lipschutz is president of Thing 7 (www.thing7.com) and helps companies speak more clearly about technology.



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USER TO USER

PC MAGAZINE'S COMMUNITY OF EXPERTS AND READERS

Another Way to Highlight Formulas

I recently read your Excel tip about highlighting cells containing formulas (www.pcmag.com/print_article/0,3048,a=116216,00.asp). But this technique only

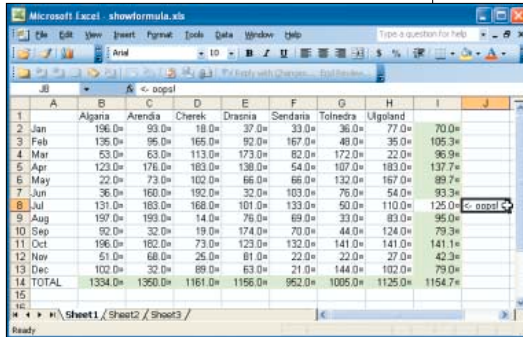


FIGURE 1: You can use a simple VBA function to highlight any cell that contains a formula.

statically formats cells that contain formulas at a particular time. It's easy, however, to create a conditional format that will adjust to the current content of cells. Select **Define Name** from the **Insert** menu. Type a name in the **Names in workbook** space; I used `cellhasformula`. In the **Refers to** section at the bottom, enter `=GET.CELL(48,INDIRECT("rc",FALSE))`. The first argument to `GET.CELL` can be a value from 1 to 53; 48 causes it to return TRUE if the cell contains a formula.

Now select the range of cells you want to apply the conditional formatting to. Then select **Format | Conditional Formatting** from the menu. Choose **Formula is** from the drop-down list box and enter `=cellhasformula`. Select the format to be used for cells containing formulas and click on **OK**.

VICTOR WOROBEK

You won't find any help for `GET.CELL` in Excel's help system. And if you try to use `=GET.CELL` as a formula in a cell, Excel will respond "That function is not valid." Typically, if you enter a nonexistent function, Excel simply displays `#NAME?`; this is a different response. So what is `GET.CELL`? Old-timers may recognize it as an Excel 4.0 macro

function. These functions are still recognized in modern versions of Excel but are rarely useful. You can get a help file describing the old XLM functions from the Microsoft Download Center (www.microsoft.com/downloads); search for `xlmacr8.hlp`.

If you'd rather not dig into the dim and distant past, you can accomplish the same thing using an extremely simple VBA function. Select **Macro | Visual Basic Editor** from the **Tools** menu. You should see a project tree at top left, which will include a list of worksheets in the current workbook. If there is no entry for **Modules**, right-click on the workbook and choose **Insert | Module** from the pop-up menu. If a module already exists, select it. In the code-editing window that appears,

enter this function:

```
Function HasFormula(C As Range) As Boolean
    HasFormula = C.HasFormula
End Function
```

Press **Alt+Q** to close the editor and return to Excel. Click in cell A1, select **Format | Conditional Formatting**, and again choose **Formula is** from the drop-down list. This time, enter `=hasformula(A1)` and select a format, perhaps a green background. Use the **Format Painter** from the toolbar to paint this format over all the other cells involved. Any containing formulas will now be green. A cell whose formula has accidentally been replaced by a static value will stand out.

—Neil J. Rubenking

Find, Format, Replace

Here's the scenario: I copy some text into my Word document and find that numbered bibliography references are numerous and hard to find. My goal is to make all

the numbered referrals in the text boldface. I don't want to change the numbers or brackets, just boldface all instances of [1], [2], [3], and so on, so they are easy to find. Is there a way to do this?

RED RADDAR

Word's **Find and Replace** dialog does indeed include the option to specify formatting. If you apply formatting to the **Find what** box, only text that also matches the formatting will be found. If you apply it to the **Replace with** box, the inserted text will be formatted as you specified. The catch is, you don't want to insert specific text, you want the same text in a new format. Word's special **Find and Replace** codes make this possible.

In the **Find what** box, enter `[]` and move the cursor to between the brackets. Click on the **More** button, then click on the **Special** button and select **Any digit** from the menu. Your **Find what** text will now be `[^#]`. Click in the **Replace with** box and again click on **Special**. This time the menu is slightly different; select **Find What Text**, which will insert the code `^&`. Now click on the **Format** button, select **Font**, and select **Bold**.

When you click on the **Replace All** button,

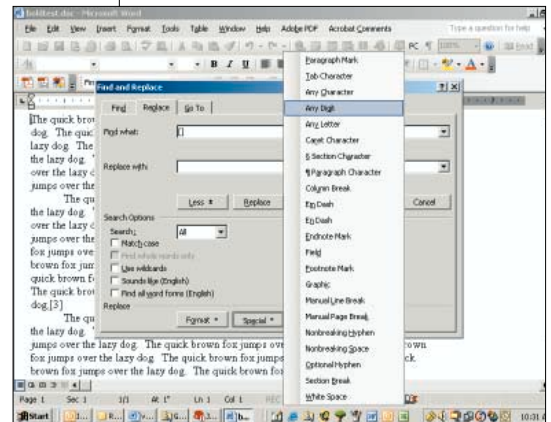


FIGURE 2: You can specify formatting when you find and replace text in Word.

Word will replace all the bracketed single digits with the same text in boldface. If any of the references are two-digit numbers, just repeat this process using `[^##]`. Note that once you know the codes, you can type

Word's *Find and Replace* dialog box includes the option to specify formatting.

Many services are critical to Windows operation, but some of the others can be disabled.

them in yourself without going through the menus. You can, of course, use this technique to apply specific formatting to other character patterns.—*NJR*

Stop Win XP from Searching Within ZIP Files

Windows XP's search takes a really long time, because in addition to folders, it also searches through ZIP files (which Win XP calls *compressed folders*). I have a ton of ZIP files that contain many, many files and folders, but when I'm searching for a file, very often I know it is in an ordinary folder, not in a ZIP file. I'd like to search just the folders, not the ZIPs. Is there a way to do this?

LYLE O'LEARY

The only way to disable searching in ZIP files is to turn off Win XP's support for treating ZIP files as folders. This is easy to do—and to undo.

From the Start menu's Run dialog, enter this command: `regsvr32 /u zipfldr.dll`. Repeat and enter `regsvr32 /u cabview.dll`. Each time, you should get a notice thatDllUnregister succeeded. Con-



FIGURE 3: Here's one of the messages you'll see when you run `regsvr32`.

trary to numerous Web sites displaying this advice, you need to restart the computer for the change to take effect.

Now, when you search, the operating system will ignore ZIP folders instead of treating them as folders. If you don't care about that feature, you can leave it turned

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off. But turning it back on is as simple as repeating the two `regsvr32` commands without the `/u`.—*NJR*

Eject a Stuck CD

I had a new CD drive put into my tower. I inserted the first CD, and the drive took it in, but the disc would not start up and run, and the machine will not eject it. What can I do?

PEGGY HILL

We can't repair the drive for you remotely, but we can help you rescue the CD that's stuck inside.

Start by turning the computer off. Get a medium-size or large paper clip and straighten the long leg. Look closely at the front of the CD drive; you should find a hole that's about the right size for the paper clip. (Not the earphone jack, of course!) Sometimes there's a groove just below the drive door instead of a hole.

Carefully push the paper clip straight into the hole to release the catch. The drive door should open without too much pressure. If this doesn't work, the drive may be physically jammed shut. In that case you'll need a hardware technician to fix it.—*NJR*

Controlling Services at Windows Startup

My wife's computer always has Symantec's WinFax program running in the system tray. We haven't been able to get rid of it. If we use Task Manager to stop the process from running, it's back at the next reboot. I downloaded and installed Startup Cop from *PC Magazine*, but WinFax doesn't appear in the list. How can I disable this program?

B. TRELOAR

You can prevent WinFax from launching at startup by removing it from the Startup program group. Select *Start | Programs | Startup* and click on the *WinFax Controller* icon. From the pop-up menu, select *Delete* and then *OK*.

But every time you use WinFax, by default the Controller remains running after the Message Manager has been closed. To get the Controller to exit whenever the Message Manager closes, go to *Start | Programs | Symantec WinFax PRO | Program*

Setup. Select *Call Status and Controller* and click on *Properties*. Then select *Close Automatically* from the *When not in use* control, and click on *OK*.

The reason WinFax doesn't appear in

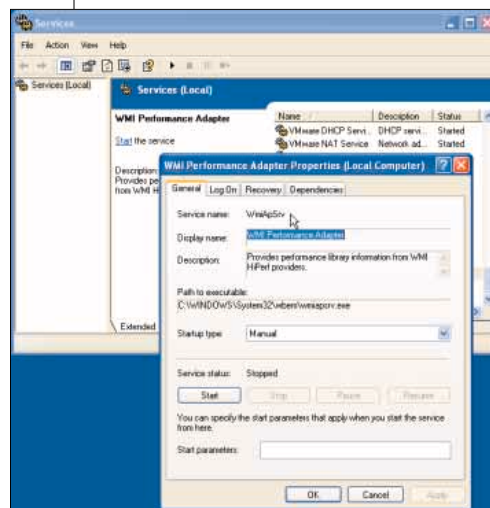


FIGURE 4: You can use the *Services.msc* application to manage some Windows services.

Startup Cop's list is that the utility controls only *applications* that are launched at startup. WinFax is a *service*, not an application, and as such is launched in a completely different fashion.

Many services are critical to proper Windows operation; but some, including WinFax, can be disabled without destabilizing your system. Windows includes a handy application for managing services, giving you another way to handle WinFax and (if you do it carefully) other troublesome services.

Launch *Services.msc* from the *Start* menu's *Run* dialog. Scroll down to the WinFax service in the list and click on the *Stop* button. If you want to stop it altogether, set its *Startup* type to *Disabled*. If you want to turn it on only when you need it, set the *Startup* type to *Manual*. Carefully note the *Service name* at the top of the *Properties* page; for example, the service name of the WMI Performance Adapter is *WmiApSrv*. To turn on the service, enter the command `net start name` at a command prompt or the *Start* menu's *Run* dialog, replacing *name* with the service name. To turn the service off, enter `net stop name` in the same way.—*NJR*

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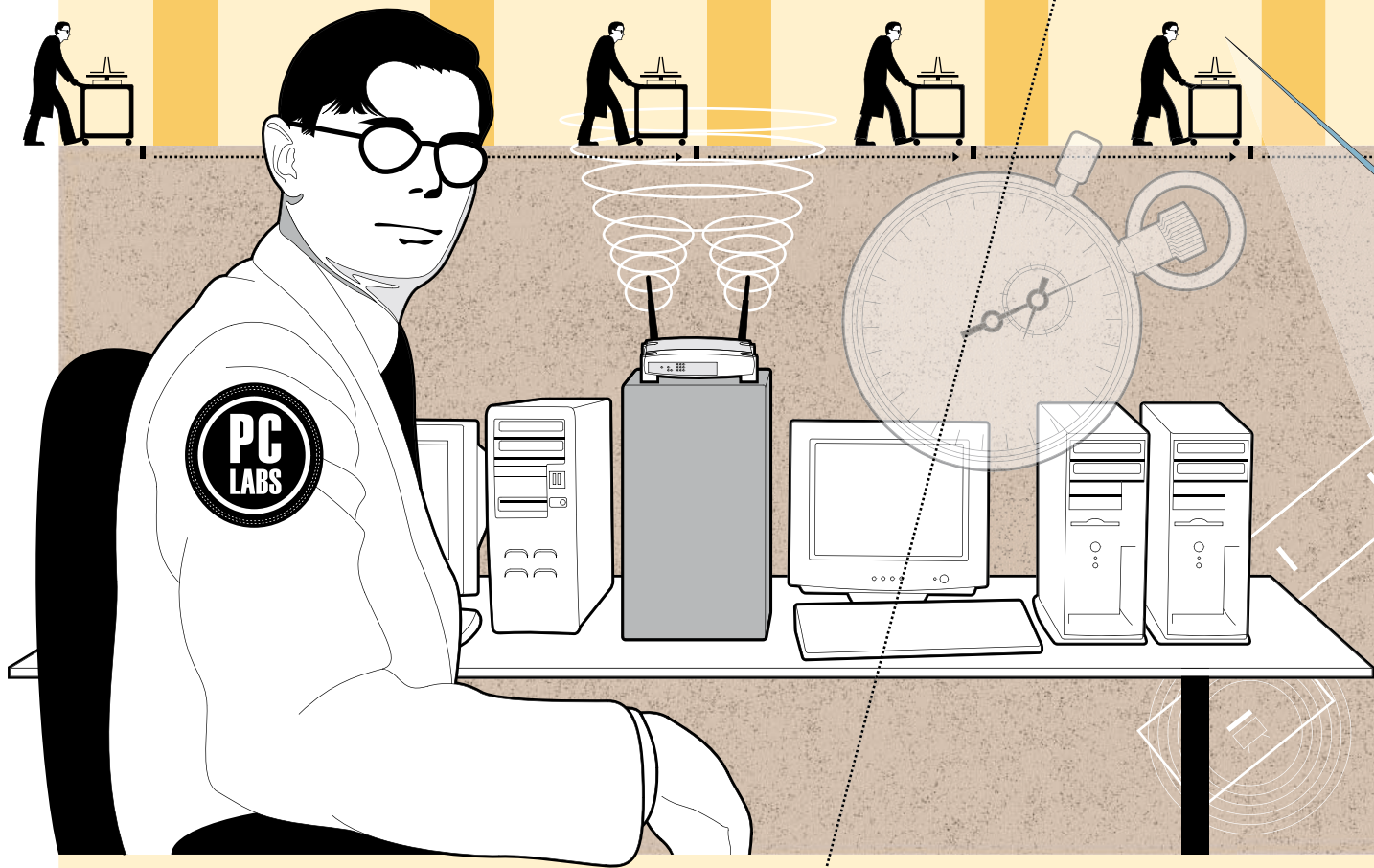
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WI-FI NETWORKING

Rated “G” for Everyone

802.11g has taken the wireless world by storm. Here's a look at the latest “g” and “a/g” routers for the home and small office, all tested in PC Labs.

BY CRAIG ELLISON ILLUSTRATION BY HENRY YUNG

Oh, what a tangled Web we once weaved. Cables scattered chaotically across living room floors, jagged holes drilled hideously into walls and ceilings, all in the name of shared connectivity. Thanks to the wireless revolution, though, millions have traded in that tangle for pristine radio waves to transmit their data.

The past two years have seen explosive growth in wireless networking both in the business market and homes. In fact, more than 1 million U.S. households now have wireless networks, according to several market analyst firms. And as the technol-

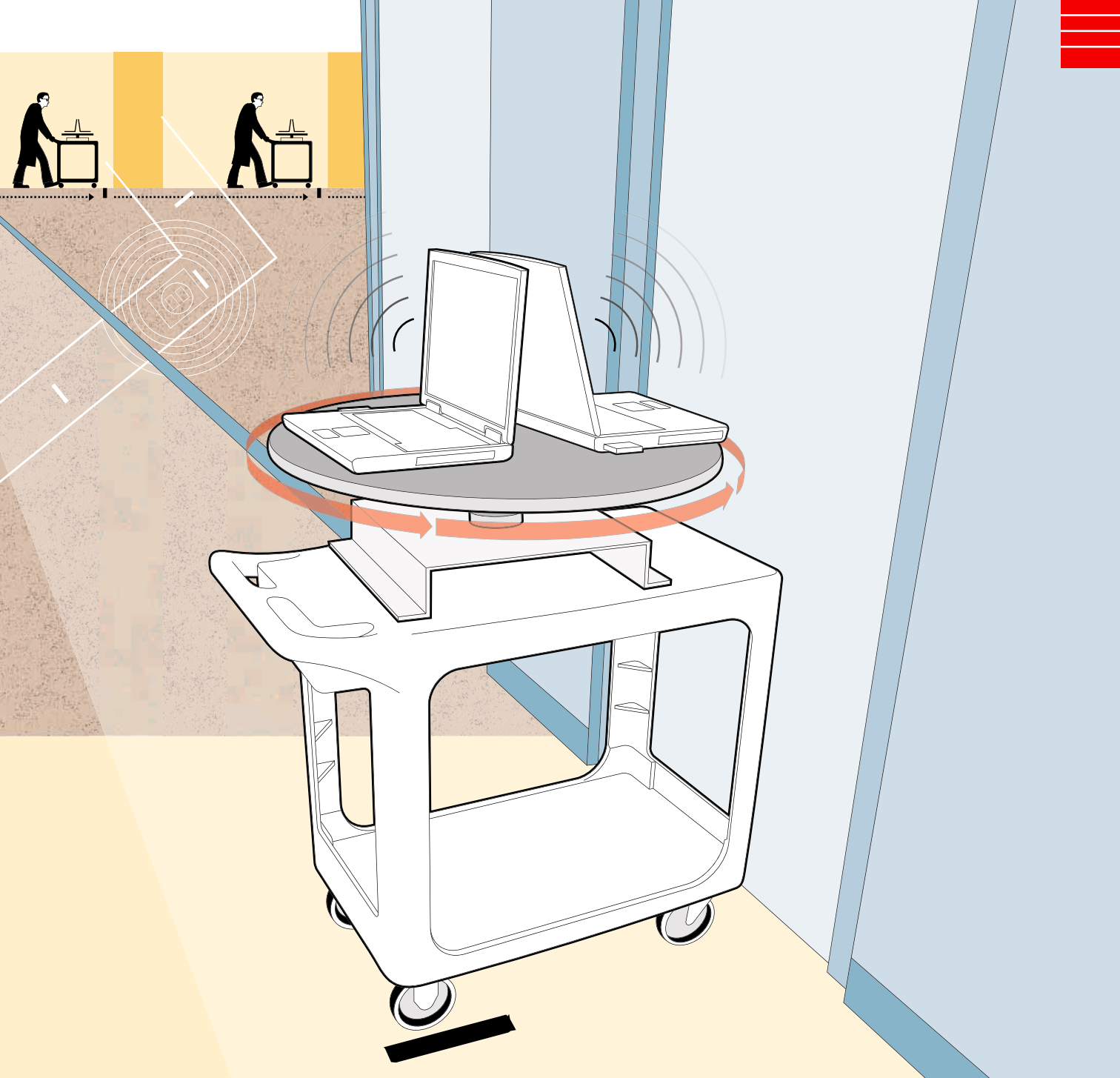
ogy has evolved, throughput has increased manifold, while prices have dropped significantly. Wireless technology continues to be tweaked, and the promise of even faster, more secure wireless solutions is not so far away.

802.11G TAKES THE LEAD

In the past year, 802.11g products have shaken up the retail shelves, promising faster throughput than those with the slower and older 802.11b technology. Demand for “g” products has grown so significantly that by the fourth quarter of 2003, sales outpaced those of 802.11b de-

vices. As a result, prices for “b” products have dropped to the point where you can now buy a wireless “b” card and router bundle for as low as \$60.

“G” products, which are interoperable with “b” products and operate in the same 2.4-GHz radio spectrum, have also easily surpassed sales of 802.11a products, which offer the same speeds as “g” products but are not compatible with either “b” or “g.” But because “a” operates in the 5-GHz spectrum, it encounters less interference than do 802.11b and 802.11g products, whose spectrum is shared by common household electronics such as microwave



ovens and cordless phones.

Sales of products that support all three standards have been increasing in corporate settings.

WHAT TO BUY, WHETHER TO UPGRADE

If you are setting up a new wireless network for your home and your needs are simple, 802.11g products are the way to go. They're faster than and compatible with 802.11b products, and they cost only \$10 to \$20 more on the average. "G" products can satisfy the needs of most homes, but for those few with complex plans for their

networks, a dual-mode 802.11a/g device may work better.

What do we mean by complex? Networks that regularly stream audio or video or send and receive lots of large files, such as graphics files, can benefit greatly from the additional bandwidth that dual-mode products offer. Using a dual-mode product you can, for example, set the router to use 802.11a to stream video while keeping your traditional e-mail/browsing traffic running over 802.11g. Dual-mode products also work well for small and midsize businesses because they incorporate a larger number of channels and therefore can

IN THIS STORY

- 88** 802.11g routers
- 98** 802.11a/g routers
- 86** Editors' Choice
- 87** Deconstructing 802.11 Wireless
- 88** Wireless Glossary
- 94** Summary of Features: 802.11g Wireless Routers
- 99** Summary of Features: 802.11a/g Wireless Routers
- 100** Performance Tests

serve more users at one time.

What if you already have an 802.11b network? Is it worthwhile to upgrade? For most home users, probably not. If you're planning mainly to browse the Internet, send and receive e-mail, and transmit small local files on your network, "b" products can ably handle such tasks. Anything more than that might justify an upgrade to "g." Also, if you're concerned about security and you've had your "b" network for a while, you might also consider upgrading.

IMPROVED SECURITY

A year ago, the only security available for wireless networks was WEP (Wired Equivalent Privacy). WEP was maligned for its well-documented cryptographic weaknesses, and hackers quickly developed tools that could crack static WEP keys. In response to this, the IEEE and the Wi-Fi Alliance, an industry association that tests and certifies wireless products for compatibility, adopted a security specification named WPA (Wi-Fi Protected Access) last fall. WPA addresses all of the weaknesses of WEP; it usually includes 802.1x authentication and TKIP encryption, and has varying levels of security in the form of an enterprise mode and a personal mode.

Since late 2003, some 240 WPA-capable products have been certified by the Wi-Fi Alliance and are now on the market. For more on this, see the online version of this story at www.pcmag.com.

What to Look For



There are many things to consider when searching the retail shelves for wireless products. Here are a few helpful buying hints.

► Buy Wi-Fi-certified products.

Just about all wireless networking products claim to be standards-based, but those with the Wi-Fi label can prove it. All Wi-Fi-certified products have passed standards and interoperability tests.

According to Brian Grimm, director of marketing for the Wi-Fi Alliance, about 22 percent of the products submitted to the

Wi-Fi Alliance fail the tests and need to be resubmitted for testing after the issues have been resolved.

► **Buy products with matching Wi-Fi compatibility labels.** Make sure the products all include support for WPA (Wi-Fi Protected Access) and that they all operate in the same radio band (2.4 GHz or 5 GHz, or both).

► **Buy components made by the same manufacturer.** If you end up having problems, you'll have to make only one tech support call.

WPA is forward compatible with the 802.11i security standard, which the IEEE expects to ratify by the third quarter of this year. Sometimes referred to as WPA2, it will improve on the already robust security offered by WPA and will include AES (Advanced Encryption System), which is actually already built into most newer wireless products and can be enabled with a driver or firmware upgrade from manufacturers.

PERFORMANCE ENHANCEMENT

Security isn't the only aspect of wireless technology that is constantly evolving and improving. A number of chipset manufacturers have devised proprietary methods

for boosting the throughput of 802.11g products far beyond their typical throughputs, which are from 15 to 22 Mbps.

How these proprietary, enhanced modes all work varies, depending on the chipsets, but all involve differing methods of compressing data and increasing throughput by transmitting more data per frame.

One of the players in this field is chipset manufacturer Broadcom, which announced its 125-Mbps Afterburner technology earlier this year. Belkin, Buffalo, and Linksys products contain Broadcom chips. And Conexant (formerly GlobespanVirata, and before that, Intersil) also announced its 140-Mbps Prism Nitro XM Extreme multimedia technology early this year. You can find Conexant chips in D-Link, Netgear, and SMC products. (Many hardware manufacturers use the chipsets of multiple vendors.) Afterburner technology relieves access points from client traffic by establishing side sessions of data transmission between clients and multimedia sources. This leaves the APs responsible for scheduling data transmission sessions and session security.

A third player, Atheros, boasts a data rate of 108 Mbps with its "Super G," which can be found in D-Link and Netgear products. Beyond compressing data and scheduling air time for data transmission more efficiently, this technology bonds radio channels together to fatten the pipe in which data is wirelessly transmitted. Super G can potentially cause channel interference with neighboring networks, but new, recently released drivers offer improved performance yet maintain a good "RF" neighbor policy.

Our contributors: **Craig Ellison** is the director of operations for PC Magazine Labs. Associate editor **Davis D. Janowski** and lead analyst **Oliver Kaven** were in charge of this story.

802.11g: Linksys Wireless-G WRT54GS 802.11a/g: Netgear ProSafe FWAG114



Ancestors of the Linksys Wireless-G WRT54GS router have received good grades from us before, and with its improved interface, superior parental controls, and strong throughput performance, the WRT54GS gets our Editors' Choice award in the 802.11g category. The added S in the model name stands for *Speedbooster*—Linksys's rebranded name for Afterburner, the performance-enhancing technology developed by chipset manufacturer Broadcom.

We really like the WRT54GS's intuitive interface, which makes setup very easy. The product also provides by far the best set of parental controls for enforcing safe Web-browsing for those using your network. Though we are exceedingly impressed with the throughput performance of the D-Link DI-624 on one of our tests, the Linksys WRT54GS was simply the most well-rounded product of the bunch.

An honorable mention in the 802.11g category goes to the Buffalo AirStation WHR3-G54. With its one-touch AOSS security system, Buffalo has impressively removed all the mystery and misery involved in configuring a secure home network. Bravo!

In the 802.11a/g category, the Netgear ProSafe FWAG114 has the most well-rounded—albeit significantly more expensive—product. We were able to install and configure the product flawlessly, something we could not do with the other "a/g" devices in this roundup. The FWAG114 also offers the best help features among the products tested and is one of only two devices here with a built-in VPN server.

Deconstructing 802.11 Wireless

WIRELESS STANDARD ▶	802.11b	802.11a	802.11g	802.11a/g
++Standards-based products began shipping	Late 1999	Late 2001	Mid-2003	Mid-2003
Current cost of an access point or router	\$50-\$130	\$200-\$350	\$80-\$150	\$130-\$320
Current cost of a PC Card	\$50-\$90	\$100	\$80-\$130	\$100
Frequency	2.4 GHz	5 GHz	2.4 GHz	2.4 GHz, 5 GHz
Data rate	11 Mbps	54 Mbps	54 Mbps	54 Mbps
Usable throughput at 20 to 60 feet*	4-6 Mbps	15-22 Mbps	15-22 Mbps	15-20 Mbps
Maximum usable indoor range*	150 feet	75 feet	150 feet	"a," 75 feet; "g," 150 feet
Compatibility	Not designed to be compatible with other standards.	Cannot communicate with "b" and "g" products but can coexist in the same device.	Backward-compatible with "b" products (but in a "b" or mixed environment will realize slower speeds).	802.11a cannot communicate with "b" and "g" but can coexist in the same device. "g" is compatible with "b."
Nonoverlapping channels	3	13	3	16
Most popular environments and why	Widely adopted in homes and offices; products are mature and inexpensive.	Adopted in offices and enterprises; the higher throughput and larger number of channels can serve more concurrent users.	Quickly replacing "b" as the de facto networking standard in both home and small-office environments, thanks to its better throughput and increasing affordability.	More expensive than "g"-only products but gaining a foothold in small offices and enterprises; the combination of standards allows greater throughput, user density, and compatibility.
Common in public hot spots and why	Yes. The low cost of APs and PC Cards has led to widespread adoption.	No. It is not widely adopted and is primarily an enterprise-level standard.	No. Cheaper 802.11b devices are still the most prevalent in public hot spots, but "g" PC Cards can be used there.	No. Although "a/g" PC Cards can be used at "b" hot spots, "a/g" hot spots are almost nonexistent because of the high cost and low adoption rate.

* Based on PC Magazine Labs testing.

Do these products really blast data at rates beyond 100 Mbps? No. The fastest throughput we've seen is 73.8 Mbps, which is faster than regular "g." For more on this, see the results of our performance tests on page 100.

Products with performance-enhancing features can still operate in standards-based 802.11g mode, but the enhanced proprietary mode of one chipset manufacturer likely won't interoperate with that of another chipset manufacturer. Not all of these fast new modes are tested for interoperability by the Wi-Fi Alliance, so users with some existing wireless equipment may want to think twice before adding an enhanced-mode router from another manufacturer to their networks. What's more, these products won't boost the performance of any existing "b" products on a network. Both wireless PC Cards and routers/access points must be set in the same mode, whether it's regular old "g" or enhanced "g," in order for them to communicate.

ON THE HORIZON

In addition to enhanced modes, several other new and exciting technologies will shake up the wireless landscape in the next year or two. And true to form, they'll add a whole new group of letters and numbers to the lexicon, just as we were finally getting used to the idea of 802.11a, "b," and "g."

In addition to the 802.11i security standard we mentioned earlier, 802.11e will

add quality of service to 802.11 wireless networking. This standard, which the IEEE is expected to ratify later this year, allows different types of traffic to receive prioritization on the network. That is especially important for applications such as Voice over IP (VoIP) and streaming audio or video.

As for performance-focused technologies, the 802.11n task group and specification is likely to make "g" obsolete, boosting standards-based wireless performance to 100 Mbps or greater. Don't worry, though; your "g" purchase should be safe for at least a year or two to come. The 802.11n standard isn't expected to be ratified until at least the second half of next year, and it will have to be backward-compatible with "g" and other existing standards.

WiMAX promises to bring wireless to wide-area networks (WAN) and metropolitan area networks (MAN) in a way that's inexpensive and simple to deploy. The WiMAX forum (www.wimaxforum.org) is focusing on products based on the 802.16d standard. Intel will start shipping standards-compliant chipsets late this year. For the foreseeable future, WiMAX

will continue to service the MANs while Wi-Fi products will be the primary WLAN technology. Still, we may see some client-based WiMAX products in late 2005.

TODAY'S CHOICES FOR HOME NETWORKS

For now, 802.11g and "a/g" are the best options for home users wanting a wireless network. On the following pages are reviews of 19 wireless routers and their corresponding wireless PC client cards. The routers have wireless access points, routing capabilities, and possibly SPI (stateful packet inspection) firewalls all in one box, though manufacturers also sell standalone access points for people who already own routers.

Of the 19 products we review, 15 are 802.11g solutions and 4 others represent 802.11a/g. We tested the throughput of all these devices (except the Apple Airport Extreme), and we also tested several USB 802.11g adapters.

Though this roundup is devoted to 802.11a and 802.11g, you can find reviews of several updated 802.11b products at www.pcmag.com.

MORE ON THE WEB Visit our Web site at www.pcmag.com for reviews of 802.11b wireless products. You'll also find additional test results as well as analysis and links to previous coverage of wireless LAN technology.

WIRELESS GLOSSARY

- **AES (Advanced Encryption Standard)** A federal information-coding protocol that ensures privacy via 128-, 192-, and 256-bit keys. AES is part of the forthcoming 802.11i specification.
- **Centrino** Intel's wireless mobile technology, which integrates the company's Pentium M chip, its 855 chipset, and the Intel PRO/Wireless 2100—an

802.11b wireless solution.

- **DHCP (Dynamic Host Configuration Protocol)** A standard that enables individual computers on an IP network to retrieve their IP addresses and other settings from a server on demand.
- **DMZ (demilitarized zone)** A small network inserted as a neutral area between a company's private network

and the outside public network. It provides indirect access to internal resources.

- **802.11e** A proposed IEEE standard that defines quality of service for various types of applications, whether data, video, or voice, that run on wireless networks.
- **802.11i** A proposed IEEE standard that would

provide added security specific to wireless LANs.

- **802.11n** An IEEE WLAN standard, proposed for release in 2005 or 2006, which is expected to reach speeds between 100 and 320 Mbps.
- **Enhanced-performance 802.11g** A blanket term for various proprietary technologies that boost throughput of 802.11g devices by implementing

methods such as frame bursting, channel trunking (or bonding), and shortening the preamble.

- **Frame bursting** A technology created to enhance 802.11g performance by allowing the transmission of more data packets (carried in frames) in a given amount of time.
- **MAC (media-access control) address** A hard-

ABOUT THE RATINGS: Each product's overall rating is not an average but an aggregate, based on discussions among *PC Magazine* staff. For **initial configuration**, the highest ratings go to products with intuitive installation wizards and clear, well-written documentation. Products supporting WPA and authentication, with good parental controls, receive the highest **security** ratings. The **performance** scores shown here represent test results using compressed data, with performance-enhancing features enabled, wherever possible.

802.11g

ALL REVIEWS BY OLIVER KAVEN

Apple AirPort Extreme

\$200 direct; AirPort Extreme card, \$99. Apple Computer Inc., www.apple.com. ●●●○○

As usual, Apple sets its products apart visually from the competition. In this case, the Apple AirPort Extreme router resembles a large, collapsed marshmallow. Although the AirPort lacks many of the features that other wireless routers in our roundup have, it certainly serves its intended purpose and target audience in providing basic and secure wireless network access for Apple laptop and desktop systems. The system is Wi-Fi compliant and can support Windows PCs.

INITIAL CONFIGURATION AND DOCUMENTATION ●●●○○

Apple provides a thorough documentation booklet—a welcome rarity these days—and we encountered no difficulties with the largely automated AirPort Setup Assistant application. There's an equally easy-to-use Airport Admin utility in case you need to configure the product directly.

MANAGEMENT AND FEATURES ●●●○○

The AirPort base station lacks a lot of advanced features, such as a DHCP server, SPI firewall, or highly configurable NAT, but it will still satisfy most users. It does include DHCP bridging capabilities.

SECURITY ●●●○○

This newest iteration of the AirPort includes WPA and WEP security. But you'll have to rely on third-party applications for Web filtering or parental controls.

PERFORMANCE

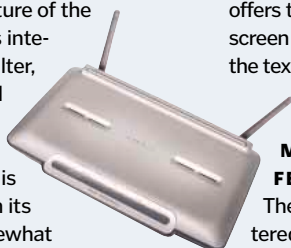
Mac OS X is not compatible with NetIQ's performance-testing application Chariot, and we were therefore unable to measure the AirPort's throughput. Also, we could make no performance assumptions based on the AirPort's wireless chipset because Apple declined to provide this information.



Belkin F5D7230-4

\$80 street; F5D6020 PC Card, \$60. Belkin Corp., www.belkin.com. ●●●○○

The most notable feature of the Belkin F5D7230-4 is its integrated Web content filter, which lets you control the browsing activities of others simply and easily. The router is easy to set up, though its Web interface is somewhat inconsistent. As for throughput, it is a middle-of-the-road performer.



explicitly describing every step of the configuration process with detailed photos. If a configuration step fails, the system even offers troubleshooting tips. But the graphical screen elements are often misaligned, and the text flows over the borders—a cosmetic flaw that can easily be fixed.

MANAGEMENT AND FEATURES ●●●○○

The router's menus have a rather cluttered layout, which could lead to configuration errors. As for features, the parental controls work well; when they're turned on, every Web site request results in a duplicate request to Belkin's site, where it is checked against 2.5 million blacklisted URLs. Another noteworthy feature is a wireless bridge,

which lets you connect multiple routers.

SECURITY ●●●○○

Gamers wanting to play over the Internet will be impressed with the more than 100 games defined in its virtual server. This means specific ports for specific games have been preprogrammed into the router and can be turned on, allowing traffic to pass through the firewall. Nonetheless, we wish that the included stateful firewall was more configurable. This would let users create explicit deny and allow rules.

PERFORMANCE ●●●○○

1 foot:	25.3 Mbps	<div style="width: 100%; height: 10px; background-color: #0070C0;"></div>
60 feet:	20.3 Mbps	<div style="width: 90%; height: 10px; background-color: #0070C0;"></div>
120 feet:	4.0 Mbps	<div style="width: 15%; height: 10px; background-color: #0070C0;"></div>
160 feet:	No signal	<div style="width: 0%; height: 10px; background-color: #0070C0;"></div>

coded or permanent address applied to hardware at the factory.

- **NAT (Network Address Translation)** A security technique—generally applied by a router—that makes many different IP addresses on an internal network appear to the Internet as a single address. Thus, the specifics of the internal network remain hidden.
- **Preamble** A preliminary signal that network hardware transmits to control signal detection and clock synchroniza-

tion in a wired or wireless network.

- **RADIUS (Remote Authentication Dial-In User Service)** An authentication and accounting system that verifies users' credentials and grants access to requested resources.
- **Roaming** Moving from one access point to another in a WLAN with uninterrupted connections.
- **Router** A device that links two discrete networks and forwards packets between them.

A router uses a networking protocol such as IP to address and direct packets flowing into and out of its network. A home or small-office router often includes a four-port switch, which handles moving data inside the network from one device to another.

- **Shared key** An encryption key known only to the receiver and sender of data.
- **SPI (stateful packet inspection)** A type of firewall that uses either a predefined or an ed-

itable rule set to determine whether packets are going to be forwarded or denied.

- **SSID (service set identifier)** A unique 32-character password that is assigned to every WLAN device and detected when one device sends data packets to another.
- **UDP (User Datagram Protocol)** A connectionless protocol that runs on top of IP networks. Unlike TCP/IP, UDP/IP provides very few error recovery services. In-

stead, it offers a direct way to send and receive datagrams over an IP network. UDP is used primarily for broadcasting messages over a network.

- **UPnP (Universal Plug and Play)** An architecture that allows easy connection between PCs and other devices using TCP/IP and a derivative of HTTP. It lets each device automatically acquire a network address and announce its presence to other devices on the network.

Buffalo AirStation WHR3-G54

\$129 list; AirStation WLI-CB-G54 PC Card, \$69.99; AirStation WLI-USB-G54 USB adapter, \$59.99. Buffalo Technology (USA), www.buffalotech.com/wireless. ●●●●○

With its emphasis on easy-to-set-up security, the Buffalo AirStation WHR3-G54 is a router for nontechnical yet paranoid users.

INITIAL CONFIGURATION AND DOCUMENTATION ●●●●○

Initial configuration for the Buffalo AirStation WLI-CB-G54 PC Card is guided by a new and much improved installation wizard. Step-by-step directions help less experienced users connect their laptops to the wireless router. The router itself

does not have an installation wizard; it is set up and configured through a Web interface that provides context-sensitive help with each step.

MANAGEMENT AND FEATURES ●●●●○

Like the PC Card's installation wizard, the card manager has received a complete overhaul. The layout of menus and submenus could stand to be simplified a bit, but the WHR3-G54's features give you all you need to establish a secure and flexible network, with configurable routing, filtering, and manual NAT configuration, as well as intrusion detection.



SECURITY ●●●●●

AOSS (AirStation One-Touch Secure System) is a unique, effective way to deploy a secure wireless connection quickly. This proprietary solution requires no prior security knowledge on the part of the user. With a few mouse-clicks on the client side and "one touch" of the AOSS button on the router, the Buffalo management utility takes care of the rest. After a couple of minutes a WPA secured connection with a unique SSID is up and running.

PERFORMANCE ●●●●○

1 foot:	28.5 Mbps	■■■■■
60 feet:	20.7 Mbps	■■■■■
120 feet:	2.4 Mbps	■■■■■
160 feet:	No signal	■■■■■

Dell TrueMobile 2300

\$89 list; TrueMobile 1300 PC Card, \$49; TrueMobile 1180 USB adapter, \$49. Dell Inc., www.dell.com. ●●●●○

The Dell TrueMobile 2300 is one of the very few units in this roundup that doesn't require any second-guessing during setup. Its performance proved above average, and its wireless signal was among the few that reached 160 feet.



with an included Windows-based application—a great tool for users unfamiliar with network settings and terminology. You can add subsequent PCs to the network using this same application. Aside from a small quick-start guide, all documentation is confined to the included CD, though it may not be needed because the excellent setup wizard covers all the bases.

MANAGEMENT AND FEATURES ●●●●○

The management interface is easy to navigate and provides a good graphical status overview of all connected wireless devices, the LAN, and the Internet connection—very useful for troubleshooting. Other features

include DMZ settings, support for applications that require multiple TCP or UDP connections, and a configurable firewall.

SECURITY ●●●●○

The TrueMobile 2300 offers sufficient security through WEP and WPA, though it is not as easy to set up as is the Buffalo router. The product's parental control feature is essentially a URL filter with scheduling that either blocks or allows access to sites. It's helpful but much more tedious to set up than Belkin's filter.

PERFORMANCE ●●●●○

1 foot:	21.1 Mbps	■■■■■
60 feet:	17.0 Mbps	■■■■■
120 feet:	4.8 Mbps	■■■■■
160 feet:	1.6 Mbps	■■■■■

INITIAL CONFIGURATION AND DOCUMENTATION ●●●●○

Both the router and PC Cards are set up

D-Link AirPlus Xtreme G DI-624

\$119.99 list; AirPlus Xtreme G DWL-G650 PC Card, \$79.99; AirPlus G DWL-G120 USB adapter, \$99.99. D-Link Systems Inc., www.dlink.com. ●●●●○

The D-Link AirPlus Xtreme G DI-624 more than lives up to its name, delivering astounding throughput when in turbo mode and using highly compressible data traffic.



INITIAL CONFIGURATION AND DOCUMENTATION ●●●●○

D-Link has created well-written documentation and an intuitive installation wizard for both its router and PC Card. Our only suggestion is that the network configura-

tion information be moved from the appendix to the front of the installation guide, since that configuration is essential for gaining access to the router.

MANAGEMENT AND FEATURES ●●●●○

Ongoing management is easy with the DI-624. The single most notable feature about the router is its performance in enhanced-“g” mode. It can be configured for static or dynamic mode, depending on whether you must accommodate nonenhanced-“g” devices on your network. In addition, the DI-624 is packed with advanced features such as a DMZ option, filtering, DDNS capabilities, and configurable NAT. Gaming and telephony or

videoconferencing applications are also supported.

SECURITY ●●●●○

WPA with shared-key or 802.1x authentication in addition to WEP round out its impressive security features. We were disappointed, however, by the parental control function (Belkin and Linksys have much better offerings), as its only means of identifying questionable content on a site are the filter keywords that the guardian enters.

PERFORMANCE ●●●●○

1 foot:	73.8 Mbps	
60 feet:	73.8 Mbps	
120 feet:	65.2 Mbps	
160 feet:	37.7 Mbps	

Gateway WGR-250

\$99 direct; WGC-220 PC Card, \$59.99; WGU-210 USB adapter, \$59.99. Gateway Inc., www.gateway.com. ●●●●○

Although Gateway is a newcomer in the wireless router market, the Gateway WGR-250 router more than holds its own against many of the models from the more established manufacturers. We were impressed with the breadth of its feature set as well as its interface design, ease of setup, and performance.

INITIAL CONFIGURATION AND DOCUMENTATION ●●●●○

Though it lacks a wizard, the Gateway setup application covers all Internet connection settings, security preferences, and

local PC network configurations. The router installation guide included on the CD is excellent, but the printed client installation documentation doesn't include details on the overall wireless network setup: It simply refers you to the CD.



what's available. The interface is also well organized and easy to configure.

SECURITY ●●●●○

The WGR-250 supports all common security protocols, such as WEP and WPA with shared keys or RADIUS authentication. In addition, you can use the WGR-250 to create extensive incoming and outgoing filters that block questionable URLs, either to control your children's browsing activities or to secure your network against intruders.

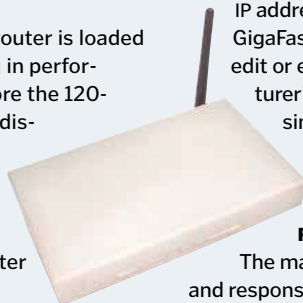
PERFORMANCE ●●●●○

1 foot:	22.6 Mbps	
60 feet:	18.6 Mbps	
120 feet:	5.6 Mbps	
160 feet:	2.2 Mbps	

GigaFast WF717-APR

\$89.99 list; WF727-AEK PC Card, \$59.99 list; WF741-UIC USB adapter, \$49.99. GigaFast Inc., www.gigafast.com. ●●●●○

The GigaFast WF717-APR router is loaded with features but lacking in performance: It lost signal before the 120-foot mark. We were also disturbed that client PC Cards could not reconnect to the router once they lost their connection—a reboot of the router was required.



WF717-APR and PC Card are minimal; thus the setup requires some networking knowledge (at least of changing your PC's IP address and installing hardware). GigaFast also makes no attempt to edit or enhance the chipset manufacturer's PC Card driver; the system simply identifies the card as a Broadcom PC Card.

MANAGEMENT AND FEATURES ●●●●○

The management interface is clean and responsive but supplies little integrated help. Features are abundant and include support for virtual servers, extensive third-party applications (including streaming applications), and a DMZ.

SECURITY ●●●●○

Unfortunately, the GigaFast router lacks support for the WPA encryption protocol, which we think should be included in every router. (The WF717-APR does, however, support WEP encryption.) The router also supports simple URL blocking, and it lets you schedule PC Card access to the Internet. This is actually a more effective method of controlling the browsing activities of your children than the methods employed in many other products.

PERFORMANCE ●●○○○

1 foot:	21.7 Mbps	
60 feet:	13.2 Mbps	
120 feet:	No signal	
160 feet:	No signal	

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Hawking HWR54G

\$139 list; HWP54G PC Card, \$79; HWU54D USB adapter, \$99. Hawking Technology Inc., www.hawkingtech.com. ●●●○○

Despite the Hawking HWR54G's very clean interface and respectable feature set, its performance left us unimpressed. This router barely maintained a connection at the 120-foot mark.

INITIAL CONFIGURATION AND DOCUMENTATION ●●●○○

Hawking has made a noble attempt at providing detailed and intuitive user documentation and setup routines. Most users will find the documentation helpful and will have little difficulty installing

the router using the setup wizard. When installing the PC Card, we recommend using the optional Windows XP client if you are running that OS.

MANAGEMENT AND FEATURES ●●●○○



The HWR54G includes many features you'd normally find only in higher-end models, such as support for UPnP, DMZ, and virtual servers. One minor complaint: We wish that the advanced configuration tab would not open up a new browser window. We are, however, impressed by Hawking's attention to detail, such as completing IP address information—with the correct

digits for the gateway subnet—automatically. This will definitely help reduce user errors.

SECURITY ●●○○○

Since the HWR54G lacks WPA support, we cannot recommend this device for use in a small-office environment. For home use, WEP may be sufficient, although we recommend WPA. Finally, the device also includes the ability to filter on the client PC Card as well as simple URL filtering.

PERFORMANCE ●●○○○

1 foot:	21.7 Mbps	■■■■■
60 feet:	14.9 Mbps	■■■■■
120 feet:	0.8 Mbps	■■■■■
160 feet:	No signal	■■■■■

IOGear GWA501

\$129.95 list; GWP511 PC Card, \$69.95; GWU513 USB adapter, \$89.95. IOGear Inc., www.iogear.com. ●●●○○

Unfortunately, the innovative interface design, easy-to-use setup wizard, and uncomplicated PC Card utility were all overshadowed by the IOGear GWA501's poor performance. This router's throughput was low throughout our tests, and it lost signal completely at 160 feet.

INITIAL CONFIGURATION AND DOCUMENTATION ●●●○○

Setting up the router and PC Card was easy, thanks to good documentation and setup tools. The interface has two modes—typical and custom. Custom mode lets you config-

ure all aspects of the GWA501 manually, whereas selecting typical mode launches a setup wizard. The PC Card utility interface closely resembles Windows' native wireless configuration tool, with added tabs for site monitoring, diagnostics, and link status information.

MANAGEMENT AND FEATURES ●●●○○

The GWA501 has a host of features, including support for DDNS, virtual DMZ, and special applications that require multiple protocol connections. One notable feature included here but missing from many of the wireless routers we reviewed is the DHCP IP-to-MAC mapping option. The device also includes a simple print server on its USB port.



SECURITY ●●●○○

An SPI firewall as well as WEP and WPA encryption are all included. The firewall is one of the easiest to configure and best designed among the products we reviewed. IOGear offers predefined security templates for network novices. For advanced users, the GWA501 offers full access to the policy engine. Unfortunately, it lacks parental-control tools.

PERFORMANCE ●●○○○

1 foot:	20.8 Mbps	■■■■■
60 feet:	16.2 Mbps	■■■■■
120 feet:	1.4 Mbps	■■■■■
160 feet:	No signal	■■■■■

Linksys Wireless-G WRT54GS

\$129 list; WPC54GS PC Card, \$79; WUSB54GP USB adapter, \$79. Linksys Group Inc., www.linksys.com. ●●●○○

With its superior performance, myriad features, superb documentation, and very intuitive installation wizards, the Linksys Wireless-G WRT54GS bested all the other routers in the 802.11g roundup. Speed-booster, Linksys's name for Afterburner (Broadcom's specification-compliant enhancement technology), accounts for the product's top performance.



INITIAL CONFIGURATION AND DOCUMENTATION ●●●○○

Clear, step-by-step instructions with screenshots and a well-designed wizard make initial configuration for both the router and PC Card a breeze.

MANAGEMENT AND FEATURES ●●●○○

Many years of interface development have led to a clean, simple, and consistent interface. The PC Card utility is equally good, presenting a useful alternative to the Windows wireless client. The device also provides a rich feature set, including a DHCP server, DMZ and UPnP support, and support for applications requiring multiple TCP/UDP connections.

SECURITY ●●●○○

Linksys offers all the latest security protocols, though we wish it had a slightly more assertive approach in establishing a secure wireless network without requiring much user input or knowledge. The Parental Control Service is unmatched (30-day free trial, then \$39.95 for one year). You can configure user profiles with time-of-day access restrictions and 16 content categories tailored to users' needs. In addition, e-mail and content filtering make this a truly versatile system for parental supervision.

PERFORMANCE ●●●○○

1 foot:	33.5 Mbps	■■■■■
60 feet:	26.9 Mbps	■■■■■
120 feet:	3.7 Mbps	■■■■■
160 feet:	No signal	■■■■■

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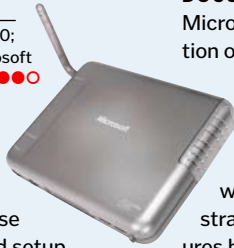
<p>HOW IT WORKS</p>  <p>WIRELESS ROUTER WITH HAI15SC CORNER ANTENNA</p> <p>DESKTOP WITH WIRELESS PCI CARD AND HAI6SDP HI-GAIN DIRECTIONAL ANTENNA</p>	 <p>LAPTOP WITH HWU54D WIRELESS HI-GAIN USB ADAPTER</p>	 <p>OMNI DIRECTIONAL MULTI-DIRECTIONAL BOOSTED SIGNAL</p>	 <p>DIRECTIONAL STRONG CONCENTRATED BOOSTED SIGNAL</p>	<p>CONTACTS:</p> <p>www.hawkingtech.com sales@hawkingtech.com 1.888.662.8828</p>
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<p>WHERE TO BUY</p> 		<p>CAREFREE</p> <ul style="list-style-type: none"> ▶ WIRELESS ▶ NETWORKING ▶ MULTIMEDIA
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Microsoft Wireless Base Station MN-700

\$80 street; MN-720 PC Card, \$60; MN-710 USB adapter, \$70. Microsoft Corp., www.microsoft.com. ●●●●○

Home users who want a solid-performing, no-frills router that's easy to set up will be happy with the Microsoft Wireless Base Station MN-700. Its refined setup utility for the router and PC Card will be especially appealing to networking novices. Although the MN-700 does not provide many of the advanced features that other routers in our roundup offer, its performance on our benchmark tests was excellent.



INITIAL CONFIGURATION AND DOCUMENTATION ●●●●○

Microsoft has done a lot to make installation of the MN-700 as unimposing as possible. It has provided careful packaging, stickers warning you not to disconnect your existing equipment, and comprehensively written documentation. And the straightforward installation utility configures both the router and PC Card.

MANAGEMENT AND FEATURES ●●●●○

Additional features and management options are kept to a minimum in this device. Though the unit has both an SPI and a NAT firewall, neither is configurable. But it has everything you need for a simple home

network, including a DHCP server and virtual DMZ. The management interface is rather primitive, yet it is easy to use and well integrated with Windows XP.

SECURITY ●●●●○

For a product geared toward the home market, we expect a more comprehensive and active approach to parental-control features than this router has. The solution is limited to URL filtering. In terms of other security, it supports WEP and WPA.

PERFORMANCE ●●●●○

1 foot:	21.2 Mbps	<div style="width: 100%; height: 10px; background-color: #0070C0;"></div>
60 feet:	16.9 Mbps	<div style="width: 80%; height: 10px; background-color: #0070C0;"></div>
120 feet:	5.2 Mbps	<div style="width: 25%; height: 10px; background-color: #0070C0;"></div>
160 feet:	2.5 Mbps	<div style="width: 12%; height: 10px; background-color: #0070C0;"></div>

SUMMARY OF FEATURES

802.11g Wireless Routers

■ YES □ NO	Apple AirPort Extreme	Belkin F5D7230-4	Buffalo AirStation WHR3-G54	Dell TrueMobile 2300	D-Link AirPlus Xtreme G DI-624	Gateway WGR-250	GigaFast WF717-APR
Router price	\$200 direct	\$80 street	\$129 list	\$89 list	\$119.99 list	\$99 direct	\$89.99 list
PC Card price	\$99 direct	\$60 street	\$69.99 list	\$49 list	\$79.99 list	\$59.99 direct	\$59.99 list
USB adapter price	None	None	\$59.99 list	\$49 list	\$99.99 list	\$59.99 direct	\$49.99 list
HARDWARE							
Chipset	Info not available	Broadcom	Broadcom	Broadcom	Atheros	Broadcom	Conexant
Maximum radio wattage (mW)	32	50	32	100	32	40	25.4
Adjustable wattage	■	□	■	■	■	□	□
RJ-45 / RS-232 / USB port	■ □ ■	■ □ □	■ □ □	□ □ □	■ □ □	■ □ □	■ □ □
INSTALLATION AND MANAGEMENT							
Wizard-driven/Web-based setup	■ □	■ ■	□ ■	■ ■	■ ■	■ ■	□ ■
Wizard sets up WLAN/WAN connections	■	□	■	■	■	■	□
Console/Web/proprietary management	■ □ ■	□ ■ □	□ ■ □	■ ■ □	□ ■ □	□ ■ □	□ ■ □
Can run without its own client software	■	□	□	□	□	□	□
Firmware updates through Web/TFTP	■ □	■ □	■ ■	■ ■	■ □	■ □	■ □
OPERATIONAL FUNCTIONS							
DHCP server/client	■ □	■ ■	■ □	■ □	■ ■	■ ■	■ ■
802.11d transparent bridging	□	□	■	■	■	■	□
PPTP/IPsec pass-through	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ □
Reconfigurable MAC address	□	■	■	■	□	■	■
Support for DDNS/UPnP	□ □	□ ■	■ ■	■ ■	■ ■	□ ■	■ ■
System/access log	■ □	■ ■	■ ■	■ ■	■ ■	■ ■	■ □
Selectable RTS or CTS/fragmentation threshold	□ □	□ □	■ □	■ ■	■ ■	■ ■	■ ■
SECURITY							
NAT/Stateful packet inspection	■ □	■ ■	■ ■	■ ■	■ ■	■ ■	■ □
Packet/MAC address filtering	■ □	□ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Port forwarding	■	■	■	■	■	■	■
User can hide public IP address	□	■	□	■	□	■	■
Parental controls	■	■	□	□	■	■	■
802.1x/RADIUS/Kerberos authentication	■ □ □	□ ■ □	■ ■ ■	■ ■ □	■ ■ □	□ ■ □	■ □ □
Access control lists based on MAC addresses	■	■	■	■	□	■	■
WEP 40-bit/64-bit/128-bit encryption	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	□ ■ ■	■ ■ ■	□ ■ ■
WPA/preshared key mode	■ □	■ ■	■ ■	■ ■	■ ■	■ ■	□ □

RED denotes Editors' Choice.

Netgear WGR624

\$130 street; WG511T PC Card, \$90; WG121 USB adapter, \$100. Netgear Inc., www.netgear.com. ●●●○○

Though it has plenty of features and impressive performance in its proprietary turbo mode, the Netgear WGR624 has a setup that's less intuitive than that of other routers in its class, such as those from D-Link and Linksys.

INITIAL CONFIGURATION AND DOCUMENTATION ●●●○○

Because this product lacks a wizard-driven installation utility, you must feel comfortable manually changing your PC's network configuration. The printed docu-



mentation is limited and lacks detail. Once the WGR624 is installed and accessible, a helpful integrated wizard assists with the remainder of the configuration, including setting up your broadband connection.

MANAGEMENT AND FEATURES ●●●○○

We like the router's three-pane management interface. Clean and easy to maneuver, it constantly displays help and explanations in the right-hand pane. This router does provide all the basic functions you'd need, such as a DHCP server, NAT, and an SPI firewall.

SECURITY ●●●○○

In addition to WPA, the product includes the ability to schedule the browsing times of client PCs on your network by filtering on MAC addresses. The router also includes NAT support and an SPI firewall. Unfortunately, the parental-control functions on the WGR624 are limited. You must manually enter keyword and URL entries to create a blacklist. But the unit can be set up to send alerts via e-mail if suspicious browsing activities should occur.

PERFORMANCE ●●●○○

1 foot:	35.0 Mbps	<div style="width: 100%; height: 10px; background-color: #0070C0;"></div>
60 feet:	30.8 Mbps	<div style="width: 95%; height: 10px; background-color: #0070C0;"></div>
120 feet:	15.2 Mbps	<div style="width: 50%; height: 10px; background-color: #0070C0;"></div>
160 feet:	No signal	<div style="width: 0%; height: 10px; background-color: #0070C0;"></div>

Hawking HWR54G	IOGear GWA501	Linksys Wireless-G WRT54GS	Microsoft Wireless Base Station MN-700	Netgear WGR624	SMC Barricade SMC2804WBRP-G	U.S. RoboticsUSR8054	ZyXEL Prestige 334W
\$139 list	\$129.95 list	\$129 list	\$80 street	\$130 street	\$129.99 list	\$99 list	\$89.99 list
\$79 list	\$69.95 list	\$79 list	\$60 street	\$90 street	\$89.99 list	\$79 list	\$79 list
\$99 list	\$89.95 list	\$79 list	\$70 street	\$100 street	\$79.99 list	\$79 list	\$79 list
Conexant	Conexant	Broadcom	Broadcom	Atheros	Conexant	Texas Instruments	Conexant
100	17	60	50	100	200	70	13
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
■ □ □	■ □ ■	■ □ □	■ □ ■	■ □ □	■ □ ■	■ □ □	■ □ □
■ ■	■ □	■ ■	■ □	■ ■	■ ■	■ ■	■ ■
■	■	■	■	■	■	■	■
□ ■ □	□ ■ □	□ ■ □	■ ■ ■	□ ■ □	□ ■ □	□ ■ □	■ ■ □
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	<input type="checkbox"/>	<input type="checkbox"/>
■ ■	■ ■	■ ■	■ ■	■ ■	■ □	□ □	■ ■
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<input type="checkbox"/>	■	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■ ■	■ □	■ ■	■ ■	□ ■	■ ■	■ ■	■ ■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
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□ ■	■ ■	□ ■	■ ■	■ ■	■ ■	□ ■	■ ■
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<input type="checkbox"/>	■	■	■	■	■	<input type="checkbox"/>	■
■	<input type="checkbox"/>	■	■	■	■	<input type="checkbox"/>	■
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■	■	■	■	■	■	■	■
■ ■ ■	■ ■ ■	■ ■ ■	□ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
□ □	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■

SMC Barricade SMC2804WBRP-G

\$129.99 list; EZ Connect SMC2835W PC Card, \$89.99; EZ Connect SMC2862W-G USB adapter, \$79.99. SMC Networks Inc., www.smc.com.



The SMC Barricade SMC2804 WBRP-G router is a solid performer and has a polished interface that's easy to navigate. Its feature set goes beyond the typical, impressing us with configurable intrusion detection options.

INITIAL CONFIGURATION AND DOCUMENTATION ●●●●○

The same setup wizard application is



used for both the router and PC Card. We had a few problems during setup, however, including one glitch that should be addressed: The PC Card lacks documentation for its adjustable burst-control feature. This feature is part of the product's enhanced-performance mode.

MANAGEMENT AND FEATURES ●●●●○

You'll find almost everything you'd expect in a router, except for extensive parental-control options. A DMZ, special application support, virtual server functions, and an extensive SPI firewall are all part of the package. The unit's overall configuration

interface for additional features is one of the better ones in this roundup.

SECURITY ●●●●○

SMC includes all relevant security mechanisms—WEP, WPA with preshared key, and 802.1x authentication. In addition, this router offers configurable intrusion detection to prevent DoS or flood attacks, features that aren't found in most other routers. It doesn't have a parental-control engine, however.

PERFORMANCE ●●●●○

1 foot:	24.3 Mbps	<div style="width: 100%; height: 10px; background-color: #0070C0;"></div>
60 feet:	17.4 Mbps	<div style="width: 71%; height: 10px; background-color: #0070C0;"></div>
120 feet:	4.1 Mbps	<div style="width: 17%; height: 10px; background-color: #0070C0;"></div>
160 feet:	1.2 Mbps	<div style="width: 5%; height: 10px; background-color: #0070C0;"></div>

U.S. RoboticsUSR8054

\$99 list; USR5410 PC Card, \$79; USR5420 USB adapter, \$79. U.S. Robotics, www.usr.com.



The U.S. Robotics USR8054 boasts solid wireless performance and offers a lot of traffic-filtering choices—not to mention a configurable NAT firewall. Unfortunately, the USR8054's setup tools are a little confusing, and security options don't include WPA.

INITIAL CONFIGURATION AND DOCUMENTATION ●●●●○

We are puzzled by the installation CD's title, "Ready Set Connect," since it contains nary a wizard or assistance besides a simple help file. Only after you're connected to

the router's main interface do you find a setup wizard that helps you with the basics of your broadband connection, including security. The PC Card utility, however, strongly resembles D-Link's tool and is equally easy to use.

MANAGEMENT AND FEATURES ●●●●○

This product does have a clean, easy-to-navigate management interface, though the integrated system help file seemed to be missing some of the menu items. One glitch we noticed: The interface failed to return to the appropriate menu upon reboot. This occurred after changing



the device's configuration. Still, the router has plenty of features, including a DHCP server, DMZ support, and UPnP.

SECURITY ●●●●○

Filtering is one of the biggest strengths of the USR8054. You can filter traffic by IP, MAC, or protocol. The integrated firewall is also very configurable. But because the router lacks WPA support, we cannot recommend it for business use.

PERFORMANCE ●●●●○

1 foot:	25.1 Mbps	<div style="width: 100%; height: 10px; background-color: #0070C0;"></div>
60 feet:	18.3 Mbps	<div style="width: 73%; height: 10px; background-color: #0070C0;"></div>
120 feet:	2.0 Mbps	<div style="width: 8%; height: 10px; background-color: #0070C0;"></div>
160 feet:	No signal	<div style="width: 0%; height: 10px; background-color: #0070C0;"></div>

ZyXEL Prestige 334W

\$89.99 list; ZyAIR G-100 PC Card, \$79; ZyAIR G-200 USB adapter, \$79. ZyXEL Communications Corp., www.zyxel.com.



Although ZyXEL markets the ZyXEL Prestige 334W for home use, its feature set is more suited to small businesses. The router's installation, which requires a working knowledge of networking, also makes us a bit leery about recommending it for the home market.

INITIAL CONFIGURATION AND DOCUMENTATION ●●●●○

While experienced computer and networking enthusiasts will breeze through its responsive installation wizard and



interface, average home users might find themselves stumped at times. Documentation is limited to the included CD. We encountered a serious glitch once we had the router running: Client PC Cards could not reconnect to the router once they lost their connection; as with the GigaFast router, a reboot of the router was required.

MANAGEMENT AND FEATURES ●●●●○

RADIUS accounting, built-in IPsec VPN services, an internal user database, and advanced NAT support are not found in any of the other products in this roundup. Such

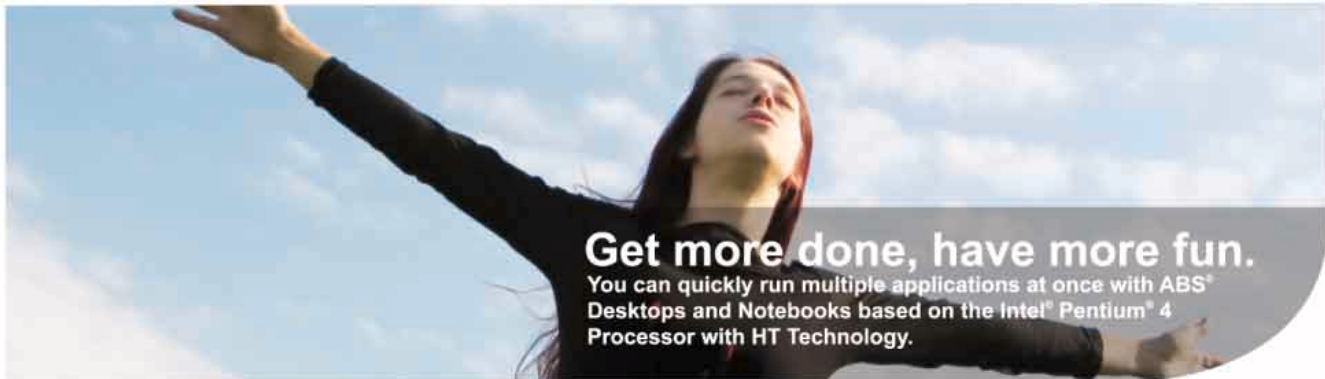
features, combined with WPA support, easily make the 334W a low-cost alternative to small-business products from companies such as SonicWall and WatchGuard.

SECURITY ●●●●○

The 334W offers ample security, supporting all common authentication schemes, protocols, and standards. Content filtering and URL blocking are also included. The URL-blocking feature, however, is limited to manually specified URLs.

PERFORMANCE ●●●●○

1 foot:	23.1 Mbps	<div style="width: 100%; height: 10px; background-color: #0070C0;"></div>
60 feet:	16.9 Mbps	<div style="width: 73%; height: 10px; background-color: #0070C0;"></div>
120 feet:	No signal	<div style="width: 0%; height: 10px; background-color: #0070C0;"></div>
160 feet:	No signal	<div style="width: 0%; height: 10px; background-color: #0070C0;"></div>



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 Seagate 120GB 7200RPM 8MB Cache
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 512MB DDR 2100 SDRAM
 DVD-ROM/CD-RW Combo Drive
 56K V.92 Modem & 10/100 NIC
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 1 Multimedia (SD/MMC/MS) Reader
 Travel Weight: 6.2 lbs.

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802.11a/g

D-Link AirPremier AG DI-784

\$169.99 list; AirPremier DWL-AG660 PC Card, \$99.99. D-Link Systems Inc., www.dlink.com. ●●●●○

Even though the D-Link AirPremier AG DI-784 has only one antenna, it provided phenomenal throughput, especially in D-Link's proprietary turbo mode. We did, however, find that the signal in this mode was less stable than in nonturbo mode. Security with this dual-mode ("a/g") router is top-notch and offers a lot of extra features, including a virtual cable tester and a special gaming mode to bypass firewall incompatibilities.



INITIAL CONFIGURATION

AND DOCUMENTATION ●●●●○

Setting up the DI-784's access point is an intuitive process, which is made easier by the detailed step-by-step CD documentation. Client card installation is also well documented but required reinstallation in one instance, because our test laptop froze after we inserted the PC Card. Otherwise, the client utility is one of the best available: It indicates link quality, signal strength, and data rate.

MANAGEMENT AND FEATURES ●●●●○

The router's management interface is fairly polished—but counterintuitive at times. For example, the tabs and buttons

of the menus' layout should be reversed. A feature unique to the DI-784 is its integrated cable-testing software, which diagnoses WAN-side networking problems, such as opens, shorts, or impedance mismatches.

SECURITY ●●●●○

The DI-784 is one of the most secure routers in our roundup, including IP and MAC filtering, parental controls (with URL blocking), an SPI firewall, and WEP and WPA support.

PERFORMANCE ●●●●○

1 foot:	40.7 Mbps	
60 feet:	38.0 Mbps	
120 feet:	20.1 Mbps	
160 feet:	No signal	

Linksys Wireless A+G WRT55AG

\$289 list; Wireless A+G WPC55AG PC Card, \$99. Linksys Group Inc., www.linksys.com. ●●●●○

Terrific installation help—both in the form of a quick-start guide with screenshot examples and an intuitive interface—make configuring the Linksys Wireless A+G WRT55AG simple. But the router lacks WPA security and showed comparatively poor performance.

INITIAL CONFIGURATION AND DOCUMENTATION ●●●●○

The setup wizard for the WRT55AG is extremely intuitive and easy to complete. An equally helpful wizard guides you through the installation of the PC Card for Windows 98, Me, and 2000. Linksys

recommends that Windows XP users take advantage of Microsoft's integrated wireless configuration utility.

MANAGEMENT AND FEATURES ●●●●○

For those who need flexibility in setting up their networks, the router offers two operational modes—gateway and router—to accommodate most installation scenarios. Support for DMZ and virtual server, as well as configurable NAT, are also part of the package.

SECURITY ●●●●○

Although the WRT55AG provides configurable URL filtering, it does not include



WPA security features—a serious issue that Linksys should address soon. But to its credit, Linksys includes "allow" statements—rather than merely "block" statements—in the router's configurable access filter. This handy feature simplifies the process for parents to allow access only to certain Web sites, rather than trying to block every one of the slough of sites offering questionable content.

PERFORMANCE ●●●●○

1 foot:	21.6 Mbps	
60 feet:	17.0 Mbps	
120 feet:	7.2 Mbps	
160 feet:	No signal	

Netgear ProSafe FWAG114

\$418 list; WAG511 PC Card, \$99.99. Netgear Inc., www.netgear.com. ●●●●○

The Netgear ProSafe FWAG114 represents the old-school Netgear—even down to the metal chassis. This VPN firewall is a solid performer with an intuitive interface. And the FWAG114 was the only 802.11a/g product in our roundup that didn't present a single hiccup during setup.



started is still simple using the browser-based interface. The PC Card's installation application runs off the CD and leaves you with an intuitive and feature-rich client utility installed on your PC.

MANAGEMENT AND FEATURES ●●●●○

We like Netgear's main configuration interface, mostly because of its clean design and comprehensive help frame on the right-hand side of the browser window—an appealing feature that does not require you to pull up the help menu constantly when doing advanced configuration tasks. The menu structure is also well laid out, intuitive, and responsive. We were also

pleased with the number of additional features, including DoS attack prevention and intrusion detection.

SECURITY ●●●●○

Not only does the FWAG114 offer a highly configurable SPI firewall and schedulable filtering, but it's also one of only two products in this story to include a VPN server (the other is the ZyXEL Prestige 334W). It supports two IPsec VPN tunnels, which is especially helpful for a branch-office configuration.

PERFORMANCE ●●●●○

1 foot:	38.1 Mbps	
60 feet:	32.5 Mbps	
120 feet:	11.8 Mbps	
160 feet:	No signal	

SMC EZ-Stream SMC2304WBR-AG

\$199.99 list; EliteConnect SMC2536W-AG PC Card, \$89.99. SMC Networks Inc., www.smc.com. ●●●●○

Like its cousin in our “g” roundup, the SMC EZ-Stream SMC2304WBR-AG is housed in an attractive new case. More important, it has a polished, easy-to-navigate interface, a rich feature set, and configurable intrusion detection options. Unfortunately, however, its performance on our tests was only mediocre.

INITIAL CONFIGURATION AND DOCUMENTATION ●●●●○

We had no problems during setup, but we did encounter a problem during the wireless configuration process. The client

interface for the PC Card contains an advanced feature called adjustable burst control. Not only is this feature not documented or included in the help file, it also isn't mentioned on SMC's Web site (something that should be addressed by the time you read this).

MANAGEMENT AND FEATURES ●●●●○

The router comes with everything you need—except extensive parental-control options. Otherwise, DMZ and support for special applications, UPnP, and DDNS are all part of the package. The SMC2304WBR-AG also contains virtual server features and an extensive SPI firewall.



SECURITY ●●●●○

The SMC2304WBR-AG has all the relevant security mechanisms: WEP, WPA with pre-shared key, and 802.1x authentication.

In addition, the router offers configurable intrusion detection for DoS attacks or flooding, features that are not configurable in most other routers. To make this unit a better fit for home environments, we would like to see parental control integrated into the interface.

PERFORMANCE ●●●●○

1 foot:	33.6 Mbps	
60 feet:	33.2 Mbps	
120 feet:	16.4 Mbps	
160 feet:	No signal	

SUMMARY OF FEATURES

802.11a/g Wireless Routers

■ YES □ NO	D-Link AirPremier AG DI-784	Linksys Wireless A+G WRT55AG	Netgear ProSafe FWAG114	SMC EZ-Stream SMC2304WBR-AG
List price	\$169.99	\$289	\$418	\$199.99
PC Card list price	\$99.99	\$99	\$99.99	\$89.99
HARDWARE				
Chipset	Atheros	“g,” Broadcom; “a,” Atheros	Atheros	Atheros
Maximum radio wattage (mW)	32	“g,” 32; “a,” 79	40	50
Adjustable wattage	■	■	□	□
RJ-45 / RS-232 / USB port	■ □ □	■ □ □	■ □ □	■ □ □
INSTALLATION AND MANAGEMENT				
Wizard-driven/Web-based setup	■ ■	■ ■	■ ■	■ ■
Wizard sets up WLAN/WAN connections	■ ■	■ ■	■ ■	■ ■
Console/Web/proprietary management	□ ■ □	□ ■ □	□ ■ □	□ ■ ■
Can run without its own client software	■	□	N/A	□
Firmware updates through Web/TFTP	■ □	■ □	■ ■	■ □
OPERATIONAL FUNCTIONS				
DHCP server/client	■ ■	■ ■	■ ■	■ ■
802.11d transparent bridging	■	□	■	□
PPTP/IPsec pass-through	■ ■	■ ■	■ ■	■ ■
DMZ or virtual DMZ support	■	■	■	■
Reconfigurable MAC address	□	■	■	■
Supports DDNS/UPnP	■ ■	□ □	■ □	■ ■
System/access log	■ ■	■ ■	■ ■	■ ■
SECURITY				
NAT/Stateful packet inspection	■ ■	■ ■	■ ■	■ ■
Packet/MAC address filtering	■ ■	■ □	■ ■	■ ■
Port forwarding	■	■	■	■
User can hide public IP address	□	■	■	■
Parental controls	■	□	□	■
802.1x/RADIUS/Kerberos authentication	■ ■ □	□ ■ □	□ □ □	■ ■ □
Access control lists based on MAC addresses	■	■	■	■
WEP 40-bit/64-bit/128-bit encryption	□ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
WPA/preshared key mode	■ ■	■ ■	■ ■	■ ■
Option for closed network (nonpublic SSID)	■	■	■	■

RED denotes Editors' Choice. N/A—Not applicable: The product does not have this feature.

Wireless Routers



Each year, we face new challenges in testing wireless networking products. This year we encountered routers with a variety of performance-enhancing modes. One such mode is *frame bursting*, which allows for improved throughput by increasing the number of packets that can be sent at once before a client PC Card

temporarily exits the airwaves and allows other devices on the network to send traffic. *Fast frames*, a similar technology, allows a frame—or group of packets—to contain a larger number of packets without the need for multiple headers (which include information such as packet destinations).

Then there are two main varieties of *compression technologies*: hardware and software compression. The compression algorithms are much the same as those used by file compression utilities. Although hardware compression is usually more expensive, it does not take up general system processing cycles and is usually faster.

Finally, *channel bonding* is a method of combining the throughput of two nonoverlapping radio channels, though this can have potentially detrimental effects on neighboring 802.11g networks and reduce their available bandwidth.

For our throughput tests, we used NetIQ's Chariot (www.netiq.com), a software tool that evaluates the performance of networked applications and devices.

We configured two mobile Chariot endpoints, running on two Dell Inspiron 1150 laptops. We chose Microsoft Windows XP Professional as the OS and used the native drivers supplied by each tested product's manufacturer—both for PC Cards and for USB adapters. To minimize performance differences that could be caused by minute variations in the position and direction of a PC Card's antenna, we placed our test laptops on a motorized turntable spinning at a rate of approximately 20 rpm. Our stationary end-

points were two Dell Dimension 4100s running Windows 2000.

For all 802.11g tests, we paired one laptop with one stationary endpoint running upstream data, while the other laptop was paired with the other stationary endpoint running downstream data. This configuration let us detect asynchronous speeds caused by driver or chipset design.

We used two different sets of data as traffic during our throughput testing. One set contained only zeros; this was an example of *highly compressible* data. The other set was composed of randomly generated *uncompressible* data. The compression algorithms found in the new turbo modes benefit from—and yield the best results with—traffic that is highly compressible.

Most real-world data traffic that demands high bandwidth (HDTV streams, JPEG images, MP3 audio, or MPEG-2) is already compressed. Cutting through some of the marketing hype, our tests revealed that the performance gain with already compressed data was much less impressive than the performance gain with compressible data.—*Analysis written by Oliver Kaven*

802.11G WIRELESS ROUTER THROUGHPUT

Without performance-enhancing features

All scores represent average throughput (Mbps).
High scores are best.
Bold type denotes first place.

	Distance to router (feet)			
	1	60	120	160
UNCOMPRESSIBLE DATA				
Belkin F5D7230-4	22.7	17.6	3.3	—
Buffalo AirStation WHR3-G54	25.2	18.4	2.3	—
Dell TrueMobile 2300	21.1	17.0	4.8	1.6
D-Link AirPlus Xtreme G DI-624	22.4	21.2	8.4	0.4
Gateway WGR-250	22.6	18.6	5.6	2.2
GigaFast WF717-APR	21.7	13.2	—	—
Hawking HWR54G	21.7	14.9	0.8	—
IOGear GWA501	20.8	16.2	1.4	—
Linksys Wireless-G WRT54GS	28.4	24.1	8.4	3.9
Microsoft Wireless Base Station MN-700	21.2	16.9	5.2	2.5
Netgear WGR624	17.6	15.9	9.5	2.2
SMC Barricade SMC2804WBRP-G	21.6	16.1	5.7	—
U.S. RoboticsUSR8054	18.3	14.4	2.3	—
ZyXEL Prestige 334W	23.1	16.9	—	—

RED denotes Editors' Choice. A dash indicates that no signal was received at this range. The Apple AirPort Extreme was not compatible with our Chariot testing software.

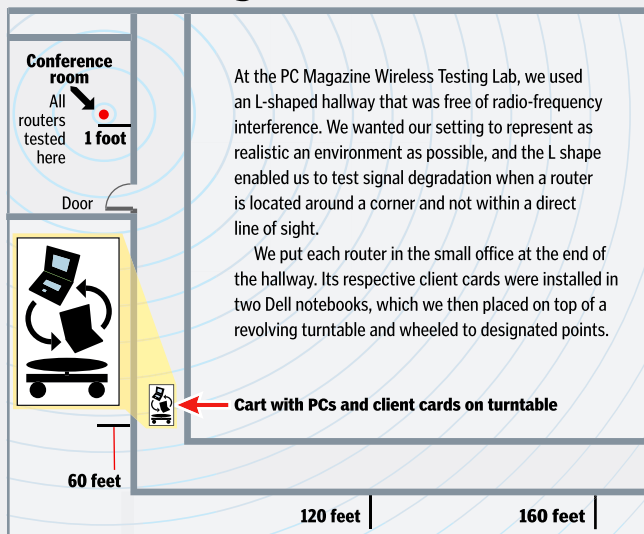
▲ **This table shows results that** were generated when all the features that would enhance wireless performance on the 802.11g routers were disabled. The devices were configured to run without frame bursting in "g"-only mode. In this mode, devices that have received Wi-Fi-compatibility certification should be compatible with each other. We ran all the Chariot tests with uncompressible data.

The Linksys Wireless-G WRT54GS was the best performer at three of our four test distances, reaching 28.4 Mbps at 1 foot—the highest non-per-

formance-enhanced throughput we have seen in a wireless router so far. It was followed by the Buffalo AirStation WHR3-G54, with a score of 25.2 Mbps at the same distance. The Linksys router even maintained a signal at 160 feet, scoring a respectable 3.9 Mbps.

We were disappointed to see that the ZyXEL Prestige 334W and the GigaFast WF717-APR had lost the signal at 120 feet. The farthest distance at which both routers could maintain a signal was 90 feet; at that point, the ZyXEL router scored 11.7 Mbps and the GigaFast router 7.8 Mbps.

WLAN Testing Area



802.11G WIRELESS ROUTER THROUGHPUT

Performance-enhancing features enabled

All scores represent average throughput (Mbps). High scores are best. Bold type denotes first place within each group.

	Distance to router (feet)			
	1	60	120	160
UNCOMPRESSIBLE DATA				
Belkin F5D7230-4	25.3	20.3	4.0	—
Buffalo AirStation WHR3-G54	28.5	20.7	2.4	—
D-Link AirPlus Xtreme G DI-624	33.2	30.1	7.4	—
Linksys Wireless-G WRT54GS	33.3	26.5	2.7	—
Netgear WGR624	32.4	28.5	15.0	—
SMC Barricade SMC2804WBRP-G	23.1	17.1	3.2	—
U.S. Robotics USR8054	24.3	17.7	2.1	1.6
HIGHLY COMPRESSIBLE DATA				
D-Link AirPlus Xtreme G DI-624	73.8	73.8	65.2	37.7
Linksys Wireless-G WRT54GS	33.5	26.9	3.7	—
Netgear WGR624	35.0	30.8	15.2	—
SMC Barricade SMC2804WBRP-G	24.3	17.4	4.1	1.2
U.S. Robotics USR8054	25.1	18.3	2.0	—

RED denotes Editors' Choice. A dash indicates that no signal was received at this range.

▲ For these two tests, one using uncompressible data and the other highly compressible data, we sought to measure the maximum throughput of routers that offer performance-enhancing features. Such features could include technologies like frame bursting and turbo modes that perform fast-frame acceleration, compression, or channel bonding.

Examples include chipset manufacturer Conexant's Nitro technology (found in the SMC router), Broadcom's Afterburner (rebranded as Speedbooster in the Linksys device), and Atheros's Super G technology (found in the D-Link and Netgear routers). The Belkin and Buffalo routers are represented only in the *uncompressible data* section of the table of test results, because their performance-enhancing features don't include frame bursting or fast-frame technologies, which can compress highly compressible data even further.

In proprietary performance-enhancing modes, compatibility among products from different manufacturers running on the same network cannot be assured. Some of the technologies, such as Super G, definitely make your network inaccessible to standard 802.11g devices when a router runs in static performance mode. In dynamic performance mode, a router allows

standard 802.11g on the network but consequently throttles all turbo clients down to 802.11g standard speeds.

If you are not concerned about compatibility and plan to run only Super G clients, the performance boost can be tremendous, especially with highly compressible data such as text files. The D-Link AirPlus Xtreme G DI-624's throughput was a staggering 73.8 Mbps at 1 foot and 65.2 Mbps at 120 feet. It is important to keep in mind though, that as noted previously, real-world traffic will rarely be composed entirely of such highly compressible data.

With uncompressible data, the performance gain of Super G was significantly lower and on a par with the Speedbooster technology in the Linksys Wireless-G WRT54GS, which scored 33.3 Mbps at 1 foot. We also noted that our turntable posed a significant challenge to Super G devices. Signal stability was significantly affected in these products, resulting in lower throughput scores than we expected. When tested without the turntable, the Super G devices achieved throughputs of slightly more than 40 Mbps at 1 foot and proportionally better results at subsequent distances. For consistency, we've reported all the routers' test scores as measured on the turntable.

802.11G USB ADAPTER THROUGHPUT

All scores represent average throughput (Mbps). High scores are best. Bold type denotes first place.

	Distance to router (feet)			
	1	60	120	160
Buffalo AirStation WLI-USB-G54	23.0	19.1	4.6	1.8
Dell TrueMobile 1180	20.6	16.6	—	—
D-Link AirPlus G DWL-G120	20.0	14.3	2.6	1.3
Gateway WGU-210	18.4	16.4	8.9	—
Hawking HWU54D	18.0	15.1	4.8	2.2
IOGear GWU513	16.6	7.5	—	—
Linksys Wireless-G WUSB54GP	22.5	18.0	—	—
Netgear WG121	22.2	18.3	9.7	3.9
SMC EZ Connect SMC2862W-G	18.4	14.1	3.6	—
U.S. Robotics USR5420	23.1	16.7	4.0	—
ZyXEL ZyAIR G-200	13.0	7.4	1.2	—

A dash indicates that no signal was received at this range. We did not test every USB adapter available.

▲ We generated the test results for our USB wireless client adapters by configuring the routers to their highest performance settings. We then tested the adapters with an uncompressible data stream. As we tested each USB adapter with its respective router, the adapters from Dell, IOGear, and Linksys had lost the

signal at 120 feet, producing the last measurable results at 100 feet. At that distance, the Dell adapter scored 10.6 Mbps, the IOGear adapter 1.4 Mbps, and the Linksys adapter 11.7 Mbps. We were impressed with the performance of the Netgear WG121, which turned in strong throughput numbers out to 160 feet.

802.11A/G WIRELESS ROUTER THROUGHPUT

Without performance-enhancing features

All scores represent average throughput (Mbps). High scores are best. Bold type denotes first place.

	Mode	Distance to router (feet)			
		1	60	120	160
UNCOMPRESSIBLE DATA					
D-Link AirPremier AG DI-784	A	20.2	17.1	7.4	—
	G	20.7	20.1	12.8	—
	A+G	40.7	38.0	20.1	—
Linksys Wireless A+G WRT55AG	A	21.4	5.6	1.2	—
	G	19.1	14.6	6.1	—
	A+G	21.6	17.0	7.2	—
Netgear ProSafe FWAG114	A	22.6	18.9	6.0	—
	G	20.8	16.7	6.5	—
	A+G	38.1	32.5	11.8	—
SMC EZ-Stream SMC2304WBR-AG	A	22.1	19.8	5.3	—
	G	12.6	13.5	10.8	—
	A+G	33.6	33.2	16.4	—

RED denotes Editors' Choice. A dash indicates that no signal was received at this range.

▲ We tested all the dual-band 802.11a/g routers using uncompressible data streams, with performance-enhancing modes turned off.

For each "a/g" router, we first tested the "a" and "g" radios separately, then performed a test run using both radios simultaneously. In the latter case, all devices except the Linksys Wireless A+G WRT55AG produced results that were reasonably consis-

tent with the combined throughputs of the separate radios.

We expected the Linksys router to have a total throughput of about 40.5 Mbps during simultaneous radio testing. Instead, the router turned in a score of only 21.6 Mbps. Such performance while running the router in combined mode is likely to make using both radios for high-throughput applications problematic. ☹

I AM JOHNSONVILLE SAUSAGE.

I AM SO MUCH MORE THAN A HOT DOG. I HAVE VISIONS OF BRATWURSTS BEING GRILLED ALL OVER THE WORLD. WHICH MEANS I HAVE TO FILL MORE ORDERS. I HAVE TO TRACK MORE INVENTORY. BUT I WOULD RATHER SPEND TIME PERFECTING MY NEW TOP-SECRET SAUSAGE FLAVOR.



I AM JOHNSONVILLE SAUSAGE WITH EVERY LINK ACCOUNTED FOR.

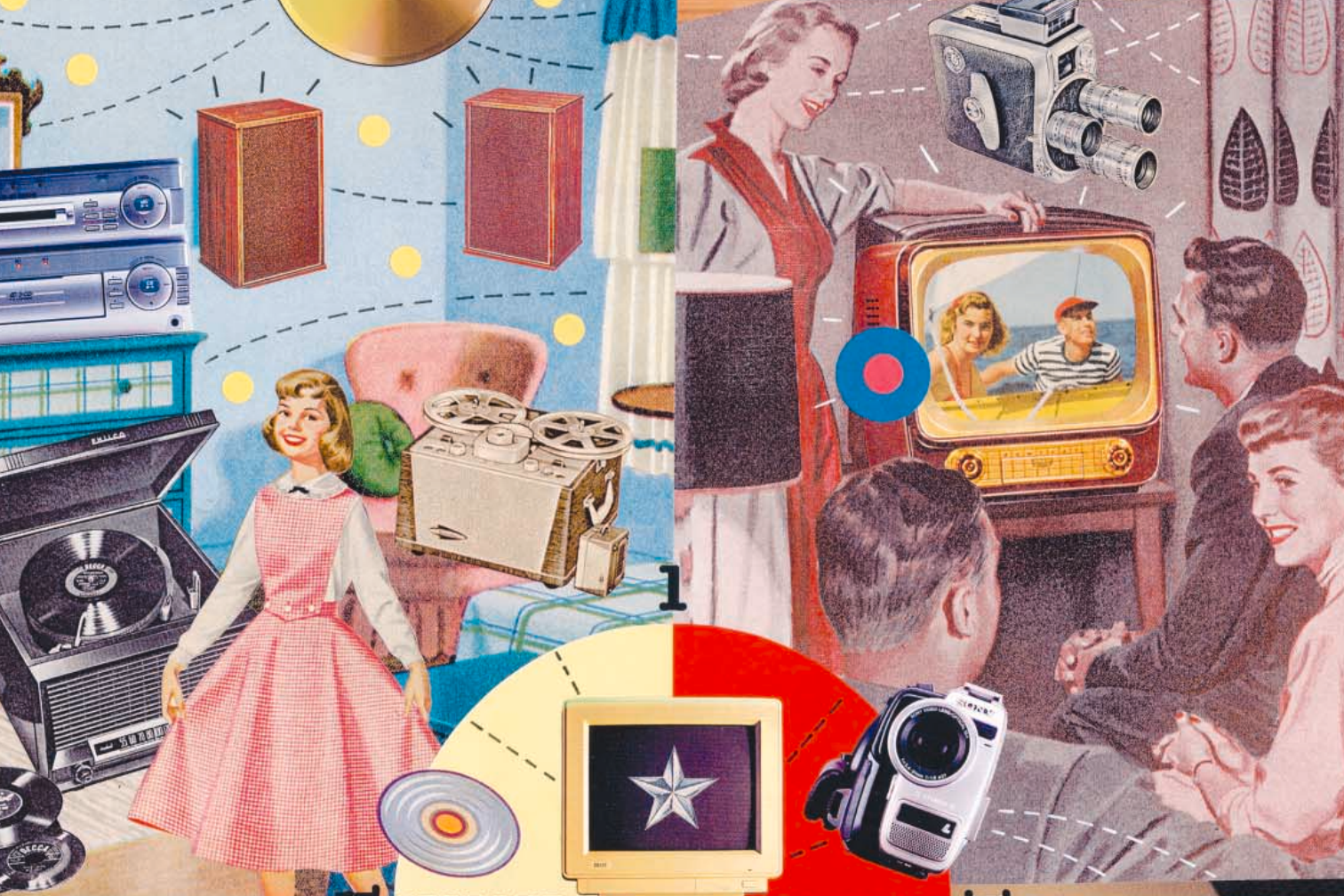
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ENTERTAINMENT central

By Bill Howard

Illustrations by Edward Schnurr

Photography by Thom O'Connor

The wild popularity of digital entertainment has caused a commotion; People are clamoring for devices to link the various TVs, stereos, digital cameras, and PCs in their homes. Simply put: Digital media hubs have arrived.

The 10 hubs we reviewed for this story (also called *music streaming devices* or *digital media receivers*) send digital music, photos, and videos from your PC to your audio system and TV. But a bewildering array of entertainment sources and output devices means there is an equally confusing assortment of features in these devices, as manufacturers have each taken a slightly different approach. But after our extensive testing in PC Magazine Labs, we can help you find the hub that fits your lifestyle.

BUT CAN IT TAKE DICTATION?

Hubs can play a wide assortment of media types, but not all hubs can play all types. Here's a quick look at the media formats you'll encounter.

Music. Almost all the hubs we tested play music files—typically MP3 or WMA, and sometimes AAC. Some products will play WAV (640-Kbps uncompressed CD files) or FLAC (the Free Lossless Audio Codec creates 320-Kbps files) as well, but few support digital rights management (DRM). Many hubs have TV-screen displays that let you see the cover art, artist, and album info, and the current and upcoming songs. Others have two- to four-line displays on the units themselves, which give you Joe Friday levels of information.

Media hubs can stream your digitized music into any room in the house, not just the room with the PC. Audiophiles may hear differences between formats. We be-

lieve you'll more likely notice differences in compression, and if you're using 192-Kbps files or better, you'll have a hard time telling MP3 and WMA files apart from CDs.

Video. Most hubs play videos but not commercial DVDs—they generally lack DVD drives. A one-hour DV tape compressed to MPEG-2, MPEG-4, or WMV format with close to DV quality may be as little as 500MB, not an unreasonable size in an era of 250GB hard drives.

Photos. With a media hub, you can create slideshows of your favorite pictures and display them on your television. With some you can add a musical soundtrack, or display artwork or soothing nature scenes, using the TV as a digital picture frame.

Streaming radio. Several hubs offer access to Internet radio, directly or through a streaming service such as Rhapsody. Beware: Sometimes a vendor's claim to provide Internet radio means you can paste only one URL that you already know into the media player.

DRM: DARN RIGHTS MANAGEMENT! You can always play music you've ripped (from CDs) and ripped off (from the original Napster and its peer-to-peer successors), but if you're the honest type who pays for downloaded music, you're hosed. When a music file with DRM leaves your PC and heads for the hub, it's generally treated as an illegal copy and won't play.

DRM: DARN RIGHTS MANAGEMENT!

A Microsoft-sponsored solution to this problem (code-named Janus) is in the works for the second half of 2004, for WMA files and subscription music-

IN THIS STORY

106 Actiontec Wireless Digital Media Player ●●●○○

106 Creative Labs Sound Blaster Wireless Music ●●●●○

107 Escent FireBall DVDM-100 ●●●●○

108 Gateway ADC-320 ●●●●○

108 Hauppauge MediaMVP ●●●●○

111 Macsense HomePod ●●●●○

111 Netgear MP101 ●●●●○

112 Omnifi DMS1 Digital Media Streamer ●●●●○

113 Slim Devices Squeezebox ●●●●○

113 Turtle Beach AudioTron AT-100 ●●●●○

108 Five Key Criteria

110 Summary of Features

107 Editors' Choice

112 Media Hub Alternatives

streaming services. It will work on devices that are compliant with Universal Plug and Play (UPnP). Janus will likely take the form of an updated version of Windows Media Player and be part of the next Windows XP Service Pack, SP2. The rights-management function could be used by other players too—Musicmatch, for instance. But even if their devices are UPnP-compliant, some hardware makers say more than one release of Microsoft's solution may be required before the products will stream rights-protected music.

EXPANDING, CONTRACTING FIELD

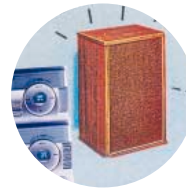
The Editors' Choice from our most recent roundup (July 2003), the Prismiq Media Player, is essentially unchanged. The MediaPlayer distinguished itself by its music-, photo-, video-player, and Web-browser capabilities. Its price is now down to \$200 (list) with wired Ethernet and a PC Card socket for your choice of wireless.

Just missing our review were 802.11g players from big-name companies such as Belkin and Linksys; the new 54-Mbps standard makes video playback possible. (But an 802.11g device in a heavily trafficked network shared with 802.11b devices may sink to 11-Mbps speed.) Roku's update for its HD-capable player is almost ready. We tested a DVD-player/media hub from Gateway; you can expect others shortly, including products from Apex and Linksys. Finally, Microsoft recently announced Media Center Extenders, which will let PCs running Media Center Edition share content with TVs and stereos. They will start shipping late this year. Audio-only hubs work great; but if you're looking for video as well, consider waiting to see what the future brings.

At the same time, some of the early players have changed direction. Hewlett-Packard won't offer a standalone successor to the promising en5000. Similarly, the now-aging Motorola simplefi, RCA Lyra Wireless RD900W, and TDK DA-9000 will not be updated.

Perhaps these manufacturers feel the media hub is just an interim solution, until hub functionality comes as a standard feature on DVD players and other consumer electronics devices. But we say, why wait? You've got all that wonderful digital media—and you can enjoy it more fully, in more places, right now.

OUR CONTRIBUTORS: Associate editor **Jeremy A. Kaplan** and contributing editor **Bill Howard** were in charge of this story.



Actiontec Wireless Digital Media Player

Actiontec Wireless Digital Media Player

\$200 direct. Actiontec, www.actiontec.com. ●●●○○

The affordable Actiontec Wireless Digital Media Player has almost every item on the “perfect media hub” checklist: music, high-definition photos, photos with music tracks, video support, a Web browser, and multisource and multiroom support. Unfortunately, less attention was paid to the setup, interface, and remote control. The result is a well-intentioned product with so many usability issues that its appeal may be limited to the technically savvy.

The Player is a silver box bristling with rear connectors: composite video, S-Video, component video, DVI video, and analog and optical digital audio. Wired Ethernet is also in back, and an Actiontec 802.11b Wi-Fi card comes standard and fits into a PC Card slot on one side. The remote control has 47 buttons, but four are unmarked and appear to have no function; press them and the screen reports *Invalid*, although you'll get that message with working buttons too if you press them at the wrong time. There's a barebones on-screen display. A few setup functions are controlled from your PC.

For music, the player supports Ogg Vorbis and AAC, in addition to MP3 and WMA. All video formats but WMV are supported. This is a PC-only device (no Mac or Linux). It can't display album art, and the small remote has a mute button but no volume control.

Actiontec's default music setting should be for the blues. That's what you'll be singing from the moment you begin to set up, see three setup buttons, and find you need to run the second step first. If you

want to go from music to photos once the Player is running, you can't just press the Photos button: You must first press Stop, then Photos. Also, the remote felt too small in the hand, and music information is skimpy: just artist name and song title.

As with most other products, music transfer was fine. Video transfer was problematic on the supplied Wi-Fi card, but that's more the fault of 802.11b than Actiontec, which doesn't yet support 802.11g, the faster standard. Because of the Player's high-resolution capabilities, you may want to play photos at full resolution and not scale them back to VGA, which some people do when creating a slide show directory.

Compared with the other reviewed products, the Player wins on features and loses on usability. If you want to show photos on an HDTV, the Roku HD1000 (not reviewed here) is more polished, but costs \$100 more. For Web browsing, the Player is most similar to the Prismiq MediaPlayer, our Editors' Choice a year ago, but Prismiq's player is easier to use.

The Actiontec Wireless Digital Media Player provides a superior set of features. But only choose this product if you're comfortable going one-on-one with cantankerous gadgets.



Creative Labs Sound Blaster Wireless Music

Creative Labs Sound Blaster Wireless Music

\$200 street. Creative Labs Inc., www.soundblaster.com.

●●●○○



The Creative Labs Sound Blaster Wireless Music has a display built in to the remote control, so you don't need a TV or set-top receiver to see what's playing: It's all in the palm of

Audio: Turtle Beach AudioTron AT-100
Audio: Creative Labs Sound Blaster Wireless Music
Video: Not there yet



Of the nearly dozen digital media hubs that transport music, photos, and video from your PC to your stereo and TV set, none does it all perfectly. Our ideal player (which doesn't exist) would have a TV display as well as a front-panel display. It would play audio, photos (with high-definition output, of course), and videos, and you could choose a musical background for your photos. It would have wired and wireless Ethernet, work with PCs, Macs, and network-attached storage drives, and play rights-managed music files. It would have flash media slots, so you could display digital photos on your TV.

If you're interested only in music and can live without Wi-Fi or an on-screen display, look to our first audio-only Editors' Choice, the Turtle Beach AudioTron AT-100. It works reliably with any hard drive on your home LAN; it can be controlled from your PC, a Pocket PC, or over the Web; and it even has a rudimentary way of playing rights-managed WMA files.

Some might not like the AudioTron's somewhat challenging setup, however, and for them we've made a second Editors' Choice, the Creative Labs Sound Blaster Wireless Music. Its clever remote control includes a six-line display, works one or two rooms away from the hub, and has thoughtful features like a beeping remote finder. This convenience plus ease of use equals a clear best bet.

If you're in the market for a hub that can handle music, photos, and videos, you'll find yourself unsatisfied with the products on the market. We liked the Hauppauge MediaMVP a great deal, but the software still needs a few tweaks. Our former Editors' Choice, the Prismiq MediaPlayer, is still a good option too. An honorable mention goes to the Escient FireBall DVDM-100, a \$2,000 product intended to be used with an Escient hard drive music server and up to three 400-disc DVD/CD changers. Ka-ching!



Escient FireBall DVDM-100

Escient FireBall DVDM-100

\$1,995 list. Escient, www.escient.com. ●●●●○

Though it may seem expensive, in the world where Escient plays—high-end A/V installations—\$1,995 is a reasonable price. If you've got hundreds of DVDs, or if you prefer physical media to digital, the Escient FireBall DVDM-100 provides a simple way to look up disc information and cover art and display it on your TV. Once you've loaded one, two, or even three Kenwood or Sony 400-disc megachangers with a mix of CDs and DVDs, the DVDM-100 looks up the discs online, then lets you browse your music and videos by genre from your TV.

The magic is inside the box. On the outside the DVDM-100 looks like a button-free black VCR. On the back is every kind of analog or digital A/V connector, plus four RS-232 ports used to connect the disc changers or an Escient hard drive jukebox (neither is included). A wireless keyboard and a remote control are included. The keyboard is the way to go.

Between Escient's 18,000-title DVD database, called OpenGlobe Entertainment Services, and the Gracenote CD lookup database, the DVDM-100 can identify virtually every CD and DVD. Discs are sorted into broad categories, so you can search a list of, say, 40 rock albums rather than 10 classic rock, 10 southern rock, and 20 country rock albums. The on-screen display shows cover art, genre, year of release, and company.

Navigation with the keyboard is easy; just press Music or Movies, pick the genre and the media, and the disc plays. You can't currently browse by artist, actor, or director, but Escient says a fix is in the works. And you can find most disc information online, along with such fluff as trivia and ads for more discs to buy through Escient. You can connect the company's digital audio servers (\$2,500 for the 120GB Escient FireBall E-120) but not

your hand. That's not only creative, it's also good design.

The 27-button remote is big, but the bulk is put to good use. The 2.5-inch display has room for six lines of information, 25 characters each. A nondescript receiver unit goes near your audio gear or powered speakers, and control software installs on your PC. The PC-to-receiver interface is over Wi-Fi, and the receiver-to-remote connection is relayed at 900-MHz RF (like a cordless phone). Creative includes a USB cable to connect the receiver to your PC for setup purposes.

The display shows you song, album, and artist info for the song playing and what's up next. The remote has the usual buttons (Play, Skip, and so on) and nine more for your favorite tracks or playlists. Even big remotes can get lost, so the receiver has a remote-finder button that triggers a beeper on the remote.

Day-to-day operation is hassle-free, thanks to nice touches like the Now Playing button (it works no matter what menu you're in) and presets for Favorites. The glut of software with confusing names like Wireless Music Server, Wireless Music Console, and Creative Media Source could

have been rolled into a single program plus the server applet. If you've used other Creative Products, at least you'll be familiar with Media Source.

Music performance was fine over both analog and digital connections. The remote scrolls fairly quickly through long playlists. Although the remote's 900-MHz signal should let it cover an entire house, like a cordless phone, we found that one room away, the connection was iffy. And early units (the Sound Blaster Wireless Music shipped in late 2003) had some speed and reliability issues, but most have been resolved by downloadable updates.

The remote with a display is unique among digital media hubs, although you could cobble together a costlier solution using a Pocket PC and a universally controllable hub, such as one from Turtle Beach or Slim Devices. For ease of use, only the wall-mount Macsense HomePod is superior.

As the price for the Sound Blaster Wireless Music drops as low as \$175, you won't mind so much that it doesn't show photos. Too bad there isn't a Sound Blaster Wireless Premium with a color display, a long-range remote, and simpler software.

FIVE KEY CRITERIA



Digital media hubs have such a wide assortment of potential features, it can be hard to find the one that best suits your needs. Your first task is to figure out which features are most important to you. Then take a look at this grid, showing in broad terms which product has which features.

A solid square means the product has the feature; a hollow square means the feature is not supported; a plus means the feature is especially well implemented. For audio, this means support for Linux servers in addition to PCs. In the context of photographs we look for a high-definition display or the ability to synchronize music with photos. In the wireless category, 802.11g adds enough oomph to a connection to stream video, earning a plus for a device.

	Audio	Photos	Video	Wired	Wireless
Actiontec Wireless Digital Media Player	■	■	■	■	■
Creative Labs Sound Blaster Wireless Music	■	□	□	□	■
Escient FireBall DVDM-100	+	□	■	■	■*
Gateway ADC-320	■	+	■	■*	+
Hauppauge MediaMVP	■	■	■	■	□
Macsense HomePod	■	□	□	■	■
Netgear MP101	■	□	□	■	■
Omnifi DMS1 Digital Media Streamer	■	□	□	■	■*
Slim Devices Squeezebox	■	□	□	■	□
Turtle Beach AudioTron AT-100	+	□	□	■	□

RED denotes Editors' Choice. * Requires an optional PC Card or USB network adapter.

the growing number of Linux servers or repurposed PCs that do the same job for 1/5 the price.

Speed is a nonissue with the DVDM-100; anything that seems slow, such as disc shuffling, takes place outside the box. There are only brief lags when you shift from CDs to DVDs. But annoyingly, when you start browsing DVDs, the CD music stops. We tested with a Sony DVP-CX777ES 400-disc progressive-scan DVD/CD changer (\$700 street); the combination worked impeccably. And although CD lookup is commonplace, the DVDM-100 has no competition for DVD lookup and categorization on this scale.

Future competition is likely to come from PC or Linux boxes that offer much the same intelligence for a fraction of the cost. But for now, the DVDM-100 stands alone.



Gateway ADC-320

Gateway ADC-320

\$199 direct. Gateway Inc., www.gateway.com. ●●●○○

Even the smallest digital media hub adds one more box to your AV gear, not to mention more cables. Enter the Gateway ADC-320, a multifunction DVD player. In addition to playing DVDs and CDs, it streams your PC's digital music, photos, and videos to your AV system. Expect to see a slew of similar products in mid-2004.

The ADC-320 looks like a standard DVD player, except for a PC Card slot in back that holds a wired or wireless Ethernet card; an 802.11g wireless adapter is included, along with a 44-button remote and a software applet for the host PC. Annoyingly, there's a 16-character CD key to prevent use on other UPnP devices, which we find unlikely. Memo to Gateway: Don't flatter yourself. The software's not *that* good. You can control most multimedia functions from the front panel.

The ADC-320 plays MP3 and WMA files, shows photos, and plays MPEG videos, but slideshows don't have a music-background feature. The player handles CDs too, but doesn't look up discs online. It's a progressive-scan DVD player, with outputs including component video and optical digital audio.

The on-screen interface is easy to navigate. A bar on the left lets you pick Audio,

Photos, or Movies (video), and the right gives you such options as Genres and Folders. During playback, you can see artist, album, elapsed time, and the current and next 10 tracks (some interfaces don't even show the next track). Album art is not available.

The player's core performance was fine, but we found plenty to nitpick. The ADC-320 has a mirror face and buttons so tiny you may need a magnifying glass. Rather than showing what song is playing or a photo's filename, the display shows only the elapsed time or the number of the photo in the sequence. To navigate, you can search for a word or jump to a song or album number, but you can't jump to albums starting with a specific letter.

Because of the ADC-320's 54-Mbps wireless card, we saw no performance problems. Note that if you also have 802.11b devices in your house, a burst of traffic may slow the ADC-320 down to almost b-level speeds, making video playback choppy (but not audio or photo playback).

The ADC-320 will have plenty of competition in the near future, and Apex offers a similar product at about \$200 (street). For now, the Gateway ADC-320 provides a simple way to handle DVD and CD in addition to digital media playback. If you're about to upgrade to a progressive-scan DVD player anyway, the PC multimedia features add just \$100 to the bottom line.



Hauppauge MediaMVP

Hauppauge MediaMVP

\$100 street. Hauppauge Computer Works Inc., www.hauppauge.com. ●●●○○

Ever buy a product with a defensively optimistic attitude: "It may not be much good, but at least it's cheap"? Pick up the Hauppauge MediaMVP, though, and we guarantee you'll be happy, because there is no long-term downside—it's cheap and good. This capable, wired-Ethernet media player has a too-good-to-be-true street price of \$100, and the only flaws we could



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SUMMARY OF FEATURES

Media Hubs

	Actiontec Wireless Digital Media Player	Creative Labs Sound Blaster Wireless Music	Escent FireBall DVDM-100	Gateway ADC-320	Hauppauge MediaMVP	Macsense HomePod	Netgear MP101
■ YES □ NO							
Price	\$200 direct	\$200 street	\$1,995 list	\$199 direct	\$100 street	\$220 street	\$130 street
Category	Media hub	Audio hub	DVD/music manager	DVD player	Media hub	Audio hub	Audio hub
Front-panel controls	□	□	□	■	□	■	□
On-screen/built-in display	■ □	□ ■	■ □	■ ■	■ ■	□ ■	□ ■
AUDIO							
MP3/WMA/AAC	■ ■ ■	■ ■ □	■ ■ □	■ ■ □	■ □ □	■ □ □	■ ■ □
WAV/FLAC/OGG	■ □ ■	□ □ □	■ □ □	□ □ □	■ □ □	□ □ □	■ □ □
RCA / 1/8-inch headphone jack	■ □	■ □	■ □	■ □	■ □	■ ■	■ ■
Coax/optical digital output	■ ■	□ ■	■ ■	□ ■	□ □	■ ■	□ □
Album art	□	□	■	□	□	□	□
M3U/PLS/WPL playlists	■ □ □	■ □ □	■ □ □	■ ■ □	■ ■ □	■ ■ □	■ ■ □
Music presets	0	9	1	0	0	0	10
Internet radio	■	□	■	□	□	■	■
PHOTO/VIDEO							
Shows photos	■	N/A ¹	□	■	■	N/A ¹	N/A ¹
Supports video	■ (PC videos)	N/A ¹	■ (DVDs)	■ (PC videos, DVDs)	■ (PC videos)	N/A ¹	N/A ¹
RCA / S-Video output	■ ■	N/A ¹	■ ■	■ ■	■ ■	N/A ¹	N/A ¹
Component/DVI/VGA output	■ ■ □	N/A ¹	■ ■ ■	□ □ □	□ □ □	N/A ¹	N/A ¹
MPEG/WMV/DivX support	■ □ ■	N/A ¹	□ □ □	■ ■ ■	■ □ □	N/A ¹	N/A ¹
Music with photos	■	N/A ¹	N/A ²	■	■	N/A ¹	N/A ¹
NETWORK							
Wired Ethernet	■	□	■	Optional	■	■	■
Wireless Ethernet	802.11b	802.11b	802.11b optional**	802.11g	None	802.11b	802.11b
Runs without an applet	□	□	■	□	□	□	□
Works with Windows/Linux/Mac OS	■ □ □	■ □ □	N/A ³	■ □ □	■ □ □	■ ■ ■	■ □ □
Multiple players supported	■	■	■	■	■	■	■
Plays files from more than one PC	■	□	N/A ³	■	■	■	■
Web browser	■	□	□	□	□	□	□
Universal Plug and Play (UPnP)	□	□	□	■	■	■	■

RED denotes Editors' Choice. * For album art only. ** Via USB adapter. N/A¹—Not applicable: This product is an audio hub only. N/A²—Not applicable: This product does not display photos. N/A³—Not applicable:

find were a few features yet to be implemented and a clunky remote. We're confident that Hauppauge, a longtime maker of TV tuner cards, has the resources to make good on its IOUs.

The MediaMVP is a small, round-edged plastic case that sits horizontally on your stereo receiver or vertically on an included stand. The remote is cluttered with 34

buttons, though several don't do anything for the current version of the MediaMVP. A PC application lets the device access media files over an Ethernet connection.

The MediaMVP plays MP3 audio, displays photos, and streams MPEG-1 and MPEG-2 videos. It has composite and S-Video jacks, wired Ethernet, and analog audio (RCA jacks), but no digital output. Hauppauge plans updates, including support for WMA files, DivX video, Internet radio, and a printed manual, which should put it on a par with most other media hubs.

Setup was fast and easy using the quick-install card and common sense. The TV display makes good use of screen real estate, showing the artist, album, current song, and next six songs, but not album art or elapsed song time. Music can accompany a photo slideshow, but you must begin playing music or

an MP3 playlist and then start your slideshow. Minor annoyances abound: a screen saver that kicks in after a minute, and remote buttons that do something unexpected—Skip, for example, jumps down six lines rather than skipping to the next track.

Because the MediaMVP uses wired Ethernet, music, photo, and video playback was smooth. Switching modes is a bit slow, because there are no dedicated buttons. Instead, you press Go to open the main menu, then use arrow keys and the OK button.

Other products priced anywhere near \$100 lack video and photo display, or in some cases don't even have a display, relying instead on voice synthesis or simple beeps. We'd buy the MediaMVP in a second, but that doesn't make it our Editors' Choice: Too many features are still short-term IOUs. We bet Hauppauge will soon

MORE ON THE WEB

Our sister Web site ExtremeTech has an in-depth story on building your own media hub. Also, we will review additional media hubs in future issues, such as the Philips Streamium and the Pinnacle ShowCenter. See them all side by side at www.pcmag.com.

Omnifi DMS1 Digital Media Streamer	Slim Devices Squeezebox	Turtle Beach AudioTron AT-100
\$230 street	\$299 direct	\$200 street
Audio hub	Audio hub	Audio hub
■	□	■
■ ■	□ □	□ ■
■ ■ □	■ □ ■	■ ■ □
□ □ □	■ ■ ■	■ □ □
■ □	■ ■	■ □
□ □	■ ■	□ ■
□	□	□
■ □ □	■ ■ □	■ ■ ■
8	0	9
■	■	■
N/A ¹	N/A ¹	N/A ¹
N/A ¹	N/A ¹	N/A ¹
■ * ■ *	N/A ¹	N/A ¹
□ □ □	N/A ¹	N/A ¹
N/A ¹	N/A ¹	N/A ¹
N/A ¹	N/A ¹	N/A ¹
■ **	■	■
802.11b optional**	802.11b	None
□	□	■
■ □ □	■ ■ ■	■ ■ ■
■	■	■
■	■	■
□	□	□
■	■	■

The Escent FireBall DVDM-100 does not require a PC to play media.

add the missing functions (WMA support in particular) and fix the quirks in the interface and remote.

Macsense HomePod

\$220 street. Macsense Connectivity, www.macsense.com. ●●●○

The Macsense HomePod has Mac in its name and comes in iPod white. It doesn't come from Apple, however, but from an Apple peripherals vendor. The HomePod works with Windows, Mac, and Linux PCs, even if it doesn't play all the music you may have. Most people will find this wall-mount device the easiest to use in our roundup, but it has a few quirks.

The HomePod looks and feels like a baby monitor or burglar alarm, and you can screw it to the wall or set it on a table. It has an integrated LCD and 11 well-spaced controls, plus an 18-button remote. A pair of small speakers are

built-in, but they're not very good.

The design looks great in advertising photos but less so in real life. When the HomePod's placed on a table or on the stereo, it's top-heavy. Wires stick out at right angles from both the left and right sides, like the tufts of hair sticking out of Grandpa's ears. If you mount it on the wall, invest in a cord-hiding plastic conduit like the Wiremold CordMate.

The HomePod plays music only: digital files from your PC, FM radio from the built-in tuner, and Internet radio. It connects via wired or wireless (802.11b) Ethernet, but analog, coaxial digital, optical digital, and headphone jacks are also included. It even has a USB 1.1 jack, allowing playback from a portable hard drive.

Setup is easy; you load a small server applet on every machine you want to take music from. To use the HomePod, just turn the center dial to choose a source, music di-



rectory, or genre, then push the center of the knob to start play. The HomePod plays MP3 and AAC files, and playlists. It does not, however, read WMA files (an upgrade is promised) or rights-managed AAC files. So beware: All those songs you bought from the iTunes store? Sorry. Apple has no plans to let devices other than iPods and Macs play protected AAC files.

There were no performance issues using wired or wireless Ethernet. Directory navigation was quick. To play audio files only, several products do the job more cheaply, though none are easier to use, and the HomePod is an especially good choice if you have music on a Mac or in AAC format—just not rights-managed AAC files. The wall-mount capability is unique; nearly unique is the inability to play WMA files. All in all, though, if you can mount it on the wall and hide the cords, the HomePod is a winner.

Netgear MP101

\$130 street. Netgear, www.netgear.com. ●●●○

Within the nondescript Netgear MP101 lies a competent wired and wireless music player, with a price that would



have been extraordinary a year ago. The MP101 measures 1.5 by 11 by 9 inches, with a four-line, 25-character LCD. The front is silver, and the rest is gray. Sitting atop a rack of audio gear, it should fit right in; on a side table, it may look a bit industrial. It comes with a 37-button remote, and the rear has both standard RCA analog and headphone (1/8-inch) jacks.

The MP101 plays MP3 and WMA files and can search existing Musicmatch and Windows Media Player directories for songs and M3U playlists. A host PC running a server applet lets the MP101 fetch music files. It can play Internet radio, if it's available on the server. Output to a receiver is analog only. Both wired and wireless Ethernet connections are included.

This device is simple to set up and simple to use. You almost don't need a manual. Buttons on the remote let you access files by artist, album, and genre and see a list of all available tracks. To jump quickly to the music you want, you tap out the first letters, cell-phone style, on the keypad. The four-line display is adequate for providing information; many of the competing hubs' on-screen displays don't do much more than show the same artist, album, and track information that the MP101 does.

Some information may be overkill: Do you really need to know you're listening to a 192-Kbps, 44.1-kHz song? The MP101 lacks front-panel controls, which other audio-only players—the Macsense HomePod, Omnifi DMS1 Digital Media Streamer, and Turtle Beach AudioTron AT100—have. But these all cost more too.

Since it has no video (or photo) capabilities, the MP101 isn't affected by its 802.11b wireless connection. Finding music in a large playlist was easy and quick when we knew which song we wanted.

If you can live without photos and video, an on-screen display, and front-panel controls, this device is a good value.



Omnifi DMS1
Digital Media Streamer

Omnifi DMS1 Digital Media Streamer

\$230 street. Omnifi, www.omnifimedia.com. ●●●○

The audio-only Omnifi DMS1 Digital Media Streamer offers both a built-in display and an on-screen TV display, which all players should have. But the DMS1 networks via USB dongles, and wireless

Ethernet is an extra cost.

The DMS1 is a small black box with front-panel buttons and a three-line, 28-character display. The SimpleCenter software helps you set up the DMS1 and the optional Rhapsody music service. SimpleCenter rips and burns CDs; it also programs and loads music onto Omnifi's car player, the Omnifi DMPI, a shock-mounted 20GB player (\$600 list) that can be updated via Wi-Fi once it's in the car, or by USB if the car is parked out of wireless range.

Dual-display capability is the DMS1's best feature. After all, sometimes you don't want your whole TV screen consumed by what music is playing, especially if there's no album art. Omnifi promises a firmware upgrade that will allow the device to display album names and art, as well as connect directly to the car's hard drive player

for playback at home.

In addition to music, you can also play Internet radio: Yahoo!'s Launch, Virgin Radio, Shoutcast, and Live365, plus the fee-based Rhapsody. Output is analog RCA jacks for the music, and composite and S-Video jacks to show track info on the TV.

The DMS1 couldn't be easier to use. Both displays give you lots of information. The TV display shows the current artist and song playing, elapsed and remaining time, and the next three songs (more than most players), but oddly, not the album name. It has eight presets on both the hub and the remote; virtually everything you can do on the remote can also be done from the front panel. A Jump button on the remote moves you 1/10 of the way through any list.

Despite the 12-Mbps cap imposed by

The products in this roundup are designed to serve as the hub of your digital media world, but you might not want—or even need—to purchase a standalone product. Here are a few other ways to share your music, videos, and photos around your home.

DIY (WELL, NEARLY)

You may be able to cobble together a solution with an inexpensive purchase or with equipment you already own. (Also, check out our sister site, ExtremeTech, for in-depth articles on building your own media server or personal video recorder.)

Ethernet hard drives. This is our favorite option; we just wish that it worked more universally. You store media files on a self-contained hard drive with a power supply, Ethernet, and a simple OS, usually Linux. Such drives are called network-attached storage (NAS), and sell for \$150 to \$500. On the plus side, you'll no longer depend on a computer that might crash, go into standby, or be removed (such as a laptop). But most media hubs and some NAS devices require you to load a small driver on a PC, which means at least one PC must be running at all times.

TiVo Series2 Home Media Option. Add a \$50 USB network adapter (wired or wireless), pay TiVo a \$99 fee, and you can access music and photos stored on PCs on your network. With multiple TiVo's you can stream video from unit to unit but not in real time. The Home Media Option makes the most sense if you already have TiVo where you want your music.

Xitel HiFi-Link. This USB-to-audio adapter works if your computer is in the same or an adjacent room to your stereo system. The audio file is expanded inside the PC (so DRM files work) but bypasses the sound card. For \$50 (street), the HiFi-



Link includes a 30-foot cable with gold-plated tips. You'll have to control the music from your computer.

TAILOR-MADE PCs AND SOLUTIONS

If you buy the right PC, you won't need a separate solution: The media-hub functions are built in.

Windows XP Media Center Edition PC. This kind of PC rips, stores, and plays all digital media locally, has digital and analog audio and video outputs, a remote control, and a large-font TV output that would rank among the better interfaces if it were a media hub. It plays DRM files, and it has a TV tuner, DVR, and Web access. But there is a downside:

Most units are tall with noisy fans, whereas stereo gear is usually horizontal and quiet.

Windows Media Center Extenders. If you've already got a Media Center PC, keep your eyes open this fall for Extenders, which will let you watch TV shows and movies from your Media Center PC in other rooms. And a special title, Media Center Extender for Xbox, will bring this functionality to Xbox consoles.

Media PCs. These are Microsoft Windows PCs, but with vanilla Windows XP and the vendor's own interface. Sony has several models, although the interfaces vary from music to photo to video; you're better off with the company's MCE PCs, which include all Sony's great proprietary tools plus the Media Center interface. There are also Linux-based systems meant as media recorder/player-only devices.

Sony RoomLink Network Media Receiver. The RoomLink, a table or wall-mount box (\$200 list) with a remote, lets you play photos, music, and video stored on your home PC, including TV shows recorded with Sony's GigaPocket software. At least one PC must be a Sony, though, for RoomLink to work.

the USB 1.1-to-Ethernet dongle, most music streamed without a hiccup. Omnifi warns that dropouts are possible when you're playing 320-Kbps MP3 files on a heavily loaded network; but we noticed that only rarely with wireless (a D-Link 802.11b USB plug-in, about \$50) and not at all with wired Ethernet.

Our concern is the design; the dongle can be tugged out by mistake and is just one more device in your audio rack taking up space and gathering dust. In our judgment, the DMSI's controls were easier to work than the AudioTron's. But the other devices we tested have real, dongle-less Ethernet and lower prices. On the other hand, if you want one PC interface to set up music for both home and car, nothing else does it. The DMSI will be more desirable by mid-2004 when the company plans support for photos and WMA audio.



Slim Devices Squeezebox

\$299 direct (wired Ethernet only, \$249). Slim Devices Inc., www.slimdevices.com. ●●●●○

The Slim Devices Squeezebox plays only MP3 audio (and a bunch of lesser formats) but does so with exceptional competence and flexibility. It's best suited for a high-end AV installation where the words "Windows Media" are never uttered. It's less suited to mainstream users concerned with bang for the buck or transferring multimedia content such as JPEG photos.

The Squeezebox looks like a hobbyist kit: Look through the clear plastic inset in this small, rubbery black box, and you can see a printed circuit board holding a two-line, 40-character display and an infrared sensor. Audio outputs include mini-headphone and RCA analog jacks, and coaxial and optical digital jacks. One version is wired Ethernet only; we tested a model with 802.11b support as well.

The Squeezebox features list is deep and esoteric rather than broad. Format support includes MP3, AAC, uncompressed WAV, AIFF, FLAC, and OGG. The Squeezebox doesn't play WMA files and has no TV display—thus no album art, photo sup-

port, or video support.

You can control the Squeezebox from a Web interface, typically your PC, but also from a Pocket PC, tablet, and—since the code is open-source and customizable—a touch-screen AV control panel. Punch a hole in your firewall, and you can even access music streams from the office or your hotel room. You can use the Squeezebox with a Windows PC, Mac, Linux PC, or Linux server, provided you can load a small applet on the device.

Setup was relatively easy once we downloaded the SlimServer software (no disc is included). Navigating by remote is moderately easy, and you can find music and playlists using the keypad, cell-phone style, to type in the beginning of a search phrase.

The Squeezebox can be made to play Internet radio if you beat it with a stick: You create a playlist containing only the URL of the streaming audio you want to hear.

Over a period of several days, the Squeezebox plowed through music without a hitch on the wired Ethernet version. And even uncompressed WAV files that run about 1.5 Mbps played well over 11-Mbps Wi-Fi, provided the access point was close by.

The Squeezebox and the AudioTron are similar in concept. Squeezebox has a wireless version; the AudioTron requires a wireless bridge. But the AudioTron plays WMAs, has front-panel controls, and costs \$50 less. And it works with any device on your network, such as an Ethernet hard drive; the Squeezebox requires you to install a small applet on the unit. Our three-star rating reflects the Squeezebox's bulletproof performance, offset by its modest mainstream features set and its not-so-modest price.

Turtle Beach AudioTron AT-100

\$200 street. Voyetra Turtle Beach Inc. www.audiotron.net. ●●●●○



The Turtle Beach AudioTron AT-100 is the best choice if you want a first-class wired-Ethernet music hub, and it may be the only choice if you want to play rights-managed music. Setup is a bit difficult, and wireless Ethernet requires an external bridge. But once the AudioTron is up and running, it will stay up and running.

The AudioTron is a square-edged black box, the same width as AV gear, with a dozen buttons, one big tuning knob, and a two-line LED display. It comes with a 43-button remote. You'll want to leave the box in sight to see what music is playing.

The AudioTron plays music only: MP3, WMA, WAV, and Internet radio. Unlike most other products here, it doesn't require an applet running on your PC. Instead, it hunts down any device on the network with music files, and if it has access, plays them. That means it talks to network-attached storage (NAS) devices running Linux, which are more stable than PCs. You can dial-in any Internet



radio service, though it's easiest if you go via TurtleRadio, a free online aggregator for AudioTron owners.

Compared with TV displays, the AudioTron's two-line display seems small, but it packs in virtually all the file information you would see on a TV display (artist, album, title, and time). Nine presets on the remote recall your favorite playlists, and there are enough buttons on the front panel to do just about everything you want. You can also control the AudioTron from a Web browser—which is the way to go if you want to set up a complicated playlist—or from a Pocket PC via Wi-Fi. You can also have multiple AudioTrons throughout the house, and even in the bedroom—you geek, you!—since there's an alarm clock as well.

In hours of playback, the AudioTron never missed a beat, although playing music over 100-megabit wired Ethernet isn't much of a performance burden. The most important performance issue is that it can play rights-managed WMA music. You download a setup utility, create a new folder on your computer (say, My Music/DRM) and place all the music there; this tricks the music into thinking it's been checked out to a portable device. This does not, however, work with iTunes downloads.

Among the audio-only, integrated-display products, the AudioTron may seem an unlikely first choice. The NetGear MPI01 beats it handily on price and setup ease. Still, the freedom from having to load an applet on your PC, the ability to pull music files off any hard drive on your network, and the flexibility to run from a Web browser are near-unique features among media hubs. ■

Personal Pr

By M. David Stone

Illustrations by Nick Rotondo

READ ON TO LEARN:

- Whether you should choose ink jets over lasers, color over monochrome, and networked over nonnetworked printers.
- The top five printer companies in each segment of the market.
- Whether a mobile printer is right for you.
- What features and functions you should consider before you buy.

Buying a personal printer today involves making not one choice but several in an increasingly crowded market. Prices range from under \$100 to over \$1,000. You can buy a standard printer, a dedicated photo printer, or an all-in-one (also called a multifunction printer). Then there's the choice of technology: ink jet or laser, monochrome or color. And personal printers aren't even necessarily personal: Some are more office-oriented, with network connections built in.

First, you'll need to decide on the type of machine you want: a standard ink jet for reasonable photos and a low purchase price, a photo ink jet for superior photo quality, a monochrome laser for text-heavy jobs, or a color laser if you need good text and color graphics and have at least \$700 for the initial purchase.

Once that's done, your next step is to decide between a dedicated printer and



Whether you share your printer with a spouse and kids or enjoy the quiet solitude of an office, the perfect personal printer awaits. We'll help you find it.

Printers

an MFP. If you need to print from more than one computer, consider connecting the printer to a network with either a wired or a wireless connection.

We realize that's a lot to sort out, so on the right we offer a checklist to help you decide which features of a given printer category best apply to your needs. Go ahead: Find the printer that's right for you.

Ink Jets

Mention personal printers and people generally think of ink jets, most of which are small enough to fit on a desk for personal use in your home or office. Apart

from photo ink jets, which we'll cover in the Photo Printers section, we can define several subcategories: deadly-slow home printers (under \$100), moderately fast midrange printers (\$100 to \$300), and near-laser-speed business ink jets (\$300 to over \$1,000). But all ink jets share some key features that may make this your technology of choice.

Ink jets are undeniably appealing for those on a tight budget. Prices start at less than \$40, with only a few business-level ink jets costing more than \$700—the starting point for color lasers. And ink jets that handle tabloid-size paper start at less than \$500, which is thousands less than tabloid-size lasers cost.

Ink jets have one other clear advantage: high-quality color photo output. You can usually tell that the quality does not match even drugstore prints—but often only on very close inspection. Whatever the price, today's ink jets show little difference in output quality. But more money will buy you more speed.

Performance has always been the Achilles' heel of ink jet printers. Manufacturers regularly make unrealistic speed claims, basing them on draft mode, which cuts corners on output quality. Even then, they are wildly optimistic compared with the results we've seen at PC Magazine Labs. At best, the claims indicate relative speeds among printers from the same manufacturer. So don't compare claimed ink jet speeds against those for laser printers, which really can print at close to their claimed speeds.

Another manufacturer claim you shouldn't take too seriously is resolution, which doesn't tell you everything you need to know about output quality. For example, you won't get laser-quality text and graphics from an ink jet, even though the ink jet offers the same or higher resolution, because the ink tends to spread, or wick, as the paper absorbs it.

You should consider total cost of ownership for any printer, and particularly for ink jets. Essentially, manufacturers give away the razor to sell the blades. The initial cost of a printer may be low, but continually feeding it ink and photo paper gets pricey.

To calculate total cost of ownership, consider how many pages you'll print over the printer's lifetime (about three years), then multiply the total by the best estimate you can find for the printer's cost per page (usually available from the manufacturer, or from *PC Magazine* if we've reviewed the printer). The more you print, the more likely that the total cost will be higher for a bargain printer

Which type of printer to buy?

This checklist can help you narrow down the field.

Reasons to buy an ink jet or ink jet-based multifunction printer:

- You print in color.
- High-quality photos are more important than high-quality text, graphics, and speed.
- You're more concerned with initial purchase price than speed or total costs over the unit's lifetime.
- You have extremely light-duty printing needs.

Reasons to buy a monochrome laser or monochrome laser-based multifunction printer:

- You don't print in color.
- High-quality text is important.
- Speed is essential.
- You are more concerned with total costs over the printer's lifetime than the initial purchase price.
- Your output volume is at least moderately heavy.

Reasons to buy a color laser:

- You print in color.
- High-quality text and graphics are more important than high-quality photos.
- Speed is essential and more important than photo quality.
- Your output volume is at least moderately heavy.
- You're willing to spend at least \$700 for the initial purchase.

Reasons to buy a multifunction printer:

- You've ruled out the possibility of a color laser.
- You need some combination of scanning, copying, and faxing capabilities.
- Space is at a premium.
- You can afford to compromise on the printer, the scanner, or both.

Reasons to buy a photo printer:

- You need superior photo quality.
- You want to print from your memory card.
- You want to print from your camera.

Reasons to have a network connection:

- You share your printer with multiple PCs.
- You need the printer to be available whether other computers are on or not.
- You already have a network, or you're willing to install the cables, snaking wires though the walls as needed.
- You're willing to invest at least \$100 in setting up a network.



Ink Jets



Standard ink jets remain the least expensive printers. With few exceptions, however, their cost per page is higher than for lasers, so if you print enough pages they can cost more in the long run than more expensive printers. Text and line graphics are not a match for laser output, although most ink jets produce something approaching true photo quality for photos.

PRICE • \$40-\$300

U.S. Market Share Leaders

INK JETS		INK JET MFPs	
1. HP	53.7%	1. HP	56.0%
2. Lexmark	17.2%	2. Lexmark	23.1%
3. Epson	15.3%	3. Dell	10.3%
4. Canon	12.7%	4. Epson	6.5%
5. Dell	1.1%	5. Brother	3.1%
MONOCHROME LASERS		LASER MFPs	
1. HP	65.6%	1. Canon	25.2%
2. Lexmark	10.1%	2. Brother	16.4%
3. Samsung	6.8%	3. Sharp	12.0%
4. Brother	5.6%	4. HP	10.4%
5. Oki Data	2.5%	5. Xerox	9.8%
COLOR LASERS		PHOTO PRINTERS	
1. HP	47.6%	1. HP	33.1%
2. Xerox	13.6%	2. Epson	25.2%
3. Minolta-QMS	13.4%	3. Canon	22.1%
4. Oki Data	8.7%	4. Lexmark	17.0%
5. Konica Minolta	5.8%	5. Dell	2.5%

Based on the number of units sold.
Source: IDC's Quarterly Hardcopy Peripherals Tracker, 4Q 2003.

Our contributors: Associate editor **Sarah E. Anderson** and PC Magazine Labs lead analyst **M. David Stone** were in charge of this story.

than for a more expensive one. (You can find an analysis of the true cost of printing in our issue of August 5, 2003, page 68, or online at www.pcmag.com/printcosts.)

Remember that if the printer uses a tricolor cartridge, you have to throw out the entire cartridge when any color runs out. That tends to make printers with separate-color ink cartridges less expensive to run.

Different printers also use different techniques for photos. Almost all printers use *dithering* to create the illusion of color, with your eye mixing the colors from many individual dots. Some use high resolution, with eight possible colors for each dot and plenty of dots in any given area on the page. Others get the same visual effect at a lower resolution by printing each dot in a greater range of colors and using fewer dots per square inch. HP, for example, says that at 300 dpi its PhotoREt IV can print 289 shades for each ink color, with a palette of more than 1.2 million colors for each dot. Higher resolutions yield fewer shades per ink color and fewer colors per dot.

Don't rely on the claimed resolution. Instead, try to see some photo samples before you buy. And although you can add network connections to most printers, the installation for most ink jets is cumbersome. The one notable exception is HP printers, which take advantage of the same easy installation routine that HP's network laser printers use.

Monochrome Lasers

If you print a lot of text, a monochrome laser printer is your best bet as your sole

printer as long as you never need color, or as a primary printer with a photo or mobile printer on the side. It's also good as a secondary printer to supplement an ink jet. Monochrome lasers are faster than ink jets, with better text quality and a potentially lower cost of ownership, and can handle larger output volumes. They are small enough to share your desk and can churn out pages at engine speeds of 15 to 20 ppm. You can generally find one for \$120 to \$300. Add a network card, however, and the price may go as high as \$600. This category also includes LED and LCD printers, which work essentially the same way as laser printers. The technologies differ only in the light source they use.

Virtually any monochrome laser printer offers a lower cost per page than nearly any ink jet printing monochrome pages. So even though you may pay more for a laser printer, you will spend less in the long run. For instance, if you print 100 pages a week, 50 weeks a year, a 1-cent-per-page difference will add up to \$50 per year or \$150 over three years, the typical lifetime for a printer.

Laser printers also offer better text quality than ink jets. Edges for both text and graphics are crisp and clean, because laser printers melt plastic toner particles onto the page rather than spraying ink that the paper absorbs. But monochrome lasers—and particularly personal monochrome lasers—often do a poor job on photos and gradients in graphics.

As with ink jets, you can't always take the manufacturer's claims for laser printer resolution at face value. Watch out for claims like *1,200-dot-per-inch image quality* or *1,200-dpi effective output* (as distinct from *1,200 dpi*). Such phrases usually mean the printer is using a lower resolution with some sort of enhancement.

Many printers, for example, add edge enhancement in the form of small dots to fill in the edges of what would otherwise be a ragged or aliased line. Edge enhancement can make text and line graphics visually identical to output with twice the resolution, but it does nothing for improving gradients or photos. If you want a better idea of how a printer's output will look, find out the actual resolution, as well as what kind of image enhancements are hidden in the claim for any enhanced mode. You can do this by asking the

technical-support staff or reading the spec sheets online.

Claimed speeds for lasers are usually close to reality—but only for documents that don't need much processing. The print speed for heavily formatted output, graphics, and photos depends mostly on how fast the images are processed by your computer's processor, or the printer's, if it has one.

If your printer doesn't have a processor, printing speeds can vary considerably, depending on your computer. Before you buy, check not just the minimal computer requirements but also the recommended minimum for optimal performance. The speed for printers with built-in processors can still vary and may depend on the amount of internal memory. If a memory upgrade is an option, find out what the given printer does with the extra memory and whether it will affect performance.

Setting up a network configuration with a monochrome laser printer is usually easy. Many printers with network connection options come from the same companies that sell high-end network printers. They usually use the same installation routines, which have become extremely easy. That said, you should investigate the printer's ease of network installation before you commit to setting it up yourself. You can do this by reading reviews from users or other knowledgeable sources.

Color Lasers

If you demand the crisp, clean text and lines—not to mention speed—that you

get with a laser printer, and you need color, you're a prime candidate for a color laser printer. Prices range from about \$700 to \$1,000, considerably more than for a monochrome laser or ink jet. The good news is that if you have the budget, you can have it all—except for true photo quality. The bad news is that nearly every color laser is too big to share a desk with comfortably.

Almost any printer in the color laser category gives you good to excellent output for graphics, with brilliant colors and solid fills. But the photo output is not in the same league as today's ink jet output. It may pass for photo quality from a distance, but expect to see obvious flaws on close examination.

Most other buying issues for personal color laser printers—from claimed resolution to network setup—are the same as for monochrome laser printers, but with a few differences. The price per monochrome page tends to fall between those of monochrome lasers and most ink jets. And the price per color page is also less than for ink jets. The quality of text and edges in graphics is almost always a match for monochrome laser output, but some printers put too much toner on the page, creating a shiny look you may find bothersome.

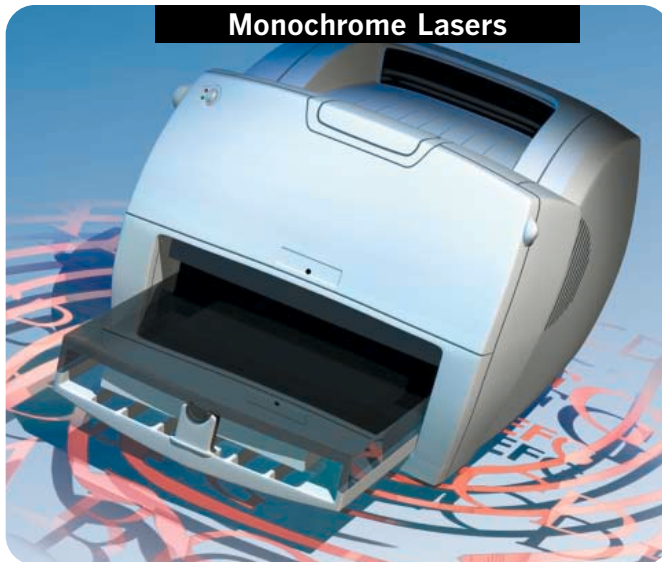
Color laser printers come in two variations: four-pass and single-pass. A *four-pass* printer moves each sheet through its mechanism four times for color output, printing a separate image for each color of ink, one on top of another. *Single-pass* printers move the paper through only one time, printing all four colors at once.

Four-pass printers take four times as long to print a color page as a monochrome page. Single-pass printers can potentially print at the same speed in either case. Monochrome engine speeds for personal color lasers range from 16 to 30 ppm. For color output, single-pass printers offer 12 to 24 ppm, compared with just 4 to 8 ppm for four-pass printers.

Despite the lower speeds, you may need to choose a four-pass printer, because the only single-pass choices in this price range use LED or solid-ink

↓ Monochrome lasers offer high speeds and high-quality text and line graphics. They also tend to have a lower cost per monochrome page, which can save you enough to pay for any difference in purchase price between an ink jet and a laser. Most monochrome lasers can't print photos or gradients very well.

PRICE • \$120–\$300; with a network card, up to \$600



Monochrome Lasers



Color Lasers

↑ Personal color lasers have all the benefits of monochrome lasers, including high speed, high quality for text and line graphics, and a lower cost per page than ink jets, plus the ability to print in color. Color lasers generally outdo standard ink jets for color graphics but can't match them for photos.

PRICE • \$700–\$1,000



Mobile Printers: Going somewhere?

For printing on the run—or in really tight spaces—a mobile printer fits the bill. It's small, lightweight, and preferably battery-powered. All other considerations are secondary.

The largest mobile printer available is 6.5 by 13.3 by 3.2 inches (HWD). The smallest is 2.0 by 11.9 by 4.4 inches. You could fit both into one large shoebox. The heaviest is 4.6 pounds, the lightest 2.1 pounds; even together, they weigh less than some notebook computers. For most, batteries are either standard or available as an option. (Make sure the quoted price includes a battery if you want one.) They are also remarkably similar in price, with a range of \$250 to \$350.

Do insist on a sheet feeder. Some printers don't have one or offer one only as an option. Don't expect fantastic speed from a mobile printer. Claims in draft mode run from about 9 to 14 ppm for black and 2 to 10 ppm for color. As with ink jets, these claims tend to be unrealistic, and you'll probably want to use a higher-quality mode. The best-mode claims are as low as 1.6 ppm for black and 0.2 ppm for color.

Even if you have a mobile printer, you may be better off seeking out a regular ink jet or laser, when possible, for better speed. But if you're stuck in a hotel room, a mobile printer can be a lifesaver.

technology, and even those are limited in number. Color laser printers deliver slightly better output than LED printers, but for now at least, you're stuck with four-pass models. A solid-ink printer can stand up to a laser in quality, but prices for color lasers start at \$700, compared with just under \$1,000 for a bare-bones solid-ink printer. So if you care about both quality and price, you should seriously consider a four-pass printer.

Early color lasers had a reputation for breaking down more often than monochrome lasers. According to the manufacturers, this is not the case anymore, but you still might want to consider a service contract if one is available.

Multifunctions

If you've decided on an ink jet or monochrome printer but you also need a scanner, a copier, a fax machine, or some combination of these, consider a multifunction printer. If you've decided on a color laser printer, this section doesn't apply to you—at least not yet. At press time, no personal-level color laser MFPs exist.

MFPs are a little more expensive than regular printers. An ink jet-based MFP is roughly \$100 to \$400 without an automatic document feeder (ADF), or \$200 to \$500 with one. Laser-based MFPs run roughly \$330 to \$700.

A simple test can help you decide between an MFP and a separate printer and scanner. You probably have some specific requirements for your printer, based on speed, output quality, or other features. If you also need to scan transparencies at a particular resolution, size, and quality—or you require an ADF with at least a 50-page capacity and duplex scanning capabilities, as well as a tabloid-size flatbed—you're better off with a separate printer and scanner. If you'd be happy with any reasonably capable scanner, you should be able to find a suitable MFP.

Almost all MFPs print, copy, and scan, but many don't fax. And those that do may depend on the fax modem in your computer, using a utility that lets them send scans directly to your fax modem and receive pages through the modem and send them to the printer. Others offer built-in fax modems, so you can use your MFP as a standalone fax machine, sending and receiving faxes even when your PC is off. Your MFP may also come with a driver that lets you fax by printing to the machine's fax driver from any program. This is particularly helpful if you don't have a fax modem in your PC. If you want standalone fax capability, look for a complete set of fax controls on the MFP, including a numeric keypad.

An MFP should let you make photocopies in monochrome or color. And it should let you make multiple copies, set the paper type, enlarge or shrink the image, and adjust the darkness setting, all from the front panel.

For the scanner, don't take company-claimed resolutions at face value. Scanners have a mechanical resolution, which is typically twice the optical resolution. The maximum resolution, however, is defined by the optical resolution. When a company claims that the optical resolution is 6,400-by-3,200, the 6,400 is at best a stretch. That's the mechanical resolution, not the optical resolution; the company is simply making the resolution sound higher than it is.

Most manufacturers claim optical resolutions of 600 pixels per inch (ppi) or higher, but the optics in most inexpensive scanners can't deliver on that claim. Fortunately, this isn't a problem, because you'll rarely need more than 300 ppi, even for photographs, unless you're planning to enlarge them substantially.

You should also discount claims for color depth, usually given in terms of the number of bits. Here again, the optics rarely live up to the claim, and most of the bits are simply noise. Unless you're scanning transparencies, you don't need more than 24 bits, and virtually any scanner can deliver that.

Do pay attention to paper handling. Flatbed scanners are the obvious choice for photos and materials that won't fit through an ADF. But for faxing, copying, or scanning stacks of paper, you'll want an ADF. You can find both flatbed and sheet-fed scanners on MFPs, and if you want an ADF, a sheet-fed scanner is the better buy.



CDW



If time is money, how much is a slow printer costing you?

It's time for a new printer from CDW. When you consider everything, keeping an old printer may be costing you more than buying a new one. Costs for things like maintenance and supplies are higher for old printers. Slow print speeds decrease productivity and breakdowns stop you in your tracks. CDW has a full line of high-quality, high-speed color printers. So call today. They're not just great printers. They're good investments.

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- 1 yr onsite standard warranty
- Network Ready



\$999 CDW 574756

-233 Estimated Trade-In¹

\$766 Your Price

Recommended supplies and accessories:

HP Print Cartridge Black-**\$132.99** (CDW 578556)

HP Print Cartridge Color-**\$129.99** (CDW 578560, 578561, 578562)

Network Cable-**\$6.82** (CDW 179663)

HP Next Day Onsite 3 Yr Warranty-**\$587.00** (CDW 579343)

Xerox Phaser 8400B

- 24ppm color/24ppm black and white
- 128MB standard memory
- Up to 600x600dpi (2400 Fine Point)
- Network Optional
- 1 yr depot warranty standard

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CDW 563463

Xerox Genuine Solid Inks Black-**\$64.99** (CDW 570058)

Xerox Genuine Solid Inks Color-**\$99.99** (CDW 570107, 570108, 570109)

10/100 Base-TX Ethernet Interface-**\$399.99** (CDW 586141)

Xerox 1 Yr Onsite Warranty Upgrade-**\$99.99** (CDW 570121)



Free Rainbow Pack of Ink with the purchase of the 8400 series printer; a \$115 value.²



Lexmark C510

- 8ppm color/30ppm black and white
- 64MB standard memory
- 2400 image quality
- Network optional
- 1 yr onsite warranty standard

New Product



\$699

CDW 585935

Lexmark C510 Network Bundle*
\$749 (CDW 587373)

Recommended supplies and accessories:
 High Yield Toner Cartridge Black-**\$119.99** (CDW 585945)
 High Yield Toner Cartridge Color-**\$169.99** (CDW 585936, 585938, 585941)
 Lexmark MarkNet N2101e Internal Printer Server-**\$429.00** (CDW 478840)
 Lexmark Additional 1 Yr Extended Onsite Warranty-**\$375.95** (CDW 205959)

Oki C5100n Color Laser

- 12ppm color/ 20ppm black and white
- Up to 1200x600 dpi
- Network ready
- 32MB standard memory
- 1 yr overnight exchange limited warranty standard

\$799 CDW 454440
- 100 Mail-in rebate¹

\$699 Your Price



Recommended supplies and accessories:
 Oki Type C6 Toner Cartridge Black-**\$43.99** (CDW 467599)
 Oki Type C6 Toner Cartridge Color-**\$109.00** (CDW 467598, 467597, 467596)
 Oki Duplexer-**\$330.00** (CDW 465295)
 C5100 Series Oki Care Led Color 1Yr Overnight Exchange Warranty
 Extension-**\$198.72** (CDW 491964)

Brother HL-2700CN

- 8ppm color/ 31ppm black and white
- Up to 2400x600 dpi
- Network ready
- 64MB standard memory
- 1 yr onsite warranty standard

\$799 CDW 570441
- 50 Mail-in rebate¹

\$749 Your Price




Recommended supplies and accessories:
 Brother Toner Cartridge Black-**\$169.99** (CDW 573269)
 Brother Toner Cartridge Color-**\$164.99** (CDW 573271, 573272, 573273)
 Duplex Unit For HL-2700CN-**\$799.99** (CDW 586077)
 Brother HL-2700CN Additional 1 Yr Onsite Warranty-**\$609.99** (CDW 585461)

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Multifunctions

 MFPs come in all sorts of variations to meet a variety of needs. But they each join a printer and scanner in one package to offer printing, scanning, copying, and often faxing capabilities. They can be ink jet- or laser-based.

PRICE • Ink jet, 100-\$500; laser, \$330-\$700



Photo Printers

 Most photo printers offer better photo quality than most standard ink jets, and some offer true photo quality. Some have unique features, such as printing directly on CDs or DVDs.

PRICE • \$100-\$500

Photo Printers

Standard ink jet printers may someday print photographs better than photo printers do, but for now, the difference in quality is noticeable.

While standard ink jet output approaches true photo quality, photo printer output often is true photo quality. If you want photos that are indistinguishable from photographic prints, a photo printer is the way to go.

Not all photo printers are all-purpose printers. For instance, thermal-dye printers (often misidentified as dye sublimation printers) are not all-purpose printers, because they can't print on plain paper. They may also be limited to prints at a maximum size of 4-by-6 or 5-by-7. And some ink jet photo printers are simply too slow to be considered all-purpose. Here we'll focus on models that can be classified as all-purpose printers and save the others for our upcoming photo printer buying guide.

Most photo printers sell for \$100 to \$500. They tend to be slower than similarly priced standard ink jets for most output, but they are far faster for photos. Speed is the main difference among photo printers as you move up in price. Starting at about \$400, you'll also find the ability to handle paper of up to 13 by 19 inches.

Even in the all-purpose market, there is no shortage of variation. Many use more than four ink colors. Most often, this means adding light cyan and light magenta to the traditional cyan, yellow, magenta, and black. At least one printer adds blue and red ink (the latter is closer to orange).

The additional ink colors are meant to widen the gamut the printer can produce and make creating subtle gradations in hard-to-reproduce colors like skin tones or blue skies easier. But having extra shades of ink doesn't guarantee better quality, and some printers offer true photo quality without them.

You can also find printers that offer gray ink or a pigment-based black to supplement the usual dye-based black. In both cases, the purpose of the extra ink is to improve the look of gray-scale photos. If you appreciate black-and-white shots, you'll definitely want to take a close look at printers with these inks.

Some photo printers offer design touches that optimize photo print speeds without necessarily speeding up other kinds of output. Printers with thousands of nozzles, for example, can put far more dots on the page in far less time. That lets them zip through photos quickly, even though their speed for other kinds of output may barely match a slow standard ink jet.

Still another kind of photo printer provides direct printing from a camera or memory card. Typically, printers that offer direct printing have many of the same features as the kiosks you find in drugstores and photo shops. Many include small color LCDs with menus to let you preview your pictures, crop them, choose which ones to print, specify the print sizes, and so on. Those that don't have LCDs let you print an index sheet, so you can pick which pictures to print.

If you want to bypass your computer, look for a printer with media card slots, or if you have a PictBridge camera, find a printer with PictBridge support.

This lets you connect your camera to the printer without removing the memory card. Even if your current camera doesn't offer PictBridge, this is a good feature to consider, because your next one probably will.

Most other considerations, including networking and total cost of ownership, are much the same as for standard ink jets. And for those who want true photo quality, the output from a photo printer trumps everything else. ☐

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Code for the Road

By Richard V. Dragan • Illustrations by Matt Herring



Clear skies ahead for mobile enterprise applications.

JetBlue Airways may be known for its high-tech efficiencies, but its system for tracking cargo—computers and airplane parts—that it hauls between hubs in New York; in Long Beach, California; and around the country was decidedly low-tech. As the airline grew, its inventory tracking needed to keep pace with the times too. JetBlue turned to a mobile application to solve the problem.

Working for three months, three of its in-house programmers built an application in Microsoft Visual Studio .NET 2003 that lets personnel on the ground track shipments. Using Pocket PC-based handhelds with bar code scanners, up to 20 people in each cargo center can scan shipments and store time stamps and destination information. All the information is synchronized with a main database when they

cradle their handhelds at the end of the day. In only seven months, “the application has paid for itself,” says Ryan Plant, manager of development and systems architecture at the airline. Now the company is considering rolling out the same application for its consumer cargo business.

Such success stories are playing out in more and more businesses as mobile application development rides a definite upswing and heavy hitters like Microsoft and IBM deliver robust tools for building mobile apps. These kinds of projects typically break even in six months, according to Gartner Research, and analysts there forecast an 80 percent increase in the number of mobile applications in use from 2003 to 2004. By giving workers in the warehouse, showroom, or customer location access to critical enterprise information, mobile applications are starting to

have a direct impact on the bottom line.

When *PC Magazine* last covered mobile development in the fall of 2002, mobile corporate applications were just emerging. Since then handhelds have become more powerful, with faster CPUs and more memory, and development tools have come a long way. For this story, we evaluated four mobile development tools by building our own application to help taxi drivers record their fares. We tested the mobile versions of two competing programming environments: Java 2 Micro Edition and Microsoft .NET Compact Framework.

DEVELOPERS' DECISION: J2ME OR .NET CF?

Sun Microsystems' Java beat Microsoft to the punch in adding mobile capabilities to its programming environment via J2ME and reaching out to all varieties of mobile devices, including cell phones and Palm OS PDAs. Microsoft .NET CF is competitive thanks to its richness and ease of use, but it works only with Pocket PC-based devices. Pocket PC devices are expensive but powerful and favored by big enterprises.

The rise of Pocket PC coincides with the launch last year of .NET CF, which gives programmers a subset of the full .NET Framework for desktop and server development. Its unified model means an easier development process, because what works on a desktop works on a mobile device. Besides offering a rich set of controls, features for enterprise developers like Web services support are standard in .NET CF.

That said, J2ME still reaches the widest range of handhelds. “With Microsoft, you can run your software on a \$600 device,”

IN THIS STORY

- 127** Crossfire 5.0 ●●●○○
- 127** Borland Mobile Studio 1.5
●●●○○
- 128** IBM WebSphere Studio Device Developer 5.6 ●●●●○
- 134** Microsoft Visual Studio .NET Compact Framework ●●●●○
- 126** How We Tested
- 127** Editors' Choice
- 128** Scorecard
- 130** Sybase Serves Up On-the-Go Databases
- 132** Summary of Features
- 134** J2ME vs. Microsoft .NET CF Comparison Table

says David Rivas, CTO of Sun Microsystems' Consumer and Mobile Systems Group. "With J2ME, apps can run anywhere from a giveaway cell phone to that \$600 device." In fact, Microsoft's emerging Smartphone 2003 SDK is available for free download and can extend .NET CF to many newer (though certainly more expensive) phones, but support for it won't be built into .NET CF natively until the next version rolls out in 2005.

Although Java apps can run on vastly more hardware than .NET CF can, being first to market has meant some growing pains. J2ME includes a bewildering set of configurations that support portions of Java's core toolset, and profiles that address specific devices. J2ME developers have two options for mobile devices: the Mobile Information Device Profile (MIDP), which allows for simple interfaces on cell phones, and the Personal Profile, which presents

tools for handhelds and allows for a wider selection of display elements.

The problem is that current products don't support the two equally, providing plenty of MIDP options but few for Personal Profile. So J2ME can do everything .NET CF can do, but all its capabilities have not yet appeared in force on the ground. This kind of incremental improvement is not an issue for Microsoft, which has complete control of its standard.

The best example of this is Web services support. Sun Microsystems has defined the standard, but it's still missing from most shipping J2ME applications. It's up to hardware manufacturers to deliver implementations of newly approved Java features, but even these will differ slightly from one device maker to the next. Testing on two or three handhelds and accounting for subtle differences is a bane of Java's mobile development.

How We Tested

To test the mobile development tools for this story, we built two functionally equivalent applications for tracking taxi fares: one for J2ME and one for .NET CF. Rather than using a clipboard and pencil, our high-tech taxi drivers can record trips and fares on their handhelds and receive reports and alerts from the dispatcher. Building the program, we focused on the key elements of a mobile application paradigm: interface design, mixed-modality connectivity, and Web services.

We first built a simple server-side system using J2EE running on Tomcat 4.1, with Web services powered by AXIS, an open-source implementation for simpler SOAP-based services on Java. This system connected to a database running on Microsoft SQL Server 2000. We populated the database with *drivers*, *fares*, *customers*, and *alerts* with support for several hundred sample records for each table. We also included a simple, Web-based JSP administration interface for managing alerts and basic server configuration.

We then created six SOAP-based Web services calls on our server, exposing feature sets for mobile clients. We used Web services to add fares to the remote database (a transactional operation) and to query alert and report information (read-only functions). This approach matches current enterprise-level mobile applications, which typically expose business logic to different clients via SOAP-based Web services. Our system exposed the methods of these calls via WSDL so they could be consumed easily by the mobile-development tools.

For our fare-tracking system, we supported intermittent connections and synchronization via local storage on J2ME and .NET CF. Before a fare is posted to the database, the client checks for an available network connection. If there's no connection, the client stores fare records in XML on the local device. When the connection becomes available, these local records are read and posted via Web services calls to the database. On .NET CF, we stored these XML records to a text file. On J2ME, which has no support for local files, we stored these temporary XML records with the standard J2ME RecordStore APIs, which are supported even on today's lightweight J2ME-enabled cell phones.

We made the interface simple. Mobile applications for smart phones and even PDAs must take into account the limited real estate and navigation tools of the devices. Furthermore, the J2ME version has less visual precision because of inherent programming restrictions. For example, we could not place controls on the screen or use screen tabs.

J2ME and .NET CF were well matched with respect to data access and Web services connectivity. The clear advantage of J2ME is the breadth of mobile-device support. For a rich, well-designed interface, however, look to .NET CF.— *RVD and Sahil Gambhir*



IBM AT BAT

In the meantime, IBM has stepped up to the plate to deliver enhancements to the J2ME platform, relying on Sun Microsystems' standards but implementing them faster and adding proprietary technology. IBM provides a Java Virtual Machine (JVM) that can be deployed on PDAs running Palm OS, Pocket PC, Nokia, and Zaurus. Based on open-source Eclipse technology, IBM's new WebSphere Device Developer is proof that J2ME can rival .NET CF even for the most robust devices.

Another option is Borland Software, which provides a solid set of Java tools with its JBuilder Mobile Edition. And it offers native-code targeting for Symbian, Nokia, and Palm in C++ with its C++BuilderX

product. Though Borland is bucking the trend with a strong offering in native code on an older language, it has added support for Web services too, bringing the aging player up to XML-based standards for sharing data and processing.

And finally, AppForge strikes a balance between the old and the new with its Crossfire tool, which piggybacks on top of Microsoft Visual Basic .NET. This tool lets programmers design software using components, but unlike Microsoft's tools, it targets a range of mobile devices beyond Pocket PC, including Symbian, Palm, and recent Nokia phones.

Note that Sun Microsystems' own development title, Java Studio Enterprise, is

reviewed in this issue's First Looks section. Release dates for Studio Enterprise's mobility modules are still being determined, so the product was not available for this roundup.

Deploying mobile applications can save time and money by eliminating paper forms and increasing efficiency, and Jet-Blue is just one of many success stories. In deciding between J2ME and .NET CF, a business needs to consider the kind of handhelds and back-end database infrastructure already running, the language skills of its developers, and the tasks that need streamlining. One of the following tools may be just the ticket to get your organization's mobile efforts off the ground.

ALL REVIEWS BY RICHARD V. DRAGAN

Crossfire 5.0

\$1,000 direct (includes a year of software updates and tech support). AppForge Inc., www.appforge.com.

●●●○○

With cross-platform support for handhelds, AppForge's Crossfire 5.0 (\$1,000 direct) offers the familiarity of a traditional Visual Basic-like approach to programming with components. If you need access to scanners, serial ports, or multimedia on your workforce PDAs, this tool may be exactly what you need.

Installing Crossfire was effortless, as it piggybacks on top of any installation of Microsoft Visual Basic .NET. (AppForge also ships an older version of its toolset called MobileVB, if you don't want to use VB.NET.) With an IDE any .NET developer will find familiar, Crossfire lets you use components to build forms-based applications for mobile devices. But it also brings cross-platform support into the mix with a run-time module called AppForge Booster, which targets Palm, Nokia Series 60, Ericsson P800 and P900, and Pocket PC/Windows CE devices. The Booster run-time requires about 1MB of code to deploy.

We built part of our taxi-tracking app with Crossfire using user interface widgets on forms. The project wizard let us choose a different size screen for each platform. You can change the size of the display at any time and reuse code for a new device easily.

As with traditional VB, you drag and drop Crossfire objects onto forms, change properties, then add snippets of code be-

IBM WebSphere Studio Device Developer 5.6



For building the most versatile mobile applications that run on the widest variety of handhelds, IBM WebSphere Studio Device Developer 5.6 is our pick. WebSphere's reasonable price and easy set-up let you maximize budget and time resources, and its auto-update keeps your toolbox fresh. It's also the only Java tool that adds robust Web services support and richer, Personal Profile-based components, making J2ME a viable choice for high-end PDAs. Despite its open-source roots, WebSphere's IDE is friendly and approachable, and its support for IBM's Java virtual machine means smooth deployment to Palm OS PDAs, Symbian-based smart phones, and even Pocket PCs. IBM deserves credit for implementing these advances to the J2ME standard ahead of the pack.

At the same time, we acknowledge the excellent development environment of Microsoft .NET Compact Framework, which makes application design for handhelds no more complex than for desktops and notebooks. Its integrated Web services support and excellent debugging tools are compelling. So if your mobile workforce comprises only Pocket PC users, .NET CF is your best option.

hind events. AppForge is adding C# language support later this year. The company's Enterprise Developer Suite (another \$800 direct) includes a year of software updates plus technical support.

One of Crossfire's strong points is its nonvisual or advanced components, which provide easy access to device-specific features like serial ports, bar code scanners, cameras, and more. Other controls let you work with sound, still pictures, and movies. (Conversion utilities are also provided to bring graphics, movies, and databases onto the Palm platform.) Instead of forcing us to dig into native code to access more advanced device features, Crossfire offers an approach familiar to any VB developer.

These advanced controls help you design rich mobile-client applications, but we noticed that not all components are supported by all devices. The documentation doesn't help with this, either. Al-

though Crossfire includes two controls for network connectivity (for HTTP and for TCP sockets), it does not support Web services directly. On the plus side, Crossfire supports coding to Palm, Symbian, and Pocket PC databases with separate APIs for querying and updating data.

As you build and test code, Crossfire uses its own emulator that runs inside Visual Studio and makes good use of Microsoft's IDE for solid debugging capabilities. Starting and stopping the emulator is snappy. We liked the short edit-compile-run cycles here. Until Microsoft adds edit-and-continue to its .NET offerings, you can arguably work faster in Crossfire than in .NET CF.

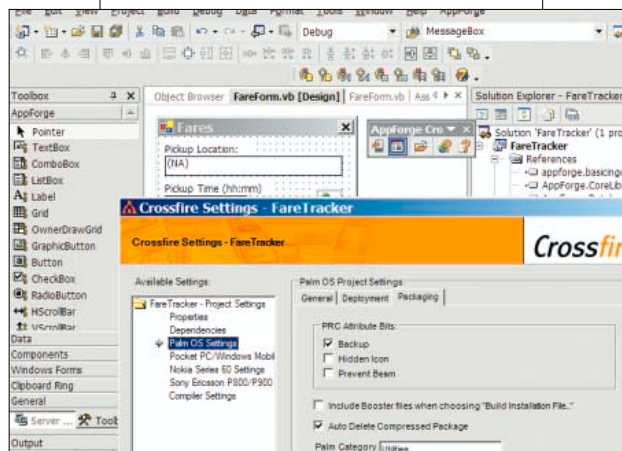
When you are ready to deploy your application, Crossfire's Booster add-on automates bundling up your application. A nicely detailed dialog box let us control specific options for different deployment platforms.

Crossfire can create feature-rich clients on three significant mobile platforms, all from the same code base. What it lacks in Web services support, it makes up for in ease of use.

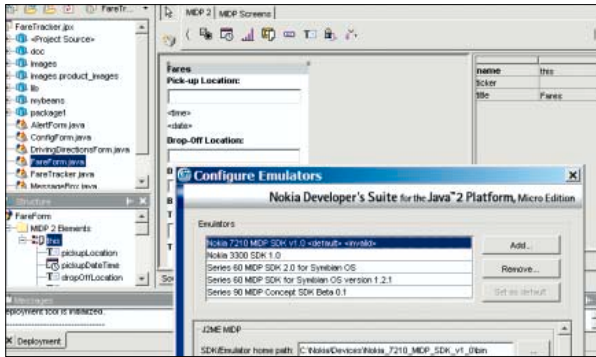
Borland Mobile Studio 1.5

\$699 direct. Borland Software Corp., www.borland.com. ●●●○○

Borland Mobile Studio 1.5 offers an ambitious solution for developing mobile applications in both Java and C++. The real strength of this toolset is the very solid JBuilder Mobile Edition Java compiler for creating mobile software.



APPFORGE'S CROSSFIRE provides excellent support for Palm OS, including utilities to convert graphics, fonts, and databases.



THE CORNERSTONE of Mobile Studio 1.5 is JBuilder, a powerful yet approachable Java compiler.

We evaluated Mobile Studio as part of Borland Enterprise Studio for Mobile (\$6,999 direct), which comes with 11 CDs that took over 2 hours to install—by far the most complex installation in our roundup. Though this extensive bundle is more of a grab bag than a synergistic whole, Borland's JBuilder Mobile Edition for Java and C++BuilderX are the core tools for mobile development. The enterprise suite adds end-to-end control of the entire project lifecycle, including UML diagramming, coding, testing, profiling, and quality assurance. We tested its J2ME abilities by writing our taxi-tracking application using JBuilder.

As a Java IDE, JBuilder is a very approachable and solid offering. It's powerful but easy to use, and it's filled with features like refactoring wizards, excellent on-the-fly help, and support for J2EE server projects. Its control of projects and targets is somewhat easier to master than that of

Borland doesn't attempt to go beyond Sun Microsystems' standards for J2ME, so Mobile Studio doesn't support Web services or lightweight databases, which IBM does. We relied on the standard Record-Store APIs to simulate a local database in our taxi application. Support for the emerging J2ME Personal Profile is sparse, though you can use a Palm OS emulator with the product if you roll up your sleeves a little.

The built-in emulation was more than adequate for creating our J2ME test application, and we used the capable MIDP editor to design the screens. (We relied on the popular open-source kSOAP libraries for our Web services support.) Integrated debugging, which has long been a staple of JBuilder, is a winning feature.

Mobile Studio offers some impressive innovations with its C++BuilderX tool, which can run inside the same Mobile Studio shell as JBuilder. Support for native

IBM WebSphere (which still shows its open-source Eclipse roots). For mobile development, JBuilder provides emulators from Sun Microsystems to test J2ME MIDP projects, plus the Nokia SDK and emulators (including Series 60 support), though this was tricky to get working. For projects in Asia, Mobile Studio also bundles DoCoMo tools.

applications in C++ for Symbian (used in Nokia and other devices) is a powerful option. With a little digging, you can also target the Microsoft platform with the included SDK for C++.

Mobile Studio also includes support for Web services in C++ with an add-on library and wizard that consumes WSDL and generates the appropriate stub files. A quick look at the generated C++ code showed some real syntactical complexity. Newer languages like Java and C# make Web services programming a lot easier for developers. For writing games and other applications that take full advantage of particular device hardware, C++BuilderX certainly fits the bill.

JBuilder X is a very approachable, powerful, and versatile Java compiler tool. Though the Java and C++ tools can share an interface, developers have little reason to use both languages at the same time. Businesses planning mobile development projects will probably pick and choose from within the larger Enterprise Suite toolset, but Mobile Studio is a fine choice for cross-platform handheld development.

IBM WebSphere Studio Device Developer 5.6

\$600 direct. IBM Corp., www.ibm.com/websphere.



IBM WebSphere Studio Device Developer 5.6 (\$600 direct) offers a well-rounded and versatile Java tool that extends the J2ME platform for business applications. With innovative Java technology supporting Palm OS, Pocket PC, and other handhelds, this tool is the best all-around solution for mobile development we've seen.

We installed WebSphere on Windows XP from a single CD. (It also runs on Linux.) Like Borland, WebSphere bundles the Nokia SDK with Series 60 support. An innovative live-update feature took us to IBM's Web site, where we downloaded updates for Web services (IBM Web Services Tool Kit v5.6), which added Web service security. We also downloaded a lightweight database option called DB2 Everywhere (DB2e), which runs only on the Personal Profile.

SCORECARD



For **development environment**, we consider IDE interface usability, programming wizards, debugging features, code manipulation options, and display options. For **connectivity**, we look at the ability to connect to data stores and Web services. For **device and emulation support**, we evaluate the level of support for cell phones and other handheld devices. For **deployment**, we consider the factors necessary for taking a mobile application live, including support of automated and over-the-air deployment.

	Development environment	Connectivity	Device and emulation support	Deployment	OVERALL
Crossfire 5.0	●●●●	●●	●●●●	●●●	●●●
Borland Mobile Studio 1.5	●●●●	●●	●●●●	●●●	●●●
IBM WebSphere Studio Device Developer 5.6	●●●●	●●●●	●●●●●	●●●●	●●●●
Microsoft Visual Studio .NET	●●●●●	●●●●	●●●	●●●	●●●●

RED denotes Editors' Choice.

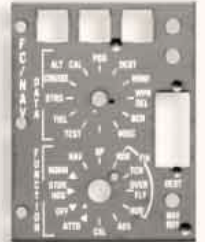
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WebSphere is powered by IBM's Eclipse technology, an open-source effort that lets developers add tools and compilers to a workbench or IDE. The inherent flexibility in Eclipse is a natural fit for developing mobile applications for a wide variety of handhelds. The basic WebSphere IDE, however, keeps Eclipse's complexity in check, but opening and controlling files within different projects takes some getting used to. Eclipse is quirky in that you

need to save files as a separate step before compiling them.

Besides superior refactoring wizards and on-the-fly quick tips to solve problems, WebSphere includes a capable MIDP visual designer and a good integrated debugger. We used the MIDP editor to design screens for our test taxi application, adding code to events behind a handful of J2ME controls. Though it supports Personal Profile with its Virtual Machine, we

missed an interface designer for creating higher-end PDA screens.

The real strength of WebSphere is its support for IBM's own mobile Java Virtual Machine (JVM), called the IBM WebSphere Micro Environment. This gives you a JVM that will run on Palm, Nokia, and Pocket PC. Moreover, WebSphere lets you target each device, and with a little configuration, build the requisite executables and deploy them along with the JVM. It supports built-in op-

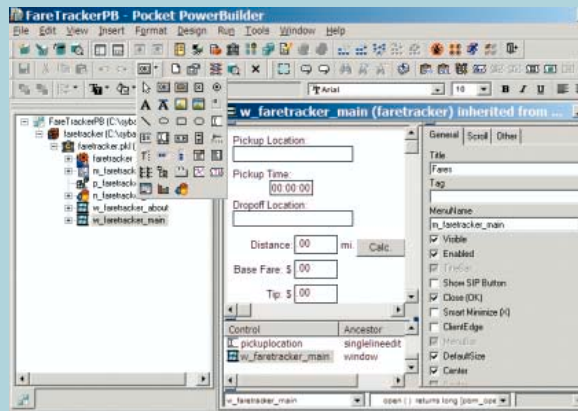
Sybase Serves Up On-the-Go Databases

When it comes to mobile databases for Pocket PC and Palm OS handhelds, Sybase subsidiary iAnywhere Solutions has been the go-to choice for application developers. When you don't need a full-blown development environment, Sybase delivers a quick way to prototype mobile applications, too. SQL Anywhere Studio 9.0 (\$399 direct) is a flexible mobile database with excellent synchronization for both Pocket PC and Palm OS. Sybase Pocket PowerBuilder 1.5 (\$495 direct) bundles many of the same database tools and offers a developer tool to build client interfaces for mobile Windows.

Installing SQL Anywhere Studio 9.0 was very quick, and half a dozen tools helped us get started. The core Adaptive Server Anywhere database is a remarkably functional small-footprint database with an excellent console for creating, tweaking, and monitoring your data. And with the capable database diagram design tool, PowerDesigner, we were able to generate modeling diagrams and database scripts for our taxi database.

The really impressive technology here is the UltraLite mobile database, which provides a well-designed set of features and APIs that are just right for a mobile market divided between Pocket PC and Palm OS. The database runs on both of these platforms and exposes functionality through .NET APIs (for use with Visual Studio .NET) and Java (for use with Palm OS), plus C++ calls for native development. A quick look at the APIs here shows a robust assortment of database objects modeled after the popular JDBC and ADO.NET standards.

Better yet, this ultra-lightweight platform includes APIs and a server, called Mobilink, for synchronizing mobile devices and centralized servers. (Support for IBM DB/2, Oracle 9i, SQL Server, and Sybase's own Adaptive Server Enterprise is standard.) After running a script to configure the central database server, we were able to sync up customer records from a mobile client through the Mobilink server process back to our Oracle 9i database. The same approach works with the Windows CE version of Adaptive Server Anywhere.



FOR POCKET PC DEVELOPMENT, Pocket PowerBuilder provides component-based programming using Sybase's PowerScript language and a productive IDE for writing and debugging code.

In custom projects, you manage this conversation through the Mobilink server via API calls that establish and monitor the synchronization process. With just a few calls, you can also take advantage of cradled synchronization to update databases when a user is connected to a desktop.

Sybase Pocket PowerBuilder offers a rapid application development tool comparable to Visual Basic and AppForge's Crossfire 5.0 for building mobile clients, but handheld support is limited to Pocket PC. In building a cross-section of our test client in Pocket PowerBuilder, we found

the visual designer for creating forms to be smoother than most of the tools in our main roundup. With nearly three dozen components to choose from, the software lets you build rich interfaces on a par with Visual Studio .NET.

But the PowerScript programming language is last year's model, and we missed on-the-fly pop-up language help, which is standard on all the other tools we tested. Support for Web services is also missing from this release.

The tool does a good job with databases via the powerful DataWindow object, which lets you manage database queries and updates with little coding. We also liked the emulation and debugging. You can even plug the Pocket PowerBuilder into Microsoft Pocket PC emulators on the desktop. A wizard speeds up deployment to Windows Mobile devices.

At press time, iAnywhere released a new version of its recently acquired AvantGo technology called M-Business Anywhere Server Application Edition (\$3,588 direct and up), which allows content creators to design and distribute mobile content to Pocket PC, Palm OS, and RIM devices. This Web-based system is now powered by the same iAnywhere database technologies, including its lightweight tools for clients.

Sybase/iAnywhere's expertise with small-footprint databases is paying off, because synchronization is so important to today's mobile development efforts. Its tools deserve consideration from any organization that wants to let mobile users access and sync up safely with central databases. —RVD

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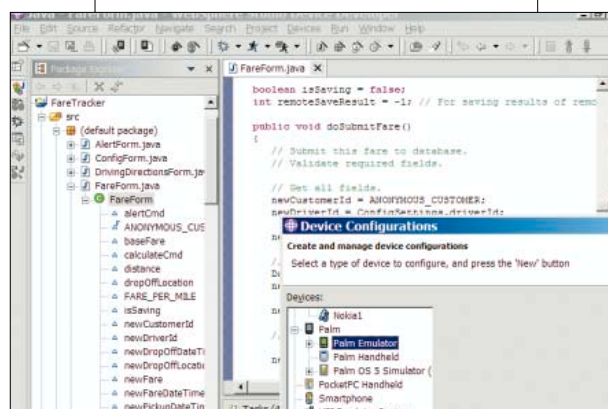
Mobile Development Tools

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Products listed in review order. ■ YES □ NO	Crossfire 5.0	Borland Mobile Studio 1.5	IBM WebSphere Studio Device Developer 5.6	Microsoft Visual Studio .NET 2003/.NET Compact Framework
Direct price per developer seat	\$1,000 (plus \$25 per deployed device)	\$699	\$600	\$1,079
DEPLOYMENT				
SDKs and OSs supported	Nokia Series 60, Palm OS 3.1 or later, Pocket PC 2000/2003, UIQ, Windows Mobile 2003 for Pocket PC	J2ME, Nokia Series 60/80/90, NTT DoCoMo, Symbian, UIQ	J2ME, Nokia Developers Suite, Palm OS 3.1 or later, Pocket PC 2000/2003, Windows Mobile 2003 for Pocket PC, Zaurus	Pocket PC 2000/2003, Windows CE .NET 4.1 or later, Windows Mobile 2003 for Pocket PC
Development languages supported	Visual Basic 6, Visual Basic .NET	C++, Java	C/C+, Java	Visual Basic .NET, Visual C# .NET
CONNECTIVITY FEATURES INCLUDED				
Client Web services call	□	□	■	■
Over-the-air provisioning tools/components/APIs	□ □ □	■ ■ ■	■ ■ ■	□ □ ■
Personal database included	None	None	DB2e	SQL Server CE
Cradle or RF data-transfer tools	■	■	■	■
Serial-port data-transfer tools/components/APIs	■ ■ ■	■ ■ ■	□ □ ■	□ □ ■
Tools to build queues for the device to sync later	■	■	■	■
EDITOR				
Form designers in J2ME tools:				
Personal Profile	N/A ¹	□	□	N/A ¹
MIDP 2.0 Profile	N/A ¹	■	■	N/A ¹
WYSIWYG form designers in .NET CF tools:				
For Pocket PC 2002 .NET CF	■	N/A ²	N/A ²	■
For Smartphone .NET CF	■ (Nokia, Palm, and Sony Smartphones only)	N/A ²	N/A ²	■
For Windows CE	■	N/A ²	N/A ²	■
A design environment specifically for Smartphones	■	■	■	□
Native support for Palm API	■	■	■	□
Native support for Pocket PC API	■	■	■	■
EMULATION				
Palm/Pocket PC emulator	□ ■	□ □	■ (download) □	□ ■
Preserves emulator session state	□	□	■	■
Configurable emulator settings	□	■	■	■
RED denotes Editors' Choice. N/A ¹ —Not applicable: This is a .NET tool. N/A ² —Not applicable: This is a Java-based tool.				

tions for Palm, Nokia, Zaurus, and even Pocket PC. A handy wizard lets you select and run the appropriate target as you compile code for different platforms. We also liked IBM's built-in support for targeting actual devices alongside emulators.

The Java community is working to enhance the J2ME platform with new features, but IBM jump-starts the process with Web services and new support for the Personal Profile, among other enhancements. In testing, we were pleased to see that floating point support—which has long been missing from J2ME—comes standard in IBM's foundation classes.



IBM WEBSHERE STUDIO Device Developer 5.6 targets leading handheld platforms including Palm OS and Pocket PC using IBM's own Java Virtual Machine (JVM), which brings Web services and other enhancements to the J2ME platform.

A wizard let us import a WSDL file and generate stub code to call up a Web service. IBM also tied its mobile JVM to its larger enterprise platform, with provisioning and administration efforts via its software management framework (SMF) tools. Though this will take programming effort to implement (with a separate downloadable SDK), it is a cost-saving possibility for the enterprise.

Note that not every enhancement works for every device, but if your organization is using a variety of handhelds, IBM's solution is clearly the best J2ME option available.



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J2ME vs. Microsoft .NET CF at a Glance

	J2ME Connected Device Configuration*	Microsoft .NET Compact Framework
Language support	Java	Visual Basic .NET, Visual C# .NET
Platforms	Linux, Symbian OS, Windows CE	Pocket PC 2000, 2003; Windows CE .NET 4.1, Windows Mobile 2003 software
Development tools	JBuilder X, Oracle JDeveloper, Sun Java Studio, WebSphere	Visual Studio .NET 2003
Virtual machine	JVM	.NET CLR
API compatibility	Upward-compatible with J2SE 1.2	.NET Compact Framework class libraries, Win32 API (P/Invoke)
E-mail and PIM	Third-party solutions	P/Invoke
User interface	AWT (a subset of Java 2D Graphics, Advanced Imaging, and Swing is in development)	Windows Forms
Database API	JDBC	ADO .NET
Database synchronization	Third-party application (JSR 230 Data Sync API is in development)	SQL Server CE

* We used the Connected Device Configuration of J2ME on our tests.

Microsoft Visual Studio .NET Compact Framework

\$1,079 direct. Microsoft Corp., www.microsoft.com/vstudio. ●●●●●

Beyond its role for server-side and desktop development, Microsoft Visual Studio .NET 2003 offers a compelling mobile development tool for the Pocket PC: .NET Compact Framework. It has superior user interface design tools, excellent support for Web services, and the smoothest integrated emulation and debugging in this roundup. Of course, it runs only on Windows mobile devices.

In the early days of Windows CE development, Microsoft's mobile tools required a separate version of Visual Studio. Today, a well-integrated Pocket PC emulator comes standard with Visual Studio .NET. We installed with three CDs and were up and running quickly.

.NET CF is a subset of Microsoft's API classes for the server and desktop. You can program in any of the languages that Microsoft Visual Studio supports (including C# and Visual Basic .NET) and target .NET CF with ease. Because many of the controls in standard Windows Forms—the user interface library for desktop .NET—are available for mobile clients, developers can use what they already know when turning to mobile projects. Although

.NET CF supports fewer mobile devices than J2ME does, you do not have to contend with different user interface APIs.

We sped through developing our taxi-tracking application. The user interface design tools are very rich, offering a familiar drag-and-drop model of programming where you design forms and

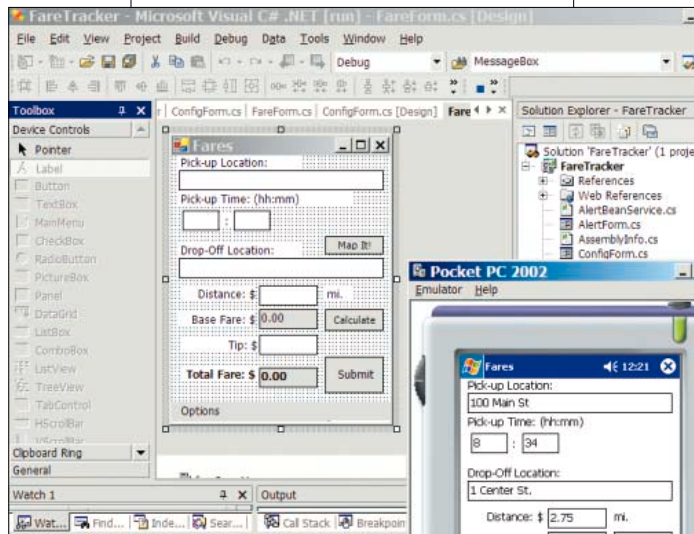
wizard generates stub classes for your WSDL files, and Web services calls are hard-wired into the fabric of .NET, making for a much simpler coding style than J2ME. Microsoft also offers a winning lightweight database (SQL Server CE, available separately), which can buffer local data and synchronize it to a remote server via just a few lines of code using powerful ADO.NET database APIs.

Because mobile emulation is integrated into Visual Studio .NET and not an add-on as with the J2ME tools, debugging and testing code is arguably the smoothest that we saw in this roundup. Along with Borland, Microsoft does a good job of hiding the complexity of compiler and project options. The tool automates setup and deployment of mobile code from within the IDE.

Microsoft has announced that the next version of this tool, code-named Whidbey, will be delayed until 2005. Until then, Smartphone

developers have to download a separate SDK, which is available free.

Although .NET CF is limited to Pocket PC handhelds, these devices offer plenty of CPU horsepower and memory. For the enterprise developer, Visual Studio .NET 2003 and .NET Compact Framework are a powerful combination that takes full advantage of Web services and delivers a familiar coding environment. Provided your organization is committed to Windows handhelds, this tool can speed up the delivery of any enterprise mobile project. ☰



WITH A SMOOTHLY integrated emulator for PC Pocket devices, Microsoft Visual Studio .NET 2003 offers seamless development and debugging for mobile development in C#, Visual Basic .NET, and other .NET languages.

attach code in snippets to objects on-screen. Over 20 components are available, including sophisticated controls like trees and grids. Only AppForge offers more options, adding components for bar-code scanners and signatures.

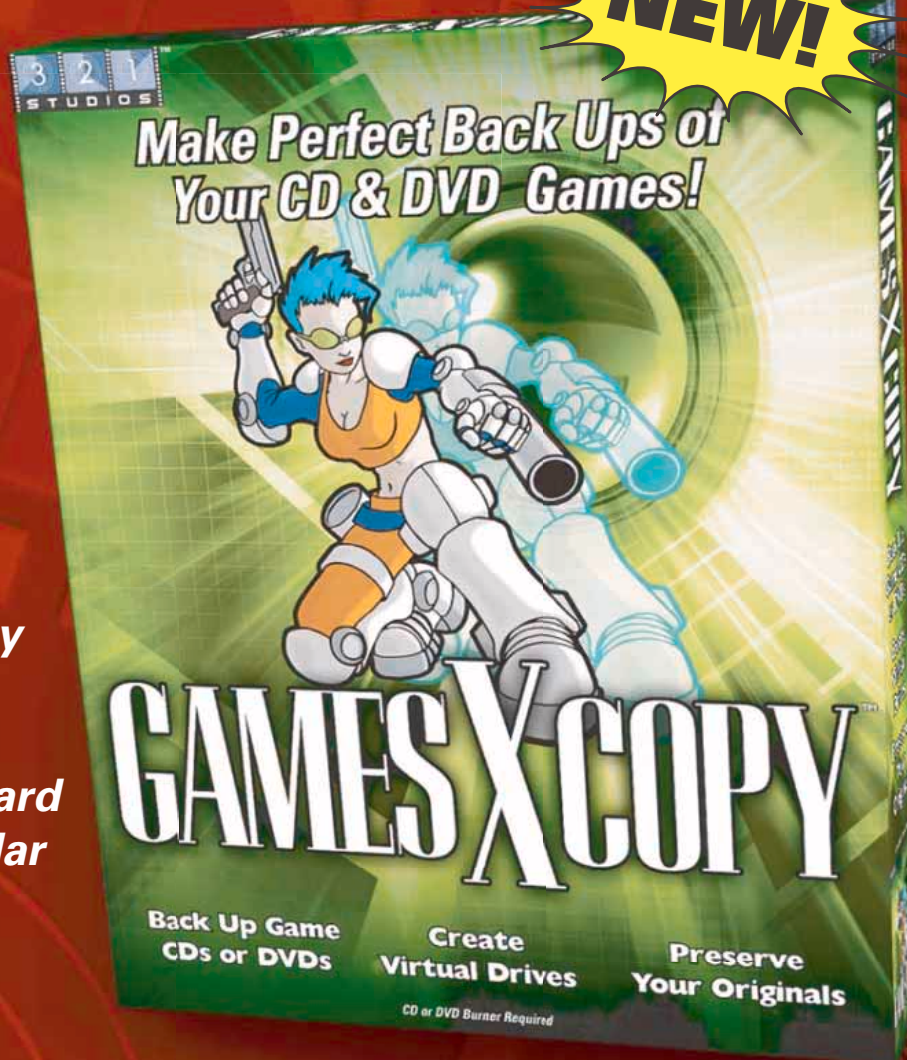
Beyond building screens, .NET CF has the simplest support for Web services. A

OUR CONTRIBUTORS: Richard V. Dragan is a contributing editor of *PC Magazine*. Associate editor Michael J. Steinhart and PC Magazine Labs lead analyst Sahil Gambhir were in charge of this story.

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AFTER HOURS

TECHNOLOGY ON YOUR TIME

O Brother, Where Am I?

BY DAVIS D. JANOWSKI AND OLIVER KAVEN

You can't watch a luxury car commercial these days without hearing about GPS—but what about GPS for the rest of us? Fear not: A new batch of relatively inexpensive GPS products for both in-car navigation and outdoor direction-finding have arrived. • The most popular GPS packages include the larger, more expensive portable in-car systems. But you'll also find Bluetooth receivers for PocketPC and Palm-based PDAs (our current Editors' Choice in that arena is the TomTom Navigator USA Bluetooth GPS, reviewed in February),

as well as standalone handhelds more suited to open-air pursuits. All are accurate to about 3 meters from your destination and are very similar in terms of the GPS hardware. In-car systems come with color displays, but you'll pay a premium for that luxury on a dedicated handheld.

Another difference between units designed for in-car navigation and those designed for outdoor use is found in the mapping software. The Magellan RoadMate 700 (an in-car system) is

the only GPS product we reviewed that has an on-board hard drive and comes fully loaded with maps. Other in-car devices and the standalone and PDA devices usually ship with only a basic base map that has major highways, landmarks, and little else on-board. For details, you have to download additional map data from software running on a PC to the unit directly or via an MMC or SD memory card.

Once you've loaded your maps and started your journey, though, you'll never have reason to get lost again.

IN-CAR PRODUCTS

DeLorme Earthmate GPS Receiver with Street Atlas USA 2004

Anyone in the market for mapping software is sure to come across this bundle, which at \$129.95 (list) seems a considerable bargain. It has extensive and fast map searching, a feature that e-mails custom maps to your friends, and more than 6 million streets and 4 million points of interest, but we were disappointed by the software's performance.

Although updated maps and graphics make viewing details easier, the interface is not what we would call user-friendly. The tabbed menu at the bottom of the screen reveals many different configuration options, but its inconsistent mix of drop-down menus, check boxes, buttons, and text fields will often leave you guessing how to perform even simple tasks. We do like the online tracking and route replay features, which clearly mark

your route with a green arrow.

The Earthmate GPS Receiver worked quite well; it acquires satellites quickly, and DeLorme offers an optional Bluetooth Wireless Powerpack for extending the receiver's use to Bluetooth-enabled handhelds and laptops. But as far as mapping programs go, we would have to recommend Microsoft MapPoint over Street Atlas USA.

\$129.95 list. DeLorme, www.delorme.com.

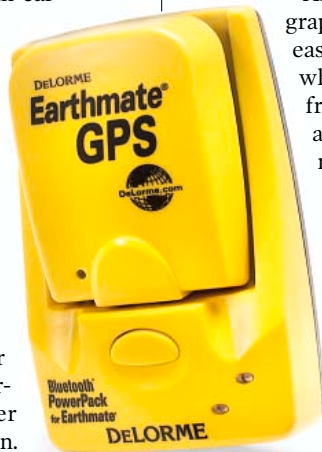
●●○○○

Garmin StreetPilot 2610 and MapSource CityNavigator v5

Garmin deserves praise for the forward thinking it showed in bringing its self-contained, in-car, turn-by-turn product to market before anyone else over a year ago. But today, the product suffers when

WHAT THE RATINGS MEAN

- EXCELLENT
- VERY GOOD
- GOOD
- FAIR
- POOR



compared with the Magellan RoadMate 700. Garmin's software interface is comparatively rough around the edges.

The Garmin StreetPilot 2610 ships with a 128MB CompactFlash card. This is probably enough storage for most people's needs, but you may have to use a bit of finesse when loading maps into the StreetPilot to prevent exceeding the memory limitations of the standard CF card. You can upgrade to a 2GB card, to allow room for all of CityNavigator's maps.

Once you install the device in your car, you'll appreciate the sandbag mount,

which sits flat on your dash without blocking your vents or requiring screws. But route planning and navigation are sometimes cumbersome, because of the outdated feel of the user interface and the relatively small screen.

The StreetPilot 2610 offers numerous configuration options not found in any other in-car navigational system. We especially liked the avoidance option for toll roads and highways and the ability to set up the system to devise routes based on the type of vehicle you are driving. And safety-conscious drivers can configure the StreetPilot 2610 to refuse any input while the car is in motion, keeping distractions to a minimum. If Garmin focuses on making interface improvements, it will be a strong contender in the GPS arena.

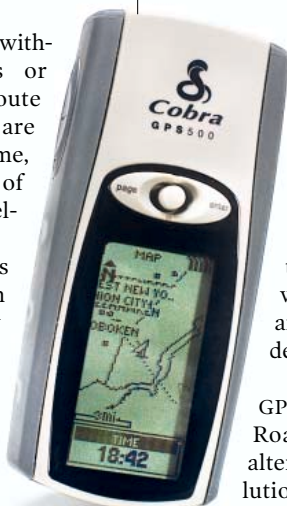
\$860 street. Garmin Ltd., www.garmin.com.



Magellan RoadMate 700

PC At a list price of \$1,299, the Magellan RoadMate 700 in-car GPS, with preloaded maps and turn-by-turn navigation, does not come cheap. But it works—very well. The product really impressed us with its design, level of accuracy, ease of use, and crystal-clear voice instructions. Another bright spot (literally) is the brilliant 2.3- by 3-inch, high-resolution, color TFT LCD screen, which is easily readable both during the day and at night.

One of the most crucial design aspects of an in-car GPS is the interface. Although we do not promote planning routes with such units while driving, we know that many people will



anyway. Fortunately, the RoadMate 700's interface is designed well, and planning a route is easy. From the time you turn on the system until you receive your first clear voice prompts with turn instructions, you never doubt which choices to make, nor and that you will reach your destination.

Our favorite of the in-car GPS solutions, the Magellan RoadMate 700 is an effective alternative to factory in-car solutions, with the added benefit of portability.

\$1,299 list. Thales Navigation Inc., www.magellangps.com. ●●●●●

OUTDOOR HANDHELDS

Cobra GPS 500

A longtime manufacturer of CB radios and other electronics devices, Cobra Electronics Corp. has entered the GPS field. Although the Cobra GPS 500 provides the basics in terms of interface design and function, it offers little more, besides a low price.

Most notably, the GPS 500 lacks the higher screen resolution found in products from Garmin, Lowrance, and Thales. Also, we were not impressed with the receiver's sensitivity: It took several minutes to get a cold fix with a pretty open 360 degrees of horizon.

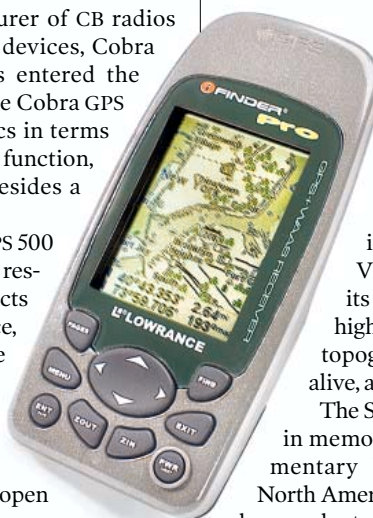
Finally, we encountered problems with the device's ergonomics. Our thumb often covered a part of the screen when we were using the GPS 500's pointer stick. All in all, you can do better with a similar entry-level device, such as the Garmin Geko 101 or eTrex.

\$130 street. Cobra Electronics Corp., www.cobra.com.



Lowrance iFinder Pro

The Lowrance iFinder Plus impressed us when we first reviewed it in December 2002, and the new Pro model is no slouch either. On its slightly larger, higher-resolution screen (3 inches diagonally, 240 by 180 pixels, 16-level gray scales), maps are crystal-clear.



MORE ON THE WEB

www.pcmag.com/afterhours

See After Hours online for more GPS, Quick Clips, and Gear & Games reviews.

The device is simple to learn and operate with an intuitive interface; we highly recommend it.

One accessory in particular will make this product attractive as a gift for the non-computer-savvy nature lover in your life—FreedomMaps (each \$99.95 direct). The USA series of these pre-loaded 128MB MMC cards covers several states per card (Canada and Europe are also available). Simply slide in the card and you—or a computer-illiterate family member—won't have to bother creating map files and downloading them to the iFinder.

\$200 street. Lowrance Electronics Inc., www.lowrance.com. ●●●●○

Magellan SporTrak Color

Don't get us wrong—we know that Magellan has a full line of less expensive, very capable handhelds—but we wanted to take a look at its newest color product. Viewable even in sunlight, its 240- by 160-pixel, 16-color high-resolution display brings topographic maps vibrantly alive, as they should be.

The SporTrak has 32MB of built-in memory, including a 9MB rudimentary base map of North America. That still leaves plenty of memory for downloading more detailed maps from any number of optional MapSend software programs (each program is \$100 street). Although the SporTrak has a slightly narrower screen than its cousin, the Magellan Meridian Color, we think that it could also do passable double duty as an outside and in-car unit.

\$310 street. Thales Navigation Inc., www.magellangps.com.



GEAR & GAMES

Charge on the Go

The Zip-Linq Sync-N-Charge retractable cable is a convenient, portable alternative to the power-and-sync systems that come with PDAs. The cable is a spooled reel that extends from 4 inches to more than 2 feet. You can use it not only to sync your PDA to your PC via USB but also to recharge your mobile device.

The Zip-Linq does not have a hot-sync button, so you use the PDA's sync program to activate it, and the short cable requires you to keep your PDA close by. For travel, though, it's a cool solution.—*Michal Dluginski*

\$17.99 direct. Zip-Linq, www.ziplinq.com. ●●●●○



Cool Looks for Hot PCs

Computer modifications enter the mainstream with this line of add-ons. They're easy to install, attractive enough for the mod enthusiast, and reasonably priced. We tested the **Memorex Modz Glowing LED Fan**, which is made out of sturdy plastic with a chrome grill, and the **Modz Cold Cathode Light Kit**, for lining the inside of your case. Both installed in minutes, bathing our computer in a cool, blue-neon glow. The fan includes a temperature detector, so it runs faster when your computer needs more cooling. The light has an on/off switch, and two lights can plug into the same switch.—*Troy Dreier*

Fan, \$10.99 list; light, \$18.99. Memorex Products Inc., www.memorexmodz.com. ●●●●○

Keep Your Camera Clean

The **Norazza Digital Cleaning Kit** is an inexpensive package that provides everything you need to keep your digital camera spotless (and avoid repairs and read errors caused by dust, crumbs, and so on). Even the inside of your memory card slot is taken care of, with a card-size insert covered in a cleaning cloth. Separate kits are sold for CompactFlash,

Memory Stick, SD/MMC, SmartMedia, and xD Picture Card products.—*Carol A. Mangis*

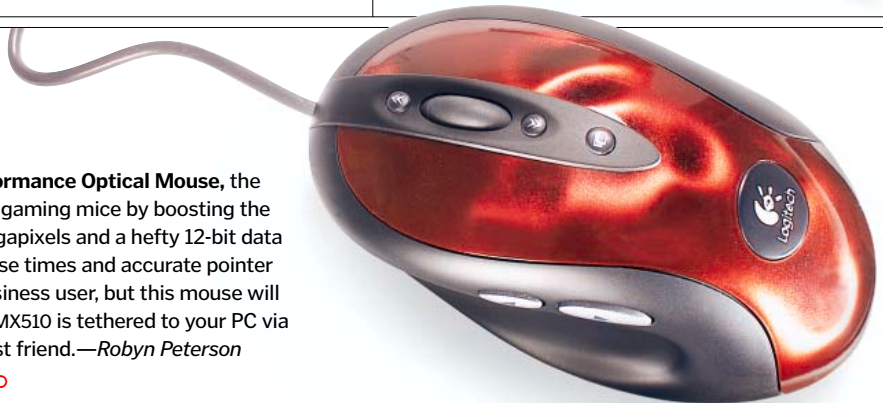
\$19.99 list. Norazza Inc., www.norazza.com. ●●●●○



Ultra-Powerful Gaming Mouse

With the **Logitech MX510 Performance Optical Mouse**, the company upped the ante for gaming mice by boosting the MX Optical Engine to 5.8 megapixels and a hefty 12-bit data path: This assures lightning-fast response times and accurate pointer movement. It might be overkill for a business user, but this mouse will escalate a LAN party to a frag fest. The MX510 is tethered to your PC via USB—but wires are a frugal gamer's best friend.—*Robyn Peterson*

\$49.95 list. Logitech, www.logitech.com. ●●●●○

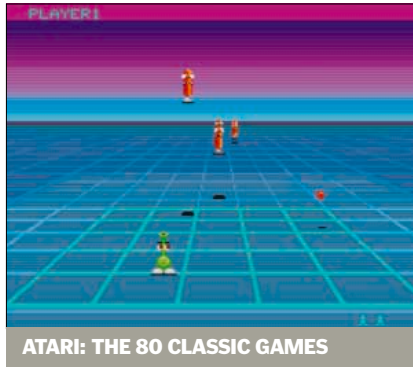


Playing in the Past

BY SASCHA SEGAN

Classic gaming isn't just about nostalgia; many old games have a simple, flexible quality missing from a lot of today's complicated multimedia extravaganzas. You can pick up Pac-Man in seconds, for example, and play it for minutes or hours.

To play classic games you can buy commercial game packs, load freeware emulators, or pick up some nifty little joysticks preloaded with games. We tried all three.



ATARI: THE 80 CLASSIC GAMES

Atari: The 80 Classic Games

We wanted to do things on the level, so we picked up this CD compilation of 70 Atari 2600 games and 10 old arcade games. The disc is packed with the wonderful old manuals and art, and the arcade games show up in windows surrounded by the original cabinet art.

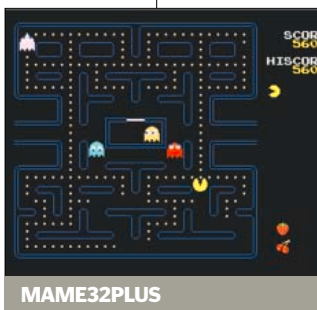
Of the 10 arcade games Atari picked, most demand oddball controllers for the best experience—such as Battlezone's dual sticks, Asteroids' slew of buttons, and Centipede's track ball. For the 2600 games, we had fun using RedOctane's imitation Atari USB joystick (\$20 list, www.redoctane.com), but we had to tweak the joystick tracking and button settings in every game.

\$19.99 list. Atari Inc., www.atari.com. ●●●●○

Jakks TV Games

The closest you can come to the effortless joy of true old-school gaming is with these fun, convenient gadgets. They solve the controller problem because they *are* the controllers.

Jakks currently sells five classic-gaming sticks (each stick is \$20 street). All are cool-looking, comfortable controllers that plug directly into your TV. The Activision, Atari, and Atari Paddle models are loaded up with Atari 2600 games. We were much more impressed with the



MAME32PLUS

Namco and Ms. Pac-Man sticks, which play old arcade games.

The Namco stick is a sturdy little brick with great action and responsiveness, for Bosconian, Dig Dug, Galaxian, Pac-Man, and Rally-X. Plug the stick in, try to avoid the too-easy-to-press reset button, and you're good to go. Game play is authentic, but the sound effects are new.

There's no tweaking with these sticks, no Windows worries, and no legal issues. If you just want to play, and Jakks' game list appeals to you, these gadgets are the way to go.

\$20 list. Jakks Pacific Inc., www.jakksstvgames.com.

●●●●○

MAME32Plus

Freeware emulators (labors of love created by gaming cultists) run thousands of old arcade, console, and computer games, from Mr. Do! to MULE. The vast majority of these games are available nowhere else. There's only one problem: Although the emulators themselves are legal, running the games is almost always not. Because nobody's losing money on out-of-print games from 1983, though, the laws aren't enforced very heavily.

The granddaddy of emulators is the MAME, the Multiple Arcade Machine Emulator, which supports more than 4,000 old arcade games. The MAME32Plus spin-off adds a useful Windows GUI to the game selection process. Computer emulators for everything from the Atari 800 to the Commodore 64 are out there too.

Emulators are often tweaky and full of dozens of poorly explained hardware settings, and you have to hunt out your games on Kazaa or obscure Web sites. The game

play, though, can be great. We combined the MAME with the X-Arcade controller (\$99 list, www.x-arcade.com), which offers a rugged stick and a slew of buttons, and enjoyed the complete arcade experience.

Free. MAME Plus!, www.mame.emu-zone.org.

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QUICK CLIPS

Judge Dredd: Dredd vs. Death

This first-person shooter is true to the Judge Dredd comic books and a must for fans of the character. Maps and objec-



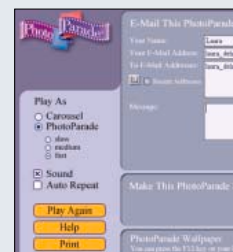
tives require you to cover a lot of ground, which can be confusing, but Mega City One is a beautiful backdrop for hunting Judge Death and his cronies. Perp AI is intriguingly complex; story mode is excellent, and arcade and battle modes are fun as well.

—Matthew D. Sarrel

For PC and all console platforms. \$49.95 list. Evolved Games, www.dreddvsdeath.com. ●●●●○

PhotoParade Essentials 5.0

Create lively digital slide shows with this all-purpose photo program by dragging pictures from your hard drive onto an inter-



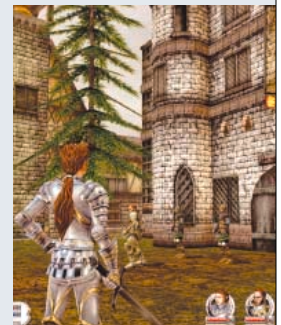
face that lets you easily rearrange, add, and remove shots. You can do some basic editing as well, add titles and audio narration, and then apply a theme, such as

birthday, holidays, or kids. Once you're done, share your photos or slide show via e-mail or CD or host them for ten days on PhotoParade's Web site.—Laura Delaney

Standard, \$24.99 list; Super, \$39.99. Callisto Corp., www.photoparade.com. ●●●●○

War & Warriors: Joan of Arc

You play as the heroic title character during the height of the Hundred Years' War—sadly, without Joan's divine inspiration. The 3-D locations and characters



look spectacular in this third-person action game. But the hack-and-slash game play wears thin, and the seemingly endless melees and mangled plot would sap even Joan's conviction.

—Peter Suci

\$29.99 list. Enlight Software Ltd., www.joa-game.com. ●●○○○

BACKSPACE

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Edited by Don Willmott



Holiday e-tailers sing 'ka-ching'

Thanks to the Internet, 2003 is turning out to be a record year for online holiday sales.

<<We couldn't have done it without you. (MSN site)

>>Actually, it's AOL's spelling that stresses us out.

AOL News

This City Might Stress You Out

Takoma, Washington Tops List Of Most Stressful Cities in U.S.

>>One way to remember passwords: Write them on your arm with indelible ink. (PhoneShark.com)

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<<There's a sensible question here somewhere, but you'll need a minute to find it. (MSN site)

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The Lingo - its definition	
1FS	One finger salute
1FS	Middle finger
1FS	The finger
1FS	Flipping the bird
1FS	The middle finger

Find that special message for your Valentine.

>>Backspace on the Road: Barbados. What? No planter's punch?

<<Special message indeed! (www.lingo2word.com)



>>We know people who use this feature every month! (Microsoft Excel)

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Winners this issue: Dave Baker, Jason Goldfeder, Samuel Hunter, Andrew Love, Jack Plunkett, Howard Wexler and Dean Wilson.

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DIMENSION™ 8300 DESKTOP

Cutting-Edge Technology

- Intel® Pentium® 4 Processor with HT Technology at 3GHz with 800MHz Front Side Bus
- Microsoft® Windows® XP Home Edition
- 512GB Dual Channel DDR SDRAM
- 80GB Hard Drive
- 19" (18.0 v.i.s., 24dp) M992 Monitor
- 128MB DDR ATI's RADEON™ 9800 PRO Graphics Card
- 16x DVD-ROM Drive
- Sound Blaster® Audigy™ 2 (D) Sound Card
- Dell A425 Speakers with Subwoofer
- Productivity Pack including WordPerfect® and Money®
- 6 Months of America Online® Membership Included¹
- 1-Yr Limited Warranty;¹ 1-Yr At-Home Service²

\$1499 Ask about No Payments for 90 Days for well-qualified customers!³
E-VALUE Code: 00042-D50414m

NEW INSPIRON™ 1150 NOTEBOOK

Notebook Essentials – Budget Friendly

- Intel® Celeron® Processor at 2.40GHz²
- Microsoft® Windows® XP Home Edition
- 14.1" XGA TFT Display
- 256MB Shared® DDR SDRAM
- 20GB Hard Drive
- 8x DVD-ROM Drive
- Integrated Intel® Extreme Graphics
- 65Whr Li-Ion Battery (8-Cell)
- Internal Fax Modem and NIC Included
- Productivity Pack including WordPerfect® and Money®
- 1-Yr Limited Warranty;¹ 1-Yr Mail-In Service²

\$799 Ask about No Payments for 90 Days for well-qualified customers!³
E-VALUE Code: 00042-D80407m

Recommended Upgrades:

- 24X CD Burner/DVD Combo Drive, add \$59
- 3-Yr Limited Warranty;¹ 3-Yr At-Home Service;² add \$179

INSPIRON™ 5150 NOTEBOOK

Perfect Balance of Price and Performance

- Mobile Intel® Pentium® 4 Processor at 2.66GHz²
- Microsoft® Windows® XP Home Edition
- 15" XGA TFT Display
- 256MB DDR SDRAM
- 30GB Hard Drive
- 24x CD Burner/DVD Combo Drive
- 32MB DDR NVIDIA® GeForceFX™ Go5200 AGP 4X Graphics
- 65Whr Li-Ion Battery (8-Cell)
- Internal Fax Modem and NIC Included
- Productivity Pack including WordPerfect® and Money®
- 1-Yr Limited Warranty;¹ 1-Yr Mail-In Service²

\$1179 Ask about No Payments for 90 Days for well-qualified customers!³
E-VALUE Code: 00042-D80411m

Make this your perfect PC:

- 40GB Hard Drive, add \$59
- 3-Yr Limited Warranty;¹ 3-Yr At-Home Service;² add \$269

NEW INSPIRON™ 9100 NOTEBOOK

Multimedia Powerhouse

- Intel® Pentium® 4 Processor with HT Technology at 2.80GHz²
- Microsoft® Windows® XP Home Edition
- 15.4" UltraSharp™ Wide Screen XGA TFT Display
- 256MB DDR SDRAM at 400MHz
- 40GB Hard Drive
- 24x CD Burner/DVD Combo Drive
- 64MB DDR ATI's MOBILITY™ RADEON™ 9700 AGP 4X Graphics
- 96Whr Li-Ion Primary Battery (12-Cell)
- Internal Fax Modem and NIC Included
- Productivity Pack including WordPerfect® and Money®
- 1-Yr Limited Warranty;¹ 1-Yr Mail-In Service²

\$1549 Ask about No Payments for 90 Days for well-qualified customers!³
E-VALUE Code: 00042-D80415m

Make this your perfect PC:

- 512MB DDR SDRAM, add \$100
- 3-Yr Limited Warranty;¹ 3-Yr At-Home Service;² add \$269



Small Business Desktops

DIMENSION™ 2400 DESKTOP

Economical, Essential Technology Desktop

- Intel® Celeron® Processor at 2.40GHz
- Microsoft® Windows® XP Home Edition
- Core!® Productivity Pack including WordPerfect® and Money®
- 128MB Shared™ DDR SDRAM
- 40GB Hard Drive (7200 RPM)
- Integrated Intel® 3D Extreme Graphics
- 48x CD-ROM; Integrated Audio
- Integrated 10/100 Ethernet
- 1-Yr Limited Warranty; 1-Yr On-Site Service¹
- Monitor Not Included

\$349 E-VALUE Code: 00042-S50403y

Recommended Upgrades:

- 17" (16.0" v.i.s.) E773 Monitor, add \$100
- 3-Yr Limited Warranty; 3-Yr On-Site Service; add \$99

NEW OPTIPLEX™ 170L DESKTOP

Network-Optimized, Value Business Desktop

- Intel® Pentium® 4 Processor at 2.80GHz with 533MHz Front Side Bus
- Microsoft® Windows® XP Professional
- 128MB Shared™ DDR SDRAM
- 40GB Hard Drive (7200 RPM)
- Integrated Intel® Extreme Graphics 2
- 48x CD-ROM
- Integrated 10/100 Ethernet
- 1-Yr Next Business Day On-Site Service¹
- Monitor Not Included

\$649 Lease as low as \$18/mo., (48 prnts.²) E-VALUE Code: 00042-S30406y

Recommended Upgrades:

- 48x CD Burner, add \$30
- 3-Yr Next Business Day On-Site Service; add \$99
- 17" Dell™ UltraSharp™ 1703FP Digital Flat Panel, add \$479

DIMENSION™ 4600 DESKTOP

Exceptional Performance Desktop

- Intel® Pentium® 4 Processor with HT Technology at 2.80GHz with 800MHz Front Side Bus
- Microsoft® Windows® XP Home Edition
- Core!® Productivity Pack including WordPerfect® and Money®
- 256MB Dual-Channel Shared™ DDR SDRAM
- 80GB Hard Drive (7200 RPM)
- 128MB DDR NVIDIA® GeForce FX 5200 Graphics Card with TV-Out
- 48x CD Burner; Integrated Audio
- Integrated Intel® PRO 10/100 Ethernet
- 1-Yr Limited Warranty; 1-Yr On-Site Service¹
- Monitor Not Included

\$799 Lease as low as \$22/mo., (48 prnts.²) E-VALUE Code: 00042-S50407y

Recommended Upgrades:

- 3-Yr Limited Warranty; 3-Yr On-Site Service; add \$149
- Dell™ All-In-One Printer A960, add \$179



Small Business Notebooks

NEW LATITUDE™ D505 NOTEBOOK

Balance of Price and Performance – Starting at 5.1 lbs²

- Intel® Celeron® M Processor at 1.20GHz
- Microsoft® Windows® XP Home Edition
- 14.1" XGA TFT Display
- 128MB Shared™ DDR SDRAM
- 20GB Hard Drive
- Modular 24x CD-ROM Drive
- Intel® PROWireless 2100 802.11b 11Mbps® Mini-PCI Wireless Card
- Integrated Intel® Extreme Graphics
- 1-Yr Mail-In Service; Serial and Parallel Ports Included

\$999 Lease as low as \$27/mo., (48 prnts.²) E-VALUE Code: 00042-S70409m

Recommended Upgrades:

- Microsoft® Windows® XP Professional, add \$60
- 3-Yr Next Business Day On-Site Service; add \$225

INSPIRON™ 600m NOTEBOOK

Great Performance, Compact Design – Starting at 4.98 lbs²

- Featuring Intel® Centrino™ mobile technology
- Intel® Pentium® M Processor at 1.40GHz
- Intel® PROWireless 2100 802.11b 11Mbps® Mini-PCI Wireless Card
- Microsoft® Windows® XP Home Edition
- Productivity Pack including WordPerfect® and Money®
- 14.1" XGA TFT Display
- 256MB DDR SDRAM
- 30GB Hard Drive
- Modular 8x DVD-ROM Drive
- 32MB DDR ATI's MOBILITY™ RADEON™ 9000 AGP 4X Graphics
- 1-Yr Mail-In Service; Serial and Parallel Ports Included

\$1349 Lease as low as \$36/mo., (48 prnts.²) E-VALUE Code: 00042-S80413n

Recommended Upgrades:

- 128MB Dell™ USB Memory Key, add \$40
- Dell™ Laser Printer P1500, add \$249

INSPIRON™ 8600 NOTEBOOK

Power on the Go – Starting at 6.9 lbs²

- Featuring Intel® Centrino™ mobile technology
- Intel® Pentium® M Processor at 1.60GHz
- Intel® PROWireless 2100 802.11b 11Mbps® Mini-PCI Wireless Card
- Microsoft® Windows® XP Home Edition
- Productivity Pack including WordPerfect® and Money®
- 15.4" UltraSharp™ Wide Screen XGA TFT Screen
- 256MB DDR SDRAM
- 30GB Hard Drive
- Modular 24x CD Burner/DVD Combo Drive
- 32MB DDR NVIDIA GeForce FX Go5200 AGP 4X Graphics
- 1-Yr Mail-In Service; Serial and Parallel Ports Not Included

\$1499 Lease as low as \$40/mo., (48 prnts.²) E-VALUE Code: 00042-S80414n

Recommended Upgrades:

- 3-Yr Gold Technical Support, add \$79
- Microsoft® Office Basic Edition 2003, add \$139



Small Business Servers & Workstations

POWEREDGE™ 400SC SERVER

Small Business Value Server

- Intel® Celeron® Processor at 2GHz
- Upgradable to Intel® Pentium® 4 Processor at 3.20GHz with 800MHz Front Side Bus
- 128MB ECC DDR SDRAM (Up to 4GB)
- 40GB (7200 RPM) IDE Hard Drive
- Upgradable to 500GB of Internal Hard Drive Storage
- Embedded Intel® PRO Gigabit™ NIC
- RAID 1 Optional
- 1-Yr Next Business Day On-Site Service¹
- Small Business Pricing

\$499 Lease as low as \$14/mo., (48 prnts.²) E-VALUE Code: 00042-S20404h

Recommended Upgrades:

- PowerConnect™ 2608 8-Port Gigabit Ethernet Switch; add \$159
- System Including Microsoft® Windows® Small Business Server 2003 (256MB SDRAM Min. Required);³ now \$1099

POWEREDGE™ 1600SC SERVER

High-Speed Small Business Server

- Intel® Xeon® Processor at 2.40GHz
- Dual Intel® Xeon® Processor Capable (Up to 3.20GHz)
- 256MB DDR SDRAM (Up to 4GB)
- 36GB (10K RPM) Ultra320 SCSI Hard Drive
- Upgradable to 876GB of Internal SCSI Hard Drive Storage
- Embedded Intel® PRO Gigabit™ NIC
- Six PCI Slots (2-64/100MHz, 2-64/66MHz, 2-32/33MHz)
- RAID 1 or RAID 5 Optional
- 1-Yr Next Business Day On-Site Service¹
- Small Business Pricing

\$899 Lease as low as \$24/mo., (48 prnts.²) E-VALUE Code: 00042-S20408h

Recommended Upgrades:

- PowerConnect™ 2616 16-Port All-Gigabit Switch; add \$329
- System Including Microsoft® Windows® Small Business Server 2003 (256MB SDRAM Min. Required);³ now \$1399

DELL PRECISION™ 360 WORKSTATION

Maximum Performance, Single Processor Workstation

- Intel® Pentium® 4 Processor at 2.80GHz with 800MHz Front Side Bus (Up to 3.40 GHz with HT Technology)
- Microsoft® Windows® XP Professional
- Mini-Tower Chassis
- 256MB Dual-Channel DDR SDRAM
- 40GB (7200 RPM) IDE Hard Drive; 48x CD-ROM
- 64MB NVIDIA® Quadro NVS 280 AGP 8X Graphics
- Integrated Intel® PRO 1000MT Gigabit™ NIC
- Lifetime 24x7 Dell Precision™ Dedicated Tech Support
- 3-Yr Next Business Day On-Site Service¹
- Monitor Not Included

\$999 Lease as low as \$27/mo., (48 prnts.²) E-VALUE Code: 00042-S40409y

Recommended Upgrades:

- 3-Yr Same-Day 4-Hour (5x10) On-Site Service; add \$199
- 19" Dell™ UltraSharp™ 1901FP Digital Flat Panel, add \$699

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NEW INSPIRON™ 1150 NOTEBOOK

Starting at \$799
Notebook Essentials – Starting at 7.17 lbs.*

- Mobile Intel® Pentium® 4 Processor at 2.66GHz¹
- Microsoft® Windows® XP Home Edition
- 14.1" XGA TFT Display
- 256MB Shared® DDR SDRAM
- 20GB Hard Drive
- 8x DVD-ROM Drive
- Integrated Intel® Extreme Graphics
- 65Whr Li-Ion Battery (8-Cell)
- Internal Fax Modem and NIC Included
- Productivity Pack including WordPerfect® and Money®
- 6 Months of America Online® Membership Included²
- 1-Yr Limited Warranty³; 1-Yr Mail-In Service

\$949 Ask about our financing plans
for qualified customers
E-VALUE Code: 00041-D80409m

Make this your perfect PC:

- Dell Wireless 1350 802.11b/g 54Mbps⁴ Mini-PCI Wireless Card, add \$39
- 24x CD Burner/DVD Combo Drive, add \$59
- 40GB Hard Drive, add \$79
- 3-Yr Limited Warranty³; 3-Yr At-Home Service⁵; add \$179

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