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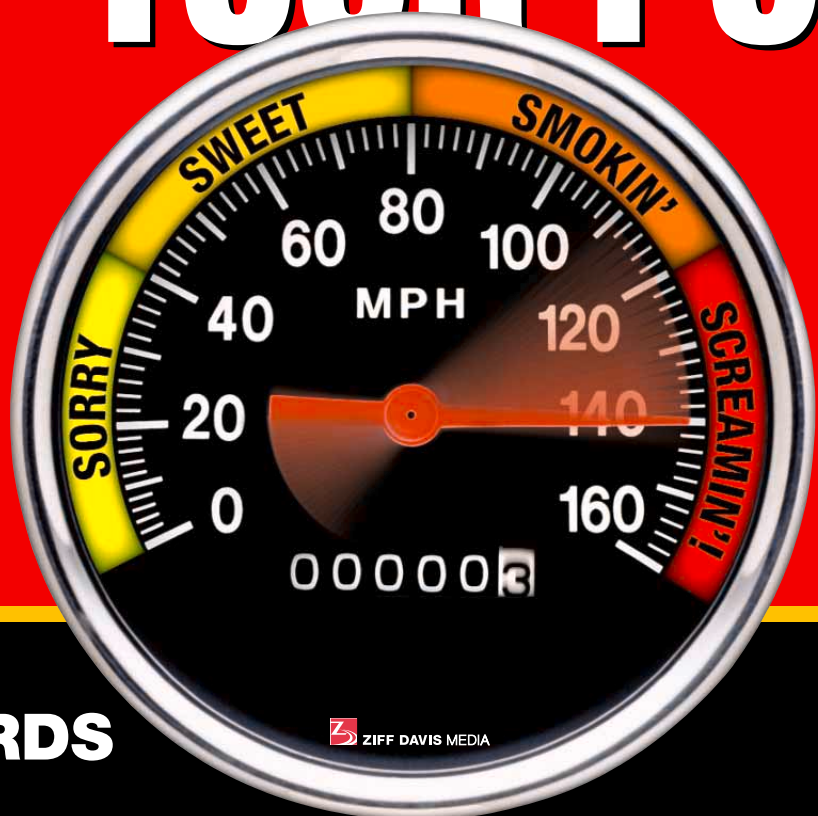
FEBRUARY 3, 2004

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See Page 80



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monitor not included

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- 48X CD-ROM Drive†
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- Advanced Port Replicator, add \$279



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- 30GB Hard Drive†
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- "Editors' Choice Award"
PC Magazine, December 9, 2003

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wireless communication. Wireless Internet use requires a separately purchased service contract. Check with service provider for availability and coverage in your area. Not all Web content available. During the HP/Compaq product transitions, some HP/PAQ products and packaging may be labeled with the Compaq brand. †18X, 48X CD-RW drive data transfer rates may vary as follows: for recording to CD-R media, the max transfer rate may be up to 4800 Kbps (use 48X discs for best performance); for writing to CD-RW media, the max transfer rate may be up to 1500 Kbps (use 4X-12X high-speed media discs for best performance); for reading CD media, the max transfer rate may be up to 6000 Kbps. Actual transfer rates may vary depending on media quality. **T1U V.92 Modems are designed only to allow faster downloads from K56flex- or V.92/V.92-compliant digital sources. Maximum achievable download transmission rates are currently unknown, may not reach 56 Kbps and will vary with line conditions. Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries. Intel, Intel Inside, the Intel Inside Logo, Intel Centrino, Pentium, Celeron and Xeon are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries. Other products mentioned herein may be trademarks or registered trademarks of their respective companies. ©2003 Hewlett-Packard Development Company, L.P.

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TechXNY, September 2003

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256M DDR SDRAM Memory
40GB Hard Drive† (5400 rpm)
48X CD-ROM Drive†
Integrated 10/100 Ethernet
PS/2 Scroll Mouse
1-1-1 (Parts/Labor/On-site) Limited Warranty**


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Forward Thinking

TECHNOLOGY AND POLITICS: THE CHOICES FOR 2004

FOR THE TECH INDUSTRY, this year will be shaped more by political and legal issues than by any great technical advances. Here are just some of the issues on the agenda.

■ **Spam legislation.** At the end of last year, President Bush signed the CAN-SPAM Act of 2003, designed to help end the flood of unsolicited e-mails. I'm glad we finally have some legislation at the federal level, but there's just one problem: It won't work.

Spammers still have many options to run their businesses. They'll just harvest new lists or move overseas to send their offers. We can reduce some spam through legislation and swift legal action against offenders, but e-mail filters will continue to be the best defense. Of course, spammers will then devise more sophisticated spamming techniques. The only real answer is to rework Internet protocols to make the accurate tracking of e-mail possible. We may see some steps in this direction in 2004, but I'm not holding my breath.

■ **Internet regulation.** No one wants to regulate the Internet, right? Of course not—unless you count Congress, the FCC, state legislatures, the United Nations, and just about every country on the planet. Some countries are complaining that U.S.-dominated institutions such as ICANN control too much of the Internet, including top-level domains. This topic will continue to stir controversy over the next few years, but any changes to the existing system will be more symbolic than revolutionary. Why? Because the basic system works.

Meanwhile, the FCC is hard-pressed to draw the line between unregulated (and untaxed) data services, such as the Internet, and traditional phone services. With Voice over IP becoming more mainstream, the line between voice and data services is blurring. For Internet users, the idea of unregulated (and untaxed) voice services sounds wonderful. But it's not so good for people in rural areas who rely on universal service taxes to get their phone service. I expect the tax issue will be a political hot potato during this election year.

I wouldn't be surprised if a decision on this is put

off for a while, but in the long run, the technology is moving toward a converged network. Eventually, the government will have to decide between regulating the Internet and removing regulation from telecom services. The latter choice may be the better one: Can someone explain to me why we're spending billions to subsidize *broadcast* HDTV?

■ **Internet taxes.** Congress debated a number of issues related to Internet taxes in 2003, although nothing came to a vote. This year I expect

Congress to deal with whether to extend the current moratorium on Internet access taxes and whether states can collect sales taxes from vendors who sell goods over the Internet.

The industry continues to hope that the moratorium stays in place, but that is unlikely in the long run. If something can be taxed, the government usually finds a way to tax it.

■ **Patent lawsuits.** I expect we'll see more lawsuits based on software patents this year, particularly in light of the initial victory by

Eolas in its patent suit against Microsoft. In this case, Microsoft

Internet Explorer was ruled to have violated a patent on plug-ins that Eolas held. The ruling seems silly to me since products like Lotus Notes had similar features years before the Eolas patent. This case has received so much attention that it just might be overturned. Meanwhile, Optima Technologies recently sued Roxio (maker of Toast and Easy CD Creator) for violating a patent on software that burns discs that any computer can read. Optima says the Optical Storage Technology Association standards infringe on this patent.

The patent system is broken, especially for software and business process patents. I'm not all that concerned about the small companies suing the big guys, since the big guys can defend themselves. But I am worried about the giant companies deciding that they have patents on just about everything and forcing start-ups to license technology for anything they want to do. That could lead to a chilling effect



Eventually, the government will have to decide between regulating the Internet and removing regulation from telecom services.

Forward Thinking

MICHAEL J. MILLER

on innovation. I expect some discussion on this topic but little real progress this year.

■ **Privacy and security legislation.** This has the potential to be the big technological issue of the year. We'll see more efforts to extend and alter the Patriot Act, which allows the government, under certain circumstances, access to database information from private companies, ISPs, and libraries. I'm concerned that the Patriot Act threatens privacy and that indiscriminate data mining yields many false positives without providing much additional security. But in the current environment, anything that looks like it's a security measure is likely to win favor.

■ **Financial issues.** Congress will probably spar over a number of economic issues affecting technology, such as jobs moving overseas, stock options, and the demand for more financial disclosures from companies. This last issue will force lots of businesses to revamp their accounting and financial systems to adjust to the new rules.

With the presidential candidates focusing on foreign policy and the economy, I doubt we'll hear much debate on these technology issues. But I'd like the Bush administration and the Democratic candidates to articulate their visions for dealing with the political issues raised by technology. This would be good for the country—and for the tech industry.

NEW YEAR'S RESOLUTIONS

HERE ARE SOME THINGS to keep in mind for the new year:

1. Back up your data.
2. Keep your operating system up to date with all the necessary security patches.
3. Keep your antivirus software up to date.
4. Know what applications are running on your computer so you can avoid spyware.
5. Run antispyware software.
6. Don't publish your main e-mail address in a public location. Use a disposable e-mail address or one you don't rely on.
7. Be careful when opening or responding to e-mails. No

legitimate company asks for credit card information via e-mail. Don't give your credit card information to a Web site you click to from an e-mail; instead go directly to the company's Web site.

8. Get to know the alternatives to Microsoft software. You may not want to move to a Mac or open-source, but you should know what is going on.

9. Be careful what information you give out in chat rooms and in social-networking sites such as Friendster and Match.com. Remember, this information can easily become public.

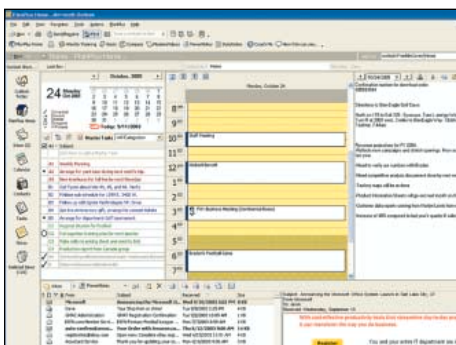
10. Back up your data.

Here's to safer, better computing in 2004.

GETTING ORGANIZED FOR THE NEW YEAR

THERE'S NO BETTER TIME to begin getting yourself organized than the start of the New Year. One of my favorite new programs is Franklin Covey's Plan Plus for Microsoft Outlook. As you might expect, this program follows the Franklin Covey process of listing your mission and values and scheduling and prioritizing goals and tasks. Your prioritized task list lets you easily set tasks for particular days or for broader goals. You can then mark the priority of each task and note when you've completed or delegated it. I really like the weekly planning process, which helps you organize goals, tasks, and appointments. And since it integrates with Outlook, the Home view lets you see goals and notes entered in Plan Plus alongside your e-mail messages and Outlook calendar.

Plan Plus also has a note-taking section called PowerNotes that lets you take notes and store them in tabbed



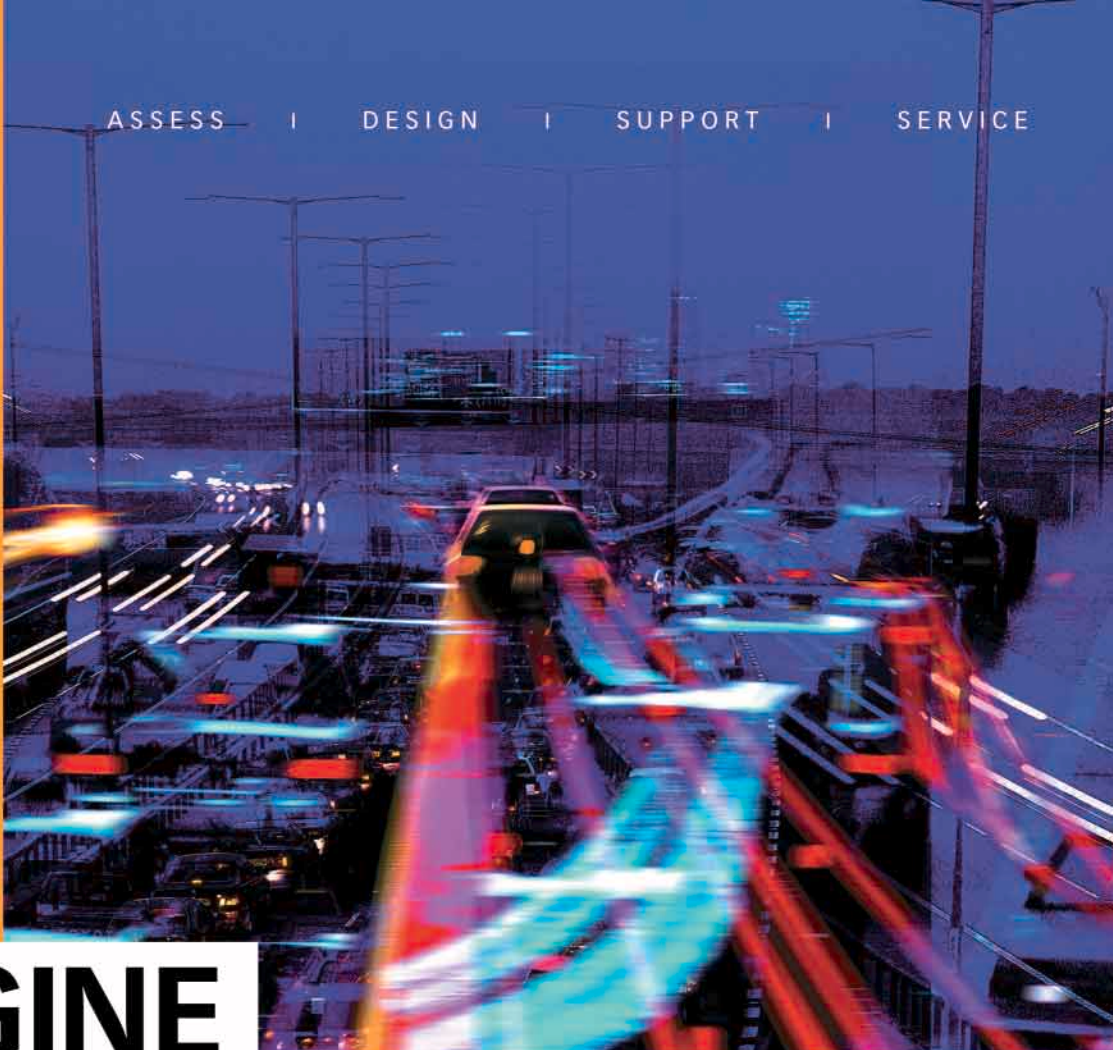
Franklin Covey's Plan Plus for Microsoft Outlook offers several tools for staying organized.

sections. This free-form note taker also supports handwriting on a tablet computer. (This is similar to the note-taking features in Franklin Covey's TabletPlanner, which doesn't require Outlook.) And it has tools to synchronize your notes with your PDA. It also prints in formats designed for popular planners.

Lots of other good organizational tools are available. For Palm-based PDAs, I've used the outliner ThoughtManager and the task manager ToDoPlus from Hands

High Software. And I know a number of people who swear by Micro Logic's personal information manager InfoSelect. Whatever software you choose, finally being organized is a great feeling.

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- Microsoft® Movie Maker 1.0
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PC Accessories

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not only invigorate your system but also make your coworkers envious—or at least intrigued.

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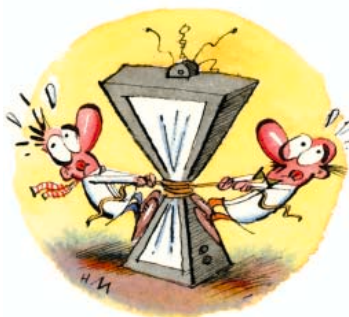
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PIPELINE

No Phishing Allowed

Striking back at e-mail scams.

Phishing, the e-mail and Web-based efforts by online scammers to hijack personal information, faces a new obstacle. A group of global banks and technology companies is aiming to fight the scams via a Web site called Anti-Phishing.org (www.antiphishing.org), where you can report e-mail scams.

Secure-messaging firm Tumbleweed Communications Corp. started Anti-Phishing.org with several banks, but the list of partners now includes many technology companies. "We're putting an infrastructure in place so there will be people who can respond to phishing reports in a timely fashion," says Dave Jevans, Tumbleweed's senior vice president of marketing. "That's critical, because the Web sites designed for collecting personal information in phishing attacks are often only in place for a day."

Jevans forwarded an example of an attack from early December to *PC Magazine*. The e-mail appeared to come from the U.K. bank NatWest and asked the recipient to enter personal account information

at a linked Web page. Anti-Phishing.org personnel tracked the IP address of the original e-mail to a home computer in San Francisco. Site personnel were convinced the message originated in Europe. Clearly it was *spoofed*—relayed from a hijacked computer, making the origin hard to trace. "The owner of the computer probably had no idea he'd been hijacked," says Jevans.

The Anti-Phishing.org team is currently working on about 20 phishing reports. "It's very hard to put real numbers on the damages," says Jevans. "The major banks don't want to divulge the amount of losses they're seeing. But just to give one rough example, a major Australian bank has put several million dollars in reserve since August to cover phishing damages."

To avoid being a victim of phishing, never respond to e-mail requests for personal information, no matter how official the message looks. "The people behind these attacks are getting smarter," says Jevans, "because they realize there's something to this now. There's money."—*Sebastian Ruple*

Ghostly Keys

CONSIDER THE KEYBOARD THAT isn't there. Slated to be one of many gadgets showcased at January's Consumer Electronics Show in Las Vegas is a projectable keyboard for use with PDAs and notebooks developed by iBiz Technology Corp.

A bit like Canesta's projectable keyboards, the iBiz Virtual Keyboard (\$99.99), available starting in January, projects a full-size keyboard onto a flat surface. A 2-ounce infrared- and laser-driven device uses a serial-cable to communicate with a PDA or notebook.

"As you type on the projection, the device realizes what you're



typing by the coordinates of that location," says Ken Schilling, CEO of iBiz Technology. The laser and infrared technology is housed in a sensor that determines the coordinates of each key and observes the typing.—*SR*

Don't Take My PC

According to a recent survey, 74 percent of the young tech elite (with an average age of 22) say it would be very hard to give up their computers. Only 12 percent of them say the same about giving up newspapers—as opposed to baby boomers (with an average age of 52), at 21 percent.

What users would find "very hard to give up"

	Young tech elite	Baby boomers
Computer	74%	64%
Internet	68%	55%
Cell phone	58%	50%
Telephone	56%	57%
Television	48%	50%
Newspaper	12%	21%

Based on a survey of 1,677 U.S. Internet users. Source: Pew Internet & American Life Project, November 2003.

MY BODY, MY CHIP

Applied Digital Solutions has announced VeriPay, a payment system that lets consumers pay for transactions via microchips (called Verichips) that are implanted beneath their skin. The Verichip is a tiny radio frequency identification (RFID) chip, and the technology has already been implanted in many people. VeriPay scanning would eliminate the possibility of lost or stolen RFID payment devices. Christian groups have blasted the company, calling the implants "the mark of the beast" (referring to Revelation 13:11–18).

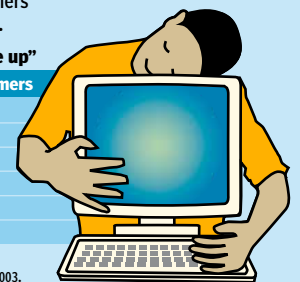
TARGETING SPAM

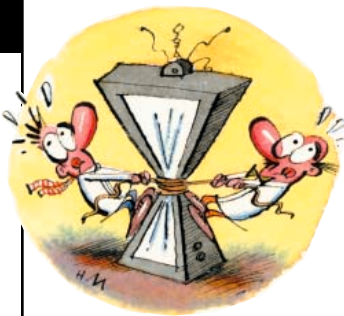
President Bush's approval of the national CAN-SPAM Act of 2003 in December could take a bite out of unsolicited e-mail. Among other rules, the legislation requires senders of unsolicited e-mails to include reply features so that recipients can specify that they do not want mass mailings. Critics of the bill argue that most spam is relayed from open proxies and from outside the U.S.

QUIT HASSLING ME

Symantec has acknowledged a problem with the activation process in several of its software products, including Norton AntiVirus 2004. The bug forces users to enter and reenter activation codes each time they restart their PCs.

To get a patch, search for "SymKBfix.exe" at www.symantec.com.





Carbon Nano TVs

Could your television become as thin as a picture hanging on a wall? Researchers at DuPont and Motorola are on the case. Carbon nanotubes (CNTs)—microscopic cylinders made up of a mesh of individual carbon atoms—may be the key. Their unique properties have caught the imagination of scientists for everything from superconductors to tools for making nanotechnology components. One of the most promising applications is a thin panel called a *field emitter display* (FED).

A CRT display has three electron guns that spray beams of electrons across the face of the screen, causing tiny phosphor dots to glow. FEDs eliminate the guns by placing hundreds or even thousands of tiny emitters behind the phosphors.

The discovery of CNTs has revived previously dormant interest in FEDs. CNTs make excellent emitters as long as they are not exposed to oxygen, which causes them to combust. The problem is getting them oriented correctly.

Motorola has announced a technique that “grows” CNTs in the correct position directly on glass substrates. And DuPont has developed a process that uses DNA strands to untangle jumbled CNTs that are produced by traditional methods. If either approach yields affordable production of CNT emitters for FEDs, television and many other kinds of displays may become thinner than ever.—*Alfred Poor*

Out-Googling Google

Picture new ways to search the Web.

AS CARL SAGAN MIGHT HAVE put it, there are billions and billions of Web pages out there. So it comes as no surprise that the results lists from search sites are getting longer. That’s given rise to a new breed of solutions to help manage the information overload. One of the most ambitious recent entries is a major update of Groxis’ Grokker, a program that is now a useful adjunct to any major search engine.

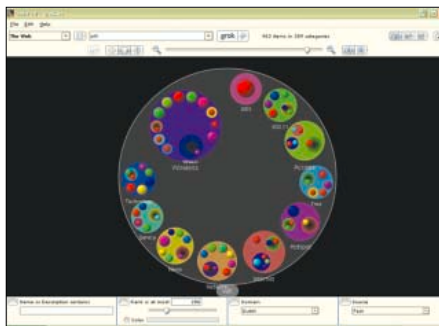
Grokker 2.0 converts text lists of search results into a map of floating spheres and other graphical representations (see the photo, which shows a Grokker window after searching for “Wi-Fi”). You can drill down on each object individually, and each is labeled according to organizing principles, including date and context, so you get what amounts to a visual relational database that includes Web pages, documents, and pictures.

“We do it not just by putting the results in files and folders,” says R.J. Pittman, CEO of Groxis, “but by using color, shape, size, position, and order.” John Seely

Brown, of Xerox’s Palo Alto Research Center fame, helped develop Grokker 2.0.

The graphical approach lets you locate related information at a glance. Grokker now supports all the major search engines and can do custom, simultaneous searches as well as views of unstructured enterprise data. It also lets you rearrange results. Because it’s a Java program, Grokker works on Windows and Apple systems.

Meanwhile, Chicago-based



Dipsie is working on what it claims will be a more complete index of the Web than Google has. Dipsie promises to deliver more relevant results when it debuts later this year. No one is revealing exactly how it will work, but the Dipsie bot is already crawling the Web.—*John R. Quain*



What’s Geocaching?

What happens when techies gain access to a multibillion-dollar defense satellite system? They play.

Days after the May 2000 order making precision GPS data available to civilians, GPS enthusiast Dave Ulmer hid some goodies in the hills of Oregon and posted the GPS coordinates online. Mike Teague found the booty, logged the event—which he called the GPS Stash Hunt—and a sport was born.

Jeremy Irish and two friends from a failing dot-com started an official site to promote what is now commonly called *geocaching* (www.geocaching.com). The items stashed are often whimsical: Irish’s first find was a bottle of Sunny Delight and a log book.

The thrill of the chase is the real motivation, however. “It’s a directed adventure,” says Irish. “You explore places you would have never gone to before.” —*Gary Berline*

The Ultimate Remote

BE CAREFUL WHAT YOU WISH FOR: MEDIA RECEIVERS providing more places to play streaming digital music in your home could mean more remote controls cluttering your coffee table. On the other hand, the number of remotes needed could actually drop with the arrival in early 2004 of BravoBrava!’s AllMiMedia, the universal, programmable remote-control software that turns PDAs and other wireless devices into all-knowing remote controls that function anywhere in the house.

To work AllMiMedia, “all you have to do is choose your content and choose your player,” says Jim Behrens, CEO of BravoBrava!, which previewed the software at the Phoenix Strategy 2004 conference in Monterey, California, in late November. Behrens demonstrated AllMi-

Media running on both a Pocket PC device with Wi-Fi and a GSM cell phone with a data link. It can also work with Tablet PC devices (see the photo), smart displays, and notebooks.

According to Behrens, infrared remotes, with their line-of-sight range, won’t cut it in the future, when your music source is on your home office PC, the output device is in your family room, and you’re in the kitchen. Not only can AllMiMedia control digital home devices, it can pull TV listings from your satellite or local cable provider. And the software doesn’t just show remote functions or a program guide; it’s also able to display images, such as photos stored on your PC.

BravoBrava! plans to debut AllMiMedia at the CES show in January and will ship in the first quarter of 2004. The software will cost \$12 a year.—*Bill Howard*





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COMING ATTRACTIONS

A True Living-Room PC

Computers based on Microsoft Windows XP Media Center Edition are naturals for your family room or den, because of their TV tuners, PVR capabilities, and prowess at handling photos, music, and video. The problem is that most look like desktop PCs, not AV equipment. But the **Gateway FMC-901 Family Room Media Center** changes that. The champagne metallic case looks like a stereo component, and the system can replace your TiVo, your CD player/recorder, your DVD player (and recorder, with the high-end model, the **FMC-901 X**), and even your gaming console. And of course, with its wireless remote and mouse, it's a fully functional PC.—*Jamie M. Bsales*

Gateway FMC-901, \$999.99 direct; FMC-901 X, \$1,799.99. Gateway Inc., www.gateway.com.



The End of The VCR Is Nigh

One look at the brand name on this set-top DVD recorder and you'll believe that Gateway is serious about becoming a consumer electronics company—and not just a PC company. The **Gateway AR-230 DVD Recorder** is a progressive-scan DVD player that also lets you record television shows, analog camcorder footage, and videos on VHS directly to DVD+R or +RW media. Even better, it's just about the least expensive DVD recorder on the market.—*JMB*

\$299 direct (after \$50 mail-in rebate). Gateway Inc., www.gateway.com.



Easier Video Editing

Pinnacle Systems is putting the finishing touches on its **Pinnacle Studio 9** video-editing suite. In addition to new automated editing capabilities,

the package will let users improve old or damaged video footage with just one mouse click. For example, you'll be able to brighten poorly lit or faded footage, steady shaky footage, and remove snow and noise inherent in older analog tapes.—*JMB*

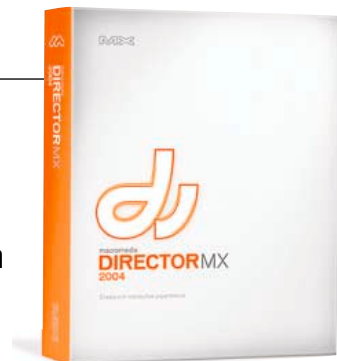


\$99 list. Pinnacle Systems Inc., www.pinnaclesys.com.

Better Multimedia Authoring

Developers who need to deploy interactive multimedia content to CD, DVD, kiosks, or the Web will welcome **Macromedia Director MX 2004**. This latest build of the authoring heavyweight will let coders import Macromedia Flash MX 2004 content more efficiently, use Flash MX components in Director applications, add DVD video to projects easily, and more.—*JMB*

\$1,199 direct. Macromedia Inc., www.macromedia.com.



Low-Cost Color Laser

Brother is getting into the sub-\$1,000 color laser printer market with the **Brother HL-2700CN**. The printer's engine delivers up to 31 ppm in black and white or 8 ppm in color. A one-year on-site warranty and built-in Ethernet networking are included.—*JMB*



\$1,000 street. Brother Industries Ltd., www.brother.com.

Home Video Network

ATI's new **EazyShare** software turns All-in-Wonder-equipped PCs into video servers that can deliver TV content to any networked PC equipped with an ATI Radeon graphics card. The 2-Mbps stream even works over wireless networks.—*JMB*



Free download. ATI Technologies Inc., www.ati.com.

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Tablets Take a Step Forward—and Back

BY KONSTANTINOS KARAGIANNIS

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More makers and more models are adding up to a range of choices for buyers thinking of a Tablet PC—from the latest \$2,000 convertible to a tiny \$800 slate. But we found that execution still varies widely. • In our recent look at convertible Tablet PCs (December 9, page 43), HP impressed us with the HP Compaq TC1100 by resolving some of the problems we found with

first-generation models. The five in the latest batch we tested—convertible models from Acer, Toshiba, and ViewSonic, plus affordable slates from Electrovaya and TDV—also contain some interesting innovations.

The most notable new feature here is found in Toshiba's use of a higher-than-XGA resolution screen.

Until now, the resolving ability of the digitizer has somewhat limited the choice of screen resolution. Sadly, the most notable flaw in all the machines here still remains screen viewing angle and quality. Unlike the HP model we

reviewed last time around, the screens on all the units here exhibit washed-out colors and photonegative effects when viewed even slightly off-axis from one of the four possible viewing perspectives.

But there is good news. For example, the Acer and Toshiba models show that Tablet PCs are indeed becoming more like nontablet portables in terms of performance and battery life. Among the batch reviewed here, the Toshiba Portégé M205-S809 is clearly the best. And it's currently our favorite model for users who primarily want a notebook with Tablet PC abilities. If you primarily want a slate device, with the ability to switch it to a notebook, then the HP Compaq TC1100 is top dog.

Acer TravelMate C300

In our previous roundup, Gateway introduced us to the first Tablet PC with a 14.1-inch screen. We found that 5.7-pound design to be arm-challenging when used as a tablet, but its price was decent, and it did have some useful components. Now we're faced with the Acer TravelMate C300, which is half a pound heavier, has a smaller hard drive and a slower processor, and costs \$200 more. It's difficult to be uncritical from the get-go.

As with the Gateway unit, this tablet is not meant to be used by hallway warriors. Unless you were recently elected governor of California, you'll be using the 6.2-pound C300 mostly while seated. The seemingly large amount of screen real estate is exciting at first, but it's misleading, because the resolution is only XGA. Toshiba's improvement to SXGA+ resolution would be even more welcome here.

In addition to the viewing-angle problem inherent on all the units here, the screen exhibits the extra glare we find in some tablets due to their thick surface reinforcement. One handy feature: The screen has a sensor that can adjust brightness based on room lighting conditions.

If you can live with the low resolution, the Acer TravelMate C300 does make an okay notebook. It has a 1.5-GHz Pentium M processor and 512MB of DDR SDRAM. The 40GB hard drive is average. The built-in DVD/CD-RW drive is accompanied by



The Acer TravelMate C300 has a 14.1-inch screen, but weighs in at an arm-challenging 5.7 pounds.

LOOKS

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WHAT THE RATINGS MEAN

- EXCELLENT
- VERY GOOD
- GOOD
- FAIR
- POOR

CyberLink's PowerDVD and the modest NTI CD Maker—the only full apps installed in addition to the OS. Other I/O support includes a 4-in-1 card reader, FireWire and USB 2.0 ports, and a PC Card slot.

The C300's keyboard has an ergonomic, 5-degree curved design. The stylus, which can be stored in the screen bezel, is comfortable to use, and the touch pad is quite nice, complete with a scroll button. Best of all from a design standpoint, the C300 does away with the kludgy side fasteners on the swiveling screen that Acer has used on its other convertibles. Instead, there's a single solid swivel joint.

The C300 matched the Toshiba model's performance on Business Winstone and Multimedia Content Creation Winstone. But in 802.11b wireless testing, the C300 performed below average on our obstacle course.

All told, the C300 is an average two-spindle notebook. As a Tablet PC, though, this bulky model seems more like a machine looking for an audience than one that an audience will go out of its way to find.

Acer TravelMate C300

With 1.5-GHz Pentium M, 512MB DDR SDRAM, 40GB hard drive, DVD/CD-RW combo drive, 14.1-inch XGA screen, wired and wireless Ethernet, \$2,299 direct. Acer America Corp., www.acer.com/aac. ●●●●

Toshiba Portégé M205-S809



The Toshiba Portégé M205-S809 is a solid choice for those who know they need an ultraportable notebook but aren't sure how many tablet functions they require. The \$2,399 list price might seem high, but it's actually a good value considering the internal components, the included external DVD/CD-RW combo drive, and the reasonably small chassis.

Given that slates we've seen weigh around 2 pounds, the 4.6-pound Portégé is definitely a notebook first and a tablet second. The real news is the SXGA+ screen. Having 1,400-by-1,050 resolution in a 12.1-inch screen makes for some tiny icons and fonts, but it does at least allow for more virtual screen real estate; for instance, marking up larger images is easier.

We also like how much sharper the screen makes diagonal lines of digital ink. In testing, however, the extra resolution didn't seem to help handwriting recognition in any conclusive way. All tablets performed similarly.

With a shallow plunge depth, the keyboard doesn't provide the greatest typing experience, but at least it has full-size keys. The stylus is comfortable to hold and

slips into a neat spring-action slot in the base. Far less likable is the touch pad, which has poor sensitivity and a minuscule tracking area. In addition to the OS, the Portégé comes preloaded with Microsoft Works 7.0 (that's the version without Word) and Microsoft Office OneNote 2003.

With a 1.5-GHz Pentium M and 512MB of DDR SDRAM, the Portégé was a good performer on our tests. And on our wireless obstacle course, the unit easily surpassed the other models here in terms of range and throughput. The

The Portégé is best for those who want a notebook primarily and a tablet some of the time.

Portégé makes the most of its Centrino (802.11b) architecture.

The Toshiba Portégé M205-S809 is a solid package that straddles the line between ultraportable and tablet adeptly.

Toshiba Portégé M205-S809

With 1.5-GHz Pentium M, 512MB DDR SDRAM, 40GB hard drive, USB DVD/CD-RW combo drive, 12.1-inch SXGA+ screen, wired and wireless Ethernet, \$2,400 street. Toshiba America Information Systems Inc., www.csd.toshiba.com. ●●●●



ViewSonic Tablet PC V1250

At first glance, the ViewSonic Tablet PC V1250 has a cool-looking new design—one you couldn't easily pass by in a store.

What we didn't expect from this monitor vendor, however, was a screen that adds an entirely new problem to the tablet world. Ever press your finger against a normal LCD and see that LCD squish effect as the picture warps under your touch? This is the first tablet we've seen that does

TABLET PCs

High scores are best. Bold type denotes first place.

	Processor	RAM	Business Winstone 2004	Multimedia Content Creation Winstone 2004	Business Winstone BatteryMark 2004 (min:sec)	Average Wireless Throughput (Mbps)			
						1 foot	60 feet	120 feet	160 feet
Acer TravelMate C300	Pentium M (1.5 GHz)	512MB	13.7	16.9	3:03	3.3	2.8	1.1	0.6
Electrovaya Scribbler SC-2000	Pentium M (1.2 GHz)	256MB	10.1	11.8	5:28	4.8	4.3	0.4	0
TDV Visionary V800XPT	Transmeta TM5800 (800 MHz)	256MB	4.0	4.6	2:24	N/A	N/A	N/A	N/A
Toshiba Portégé M205-S809	Pentium M (1.5 GHz)	512MB	13.7	17.0	4:03	3.9	3.6	2.3	1.9
ViewSonic Tablet PC V1250	Pentium M (1 GHz)	256MB	10.7	12.1	2:30	3.8	3.2	1.3	0.5
HP Compaq TC1100*	Pentium M (1 GHz)	512MB	12.7	13.6	3:10	3.5	3.0	1.0	0.8

RED denotes Editors' Choice. * Reported for comparison. N/A—Not applicable: This model could not complete our wireless testing.



A Slate for Every Budget

Electrovaya Corp.'s claim to Tablet PC fame has always been long battery life. The newest model, the Electrovaya Scribbler SC-2000, continues the emphasis on battery life and adds cool features and an improved chassis with rounded edges.

The SC-2000 comes standard with a convenient USB keyboard/stand/cover combination.

This combination (above) does duty as a protective cover for the 12.1-inch display but can also hold the SC-2000 upright to allow use of the keyboard in an almost-notebook configuration. (A wire stand is also included, but we found it took some firm adjustments to hold the Tablet PC securely.) Without the 1-pound keyboard, the unit weighs a manageable 3.1 pounds.

The SC-2000's pen has a bit of drag when writing on the display—a realistic pen-on-paper feel we prefer to the more slippery feel of other stylus/screen combos. The size of the display means that, in portrait mode, it seems like you're writing on a conventional 8.5- by 11-inch pad of paper.

As in most other Tablet PCs, the side-to-side angle of visibility when holding the SC-2000 in portrait mode can decrease significantly when the viewing angle changes. This isn't much of a problem when taking notes with the Microsoft Journal application, but it could be a problem if you were watching a video in portrait mode. In the SC-2000's favor, a convenient navigation ball on the right front bezel is great for scrolling documents.

With its 1.2-GHz processor but just 256MB of RAM, the SC-2000 was not a speed leader in this roundup, though performance was fine for typical business apps. Where the unit shines is battery life: It lasted 5 hours 28 minutes on our tests—1 hour 25 minutes longer than the second-place Toshiba convertible entry. Wireless throughput was also strong at distances up to 60

feet (before we rounded the corner on our obstacle course).

The SC-2000's chassis, stylus drag, and excellent battery life make it a strong choice among slates.

Electrovaya Scribbler SC-2000

With 1.2-GHz Pentium M, 256MB RAM, 30GB hard drive, \$2,299 list. Electrovaya Corp., www.electrovaya.com. ●●●●

If price has been a barrier in buying a Tablet PC, the TDV Visionary V800XPT—at just \$999 list—may ease your decision path. With its smallish 8.4-inch screen, the V800XPT doesn't make a great primary PC. But with its standard carrying case (which also works as a stand and has an integrated keyboard) it's a convenient package for taking notes while traveling or in the field.

The diminutive slate weighs 2.5 pounds and measures 7.2 by 9.5 by 1 inches (HWD). The case and keyboard combination increases the total weight to 4.3 pounds. If you'll be using it in your arm for long, you'll want to keep it in the case: We found the bottom of the chassis became uncomfortably hot.

The V800XPT has an integrated digital camera that can take 640-by-480 still shots or video. There is no flash, but you can adjust the lighting settings via software. In our testing, still image clarity was on a par with that of most VGA cameras, but the color was somewhat washed out.

Also, switching between landscape and portrait modes is a weakness. Unlike most Tablet PCs, which have a button for changing screen orientation, the V800XPT requires you to go into the Advanced section of the Display Properties screen.

Powered by an 800-MHz Transmeta Crusoe CPU, the V800XPT is a poor performer when compared with a typical portable PC these days. It ran for 2:24 on our battery test yet could not complete our wireless tests. But if you need an inexpensive tablet for field use, the affordable V800XPT might suffice, especially considering the price.—*Bruce Brown*

TDV Visionary V800XPT

With Transmeta TM5800, 256MB RAM, 20GB hard drive, wired and wireless Ethernet, \$999 list. TDV Vision Inc., www.tdvvision.com. ●●●●

nothing to prevent that. While the warping isn't extreme enough to introduce rainbow patterns, it's irksome when you're trying either to draw or mark something up with precision.

The reasonably priced unit does have some strengths. At 3.9 pounds, the V1250 is fairly light and compact. In tablet mode, it feels comfortable in your arm. The keyboard and touch pad are above average. You'll notice that the body has an extended section that juts out away from the touch pad when it's in laptop mode. In tablet mode, this section houses a delightful scroll wheel as well as programmable launch keys. Switching between modes is a lit-

tle clumsy due to a tricky latch.

To meet its size and weight goals, ViewSonic chose to go with a small battery and the 1.0-GHz ultra-low-voltage version of the Pentium M. The similarly configured HP Compaq TC1100 did about 20 percent better on performance tests and had an extra 40 minutes of battery life. The V1250 at least did well on our wireless tests.

There's no major software installed. Wired Ethernet, FireWire, and two USB 2.0 ports offer some expandability,



The V1250 looks attractive—until you touch or tap on the screen.

and for an extra \$400 you can get a docking station along with an extra battery and stylus. Considering its performance, however, the ViewSonic Tablet PC V1250 might be best if used as an extra machine rather than your only one.

ViewSonic Tablet PC V1250

With 1.0-GHz Pentium M, 256MB DDR SDRAM, 30GB hard drive, 12.1-inch XGA screen, wired and wireless Ethernet, \$1,895 direct. ViewSonic Corp., www.viewsonic.com. ●●●●

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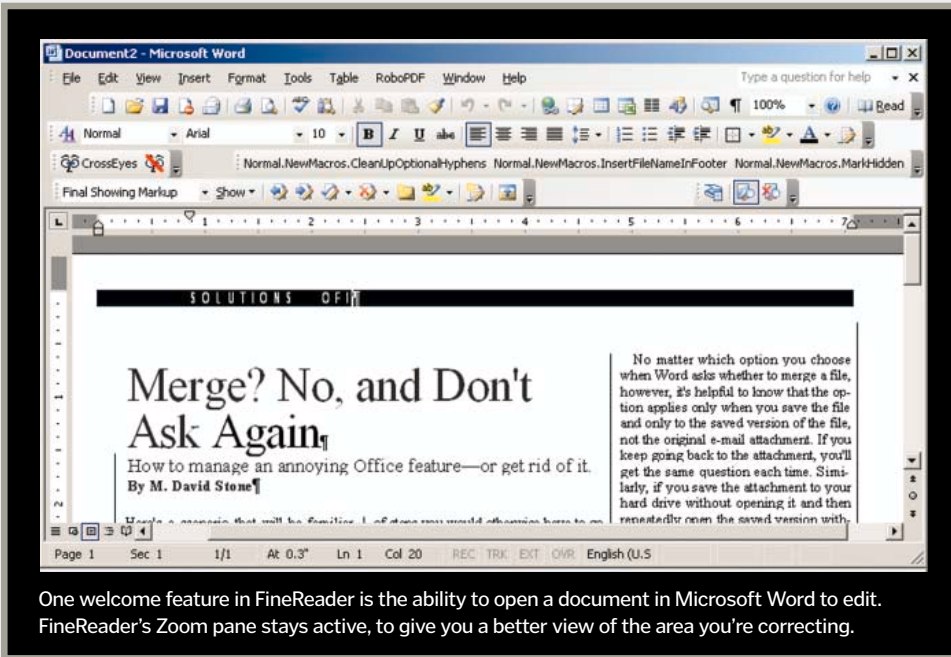
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OCR Packages Get Serious



One welcome feature in FineReader is the ability to open a document in Microsoft Word to edit. FineReader's Zoom pane stays active, to give you a better view of the area you're correcting.

BY M. DAVID STONE

Ity the poor OCR (optical character recognition) program designer. As OCR programs have grown more capable, we've learned to expect more from them: not just accurate reading of printed text but tasks like parsing complex formats and the ability to read and write PDF files. We tested new versions of three leading packages—Abbyy FineReader 7.0 Corporate Edition, ScanSoft's OmniPage Pro 14 Office, and Readiris Pro 9 from I.R.I.S.—to see how well they meet our growing expectations. Note that we tested the high-end versions from Abbyy and ScanSoft; lower-priced editions are available that offer the same OCR engines but fewer features.

To test the products, we scanned four sample documents in each package's automatic mode and manually counted the errors we found. Keep in mind that although counting errors is an objective task, deciding what counts as an error is not. For example, if a program reads a W as VV, you can choose to count it as one

error (for the misread character), two errors (for the two wrong characters), or three (for the misread character and two incorrect characters). In this example, we counted it as one error. Also note that each program can flag characters it isn't sure about for an operator to check, which improves the accuracy of the final document.

Finally, a difference of a few errors from one program to the next does not make one superior to the other; scanning different documents could easily swap which product "wins." So while accuracy results can tell you whether one program is far more capable than another, a difference of 20 or 30 errors in reading several thousand characters is best understood as a tie.

ABBYY FINEREADER 7.0 CORPORATE EDITION

Abbyy FineReader 7.0 Corporate Edition remains a top OCR contender. Version 6.0 already offered such features as support for 177 languages and a large number of output formats. Version 7.0 adds a generous helping of new features.

The interface is largely unchanged: A narrow pane on the left shows thumbnails of all the pages in the current batch; a pane in the middle shows the page you're working on (with blocks marked to indicate text to recognize); you edit and correct the recognized text in a pane on the right. A Zoom pane across the bottom shows a magnified image of the area where you're working in the Edit pane.

One welcome addition is a keyboard command to cycle through the panes, so you don't have to reach for the mouse. Another is a formatting toolbar at the top of the Edit pane. Even better is Word 2003 integration: Export a file to XML format and you can open the document in Word to edit and correct it, complete with the FineReader Zoom pane working in tandem with Word, just as it works within FineReader.

Note, too, that FineReader saves PDF files in a format that's optimized for the Web. Users see the first page in their browser while the rest of the file is downloaded in the background.

FineReader's accuracy is still among the best. It scored 99.7 percent or better on three of our four test documents. But the program did fail one of our magazine-page tests because it did not parse the format properly (it put part of one column in the middle of another). FineReader does let you manually redefine the order in which elements on a page should be read, though part of what we were testing was precisely how well the fully automatic mode parsed a page.

FineReader remains one of the best OCR choices despite this question. Whether you consider it your best choice may depend on the presence or absence of a particular feature that you happen to need.

Abbyy FineReader 7.0 Corporate Edition

Street price: \$500; upgrade from any brand of OCR, \$399. Requires: 64MB RAM, 220MB hard drive space, Microsoft Windows 98 or later. Abbyy USA Software House Inc., www.abbyyusa.com. ●●●●●

	OCR ACCURACY							
	Single-Column Typed Text (1,622 characters)		3-Column Magazine Page				Trifold Brochure (3,757 characters)	
	Accuracy ▲	Errors ▼	No background (4,757 characters)	Color background (2,726 characters)	Accuracy ▲	Errors ▼	Accuracy ▲	Errors ▼
Abbyy FineReader 7.0 Corporate Edition	99.9%	2	Failed	99.7%	8	99.9%	2	
OmniPage Pro 14 Office	99.9%	2	99.3%	35	98.9%	30	99.9%	5
Readiris Pro 9	98.0%	32	Failed	—	98.8%	32	Failed	—
Abbyy FineReader 6.0 Professional*	99.9%	2	Failed	—	99.8%	6	99.8%	6
OmniPage Pro 12 Office*	99.8%	3	99.4%	29	99.0%	28	99.8%	6

RED denotes Editors' Choice. * Reported for comparison.

We've got compatibility issues.
Her CD player doesn't support
my custom music mix. And his
DVD player won't access my
digital photos on CD-R.

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OMNIPAGE PRO 14 OFFICE



Like builders who skip over 13 when they number floors, ScanSoft has taken OmniPage Pro 14 Office directly from version 12 to 14. They've also added enough new features to justify the jump in version numbers.

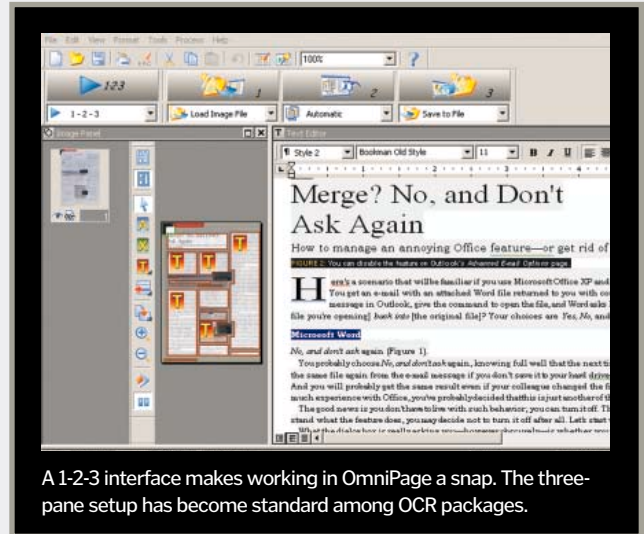
Version 14 offers so many new features that we don't have room to list them all, let alone delve into each. Many go well beyond what you might expect from an OCR program. For example, OmniPage lets you define workflows for automatic document processing. You can now specify which workflow scheme to use by printing a bar code cover page from OmniPage and adding the cover page to the document as the first page to be scanned. Other new features include the ability to get files from or save them to an FTP site or Microsoft SharePoint server.

If you have Microsoft Word

97 or later, you'll find that after installing OmniPage you can use Word's File | Open command to open PDF documents to edit in Word. If OmniPage's PDF converter finds a text layer, it will open the file directly in Word. Otherwise, the utility will give you the option to open the document in OmniPage. (Note that the converter can't find the text layer if there is an image layer also.)

You'll also find a PDF printer driver that lets you create PDF files by printing to the driver from nearly any application. And when creating a PDF file with any OmniPage PDF creation option, you can now add a digital signature and file encryption.

OmniPage can recognize 114 languages. It can save files in a wide variety of formats, including XML. The main screen is essentially the same as in Version 12, with a column of thumbnails on the left. The currently selected page is in the middle, divided into blocks for



A 1-2-3 interface makes working in OmniPage a snap. The three-pane setup has become standard among OCR packages.

recognition, and an editing pane with recognized text is on the right. Alas, the proofreading tool still lacks an Undo button.

On our tests, OmniPage not only demonstrated 98.9 percent accuracy or better in every case, but it was the only program that correctly parsed all four of our test documents. The combina-

tion of accuracy and features makes it the OCR program we'd most like to have on our system.

OmniPage Pro 14 Office
 Street price: \$520 (upgrade from any brand of OCR, \$200). Requires: 128MB RAM, 135MB hard drive space, Microsoft Windows 98 SE or later. ScanSoft Inc., www.scansoft.com. ●●●●●

Low-Cost OCR

Readiris's claim to fame is that a version of the program is bundled with Hewlett-Packard scanners, which tells you that the program is up to HP's standards, at least. Readiris Pro 9 offers support for roughly 110 languages, has a reasonably large number of output formats to choose from, and includes key features like the ability to recognize and create PDF files.

Unfortunately, compared with FineReader and OmniPage, it's also limited in some ways. It exports to RTF files rather than Word's native DOC format, for example. And its automatic parsing feature fared poorly on our tests.

Unless you're a fan of activation routines, you'll want to buy the boxed version. If you download and install the program, you have 30 days to register it and get the key that lets you keep using it. According to I.R.I.S., the boxed version does

not make you go through this step.

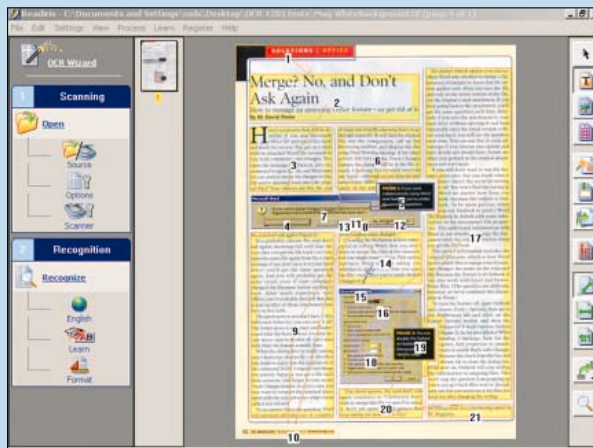
The interface is broadly similar to the FineReader and OmniPage interfaces. But instead of offering buttons across the top to step you through the OCR process, the choices are along the left side of the window. Next to that is a narrow pane showing thumbnails of the pages. To the right of that is a pane showing the current page, with areas

marked off to indicate blocks of text to recognize. Missing from the screen, however, is an editing window. After the program recognizes the text, you have to save the result to open and correct it in another program.

Readiris failed on two of our four test documents, incorrectly parsing the magazine pages and intermixing text from two columns. It also interpreted nearly every line in our single-column, double-spaced text page sample as a separate paragraph, which is the source of most of the errors on that page.

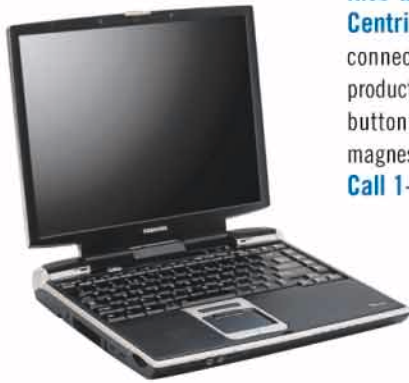
The one thing Readiris Pro 9 has strongly in its favor is its low price. If you use OCR software rarely enough that you can't justify paying more, you may want to consider it. But even for medium-duty OCR needs, this program is simply too much of a lightweight.

Readiris Pro 9
 Street price: \$130. Requires: 110MB hard drive space, Microsoft Windows 98 or later. I.R.I.S., www.irisusa.com. ●●●●●



Readiris Pro 9 may be affordable, but it's suitable only for light scanning jobs.

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1. Wireless connectivity and some features may require you to purchase additional software, services or external hardware. Availability of public wireless LAN access points limited. 2. Battery life may vary depending on product model, configuration, applications, power management settings and features utilized. Recharge time varies depending on usage. Battery may not charge while computer is consuming full power. After a period of time, the battery will lose its ability to perform at maximum capacity and will need to be replaced. This is normal for all batteries. To purchase a new battery pack, see the accessories information that shipped with your computer or visit the Toshiba web site at www.accessories.toshiba.com. The 10.8 hours were achieved via additional SelectBay™ battery. Tecra and SelectBay are registered trademarks, and ConfigFree is a trademark of Toshiba America Information Systems, Inc. and/or Toshiba Corporation. Intel, Centrino, Intel Inside, the Intel Centrino logo, and the Intel Inside logo are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries. Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries. Product specifications, configurations, prices, system/component/options availability are all subject to change without notice. Reseller pricing may vary. © 2003 Toshiba America Information Systems, Inc. All rights reserved.

Faster Than a Color Laser

BY M. DAVID STONE

What's faster than most laser printers, prints much like an offset printing press, and costs \$1,000? It's the **Xerox Phaser 8400 Series Color Printer**. This solid-ink printer melts its resin-based ink, sprays it on a drum, then rolls the drum against the paper to transfer the image—all at an engine speed of 24 pages per minute (ppm) for color or monochrome output.

Setting up the 8400DP takes far less work than a color laser. The unit ships with ink already loaded, so all you have to do is find a place for the printer, plug

it in, and give the ink about 12 minutes to melt (subsequent warm-ups take less than 4 minutes). While you're waiting, you can install the driver using the automated installation routine. Run the setup routine from the CD, acknowledge that setup found the right printer, and then wait for the installation to finish.

To say that the 8400DP is an impressive performer is an understatement. Compared with the low-cost laser and LED printers we look at in this issue's story ("Small Office, Shoestring Budget"), the 8400DP has hardly any competition. It leaves the four-pass lasers in the dust and beats the single-pass Oki C5100n LED printer on well over half of our individual tests. Its total time on our performance suite was 6 minutes even, compared with 7:55 for the C5100n. On our quality suite, it was a bit slower

than the C5100n (2:03 versus 1:37).

The output is worth the negligible wait. Using high-quality settings, output on Ilford's Smooth Multi-Use paper is good to excellent for text and graphics and fair to



The solid-ink Phaser 8400 is faster than most color laser printers in its price class.

for outstanding text and brilliant color graphics, the Phaser 8400 will give you beautiful output at faster speeds than any other \$1,000 color printer.

Xerox Phaser 8400 Series Color Printer

Street price: 8400B: \$1,000, 8400DP (with duplexer, network card, and additional memory), \$1,800. Xerox Office Group, 877-362-6567, www.xerox.com/office. ●●●●●

Athlon 64 Adds Some Velocity

BY KONSTANTINOS KARAGIANNIS

We may not have wide OS and driver support for 64-bit computing yet, but AMD's Athlon 64 processors prove that having the headroom can be quite welcome, even in the 32-bit space. The lat-



The Velocity Micro Vision 64 delivers a lot of bang for the buck.

est speed bump to the standard (not FX) version of AMD's 64-bit processor—the Athlon 64 3400+—brings a performance chip that competes quite nicely with Intel's HyperThreading P4.

Like the FX version, the Athlon 64 3400+ has 128K L1 and 1,024K L2 cache, 3DNow! Professional, and support for SSE2. But whereas the pricier Athlon

64 FX has a 128-bit memory interface and requires registered DDR memory, the less expensive Athlon 64 CPUs have a 64-bit interface and a single-channel, on-chip memory controller that supports 200- to 400-MHz standard DDR SDRAM.

To determine how much you get for your money, we procured

a well-equipped Athlon 64 3400+ system—the **Velocity Micro Vision 64** (\$2,988 direct)—and stacked it up against a similarly equipped 3.2-GHz Pentium 4 HT box, the Compaq X09. Note that both have 1GB of 400-MHz DDR SDRAM, the 256MB nVidia GeForce FX 5950 Ultra graphics card, and two 7,200-rpm SATA hard drives in a RAID 0 configuration. In the tests we ran, the AMD chip outperformed the P4 across the board. Of course, each company's highest-end chips (the Athlon 64 FX and the P4 Extreme Edition) are fairly evenly matched.

Besides performing well, the system is an overall delight. The ViewSonic 19-inch flat CRT looks wonderful and pulls you into movies or games. The Creative MegaWorks 650 6.1 THX speakers take full advan-

tage of the Audigy 2 ZS card and provide immersive audio.

You can get started on media projects right away, thanks to the excellent Ulead Digital Media Center bundle, which includes PhotoImpact 8, MovieFactory 2 SE, and VideoStudio 7. Burning options abound for your final products or for copying, thanks to both a 4X DVD multifunction writer and a DVD/CD-RW combo with 52X CD burning. So considering the price and performance of the Velocity Micro Vision 64, we couldn't imagine changing a thing.

Velocity Micro Vision 64

With AMD Athlon 64 3400+, 1GB 400-MHz DDR SDRAM, two 120GB 7,200-rpm SATA hard drives, DVD±RW drive, DVD/CD-RW drive, 256MB nVidia GeForce FX 5950 Ultra, 19-inch CRT, Microsoft Windows XP Home, \$2,988 direct. Velocity Micro Inc., 800-303-7866, www.velocitymicro.com. OVERALL ●●●●● ●●●●● ●●●●● ●●●●● ●●●●●

High scores are best.		Business Winstone 2004 1,024 x 768	Multimedia Content Creation Winstone 2004 1,024 x 768	3DMark03 Pro 1,024 x 768 2X/2X	Serious Sam: The Second Encounter 1,024 x 768 (fps) 1,600 x 1,200 (fps) 2X/2X 4X/8X		Tom Clancy's Splinter Cell 1,024 x 768 (fps) 1,600 x 1,200 (fps) 2X/2X 4X/8X		
Anti-aliasing/Anisotropic filtering ▶	Processor								
	Velocity Micro Vision 64	Athlon 64 3400+	26.2	33.0	5,402	155	71	58	40
	Compaq X09*	P4 (3.2 GHz)	20.3	30.2	5,120	125	64	51	35

* Reported for comparison.

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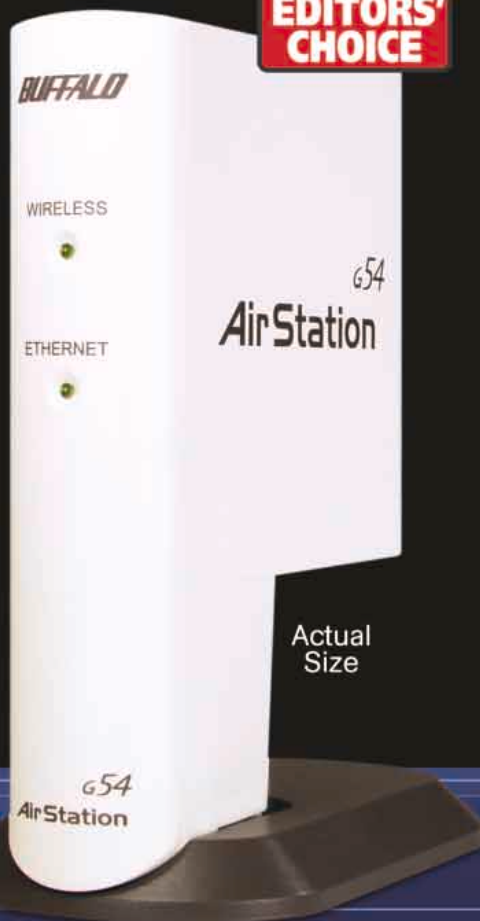
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*-Laptop Magazine, December 2003,
Editor's Choice*



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(WLA-G54C)

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BUFFALO™

Large-Format Ink Jets for Small Business

BY CADE METZ

For those who run a small business or home office, there's never been a better time to buy a laser printer. In this issue, we review eight monochrome lasers that sell for less than \$300 and five color laser models priced from \$500 to \$800 ("Small Office, Shoestring Budget"). But what if you do a lot of color printing for your business and have a monochrome laser (not color laser) budget?

HP recently introduced a pair of ink jets targeted at such users: the HP Deskjet 9300 (\$300 street) and the HP Deskjet 9650 (\$400 street). What separates these models from typical home-office ink jet models are their higher monthly duty cycles, larger ink tanks (hence lower per-page costs), and—most important—wide-format abilities (up to 19 inches), which would cost you \$2,000 or more in a color laser.

The 9300 is wonderfully easy to use. Installation is almost instantaneous, whether you attach via its FireWire or USB port (there is no internal Ethernet option), and HP's Smart Software driver lets you easily resize images, print multiple images on a page, print in sepia tone, and more. The unit's input tray handles 150 pages; its output tray, 50; that's about triple what a lower-cost ink jet can accommodate. The 9300 also handles thicker media than does your average ink jet, letting you print on true poster material.

Rated at 14 letter-size pages per minute for black text printing and 11 ppm for color, the 9300 can deliver up to 4,800-by-1,200



The HP Deskjet 9300 isn't the quickest ink jet, but it's a good bet for small businesses.

resolution in optimized color mode. In labs testing, the 9300's speed was average compared with recent general-purpose ink jets we've tested ("More for Your Money," November 11, 2003). When compared with the lowest-priced color laser printer in this issue's roundup—the Konica Minolta magicolor 2300W (\$500 street)—it was noticeably slower.

On our output quality tests, the 9300, though adept for a business printer, failed to match the nine ink jets in our November roundup. Text was crisp and legible, but we saw slight graininess in some of our graphics files, and white lines didn't always hold up against a black background when printing photos. This was surprising, given that the printer uses the same PhotoREt III color-layering technology used by the other HP models.

The Deskjet 9650 provides three major advantages over the 9300: It's faster, has higher reso-

lution for black-and-white printing, and allows borderless printing on any paper size up to 11 by 17 inches. To enable borderless printing, simply open the driver's Properties panel, click on the

tools), and HP Memories Disc Creator (which lets you burn slide shows onto CD or DVD). The free software is welcome, but we wonder whether HP could have found some business utilities, given the printer's target audience. Rated at 20 pages per minute for black-and-white test printing and 15 ppm for color, the 9650 outperformed the 9300 on most of our speed tests, most notably in producing the graphics-intensive Acrobat and PowerPoint files. But again, the 9650 can't keep pace with a color laser printer. Print quality was generally good, though we saw ragged lines in some of our graphics output and slight problems with color shading in photos.

If you're looking for the best-quality photo output, neither the 9300 nor 9650 fills the bill. And if you don't need wide-



The Deskjet 9650 is no color laser, but it delivers wide-format output in an affordable package.

check box, and select the appropriate paper size. Or if you like, you can select the Borderless Auto Fit option, and the driver will automatically fit the image to the paper.

Unlike the 9300, the 9650 ships with several additional software applications, including HP Photo Imaging (for capturing, editing, and sharing images), HP Image Editor (which offers more advanced editing

format ability, a low-cost color laser printer is a better choice. But if you need reasonably good business graphics and large-format printing in an affordable office printer, these two HP models are a good bet.

BUSINESS INK JET PRINTERS

	Acrobat 5.0	Microsoft Excel	Microsoft PowerPoint	Microsoft Word
All scores are in min:sec. Low scores are best. Bold type denotes first place among products reviewed.				
HP Deskjet 9300	3:13	0:33	3:55	3:02
HP Deskjet 9600	2:20	0:31	2:48	3:15
Konica Minolta magicolor 2300W*	1:16	0:14	1:17	2:37

* Reported for comparison. We ran QualityLogic's automated performance tests (www.qualitylogic.com) using PageSense software.

HP Deskjet 9300
Street price: \$300. ●●●●●

HP Deskjet 9650
Street price: \$400. Hewlett-Packard Co., www.hp.com. lllmm

StarOffice 7 Makes a Run at Office

BY EDWARD MENDELSON

Can Sun Microsystems' StarOffice 7 supplant Microsoft Office on your desktop? With previous versions being slow and buggy, you'd probably answer no. But the speed, power, and simplicity of the latest version—combined with its minuscule price (\$79.95 direct)—may change your mind. It's certainly worth a look

StarOffice's word processor can look simple or cluttered depending on the floating toolbars you open.

for budget-constrained government or enterprise buyers, as well as small businesses and individual users who need to buy an office suite with their own money. And attention education buyers: Sun will send you the software for just the cost of the media and shipping.

Sun Microsystems' application suite comprises the Writer word processor, HTML editor, Calc spreadsheet, Impress presentation program, Draw graphics program, as well as a database component accessed from within the other components. No mail client is provided as an Outlook replacement, however.

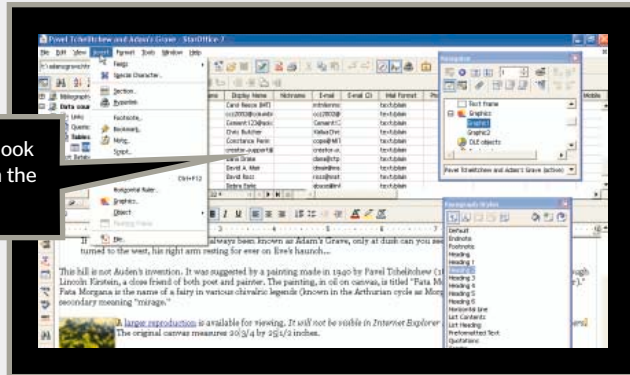
Corporations with heavy investments in VBA programming or in Office 2003's XML data manipulation features won't be interested in StarOffice. Also, the suite lacks clever automation features like Microsoft Office's SmartTags. But its StarOffice Basic programming language provides power akin to Microsoft's Visual Basic for Applications. Versions for Windows, Linux, and Solaris ship on the same CD (though we tested under Windows XP).

Microsoft Office users who switch to StarOffice will need little or no retraining, because the menus and overall behavior of the two suites are nearly identical. But StarOffice tends to be more intuitive than Microsoft

Office. StarOffice's AutoPilots resemble Office's Wizards, with plainer graphics but more efficient menus.

StarOffice is the only full-scale office suite that feels as tightly integrated as a low-end Works-style package. From the

WordPerfect, not the awkward model used in Microsoft Word. Unlike Word, StarOffice's Writer word processor places page layout options on the Format menu where you expect them, not on the File menu. It also lets you insert headers and footers from



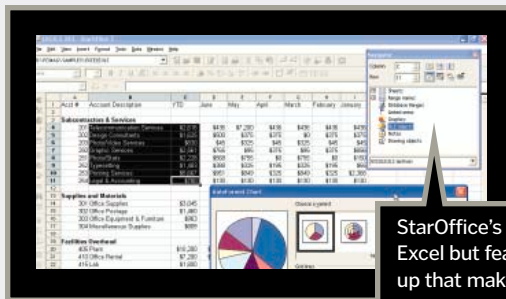
File menu of the word processor, for example, you can open or create a spreadsheet, presentation, or graphic in another window; you don't need to launch a separate program (as you do with Office). Different toolbars appear at the top and left-hand sides of the window when editing different types of documents, but the top-line menu is almost identical throughout the suite.

Other improvements over Office include a panel that automatically opens at the top of a window to display lists of data sources connected to a document. Floating panels, which open and close by hitting a function key, display lists of formatting styles or provide a toolbar for navigating through complex documents. And to open an additional toolbar with further options, simply click and hold on the primary toolbar icons.

We also like the Master Document feature for organizing multiple files in a single "container" document; it follows the flexible model used by Corel

the Insert menu; Word hides them under View.

The word processor can display a document either in print layout or in an "online" view with minimal page formatting (like Word's Normal view), or, for editing HTML documents, a view that displays raw HTML code. The HTML editor isn't a full-featured Web editor like



StarOffice's spreadsheet resembles Excel but features a Navigator pop-up that makes it easy to find your way around a large sheet.

Microsoft FrontPage (no longer shipped as part of Office), but it gets the job done efficiently. One nit: The word count feature is buried in the File | Properties dialog, not easily accessible on a toolbar or menu as in Word.

The suite's spreadsheet matches all the commonly used Excel functions that we tested, including a smooth implementation of Excel's Pivot Tables,

which StarOffice calls DataPilot. The presentations component lacks convenient features (PowerPoint's panel of notes, visible only to the presenter, for example) but includes all the standard transition and animation effects that you've seen too often. The Draw program provides basic vector graphics tools, but you'll probably use these tools within the word processor or presentations program instead of as a standalone.

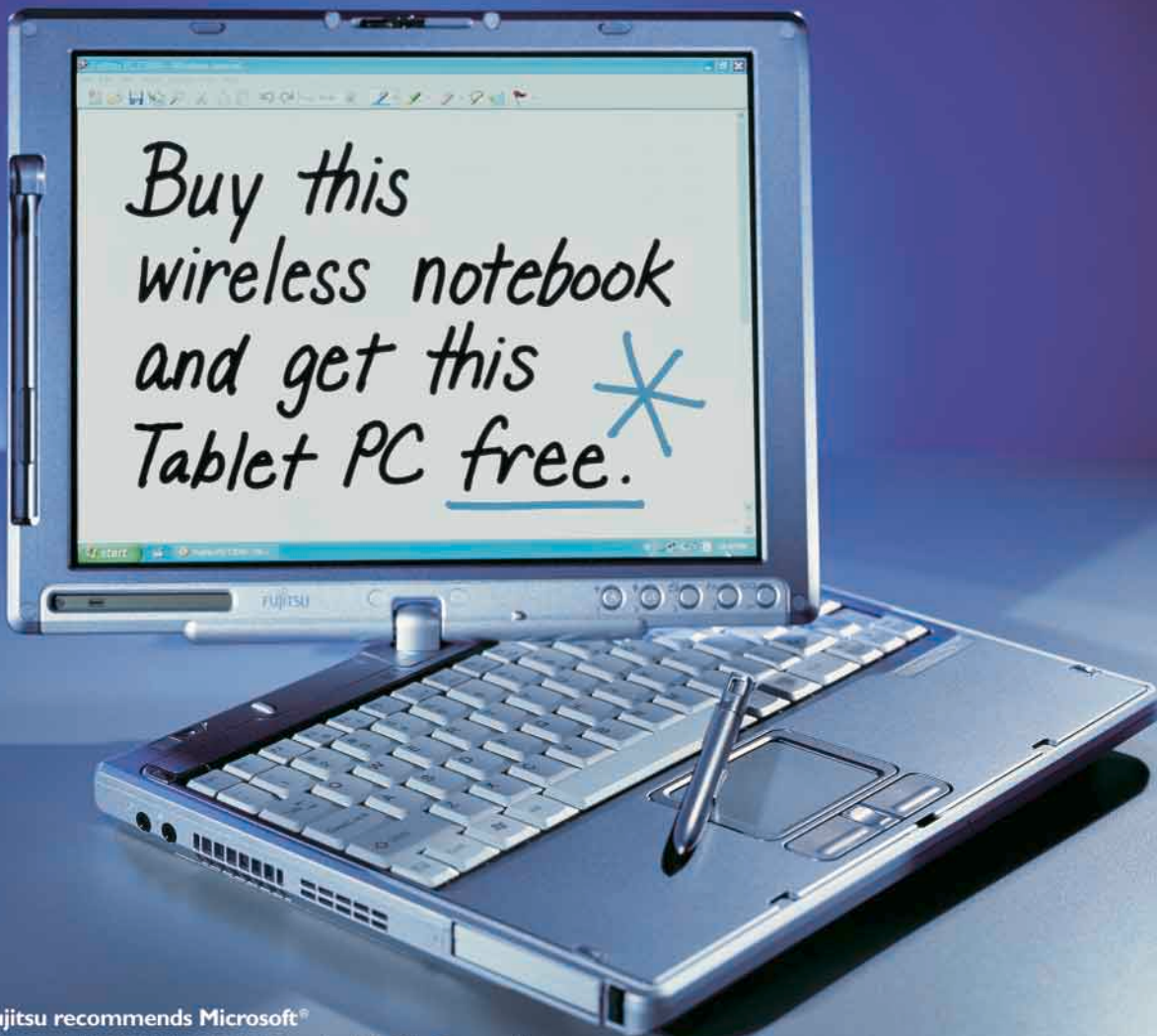
StarOffice's default file format is an XML flavor that Microsoft Office can't read, but you can choose to save files in the corresponding Microsoft format. All documents can be exported to Acrobat PDF format, and graphics and presentations can be exported as Flash SWF files.

In our informal testing, complex Microsoft Office documents imported into StarOffice with impressive accuracy, and many of Word's fields (variables like dates and cross-references) translate smoothly into Writer's fields, although some advanced fields like bar codes are ignored. StarOffice optionally opens a dialog in which you can convert imported Visual Basic for Applications into StarOffice Basic.

Minor annoyances in StarOffice include a default installation that doesn't install WordPerfect import filters, over-eager pop-ups that explain every auto-format or auto-correct

substitution (you'll want to turn them off in the Help menu), and a Find dialog that doesn't move out of the way so you can see the word it finds. But at a fraction of the price of Microsoft Office 2003 (\$149 for the Student and Teacher Edition and up), these are easy flaws to live with.

StarOffice 7
\$79.95 direct. Sun Microsystems Inc., www.sun.com/star. ●●●●●



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THE POSSIBILITIES ARE INFINITE

Uncontested Champ in Media Center PCs

BY BILL HOWARD



We're big fans of Media Center PCs. And while the latest crop of Media Center models delivers better TV image quality than the first generation, we still found room for improvement (First Looks, November 25, 2003). Well, leave it to Sony to raise the bar.

The **Sony VAIO Digital Studio PCV-RZ46G** delivers TV images free from the snow and other artifacts we've seen in the past. Its picture was also sharper than images from other models, which tend to look a bit soft when shown full-screen. And while it still isn't digital-cable crisp, this is the first Media Center PC you won't have to make excuses for when you flip on *The Simple Life*.

Most of the rest of the system is top-notch, too. It includes a 3.2-GHz CPU married to 1GB of RAM, a 200GB hard drive, and a dual-format DVD burner, as well as a separate CD-RW drive. But hard-core gamers will find they can get better 3-D performance than the midrange nVidia GeForce FX 5600 card delivers, and the three-piece speaker set isn't the last word in sound.

In addition to the usual Microsoft Windows XP Media Center Edition 2004 interface and applications for PVR functions, photos, music, and video,

the RZ46G comes with a dozen multimedia applications accessible from the traditional Windows interface. Sony's own titles include the SonicStage music management utility, PictureGear for photo editing, DV-Gate for digital video editing, and VAIO Media for network file sharing. These are all useful but at the same time chaotic, because each has a somewhat different interface.

The only productivity software is the two-year-old version of Microsoft Works 7.0 (which lacks Word), Microsoft Money 2004, and a limited version of last year's Quicken. The memory



Sony's Media Center PC delivers better TV quality than any other.

That's a shame, because the PC's chassis is small enough to fit in an audio rack sideways if you don't mind the fan noise (low compared with most PCs, but high compared with audio gear).

Sony seemed a little late to the Media Center PC party, and now we see why: The company wanted to produce one that delivers the TV picture people expect from something with the name Sony on the front.

Sony VAIO Digital Studio PCV-RZ46G

With 3.2-GHz Intel Pentium 4, 1GB DDR SDRAM, 200GB hard drive, DVD±RW drive, CD-RW drive, nVidia GeForce FX 5600 graphics, Gigabit Ethernet, Microsoft Windows XP Media Center Edition 2004, \$2,200 direct. Sony Electronics Inc., www.sonymstyle.com.



card slots on the front accept CompactFlash, Memory Stick, and SmartMedia but not the popular SD format.

The keyboard and mouse that come with the VAIO are wired rather than wireless.

Stylish Media Center All-in-One

BY BILL HOWARD

The **Gateway 610XL Media Center PC** is just about the best desktop PC/media player you could buy for a space-constrained environment such as an apartment or condo—especially if style matters. Clad in matte silver with black accents, it's attractive, functional, and easily moved.

The 610XL is best described as a 17-inch, wide-aspect-ratio LCD panel with a small, high-performance PC affixed to the back. As much as possible, it's meant for wireless operation: It includes a cord-free keyboard, mouse, remote control, and networking. The speakers, two on the side plus a rear-firing subwoofer, are superior to what you'd get on a Media Center notebook (the

610XL's logical competitor).

With the 610XL, there's really no need to have a CD player in your apartment or den. The combination of the 200GB hard drive and the proven ability of the included MusicMatch Jukebox to create and use playlists makes this machine simpler and more versatile than a CD changer. Photo viewing and DVD playing are equally desirable, thanks to Windows XP Media Center Edition.

That leaves TV tuning, and here's why the 610XL, for all its inherent goodness, falls one star short of perfection. As with virtually every other Media Center PC, the quality of live TV (and of shows recorded off live TV) is no match for a standalone TV.

A DVD/CD-RW combo drive slides out of the right side of the LCD panel; we would prefer a DVD burner for archiving recorded video. There's a four-socket memory card reader on the left side and a slew of USB,

FireWire, Ethernet, and AV ports on the base of the tilting (but not turning) stand.

The 610XL offers a decent array of software based on Microsoft Works Suite 2004, Sonic Solutions' PrimeTime for archiving TV to disc, and the Napster music service. Performance is more than adequate thanks to the 3-GHz P4 CPU, but gamers will be turned off by the ATI Radeon 9200 graphics card.

If you want the style and space savings of an all-in-one PC and the added utility of Windows XP Media Center Edition, the Gateway 610XL is a fine choice.

Gateway 610XL Media Center PC

With 3.0-GHz Intel P4, 512MB DDR SDRAM, 200GB hard drive, DVD/CD-RW drive, ATI Radeon 9200 graphics, 17-inch WXGA LCD display, wired Ethernet, 802.11g wireless, Microsoft Windows XP Media Center Edition 2004, \$2,000 direct. Gateway Inc., www.gateway.com.



The Gateway 610XL is perfect for a den, kitchen, or cramped apartment.



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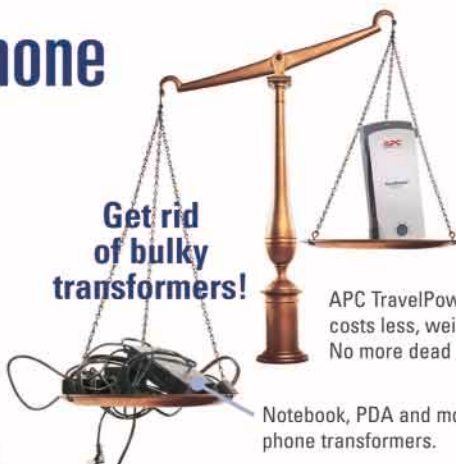
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Super G Doubles 802.11g Performance

BY CRAIG ELLISON

Once upon a time, we were awed by the 11-Mbps top throughput of 802.11b wireless networking and were glad to have it. Then last year, the much faster 802.11g appeared, with its 54-Mbps data rate threshold and 802.11b compatibility. But if that still isn't enough to keep your business or home network humming, consider the new Super G alternatives now on the market from D-Link and Netgear.

Based on wireless chipsets by Atheros, Super G products claim to double the top data rate of standard 802.11g—to a whopping 108 Mbps—while still working with other 802.11b and 802.11g devices (albeit at lower speeds). Be warned, however, that Super G is not standards-based, so compatibility is up to each manufacturer and is not inherent in the specification.

Super G products employ a number of technologies to achieve performance gains over standard 802.11g products. The primary (and most problematic from a standards standpoint) is *channel bonding*. Super G products can bond two 20-MHz channels together. This 40-MHz footprint is centered on channel 6. This can cause adjacent channel interference on the only other two nonoverlapping channels in the 2.4-GHz spectrum, channels 1 and 11. That means the introduction of a Super G access point in close proximity to an existing 802.11g network can dramatically decrease the performance of the 802.11g network.

Another technology used by Super G is *packet bursting*, which lets the AP and client card send more packets on each transmission, thereby making better use of air time by reducing the number of interpacket intervals. In addition, Super G's *fast packets* technology packs more data into each packet.

The Atheros chipset supports both *static* and *dynamic* 108-Mbps modes. In static mode, the router or AP stays in channel-bonded mode and is not backward-compatible with either 802.11b or 802.11g products. Although this mode provides the best overall performance, it can cause adjacent channel interference for nearby legacy devices operating on any channel as well as other nearby 108-Mbps networks. Configured in static mode, Super G is clearly not an enterprise product. And even for home network use, two nearby homes with Super G products in static mode could interfere with one another or with legacy products running on channels 1 or 11.

Super G's dynamic mode is intended to turbocharge performance only when needed, so channel bonding will occur when network traffic demands it. And, when in channel-bonded mode, the AP will periodically check to see if it can hear any legacy devices. If it hears a beacon, it will stay in single-channel mode but implement the other Super G performance enhancements. This mode maintains compatibility with legacy devices.

Indeed, in our testing, Super G (in static mode) delivered twice



The new Super G components deliver outstanding throughput and range.

the throughput of standard 802.11g products, and in dynamic mode it delivered compatibility with legacy 802.11b and 802.11g products. Even better, the farther we got from the access point, the greater Super G's advantage over standard 802.11g became.

So home users who feel they need the bandwidth and range of Super G—and who can be sure Super G in static mode won't interfere with neighboring networks—should consider such products. And given the neighbor-friendly dynamic mode and attractive prices of Super G products, they're not a bad bet for buyers planning on rolling out 802.11g.

D-Link continues its tradition of aggressive pricing with the \$100 (street) **D-Link DI-624 AirPlus Xtreme G Router** (which we tested with the company's \$60 DWL-G650 PC Card adapter). The router and its configuration util-

ity install effortlessly, as with previous D-Link wireless products. The changes are under the hood in the router, and features and options related to Super G have been added under a new performance tab in the driver. In testing, the D-Link duo delivered excellent throughput in Super G static mode. Moreover, the D-Link products outpaced the Netgear pair except at the very end of our test course.

In addition to the performance improvements, the big news (from a security standpoint) is that D-Link has bundled WPA supplicants for legacy (pre-XP) Windows operating systems. Those wanting to deploy WPA won't have to make a separate supplicant purchase. Encryption, site survey, and the ability to save multiple profiles are all handled nicely in the included client utility.

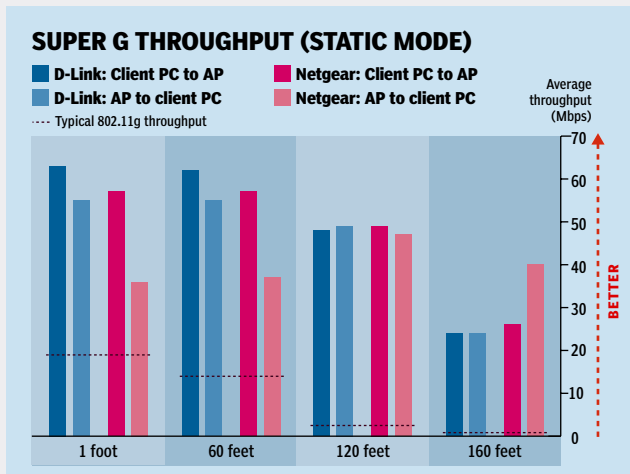
Price, performance, and included WPA supplicants make the D-Link duo the clear choice for buyers sold on Super G.

D-Link DI-624 AirPlus Xtreme G Router
\$100 street. D-Link Systems Inc., www.d-link.com. ●●●●●

We tested the **Netgear WGT624 Router** married to a Netgear WG511T PC Card. The router's Web-based configuration home page pops up a convenient utility that checks Netgear's site for firmware upgrades—a nice touch given how often cutting-edge products can change.

The client utility installs smoothly. The setup wizard pops up a dialog box suggesting that you allow Netgear's utility to manage the adapter, and it disables the Windows XP wireless network configuration utility automatically. The client software also adds support for WPA. Though WPA is supported in the router, Netgear is not currently supplying WPA supplicants.

Netgear WGT624 Router
\$130 street. Netgear Inc., www.netgear.com. ●●●●●





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Citrix Moves Beyond Thin Clients

BY S. JAE YANG

Citrix has been trying to shed its image as being solely a provider of thin-client solutions by offering an array of products in recent years, with mixed results. But now Citrix has put together a suite of products that work together to manage access to

proved slightly compared with previous versions. In the new release, however, Citrix added some bells and whistles to boost the perceived performance. Graphics-intensive Web apps load faster thanks to SpeedScreen Browser Acceleration. SpeedScreen caches the JPEG and GIF images locally on the

and populate an Access Center with various applications and content, such as stock quotes and company press releases. The Access Management Console offers an interface for centralized administration of Access Centers and applications on multiple MetaFrame servers. The Secure Gateway Server can also be deployed instantly.

MSAM supports only Windows-based clients with Internet Explorer 5 or later. But if that describes your installed base, MSAM makes the Meta-

Frame Access Suite an attractive alternative to typical VPN-based remote-access solutions, which can be expensive to deploy and tricky to maintain.

The ICA protocol allows for multiple clients to share an ICA session. Citrix harnessed this capability into the Conferencing Manager, which enables real-time collaboration. Instead of checking individual files in and out, a group can work together on the same document. As the participants take turns editing the document, everyone in the group can follow the changes visually. This tool can also be used for presentation meetings or group training sessions.

ICA client instead of having the MetaFrame server relay the images with each screen update.

In our testing, we found that the multimedia playback performance (always a tough nut in a thin-client environment) still leaves something to be desired. But Citrix's Rave technology, due out early this year, promises to change that. Rave will let the ICA display protocol stream multimedia content in its original form directly to the client.

The MetaFrame Secure Access Manager (MSAM) component lets the administrator create an *Access Center*, a secure point through which users log on and launch any published MetaFrame applications or Web content. Workers reach the Web-based Access Center interface via the Secure Gateway Server, which authenticates internal and external users for role-based access to the applications and content. The administrator can tailor the Access Center for each user and include only the applications that are necessary for the user's job.

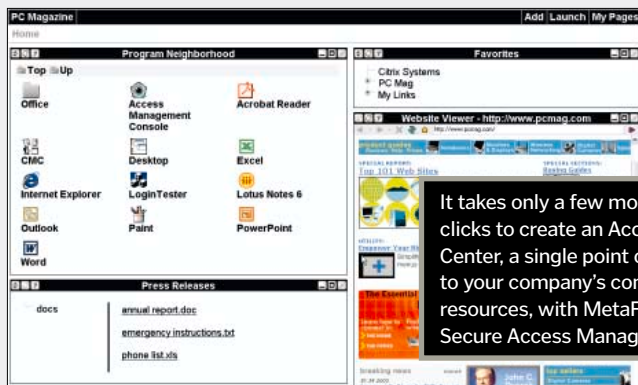
Using the New Access Center wizard, it is very easy to create

nate who is allowed to take control of the mouse and keyboard during the conference. A user can even engage in a private chat with another participant during the meeting. The Conferencing Manager can be integrated with Exchange so that a host can schedule meetings and invite attendees using Outlook.

User authentication is a crucial component of remote access, and the Password Manager aims to replace all of those yellow sticky notes covered with scribbled passwords. According to a Citrix survey, typical corporate users have 5 to 20 applications that require separate log-ons. By having the Password Manager remember all of the passwords, the user needs only one password to log on to the desktop.

Once you install the Password Manager on your system, each time you encounter a log-on interface, the Password Manager asks whether you want it to remember the password. After training the system to remember all of your passwords, your desktop becomes a single-sign-on environment.

Citrix offers a viable application delivery solution for enterprises in MetaFrame Access Suite. With the unified manage-

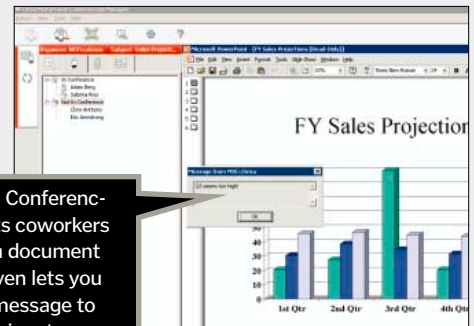


enterprise-scale computing resources. **Citrix MetaFrame Access Suite** comprises Presentation Server, Secure Access Manager, Conferencing Manager, and Password Manager. You can buy the whole suite or just the components, as your needs dictate.

The heart of MetaFrame Access Suite is still the thin-client-based system called Presentation Server, which is the foundation for the other components. Presentation Server allows remote access to applications running on Windows 2000 or 2003 Server via a LAN, WAN, or dial-up connection. The user accesses the applications using ICA (Independent Computing Architecture) client software that can be installed on a dedicated PC. The client can run on various OSS, including Windows (even Windows CE and Pocket PC), DOS, Linux, Macintosh, and Unix. The client can also run within a Web browser via ActiveX or Java.

According to NCL ThinBench tests run in PC Magazine Labs, the raw performance of Feature Release 3 of the ICA client im-

The MetaFrame Conferencing Manager lets coworkers collaborate on a document remotely and even lets you send a private message to one of the participants.



In the Conferencing Manager user interface, users see only the meetings to which they are invited. Once the conference starts, all applications that are available to the host via the Presentation Server may be used during the conference. To eliminate chaos, the host can design

ment interface for all components and a more cohesively integrated suite of products, Citrix's new message should strike a chord with IT managers looking for a new solution to access.

Citrix MetaFrame Access Suite

Direct price: \$599 per concurrent user. Citrix Systems Inc., www.citrix.com.



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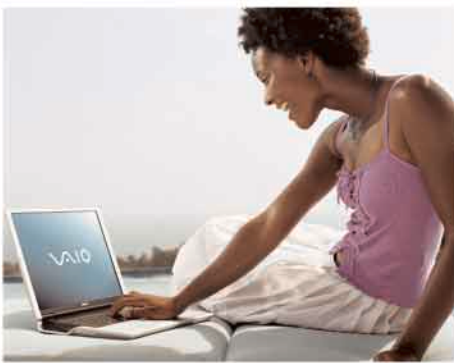
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- Convert your old analog videos to digital and record to DVD
- Integrated 802.11g wireless LAN^{2b}
- 1-Year Limited Warranty⁴

\$2,999⁹⁹ As low as \$75 per month for qualified customers.⁵

UPGRADES

- Sony VAIO® Port Replicator for \$199.99
- Sony VAIO® Standard Lithium Ion Battery³ for \$249.99

Transportable TV Entertainment Center



Essential Computing for Home FRV SERIES

PCG-FRV26

- Intel® Pentium® 4 Processor 2.80GHz¹
- Microsoft® Windows® XP Home Edition
- 40GB Hard Drive²
- 15" XGA TFT display
- 512MB RAM
- Integrated CD-RW/DVD Combo Drive³
- 1-Year Limited Warranty⁴

\$1,499⁹⁹ As low as \$38 per month for qualified customers.⁵

UPGRADES

- Sony VAIO® Standard Lithium Ion Battery³ for \$249.99
- Sony VAIO® USB Adapter with Bluetooth™ Wireless Technology⁶ for \$99.99
- 3-Year Limited Warranty⁴ for \$200

PCG-FRV37

- Intel® Pentium® 4 Processor 2.80GHz¹
- Microsoft® Windows® XP Home Edition
- 60GB Hard Drive²
- 15" XGA TFT display
- 512MB RAM
- DVD-RW/CD-RW Drive³
- Exclusive Click to DVD™ software for easy moviemaking
- Sony VAIO® Creation Suite Standard software package
- 1-Year Limited Warranty⁴

\$1,599⁹⁹ As low as \$40 per month for qualified customers.⁵

UPGRADES

- Sony VAIO® Standard Lithium Ion Battery³ for \$249.99
- Sony VAIO® USB Adapter with Bluetooth™ Wireless Technology⁶ for \$99.99



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PCG-TR2A

- Intel® Centrino™ mobile technology
- Intel® Pentium® M Processor 1GHz¹
- Integrated Wireless LAN; Intel® PRO/Wireless Network Connection 802.11b^{2b}
- Intel® 855 Chipset
- Microsoft® Windows® XP Home Edition
- 40GB Hard Drive²
- 10.6" widescreen XBRITE™ LCD display
- 512MB RAM
- Integrated CD-RW/DVD Combo Drive³
- Amazing battery life up to 7.0 hours⁴
- Integrated swivel camera
- Sony VAIO® Creation Suite Standard software package
- 1-Year Limited Warranty⁴

\$2,199⁹⁹ As low as \$55 per month for qualified customers.⁵

UPGRADES

- Privacy Screen for \$79.99
- Sony VAIO® Standard Lithium Ion Battery³ for \$299.99
- Sony VAIO® Double-Capacity Lithium Ion Battery³ for \$349.99

PCG-TR2AP1

- Intel® Centrino™ mobile technology
- Intel® Pentium® M Processor 1GHz¹
- Integrated Wireless LAN; Intel® PRO/Wireless Network Connection 802.11b^{2b}
- Intel® 855 Chipset
- Microsoft® Windows® XP Professional Edition
- 40GB Hard Drive²
- 10.6" widescreen XBRITE™ LCD display
- 512MB RAM
- Integrated CD-RW/DVD Combo Drive³
- Amazing battery life up to 7.0 hours⁴
- Integrated swivel camera
- Sony VAIO® Creation Suite PLUS software package
- 1-Year Limited Warranty⁴

\$2,299⁹⁹ As low as \$58 per month for qualified customers.⁵

UPGRADES

- Privacy Screen for \$79.99
- Sony VAIO® Standard Lithium Ion Battery³ for \$299.99
- Sony VAIO® Double-Capacity Lithium Ion Battery³ for \$349.99



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- Integrated Wireless LAN: Intel® PRO/Wireless Network Connection 802.11b²
- Intel® 855 Chipset
- Microsoft® Windows® XP Home Edition
- 60GB Hard Drive³
- 14" SXGA+ TFT display
- 512MB DDR SDRAM
- Integrated CD-RW/DVD Combo Drive⁴
- Amazing battery life up to 6.5 hours⁵
- Integrated Bluetooth™ Wireless Technology⁶
- USB 2.0
- Stylish and sophisticated design in a 4.7-lb.-light⁷ and 0.9–1.5"-thin body
- Sony VAIO™ Creation Suite Standard software package
- 1-Year Limited Warranty⁸

\$100
mail-in rebate

~~\$2,199⁹⁹~~
\$2,099⁹⁹ After \$100 mail-in rebate.¹⁴
As low as \$55 per month for qualified customers.¹⁵

UPGRADES

- Sony VAIO™ Port Replicator for \$199.99
- Sony VAIO™ Double-Capacity Lithium Ion Battery (battery life up to 12 hours)⁶ for \$499.99

PCG-Z1VAP2

- Intel® Centrino™ mobile technology
- Intel® Pentium® M Processor 1.70GHz¹
- Integrated Wireless LAN: Intel® PRO/Wireless Network Connection 802.11b²
- Intel® 855 Chipset
- Microsoft® Windows® XP Home Edition
- 60GB Hard Drive³
- 14" SXGA+ TFT display
- 1024MB (512MBx2—ideal for future upgrade) DDR SDRAM
- Integrated CD-RW/DVD Combo Drive⁴
- Includes Sony VAIO™ double-capacity battery for an amazing battery life up to 12 hours⁵
- Integrated Bluetooth™ Wireless Technology⁶
- USB 2.0
- Stylish and sophisticated design in a 4.7-lb.-light⁷ and 0.9–1.5"-thin body
- Sony VAIO™ Creation Suite PLUS software package
- 1-Year Limited Warranty⁸

\$2,999⁹⁹ As low as \$75 per month for qualified customers.¹⁵

UPGRADES

- Sony VAIO™ Port Replicator for \$199.99
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PCG-TR2A
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- Internal battery provides up to 33 hours of continuous playback¹

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MSA-128S2

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Store, transfer and share up to 250MB¹ of your digital pictures, videos, music, presentations, data, voice files and more with Sony's Memory Stick® media.
128MB X2 Memory Stick® Select Media

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MSAC-MCF1N Memory Stick Duo™ Adapter for Compact Flash Slot

Conveniently reads and writes Memory Stick Duo™ and Memory Stick PRO Duo™ media in a Compact Flash slot (Type 1). Simply insert your Memory Stick Duo™ media into the adapter and it becomes a "plug and play" memory card compatible with Compact Flash devices.

\$49⁹⁹



MSX-512 Memory Stick PRO™ Media

Store more advanced media including more data and higher-resolution moving images. With enhanced features, Memory Stick PRO™ media is Sony's next-generation storage format.
512MB™ Memory Stick PRO™ Media¹

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MSX-M256A Memory Stick PRO Duo™ Media

Ideal for use in small devices, including cell phones, portable audio players and pocket-sized digital imaging devices. Attach the adapter (included) and it can also be used in products compatible with standard-size Memory Stick PRO™ media.
256MB™ Memory Stick PRO Duo™ Media¹

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PICTURES

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- Intel® Celeron® Processor 2GHz¹
- Integrated CD-RW/DVD Combo Drive²
- 40GB Hard Drive³
- Exclusive PictureGear Studio™ software for easy photo management

\$1,399⁹⁹ As low as \$35 per month for qualified customers.¹¹

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- Combines exceptional image quality with compact design
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- Live histogram display
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Stick PRO™ Media



Advanced media with expandability and new capabilities to meet the needs of the coming broadband era, including real-time recording of high-resolution moving images. The Memory Stick PRO™ format offers high capacity and fast data transfer speeds.

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The All-in-One Entertainment PC

PCV-W510G

- Intel® Pentium® 4 Processor 2.40GHz¹
- Microsoft® Windows® XP Home Edition
- 80GB Hard Drive³
- 512MB DDR at 333MHz
- CD-RW/DVD-ROM Combo Drive²
- Built-in 17.5" widescreen LCD display
- Memory Stick™ Media Slot
- Built-in stereo speakers
- featuring SRS™ WOW™ technology
- Giga Pocket™ Personal Video Recorder
- 1-Year Limited Warranty⁹

\$1,699⁹⁹ As low as \$43 per month for qualified customers.¹¹

The Ultimate TV & PC Solution

PCV-V100G

- Intel® Pentium® 4 Processor 2.40GHz¹
- Microsoft® Windows® XP Home Edition
- 80GB Hard Drive³
- 512MB DDR at 333MHz
- CD-RW/DVD-ROM Combo Drive²
- 15" LCD display
- Wireless keyboard, wireless mouse and remote control
- Built-in stereo speakers
- Giga Pocket™ Personal Video Recorder
- 1-Year Limited Warranty⁹
- Free wireless LAN PC card¹⁰ when purchased from www.sonymstyle.com.¹⁸ While supplies last.¹⁸

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- 256MB DDR at 266MHz
- DVD±RW Drive²
- 64MB Intel® 845GV Integrated Graphics
- Stereo speakers
- Sony VAIO® Creation Suite Standard software package
- 1-Year Limited Warranty⁹

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UPGRADES

- Upgrade to a 120GB Hard Drive³ for \$40
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Build-to-Order PCV-RS400CG Series Desktop

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- 64MB ATI™ RADEON 9200 Graphics Card
- Giga Pocket™ Personal Video Recorder with remote control
- Multimedia Card Reader
- Stereo speakers
- Sony VAIO® Creation Suite PLUS software package
- 1-Year Limited Warranty⁹

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- Sony VAIO® Creation Suite PLUS software package
- Creative® Inspire™ 5.1 5200 Speaker System with Sound Blaster™ Sound Card
- Multimedia Card Reader
- 1-Year Limited Warranty⁴

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UPGRADES

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Build-to-Order RZ40CG

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- Microsoft® Windows® XP Media Center Edition
- 160GB Hard Drive² (7200 rpm)
- 1GB DDR at 400MHz
- DVD±RW/DVD-ROM Drives³
- 128MB nVIDIA® GeForce™ FX5600 Graphics Card
- Creative® Inspire™ 5.1 5200 Speaker System with Sound Blaster™ Sound Card
- Multimedia Card Reader
- Personal Video Recorder powered by Giga Pocket® Engine with remote control
- 1-Year Limited Warranty⁴

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The PEG-TJ35 CLIÉ® handheld provides everything you need to stay organized and entertained. Listen to your favorite tunes on the road with the integrated MP3 audio player. Compact and lightweight, you can take your CLIÉ® handheld wherever you go.

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- FREE shipping¹³

\$249⁹⁹



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- SwivelScreen™ design
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VAIO® RZ Series Desktop PC

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- 160GB Hard Drive²
- Exclusive Click to DVD™ software for easy moviemaking

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\$1,549⁹⁹

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MiniDV Handycam® Camcorder

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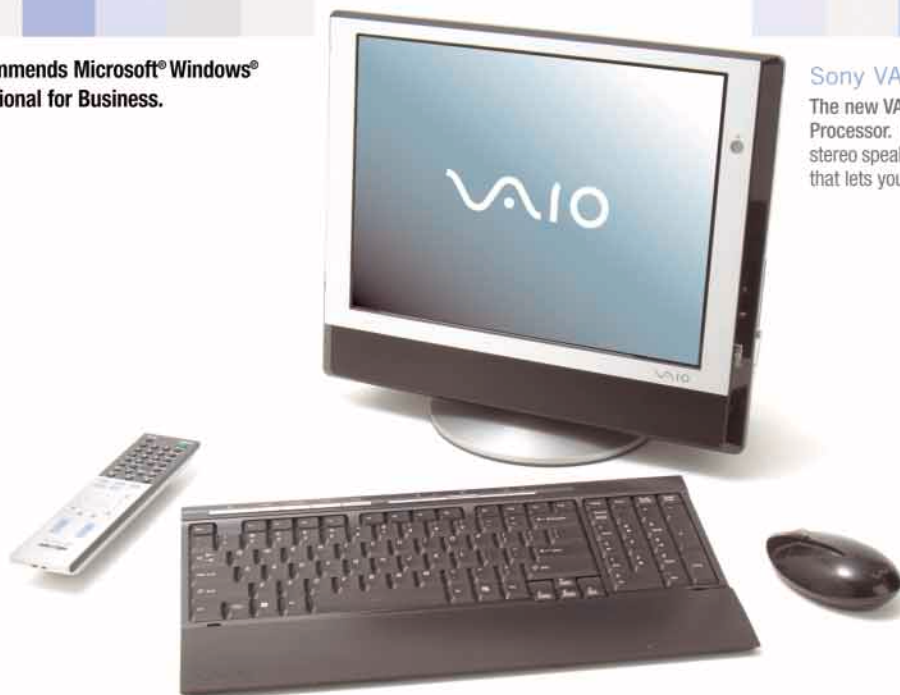
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The minimum monthly payment is 2.5% of the New Balance or \$10, whichever is greater. The number of months you will pay and the amount of your total minimum monthly payment will depend on additional purchases and your Account balance. Minimum Finance 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 1-888-367-4300 or review your credit card agreement for information. 14. Purchase must be made by 3/31/04. For rebate mail-in coupon and Terms and Conditions, please visit www.sonystyle.com. 15. After purchase of eligible Sony digital camera, receive a coupon for 100.000* prints from Sony's ImageStation® online service. Customer must provide valid e-mail address to receive this offer. Coupon valid for 100 days after issuance. Shipping charges may apply. Please visit www.sonystyle.com for details. 17. Internet service required. Broadband service recommended. 18. When recording in LP4 mode—results vary based on PC specifications and does not include title transfer. 19. Requires compatible 802.11b or 802.11g wireless access point, some of which may require a fee and/or ISP. 21. Actual usable capacity may vary. 22. White supplies last. 23. Standard ground shipping. Offer expires 3/31/04. 24. 480MB of actual usable capacity. 25. 220MB of actual usable capacity. 26. Offer valid with purchase of PC-V100G direct from www.sonystyle.com. White supplies last. 27. iLINC is a trademark of Sony used only to designate that a product contains an IEEE 1394 connector. All products with an IEEE 1394 connector may not communicate with each other.

FEEDBACK

“Providing outdated tools is not the way to create successful and productive students.”



SPAM FIGHTING: ANY IDEAS?

I READ MICHAEL J. MILLER'S Forward Thinking segment on spam solutions (December 30, page 7) with great interest. There are several flaws in all the anti-spam solutions I've encountered. Opt-in lists are worthless, because my name appears on them whether I opt in or not. And opt-out lists don't address the real problem: the e-mail address databases supplied to spammers.

I receive the same spam e-mail from dozens of senders every day, because they are all drawing from the same CD-ROM they purchased from the suppliers of the master address databases. Opting out of each of these spammers individually takes hours and does nothing to stem the flow of e-mail. Besides, many opt-out links don't work.

Unless someone can conceive of some way to get my name off of all the e-mail lists in the world permanently, any effort to stem the flow of spam is doomed before it even begins.

STEVEN BEERS

SENIOR MOMENTS

HERE'S A PIECE OF ADVICE for the reader who wrote about trying to provide computer support to his 70-year-old father (Feedback, December 30, page 57). There is a national organization called SeniorNet, which is dedicated to providing computer training and computer support to persons 55 years of age and over. The group has centers all over the country, providing computer classes taught by volunteers. Each center tries to provide computer troubleshooting and a computer laboratory so that users can practice their skills. Go to www.seniornet.org for details.

STEPHEN FRENCH

KICKED OUT OF SCHOOL

YOUR RECENT SUGGESTION TO DONATE unwanted PCs to local schools ("10 Things to Do with Old PCs," December 9, page 76) hit a nerve. I've worked with educational technology for a large school system for over 30 years, and I've been through several iterations of cast-off technology. We received thousands of computers in the late 1990s, which were discarded as newer, Y2K-compliant machines were adopted. Many of these machines did not have hard

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drives. Others did not include monitors. Our schools were taking these PCs even while attempting to achieve Y2K compliance. I'm certain this cost many thousands of dollars that could have been better spent on other things.

In modern classrooms, teachers use PCs for administrative tasks, presentations, and communication with parents. Students use them for Internet research and word processing. For many of these applications, anything below 450 MHz probably won't work. And unless a machine runs Windows 98 or later, it will have problems with many Web sites. But schools will often accept the donations anyway, incorporating them into labs that have different PCs running different OSs, all requiring support. The costs to upgrade and maintain these machines add up quickly.

Now, if you have a dozen machines of the same make and model and you include the hard drives and RAM in the donation, we may have something to talk about—especially if they have Pentium II CPUs or later. But providing outdated tools is not the way to create successful and productive students.

STEPHEN C. SILVIOUS

TIMELY ADVICE

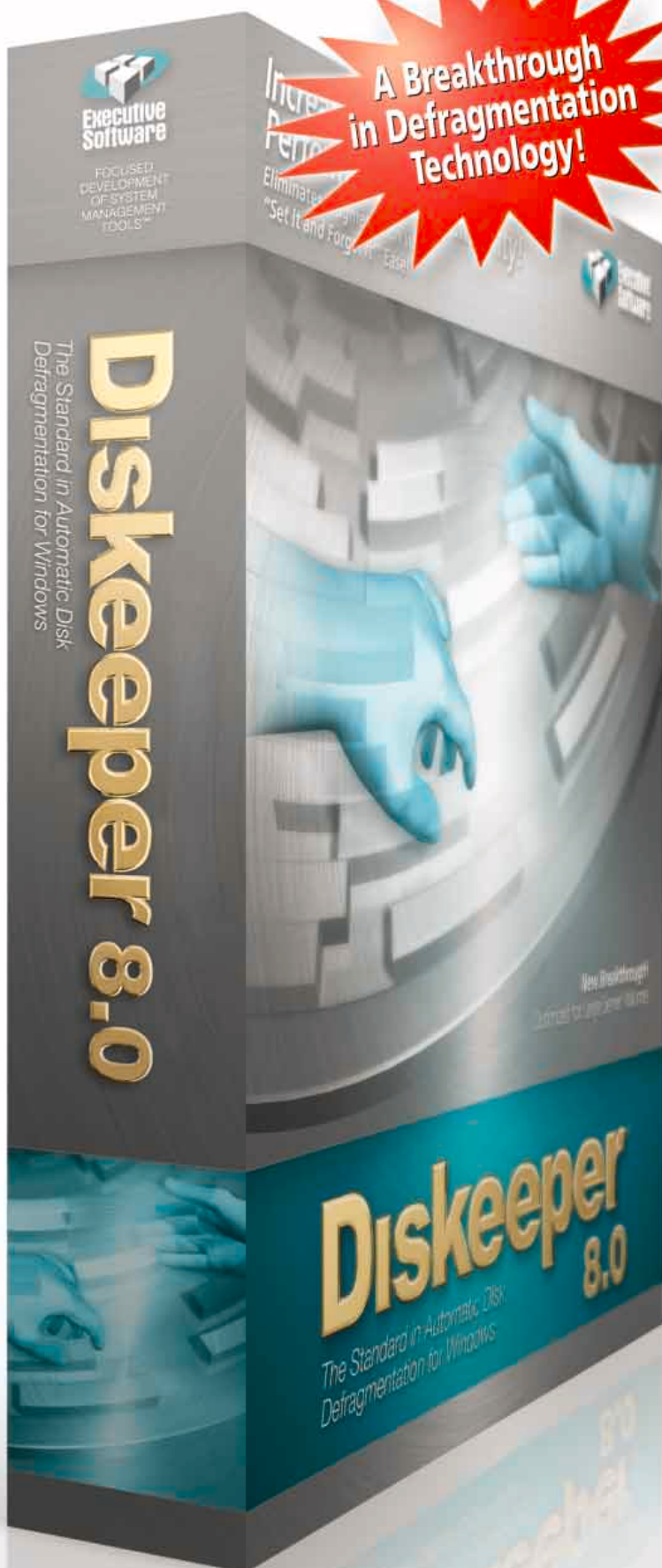
I REALLY HATE TO ADMIT THIS, but I often let four or five issues of your magazine pile up before reading them. I just finished reading the issue of November 11, and when I read the first paragraph of "Protect Your New PC" (page 74), I just had to laugh. The scenario you described is exactly what happened to me when I set up my new computer. After plugging everything in, I went online to get updates, and the very next day Norton reported that I'd been infected with the Blaster worm. I couldn't believe it. I had to use the manual-removal procedure to get rid of it. If only I had read the article earlier, I could have avoided this.

I think I've learned my lesson. From now on I will read your magazine the minute it shows up.

AUDREY HARPER

Corrections and Amplifications

- In the First Looks review of Microsoft's Smartphone platform (December 30, page 43), we indicated that the phones we reviewed use Microsoft Windows Mobile 2003 Software for Smartphones. In fact, they use Microsoft Smartphone 2002 software. The OS comes with Windows Media Player 7, not Version 8, and the version of ActiveSync bundled is 3.7.1.
- In the "Choice Blogs" sidebar of "Take Back the Net" (December 30, page 105), the URL for Boing Boing was listed incorrectly. It should have read www.boingboing.net.
- In the performance test chart for Tablet PCs in First Looks, December 9 (page 44), the wireless throughput results are in Mbps, not Kbps.
- In our December 9 story "Gadget Mania" (page 124), we incorrectly stated that both the Mickey Mouse and Winnie the Pooh mice from KidzMouse work with Magic Artist Studio software. Actually, only Mickey works with that program; Pooh comes with Pooh Learning Preschool.



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ExtremeTech

What's a Benway?

Remember when some jokester came up to you and asked, "What's a henway?" You probably said, "I don't know." To which the joker replied, "About 3 pounds." He may have made clucking sounds. Congratulations if you refrained from punching him.

The answer to the Benway question is, "It depends." *PC Magazine* executive editor Ben Z. Gottesman has been tracking his weight for the past five years. For a tall, slim guy, he has shown—shall we say—a large delta. He's kept all the weight data in an Excel spreadsheet, and he has even included comments for significant events, such as parties, holidays, and illnesses. Suffice it to say, however, that the phrase *pig out* occurs far more often than *begin diet*. Ben has done some pretty cool analysis tricks and pivot tables in the spreadsheet. In fact, it's a shining example of how to use Excel to track recurring events where the trend is as important as the data points.

Ben and I wonder if you could do something better—or much different—with the data. So we hereby announce the Benway Programming Contest. Download Ben's spreadsheet and then use whatever data analysis tools, programming languages, or visual presentation software you think is best to depict and analyze Ben's journey up and down the scales.

SOFTWARE JOCKS: SHOW YOUR STUFF

The hardware mavens have had a field day at our Fastest Geek competitions. Perhaps your software jocks can best Ben's analysis, but by all means think outside the box. Not to be too generous with hints, but in addition to color-mapped 3-D charts, consider interactive displays—go a little crazy. Grab the waistband of a Ben caricature with your mouse and drag it to show the time periods that he was different sizes. Feed the weight database into a music composition program. Show the net gain and loss of calories in a given period as bagels and charcoal briquette icons. Do data-driven graphics. Generate a calendar where the font size of the date varies with Ben's weight.

We don't have categories; we'll let the entries suggest the categories, while hoping that at least a few defy categorization. If we single out your submission for mention, we'll send you a cool *PC Magazine* T-shirt. We'll place notable entries on our Web site so others can appreciate your handiwork.

You can download the file from <ftp.extremetech.com/pub/contest/benway.zip>, which contains the Excel spreadsheet and Ben's nice little Flash demo of how the spreadsheet works. We've also tossed in an image of Ben, in case that helps with a visual presentation or interface. The deadline for submissions is March 1, 2004. E-mail your entries to me at bill_machrone@ziffdavis.com; please remember to zip your files for size reduction and because our anti-virus software and firewall will not pass EXE files. (If you send me a virus, your subscription will be summarily terminated!) All entries become the property of Ziff Davis Media, and you grant us the right to republish them in any medium. Be sure to include both your e-mail address and a postal address.

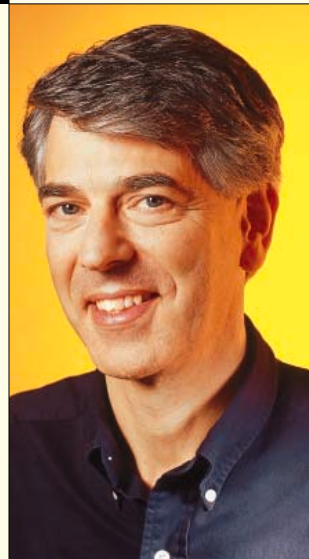
PHOTO STORY FOLLOW-UP

I wasn't alone in wanting to produce animated photo presentations ("Every Photo Tells a Story," December 30). Several readers have suggested other products that can mix animated photos and videos with voice-overs and music. Animating still photos, now commonly called "the Ken Burns effect," is the new, gotta-have-it feature in all these programs. (And yes, I know that Apple did this first in iMovie.)

PC Magazine reader Todd Mitchell has had success with PictureToTV.com's MemoriesOnTV (www.picturetotv.com). The program does a nice job with slide shows but requires additional software to burn them to disc. And Dave Herring expressed his satisfaction with 321 Studios' DVD X Show (www.321studios.com). It can do multiple targeted zooms on individual photographs. I took a closer look at DVD X Show myself, and I was impressed with the features, especially the ability to time the duration of each zoom.

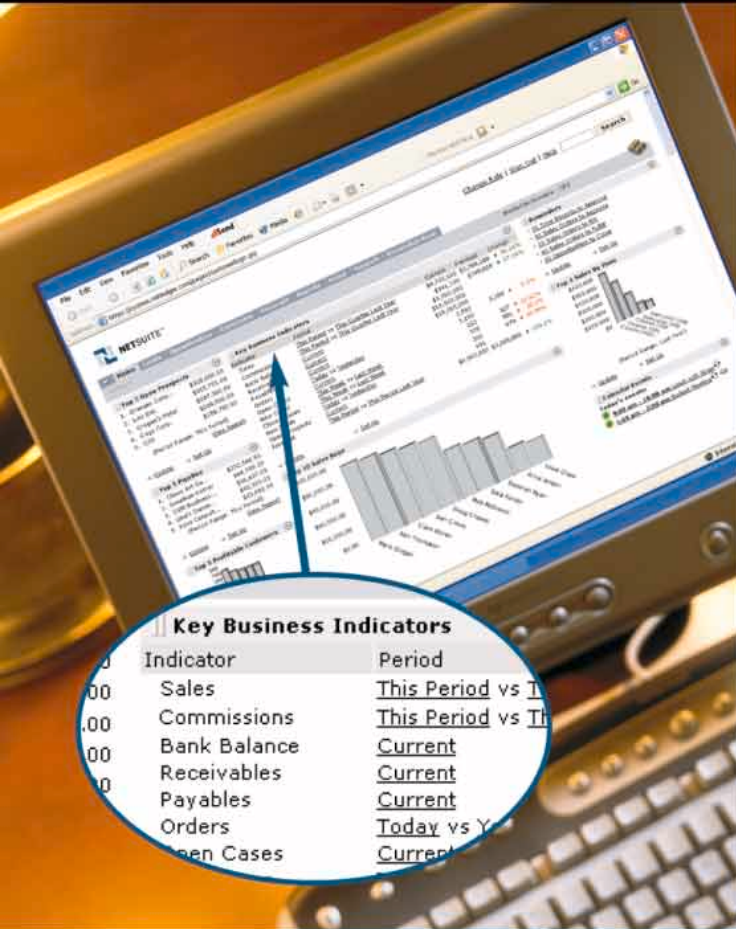
In the interim, I've discovered Sony's Screenblast Movie Studio, which combines Screenblast and the excellent Sonic MyDVD software to create videos full of impact. What I haven't discovered is an easy way to burn a DVD from the WMV file that Microsoft Plus! Photo Story creates. If you know how to do this, please let me know.

Bill Machrone is VP of editorial development for Ziff Davis Media. Visit his digs at www.extremetech.com. You can also reach him at bill_machrone@ziffdavis.com.



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John C. Dvorak

Getting It

For the past year, I've been preaching that the dot-com boom is going to recur with the success of the Google IPO. Only Microsoft can thwart the next boom, by buying Google outright. If the Google IPO goes as planned, investment bankers are going to loosen up—and then the deals start all over again.

But what's to prevent another collapse? What have we learned from the last fiasco, and how can we spot the next one before we lose our money?

Many fads begin in California, so you have to understand California culture. Some fads become fashion; most do not. One that crept into the collective unconscious of the trend-crazed California citizenry was the dip into self-actualization movements, beginning in the late 1960s and continuing strong until the mid 1980s and even the early 1990s.

California has long been clogged with all sorts of New Age training systems and methodologies. Even today, the state is crawling with crackpots promoting weird schemes designed to make you a better person. The successful ones do the best job of separating you from your money.

A prime mover years ago was a character named Werner Erhard, who developed mind control-based "training" techniques to help people improve themselves. Erhard Seminars Training (est) was popular among go-getters looking for success in life and in business.

Erhard's est established a thought process that still permeates California culture and the business investment environment. Most Erhard audio tapes were full of reassuring commentary about how est was fabulous and how it worked better than anything else. Often heard was the comment that people who say est is bogus simply "don't get it."

This idea is key. The rationale is that people don't get it because they cannot see or understand a *paradigm shift* (another key phrase). This simple notion permeated est and also permeated the dot-com revolution.

I was lucky enough to host the TV program *Silicon Spin* in the midst of the dot-com phenomenon. Executive after executive would come on the show and say that "people don't get it," to explain how online grocers, for example, not only were going to be successful but would dominate their market. The execs

would throw out some numbers but make no connection between the numbers and reality.

Pets.com, for example, came about only because people buy a lot of pet food. The investors made a ludicrous leap of faith in assuming that people would begin to buy pet food online and have it shipped via FedEx. Why? Because there was a *paradigm shift*. If you said Pets.com was a crazy idea, you were told that "you don't get it."

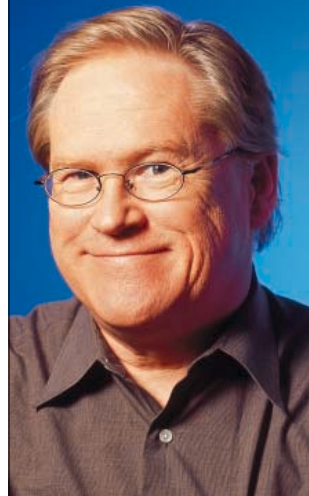
The "you don't get it" retort serves only one real purpose: to stop a conversation. You can use it as a ruse to end any debate or argument. It's uniquely dismissive, and nouveau-management decision making has been heavily influenced by the concept.

The world of mumbo-jumbo self-actualization hokum is important to the dot-com litany. Much of the computer revolution is tied up with such thinking systems. Their influence is here to stay, just as the influence of drugs—marijuana, cocaine, and methamphetamines—fuels many high-tech companies at one level or another. Just look at some of the boom-time business plans, in retrospect. The people who drew them up were snorting something. Welcome to California.

We have seen multiple versions of California group-think fads come and go. The personal-computer revolution itself began in California. It was going to change everything and liberate us. Instead, it made big business bigger and the MBA king of the hill. Then there was the artificial intelligence (AI) revolution of 1982, which died in 1984. Pen-based computing was also going to change everything. It died but has recently reemerged as tablet computing, which awaits the same fate. The CD-ROM revolution blossomed and died in the San Francisco Bay Area, as did dot-com mania.

What's next? It's hard to predict, because the group-think mind can go in any direction in the blink of an eye. But whatever is next will probably be Internet-related. The only sure thing I can predict is that things will not turn out as expected. Then again, when it happens, I probably won't "get it" anyway.

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.



If the Google IPO goes as planned, investment bankers are going to loosen up—and then the deals start all over again.

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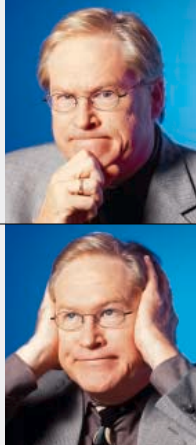
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JOHN C. DVORAK

The Buzz Is Abuzz Dept.: One of the most fascinating technologies out there is *ultrawideband* (UWB), formerly known as *pulse radio*. I've been writing about this for about five years, waiting for something to happen. At this point, it looks as though IEEE standards will let UWB deliver a **long-distance, 400-Mbps wireless** channel. This would **revolutionize** everything, if UWB were ever commercialized; that had better happen soon. Until recently, **bureaucrats**, the military, and other vested interests have kept the technology out of the public's hands.

Ultrawideband works unlike any other form of broadcasting. It relies on a **sputtering signal** across a wide range of frequencies. The pulses of the sputtering signals are received and **resequenced** to re-create the initial information. This is the same technology that can be used for ground-penetrating radar and could eventually be used to **see through walls**.

The real potential, though, is for cheap wireless broadband. UWB is believed to be so important that Texas Instruments, which holds a slew of blocking and primary patents on the technology, announced in December that it will **give away patent licenses** to people who get on the IEEE 802.15.3a bandwagon and begin building products. TI appears to be doing this from the goodness of its heart. Hmm, a semiconductor company with a heart. Yeah, right.

The fact is that ultrawideband **has struggled** to get FCC approval over the years. Airline pilots, phone companies, the Army, and others have done whatever they could to **submarine the technology**. The Army, for example, wants to keep UWB for itself. It even has its **own name** for the technology: LPI/D, meaning *low probability of interception and detection*, because the pulses are not modulated in any normal way.

An argument has been made that the buzz from UWB will interfere with con-

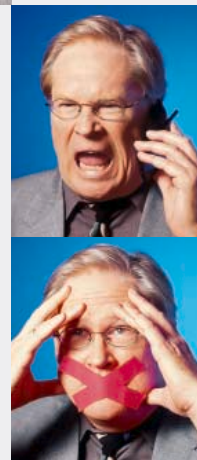
ventional radio, TV, GPS systems, and cell phones. UWB folks argue that a **blender sends out** more UWB-like signals than a typical UWB radio. The true fear is that UWB is an incredibly **disruptive technology**. The window of time for implementation may be short, if some products don't get to the market before the anti-UWB forces regroup. Texas Instruments knows that. **Watch this column** for updates on this breakthrough.

This Time It's True Dept.: Remember when Lexar was selling flash memory cards with all sorts of exaggerated speed claims? SanDisk disputed most of the claims. Curiously, the marketing and PR guy at Lexar who promoted all this speed stuff went to SanDisk and hasn't been promoting the company's **new Ultra line** of flash memory cards as heavily. (I embarrassed him about the older episode when I last saw him.) Actually, Ultra memory and much of the new flash memory are **at least twice as fast** at loading images in real-world tests. It's astonishing.

When 10 seconds drops to 4 seconds while you are shooting images, **that's a big deal**. Now if only the companies would standardize a speed specification and label products with it, so we can compare products! That would be even better than calling something *Ultra*.

While on the Subject of Digital Photography Dept.: I've recently become a huge fan of the Foveon CMOS sensor. The Sigma SD10 with the built-in Foveon X3 CMOS image sensor produces the most stunning images of any digital camera I've used. **More amazing**, though, is the Foveon software, which is used to fine-tune photos on a computer before converting them to JPEG or TIFF files.

The SD10, for example, produces only RAW files—complete data files of everything collected by the sensor. RAW files contain much more information than TIFFs or JPEGs. A **genius** at Foveon named Paul Hubel, using concepts based on the theoretical work of the



Ultra memory and much of the new flash from all vendors is at least twice as fast at loading images.

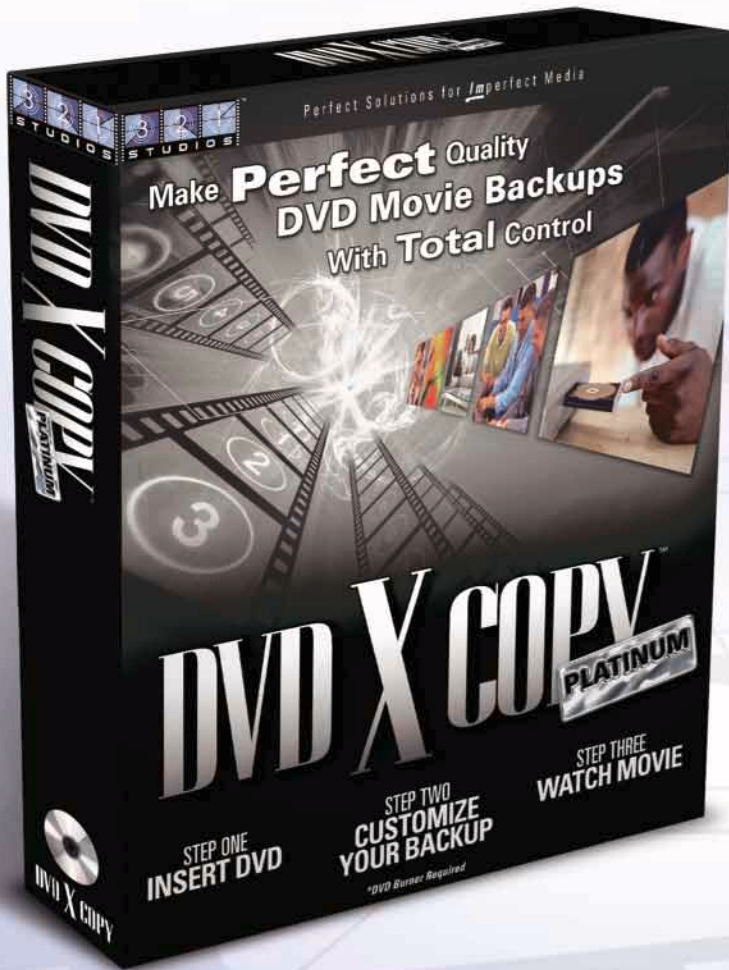
enigmatic and somewhat mysterious Edwin Land (of Polaroid fame), has perfected an algorithm that does a post production flash fill on any image: It brings out the brightness and detail of dark objects without changing anything else, including brightly lit objects in the same picture. The resulting photos look exactly as if you had used a big flash fill light or reflector when shooting. This effect has to be **seen to be believed**. Serious photographers must consider Foveon-based pro systems.

Here We Go Again Dept.: Another salvo in the never-ending disc **format wars**. Even before the DVD-RW situation has resolved, next-generation, **high-definition** DVD is heating up. The Blu-ray Disc was expected to be the top contender, but now a new format called HD-DVD, which uses a **violet laser** instead of a blue one, has emerged and is getting the most approval from the DVD Forum. How many times have we seen this kind of situation?

This will go the way of every other battle: two technologies contending for domination, with a **third laggard** in there to mix things up. Whatever the outcome, look for the new DVDs to hold about 20 gigabytes per layer. And before you think these things will be useful in data backup: By the time they are writable and available, your system will be holding a few terabytes of junk.

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On Technology

Saving Private Information

The acronym *NAS* (pronounced “nass,” sometimes sounded out as “N-A-S,” and rarely spoken as “network attached storage”) stands for one of the least sexy computing topics this side of double-entry accounting software: data backup. A *NAS* device is an information appliance—a hard drive in a shoebox with Linux (invariably) and an Ethernet jack. *NAS* just got a bit cooler, though, with the advent of several devices aimed at the needs of small businesses, home offices, and even personal users.

A *NAS* device is very small these days—and relatively cheap. Businesses use *NAS* to back up workgroups or small-office files. Home-office and family users who want to share files on a common device also use *NAS*. The trouble has been that most *NAS* devices have cost over \$1,000, and the handful of *NAS* vendors have moved upmarket over time. For instance, Snap Appliance, which created the *NAS* category in the 1990s, charges \$650 for its current smallest model, the 80GB Snap Server 1100. Bigger models run in the thousands. The products currently coming to market, however, from such companies as Belkin, Iomega, Linksys, and Mirra, are just half the price of the Snap 1100 for the same amount of storage or more.

In 2003, Linksys shipped the Linksys EtherFast Instant GigaDrive. It has two drive drawers, which can hold 80GB or 120GB drives, as well as a parallel port. The GigaDrive is a little pricey (\$500 street), so expect Linksys to be back with drives that offer more value for the price. The company anticipates that the son-of-GigaDrive will be the back end for a digital entertainment hub, a device that pulls multimedia files off your PC and plays them on your stereo or TV. Actually, all the vendors of affordable *NAS* devices have this in mind.

Iomega, which alternates what-were-they-thinking clunkers (such as the Iomega Klik! and Peerless) with solid new products, should have a hit with the Iomega Network Hard Drive. More the size of a large transformer than a shoebox, the drive has both USB 2.0 and Ethernet connections. USB is important, because there's always somebody somewhere who can't make even the simplest Ethernet device work. Not to mention that it's virtually impossible for a computer running Windows XP not to recognize a

USB hard drive instantly. Also, Iomega includes terrific backup software. At \$300 for 120GB and \$430 for 250GB, you're paying a premium of about \$150 over what it would cost to buy the hard drive all by itself.

The Buffalo LinkStation is similar: A 120GB unit costs \$300 and has Ethernet and two USB ports—one port for a direct connection to a PC and the second for use as a print server. Connect the LinkStation to a wireless access point and you can put it anywhere, if you don't mind slower transfer rates. The other devices can also be connected to a WAP and usually to a USB Wi-Fi adapter.

The Mirra M-80 and M-120 appliances cost more—\$400 and \$500 for 80GB and 120GB devices, respectively. These drives offer lots of extras, including continuous backup, multiple backups of documents in progress (versioning), and setup that—at least in the beta version we saw—appears especially simple (idiot-proof, that is). You can also access files remotely, as you can with the Linksys device.

Small businesses concerned less about the initial cost and more about getting their data safely off-site should look at the IntraDyn RocketVault (\$1,500 and up), which simultaneously backs up locally and remotely. The only similarity the RocketVault has with other *NAS* devices is that it's a shoebox with a big hard drive. The other drives are good places to store duplicates of digital photos that anyone can access, but the RocketVault is meant for safeguarding vital business files. It secures data that can protect you in case of a lawsuit or hiring grievance. It's an enterprise-class backup device for small offices.

If you don't need a network connection, the best direct-attached product is still the Maxtor OneTouch line of USB/FireWire hard drive appliances, which cost from \$200 to \$400 for 120GB to 300GB models and come with excellent backup software. If you're cheap but you still recognize the need for backup, you can buy an external hard drive enclosure with a power supply and USB 2.0 interface (no Ethernet) for \$50 or less and drop in a hard drive. Wait for the right sale and you could have a 200GB drive backup device for \$150.

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.



Some new *NAS* devices are aimed at the needs of small businesses, home offices, and even personal users.

SOLUTIONS

Spreadsheet ≠ Database

Making a spreadsheet do a database's work can lead to trouble.

Here's an introduction to relational databases. **BY HELEN BRADLEY**

Since the days of Lotus 1-2-3, people have used spreadsheet programs for everything from word processing to data management. Doing the former is silly. Doing the latter, however, is viable, especially in the latest version of Microsoft Excel. But though you may be more comfortable with Excel, a real relational database program like Microsoft Access is a better choice for managing data—for a number of reasons.

- Databases are safer. Excel, for example, does everything in memory, so that any unsaved data may be lost if your system crashes. Databases write data to the hard drive immediately.

- Databases can handle more data. Sure, Excel can technically handle more than 65,000 rows of data, but doing so will likely bog down even the fastest PC.

- Databases can easily link tables of related data together, such as customers and orders or musical groups and albums (as well as the songs on each album). This is where the words *relational* and *database* come together. Storing related data together in a single table or spreadsheet can be unwieldy and invite errors.

We'll look at a situation for which Access is a better tool than Excel and show you how an Access solution works. If you've never used Access before, that's okay; we'll walk you through how to create everything from scratch. We used Access 2002 for the instructions, but you'll find the process is similar in all versions of Access. We chose Access because so many users have it already, but you can do the same things in other relational databases such as FileMaker or Microsoft SQL Server. For more on picking the right database, see "Databases for All Reasons" in our issue of January 2003.

MORE THAN A LIST

Consider a veterinarian's office: To record pet and owner details, you could use a list in an Excel worksheet, but you'd encounter difficulties. If you create one record for each owner, how would you handle an owner with multiple pets? You could add a field for each pet, which would work for most clients. But a client who runs a breeding kennel with 25 cats and innumerable kittens would force your data record to grow to an excessive length.

On the other hand, if you organize your data so you have one record per pet, you would have to enter the owner details for each pet in the household. This is unnecessarily repetitive. And if an owner changes his address, you would have to find and update all his pets' records individually.

The better solution is to have two lists—one with the owner details and one with the pet details—and then link the two by including a field in both lists with a common piece of information. For example, give each owner a unique code number, which you can then use in his pets' records. That way, you can find a pet, check the owner code, and then find

the owner's details in the owner file. Likewise, you can look up an owner, find his code, then extract all the pet records with that owner number.

Although you have two lists, each owner and each pet has only one entry in the system. It's neat and efficient, and it solves another problem our veterinarian may encounter: When client breeders sell kittens to new owners, the new owners may become clients, too. To change a pet from one owner to another, simply change the owner code in the pet's record and if necessary add a new owner record.

CREATE THE DATABASE

To create the database requires two tables, one for owners and one for pets, with a field common to both—the owner code. We will set up the relationship between the two tables and add a form to make it easier to enter data.

Each table needs a structure that includes a list of field names and types, as well as the sizes of the fields. Each table must also have a *primary key*—a field that contains a piece of information unique to that record. In the owner's table, the primary key is the owner code; in the pet table, we'll use a similar field called the pet code. We will use an Auto-Number field type for each. Access will then assign a unique sequential value to that field for each record.

To build your database, launch Access, choose *Blank Database* from the task pane, and name your file Vet.mdb. Click on *Create* then double-click on the *Create table in Design view* option. The *Table:Table* dialog will appear. Type *ClientNo* as the first field name, then tab over to the next column and enter *AutoNumber* as the *Data Type*. (Access automatically completes the entry once you've typed the first letter.) Now enter the rest of the data as shown on the next page. Here are the fields and types:

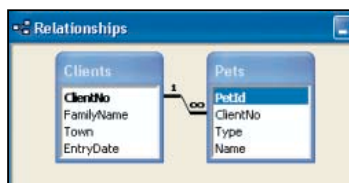
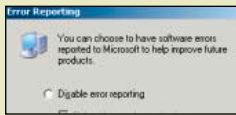
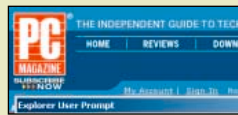


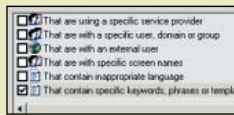
FIGURE 1: Clients and Pets have a one-to-many relationship.



64 Desktop: Windows error reporting.



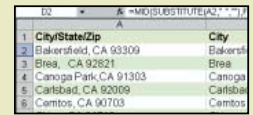
66 Internet: Bookmarklets for smarter surfing.



68 Security Watch: IM and P2P security.



70 Enterprise: 64-bit computing.



75 User to User: Tips and tricks.

MAKING TECHNOLOGY WORK FOR YOU

Field Name

ClientNo
FamilyName
Town
EntryDate

Data Type

AutoNumber
Text
Text
Date/Time

If you want, you can add a description for each field to explain its contents as well as a caption. The caption is a name that is used in place of the field name in reports and forms. If you use shortened or cryptic field names, captions are a good idea.

To set a primary key, right-click on the area to the left of the *ClientNo* field and choose *Primary Key*. A key icon will appear, indicating that the field is the primary key. Save the file with the name *Clients*, and click on the table's *Close* button.

Repeat this process to create a second table for pets with these fields:

Field Name

PetID
ClientNo
Type
Name

Data Type

AutoNumber
Number
Text
Text

Set *PetID* as the primary key, name the table *Pets*, and close it.

Once you have created the tables, you can define the relationship between them. When you do this, Access helps you maintain your data integrity. For example, you can set up the relationship so that removing an owner automatically removes any of his pets from the *Pets* table.

Choose *Tools | Relationships*. When the *Show Table* dialog appears, click on the *Clients* table and then select *Add*. Do the same with the *Pets* table and then click on *Close*. Small dialogs will appear, showing the structure of the two tables. Drag the *ClientNo* field from the *Client* table and drop it on the *ClientNo* field in the *Pets* table. When you let go of the mouse button, the *Edit Relationships* dialog appears with these two fields listed. Select the *Enforce Referential Integrity* check box and the *Cascade Delete Related Records* check box. This ensures that if an owner is removed, all his pets are removed, too. Click on *Create* to set up the relationship, which is one-to-many—one owner can have many pets (Figure 1). Click on the window's *Close* button and answer *Yes* when prompted to save the changes.

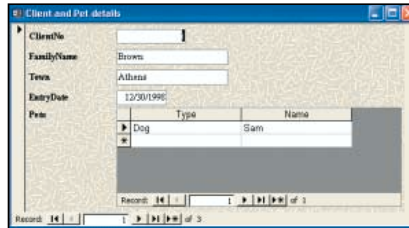


FIGURE 2: Our form shows data from both tables in an easy-to-grasp format.

Now you can enter data into the tables. Click on *Tables* in the *Objects* bar and double-click on *Clients* to open it in datasheet view. Type the following data into the table (the number in the *ClientNo* field will be entered automatically):

CLIENTNO	NAME	TOWN	ENTRY DATE
1	Brown	Athens	12/30/1998
2	Smith	Athens	2/2/2000
3	Green	Atlanta	5/5/2000

Close the table and then repeat the process to add the following data to the *Pet* table (the *PetID* will be added automatically):

PetID	ClientNo	Type	Name
1	2	Cat	Peaches
2	1	Dog	Sam
3	3	Horse	Dobbin
4	3	Cat	Ginger

CREATE A DATA ENTRY FORM

Although you could continue to add data using the two tables separately, it's easier to use a form that displays all the related data. Access can do this for you. Close both tables and click on the *Forms* icon in the *Objects* bar and double-click on *Create form by using wizard*.

From the *Tables / Queries* drop-down list choose *Table:Clients* and click on the double angle brackets (>>) to move all the *Available Fields* to the *Selected Fields* pane. Then choose *Table:Pets* and move only the *Type* and *Name* fields from the *Available Fields* to the *Selected Fields* pane. Then click on *Next*.

Access will ask you, *How do you want to view your data?* Choose *By Clients* and click on the *Form with subform(s)* option and then choose *Next*. When prompted,

select *Datasheet* as the layout type for the subform and choose *Next*. Pick a style for your form (any will do) and click on *Next*. Type a form name, such as *Client and Pet details*, click on *Open* to view or enter information in the form and click on *Finish* to end.

A form appears on the screen with the client data on top and the details of the pets belonging to the client in a table below (Figure 2). You'll see two sets of record navigation tools. The one at the bottom of the table is for the *Pets* subform and the other is for the client records. Click on the *Next Record* button for the *Client* data and you will see that two pets are displayed for Record 3.

Now you can add a new client and his pet, as well as add a new pet to one of the existing clients. To see what is happening behind the scenes, close the form and open the *Pets* table. You'll see that the data has been entered into the fields *PetID* and *ClientNo*, even though neither field was included on the form. The *PetID* number is automatically entered, because the field type is *AutoNumber* and the *ClientNo* field is added automatically, since the records are related through the form's design.

Remove a client from the *Clients* table by opening the table, selecting the client, and clicking on *Delete*. You'll be warned that a record in another data file will be affected (the client's pets will be removed when the client is). This is the result of selecting the *Cascade Delete Related Records* check box when setting up the relationship. The same does not work in reverse and it is possible to have a client with no pets in the *Clients* table.

Our scenario is a simplified one to help you see how you can set up a relational database. To learn more, check out the database section of your local library or bookstore. A good place to start is with a book such as *Database Design for Mere Mortals: A Hands-On Guide to Relational Database Design* by Michael J. Hernandez.

Helen Bradley is a contributing editor of PC Magazine. You can contact her at helen_bradley@ziffdavis.com.

Windows XP Error Reports

Should you send those crash reports to Microsoft?

By Sheryl Canter

When a program crashes under Windows XP, a dialog box may ask you to send an error report to Microsoft (see Figure 1). Does sending a report do any good? More important, do error reports contain private information about you?

Windows Error Reporting (WER), introduced with Windows XP, lets users send detailed reports when programs crash and lets vendors inform users of fixes and workarounds for reported errors. The error reports are stored in a password-protected database.

Programs must be specially written to use WER. Microsoft uses WER in all recent programs and strongly encourages other companies to do the same. There is no charge for using the system. The list of participating vendors is long (see <https://winqual.microsoft.com/parentorgs.asp>), and the feedback has been positive. Rep-

resentatives at Zone Labs say that Error reports can inadvertently contain private information. For example, a snapshot of memory might contain your name, fragments of a document you were writing at the time of the crash, or data recently submitted to a Web site. Private information also may be in Registry keys, log files, or documents sent with the error report.

Windows Error Reporting (WER), introduced with Windows XP, lets users send detailed reports when programs crash and lets vendors inform users of fixes and workarounds for reported errors. The error reports are stored in a password-protected database. Programs must be specially written to use WER. Microsoft uses WER in all recent programs and strongly encourages other companies to do the same. There is no charge for using the system. The list of participating vendors is long (see <https://winqual.microsoft.com/parentorgs.asp>), and the feedback has been positive. Rep-

Unless identifying information is captured inadvertently, the basic report is anonymous. But vendors can incorporate

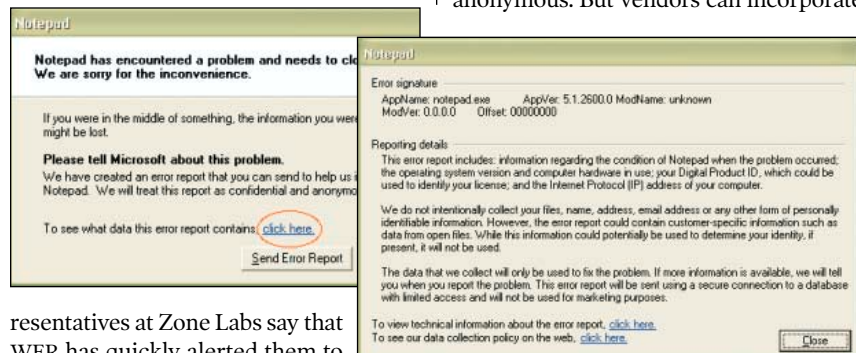


FIGURE 1: Vendors writing to the Win XP API can ask users to submit error reports if an application or driver crashes.

resentatives at Zone Labs say that WER has quickly alerted them to incompatibilities with new operating systems and patches.

WHAT ABOUT PRIVACY?

The data collected in error reports depends on the type of error and may include recent actions (for example, menu choices), network information, machine configuration, relevant files (such as documents, logs, or configuration files), a snapshot of memory, and software configuration information obtained by scanning file versions and Registry settings. A detailed list can be found at <http://oca.microsoft.com/en/dcp20.asp>.

other options when WER-enabling their software. After submitting an error report, you may be asked whether you'd like to fill out a survey or track the status of your report. Such options remove anonymity.

With the latest update to WER, information related to your report, if available, is displayed automatically when you submit the report. This may include a hotfix, an update, or information on a



FIGURE 2: You can configure WER not to send reports or to send reports only for certain programs or types of programs.

workaround. For details, see the Microsoft Knowledge Base article 821253 (<http://support.microsoft.com/default.asp?scid=kb;en-us;821253>).

CONFIGURING WER

By default, Windows XP offers to submit all error reports, but if you are logged on with Administrator privileges, you can customize which errors are reported or disable error reporting entirely.

To change your WER options, open the Control Panel, launch the System applet, and click on the Error Reporting button in the Advanced page. This launches the Error Reporting dialog (see Figure 2).

If you select *Disable error reporting*, you can still be notified when critical errors occur. To see the list of errors, go to the System Tools folder under Accessories, launch the System Information applet, expand the Software Environment node, then highlight Windows Error Reporting.

IT administrators can use the Corporate Error Reporting tool to collect reports throughout their organizations and select which to submit. The tool is part of the Office XP Resource Kit (<http://go.microsoft.com/fwlink/?LinkID=6754>). To configure Corporate Error Reporting, enable the Report Errors policy setting in the Group Policy applet and set the Corporate upload file path to the local file server where the tool is installed. All error reports will then be directed to this file server for review.

Submitting crash reports provides good information to vendors but use the feature cautiously, since private information can be included in the error report.

Sheryl Canter is a contributing editor of PC Magazine. You can visit her home page at www.sherylcanter.com.



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²For a free copy of the standard limited warranty see a reseller where Acer products are sold or write to Acer America Corporation, Warranty Department, P.O. Box 6137, Temple, TX 76503.

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acer[®]
Empowering People

Bookmarklets Boost Web Surfing

Tiny JavaScript commands supercharge your Net experience with a wide variety of functions. **By Tara Calishain**

Most if not all Internet surfers use bookmarks—saved links to the sites you visit most often. But not everyone is familiar with *bookmarklets*. These are not plain HTML links; they're small bits of JavaScript code that you run from your browser, the same way you use bookmarks. These mini-utilities (also called *favelets*) search, translate, shut off music files that play when a page launches, list all the links on a page, and more. Read on and get started using book-

marklet and drag it to the Favorites folder of your choice or set up a separate bookmarklets folder in your *Favorites* list. You can also right-click on the link and choose *Add to Favorites*. IE may warn that the link is not safe; this is because the bookmarklet contains JavaScript. Specify that you want to continue and the bookmarklet will be added to your Favorites.

- In Mozilla, right-click on the link and choose *Bookmark This Link*, or click and drag the link to your personal toolbar.
- In Opera, right-click on the link and choose *Add Link to Bookmarks*, as you would normally save a bookmark.

Despite IE's warning, bookmarklets are pretty harmless. The JavaScript used must be very short. If you mouse over a bookmarklet, you can see most or all of its code in your browser's status bar. It's difficult to hide anything malicious

in such a small package, but if you are concerned, you can review the bookmarklet before deciding to keep it. Either way, you're not installing a program; you're just adding a bookmark to your browser. Getting rid of it is as simple as deleting the bookmarklet from your *Favorites* list.

WHERE TO FIND THEM

Now that you know what bookmarklets are, here are some collections of cool bookmarklets you can browse to start your own collection.

Bookmarklets (www.bookmarklets.com) is probably the most famous bookmarklet site. The links are divided into several categories, including Page Data, Search Tools, and Calculators/Converters. The bookmarklets here let you search major sites quickly, convert measurements, and change a Web page's text or background colors. Each listing has icons indicating compatible browsers.

WorldTimZone (www.worldtimzone.com/bookmarklets) covers seven categories, including Navigation, Search Engines, and Word Definitions (dictionary, thesaurus, acronyms, and more).

If you do a lot of HTML authoring, you'll like **Favelets** (<http://tantek.com/favelets>). The bookmarklets here help you automate design and validating tasks, including validation of CSS or HTML, resizing windows all the way down to fit PDA screens, and viewing CSS and images.

At **Jesse's Bookmarklets Site** (www.squarefree.com/bookmarklets) you'll find a script that lets you send money to a site's owner through Yahoo! PayDirect, another that lets you transfer cookies to another browser, and an entire category containing favelets that let you fix site annoyances (such as removing plug-in activity, deleting cookies, and more).

Milly's Bookmarklets (www.imilly.com/bml.htm) has bookmarklets that focus on specialized searches in Google.

The aptly named **Bookmarklets for Opera** (www.philburns.com/bookmarklets.html) focuses primarily on Opera, but many of the items also work with IE and Mozilla. Options here include searching, code validation, and page data.

The **Bookmarklets** collection at <http://www.homes.uni-bielefeld.de/mheumann/soft/misc/bookmarklets.html> has some interesting items that let you check a site's server uptime, count the number of images on a page, increment the number in a URL ahead or back (useful when surfing documents or images), and more.

Explore the bookmarklets in these collections. You'll find at least a few that will



FIGURE 1: When the text on a Web page is hard to distinguish from the background, use the Remove Background Image bookmarklet to make the page more readable (right).

marklets; they'll make your browsing—and even site developing—a lot easier.

BOOKMARKLETS AND BROWSERS

Because bookmarklets are made of JavaScript, you'll obviously need JavaScript enabled in your browser for them to work. (If it's not enabled, go to Internet Explorer's *Tools* | *Internet Options* | *Security* | *Custom Level* and check the appropriate box.) Also, many bookmarklets are browser-specific; most work with IE, and many work with Mozilla, Netscape, and Opera. Most bookmarklet listing sites note which browsers work with which items.

Adding a bookmarklet to your browser is no big deal. It works much like adding a bookmark.

- In Internet Explorer, click on the book-

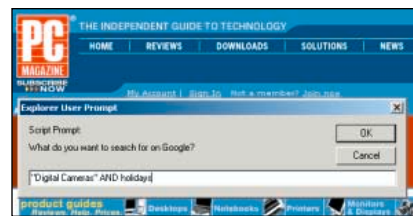


FIGURE 2: Enter your search terms in a Google bookmarklet, and your browser goes right to the results page.

make your surfing so smooth you'll wonder how you got along without them!

Tara Calishain writes ResearchBuzz, a weekly newsletter on Internet research and online information collections (www.researchbuzz.com).



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SECURITY WATCH

IM and P2P Security

The explosion of IM and P2P in the workplace can be a security nightmare. Here's how to keep your network—and your company—safe. **By Leon Erlanger**

You have all your e-mail and Web-filtering software in place, and you carefully monitor message logs for signs of abuse. But little do you know that for months, a disgruntled employee has been instant messaging company secrets to a friend who works for one of your competitors. And he's been using commonly available utilities to disguise sensitive files as MP3s, which he shares openly using peer-to-peer file-sharing services. The explosion of instant messaging and P2P file-sharing applications in the workplace is a new security challenge. Employees can easily download such applications for free, often without IT detection. The threat from such applications amounts to much more than simply lost productivity and wasted time.

Divulging company secrets is only one of the serious threats posed by IM and P2P applications. Both provide new entry points to your network for intrusions, data theft, denial-of-service attacks, viruses, and worms. In fact, security vendor Symantec reported in one of its biannual Internet Security Threat Reports that the number of attacks over IM and P2P systems quadrupled from January to June 2003. Both applications are adept at bypassing firewalls using port-scanning and tunneling techniques. And none of the popular IM clients offers strong authentication or encryption, so they are vulnerable to account hijacking and eavesdropping for valuable or damaging company information divulged by unwitting employees.

Then there are the bandwidth issues. Since each P2P node is acting as both a

client and a server, your precious network bandwidth may be devoured not only by your internal P2P and IM users but also by P2P users all over the planet downloading songs from your users' shared directories.

And don't forget the legal issues. The Recording Industry Association of America (RIAA) has repeatedly warned Fortune 1000 companies that they could be liable for employees that break copyright laws by using their networks to download, store, or distribute music or movies illegally. In fact, the RIAA sued one Arizona-based software company in 2002, resulting in a settlement of \$1 million. Companies that don't prevent downloading of pornographic material risk hostile-workplace lawsuits and negative publicity.

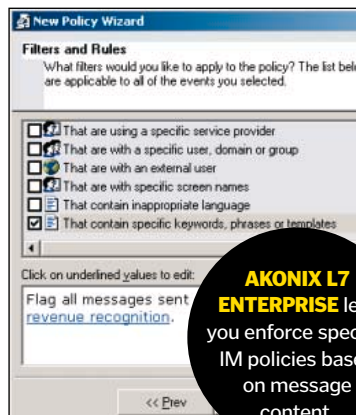
So what can you do? First, set up a company policy that clearly states when, how, and by whom IM and P2P applications and services may be used. Then you should use available network hardware and software to block or regulate the applications, or (in the case of instant messaging) bring them in-house, where you can manage and secure their use.

One way to block IM manually is to add the server address names or IP addresses of all known IM servers to your firewall block list.

This is only a start, however, because it's not easy to keep up with all of them.

Some firewall vendors have added protocol detection capabilities

to their products, allowing them to identify and block IM and P2P applications or, in some cases, to identify common attacks that use such applications. To get even more granular protection, install personal firewalls on all your PCs, which



AKONIX L7 ENTERPRISE lets you enforce specific IM policies based on message content.

THE LOOKOUT

PHISHING FOR EBAY USERS

E-mail scams known as *phishers* continue to evolve. According to antispam company MailFrontier, a new bogus e-mail that appears to be from eBay indicates that the site has suspended your account because it suspects the account has been hijacked by a foreign IP address. As with previous scams, you are asked to click on a link to a form to confirm your identity. What's different about this scam is that the link doesn't take you to a fake site that looks like eBay; rather, it takes you to a redirection page that uses JavaScript to spawn a pop-up form and then redirects you to the legitimate eBay site. What you see is the fraudulent form on top of a real eBay page.

Be suspicious of any e-mail message that asks for your personal information. Don't ever follow a link in an e-mail that asks you to enter or edit sensitive information. Close the message and either log on to your account directly or call the company.—Sharon Terdeman

you can configure to deny communications at the desktop level to specific applications, including IM and P2P.

If you want more fine-grained control, gateway-scanning and -filtering solutions from Akonix Systems, FaceTime Communications, SurfControl, and WebSense sit behind a firewall, where they can monitor the use of IM and P2P apps, block them, archive messages, or, in the case of Akonix L7 Enterprise, enforce specific corporate policies involving message content, file transfers, time-of-day use, and other variables. L7 Enterprise can also keep all internal IM communications behind the firewall.

The best way to reap the benefits of corporate IM while protecting your company may be to invest in an enterprise IM solution. For more information, see our story "Corporate IM" (www.pcmag.com/article2/0,4149,1358192,00.asp).

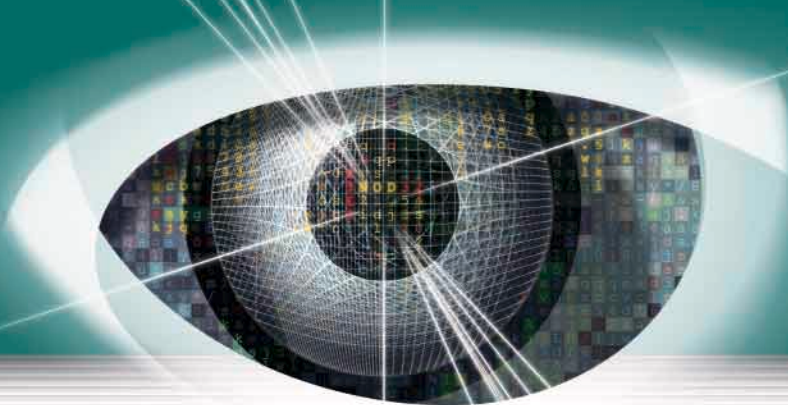
Finally, an enterprise antivirus package from McAfee, Symantec, or another vendor is essential. You should incorporate antivirus protection on every desktop and make sure you keep up with your antivirus definition updates in addition to OS, IM, and P2P software patches.

Leon Erlanger is a freelance author and consultant.

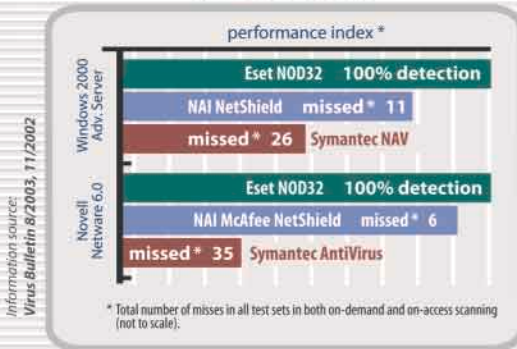


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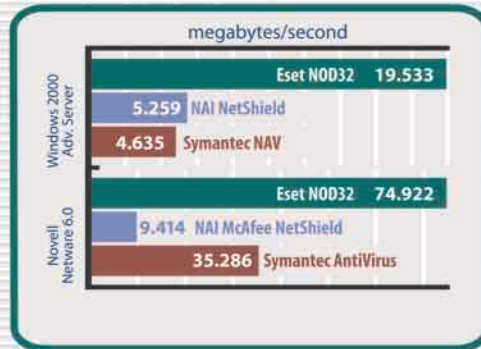
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The 64-Bit Advantage

The giant TeraGrid Project showcases the promise of next-generation processing technology. **By Jim Akin**

Few would dispute that the recent arrival of 64-bit processors in business and consumer PCs marks a significant milestone, but calling it a breakthrough is premature. That will have to wait until more critical applications (and Windows itself) are rewritten to exploit the new chips' horsepower fully.

All those gamers, designers, and data-crunchers who are eagerly awaiting the optimization of their favorite apps can take heart—and perhaps get a glimpse of the future. The TeraGrid Project, a collaboration of five top U.S. research institutions, is already reaping the rewards of its own 64-bit revolution. Launched by the National Science Foundation in 2001, the TeraGrid is a distributed *high-performance computing* (HPC) system—a virtual supercomputer dedicated to scientific research. Assembled from systems powered by standard-issue 64-bit workstation processors, the TeraGrid marks an evolutionary leap in *clustering*, in which relatively inexpensive commodity computers are combined to do work that once required superexpensive supercomputers.

Comparing this “cluster of clusters” to a quintet of networked gamers would be foolish. But in the spirit of applying fluid dynamics to both water pistols and tidal waves, it's fair to consider some ways in which 64-bit computing may benefit the applications of tomorrow the same way that it enables scientific applications on the TeraGrid.

The 32-bit Pentium-class chips that dominate today's desktops fetch and execute instructions from system memory in 32-bit chunks; 64-bit chips handle 64-bit instructions. And that's just what the workstation-class Intel Itanium 2 and HP Alpha chips do inside the TeraGrid's clusters.

New desktop-class 64-bit chips, such as the AMD Athlon64 and the Apple/IBM PowerPC G5, can handle 64-bit

instructions as well, but most PC apps—even the few that optimize some operations to exploit 64-bit processing—still rely on 32-bit instructions. A new generation of games and apps will no doubt take fuller advantage of 64-bit chips. But their ability to harness the new architecture fully may be hampered by the need to interact with Windows, since none of the desktop versions of the OS is yet slated for 64-bit optimization.

A major advantage to 64-bit processors over their 32-bit cousins is support for greater amounts of memory. In theory, a 64-bit processor can address *exabytes* (billions of billions of bytes) of RAM; 32-bit chips can use a maximum of 8GB of RAM. This breakthrough is used to good advantage at the National Center for Supercomputing Applications' (NCSA) TeraGrid, which allocates 12GB of system memory each to half of its 256 Itanium 2 processor nodes. It will be a while before anyone knows how fast Quake would run with that much memory, since PC motherboards don't exceed 8GB of RAM.

Future 64-bit apps will be able to chew on a class of computations known as

floating-point operations far faster than 32-bit apps can. Necessary for 3-D rendering and animation of everything from molecular models to Halo aliens, floating-point calculations are so essential to complex scientific analysis that FLOPS (floating-point operations per second) are used as the unit of supercomputing performance. The ability of 64-bit chips to process floating-point operations faster and far more precisely than their 32-bit counterparts make them powerhouses for simulations and visualization.

The Athlon64 desktop processor is theoretically capable of *gigaFLOPS* speed when operating at its highest level of floating-point precision. When fully deployed in 2004, the TeraGrid is expected to be capable of 20 *teraFLOPS*, or 20 trillion FLOPS.

The TeraGrid's 64-bit underpinnings and distributed architecture may provide a blueprint for future business and entertainment computing. By providing the processing power to sift and manipulate unprecedented amounts of scientific data, the TeraGrid is almost certain to bring new discoveries, explains Rob Pennington, the TeraGrid project leader at NCSA.

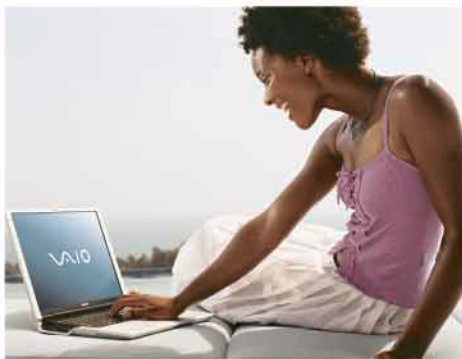
“Think about the weather,” says Pennington. “If you have access only to what you can see on the horizon, your ability to make predictions isn't going to be very good. But when you have information from, say, Omaha, you can do a better job of forecasting the weather in Chicago. With TeraGrid, the horizons people can see are going to move out.”

A Virtual Supercomputer

Launched in 2001 and still under development, the TeraGrid Project is a virtual supercomputer dedicated to scientific research. It's assembled from systems powered by 64-bit workstation processors.



SONY



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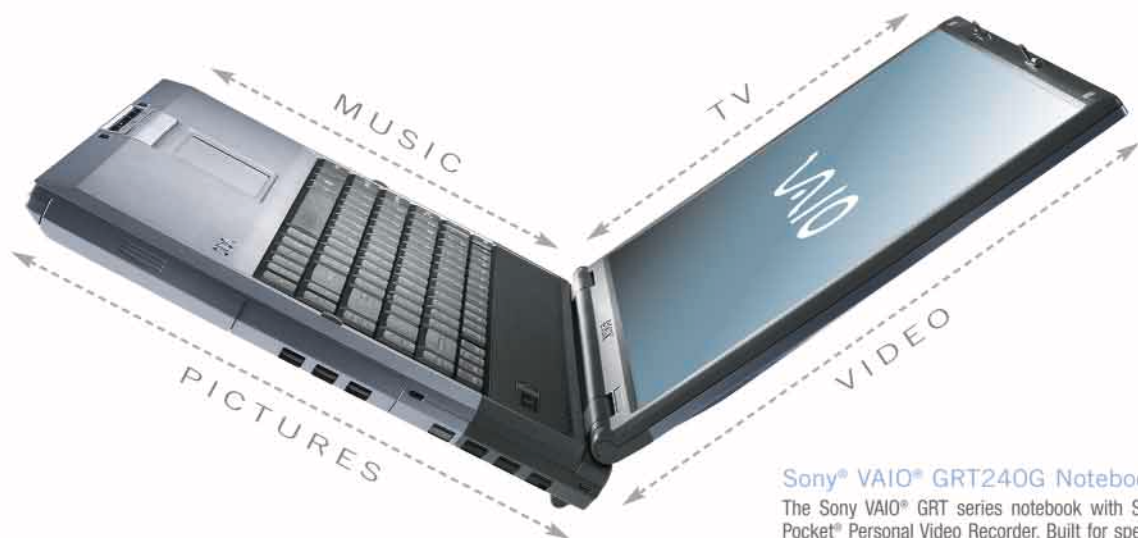
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USER TO USER

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EXPERTS AND READERS**Make Shift Turn Off Caps Lock, Revisited**

Regarding your article "Make Shift Turn Off Caps Lock" (<http://www.pcmag.com/article2/0,4149,1217876,00.asp>), it seems to me you've missed something. You don't need to dig into the Registry. In Windows 2000, at least, it's very easy to make the Shift key turn off Caps Lock.

Go to the *Control Panel*, double-click on *Keyboard*, click on the *Input Locales* tab, click on *Change*, then click on *Key Settings*. In the *Advanced Key Settings* window, you can select either *Press the CAPS LOCK* key or *Press the SHIFT* key under the heading *To turn off Caps Lock* (Figure 1).

I do have multiple keyboard definitions installed: *United States-International*, *United States-Dvorak*, and *US*. Removing all keyboards except the one I was using (*United States-International*) does not change the Caps Lock option.

FRANCIS B. BANKS

That setting is impressively well hidden! The *Key Settings* button may be disabled unless more than one keyboard definition is installed; that's why we didn't see it before. In Windows XP, you can access this setting in a slightly different way (Figure 2). Launch the

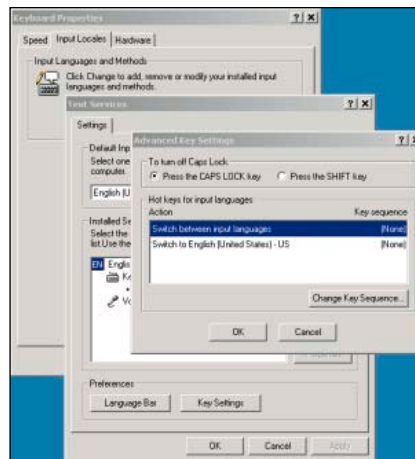


FIGURE 1: In Windows 2000, you can reach the Caps Lock settings through the *Keyboard* applet.

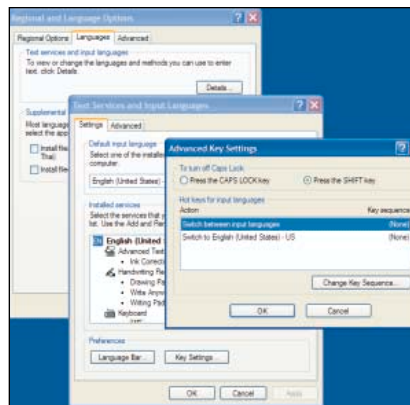


FIGURE 2: In Windows XP, you can reach the Caps Lock settings through the *Regional and Language Options* applet.

Regional and Language Options applet from the *Control Panel*. Click on the *Details* button on the *Languages* tab. If the *Key Settings* button is grayed, click *Add* and add another keyboard definition, for example, *United States-International*. Select the keyboard you normally use, click *Key Settings*, and make the configuration change as described above. —Neil J. Rubenking

A Better Way to Find a Blocked Sender

In your issue of October 1, 2003, a reader asked how to find an e-mail address in an extremely large *Blocked Senders* list. I think I have a much simpler solution that does not require using the dangerous REGEDIT.

Simply open the *Blocked Sender* list, click on the *Add* button, and then type in the name you are trying to find. Click on the *OK* button and you will see a warning that says *The blocked sender xxx@xx.xx already exists. Are you sure you want to replace xxx@xx.xx?* Click on the *Yes* button and Outlook Express replaces the original e-mail address with the new one and automatically takes you to that listing. Once there, it should already be highlighted. Just click on the *Remove* button and the sender that was mistakenly blocked will be taken off the list.

DENNIS HAMMER

This is certainly simpler than using REGEDIT to flag the item by changing it to an odd value that would stand out visually. We still wonder why Microsoft didn't provide an option to sort the list or to search for a specific address. —NJR

Highlight Cells Containing Formulas

In designing and auditing spreadsheets, I'd like to distinguish visually between cells containing formulas and those containing values. I want to use a suitable function in a conditional format, but I can't identify a function that returns this information. What's the best way to do this?

GENE TATSCH

Conditional formatting won't help you here, but there's an easy way to format all cells that contain formulas manually. First, select the entire range of cells and apply the format you want to use for cells without formulas. With the range still selected, choose *Go To* from the *Edit* menu and click on the *Special* button. In the *Go To Special* dialog (see Figure 3), check

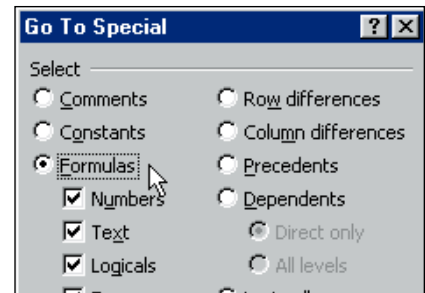


FIGURE 3: Use the *Go To Special* feature to isolate cells with specific characteristics.

the *Formulas* box, and click on *OK*. All cells containing formulas will be highlighted, regardless of whether they form a continuous area (Figure 4). Right-click on any one of them, choose *Format Cells*, and apply the desired formatting. You must repeat this process if you change the contents of the cells. —NJR

Mail Merge Formatting Problem

I prepare bills using Office XP. An Excel spreadsheet serves as my database, and I

The *Key Settings* button may be disabled unless more than one keyboard definition is installed.

Excel's number formatting doesn't carry over when you perform a mail merge.

	A	B	C
1	Numbers	More Numbers	Formulas
2	12	23	290
3	34	25	73
4	55	25	159
5	77	36	66
6	99	46	234
7	13	77	5

FIGURE 4: The three cells that contain formulas are formatted differently.

use Word's Mail Merge feature to print the bills. But if a dollar amount ends with a zero, Mail Merge will not print the zero. For example, \$19.20 prints as \$19.2, though the spreadsheet shows the amount correctly. How can I fix this problem?

HAROLD COOK

Excel stores numbers internally as plain, unadorned numbers, with no specific formatting. In your worksheet, you have formatted the cells to display a dollar sign, along with two decimal places. This precise formatting doesn't carry over when you perform a mail merge. You must add a *numeric picture* to the field to specify the formatting. The numeric picture stipulates how a number will display.

Open your merge document and press Alt-F9 to show the merge field codes; they will look something like this: {MERGEFIELD "owed"} . Find the one that corresponds to the payment amount and insert this text: \# "\$0.00" . The result might look like this: {MERGEFIELD \# "\$0.00" "owed"} . Repeat the procedure for any other numeric fields and save the merge document. Now when you perform the mail merge operation, your amounts will be formatted correctly.

Word has a number of options for display-

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ing numbers. To learn more about the feature, search Word's help for *Numeric Picture (\#) field switch*.—NJR

Spell-Check Halted in Outlook Express

Whenever I send an e-mail message, I get the following error message: *The spell check on this document was halted. Do you want to send anyway? I am running Microsoft Windows XP Home, Outlook Express 6.0, and Word 97. The spell-checker works fine in Word but fails in Outlook Express. Why is this happening and how do I fix it?*

PETER HENRIKSON

The symptom you described typically indicates that a file named Csapi3t1.dll is missing or corrupted, or that its Registry entry needs to be fixed. Launch REGEDIT from the *Start* menu's *Run* dialog and navigate to the key HKEY_LOCAL_MACHINE\Software\Microsoft\Shared Tools . In the right-hand pane, find the value named SharedFilesDir . Its data should be the location of the shared Office files, and it absolutely must include a trailing backslash, like so: C:\Program Files\Common Files\Microsoft Shared\ . If this value's data is not correct, double-click on it and enter the correct value, being sure to end with a trailing backslash.

If that doesn't help, the file may be missing or faulty. A Google search on the filename will turn up a number of sites from which you can download the missing file. Put the downloaded file in the folder named Proof below the SharedFilesDir value you identified in the previous step; for example, C:\Program Files\Common Files\Microsoft Shared\Proof.—NJR

Separate Address Elements in Excel

I have an extensive Excel spreadsheet with company names and addresses. The city, state, and ZIP code information are combined into one cell. Is there a way this data can be split into three cells?

MICHAEL MALONE

You can use Excel's text manipulation functions to separate the elements of the ad-

resses. We'll assume that the only comma in each address is the one following the city name, and that all state abbreviations are two letters. Suppose the first combined city/state/ZIP code entry is in cell A2. This formula will extract the city portion: =LEFT(A2, FIND(",", A2) - 1)

The FIND function returns the character position of the comma, so that the LEFT function can return the portion of the text string to the left of the comma.

If every address were guaranteed to have exactly one space after the comma, a similar formula using the MID function could extract the state abbreviation. But if any addresses had multiple spaces, or no space, the formula would fail. To make sure you get the correct state abbreviation, you can use the SUBSTITUTE function to eliminate all spaces and then pull out the two characters immediately following the comma:

```
=MID(SUBSTITUTE(A2, " ", ""),  
FIND(",", SUBSTITUTE(A2, " ", ""))+1, 2)
```

By the same token, we can't assume that all ZIP codes are the standard five-digit type; some may be the newer ZIP+4 format. We'll need to select everything after the state—up to ten characters:

```
=MID(SUBSTITUTE(A2, " ", ""),  
FIND(",", SUBSTITUTE(A2, " ", ""))+3, 10)
```

As before, we strip out the spaces and locate the comma. This time, we start three character positions past the comma, at the beginning of the ZIP code, and return up to

	A	B	C	D
1	City/State/Zip	City	State	Zip
2	Bakersfield, CA 93309	Bakersfield	CA	93309
3	Brea, CA 92821	Brea	CA	92821
4	Canoga Park, CA 91303	Canoga Park	CA	91303
5	Carlsbad, CA 92009	Carlsbad	CA	92009

FIGURE 5: Excel's text manipulation functions let you separate the elements of addresses.

ten characters. If the address uses only a standard five-digit ZIP code, naturally that's all that will be returned.

You may need to make minor modifications, but the formulas shown here will allow you to separate city, state, and ZIP code data from an Excel column in which they're combined (Figure 5).—NJR



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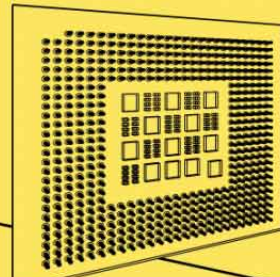
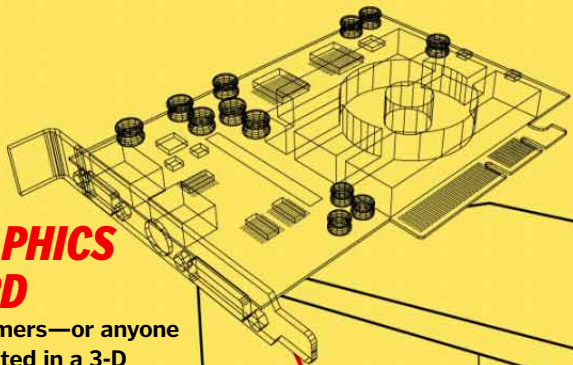
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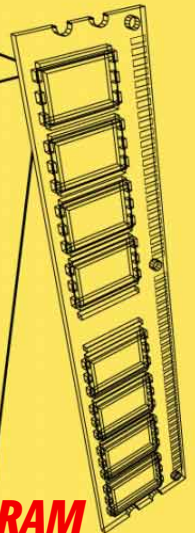
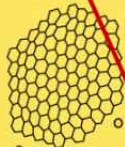
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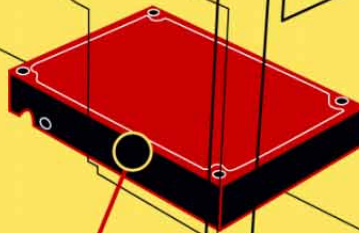


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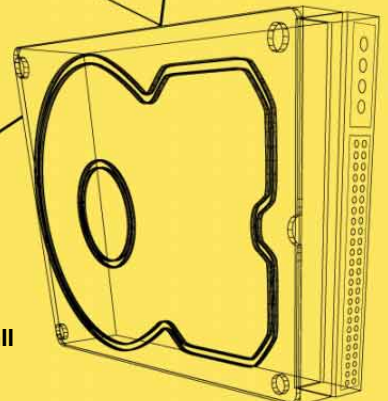


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with our easy tips and upgrades.*

this has happened to the best of us: You've taken your two-year-old PC and given it a face-lift. You have a new hard drive, additional memory, and new CPU installed. But you forgot to connect the heat sink and fan before turning on the machine. Within seconds, the CPU overheats and dies. You've just learned your lesson the hard way.

War stories like this litter the battlefield (and message boards), discouraging many from upgrading their PCs. But for every upgrade that goes wrong, there are many more that go right. Though intimidating to some, an upgrade can be a simple exercise of gathering information and following instructions. If you do so successfully, you can breathe new life into your old PC—for much less money than a new system would cost.

THE WARNING SIGNS

Sometimes we get so used to the way our PCs work that we're unaware they need a boost. For example, it's a standard routine for some people to boot their PCs in the morning, then go make a pot of coffee and toast a bagel, returning just as the log-on screen appears. Or even worse, others silently tolerate a lag time of several seconds when they switch between two open applications.

It's not just system sluggishness that should sound the alarm for an upgrade: Getting a warning message that your PC has no remaining hard drive space is another obvious sign. Then there's always the "jealousy" sign: Your brother-in-law can record

episodes of *24* on his PC and store them on DVD. Meanwhile, you missed the show twice this month. Sound familiar?

UPS AND DOWNS OF UPGRADING

The benefits of upgrading are straightforward: better performance, more capacity, cost savings, and that warm, fuzzy feeling you get from having done it yourself. As in most do-it-yourself projects, however, there are downsides and frustrations.

It is possible to make a mistake that can irreparably damage your system. That's why preparation and having the right information before you start are vital. Also, once you crack open the case and upgrade your PC, it is no longer covered under the vendor's warranty. That's not to say you're on your own; tech support might still help if you call, but you just might be charged. Also, dozens of free tech-help sites on the Internet offer advice from experts as well as from other upgrade warriors like yourself, who can tell you from experience what not to do. Some of our favorite help sites include AllExperts.com, MajorGeeks.com, Tech Support Guy (www.techguy.org), and our very own sister site, ExtremeTech. All offer free support through message boards, downloads, and lots of tips and tricks.

EASE INTO IT: MEMORY AND HARD DRIVE

Increasing your memory is the single best hardware upgrade. It's inexpensive, it's relatively easy, and it markedly boosts

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BY RICHARD FISCO • ILLUSTRATIONS BY ELLIOTT MATTICE

Give Your OS a Boost, Too



Any discussion of upgrading without mentioning the operating system would be amiss. If you are currently running Windows 98, 98 SE, or Me, upgrade to Windows XP. (Windows 2000 users can either stay or upgrade.) While changing OSs means learning new things, the benefits far outweigh the drawbacks. (But you may have to upgrade some of your applications, such as antivirus software, to get them to work with Windows XP.)

First, Windows XP is more stable than

previous versions. While you'll still get application crashes, they are far less likely to take down the whole system. In *PC Magazine's* most recent annual Service and Reliability Survey (August 5, 2003, page 81), our readers' ratings for PC manufacturers improved over the previous year, and we believe this is due in part to the stability of Windows XP.

Along with fewer crashes, Windows XP offers a more user-friendly look and feel, built-in support for new interfaces like USB, easier home networking, and

faster user switching for multiuser PCs.

If you currently have Windows 98, 98 SE, Me, NT 4.0, or 2000, Microsoft lets you upgrade to Windows XP Pro for \$199 or Windows XP Home for \$99. (If you have Windows NT 4.0 or 2000, you can upgrade only to Windows XP Pro.) If you have to buy the full version, it'll cost you about \$299 for Win XP Pro and \$199 for Win XP Home. And because of the Windows Product Activation (WPA) system, you can use the upgrade only on one machine. If you have more than one PC at home, you'll have to buy multiple copies to upgrade all your systems.—RF

performance. This should be the first upgrade you consider, and it's the foundation for allowing other upgrades to provide the fullest benefits.

There are two sides to every memory upgrade: quantity and speed. You'll get a significant performance boost from upgrading the quantity. 512MB is the minimum we recommend if you're running Windows XP; 1GB or more is ideal if you work with huge graphics and video.

If you're storing tons of digital photos and music files or trying to use your PC as a personal video recorder (PVR), then you definitely need more hard drive space. Today's IDE hard drives are enormous: The largest ones hold more than 300GB. But these units typically spin at the slower rate of 5,400 rpm, whereas the slightly smaller ones—say 250GB—spin at a far preferable 7,200 rpm.

Simply put, the faster the drive spins the better its performance. Your computing habits will determine which model is best for your system.

CRANK IT UP: GRAPHICS AND CPU

Don't consider upgrading your graphics card if all you do is word processing, e-mail, home finances, and Web surfing. But if you want to play 3-D games or want a better video experience, then a graphics card upgrade from either ATI or nVidia is a good idea. (For a comparison of the newest high-end and midrange cards from these two vendors, see "Graphics Speed for Every Budget," First Looks, January 20, page 34.)

Because processors are revved so frequently, you might think that your best upgrade bet is to get a new one, either from AMD or from Intel. But just be aware that this is one of the trickiest and most expensive upgrades you can do, and each CPU/mother-

board combination has a laundry list of limitations. Therefore, you may decide to buy a new system altogether instead of installing a new CPU in your old PC. Still, this is the king of upgrades: It can give you the most significant performance boost. Just make sure to do your research first before undertaking this project.

On the following pages, we'll help you decide whether upgrading makes sense for your PC, and if so, we'll give you advice on how to get started. In our tested upgrades, we capped the spending limit at \$500, because beyond that point you may wish to consider purchasing a new computer, depending on your needs. Also note that all specific product prices in this story are list prices.

We've targeted our upgrades at four types of people: general-purpose users, home entertainment aficionados, digital-imaging buffs, and gamers. Whatever your skill level, budget, or usage model, we have an upgrade tip for you.

Our contributors: **John Blazevic** is a technical analyst and **Richard Fisco** is a technical director at PC Magazine Labs. Associate editor **Jenn DeFeo** and PC Magazine Labs project leader **Joel Santo Domingo** were in charge of this story.

Buy or Upgrade?

Should you replace your PC, consider upgrading it, or leave it alone?
If your system is acting up, here's a quick look at what you can do.

	If your system has the following...		
Operating system	Windows 3.1, 95, NT 3.51	Windows 98, 98 SE, Me	Windows 2000, XP Pro, Home
RAM	64MB or less	128MB-256MB	512MB or more
Hard drive	10GB or less	20GB-40GB	60GB and up
Graphics card	Non-3-D-accelerated card or an integrated solution more than 2 years old	An integrated solution less than 2 years old with an AGP slot	Midrange graphics (ATI Radeon 9600XT or nVidia GeForce FX 5700 Ultra or better)
Processor*	Less than 1-GHz AMD or Intel chip	1.5- to 2.2-GHz AMD or Intel chip	2.4-GHz AMD or Intel chip or better

...you should probably

* The processor upgrade is more difficult than the others listed here. If you don't feel comfortable fiddling inside your system yourself, you should either leave it alone or buy a new PC.

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Upgrade your

GENERAL-PURPOSE PC

By Richard Fisco



Most PC owners use their systems for a variety of activities. Unlike hobbyists such as gamers or serious digital-imaging buffs, general-purpose users stick with the basics, using their PCs to create Word documents and Excel spreadsheets, surf the Web, send e-mail, and perform light multimedia tasks such as archiving photos, doing minor photo retouches, and ripping MP3s. The following upgrade tips are perfect for these types of users.

MEMORY: THE EASIEST UPGRADE

As we mentioned earlier, upgrading memory is the single most effective upgrade. When your system is low on memory and you're working with large files or you have a lot of apps open, your PC will use part of your hard drive as additional memory, creating a *swap file*, or *paging file*. Unfortunately, that can take 30 to 60 times as long as system memory.

Apart from being highly effective, adding memory is also the easiest upgrade. Finding the proper slots and installing RAM are simple tasks, and once your computer is back up, your system should recognize the RAM automatically.

Many two- or three-year-old systems have 128MB of memory. If yours is one of them, get more. Upgrading to 256MB costs only about \$40. And for just \$40 more, you can get the optimal 512MB, which can mean a 55 percent performance boost.

But before you start browsing RAM vendors online, you need to be clear on the various types of RAM.

DECONSTRUCTING MEMORY

Currently, there are three types of memory used in PCs: SDRAM, DDR (double data rate) SDRAM, and RDRAM (Ram-bus). If your PC is two or three years old, you probably have SDRAM or RDRAM. SDRAM (synchronous dynamic random access memory) is the slowest of the three types. But an SDRAM system may support DDR SDRAM, the fastest memory available. Your manual's sections on the motherboard and chipset should tell you this; if not, check your chipset manufac-

turer's Web site. If your system supports DDR memory, check what speeds it supports and upgrade to the fastest DDR memory you can. If it doesn't support DDR memory, your only options are to increase the amount and speed of SDRAM you have.

RDRAM, championed by Intel two or three years ago, was aimed at visually intensive applications like 3-D interactive games and streaming multimedia. But it was expensive and proved slower than DDR SDRAM on typical business applications, so it never really took off.

If RDRAM is installed in your PC, your upgrade options are limited. RDRAM is

available only as dual-channel modules, so you have to buy it in pairs. You can use only RDRAM RIMMs, but you may be able to upgrade from the slowest RDRAM speed (600 MHz) to the fastest (1 GHz). Check your motherboard's manual.

DDR SDRAM is currently the king of RAM. It doubles the throughput of SDRAM by moving memory data twice on each clock cycle. The more RAM the better—especially if it's DDR SDRAM.

One more key specification to be aware of when buying SDRAM and DDR memory is CAS (column address strobe) latency, or CL. It's a measure of how much time memory takes to respond to a com-

Practice Safe Upgrading

Before you make any improvements to your PC—no matter how minor—remember to clean up your system and back up your files. Doing so can save you from losing files, and it can find hidden viruses and even give your PC a performance boost. Here's a checklist of some things to do before you upgrade.

- **Run Windows Error Checking.** Go to My Computer and right-click on your hard drive. Choose Properties, then the Tools tab, and click on the Check Now button. The utility will find and fix any disk, file, or folder errors.
- **Run a full antivirus scan.** This will detect any hidden viruses that may be messing with your files and may have gotten on your hard drive before the new AV patch was available. Although it may take a while, make sure you scan all your files.
- **Defrag your hard drive.** This is the easiest and cheapest way to "upgrade" your PC. When files are no longer fragmented, or spread all over your hard drive, the drive has to work less to find them, and you will get a small performance boost. Go to My Computer and right-click on your hard drive; choose Properties, then the Tools tab, and click on the Defragment Now button to tighten things up.
- **Back up everything.** And we mean everything—from your data files to your Internet Favorites folder to any downloaded applications you may be storing. Save them to a CD, or even DVD, if you need that much storage.

After you have followed our precautionary steps and successfully upgraded your hardware, you need to make sure your PC is running safely. Here are two must-dos that you shouldn't compute without.

- **Create a startup disk.** If you have to reinstall Windows, having a startup disk will at least help you get files off of your hard drive. Open My Computer and right-click on your floppy disk drive. Choose Format, then select the Create an MS-DOS Startup Disk check box. Note that this works only when your hard drive is formatted as FAT32 and not NTFS. If you have an NTFS-formatted hard drive, you'll have to boot from the Windows CD and browse your drive.
- **Enable Windows System Restore.** System Restore will let you "go back in time" if you install an application that breaks something else. Right-click on My Computer and choose Properties. Click on the System Restore tab and make sure the Turn Off System Restore box is not checked.

mand. The measurement is usually printed on the memory module.

To keep upgrading simple, just match the CAS rating of your new memory with what you already have installed. Then check the number of memory slots you have: If you have two slots, for example, and you want to upgrade from 128MB to 512MB, you should buy two 256MB memory modules.

HARD DRIVES: CAPACITY VS. PERFORMANCE

Once your memory needs are met, consider whether you need to install a new hard drive. The two key aspects of a hard drive upgrade are capacity and speed. If capacity is your number-one priority be-

ternal drives are terrific for any amount of data, since they come as big as 300GB. They also let you easily transfer data among PCs.

If you want to store a lot of MP3s, digital photos, and video files—and opening up the case doesn't intimidate you—then you should opt for a larger 5,400-rpm hard drive rather than the 20GB to 40GB hard drive that most likely came with your computer. The easiest thing to do is to add the new hard drive as a secondary storage unit to your system.

If you're looking for better hard drive performance—for working with large graphics files or editing video and audio—as well as extra capacity, then go for a faster 7,200-rpm IDE unit. Such mod-

spinning model. When upgrading from 5,400 to 7,200 rpm, we saw a speed increase of about 9 percent on Business Winstone and 8 percent on Multimedia Content Creation Winstone. While these may not seem like significant increases, remember that a hard drive is the key component that makes you wait while you're computing (you've seen the hourglass before, right?).

ADD-ON UPGRADES

Beyond memory and hard drives, the best hardware upgrades you can make on a general-purpose PC are a few extras that can make the computing experience more enjoyable. For example, keyboards and mice have improved greatly: There are a wealth of comfortable, colorful, and wireless models. Because of the current diversity in keyboard and mouse suites, prices can range from \$50 to more than \$200. (For more on keyboards and mice, see our feature story "Keyboards and Mice: Trading Up," page 97.)

Other valuable upgrades are a DVD-recordable drive, a new monitor, and a USB hub. Though they're not performance-based, these upgrades will improve your daily computing experience. Even a small upgrade to your speakers will improve the quality of your audio experience and won't cost hundreds of dollars. If you have a digital camera, a USB 2.0 hub will speed up your photo file transfers. Hunt for deals and you can have a PC that acts brand-new.

The two key aspects of a hard drive upgrade are capacity and speed.

cause of all the MP3s, digital photos, and video files you've been saving—but you shudder at the thought of opening your PC's case—consider an external USB 2.0 or FireWire drive. You can get a 120GB external FireWire or USB 2.0 drive for about \$200.

If your system doesn't have a USB 2.0 or FireWire port, you'll need to get a PCI USB, FireWire, or combo card, which involves opening the case. A USB or FireWire card will set you back \$40, while a combo card costs about \$80. Ex-

ternals currently hold up to 250GB.

To reap the performance benefits of a new internal hard drive, you should set it as the primary drive and install the operating system on it. This will make it your C: drive. If you still want to use the space on your original hard drive, hook that drive up as a secondary unit. Then delete the Windows directory and keep only data files on it.

Hard drive prices are comparatively low per megabyte, and you'll get a pretty good performance jump with a faster-

Should You Purchase a New PC?



Any time a conversation turns to upgrading, someone inevitably chimes in with, "Wouldn't it be better if you just bought a new PC?" Even at *PC Magazine*, we were torn on the right answer. So we decided to do what we do best—put it to the test.

We configured an "old" PC, which had a 2.0-GHz Pentium 4, 128MB RAM, and integrated Intel Extreme Graphics, and upgraded it, capping our budget at \$500. We then brought in a new eMachines T2542, a bargain-basement system (\$449), and a new eMachines T2865, a typical value system (\$719). (Both prices are without a monitor.)

The first lesson we learned: Don't choose a new bargain-basement PC over an upgrade of your old PC; the T2542's performance was unimpressive. For the cost of the T2542, we pumped up our old PC with 512MB of RAM, a

7,200-rpm hard drive, and a midrange graphics card. Performance on our upgraded system easily surpassed that of the T2542 on Business Winstone 2004 and Multimedia Content Creation Winstone 2004. It also blew away both new systems on the 3DMark03 tests, thanks to having a better graphics solution. The higher-priced T2865, however, finished first on our Winstone tests.

Where the extra cost of a new PC like the T2865 really pays off, however, is in an up-to-date feature set. For example, Win-

	Cost	Business Winstone 2004	Increase over base score	Multimedia Content Creation Winstone 2004	Increase over base score
Two-year-old PC	—	10.8	—	11.1	—
Custom PC Magazine upgrade*	\$420	17.0	57%	18.5	67%
eMachines T2542**	\$449	9.8	-9%	13.0	18%
eMachines T2865***	\$719	20.1	86%	24.1	117%

* Custom PC Magazine upgrade: 512MB of RAM with a 7,200-rpm drive and a midlevel (ATI Radeon 9600 XT) graphics card. ** With 256MB of RAM,

PERFORMANCE TESTS

General-Purpose Upgrades



To see the performance boost you can get by upgrading that old PC of yours, we configured our own “old” PC and upgraded it. Our one guideline: not to exceed \$500 in parts.

To replicate a system from two years ago, we chose a base unit outfitted with a 2.0-GHz Intel Pentium 4 processor using an ASUS P4GE-VM motherboard with a p478 socket and an 845GE chipset. This chipset has integrated Intel Extreme Graphics, which can be expanded using its 4X AGP slot, and a 400-MHz front-side bus (this is the most common interface for the Pentium 4 CPU, as opposed to the newer 533-MHz and 800-MHz FSBs).

WHAT A LITTLE MORE RAM CAN DO

We tackled the easy stuff first: upgrading RAM. Our base system was equipped with 128MB of PC2100 DDR 266 SDRAM. Using the two DIMM slots, we took out this RAM and replaced it with a 256MB module; the system performed nicely with a total of 256MB. We then took out the 256MB module and replaced it with 512MB. Bingo: We hit the sweet spot. For only \$80, we experienced a 30 percent increase on Business Winstone and a 55 percent in-

crease on our Multimedia Content Creation Winstone benchmark tests.

We then substituted a larger, faster hard drive. Our base unit had a 40GB, 5,400-rpm drive, and we upgraded to a 160GB, 7,200-rpm drive. True, 160GB may seem rather large for general-purpose activities, but since we were already upgrading to a faster drive, we thought we'd take out some insurance on the size as well. Compared with the base configuration, the combination of hard drive and RAM boosted the performance 41 percent when running business apps and 67 percent when working on content creation apps like Adobe Photoshop.

PUSHING THE ENVELOPE: A NEW CPU

Going further, we upgraded the 2.0-GHz Pentium 4 CPU of our base system to a 2.6-GHz Pentium 4. With the 512MB RAM, 7,200-rpm hard drive, and faster CPU, our upgraded system ran 80 percent faster on business apps and 99 percent faster on content creation. We had all but doubled our performance for just \$420.

We don't recommend doing CPU upgrades, however, unless you are extremely comfortable and familiar with the inside of your system. For most general-purpose use, upgrading the RAM and hard drive would be plenty. You can save your money on the CPU and maybe get a cool new

wireless keyboard and mouse instead. These are nice touches, and they're the easiest upgrades of all.

—Analysis written by Joel Santo Domingo.

Our thanks to ABS Computer Technologies, ATI Technologies, Corsair Memory, Maxtor Corp., and Snapstream Media for their assistance.

High scores are best. Bold type denotes first place.	Upgrade cost (street)	Business Winstone 2004	Increase over base score	Multimedia Content Creation Winstone 2004	Increase over base score
Two-year-old PC	—	10.8	—	11.1	—
Upgrade RAM to 256MB	\$40	12.5	16%	15.5	40%
Upgrade RAM to 512MB	\$80	14.0	30%	17.2	55%
Add 160GB, 7,200-rpm ATA drive	\$210*	15.2	41%	18.5	67%
Add 2.6-GHz P4 CPU	\$420*	19.4	80%	22.1	99%

* Pricing is for a cumulative upgrade.

dows XP Home—typically a \$99 upgrade—comes preinstalled on many new systems. You'll also get USB 2.0 ports, which are faster than the USB 1.1 ports found on two- or three-year-old systems. Some new systems also include nice features like DVD±RW drives, a result of the drop in manufacturing prices over the past three years, and updated versions of preinstalled software. Perhaps best of all is the peace of mind you'll have from knowing that a new PC means warranty coverage. Unfortunately, you get none of this with a \$500 PC upgrade—and

most of this is something we think you will want.

So our answer to the age-old question “Upgrade or buy?” is this: It all comes down to what's important to you and how much you want to spend. If your limit is \$500, don't bother with a new PC; you're better off beefing up your system (if it's less than three years old). But if you're willing to throw in at least another \$250, buy yourself a new PC. For the extra expense, a new system will far outclass an upgrade in both performance and features.—Jenn DeFeo

3DMark03		Increase over base score		Adobe Photoshop 7.0							
1,024 x 768†	▲	▲	▲	Gaussian Blur 100-pixel radius (sec)	Speed increase ▲	Unsharp Mask (sec)	Speed increase ▲	Lighting Effects (sec)	Speed increase ▲	Resize Image 200% (min:sec)	Speed increase ▲
54	▲	—	▲	42	—	24	—	29	—	2:04	—
3,460	▲	6,307%	▲	5	740%	3	700%	14	107%	0:20	520%
49	▲	-9%	▲	20	110%	14	71%	20	45%	0:33	276%
159	▲	194%	▲	6	600%	4	500%	9	222%	0:27	359%

a 2.5-GHz Celeron CPU, and Intel integrated graphics. *** With 512MB of RAM, a 2.08-GHz Athlon XP 2800+ CPU, and nVidia GeForce4 integrated graphics. † With anti-aliasing off and 2X anisotropic filtering.

Upgrade to a *HOME THEATER*

By Joel Santo Domingo



As you hear more buzz about convergence, you find yourself itching to hook up your new wide-screen plasma TV to your PC. No longer are you content to wrestle with your VCR to record your favorite shows; you'd much rather have a TiVo-like *personal video recorder* that can handle it for you. And when those episodes are securely saved on your hard drive, you'll want to burn just your favorites to DVD for later viewing or sharing with friends. The real question is how to do all this with a two-year-old desktop computer.

If your PC doesn't have an AGP slot, or if you want to keep your existing video card, buy a PCI TV tuner card like the Hauppauge PVR-250 (\$149).

If you'd like to update your graphics card—and you'll have to if it lacks a video output—go with an AGP or PCI TV tuner card with video-out capability, such as the ATI All-In-Wonder series (model 9000, \$169; 9600 Pro, \$249; 9800 Pro, \$449) or the Hauppauge PVR-350 (\$199).

MAKE IT SNAPPY

Both the ATI All-In-Wonder and the Hauppauge PVR cards come with basic

your wireless network using SnapStream PVS's built-in Web server. The application can run with most TV tuner cards, including the ATI TV Wonder, but in testing, SnapStream PVS 3.3 worked best with the Hauppauge card.

OTHER GOODIES

You can make your home theater PC experience even more enjoyable by including some extras. A sound card like the Creative Labs Sound Blaster Audigy 2 ZS (\$99 to \$250, depending on the number of audio connectors) can pump 5.1-channel surround sound through your home theater's AV receiver and speakers. Or, you can hook up a 5.1 speaker set like the Logitech Z-680 (\$400 street) directly to the Audigy 2.

To make the 10-foot interface viewable from across a room, connect your home entertainment PC directly to your TV set. Or, if it's in your home office, consider investing in a 19-inch or larger CRT (\$150 and up). CRTs can keep up with the motion found in sports programs and action movies better than LCDs, though some of the more expensive 19-inch LCD panels (which can run over \$700) are video-capable. Look for a 25-ms or lower pixel response time from any LCD you plan to watch video on.

To burn TV shows to DVD—and for off-loading content from your hard drive—a dual-format DVD writer like the Memorex Dual Format DVD Recorder (\$229) is a good choice.

STORE-BOUGHT ALTERNATIVES

If all of this sounds like too much work—and if money is not a problem—consider buying a new PC that includes Microsoft Windows XP Media Center Edition (starting at around \$1,000), like the ones reviewed on page 42. Windows XP MCE can be purchased only as part of a complete system; there is no upgrade version. The advantage is that since you're buying a new system, you'll get all the bells and whistles your two-year-old system lacks, like more memory and hard drive space.

Another alternative is to buy a stand-alone PVR that doesn't require a PC, like TiVo or ReplayTV (from \$199 to more than \$1,500; EPG subscription, \$12.95 a month or \$299 for a lifetime subscription). Standalone devices work very well with your TV set, but only the highest-end models let you burn programs to DVD.

PVR programs usually generate MPEG-2 files, which eat up about 2GB for every hour of recorded video.

BOOSTER UPGRADES

Like general-purpose PC users, those who dream of upgrading their PCs to home theater systems should start with a memory upgrade—to at least 512MB—and a hard drive upgrade.

When large drives hit the market, they usually start off at 5,400 rpm instead of the faster 7,200 rpm. This works out well for home theater setups, because 5,400-rpm units run cooler and quieter yet are still fast enough for PVR functions. A 250GB, 5,400-rpm ATA hard drive like the Maxtor DiamondMax 16 (\$250) is a good start for most home theater newbies.

If you think 250GB sounds a bit excessive, you're underestimating how quickly a home theater system can fill up hard drive space. PVR programs usually generate MPEG-2 files, which eat up about 2GB for every hour of recorded video. (You can also record at lower bit rates for smaller files, which is similar to recording in EP mode on a VCR. Video quality will suffer, but you can record more on your hard drive.)

Once the memory and hard drive are upgraded, you'll need to install a TV tuner card. This gives your PC the ability to receive, display, and ultimately record off your antenna or cable feed. TV tuners are available in both AGP and PCI ver-

sions. PVR apps, which have limited capabilities. Gemstar Guide Plus+ EPG, an electronic programming guide that ATI uses, is a standalone program that is not as well integrated with ATI's PVR program as SnapStream.Net is with SnapStream Personal Video Station 3.3 (\$79), found bundled with the Hauppauge card.

SnapStream PVS stands out among its competition, because it's the only PVR program on the market that runs its own electronic program guide, SnapStream.Net, a Web-based system that lets you pick programs to record. You can log on to the site from any system with an Internet connection—or even a WAP-enabled mobile phone or wireless PDA—and set your PC to check for new programs at any time, from anywhere.

SnapStream PVS can automatically re-encode your recorded MPEG-2 videos to WMV (Windows Media) or DivX format, which shrinks the video files so they can be transferred to your notebook, viewed on a Pocket PC device, or streamed across

more on the web

Log on to www.pcmag.com/howto for step-by-step guides on the many ways to upgrade your PC.

ENPOWER® Mythos Triton

PC Club recommends Microsoft® Windows® XP Professional for Mobile Computing.



Triton ru13z th3 w0r1d



128MB ATI Mobility 9600 Pro for extreme DirectX 9.0b performance

15.4" widescreen supports 1280 x 800 resolution - gives you the best view

800FSB Intel® Pentium® 4 processor maximizes hyper-gaming performance

60GB 5400rpm hard drive eliminates data bottlenecks

7.8lbs is easy to carry to LAN parties with the **free** carrying bag

Item#: ENP758



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3.0GHz
800MHz FSB

\$1999

Mythos Triton

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- 512MB DDR333 Memory
- CD-RW & DVD Combo Drive

Smart AC 150W Car Inverter/Airplane Adapter



A5596185
\$29⁹⁹

A5596183
\$7⁹⁹

Logitech® MX 500 Optical Mouse, PS/2 & USB



A5047081
\$39⁹⁹

SimpleTech USB 2.0 128MB Flash Drive



A3411101
\$39⁹⁹

A+GPB Aluminum USB 2.0 2.5" Notebook Hard Drive Enclosure



A3326307
\$39⁹⁹

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Upgrade to a **DIGITAL DARKROOM**

By Joel Santo Domingo



You've mastered the basic photo package that came with your digital camera, and you're ready to spread your creative wings. Although your PC may be reasonably fast, updating when you crop and enlarge a picture can take a while. And you may want to do more than just that anyway. Below are ways to turn your desktop into a strong digital-imaging PC.

Editing photos with less than 512MB of memory can be painful. 512MB of memory can handle the OS, a photo-editing program, and photo files at the same time, so that your system won't need to use its hard drive to hold data temporarily, thus slowing the process significantly.

Digital photos, even those taken with a 5-megapixel (5MP) camera, rarely exceed 3MB in JPEG format. And even if you typically shoot photos as uncompressed TIFF files, 15MB is the file-size limit of a high-end 5MP consumer camera.

When we went beyond 512MB to 1GB, we found that only one photo-editing function—image resizing—improved significantly. If you know you'll be editing large photos (for example, taking a small portion of a digital image and enlarging it

to 8 by 10 inches or larger), upgrading to 1GB makes sense.

You may also want to consider a hard drive upgrade. Digital pictures take up only a few megabytes each, and even after you've accounted for Windows XP and other programs, you should be able to store seemingly endless 3MB images on a 160GB hard drive. Performance-wise, however, upgrading to a 7,200-rpm drive makes sense for the few times when image size exceeds your system's memory size (typically during an image resize).

DISPLAY ART

If you're still using the 15-inch CRT monitor that came with your PC, consider upgrading to at least a 19-inch CRT (\$150) or a 17-inch LCD (\$300). An LCD screen takes up less desk space than a CRT and is bit sharper and brighter, but a CRT has slightly better color and gray-scale fidelity, particularly with subtle details such as dark shadows and highlights. If you plan on working with images that have resolutions of 3MP or larger, look for a 17-inch or larger LCD that can handle up to 1,280-by-1,024 resolution, or a 19-inch or larger CRT that can handle 1,600-by-1,200 reso-

lution. (If you have the wherewithal, you can buy a 21-inch LCD with 1,600-by-1,200 resolution, but it will cost more than \$1,000.)

EXTRA, EXTRA

There are a few other upgrades that will round out your digital-imaging experience. A USB media card reader like the SanDisk ImageMate series (\$20 to \$40) is a must-have, allowing you to transfer digital photos directly from memory cards. This is a time-saver, especially if you have several cameras that use different card formats. You can find USB readers that handle just one or two formats, or you can get an 8-in-1 reader that handles just about all of them (CompactFlash Types I and II, Memory Stick/Memory Stick Pro, Secure Digital/MultiMediaCard, SmartMedia, and xD-Picture Card).

USB 1.1 is fast enough to get a few pictures from your media cards. But if your PC has USB 2.0 or FireWire ports, getting a card reader that supports the right format will yield faster transfers.

Also, if you have only two USB ports, add a USB hub (about \$30), like one from Belkin or Tripp Lite, especially if you al-

PERFORMANCE TESTS

Photo-Editing Upgrades



As in all our upgrade sessions, we started out with our two-year-old PC and upgraded first the memory, then the hard drive. But here we ran tests most pertinent to digital imaging, such as the Resize Image 200% test, which involves a simple blow-up of the original picture. The base system, with its 128MB of RAM, was very slow at this task, because the PC used the hard drive as temporary storage

to accommodate a large file.

With the 59MB TIFF file we used in testing, the 256MB upgrade helped quite a bit, but the 512MB upgrade helped far more. On the Unsharp Mask filter test, the 512MB upgrade gave the PC a 700 percent speed boost, so it completed the task almost immediately.

Much of the manipulation in Photoshop happens in RAM, and having more RAM can mean the difference between waiting a couple of seconds for something to happen and waiting a couple of minutes. That's an eternity if your spouse is bugging you to get off the computer so he can surf.—JSD

Upgrade	Upgrade cost (street)	Multimedia Content Creation Winstone 2004		Adobe Photoshop 7.0		Unsharp Mask		Lighting Effects		Resize Image 200%	
		Increase over base score	Score	Speed increase	Score	Speed increase	Score	Speed increase	Score	Speed increase	
Two-year-old PC	—	11.1	42	24	29	2:04	—	—	—	—	
Upgrade RAM to 256MB	\$40	15.5	30	18	25	0:41	202%	40%	33%	16%	
Upgrade RAM to 512MB	\$80	17.2	6	3	14	0:39	218%	55%	600%	107%	
Add 160GB, 7,200-rpm ATA drive	\$210*	18.5	6	3	14	0:20	520%	67%	600%	107%	
Add 2.6-GHz P4 CPU	\$380*	22.1	4	2	12	0:19	553%	99%	950%	142%	

* Pricing is for a cumulative upgrade.

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ready use a USB mouse and printer. This will give you plenty of ports for your digital camera and other peripherals.

Be sure to get a photo-cataloging program, such as Lifescape Solutions' Picasa (\$29) or Adobe Photoshop Album 2.0 (\$49), so you can keep track of thousands of photos and organize them by date, subject matter, or event.

For those who want to be more creative with their pictures, Adobe Photoshop Elements 2.0 (\$99, or \$129 with Photoshop Album) is a good midlevel photo-editing package. Based on the pro-level Adobe Photoshop (\$649), Elements

has many more features than the software that came with your camera.

A flatbed scanner for paper prints or a slide scanner for photo slides can help you arrange your most recent photos into a photo montage. One choice is the HP Scanjet 4670 See-Thru Vertical Scanner (\$200), a recent *PC Magazine* Editors' Choice (First Looks, October 28, 2003).

A photo printer like the HP Photosmart 7960 (\$300) can satisfy those seeking instant gratification, but these days even drugstores have the capacity to print digital photos directly from memory cards or other media, like CD-R. You can now bring

a memory card to your local Costco or CVS and in 1 hour get 4-by-6 prints on real photo paper, just as if you used 35-mm and APS film. Online photo companies like Ofoto and Snapfish were the first to print pictures for digital-photo enthusiasts, and they continue to do so.

Optical media like CD and DVD are now becoming an easy way to get your pictures to family and friends. Programs like Photoshop Album 2.0, Roxio Easy CD & DVD Creator 6 (\$69), or Nero 6 Ultra Edition (\$69) will burn your photo slide show to a DVD that can play in your DVD player.

Upgrade to an **AWESOME GAMING BOX**

By John Blazevec



You may realize at some point in your gaming experience that your integrated graphics card, low memory, and slow CPU aren't keeping up with today's newest games. Serious gamers want quality visuals and performance—and let's face it, that two-year-old PC just doesn't cut the mustard anymore. Upgrading a low-end PC to a gaming box can be expensive, but with a few key improvements, you can buy your older machine more time without blowing your budget.

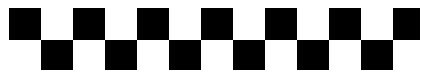
FIRST THINGS FIRST: MEMORY, GRAPHICS

As we stated in "Upgrade Your General-Purpose PC" and subsequent sections, every PC upgrade begins with memory, and gaming machines are no exception. Upgrading to 512MB of RAM will also lay down a solid foundation for any other upgrades you might want to pile up, such as a new graphics card.

The most popular upgrade for anyone interested in gaming is the graphics card. Like adding memory, upgrading your graphics card isn't too difficult; the many choices can be daunting, however. It's easy to empty your wallet on a high-end graphics card such as the ATI Radeon 9800 XT (\$499), with its many features and great performance, but putting such a high-end card into a two-year-old PC probably isn't worthwhile. The 4X AGP port found in older PCs will limit the per-

formance of the 8X AGP Radeon 9800 XT, stifling its potential performance.

Upgrading to a lower-end card like the ATI Radeon 9200 (\$99) will boost performance. But if you want to play 3-D games at higher resolutions and save some money, go for a midrange card like the Radeon 9600 XT (\$199). This option will save you money, which you can spend on other options that will bring up your per-



The most popular upgrade for anyone interested in gaming is the graphics card.

formance across the board. And this approach is a better solution than investing in just one component area.

For example, spending all the money on a Radeon 9800 XT graphics card increased our two-year-old PC's 3DMark03 score from 52 to 5,485 at 1,024-by-768 resolution, instantly making the newest games playable. But since that purchase wipes out any chance of buying more RAM, the amazing gaming experience will be peppered with long pauses, waiting for the next board to load. If you buy the more modestly priced Radeon 9600 XT, which still gives very good game performance,

you'll have enough money to upgrade your memory to 512MB (\$80) and still have some to left over. (Speakers, anyone?)

CPU AND HARD DRIVE UPGRADES? MAYBE

The CPU rivals the graphics card in importance to a gamer. Your choices for an upgrade are usually limited to what your motherboard can support, but you still have options. Today, even a "low-end" CPU, such as a 1.6- to 2.0-GHz Pentium 4, is usually enough to run the current crop of games. But if you want all the bells and whistles of next-generation games such as *Half Life 2*, and you're up for the challenge, consider a new CPU. For as little as \$200, you can ramp up your performance, going from a 2.0- to a 2.6-GHz P4. Although you will not see as much gain as you will with a graphics card upgrade, adding a better CPU is more of an "across-the-board" upgrade, meaning it will improve many other areas of your PC.

Unless your hard drive is almost full, you can probably go without replacing it. For gaming, you will barely see a measurable advantage by upgrading to a "performance" drive. But of course, upgrading to a drive with a larger cache and a faster rotational speed can improve performance in other, more general tasks.

OUTSIDE THE BOX

When it comes to gaming, the upgrade many people ignore is a new display.

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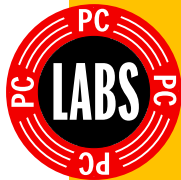
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via the web

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from behind
my cubicle walls

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after closing
my office door

PERFORMANCE TESTS

Gaming Upgrades



For gaming, good graphics are the key. If your system has integrated graphics, a RAM increase alone won't give you an appreciable improvement in 3-D performance. When we simply upgraded our base unit's RAM to 512MB, its scores on our Serious Sam and Splinter Cell tests were still below 30 frames per second, making them unplayable.

When we added the ATI Radeon 9200 (\$99), a low-end graphics card, to the RAM upgrade, we saw a boost in performance. Though you may be able to play some 3-D games

at a low resolution, this card doesn't support a resolution as high as 1,600-by-1,200.

The sweet spot, we found, is an upgrade of 512MB RAM plus a midlevel graphics card like the ATI Radeon 9600 XT (\$199). 3-D games are playable at both low and high resolutions, and you'll have money left over for a sound card, speakers, a new joystick, or even a CPU upgrade.

Just dropping in a high-level graphics card like the ATI Radeon 9800 XT, which alone costs \$499, would be a poor choice despite some formidable-looking test scores. To avoid long load times and other playability issues, you would also have to upgrade the memory, breaking the \$500 limit we placed on our performance upgrades.—JSD

Anti-aliasing/Anisotropic filtering ▶	Upgrade cost (street)	3DMark03				Serious Sam: The Second Encounter				Tom Clancy's Splinter Cell	
		1,024 x 768 (fps) Off/2X	Increase over base score	1,600 x 1,200 (fps) Off/8X	Increase over base score	1,024 x 768 (fps) Off/2X	Increase over base score	1,600 x 1,200 (fps) Off/8X	Increase over base score	1,024 x 768 (fps) Off/2X	Increase over base score
Two-year-old PC	—	52	—	16	—	6	—	3	—	6	—
Upgrade RAM to 512MB	\$80	55	6%	24	50%	11	83%	5	67%	7	17%
Add Radeon 9200	\$179*	851	1,537%	N/A	—	40	567%	N/A	—	13	117%
Or add Radeon 9600 XT	\$279*	3,460	6,554%	1,559	9,644%	53	783%	35	1,067%	30	400%
Add 2.6-GHz P4 CPU	\$479*	3,565	6,756%	1,628	10,075%	65	983%	43	1,333%	38	533%
Radeon 9800 XT	\$499	5,485	10,448%	3,182	19,788%	52	767%	44	1,367%	30	400%

* Pricing is for a cumulative upgrade. N/A—Not applicable: This configuration could not run the test at the specified resolution.

While you may be content with your 15-inch LCD or 17-inch CRT, older displays usually do not support resolutions higher than 1,024-by-768, or they do so at poor refresh rates.

Games are becoming more sophisticated about visual quality, and as a consequence, they are bumping up the resolution to 1,280-by-1,024 or higher. Not only do current games look better at higher resolutions, but in some cases you can actually see more of the playing field, giving you an advantage. Alas, running at higher resolutions can bring many systems to a crawl, even those with high-end graphics cards and CPUs.

Should you buy an LCD or CRT? Typically, LCDs cannot support the fast refresh rates of certain games, especially first-person shooters, where a split second of lag time can mean the difference between life and death. CRTs support the faster refresh rates and are cheaper: A high-quality 19-inch monitor can be had for less than \$200. For slower-paced games (graphically speaking) like simulators, an LCD should be fine.

IMMERSE YOURSELF

To complete the immersive experience, good speakers are a necessity. Speakers

can be one of the more expensive additions, but like a display, they can be one of the best. You can easily spend \$500 or more on a top-of-the-line 7.1 surround-sound speaker setup, but a nice set of 4.1 surround-sound speakers can be had for less than \$100.

A good sound card is another part of the sound equation. High-end speakers won't do you any good if you are using the built-in sound card on your motherboard. You probably don't need a top-of-the-line sound card such as the Audigy 2. Even an older Creative Labs Sound Blaster Live! card, which can be found for less than \$30, will kick up your gaming experience a notch or two. That said, the Audigy 2 ZS sound card line will give you an immersive sonic experience if you also choose to spend some extra dollars to buy some good surround speakers.

You can play most PC games just fine with a keyboard and mouse. But for flight or race simulation games, upgrading to a flight stick or steering wheel increases the fun and will set you back \$100 to \$150.

There are other options, like throttles and foot pedals, but be prepared to spend a few minutes per game session calibrating and tweaking such devices.

A FREE YET DANGEROUS UPGRADE

There is a way to boost your system's performance virtually for free. But you could potentially fry your whole system and find yourself needing a lot more than \$500 to get up and running again. *Overclocking* involves changing the CPU or graphics card clock speed (or changing both) to increase performance.

Overclocking is a risky procedure, but you can minimize the risks by taking a few precautionary steps. If you plan to overclock your CPU, upgrading your cooling system is a must. You most likely will need a new, larger heat sink and fan, as well as additional case fans to keep the air moving and cool. Fans and heat sinks cost about \$5 to \$20 each.

Another option is overclocking your graphics card. There are utilities available for overclocking your graphics card's memory and GPU—and again, you'll most likely need additional cooling fans.

Overclocking is best left to experienced gearheads who are ready for the possible damages that can occur. You should understand that any overclocking you do may void parts of your system's warranty, so proceed with caution. ☰



Editors' Choice Award Winner - ProMagix DX-W
 PC Magazine, November 2003

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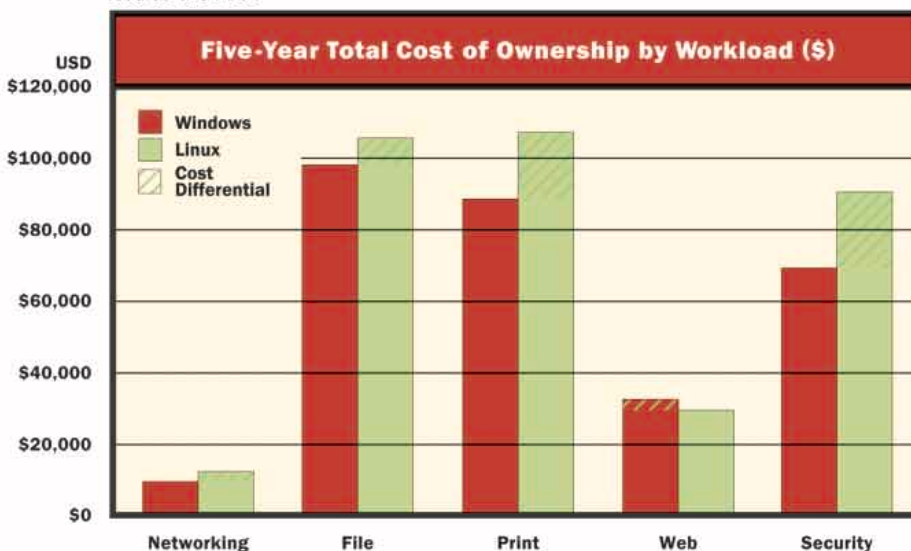
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**REAMS HAVE BEEN WRITTEN ABOUT WINDOWS
AND LINUX. LET'S SKIP TO THE BOTTOM LINE.**

Source: IDC 2002



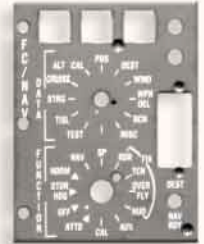
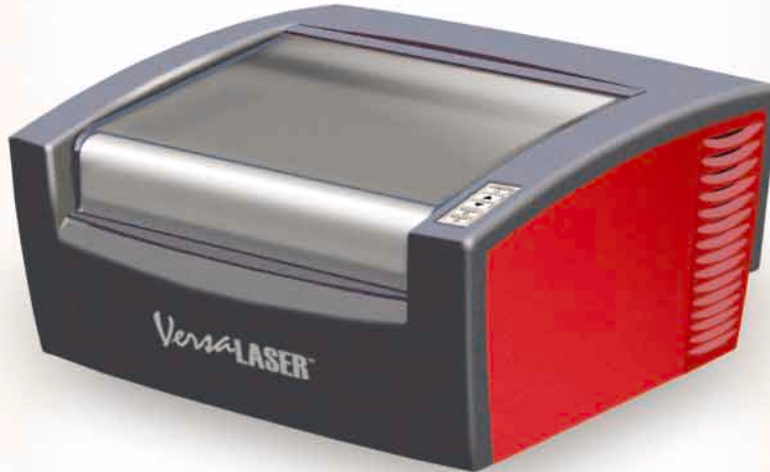
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Keyboards and Mice

T R A D I N G

UP

BY ROBYN PETERSON

Why do so many PCs come with dull keyboards and lifeless mice when there are loads of better options? We use input devices more than almost any other gadgets in our arsenals, so you owe it to yourself to find fitting mates for your fingers. You may be surprised to see how many alternatives are available. From wireless to miniature to just plain wacky, from high-end to low-end, we've put together a guide to keyboards and mice that will invigorate your system and make your coworkers drool.

• Bluetooth Wireless Keyboard Suites

THE ULTIMATE IN today's cordless technology for peripherals, Bluetooth gives you a 30-foot range and an impressive ability to communicate: Your keyboard, mouse, printer, cell phone, PDA, and headset can talk with your PC. But unlike gossip, this chatter will make your life a lot easier. Get your foot in the door with a keyboard suite and you're well on your way to a cordless wonderland.

Logitech Cordless Desktop MX for Bluetooth

\$179.95 list. Logitech Inc., www.logitech.com. ●●●●●

If the Logitech diNovo Media Desktop (below) costs more clams than you want to shell out, check out the Logitech Cordless Desktop MX for Bluetooth. It has the same Bluetooth features as the diNovo—without the MediaPad or the artistic design. Outside the keypad are shortcut buttons that streamline media playback, Web surfing, and e-mail. The bundled Logitech MX900 mouse makes this a powerful package.

Like the diNovo, the Desktop MX serves as a Bluetooth hub, turning your PC into the brain of an interconnected system. Link up any compatible peripheral to make syncing a breeze. If you don't need eye candy and the MediaPad sounds silly, this package is a much better deal for you.

Logitech diNovo Media Desktop

\$249.95 list. Logitech Inc., www.logitech.com. ●●●●●

Designed with an artist's eye, the Logitech diNovo Media Desktop blends futuristic design and powerful architecture, and the keypad's "zero-degree tilt" makes typing comfortable. With built-in Bluetooth

and well-designed management software, the diNovo turns your PC into a cordless command center. Networking up to seven devices is a snap.

Harkening back to early keyboards, Logitech has divided the main keypad and the number pad, giving it new life as the MediaPad. With the included Media Desktop software, the MediaPad becomes a PC remote, playing music or videos and even choreographing photo slide shows. With a built-in LED, it shows playing time for music and instant messages. Although it's an innovative idea, the MediaPad is too limited to do serious work.

Packaged with the Logitech MX900 Bluetooth Optical Mouse (reviewed on page 98) and a Bluetooth hub/battery charger, the diNovo becomes more than a fashion accessory. It can handle anything from business apps to rowdy LAN parties.



R E V I E W E D I N T H I S S T O R Y

Bluetooth Wireless Keyboard Suites 97

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CONTRIBUTORS: Robyn Peterson is a senior Web producer for ExtremeTech. Senior editor Carol A. Mangis was in charge of this story.



Logitech diNovo



a. Logitech Cordless Desktop MX for Bluetooth. b. Microsoft Wireless Optical Desktop for Bluetooth.

Microsoft Wireless Optical Desktop for Bluetooth

\$140 street. Microsoft Corp., www.microsoft.com. ●●●●●

The Microsoft Wireless Optical Desktop for Bluetooth toes the line as a simple, no-nonsense wireless suite. Although it's not as flashy as the Desktop MX (above) and no visual match for the diNovo, this desktopper can get the job done.

The keyboard has a raised top ridge with application and directory buttons, from My Documents to Mail and Messenger shortcuts. In the center of the ridge is the multimedia control center, complete with standard media playback features. The function keys double as Undo, Redo, and similar application-specific time-savers.

If only the new Tilt Wheel Technology were built into the mouse, it could compete with the Logitech MX900. But this mouse doesn't match the features of its cordless IntelliMouse brethren. And although the accompanying software suite sets up quickly and performs well, it is not as useful as the Logitech Bluetooth command center. Also, if you tinker with your BIOS, you'll need to keep a PS/2 keyboard around, because this one won't help you.

MAXIMUM CONTOUR → The designers at Kinesis Corp. need either less coffee or more oxygen. The **Kinesis Advantage Pro USB** (\$359 list) challenges the notion of a flat keyboard by affixing keys to a bowl-like chassis. Your palms rest on the ridge, and your fingers drape into a ravine walled with letters and numbers. Typing in this position nullifies wrist movement while keeping stress on your forearms to a minimum. → (Kinesis Corp., www.kinesis-ergo.com. ●●●●●)



High-End Wireless Mice

IF THERE ISN'T enough room in your budget for a keyboard suite, splurge on a first-class mouse. These little beauties run the gamut of designs, from wireless RF to Bluetooth.

Belkin Bluetooth Wireless Optical Mouse

\$79 list. Belkin Corp., www.belkin.com. ●●●●●

If the Logitech MX900 looked over its shoulder, it might see the Belkin Bluetooth Wireless Optical Mouse grinning back. Both mice have an 800-dpi optical-sensor resolution, providing an accurate and smooth mousing experience. But Belkin designers have constructed a leaner, less complex mouse. With only one additional shortcut button—an easy forward/backward Web navigation clicker—the Belkin mouse is simpler to use but less customizable. On the design side, a cool blue light shines through the scroll wheel, giving updates on battery life and Bluetooth connection status. And the Belkin mouse sells for \$20 less than the Logitech MX900.

Kensington StudioMouse Wireless

\$89.95 list. Kensington Technology Group, www.kensington.com. ●●●●●

Kensington donned its thinking cap to come up with the Kensington StudioMouse Wireless. The conventional scroll wheel is replaced by a flat sensor; slide your finger forward on the sensor to

scroll up and backward to scroll down. Without a wheel, you don't have as much tactile feedback, but the mouse makes up for that with fully customizable drivers. These allow for scroll-speed adjustments, application and Internet shortcuts, and even rest reminders.

With a thin, flat chassis, the StudioMouse feels comfortable in the palm. The design looks more Mac than PC, which makes sense since the built-in graphics shortcuts for Adobe Photoshop and Illustrator work only on Macs. Mouse pointer movement is very smooth, with 800-dpi optical-sensor DiamondEye technology. But the StudioMouse lacks the high-powered reach of its Bluetooth competitors, with only a 6-foot range.

Logitech MX900 Bluetooth Optical Mouse

\$99.95 list. Logitech Inc., www.logitech.com. ●●●●●

The Logitech MX900 Bluetooth Optical Mouse outpowers *and* outprices most wireless mice on the market today. Its MX



c. Belkin Bluetooth Wireless Optical Mouse. d. Kensington StudioMouse Wireless. e. Logitech MX900 Bluetooth Optical Mouse. f. Microsoft Wireless IntelliMouse Explorer.

A TOUCH OVERBOARD → Ever thought you'd need a vibrating mouse? The **Saitek TouchForce Mouse** (\$39.95 list) bumps, wiggles, and shakes as you navigate windows or play games. Designed to mimic the 3-D world on your virtual desktop, it nudges you as you mouse over the edge of a window, a hyperlink, or an application button. When you're gaming, the TouchForce jiggles to explosions and other loud noises. Immersion Corp. provided the cool TouchSense technology that powers this beast. → (Saitek, www.saitekusa.com. ●●●●●)



Optical Engine delivers an impressive 800-dpi resolution and processes 4.7 megapixels a second, which translates to accurate control and high performance.

Simple function buttons on the mouse facilitate quick Web and Windows navigation. The accompanying Bluetooth USB-connected hub, which also doubles as the mouse's battery-charging cradle, allows for a range of 30 feet and can link other Bluetooth devices to your PC. In view of the price tag, the Logitech MX900 is not exactly a steal, but look for it as a companion to one of the same company's killer desktop keyboards. In case you're not into Bluetooth, the Logitech MX700 Cordless Optical Mouse has virtually all the other features and slides in at \$20 less.

Microsoft Wireless IntelliMouse Explorer

\$59.99 list. Microsoft Corp., www.microsoft.com.

●●●●●

The Microsoft Wireless IntelliMouse Explorer, in black leather, pushes boundaries on outerwear for desktop vermin. Taking a cue from luxury carmakers, Microsoft has added tilt capability to the mouse's scroll wheel. The ability to scroll sideways as well as up and down gives you more control over the cursor without having to move the mouse. Whipping across a spreadsheet with just the nudge of a finger can save time and effort. The obligatory back/forward Web navigation buttons are also present near the thumb groove. This is a comfortable mouse to hold onto, even with sweaty palms.

The optical sensor has 400-dpi resolution, because, according to Microsoft product manager Christy Hughes, "the mouse pointer corresponds more directly to your hand movement." The pointer

- Logitech diNovo Media Desktop
- Microsoft Wireless IntelliMouse Explorer
- Kinesis Maxim Adjustable Ergonomic Keyboard
- Microsoft Wireless Optical Desktop Pro



The **Logitech diNovo Media Desktop** suite comprises a comfortable keyboard, a stellar mouse, and a serious Bluetooth control center. We love its style, innovation, and eminent usability.

The **Microsoft Wireless IntelliMouse Explorer** creates a new standard for fashionable mice (it comes sheathed in black leather). But as a comfortable, accurate mouse, it's also ready for a hard day's work.

Lofted or flat, split or conventional, with the **Kinesis Maxim Adjustable Ergonomic Keyboard**, you get to make the design choice. If you want, you can choose a new configuration every day, because it's fully transformable. This keyboard wins our Editors' Choice for its flexibility and comfort.

If you're a number cruncher who stares at spreadsheets all day, the comfy split keyboard and easy horizontal scrolling of the **Microsoft Wireless Optical Desktop Pro's IntelliMouse** (with Tilt Wheel Technology) are real sanity savers. And even the cheapest accountant won't bat an eyelash at the sub-\$100 price.

movements were accurate on our tests, which included playing first-person shooters and using business applications.

The mouse can run on just one double-A battery; we'd prefer a charger, though. And if you want to save \$10, you can get a plastic version.

• Wireless Keyboard Suites For Under \$60

IF BLUETOOTH PRODUCTS are too pricey for you, don't despair. Explore these cool wireless options that are lighter on the wallet. There are slight differences in keyboard layouts here, especially with the multimedia and shortcut buttons. On the mousing side, an optical sensor will cost you \$10 more than a ball-based one.

Belkin Wireless Keyboard and Mouse

\$44.99 list. Belkin Corp., www.belkin.com. ●●●●●

Belkin's contribution to the budget-minded is the Belkin Wireless Keyboard and Mouse. It's not a glamorous suite, but it includes a solid keyboard for standard business use within 6 feet of the receiver. The simple multimedia and Web navigation shortcut buttons are concentrated in the middle of the top ridge, leaving lots of open real estate. Unfortunately, the buttons are also identical in size, so you'll be forced to look down repeatedly until you master the exact layout.

Hands down, this is the quietest of the value keyboards. Unfortunately, the Enter key spans the length of two rows, which may mean typos galore when you're first starting out. Since the keyboard is packaged with a ball-based mouse, you'll want to avoid hard-core first-person shooters. But at \$5 less than the Logitech Cordless Access Duo, this is a decent buy.

Kensington Comfort Type Wireless Optical Desktop

\$60 street. Kensington Technology Group, www.kensington.com. ●●●●●

The Kensington Comfort Type Wireless Optical Desktop sits squarely in the unusual middle ground between split and standard keyboards. The keypad looks like an optical illusion: The right-hand keys are slanted to the left, and the left-hand keys are slanted to the right. This design lets

g. Belkin Wireless Keyboard and Mouse. h. Logitech Cordless Access Duo. i. Kensington Wireless Optical Desktop. j. Microsoft Wireless Optical Desktop.





WHERE'S THE MOUSE? → Under the **FingerWorks**

iGesture Pad (\$189 list) are sensors and a hidden micro-processor that interpret your finger movements, translating them into mouse-pointer motions or shortcuts.

Motioning with two fingers mimics the control of a standard mouse, and touching with three fingers invokes a left click.

Shortcuts for functions like copy and paste are accomplished by pantomiming simple choreographed gestures. For example, by pinching your thumb and middle finger together on the pad, you invoke the standard Copy command. To paste, slide your thumb and middle finger apart. And as a fully functioning number pad, the iGesture might help you calculate a way to fit it into your budget.

→ (FingerWorks Inc., www.fingerworks.com. ●●●●●)



Thanks to an adjustable loft on the central axis, the Maxim reduces forearm *pronation* (the rotation of your hands, when typing on a flat keyboard, so that your palms are parallel with the floor, which can stress the pronator teres muscles); it achieves this by raising the inside angle of the keypad. With slightly concave keys that cup your fingertips, typing feels more like a pleasure than an obligation. If you're finicky about your input device, we've found your ideal match.

Logitech Cordless Comfort Duo

\$99.95 list. Logitech Inc., www.logitech.com.



Though without many bells and whistles, the Logitech Cordless Comfort Duo gets the job done and still looks stylish. The keypad is split, so if you're not a touch-typist, you'll have to become one: The inefficiency of hunt-and-peck typing is amplified on a split design. Time-saving shortcut keys line the top ridge of the keypad, and a configurable thumb button lurks near the bottom edge of the mouse. The key action isn't as crisp as that of higher-end models, but the low-priced Comfort Duo is a good value.

Microsoft Wireless Optical Desktop Pro

\$99.95 list. Microsoft Corp., www.microsoft.com.



The Microsoft Wireless Optical Desktop Pro is the same price as the Logitech Cordless Comfort Duo but offers more mouse features. Equipped with Tilt Wheel Technology, the accompanying IntelliMouse streamlines up-and-down as well as side-to-side scrolling. If you work with spreadsheets all day, the mouse's easy horizontal scrolling can be a real sanity saver. And the Desktop Pro is equipped with back/forward Web navigation buttons. The two-tone keyboard has more style than the Comfort Duo, and the bounce-back of the keys during typing feels more comfortable.

your wrists approach the keys from a more natural angle than with a straight keyboard. On the upside, the Comfort Type keyboard is easy to learn to use, since the key map is so close to conventional. Multimedia buttons adorn the top ridge (playback controls and Web navigation and applications shortcuts), but the buttons are made of a metal knockoff that screams "cheap plastic." The mouse has an optical sensor and performs well for both business uses and light gaming.

Logitech Cordless Access Duo

\$49.95 list. Logitech Inc., www.logitech.com.



As a down-and-dirty wireless desktop suite for the office, the Logitech Cordless Access Duo offers bang for the buck. Like Logitech's higher-priced keyboards, the Access Duo has a comfortable "zero-degree tilt" and timesaving shortcuts for e-mail, media, and Web navigation across the top ridge of the keypad.

The ball-based mouse, however, leaves a lot to be desired; it has only standard buttons (left, right, and scroll). For business applications, the Access Duo is solid up to 6 feet away from the receiver, but don't plan on intense gaming.

Microsoft Basic Wireless Optical Desktop

\$60 street. Microsoft Corp., www.microsoft.com.



At the high end, the Microsoft Basic Wire-

less Optical Desktop stands tall, with its well-designed keyboard and a suitable optical mouse. Shortcut buttons line an up-lifted front ridge, and you can easily distinguish their placement visually, but pressing them requires a potentially uncomfortable uptilt in your wrist.

You'll find no surprises in the main keypad; all keys are where you would expect them to be. And since the mouse is optical, you won't be stuck pulling lint from the rollerball, as you will with the mice in the other value suites.

Comfortable Typing

WRISTS BOTHERING YOU? That can easily happen when you have to type on a straight, flat keyboard. For a more natural feel, convert to a split or even a vaulted keyboard. If your career depends on typing, start taking care of your money makers.

Kinesis Maxim Adjustable Ergonomic Keyboard

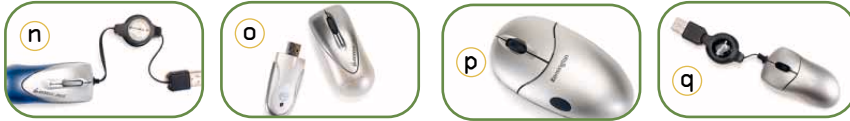
\$149 list. Kinesis Corp., www.kinesis-ergo.com.



The Kinesis Maxim Adjustable Ergonomic Keyboard is one of the most transformable ergonomic keyboards on the market. It's compact and flat out of the box, but you can split the keypad to varying degrees for a more natural approach.

k. Kinesis Maxim Adjustable Ergonomic Keyboard. l. Logitech Cordless Comfort Duo. m. Microsoft Wireless Optical Desktop Pro.





n. IOGear Memory Mini Mouse. o. IOGear USB RF Wireless Optical Mini Mouse. p. Kensington PocketMouse Pro Wireless. q. Targus Ultra Mini Optical Mouse.

• Mobile Mice

FOR YEARS, laptop users have been forced to navigate with hard-to-move pointing sticks and insensitive touch pads. Even if you find room in your computer bag to pack a standard mouse, you have to deal with the extra weight and tangled cords. We recommend a mini-mouse, a compact choice that fits in your shirt pocket. You can even go one step farther by going wireless, but beware of the battery drain on your laptop.

IOGear Memory Mini Mouse 800

\$40 street. IOGear Inc., www.iogear.com. ●●●●●

At 1.6 ounces and about 3 inches long, the IOGear Memory Mini Mouse 800 ranks among the smallest and lightest mobile mice. And with 800-dpi resolution, this mouse makes on-screen movements very accurate. Since it's tethered by a retractable USB cord, you don't need to worry about wire tangles. Also, the mouse comes with 32MB of flash memory in the chassis.

IOGear USB RF Wireless Optical Mini Mouse

\$50 street. IOGear Inc., www.iogear.com. ●●●●●

The cordless cousin of the Mini Mouse 800, the IOGear USB RF Wireless Optical Mini Mouse frees you from wires completely, with the help of a tiny USB RF base station. Just keep in mind that RF is a no-no on airplanes. This mouse is heavier and larger than the Mini Mouse 800, but both have 800-dpi resolution, which is very

high for a wireless mouse.

Since the mouse is cordless, you now have to worry about batteries. A USB-connected charger is built into the mouse body, but it draws precious energy from your laptop battery.

Kensington PocketMouse Pro Wireless

\$41.99 list. Kensington Technology Group, www.kensington.com. ●●●●●

The largest of the mini-mice, the Kensington PocketMouse Pro Wireless measures 2.4 by 4.4 inches. Don't let these dimensions deter you, though; this mouse has a secret. With the press of a button, a hidden compartment opens in the side of the chassis, allowing for easy storage of the tiny USB base station. That means you have only one item to carry. Because of the PocketMouse's larger size, mousing is very comfortable. Unfortunately, during our tests, it lost touch with the mouse pointer occasionally.

Targus Ultra Mini Optical Mouse

\$19.95 list. Targus Inc., www.targus.com. ●●●●●

For a no-thrills, ultrauseful mobile input device, put your hand on the Targus Ultra Mini Optical Mouse. At 3 inches in length, this little baby fits in any nook or cranny left in your briefcase. It's so small that you can mouse on a desktop, an airline tray table, or even your knee (we're not kidding!). The built-in 800-dpi optical sensor gives you accurate control on-screen. And the retractable cord makes wire tangles a problem of the past.

• Mobile Keyboards

IF YOU'RE DOING a lot of work on the road, typing on a laptop keyboard can feel limiting. But you don't have to lug around a full-size keyboard when traveling; you can go smaller and lighter. Downsizing can raise costs, though.



r. FrogPad Mobile Keyboard. s. Matias Half Keyboard.

FrogPad Mobile Keyboard

\$189.99 list. FrogPad Inc., www.frogpad.com. ●●●●●

The one-handed FrogPad Mobile Keyboard can replace your current QWERTY keyboard with only 20 keys and a 5.5- by 3.5-inch frame. You can hook it up to a PC, a PDA, or any device with a USB connection. The keyboard's size makes it easy to travel with; each key represents up to seven different characters. You can switch among number, symbol, and CapsLock modes using a series of buttons that line the bottom ridge.

For efficiency, the Spacebar is located near your thumb, and the vowels are wheeled around your index finger. The most commonly used letters are placed around the strongest fingers. But this board takes some time to master. If you do master it, travel will be a snap. Look for a FrogPad keyboard with Bluetooth in 2004.

Matias Half Keyboard

\$295 list. Matias Corp., www.halfkeyboard.com. ●●●●●

As its name implies, the Matias Half Keyboard looks like a keyboard broken in half. The keys match those of the left-hand side of a QWERTY layout (split to the right of the T). Hold down the Spacebar and the same keys map to a mirror image of the right-hand side. The layout favors left-handed typists, so their right hands can remain on the mouse.

At 5.8 by 3 inches, the Half Keyboard can fit into a cargo-pants pocket, so it's ideal for mobile hookups to your laptop, PDA, or cell phone via USB cable. Learning how to use it takes a lot of motivation, but hey, you're already halfway there. ☰



THE EARTHQUAKE KEYBOARD → With its three keypad units, the **Comfort Keyboard** (\$299 list) looks more like the victim of a tremor than an input device. One divide separates the main keymap into two units (similar to a split keyboard), and the second frees the number pad. A metal base joins all three, offering support while you vault, twist, and turn any of them to your heart's content. Adapting to it is simple: You can

start out flat and then slowly migrate to a healthier position. The Comfort Keyboard is a smart solution for office ergonomics—if you're not scared off by the price tag. → (Comfort Keyboard Co., www.comfortkeyboard.com. ●●●●●)



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- Microsoft Windows XP Professional
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- Intel PRO/Wireless Network Connection 802.11b³
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Distinctive IBM Innovations:

- Access Connections – Easiest wired and wireless connectivity

System Features:

- Intel Centrino mobile technology
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- Intel PRO/Wireless Network Connection 802.11b³
- Microsoft Windows XP Professional
- 12.1" XGA TFT Display (1024x768)
- 16MB ATI Mobility RADEON graphics
- 256MB DDR SDRAM⁵
- 40GB hard drive
- Integrated Gigabit Ethernet and modem
- Integrated IEEE 1394 FireWire
- 5.5-hr Li-Ion battery
- 3.6-lb travel weight
- 1-yr system/battery limited warranty⁸

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IBM ThinkPad X31 Solution Pack

Distinctive IBM Innovations:

- Access Connections – Easiest wired and wireless connectivity

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- Intel Centrino mobile technology
- Intel Pentium M processor 1.40GHz²
- Intel PRO/Wireless Network Connection 802.11b³
- Microsoft Windows XP Professional
- 12.1" XGA TFT Display (1024x768)
- 16MB ATI Mobility RADEON graphics
- 256MB DDR SDRAM⁵ • 20GB hard drive
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System Features:

- Intel Centrino mobile technology
- Intel Pentium M processor 1.60GHz²
- Intel PRO/Wireless Network Connection 802.11b³
- Microsoft Windows XP Professional
- 12.1" XGA TFT Display (1024x768)
- 16MB ATI Mobility RADEON graphics
- 256MB DDR SDRAM⁵ • 40GB hard drive
- Integrated Gigabit Ethernet and modem
- 5.5-hr Li-Ion battery
- 3-yr system/1-yr battery limited warranty⁸

Accessories Included:

- UltraBase X3 media slice
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(Monitor not included)



(Monitor not included)



(Monitor not included)

IBM ThinkCentre™ A50p

Distinctive IBM Innovations:

- Rapid Restore Ultra – Push-of-a-button data backup and recovery

System Features:

- Intel Pentium 4 Processor with Hyper-Threading Technology 2.60GHz
- Microsoft Windows XP Professional
- 256MB DDR SDRAM¹
- 40GB hard drive • CD-RW
- Intel Extreme Graphics 2
- Integrated 10/100 Ethernet
- Norton AntiVirus™ 2003 OEM Edition
- Lotus® SmartSuite™ Millennium license
- 3-yr parts/1-yr limited onsite service limited warranty²⁰

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IBM ThinkCentre A50p

Distinctive IBM Innovations:

- Rapid Restore Ultra – Push-of-a-button data backup and recovery

System Features:

- Intel Pentium 4 Processor with HT Technology 2.80GHz
- Microsoft Windows XP Professional
- 256MB DDR SDRAM¹
- 40GB hard drive • CD-RW
- Intel Extreme Graphics 2
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IBM ThinkCentre M50

Distinctive IBM Innovations:

- Rapid Restore Ultra – Push-of-a-button data backup and recovery

System Features:

- Intel Pentium 4 Processor with HT Technology 2.60GHz
- Microsoft Windows XP Professional
- 256MB DDR SDRAM¹
- 40GB hard drive • CD-ROM
- Intel Extreme Graphics 2
- Gigabit Ethernet-integrated
- Norton AntiVirus 2003 OEM Edition
- Lotus SmartSuite Millennium license
- 3-yr limited warranty with limited onsite service²⁰

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NavCode 8187D9U-M139

ServicePac® Service Upgrade:¹⁰

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#69P9161 **\$89**

IBM ThinkCentre M50

Distinctive IBM Innovations:

- Rapid Restore Ultra – Push-of-a-button data backup and recovery

System Features:

- Intel Pentium 4 Processor with HT Technology 2.80GHz
- Microsoft Windows XP Professional
- 512MB DDR SDRAM¹
- 40GB hard drive • CD-ROM
- Intel Extreme Graphics 2
- Gigabit Ethernet-integrated
- Norton AntiVirus 2003 OEM Edition
- Lotus SmartSuite Millennium license
- 3-yr limited warranty with limited onsite service²⁰

\$1,149

NavCode 8187EJU-M139

ServicePac® Service Upgrade:¹⁰

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#41L2740 **\$159**

IBM ThinkCentre S50

Distinctive IBM Innovations:

- The smallest IBM desktop without compromise: 62% smaller than a standard IBM desktop

System Features:

- Intel Pentium 4 Processor with HT Technology 2.60GHz
- Microsoft Windows XP Professional
- 256MB DDR SDRAM¹
- 40GB hard drive • CD-ROM
- Intel Extreme Graphics 2
- Gigabit Ethernet-integrated
- Norton AntiVirus 2003 OEM Edition
- Lotus SmartSuite Millennium license
- 3-yr limited warranty with limited onsite service²⁰

\$1,089

NavCode 818326U-M139

ServicePac® Service Upgrade:¹⁰

3-yr Onsite/9x5/4-hr Response
#41L2734 **\$129**

IBM ThinkCentre S50

Distinctive IBM Innovations:

- The smallest IBM desktop without compromise: 62% smaller than a standard IBM desktop

System Features:

- Intel Pentium 4 Processor with HT Technology 2.80GHz
- Microsoft Windows XP Professional
- 512MB DDR SDRAM¹
- 40GB hard drive • CD-ROM
- Intel Extreme Graphics 2
- Gigabit Ethernet-integrated
- Norton AntiVirus 2003 OEM Edition
- Lotus SmartSuite Millennium license
- 3-yr limited warranty with limited onsite service²⁰

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#22P9147 **\$250**

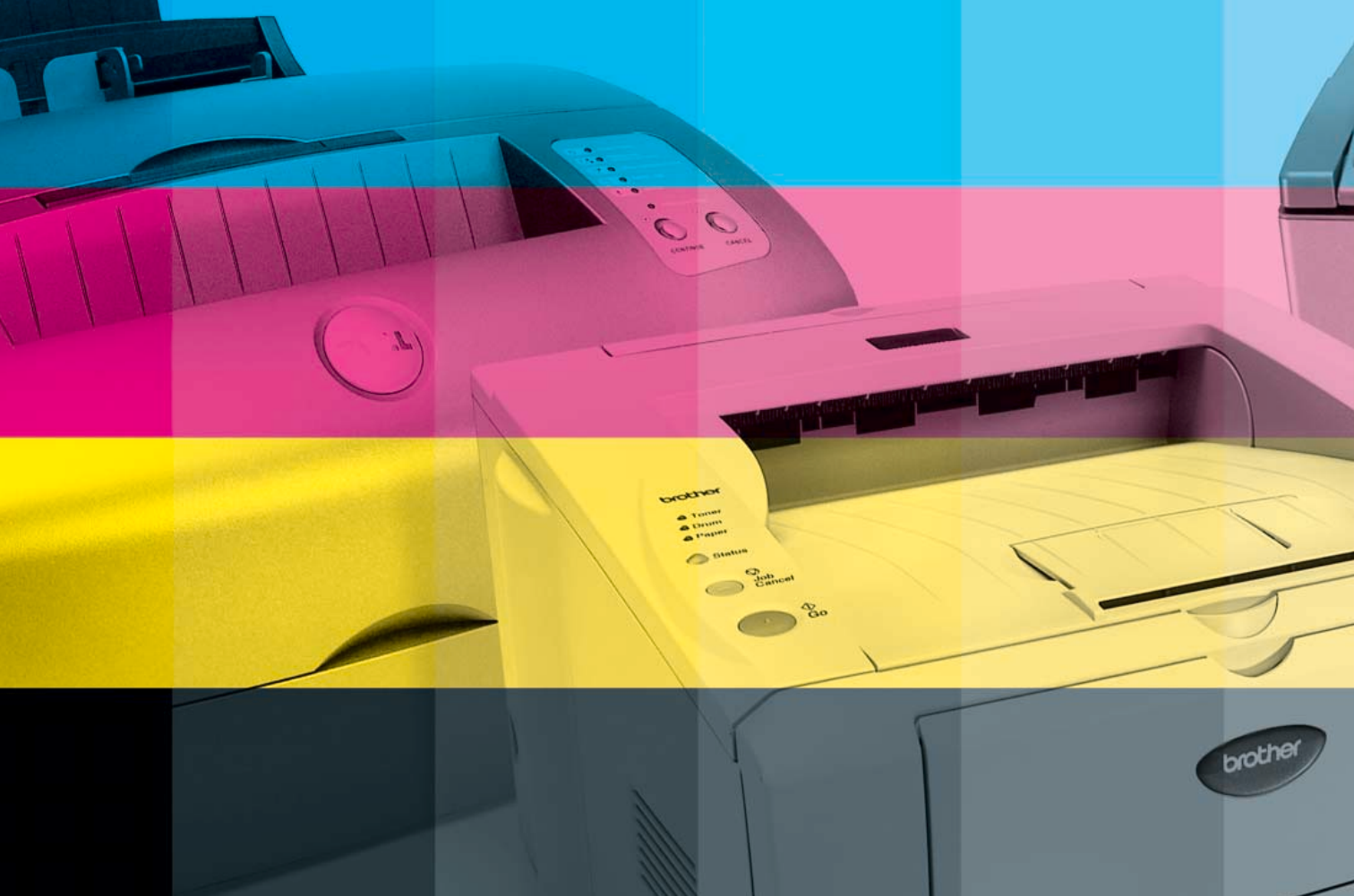
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PRINTERS: **Small Office, Shoestring Budget**

BY CADE METZ • PHOTOGRAPHY BY THOM O'CONNOR

Still the preferred choice for office work, the laser printer is affordable for even the tightest budgets. We tested 17 monochrome, color, and multifunction models.



Having a thriving small business is nothing to complain about, but rapid growth brings with it some pretty hefty demands on office infrastructure. Mike Scully should know. As the business director for MR Architecture, a small New York design firm, he has seen his company grow from 6 to 16 employees over the past year, and IT resources are stretched thin. "Now we've got to add new computers and new printers," he says, "but who's got the time, or the money, to install and administer them?"

To help small businesses like Mike's, we resolved to find out how much printer power today's dollar could buy. So we asked



vendors to send us their least expensive small-business printers. For this story, PC Magazine Labs tested eight monochrome lasers that sell for \$300 or less and five color lasers for \$750 or less. Thrifty buyers will also appreciate the four \$500 multifunction models we tested, which also handle fax, scanning, and copying.

What about \$50 ink jet models, you might ask? After all, the laser printers we tested aren't quite as cheap as the average ink jet. There's definitely a place for ink. Despite the almost scarily high cost of replacing ink cartridges, a laser printer probably doesn't make sense for everyday home use. And multifunction ink jet printers, which can print terrific color photos, sell for as little as \$80. "Home users want color photo printing," says Jennifer Thorwart, an analyst with research firm IDC who closely follows the laser market. "Although the price of color lasers has come down into the \$500 to \$600 range, you can't expect home users to pay that."

For anyone running a home office or small business, however, a \$200 monochrome or \$500 multifunction laser is nearly irresistible. And sub-\$750 color lasers are a godsend to small graphics houses—or home users who want to print like small graphics houses. As

prices have dropped, color lasers have experienced a particularly sharp rise in popularity. They now account for 12 percent of the U.S. laser printer market, and sales are expected to increase at a rate of 20 percent a year beginning in 2004, according to IDC. "Most of this is being driven by the sub-\$1,000 color laser segment," says Thorwart.

Naturally, you'll have to make a few sacrifices with the low-cost models. Of the 17 printers we reviewed, not one includes a stacker or a sorter for managing your output. Only three offer duplexers for automatically printing pages on two sides. And only one model, the \$750 Oki C5100n, has a network card.

That doesn't mean, however, that these units can't be networked to multiple PCs at your home office or small business. (We've written a special story for our Web site that details this. See "Four Easy Ways to Network a Printer.") And although low-cost lasers don't perform quite as well as high-end lasers, we had few problems with their overall printing abilities. Image quality was never less than acceptable, and on some models, print speeds were outstanding.

What did Mike Scully have to say about all this work we did for him? With all that added productivity, who can get the guy on the phone to find out?

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OUR CONTRIBUTORS

Bruce Brown and **M. David Stone** are contributing editors of *PC Magazine*. **Cade Metz** is a senior writer. Associate editor **Jeremy A. Kaplan** and project leader **Glenn Menin** were in charge of this story.

MORE ON THE WEB

To see a breakdown of our performance tests, an expanded analysis of the results, a story on how to network your new printers, and a features table for the MFPPs, log on to www.pcmag.com/printers.



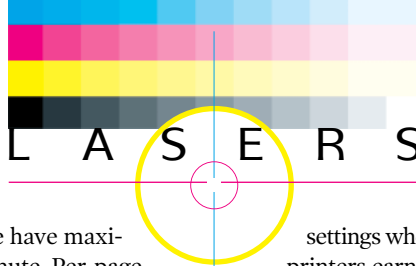
Inexpensive and simple to operate, monochrome laser printers are a productivity bargain. And with resolutions ranging from 600-by-600 to 2,400-by-600, all the printers we tested print terrific black text and graphics.

More significant than print quality and ease of use, however, are printing speed and cost of consumables. The models here have maximum rated speeds of 15 to 19 pages per minute. Per-page costs range from a low of 1.5 cents to a high of 3.2 cents, with most right in the middle at about 2.4 cents. Several models are available with high-capacity toner cartridges, which we recommend to cut costs even more. And most are GDI printers, which rely on a host PC to process page images. Host-based processing didn't hinder the fast PCs in our test-bed but may affect older computers.

To be sure that your new printer will work with any PC in your office, look for one with both parallel and USB ports (preferably USB 2.0); some don't have parallel ports (the HP and Oki Data models) and two (the Dell and Konica Minolta models) are USB 1.1-only. None of them comes with a network adapter, although most have extra-cost network adapter options or sibling models with integrated network adapter cards.

Several manufacturers have in-warranty exchange programs, which are useful if you don't want to buy or rent a replacement while your printer is being repaired. Only three vendors have 24/7 technical support; the rest have Monday-through-Friday business-hour support.

MONOCHROME



ALL REVIEWS BY BRUCE BROWN

Brother HL-5040

\$230 street. Brother International Corp., www.brother.com. ●●●●●

There's a lot to like about the sturdy Brother HL-5040, but its performance tops the list. The HL-5040 was the fastest on our performance tests using general-purpose settings when printing text documents—where most laser printers earn their keep. Output quality was only average, but this didn't stop us from awarding it our Editors' Choice.

The HL-5040 has both parallel and USB 2.0 interfaces and, at 20,000 pages per month, the second-highest rated duty cycle. Only the Panasonic KX-P7305 is rated higher, at 30,000 pages. Three other features that contribute to its overall value are the 250-sheet input tray, maximum memory capacity of 136MB, and Mac and PC compatibility. The HL-5040 has a relatively high cost per page, however, at 2.9 cents—a negative, in our book.

Conveniently, printer configuration information is readable via a browser, and the configuration utility includes a screen reader for the visually impaired. With its large-format quick-start booklet and comprehensive setup guide, the moderately priced HL-5040 is an excellent choice as a workhorse office printer.

A reasonable price, fast performance, high maximum memory, and a generous paper tray make the Brother HL-5040 a top-notch printer. At press time, we learned that Brother will soon release the HL-5140; it's designed for faster print times at the same cost.

SUMMARY OF FEATURES

Monochrome Laser Printers

Download this table at www.pcmag.com.

	Brother HL-5040	Dell Personal Laser Printer P1500	HP LaserJet 1012	Konica Minolta PagePro 1250W	Lexmark E220	Oki B4200	Panasonic KX-P7305	Samsung ML-1750
■ YES □ NO								
Street price	\$230	\$250	\$200	\$200	\$200	\$270	\$300	\$200
Rated engine speed (ppm)	17	19	15	17	18	19	19	17
Printer type	Laser	Laser	Laser	Laser	Laser	LED	Laser	Laser
Host-based processing	□	□	■	■	□	□	■	■
Maximum print resolution (dpi)	2,400 x 600	600 x 600	1,200 x 1,200	1,200 x 1,200	600 x 600	1,200 x 600	1,200 x 600	1,200 x 600
Maximum paper size (inches)	8.5 x 14 (legal)	8.5 x 14 (legal)	8.5 x 14 (legal)	8.5 x 14 (legal)	8.5 x 14 (legal)	8.5 x 14 (legal)	8.5 x 14 (legal)	8.5 x 14 (legal)
Rated duty cycle (pages per month)	20,000	15,000	5,000	15,000	10,000	15,000	30,000	15,000
Installed/maximum RAM	8MB / 136MB	16MB / 144MB	8MB / 8MB	8MB / 8MB	8MB / 72MB	8MB / 72MB	16MB / 48MB	8MB / 8MB
Connectivity	Parallel, USB 2.0	Parallel, USB 1.1	USB 2.0	Parallel, USB 1.1	Parallel, USB 2.0	USB 2.0	Parallel, USB 2.0	Parallel, USB 2.0
Engine manufacturer	Brother	Lexmark	HP	Minolta	Lexmark	Oki	Matsushita	Samsung
Dimensions (HWD, in inches)	9.9 x 15.1 x 15.0	8.7 x 15.4 x 14.5	8.0 x 15.0 x 9.0	14.6 x 15.4 x 16.1	8.7 x 15.4 x 14.2	7.9 x 14.0 x 15.6	10.0 x 15.7 x 15.4	7.7 x 13.9 x 14.6
Weight (pounds)	23.1	19.8	13.0	18.7	19.8	22.0	22.0	15.4
Duplexer	□	□	□	□	□	□	■	□
Number of included paper trays	1	1	2	1	1	2	1	2
Total input/output capacity (pages)	250 / 150	150 / 100	150 / 100	150 / 100	150 / 100	250 / Info not available	250 / 150	250 / 50
Operating systems supported	Windows 95 or later; Mac OS 8.6 or later	Windows 98 or later	Windows 98, Me, 2000, XP; Mac OS 9.1 or later	Windows 95 or later	Windows 95 or later	Windows 98, 2000, and XP	Windows 98 or later; Mac OS 8.6 or later	Windows 95 or later; Mac OS 8.6 or later; Linux
Thumbnail/booklet/watermark printing	□ ■ ■	■ ■ ■	□ ■ □	■ ■ ■	■ □ □	□ □ □	□ ■ ■	□ □ ■
Job hold/preview/reprint	□ □ ■	□ □ □	□ □ □	□ □ □	□ □ □	□ □ □	□ □ □	□ ■ ■
Rated cost per page	2.9¢	2.5¢	2.4¢	2¢	3.2¢	1.5¢	2.5¢	1.7¢
Toll-free technical-support number	800-276-7746	800-456-3355	800-474-6836	877-778-2687	800-539-6275	800-654-3282	800-726-2797	877-873-7279
Technical-support hours (eastern time)	8:00-7:00 M-F	24/7	24/7	9:00-9:00 M-F	9:00-8:00 M-F	24/7	9:00-5:00 M-F	10:00-9:00 M-F

RED denotes Editors' Choice.



OFFICE WORKHORSES: A new monochrome laser might seem out of reach, but we tested several affordable models.

Dell Personal Laser Printer P1500

\$250 street. Dell Inc., www.dell.com. ●●●●●

Look carefully at the Dell Personal Laser Printer P1500 and you'll see that it's basically the same as the Lexmark E220, but with two differences: The Dell unit comes with 16MB of RAM, expandable to 144MB; the Lexmark unit has just 8MB, expandable to 72MB. And the P1500 supports USB 1.1 only, while the E220 has USB 2.0.

On our quality tests, the Dell printer scored average. And the performance breakout was a mixed bag: It was the second-slowest on performance tests with general-purpose settings and an average performer at high-quality settings. This leaves the P1500 as an average-speed printer for the group. The cost per page is also average, at 2.5 cents.

This Windows-only printer supports PCL 5e, PCL 6, and PostScript Level 3 emulation. Dell's one-year exchange program and 24/7 toll-free technical support, combined with the printer's smooth installation, sturdy construction, and quiet operation, are justification for the Dell Personal Laser Printer P1500's higher price compared with that of the Lexmark E220.

HP LaserJet 1012

\$200 street. Hewlett-Packard Co., www.hp.com. ●●●●●

One of the printers in the four-way tie for the lowest purchase price in this roundup, the HP LaserJet 1012 gets high marks for its easy installation (on both Windows and Mac systems) and its cool Web-based status and alert pages. Troubleshooting and documentation are in the same app in the Windows taskbar, which helps a lot if you don't have an IT staff.

Quality test scores were average, as were performance scores with general-purpose settings, but the HP unit was slower than average on our high-quality test suite. It's a solid but not particularly fast laser printer, with a rated speed of 15 ppm—the slowest here—which is fair enough for its low cost.

The lower-than-average 5,000-page-per-month duty cycle, nonexpandable 8MB of RAM, and lack of a parallel port are unfortunate, but they won't matter for light to moderate use (assuming that your PC has a USB port). The HP 1012 does have a low per-page cost of 2.4 cents and 24/7 toll-free technical support working in its favor. It's hard to go wrong with an HP laser printer, and the HP 1012 is a good overall value. Just don't expect it to be a speed demon.

Konica Minolta PagePro 1250W

\$200 street. Konica Minolta Printing Solutions, www.konicaminolta.net/printer. ●●●●●

The Konica Minolta PagePro 1250W is a good example of the value available in monochrome business laser printers, but it's not an exceptional product. The \$200 1250W has a low printing cost of 2 cents per page, and it did well on photo quality tests but fared poorly on graphics tests—though we didn't see much difference between the highest and lowest scores.

It's one of the slowest printers we tested, however, particularly when printing graphics and photos at high-quality settings. The 1250W doesn't work with Mac systems, and it has a USB 1.1 (not 2.0) interface along with its parallel port. The 8MB of RAM in this GDI printer isn't expandable. Finally, the toll-free technical-support hours and 150-sheet input tray are acceptable but minimal. The Konica Minolta PagePro 1250W doesn't have any compelling features that warrant its purchase over the other printers we review here.

MONOCHROME: Brother HL-5040

COLOR: Konica Minolta magicolor 2300W

MULTIFUNCTION: Brother MFC-8420



Small-business owners will be pleasantly surprised by the values we managed to find for them. Among the monochrome models, the Samsung ML-1750 is a very solid competitor, with good performance and quality at a very low price (\$200 street). And we were stunned that Panasonic managed to bundle an auto-duplexer into its low-cost entry, which will surely be a big hit. But our monochrome Editors' Choice goes to the \$230 Brother HL-5040, which edged out the competition in speed and expandability. As low-cost printers go, this one's a winner.

In the color laser category, the \$500 Konica Minolta magicolor 2300W offers a combination of high-quality color output and a budget price that earns it our Editors' Choice. Oki Data's one-pass LED technology yields much faster printing and surprisingly nice photo prints, but we weren't satisfied with the look of text output from the Oki C5100n (clearly a crucial element of a laser printer's quality), and in view of the fact that the Oki Data unit costs an extra \$250, the Konica printer is a much better buy.

Among MFPs, Brother again earns our Editors' Choice, this time for the Brother MFC-8420. The four models we tested share the same price tag, but the MFC-8420's cost per page is a bit lower than the others, and it's the fastest printer and scanner we tested as well. The quality differences among the MFPs were minimal.

Lexmark E220

\$200 street. Lexmark International Corp., www.lexmark.com. ●●●●●

Essentially the twin of the Dell Personal Laser Printer, the Lexmark E220 is one of four \$200 printers we tested. It scored well in performance testing, with faster-than-average printing, especially with charts and graphs using general-purpose settings. And it turned in the fastest times with high-quality settings.

This Windows-only printer has an input tray that holds only 150 sheets, but it does offer PCL and PostScript emulation, as well as parallel and USB 2.0 ports. Choose your version of Windows, and installation rolls along smoothly. The driver interface is easy to follow, with many options on the Web help screen, including technical-support contacts, information on drivers and supplies, and documentation.

The Lexmark E220 comes with 8MB of RAM, expandable to 72MB—half the capacity of the similar Dell printer. One gotcha is the Lexmark unit's high printing cost of 3.2 cents per page, but that's based on buying toner at list price. The E220's duty cycle is rated at 10,000 pages per month—5,000 less than the Dell model.

The Lexmark E220 is as good if not a better buy than the Dell unit, even with the Lexmark printer's lower base memory. The cheaper purchase price (of the printer itself, not the consumables) and faster performance can save you time and money.

Oki B4200

\$270 street. Oki Data Inc., www.okidata.com. ●●●●●

The Oki B4200 stands out in one important respect: Its cost of consumables is the lowest among the batch of printers we reviewed. Thanks to the two-component, high-capacity toner cartridge and image drum, the B4200 offers a class-leading 1.5 cents per page, which is much less than the average 2.4 cents per page of the other printers. On the downside, the B4200 is the second-most-expensive printer in this roundup, with only average performance results on most of our tests.

The Windows-only B4200 doesn't have a parallel port, though it does offer a 250-sheet input tray and both PCL and PostScript support. It is also the only printer besides the Samsung ML-1750 that printed PowerPoint thumbnails correctly, which speaks well for its drivers. The drivers and other printer software install separately, and unlike the other printers, the B4200 comes with separate hard-copy guides for installing the hardware and software. Why not just combine the manuals so people have less to juggle?

Oki Data's 24/7 toll-free technical support is a big plus, but at the end of the day, Oki B4200 buyers will be happiest with its exceptionally low per-page cost.

Panasonic KX-P7305

\$300 street. Matsushita Electric Corp., www.panasonic.com/office. ●●●●●

If you're truly on a tight budget, why would you even consider the most expensive of eight printers, all of which deliver roughly equal quality output, especially one slower than most others on our performance tests? The Panasonic KX-P7305 is the only printer in the bunch that will print two-sided pages automatically.

If you want to save paper, just select duplex printing in the very

easy-to-use printer driver and sit back as the Panasonic cranks out your print job, printing first one side and then the other all by itself. The other printers we tested can duplex manually: You remove the paper when half the job is done and carefully put it back in the correct order to print the second side of each sheet.

The KX-P7305's other outstanding feature is its class-leading 30,000-page monthly duty cycle. But the good news doesn't stop there. It offers both Windows and Mac support, parallel and USB 2.0 ports, PCL and PostScript emulation, and a 250-sheet input tray (so you can print 500 pages in auto-duplex mode!).

Duplex printing does take a toll on performance, which was already slow. The KX-P7305 took just under 2 minutes to print a



BLACK AND WHITE: With monochrome printers, small differences in per-page costs add up.

30-page document in single-sided mode and just over 3 minutes in duplex mode, but it used only 15 sheets of paper. If you often print long documents and want to save on recurring costs, you should seriously consider the Panasonic KX-P7305.

Samsung ML-1750

\$200 street. Samsung Electronics America Inc., www.samsungusa.com. ●●●●●

With its faster-than-average speed, 15,000-pages-per-month duty cycle, Windows and Mac support, parallel and USB 2.0 ports, and one-year exchange program, the Samsung ML-1750 is a strong contender for top honors. To sweeten the deal, it's also one of four printers tied for the lowest price. It had the second-fastest total output time on both our general-purpose and high-quality speed tests, as well as the second-lowest rated cost per page, at 1.7 cents.

This relatively small printer is easy to move (only the HP LaserJet 1012 is lighter), and it can hold 250 sheets of paper. And it was one of only two monochrome lasers here that successfully printed PowerPoint thumbnails in our testing (the other was the Oki B4200), which attests to the quality of its driver software. We found the installation less smooth than with some other printers. You need to install the driver and other components in stages, rather than in one automated process, as with the HP printer.

The informative status monitor goes an extra step toward user-friendliness, displaying a smiley face when all is well. IT types might consider this frivolous, but less-experienced users will find the feature reassuring. Its light weight, high speed, and competitive feature set make the Samsung ML-1750 a fine choice.

If you purchased certain Microsoft software, or a computer on which it was installed, this notice may affect your rights.

Please read this Court-ordered Class Action Notice.

If you purchased in Minnesota certain Microsoft software, or a computer on which it was installed, as described in the section below called "Who is Included," you or your company may be affected by a class action lawsuit in the Fourth Judicial District Court of Hennepin County, Minnesota, called *Daniel Gordon, et al v. Microsoft Corporation*, No. 00-5994. (Although Microsoft software is licensed, the simpler term "purchased" is used here.) This notice is to tell you about the Court's certification of two "Plaintiff Classes," the claims in the case, and your right to participate in, or exclude yourself from, the Classes.

WHAT IS THIS CASE ABOUT?

The Plaintiffs claim Microsoft violated Minnesota's antitrust laws by monopolizing the markets for Intel-compatible (a) personal computer operating system software, and (b) applications software, including word processing, spreadsheet, and office suite software. Specifically, the Plaintiffs claim that Microsoft harmed Class Members by using a monopoly alleged to be unlawful to overcharge for its software. Plaintiffs are asking for monetary relief. Microsoft denies the claims and says it developed and sold high quality and innovative software products at fair and reasonable prices. The Court has not yet decided whether the Plaintiffs or Microsoft are right. A trial is scheduled to begin on **March 1, 2004**.

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Visit the website at www.MNsoftwaresuit.com or write to Zelle, Hofmann, Voelbel, Mason & Gette LLP, P.O. Box 582628, Minneapolis, MN 55458-2628. All Court records may be examined in person and copied at the Court Administrator's office, 1251 Court Tower, 300 S. 6th St., Minneapolis, MN. PLEASE DO NOT PHONE THE COURT.

Dated: December 5, 2003, The Honorable Bruce A. Peterson, Hennepin County District Court Judge.

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TO REMAIN A CLASS MEMBER, DO NOT SUBMIT AN EXCLUSION LETTER OR FORM.

Color laser printers no longer have to bust your budget. We tested five models, all for \$750 or less and all performing respectably on our quality evaluations. Though relatively small compared with more expensive color lasers, they're still too large to fit easily on your desk.

Except for the LED-based Oki Data printer, all of the models here are true laser printers. And most offer GDI processing, while the Lexmark unit processes the page-image itself. Save for the Samsung CLP-500, the host-based printers are designed well enough that they didn't interfere noticeably with foreground operations on our tests or significantly delay the return of control to the application after printing.

ALL REVIEWS BY M. DAVID STONE

HP Color LaserJet 1500L

\$700 street. Hewlett-Packard Co., www.hp.com. ●●●●●

The HP Color LaserJet 1500L is the fastest true laser printer we tested, even though its rated engine speed tied for slowest, at 16 pages per minute (ppm) for monochrome and 4 ppm for color. LED printers are usually faster than lasers, especially on color output, but they have fixed resolutions, making them less flexible.

Unfortunately, the 1500L is also one of the more expensive printers in the long run: It also tied for the highest cost per page—2.4 cents per monochrome page and 12 cents per color page. The standard model comes with a skimpy 125-sheet paper tray, but you can add optional 250- and 500-sheet trays for an ample 875-sheet capacity.

Output quality was good to excellent for all tests, with easily readable text at 5 points or smaller for the majority of fonts we tested with. One minor issue in some but not all photos was a slight posterization, with rounded objects occasionally losing subtle shading, so they appeared flat.

In total output time, the four-pass 1500L was second only to the single-pass Oki C5100n. On our performance tests using general-purpose settings, it managed 15 minutes 9 seconds total, almost even with the Konica Minolta magicolor 2300W. With high-quality settings, it edged out the 2300W, at 2 minutes 39 seconds total.

The HP Color LaserJet 1500L is an attractive package, but keep in mind that other printers—notably the 2300W—offer a better value, particularly when you take the cost of printing into account.

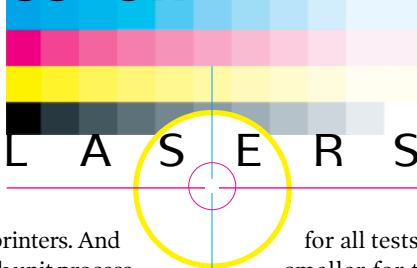
Konica Minolta magicolor 2300W

\$500 street. Konica Minolta Printing Solutions, www.konicaminolta.net/printer. ●●●●●



Although the Konica Minolta magicolor 2300W ties with the HP Color LaserJet 1500L for the slowest engine rating in this roundup, both units were the fastest of the true laser printers on our performance tests. The 2300W has a cost advantage over the HP

COLOR



printer, with both a lower price and a lower claimed cost per page, at 2 cents per monochrome page and 11.1 cents per color page. If you print 100 monochrome pages and 10 color pages per day, you'll save 49 cents per day compared with the HP unit. That works out to a savings of over \$125 per year.

Output quality was good to excellent for all tests, and text was easily readable at 5 points or smaller for the majority of fonts that we tested with. Photo quality was excellent. The only flaw was a slight misregistration that showed up primarily in graphics.

Among the true laser printers, the 2300W was a close second to the HP unit on our performance suite, with a total output time of 15 minutes 14 seconds with general-purpose settings, and falling a bit behind with high-quality settings, at 2 minutes 55 seconds.

The capable Konica Minolta magicolor 2300W is one of the better values in this group. Its fast speed and very good quality earn it our Editors' Choice award.

Lexmark C720

\$750 street. Lexmark International Corp., www.lexmark.com. ●●●●●

The Lexmark C720 is the only printer we tested that doesn't rely on a computer to process files into page images. We tested the unit with its PostScript Level 3 driver, which helps explain why it pulled in the highest scores on three out of four of our quality tests. But it is also the slowest printer in the group,

despite having the fastest rated engine speed of the true laser models. And it tied with the HP LaserJet 1500L for the highest cost per page, at 2.4 cents per monochrome page and 12 cents per color page.

On our performance tests, the C720 ranked in last place: It had a total output time of 28 minutes 14 seconds with general-purpose settings and 7 minutes 30 seconds with high-quality settings.

The underlying issue for the C720 is that it's built around older technology. This also explains why it's larger than the others, with a 20- by 20-inch footprint, and heavier, at 74 pounds. It's also the only printer without a USB port, forcing us to test it via a parallel connection.

Lexmark introduced the Lexmark C720 in February 2001. Nearly three years old, it's approaching the end of its life cycle, so we're not surprised that it suffers compared with more recent models. Its somewhat-better output quality compared with the other printers doesn't make up for the combination of slow speed, bulky size, and high cost per page.

SIZE MATTERS: Konica Minolta created a fast, affordable printer with a much smaller footprint than most.





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 PCM28103148 **\$58.00**

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Easy CD/DVD Creator Version 6 - Retail

 PCM32110204 **\$69.00**

Call of Duty PC Game - Retail

 PCM32102240 **\$39.00**

Miscellaneous

Nomad Jukebox Zen Xtra 40GB USB 2.0 - Retail

 PCM55102118 **\$325.00**

Tungsten T3 400MHz 320x480 TFT 64MB - Retail

 PCM58101121 **\$345.00**

Z640 5.1 Speaker System 71 Watts RMS - Retail

 PCM36121104 **\$65.00**

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 PCM32108136 **\$47.00**

Accessories

256MB Compact Flash Card SDCFH-256-901 - Retail

 PCM20171022 **\$63.00**

256MB Secure Digital Card SDSDB-256-768 - Retail

 PCM20180600 **\$74.00**

Oki C5100n

\$750 street. Oki Data Americas Inc., www.okidata.com. ●●●●●

If you're looking for a speed demon, look no farther than the Oki C5100n. As the only LED printer in this roundup, it is also the only one that offers single-pass color printing. Not having to run each page through the printer four times gives it a significant speed advantage. And indeed, it's the runaway champion on our speed tests. It also offers the lowest cost per color page by far. The only drawback is its output quality.

On our performance suite, the C5100n turned in a total output time of 6 minutes 55 seconds with general-purpose settings—less than half the time of the second-fastest printer. It was also a convincing first with high-quality settings, at 1 minute 37 seconds.

For recurring costs, the C5100n tied the Konica Minolta magi-

color 2300W for monochrome, at 2 cents per page, but comes in at 8 cents per page for color—3.1 cents less than the 2300W. Print 10 color pages per business day and you'll save about \$80 per year—or more, depending on which printer you compare it with.

Alas, output quality is the C5100n's Achilles' heel. Although our quality tests show that it's in the same league as the other printers, the C5100n's scores were the lowest in the color laser roundup. Graphics and photos have a shiny look, like the output from some early color lasers, which some may find objectionable. Text output was fair; it was somewhat gray instead of a crisp black, which made reading less than ideal. Text was easily readable only at 6 points or above.

Consider the Oki C5100n only if speed and low recurring costs are your key considerations, and if you're willing to sacrifice output quality.

PERFORMANCE TESTS

Laser Focus: Testing Printers



With prices as low as \$200 for monochrome models, laser printing has become very affordable. And compared with the price of ink cartridges, a laser's economical operation will leave you beaming. PC Magazine Labs tested printing speeds and evaluated output quality of 17 budget-priced monochrome, color, and multifunction laser printers.

Each vendor recommended specific driver configurations under two sce-

narios: *general-purpose settings* for use with multipurpose paper and *high-quality settings* for use with premium laser paper. We recorded performance test results and rated output quality under both scenarios to ensure that settings optimized solely for speed would yield acceptable-looking output.

To test performance, we timed the output of various documents from a variety of popular applications, such as Adobe Acrobat and Microsoft Word XP. These documents contained elements

from simple text to complex tables, charts, and bitmapped images. We recorded the timings using Quality Logic's PageSense, an automated system that times performance with an LED sensor and software.

To rate the quality of *photos*, we output a 300-dpi photo from Adobe Photoshop that let us isolate and evaluate specific attributes such as lines and edges, gradients, dithering, posterization, color, and registration. We also printed four special CorelDraw documents to use in rating *graphics* quality. We placed each printout on a Graphic-lite Color Viewing System (a light table with standard ISO D50 luminance) and

PERFORMANCE TESTS (minutes:seconds) ▼

▲ High scores are best.
▼ Low scores are best.
Bold type denotes first place within each category.

GENERAL-PURPOSE SETTINGS

Adobe Acrobat 5.0

4 pages, text and graphics 4 pages, text and photos 2 pages, text and graphics

Microsoft Word XP

2 pages, text and lines 2 pages, photos, text, and graphics 3 pages, text and graphics 12 pages, text

Microsoft Excel XP

1 page, text and table 3 pages, charts and graphs 1 page, charts and graphs 5 pages; charts, graphs, tables, and text

MONOCHROME LASER PRINTERS

Brother HL-5040	0:26	0:27	0:24	0:15	0:16	0:19	0:50	0:11	0:21	0:12	0:28
Dell P1500	1:40	1:52	5:07	0:19	0:55	0:22	0:49	0:15	0:45	0:15	0:38
HP LaserJet 1012	0:31	0:37	0:36	0:16	0:20	0:20	0:55	0:11	0:24	0:11	0:34
Konica Minolta 1250W	0:30	0:31	0:28	0:19	0:21	0:22	0:53	0:15	0:23	0:15	0:31
Lexmark E220	0:53	0:52	0:26	0:15	0:17	0:18	0:47	0:11	0:19	0:11	0:26
Oki B4200	0:49	0:48	0:28	0:17	0:19	0:15	0:45	0:09	0:27	0:10	0:41
Panasonic KX-P7305	2:24	2:34	5:14	0:20	0:37	0:19	0:46	0:11	0:41	0:11	0:49
Samsung ML-1750	0:30	0:29	0:30	0:15	0:17	0:19	0:51	0:11	0:23	0:11	0:29

COLOR LASER PRINTERS

HP Color LaserJet 1500L	1:30	1:37	1:01	0:21	0:51	1:00	3:50	0:17	1:13	0:36	1:37
Konica Minolta 2300W	2:03	2:12	1:16	0:20	1:06	1:02	2:37	0:14	1:06	0:28	1:32
Lexmark C720	4:43	5:01	8:39	0:18	2:18	0:49	1:54	0:17	1:24	0:25	1:25
Oki C5100n	0:43	0:40	0:37	0:15	0:32	0:27	1:10	0:26	0:38	0:18	0:38
Samsung CLP-500	3:47	3:44	2:03	0:29	1:33	2:09	4:46	0:18	2:12	0:42	3:40

MULTIFUNCTION PRINTERS

Brother MFC-8420	0:31	0:27	0:27	0:18	0:20	0:22	0:52	0:14	0:23	0:15	0:29
HP LaserJet 3300mfp	N/A	N/A	4:58	0:17	1:16	0:22	0:57	0:12	3:08	0:14	2:02
Lexmark X215	0:42	0:45	0:56	0:19	0:23	0:22	0:53	0:14	0:26	0:14	0:43
Samsung SCX-4216F	0:51	0:41	0:55	0:19	0:23	0:21	0:53	0:13	0:26	0:13	0:41

RED denotes Editors' Choice. N/A—Not applicable: The product did not complete our test.

Samsung CLP-500

\$700 street. Samsung Electronics America Inc., www.samsungusa.com. ●●●●●

The Samsung CLP-500 can be summed up in six words: excellent output quality at slow speeds. But that's not the whole story. It's also the only color laser in this roundup that includes a duplexer. And it's the only host-based printer that works with Windows, Mac, and Linux. The cost per page is high for monochrome, at 2.6 cents per page, but a much better 8.1 cents per color page.

Output quality was consistently good to excellent. Text was easily readable at 5 points and below for most fonts we tested with—even at 4 points for several fonts. Colors in graphics were suitably saturated and photos looked excellent.

The built-in duplexer is a nice touch, but using it slows printing down considerably. And even when printing on one side of

a page, the CLP-500 is a slow printer. The total time for our speed tests using general-purpose settings was 27 minutes 52 seconds—only 22 seconds ahead of last place. It did somewhat better using high-quality settings, at 3 minutes 32 seconds, compared with 7 minutes 30 seconds for the last-place Lexmark unit, but it was still solidly in fourth place.

More troublesome is that the host-based approach keeps the PC occupied for far too long, particularly with Adobe Acrobat. With one PDF file, we waited more than 1 minute 17 seconds after giving the print command for the printer to return control to the application. The next slowest printer took only 5 seconds.

Ultimately, the Samsung CLP-500's slow speed—particularly for returning control after printing—makes it hard to recommend. Even so, if you must have a color laser with a duplexer, or one that works with Linux, this is your least expensive choice.

carefully inspected it with a magnifying glass and loupe.

We found speed demons and slowpokes in each printer category. Top honors go to the Oki C5100n (an LED color model), which logged speeds comparable with those of a monochrome unit. The Brother printers were among the fastest in both monochrome and MFP categories, though the HL-5040 slipped when tested with high-quality settings.

Among the monochrome lasers, the Panasonic KX-P7305 was disappointing, trailing the leader in total output time (using general-purpose settings) by almost 10 minutes. The Dell Personal

Laser Printer P1500 (a rebranded Lexmark model) was also slow. It's remarkably similar to the Lexmark E220, but the E220's better drivers yielded much faster speeds. Windows XP drivers for the Dell printer were unavailable at the time of this review, so we had to use Windows 2000 PostScript drivers, which hindered performance.

Output quality for both monochrome and color printers was good or acceptable across the board. The monochrome laser printers scored lowest, even below MFPs, while color lasers scored the highest. The best quality ratings overall went to the Lexmark C720.

For the multifunction models, we

also rated scanner performance and quality. We scanned an 8- by 10-inch glossy photograph at 100 percent, setting each scanner to 300 dpi and 24-bit color. We scanned all images in Adobe Photoshop 7.0 using TWAIN drivers and saved the files as TIFFs. We then studied the images carefully and scored them for quality on twin Sony F520 21-inch CRTs, optimized with an X-Rite DTP92 Colorimeter and MonacoView 3.0 software. We evaluated clarity, dynamic range, and color, and we rated each attribute on a 5-point scale. Images were penalized for artifacts, noise, and geometric distortion.—*Analysis written by Glenn Menin*

										QUALITY TESTS * ▲			
Microsoft PowerPoint XP		TOTAL OUTPUT TIME	HIGH-QUALITY SETTINGS					TOTAL OUTPUT TIME		GENERAL-PURPOSE SETTINGS		HIGH-QUALITY SETTINGS	
4 pages, text and graphics	Average time to return to app		CorelDraw 10				Adobe Photoshop 6		Photos	Graphics	Photos	Graphics	
			Document A	Document B	Document C	Document D	Document E						
0:23	0:03	4:32	0:27	0:16	0:15	0:15	0:20	1:33	6.7	7.5	6.4	7.3	
0:25	0:08	13:22	0:15	0:17	0:14	0:16	0:29	1:30	6.4	7.5	6.4	7.4	
0:23	0:03	5:19	0:45	0:18	0:10	0:12	0:23	1:48	6.3	7.2	6.3	7.1	
0:26	0:02	5:14	0:35	0:24	0:23	0:22	0:27	2:11	6.8	6.3	7.0	6.1	
0:22	0:03	5:18	0:11	0:10	0:10	0:10	0:13	0:54	6.4	7.1	6.4	7.3	
0:19	0:03	5:26	0:20	0:19	0:19	0:18	0:21	1:37	6.2	7.7	6.4	7.5	
0:22	0:03	14:27	0:35	0:24	0:23	0:22	0:27	2:11	6.4	8.3	6.4	8.3	
0:23	0:03	4:48	0:11	0:12	0:11	0:12	0:14	1:00	6.4	7.7	7.0	7.5	
1:15	0:02	15:09	0:35	0:32	0:29	0:29	0:34	2:39	6.9	7.9	7.1	8.6	
1:17	0:02	15:14	0:45	0:37	0:28	0:28	0:38	2:55	6.9	7.6	7.0	7.8	
1:00	0:02	28:14	0:23	0:26	0:24	0:25	5:53	7:30	7.9	8.3	7.9	8.3	
0:32	0:02	6:55	0:20	0:19	0:19	0:18	0:21	1:37	6.9	7.4	7.1	7.3	
2:27	0:21	27:52	0:46	0:41	0:44	0:38	0:45	3:32	6.9	7.8	7.7	7.8	
0:25	0:02	5:04	0:14	0:13	0:13	0:12	0:18	1:10	7.0	7.6	7.2	7.6	
0:38	0:02	14:06	0:44	0:22	0:15	0:16	0:43	2:19	4.0	7.5	6.0	7.9	
0:24	0:03	6:19	0:14	0:13	0:13	0:12	0:18	1:10	6.8	7.9	6.8	7.9	
0:24	0:03	6:19	0:37	0:13	0:12	0:12	0:18	1:31	7.0	8.1	7.2	8.1	

* Rated on a scale of 1 to 10.

SUMMARY OF FEATURES

Color Laser Printers

Download this table at
www.pcmag.com.

■ YES □ NO	HP Color LaserJet 1500L	Konica Minolta magicolor 2300W	Lexmark C720	Oki C5100n	Samsung CLP-500
Street price	\$700	\$500	\$750	\$750	\$700
Rated color/monochrome speed (ppm)	4 / 16	4 / 16	6 / 24	12 / 20	5 / 21
Printer type	Laser	Laser	Laser	LED	Laser
Host-based processing	■	■	□	■	■
Maximum print resolution (dpi)	600 x 600	1,200 x 600	600 x 600	1,200 x 600	1,200 x 600
Maximum paper size (inches)	8.5 x 14 (legal)	8.5 x 14 (legal)	8.5 x 14 (legal)	8.5 x 14 (legal)	8.5 x 14 (legal)
Rated duty cycle (pages per month)	30,000	35,000	35,000	50,000	35,000
Installed/maximum RAM	16MB / 16MB	32MB / 32MB	32MB / 384MB	32MB / 288MB	64MB / 192MB
Connectivity	USB 2.0	Parallel, USB 1.1	Parallel	Ethernet, USB 2.0	802.11b, parallel, USB 2.0
Engine manufacturer	HP	Minolta	Lexmark	Oki Data	Samsung
Highest PostScript level supported	N/A	N/A	Level 3	N/A	N/A
Dimensions (HWD, in inches)	13.0 x 19.0 x 18.0	15.4 x 14.0 x 19.7	16.1 x 19.7 x 20.5	13.6 x 20.7 x 16.6	15.9 x 20.1 x 18.5
Weight (pounds)	47.5	61.2	74.0	57.3	77.2
Duplexer	□	□	□	□	■
Number of included paper trays	1	1	1	2	2
Total input/output capacity (pages)	125 / 125	200 / 200	250 / 250	400 / Info not available	350 / 250
Operating systems supported	Windows 98, Me, 2000, XP; Mac OS 9.x, OS X	Windows 95 or later	Windows 95 or later; Mac OS 8.6 or later; Linux	Windows 98, 2000, XP	Windows 95 or later; Mac OS 8.6 or later; Linux
Thumbnail/booklet/watermark printing	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	□ ■ □	□ □ ■
Job hold/preview/reprint	□ □ □	□ □ □	□ □ □	□ □ □	□ ■ ■
Rated cost per monochrome page	2.4¢	2¢	2.4¢	2¢	2.6¢
Rated cost per color page	12¢	11.1¢	12¢	8¢	8.1¢
Toll-free technical-support number	800-474-6836	877-778-2687	800-539-6275	800-654-3282	877-873-7279
Technical-support hours (eastern time)	24/7	9:00-9:00 M-F	9:00-8:00 M-F	24/7	10:00-9:00 M-F

RED denotes Editors' Choice. N/A—Not applicable: The product does not have this feature. For each printer, the maximum resolution in monochrome and color is the same.

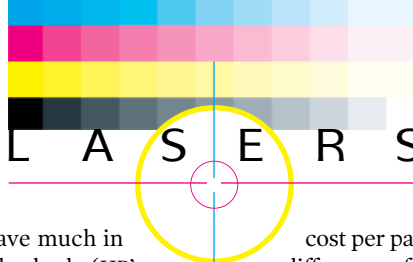
Multifunction printers have traditionally been all about making compromises, with most models suffering from notable shortcomings in at least one primary function. But today's MFPs are about finding the right balance of features at the right price for a small office.

Three of the four MFPs we tested—from Brother, Lexmark, and Samsung—have much in common, starting with a remarkably similar look. (HP's offering is the odd man out in this group, as we discuss in the HP LaserJet 3300mfp review.) Each includes a flatbed scanner stacked above a monochrome laser printer, with an automatic document feeder (ADF) as part of the scanner cover. The front panel of each model offers an LCD menu along with a numeric keypad and a raft of other buttons so they can function as standalone copiers and fax machines.

None of these models offers memory card readers, which are becoming common on MFPs based on ink jet engines. But that's in keeping with laser MFPs' business orientation and the fact that they are built around monochrome laser engines. All come with application bundles that include optical character recognition (OCR) software, to easily digitize paper documents.

The Brother, Lexmark, and Samsung MFPs also offer similar output quality as measured by their scores on our output quality evaluations and in our less formal tests with a wider range of driver settings. All three offer good to excellent quality for text, graphics, and photos.

MULTIFUNCTION



ALL REVIEWS BY M. DAVID STONE

Brother MFC-8420

\$500 street. Brother International Corp., www.brother.com. ●●●●●

Low cost of ownership is a very strong suit for the Brother MFC-8420. Although its price is the same as the other multifunction printers in this roundup, its rated

cost per page is 0.1 to 0.5 cents below the competition. A difference of 0.1 cents may not sound like much, but if you print just 50,000 pages over the printer's lifetime—about 67 per day, 5 days a week, for 3 years—that 0.1 cent per page difference will save you \$50. And the more pages you print, the more you'll save.



The MFC-8420 delivers good to excellent print quality, and it tied the HP LaserJet 3300mfp for first place on our scan quality tests. And at 5 minutes 4 seconds total for our general-purpose performance test suite, it was significantly faster than the second-fastest MFP. It was also in or close to first place on our high-quality performance suite. Even the scan speed, at 40 seconds, earned it a solid first place.

Other notable features include a hearty monthly duty cycle of 20,000 pages—twice as many as any of the other three MFPs—a bundled proprietary version of PaperPort (optical character recognition software), and a very convenient front panel, which offers prominently labeled buttons for scanning, copying, and faxing.

Brother has hit all the right notes with the Brother MFC-8420—more than enough of them, in fact, to earn our Editors' Choice.

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FEED ME: These multifunction printers are very capable paper handlers.

HP LaserJet 3300mfp

\$500 street. Hewlett-Packard Co., www.hp.com. ●●●●●

The HP LaserJet 3300mfp stands out as the only MFP we tested that offers neither an auto document feeder (ADF) nor fax features. More troubling, however, is that its output quality is significantly poorer than the competition.

Aside from the missing ADF, the 3300mfp looks much like the other three MFPs we reviewed, with a flatbed scanner stacked above a monochrome laser printer. And as with the others, you'll find an LCD menu, lots of buttons on the front panel, and OCR software. It also has a relatively high cost per page, at an estimated 2.5 cents each.

We tested the 3300mfp with its PCL 5e driver because it couldn't print some of our test files using the PCL 6 driver. Quality scores using high-quality settings were just a bit low compared with the other units. With general-purpose settings, however, the output score was significantly lower. Graphics and photos showed annoyingly obvious dithering, but text quality was on a par with the other MFPs. It did a better job at scanning, tying for first place on our scan quality tests.

The 3300mfp's performance was also disappointing. We timed it at 14 minutes 6 seconds total on our performance suite with general-purpose settings, compared with 6 minutes 19 seconds for the next-slowest MFPs. High-quality settings yielded equally poor performance.

The HP LaserJet 3300mfp comes up short on performance, output quality, and features, making it hard for us to recommend.

Lexmark X215

\$500 street. Lexmark International Corp., www.lexmark.com. ●●●●●

The Lexmark X215 is a worthy MFP, but it won't blow you away with its features or performance. The front panel is easy to use but not as straightforward as that of the Brother MFC-8420. The claimed cost of 2.1 cents per page is only slightly more than the Brother unit's 2 cents, and the output quality scores are second only to those of the Samsung SCX-4216F.

The X215 performed reasonably well on our printing speed tests. It tied for second place with general-purpose settings, clocking in at a total of 6 minutes 19 seconds, and it tied with the Brother and Samsung printers for first place with high-quality settings, at 1 minute 10 seconds. But the X215 came in last on our scanning test, at 1 minute 37 seconds—more than twice as long as the Brother MFP. It also tied with the Samsung unit for the lowest quality score for scans.

The Lexmark X215 has few notable features that make it stand out from the competition, although the inclusion of PaperPort is a nice touch. Bottom line: It's well worth considering if you can find it at a good price, but we're not convinced that it's worth \$500.

Samsung SCX-4216F

\$500 street. Samsung Electronics America Inc., www.samsungusa.com. ●●●●●

Bragging rights for the highest scores (just barely) on our print quality tests go to the Samsung SCX-4216F. Beyond that, however, this printer is a mixed bag. As with the Lexmark X215, the front panel is easy to use but not as straightforward as it could be. More important, the claimed cost of 2.6 cents per page is the highest among the MFPs we reviewed.

Printing performance was evenly matched with the X215, but

neither could hold a candle to the Brother MFC-8420. The SCX-4216F tied with the X215 for second place using general-purpose settings, at a total of 6 minutes 19 seconds. With high-quality settings, however, it placed third, at 1 minute 31 seconds. It also turned in the second-slowest time for scanning, at 1 minute 34 seconds—more than twice the time of the fastest scanner. Scan quality was average.

Like all the MFPs we tested, the SCX-4216F comes with a useful set of software but nothing that stands out from the crowd. As with the X215, it's a well-balanced package, but the Samsung SCX-4216F higher cost per page and relatively slow performance make it hard for us to recommend unless you can find it at a significantly lower price. ☰

PERFORMANCE TESTS

Printing is only half the story with a multifunction model. To test the capabilities of the scanner portion of each device, we scanned an 8-by-10 glossy photo at 300 dpi, 24-bit color. We timed each model, and then we rated the quality of each scan.

	Scan time (min:sec) ▼	Quality ▲
▲ High scores are best. ▼ Low scores are best. Bold type denotes first place.		
Brother MFC-8420	0:40	●●●●○
HP LaserJet 3300	1:21	●●●●○
Lexmark X215	1:37	●●●○
Samsung SCX-4216F	1:34	●●○○○
RED denotes Editors' Choice.		

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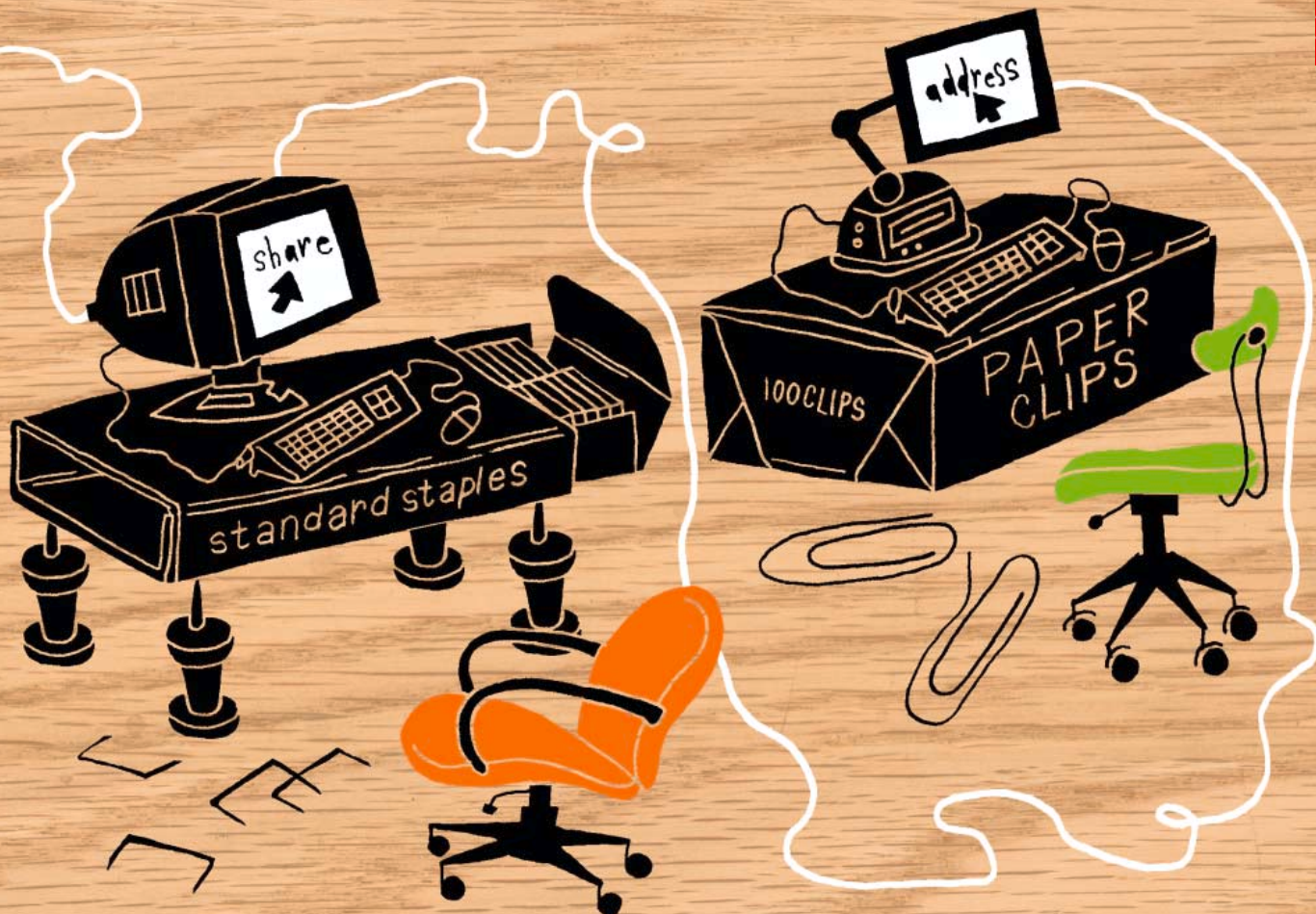
Taking Care of **small** Business

BY DAVIS D. JANOWSKI & OLIVER KAVEN

ILLUSTRATIONS BY KANDY LITRELL

Choosing the right OS for your network can be critical to insuring easy growth. Here's a look at four options.





GETTING A SMALL-BUSINESS NETWORK UP AND RUNNING can be a daunting task, particularly in terms of choosing the proper components, both hardware and software. In particular, finding the right network operating system is paramount, because it's the backbone on which everything on your network is shared and added.

Your decision requires a firm understanding of what your company's budget, work habits, staffing, and needs will be. You don't want a server OS whose initial and upkeep costs stretch beyond your means, but you also need to make sure your operating system is scalable and provides a path for future growth.

Will you want it to support mobile employees, and to offer extensive remote access or collaboration with business partners? Will you require it to integrate with third-party applications, such as CRM or accounting? And who will install and maintain your system? Will you rely on consultants or in-house IT staff?

A BRIEF OS EDUCATION

Microsoft, Net Integration Technologies, Novell, and SUSE Linux are among the companies that produce operating systems geared for small businesses, and their products are reviewed in our roundup. All offer the same basic functions, which begin with e-mail services.

Though many small businesses still outsource their e-mail to service providers, there are advantages to self-hosting. These include having your own domain and custom e-mail address. But more important from a business perspective, many in-house solutions provide other e-mail-related features such as global

address books, maintenance of centralized mailing lists, and group calendaring. Web-based e-mail clients are becoming another common feature for small-business OSs, allowing employees to log on from home or from the road.

Server OSs provide other, more basic network functions as well, such as file and print sharing or sharing of a single Internet connection throughout your business. In addition, office productivity applications run on top of the server OSs. Though many businesses will stick with Microsoft applications, we recently reviewed several alternatives ("If You Don't Do Windows," November 25, 2003).

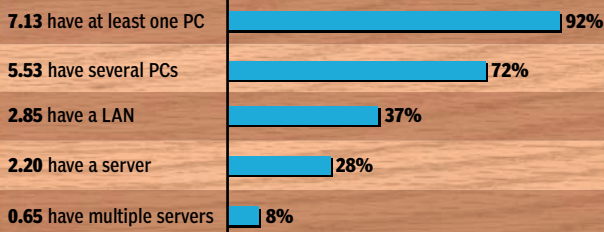
Key to maintaining a growing network is having a directory service such as LDAP (Lightweight Directory Access Protocol), Microsoft Active Directory, or NDS (Novell Directory Services). In general, a directory service provides both a directory for your entire network (including hardware and software) and a central

Reviewed in This Story

PC Magazine Labs reviews four small-business operating systems.

123	Microsoft Windows Small Business Server 2003 ●●●●●	128	Novell Small Business Suite 6.5 ●●●●●
124	Net Integration Technologies NITIX Autonomic Linux Server OS ●●●●●	130	SUSE Linux Openexchange Server 4.1 ●●●●●
		123	Editors' Choice
		124	Scorecard
		130	Summary of Features

There are 7.73 million small U.S. businesses with from 1 to 99 employees. Among them, in millions:



Source: Access Markets International (AMI) Partners Inc. (www.ami-usa.com).

location for storing user information (including passwords, privileges, and groups) and security settings.

Other features that are increasingly seen as necessities among business networks of any complexity include database support, remote access for administrators and users, and the ability to host an intranet or Web site if desired. (Most businesses, however, will continue to outsource their Web sites, so they will be easily scalable and someone else will be responsible for uptime.)

Three of the four products in this roundup come bundled with database servers. While Novell Small Business Suite 6.5 has built-in support for three different database products, these must be purchased separately.

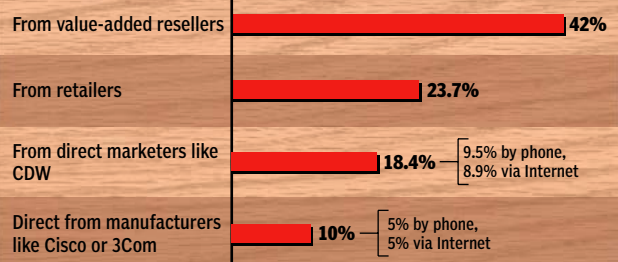
THE NEED FOR CONSULTANTS OR VARs

Server OSs have grown fat with features and at the same time more complex, leading many small businesses to hire consultants or value-added resellers (VARs) to help them choose the right OS, install it, and set it up. In fact, 43 percent of small businesses turn to VARs to purchase an OS, says Arjun Mehra, an analyst with AMI-Partners.

While that leaves a large percentage of small businesses buy-

ing their networking software and equipment elsewhere, the vast majority of these businesses are still having either consultants or in-house experts install and configure them. We cannot recommend taking the do-it-yourself route with any of the products we review here. Even Microsoft Small Business Server, with its user-friendly wizard-driven installation, still requires a sound basic understanding of networking, protocols, and security settings. We recommend hiring VARs or consultants to help with the installation and management of any server OS in our roundup, especially if you lack on-staff expertise. Doing so gives you the best chance of having a system and services that are running and secure from the start. The biggest potential pitfall, as with hiring any type of consultant, is finding someone

Where do small businesses buy network operating systems and other network software?



Based on a survey of 792 small-business owners. 5.8 percent of the survey respondents did not know or did not answer the question. Source: Access Markets International (AMI) Partners Inc. (www.ami-usa.com).

who will complete the work at a reasonable price and within your timeframe. You can also expect to incur some level of ongoing maintenance and support costs.

Finding the experts may be a challenge too, depending on the server OS you choose. Microsoft SBS is the small-business server OS most commonly sold and supported by integrators and VARs. And in metropolitan areas, the number of consultants and VARs selling and supporting SUSE and other Linux products is growing. (At press time, Novell was amid talks to acquire SUSE Linux; what this could mean for the sale and ongoing support of SUSE OS offerings is anyone's guess.)

COST AND OTHER CONSIDERATIONS

Budget is always an issue, and costs vary significantly from solution to solution. In terms of software cost alone—without considering support or hardware—you can equip a 20-person office for about \$2,000 by purchasing one of the two Linux products. Microsoft SBS comes in at around \$3,000, though several hardware manufacturers, including Dell and HP often run discounted specials on their servers when they are purchased with the OS preinstalled.

The four products reviewed here vary in level of complexity, feature set, and flexibility. The following reviews evaluate each of these areas to help you decide which OS is right for you, based on your company's needs, resources, and expertise.

We asked Ingram Micro

(www.ingrammicro.com), a leading wholesaler of IT products, sales, marketing, and logistics, for a price proposal for each product in our roundup.

The price was to be based on an office of 20 users, with the following features included: e-mail server, Web-based e-mail client for the e-mail server, file-transfer services/FTP server, print and file serving, firewall and Internet connection sharing, directory service support, remote-access server, Web server, and database server. We've highlighted Ingram Micro's responses throughout this story. (Net Integrator was not included, because Ingram Micro doesn't currently sell it.)

Microsoft Windows Small Business Server 2003

For 10 users, \$1,088. Microsoft Corp., www.microsoft.com/windowsserver2003/sbs/default.msp.

OVERALL RATING: ●●●●●

You can tell from the word *go* (or rather *start*) that the latest iteration of Microsoft Windows Small Business Server (SBS) is targeted at companies with little IT expertise. Microsoft has focused on ease of use and feature integration, making it a viable choice for small businesses with 75 or fewer employees.

Nevertheless, the wealth of options might be overwhelming for very small offices that need only simple collaboration and e-mail. These businesses might be better off with the Net Integration or SUSE offering reviewed in this story.

Included in SBS 2003 are several features not available in its predecessor, SBS 2000. The most impressive of these let workers remotely access their office desktops, synchronize their mobile devices, and use a built-in version of Microsoft SharePoint.

WHAT YOU'RE REALLY GETTING

Beneath its interface, SBS 2003 is a complex set of different servers, services, and applications. While installation and configuration wizards help achieve a quick setup, the underlying architecture contains many components: The core operat-

ing system is driven by Windows Server 2003 including IIS (Internet Information Services); e-mail runs on Exchange Server 2003, and collaborative functions are handled by SharePoint Services. Outlook 2003, Microsoft SQL Server, and FrontPage are also included in the package.

Our only concern—and a minor one—is that even with all the wizards and tremendous improvements in usability, end users might be overwhelmed by the plethora of features. But once SBS 2003 users get a handle on how to navigate the system and its features, they'll find much to boost their productivity.

Let's start with the most basic, most crucial of communications components—e-mail. Outlook has received a complete redesign of its Web access interface. The way Outlook 2003 communicates with its Exchange back-end counterpart has also been improved. Microsoft has introduced technology called *cached mode*, in which the mail folder content is downloaded into a cache on the local computer, freeing the Outlook application from constant server interaction when users read their mail.

Most significant among the groupware changes to SBS are the added remote-access and collaboration capabilities provided by Microsoft SharePoint, an intranet-based collaboration tool. When an end user logs on to the local network's intranet site (created by SharePoint), the software sets up an individual home page

for that user, who then has instant access to a variety of collaborative tools such as document archiving, document sharing, and revision management. Project files and presentations can be managed in dedicated workspaces as well.

The Remote Web Workplace feature in SharePoint is an automatically created Web portal that provides remote access to the end user's office PC (including applications such as e-mail) and to company intranet Web pages. When the user chooses to log on to the desktop remotely, the system creates a Terminal Services connection within Internet Explorer. Since the process utilizes an ActiveX control, there is no need for a locally installed Terminal Services client application. We found this connection method extremely convenient, providing end users and administrators with the exact look and feel of their office desktops.

Other impressive features in SBS 2003 include mobile connectivity to Windows Mobile 2003-based devices, application distribution, and various interface redesigns. (For more on Mobile 2003, see First Looks, December 30, page 43.)

INSTALLATION AND MANAGEMENT

While the SBS 2003 system installation is comparatively easy, we still recommend that you consult a knowledgeable IT administrator to ensure proper setup, even if you purchase your server through a

Microsoft Windows Small Business Server 2003



Microsoft Windows Small Business Server (SBS) 2003 presents the most intuitive interface by far among the products in this story. Small-business end users, consultants, in-house IT experts, and VARs responsible for installing and maintaining systems will all appreciate how easy it is to navigate this OS. We also found the Web-based e-mail client Outlook Web Access unparalleled in the number and quality of features offered. And SBS 2003's integration and synchronization features for mobile devices were both impressive and unique.

Using Microsoft's remote-access feature, we felt as if we were sitting at our workplace desktop; there was simply no learning process needed. Such features are handy both for in-house IT managers working from their own workstations within a company and for administrators or VARs that manage systems remotely.

The IT-oriented set will be pleased with the many configuration wizards, which make even the most complex installation and configuration tasks straightforward. Many server hardware manufacturers are offering the system pre-installed—a benefit for VARs, which can just perform minimal customization at their customers' sites.

SBS 2003 is the first server OS that transparently integrates Exchange, without requiring a separate purchase and dedicated configuration. With this product, Microsoft has set the standard for small-business server operating systems.

Net Integration Technologies NITIX Autonomic Linux Server OS earns an honorable mention as an extremely integrated solution that is innovative and secure. This is a good choice for small businesses that want to deploy a comparatively simple infrastructure without ongoing reliance on VARs or highly qualified IT staff for maintenance and management.

SCORECARD



Our **setup and deployment** rating reflects the complexity and effort required to set up core network functions (DNS, DHCP, e-mail, file and print sharing, and remote access). **Local management** refers to the administrative interface and the ease with which common and ongoing configuration tasks can be completed. **Remote management** involves all mechanisms available to the system administrator for performance maintenance and remote troubleshooting. We base the **user portal** rating on the intuitiveness and design of the Web portal providing such services as e-mail, file sharing, or discussion groups. For **collaboration** we

compare all system components that provide team- and group-oriented features. For **remote connectivity** we examine the system's ability to provide remote access to users; this includes traditional VPN tunnel setup, Web- or SSL-based access, and other remote services. **Mobile connectivity** involves the server's ability to provide access to mobile devices or synchronize data with them. **Data security** means file system security, including provisions for secure backup. **Access security** involves security protocols, firewall options, and the remote-access technologies used. Finally, the **overall** rating is not an average but an aggregate based on analysis by PC Magazine Labs staff and reviewers.

	Setup and deployment	Local management	Remote management	User portal	Collaboration	Remote connectivity	Mobile connectivity	Data security	Access security	OVERALL
Microsoft Windows Small Business Server 2003	●●●●	●●●●●	●●●●●	●●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●
Net Integration Technologies NITIX Autonomic Linux Server OS	●●●●●	●●●●	●●●●	●●	●●	●●●●	●●	●●●●●	●●●	●●●
Novell Small Business Suite 6.5	●●	●●●	●●●	●●●●	●●●●	●●●	●●	●●●●	●●●●	●●●
SUSE Linux Openexchange Server 4.1	●●●●	●●●	●●●●	●●●	●●●	●●●	●●	●●●	●●●●	●●●

●●●●●—EXCELLENT
 ●●●●—VERY GOOD
 ●●●—GOOD
 ●●—FAIR
 ●—POOR

RED denotes Editors' Choice.

system vendor and receive it preinstalled.

Those already familiar with setting up SBS will recognize the new To Do List page as the first significant change in the latest version of the product. This page, which offers a compilation of wizards, appears after the initial installation is complete and the administration console is launched. It guides whoever is setting up

Microsoft Exchange does not include spam filtering, administrators can configure the server to strip certain file types from incoming e-mail.

Adding users to your network is another process that has been greatly improved, with four predefined templates included—user, mobile user, power user, and administrator. Additional templates

up is still better than none. We suggest that your organization invest in a dedicated drive for backup, or even better, a tape solution that allows data storage off-site.

Another administrative component unparalleled in this roundup is monitoring and reporting. Performance and usage reports that highlight critical failures can be sent automatically to the administrator (or a designee) via e-mail or viewed on the server, including the Remote Web Workplace (just in case your Exchange server is the failing component). These reports, however, demand a higher level of IT expertise to decipher.

Without question, Microsoft Windows Small Business Server 2003 presents the greatest breadth of features. The only real question is whether you will need them all. Regardless, if you want a system offering all the features to be found on any enterprise network and an upgrade path that will accompany your own business's growth, then SBS 2003 is the right choice for you.—OK

INGRAM MICRO PRICE QUOTE: Microsoft Windows SBS 2003 Premium Edition with 5 user licenses, \$1,499. 15 additional client licenses, \$1,467. Total: \$2,966 (including Microsoft SQL Server).

SBS 2003 through all the necessary steps of server installation and configuration.

The E-mail and Internet Connection Wizard walks administrators through various network topologies, which can also be found on the setup poster that ships with the OS.

After setting up e-mail and Internet connections, the administrator can decide which services to make available to users from the Internet. The choices include OWA (Outlook Web Access), Share-Point services, and the new Remote Web Workplace, to name just a few. Although

can be created if necessary. Use of these templates largely automates the configuration of security and rights settings, remote-access settings, and automated application installation (this last feature lets administrators deploy such programs as Outlook or Internet Explorer directly to client workstations over the network).

We were pleasantly surprised to see SBS 2003 arrive complete with a backup strategy as part of the initial To Do List. Though we do not recommend backing up to a share on the same hard drive—as SBS 2003 is configured by default—some back-

Net Integration Technologies NITIX Autonomic Linux Server OS

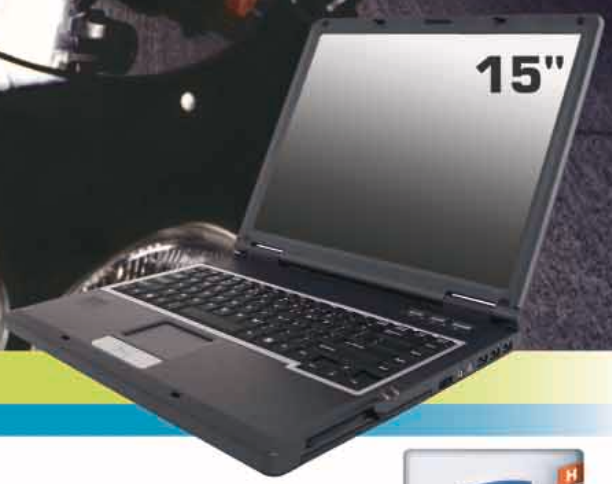
For 25 users, \$1,999. Net Integration Technologies Inc., www.net-itech.com. ●●●●●

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products, January 2003), and this small company awes us once again. Its newest concept is innovative: a complete server OS on a chip. You plug it into the IDE slot of your server, and you're ready to go. Still, only an experienced IT administrator should handle installation. By the time you read this, NITIX should also be available on CD, with all the same features found on the chip version.

The chip must contain an amazingly clean bit of code; it's all of 16MB in size. By contrast, Microsoft's SBS 2003 requires 4 gigabytes of hard drive space. But therein lie both the beauty and the catch of NITIX. It is a good fit only for companies that are interested in a very simple, highly automated system and want to spend little time thinking about backup, security, and IT in general. If you're looking for a system that integrates complex databases or third-party CRM solutions, this is not for you.

KEY FEATURES

Our version of NITIX was customized to run on a Sun Fire V65x.

NITIX is essentially a very stripped-down and hardened version of Linux. The OS can function as your core infrastructure server, delivering file sharing, e-mail (including Web mail), a Web server, an FTP server, and a DNS server. Net Integration provides free dynamic DNS listings for customers, so you can host your own domain even if your ISP provides dynamic IP addressing only. File sharing services are available via NFS (Network File System) and SMB (Server Message Block), ensuring compatibility with attached Linux/Unix and Windows clients.

Though the integrated Web mail client is easy to use, it lacks much of the sophistication found in SUSE's Web interface and doesn't come close to the quality of Microsoft Outlook Web Access. Aside from access to your e-mail, the Web mail interface is limited to fairly simple contact management and calendaring functions.

NITIX provides little in the way of collaborative options, so if you rely heavily on features such as group scheduling, shared contact management, and task scheduling, especially for remote users, you'll need to install Net Integration's ExchangeIt! software. This comes bun-

dled with the OS but must be installed separately, as does the client side of the application. ExchangeIt! enables the collaborative features found in Microsoft Outlook or the Linux desktop product Ximian Evolution. But NITIX does not contain any file management features or built-in team workspaces or discussion groups.

An aspect of NITIX that particularly intrigues us is the Expression Desktop and Expression server-side module. Using a boot CD-ROM or a USB memory token

atically to identify the subnet connected on your LAN and WAN and configure itself with a valid IP address. NITIX will not configure itself with an IP address that already exists on your network; instead, it automatically enables or disables its built-in DHCP server based on its discovery results.

For an IT person experienced with a simple network, configuring NITIX is just as easy as installing it. All configuration tasks are performed using the server's Web interface. In it you handle every-

NET INTEGRATION PRICE QUOTE: NITIX

Autonomic Linux Server OS. Total: \$1,999 for 25 users.

(including MySQL database server).

(for systems that can boot off a USB device), you can load the Expression Desktop even on legacy hardware, without needing to configure hard drives. Using this means of loading the desktop provides that all drive mappings and your e-mail will be instantly available from the Expression server—a simple solution for setting up PCs in places where workers need just a limited set of applications. Key applications included with Expression are Galeon as the default Web browser, OpenOffice 1.1, and the Ximian Evolution e-mail client.

CORE OS MANAGEMENT

Installation of the core OS should be very simple for an IT person. Once the NITIX chip is physically installed, on boot-up the server accesses the chip as though it were booting off an ordinary IDE hard drive. The server then copies the OS and all included services to the hard drive and fires up the OS. Core system functions remain on the chip's nonvolatile memory, enabling the OS to provide Internet and firewall services even if your main hard drive dies.

You would usually set up NITIX with two network interfaces: one for your external network and one for your internal network. This enables the OS to handle NAT (Network Address Translation) automatically. Net Intelligence, a discovery and setup system, also works auto-

thing from creating user accounts to managing the system. And we really like the included balloon help.

NITIX configures a gateway and provides a built-in firewall, which allows users to plug the server directly into a cable or DSL modem. While traditional IPsec (IP Security) VPNs require the configuration of users, security settings, and your firewall, NITIX handles all of this internally.

Access and data security were also of paramount importance in the design of the OS. NITIX utilizes two hard drives, storing incremental backups onto the second hard drive every 15 minutes. This procedure is enabled by default and requires no user intervention. Should the first hard drive fail, simply replace it and the system will rebuild itself automatically.

Unique to NITIX is the DoubleVision feature, which provides load balancing across multiple WAN links. If one link fails, the feature reroutes traffic to a working connection.

Web-based services are provided by the integrated Apache Web server, which can serve public content to the Internet and reserve personal Web space for internal users. The Web server, which also provides access to Web-based e-mail, includes SSL 128-bit encryption and support for CGI, Perl, and PHP4 scripts, in case you need to supply dynamic content.

NITIX is an attractive option because of its simplicity, but anyone looking for complex features will need to look elsewhere.—OK

Our contributors: **Padraic Boyle** is a freelance writer and networking consultant. Associate editor **Davis D. Janowski** and PC Magazine Labs project leader **Oliver Kaven** were in charge of this story.

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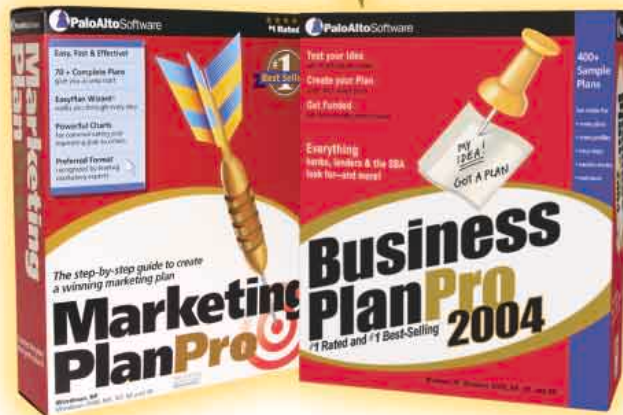
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Novell Small Business Suite 6.5

Pricing unavailable at press time. Novell Inc.,
www.novell.com. ●●●●●

With its solid base of core OS features and host of bundled applications, Novell Small Business Suite (NSBS) is the product most comparable to Microsoft Windows Small Business Server 2003 in this roundup. We reviewed a closed beta version of NSBS 6.5; this means there will be no significant changes before the software becomes available in the first quarter of this year. Novell had not

small and medium-size businesses well, but only if they have qualified Novell administrators on staff—or if they can afford to hire qualified Novell consultants to install and manage their networks.

In Version 6.5 of the suite, Novell has doubled the number of licenses supported, from 50 in NSBS 6.0 to 100 users now; Microsoft's SBS 2003 supports 75 user licenses. And Novell throws in support for two-node clustering as well as iSCSI support for increased availability and high-speed backup.

One compelling feature of NSBS 6.5, at least for any company that expects rapid growth in employees and network size, is Novell Directory Services (NDS). While it might be overkill for the typical small business—NDS has always been considered ideal for larger installations—the directory service provides a central repository for user information, such as passwords, access-control lists, and groups, and is easily scalable. Moreover, NDS is compatible with most operating systems (including AIX, Linux, Solaris, and Windows 9x, NT, 2000, and XP), allowing for a single point of log-on, file sharing, and application delivery across platforms. By comparison, Microsoft's Active Directory is currently supported only under Windows 2000 and XP, and it does not provide the breadth of features that NDS boasts.

Beyond the strong NDS engine under the hood, NSBS 6.5 provides a host of bundled products comparable to those found in Microsoft's SBS 2003, including Novell GroupWise 6.5, BorderManager 3.8, and ZENworks 4.01. These products are installed by default, but unfortunately they do not have the simple, integrated configuration tools available for Microsoft's SBS; instead, NSBS provides a host

INGRAM MICRO PRICE QUOTE: Novell Small Business Suite.

Version 6.01, with 5 user licenses, \$1,295 (6.5 pricing unavailable). 15 additional client licenses, \$900. Pervasive SQL 8 database server for 20 users, \$1,995. Total: \$4,190.

finalized the product's pricing or release date at press time but said it would come in at considerably less than a similarly configured NSBS 6.01 system and be comparable in price to Microsoft's SBS 2003.

We believe Novell's product will serve

BELLS AND WHISTLES

For all intents and purposes, NSBS 6.5 is a fully functional version of NetWare, complete with all the standard applications and utilities such as NDS, Apache Web server, Tomcat application server, iFolder, iManage, and iPrint.

of utilities with differing interfaces.

In the past Novell had also bundled third-party applications such as Tobit's FaxWare, but at press time it was considering making them available for download from its Web site instead, to ensure that customers have the current versions.

On the e-mail and calendar collaboration front, GroupWise covers the bases, and it includes a spam blocker that can be configured on a per-user and per-site basis. Much like Microsoft's SBS 2003, GroupWise provides mobile-device synchronization with e-mail, calendaring, and group tasks. Because of Novell's slipping market share, GroupWise—unlike its Microsoft counterpart—has not been such a lightning rod for hackers; thus end users may be less of a target. This is also true of the included Apache Web server: It is less targeted than its Microsoft counterpart.

On the security front, NSBS 6.5 provides excellent protection with BorderManager 3.8. Using a proxy server and caching capabilities, BorderManager provides typical firewall functions such as packet filtering on both inbound and outbound traffic to prevent unauthorized

users from accessing the network. A VPN can also be set up for remote access (though it's no simple task), and content filtering is available through third-party products. A wizard helps to create the filter rules, but BorderManager demands an in-depth configuration commitment and is not for the faint of heart. It is best handled by an experienced Novell consultant.

Rounding out the bundled product list is ZENworks 4.0, an application deployment tool. With it you can deploy applications based on specific criteria, such as machine type, space requirements, and processor. Utilizing the NDS Tree and policies, ZENworks can be configured to deploy applications and updates by user, by group, or to an entire office from a single point. And ZENworks provides self-securing for applications; for example, if Microsoft Word has a corrupted DLL, ZENworks will overwrite the file.

COLLABORATING REMOTELY

Virtual Office, a Web-based portal, is a key application in NSBS 6.5, because it is the springboard to group and team collaboration, either locally or remotely. It lets users

securely access e-mail and calendars, connect to network printers, and install applications. But it also lets them create "virtual teams" on the fly; the members can have access to team calendars, share documents, and chat with other members.

INSTALLATION AND COST CONCERNS

Although most of the installation and configuration of NSBS 6.5 are done using wizards, these steps require a strong knowledge of NDS and networking in general. Moreover, the standard installation process does not install BorderManager or ZENworks. We strongly recommend that a certified Novell VAR or consultant or a qualified IT staff member perform the installation and configuration to make the most of the product's features. Novell encourages the use of VARs by serving up special deals; for example, it plans to offer a Starter Pack of NSBS 6.5 with a free five-user license if you purchase it through a certified VAR.

We recommend you research the Novell-certified VARs and consultants available in your area (www.novell.com/nsbs_starterpack/locator) and seek

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SUMMARY OF FEATURES

Server Operating Systems for Small Business

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	Microsoft Windows Small Business Server 2003	Net Integration Technologies NITIX Autonomic Linux Server OS	Novell Small Business Suite 6.5	SUSE Linux Openexchange Server 4.1
■ YES □ NO				
Price: 10 / 25 / 50 users	\$1,088 / \$2,528 / \$4,946	N/A / \$1,999 / \$3,474	Not available at press time	\$1,249 / \$1,996 / \$3,147
SYSTEM				
Operating system	Microsoft Windows Server 2003	NITIX Autonomic Linux 3.72 with Linux Kernel 2.4.19	NetWare 6.51	SUSE Linux Enterprise Server 8
Support for multiple/virtual domains	■ ■ (Web domains only)	■ ■	□ □	■ ■
Online software update engine	■	■	□	■
Access for thin clients	■	■ (Expression only)	■	■
COMPONENTS INCLUDED				
E-mail server	Microsoft Exchange Server 2003	Qmail	Novell GroupWise 6.5	Postfix
Web server	Internet Information Services	Apache	Apache	Apache
Database server	Microsoft SQL Server 2000	MySQL	MySQL	PostgreSQL
Application server	Windows Server 2003	None	Extend Application Server	Tomcat
File and print sharing	■ ■	■ ■	■ ■	■ ■
COLLABORATION				
Centralized contact management	■	■	■	■
Searchable by user/company	■ ■	■ ■	■ ■	■ ■
Group mailing lists	■	■	■	■
Calendaring	■	■	■	■
Group scheduling/Conflict check	■ ■ (via Outlook)	■ ■	■ ■	■ ■
User can view colleagues' calendar	■ (via Outlook)	■	■	■
Integrated instant-messaging server	□	□	■	■
User or team portal	■	■	■	■
Discussion forum	■	□	■	■
MAIL AND FAX				
Supports IMAP4, POP3, SMTP	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Full Microsoft Outlook compatibility	■	■	■	■ (using iSLOX MAPI provider)
Web mail	■	■	■	■
User-list storage	Active Directory	Proprietary	eDirectory	LDAP
Mail storage	Exchange mail store	File system	GroupWise Database	File system
Integrated SPAM filtering	□	■	■	■
Integrated fax management	■	□	□	■
CLIENT DESKTOPS AND ACCESS				
System provides user Web pages	■	■	■	□
Administrator can distribute applications to desktops	■	■	■	□
Users can access data with mobile devices	■	■	■	■
SECURITY AND PROTOCOLS				
VPN server/setup wizard	■ ■	■ ■	■ ■	□ □
Built-in firewall	■	■	■	■
Automated system backup by default	□	■	□	□
Backup wizard for external devices	■	■	□	□
Transport Layer Security (TLS)	■	□	■	■
Simple Authentication and Security Layer (SASL)	■	□	■	■
SMTP Authentication (SMTP-AUTH)	■	■	■	■
Secure Sockets Layer (SSL)	■	■	■	■

RED denotes Editors' Choice. N/A—Not applicable: No price is specified for a 10-user configuration.

quotes for ongoing support before purchasing NSBS. If there are few or none in your area, or if potential support costs are beyond your company's means, you would be better off with one of the other solutions reviewed here.—*Padraic Boyle*

SUSE Linux Openexchange Server 4.1

With 10 groupware licenses, \$1,249. SUSE Inc., www.suse.com. ●●●●●

If your organization doesn't need the fanciest features of Microsoft Windows Small Business Server 2003, such as mobile-

device synchronization or remote desktop access, SUSE Linux Openexchange Server 4.1 is an ideal, cost-effective choice. It can be deployed quickly and requires little in the way of ongoing IT expertise.

Although the Openexchange user and management interfaces are not quite as polished and refined as those in Microsoft's product, they're still impressive, particularly the collaboration features. We found both interfaces easy to navigate, letting users at any expertise level painlessly complete their daily chores.

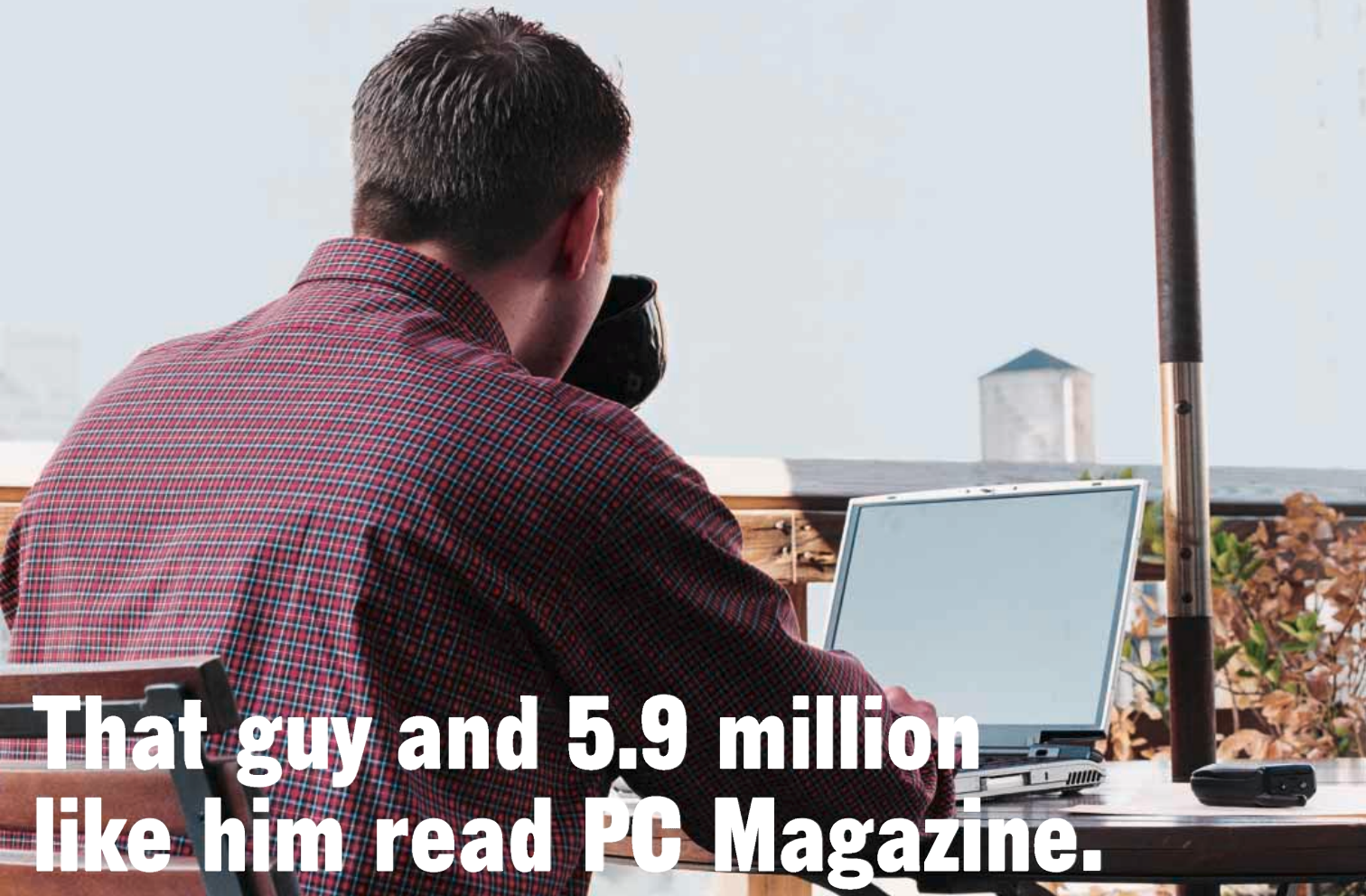
Openexchange is built on top of SUSE

Linux Enterprise Server 8, a stable server OS based on open-source standards; it is practically transparent to users and administrators, unless your environment requires special configuration. Additional included components are the Apache Web server, OpenLDAP, the Postfix mail server, a PostgreSQL database, Samba (for Windows-compatible file sharing), and the Tomcat application server.

E-MAIL AND WEB SERVING

SUSE's own impressive e-mail client, with its Web-based interface, is intuitive and

You know a guy who won't go anywhere without his laptop. He commutes with a guy who uses a digital video camera to analyze his golf swing. He has a standing tee time with the guy who is coding a security app for what he calls "no doubt about it, the next big thing."



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can easily serve the needs of most businesses and users. But if you truly want or already depend on Outlook, you can use it via the WebDAV/XML connector application and get full calendaring and conflict management capabilities.

Though the Web-based mail client is not as feature-rich and refined as Microsoft's new Outlook Web Access client (OWA), it meets all of a user's basic needs. For example, the Openexchange client can be used in conjunction with both the contacts and calendaring components via the portal. The system is also very secure, relying on an SSL (Secure Sockets Layer) connection by default.

The portal offers a variety of other collaborative elements, which can be extensively tailored. In addition to calendaring and contact management, Openexchange offers a discussion forum, a simple project management tool, and a bookmark and knowledge depository.

Many of the collaborative elements take advantage of the integrated PostgreSQL database, which allows linking objects from different parts of the groupware portal. For example, you can create a meeting and link a PDF document from the document management section to it, or link a bookmark to a meeting or contact. Since everything is stored in the PostgreSQL database, users are just creating links and not duplicating documents.

Other useful collaborative elements include the integration of DyCE Instant Messenger for your organization's internal use, as well as a bulletin board.

INSTALLATION

Designed as a complete groupware solution targeted at a broad range of customers (companies with anywhere from 5 to 2,500 users), Openexchange cannot be installed on systems already running a SUSE server OS; it is intended to be set up as a dedicated system. Typically, a small business will be starting from scratch and installing a fresh Openexchange server anyway. While Openexchange is comparatively uncomplicated, small-business owners will still probably want a consultant or VAR completing the initial installation and

configuration, especially if their businesses need any customization or additional applications installed.

After the initial installation, all configuration and management of groupware-related functions are performed through the dedicated Web-based interface. This lets administrators or consultants remotely configure and maintain the system with ease from their own workstations.

One catch: For specialized setups and the integration of some applications, especially enterprise-level products, an administrator may still need to log on to the server locally and use either the YaST2 management tool or the command line interface. Also, the architecture ties some core networking components directly into the Openexchange administrative

SMTP (Simple Mail Transport Protocol) authentication, TLS (Transport Layer Security), and the user-configurable SpamAssassin, a spam-filtering solution. POP (Post Office Protocol) and IMAP (Internet Message Access Protocol) are also supported.

From an administrative point of view, Openexchange is easy to manage. All basic configuration is straightforward and explained with balloon help, a feature that is also accessible to end users. Using the Web interface, the administrator also has access to various monitoring items, such as graphs that display historical data over time (up to one year). These are helpful tools for detecting bottlenecks.

If you are a Linux expert, you might want to take advantage of the Web-

INGRAM MICRO PRICE QUOTE: SUSE Linux

Openexchange Server 4.1. With 10 groupware client licenses, \$1,249.

Additional 10 groupware licenses, \$498. Total: \$1,747

(including PostgreSQL database server).

platform. DNS and LDAP are good examples of applications that should be changed only through Openexchange—and not edited or manipulated at the SUSE Linux OS level unless you know exactly what you are doing.

GROUPS AND MANAGEMENT

Openexchange lets designated administrators easily create groups that include any system users and any shared folders. The separation of groups and folders might be a little confusing at first, but it actually turns out to be a flexible and handy tool once you're used to the concept, which is similar to the shared folders in Microsoft Outlook. Shared folders are used in the e-mail portion of the system and can be used not only to store mail but as global mailing lists. Users can subscribe to a shared folder, and new mail will appear within the folder in each user's mail tree.

The mail server is fully featured with

DAV/XML interface documentation for the calendaring, contacts, and document management sections of the system. Companies that already have existing XML-based CRM or project management solutions can transparently exchange and synchronize data with Openexchange.

Our one big complaint is that Openexchange lacks a backup mechanism or even advice on how to choose the right backup plan. You can set up your own bare-bones server backup through the local interface or YaST2, but only if you are an experienced Linux administrator; no guidance is offered.

Having said this, we find that on the whole, SUSE Linux Openexchange Server 4.1 is a well-rounded, affordable product. It provides all the key ingredients needed to get a small business or organization off the ground. And a knowledgeable administrator, VAR, or consultant can add many other applications to the system's basic feature set. **WOK** ☰

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Model	BlackWatch S38i	BlackWatch X38i	BlackWatch X38i
Form Factor	3U Rackmount	3U Rackmount	3U Rackmount
Intel® Processors	Pentium® 4 2.4B GHz 533 FSB ServerWorks GC-SL	Dual Xeon® 3.06GHz 533MHz FSB ServerWorks GC-SL	Dual Xeon 3.06GHz 533MHz FSB ServerWorks GC-SL
Chipset	512MB (max 8GB) DDR266	1GB (max 8GB) DDR266	2GB (max 8GB) DDR266
ECC Registered Memory	3ware® Escalade™ 7500	3ware Escalade™ 7500	3ware Escalade™ 7500
RAID Controller	8 x IDE Included	2 x 5 1/4 (free), 1 x 3 1/2, 1 slim CD	8 x IDE Included
Hot Swap Drive Enclosures	2 x 5 1/4 (free), 1 x 3 1/2, 1 slim CD	8 x 250GB 5400 rpm 2MB cache	2 x 5 1/4, 1 x 3 1/2, 1 slim CD
Additional External Drive Bays	8 x 250GB 5400 rpm 2MB cache	2 x Gigabit	8 x 250GB 7200 rpm 8MB cache
Included IDE Hard Drives	2 x Gigabit	ATI® Rage XL 8MB	2 x Gigabit
Integrated Network Controllers	ATI® Rage XL 8MB	ATI® Rage XL 8MB	ATI® Rage XL 8MB
AGP VGA Controller	2 x 64-bit, 3 x 32-bit	2 x 64-bit, 2 x 32-bit	2 x 64-bit, 1 x 32-bit
Available PCI Slots	Included	Included	Included
1.44 MB Floppy Disk Drive	24X max	24X max	24X max slim CD-RW/DVD combo
IDE Low Profile CD-ROM	Optional	Optional	SDLT 160/320GB
Tape Drive SCSI	3 x 9 cm Fans	3 x 9 cm Fans	3 x 9 cm Fans
Cooling Subsystem	460 Watt	500 Watt Redundant	500 Watt Redundant
Power Supply	Optional	Optional	Microsoft® Windows® 2000 Server
Operating System	Optional	Optional	Dantz® Retrospect® Multi Server
Backup Software	Optional	Optional	
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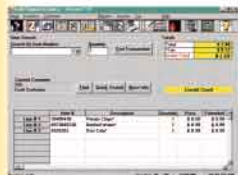
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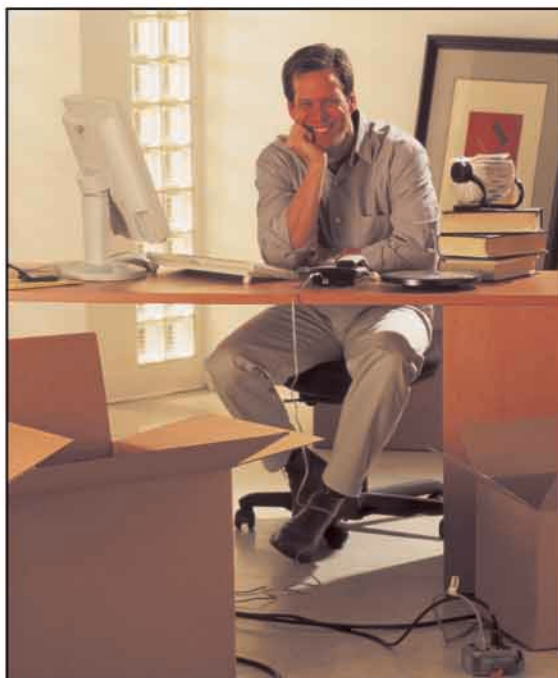
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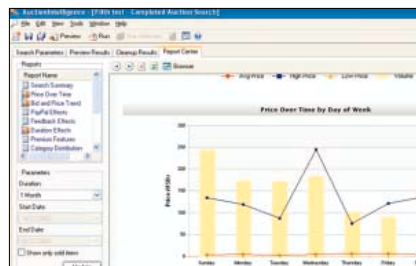
BY DON LABRIOLA

Online auctions were once little more than electronic yard sales where savvy buyers could search for deals on collectibles and used household goods. That image seems quaint, now that millions of items are posted every day at enormous auction sites such as eBay, Amazon Auctions, and Yahoo! Shopping Auctions. Private individuals still make up a big part of this market, but now amateurs have to compete with professional auctioneers and buyers.

The burgeoning cottage industry of auctioneering software

tools may help level the playing field. These applications perform tasks that range from programmable sniping (placing bids right before an auction closes) to creating and uploading professional-looking auction pages and performing sophisticated market research and pricing analyses, as well as streamlining correspondence, feedback, and logistics chores.

In this story, we survey auction utilities designed for both buyers and sellers that offer free trial versions. Whether you're a casual bidder or you aspire to run your own part-time auction business, these tools can give you the edge.



AuctionIntelligence

This is a sophisticated research and analysis tool that provides copious data to sellers who want to squeeze every last bit of profit from their auctions. Its powerful search utility extracts and downloads information from auctions offering the same types of items that you plan to sell and then massages that data into a battery of detailed reports. Savvy sellers use the data to identify bidding and price trends and to determine the effects of factors such as posting and closing times, auction durations, payment options, and eBay category selection.

Our only caveat is that AuctionIntelligence could be too advanced for novices: It provides so much

WHAT THE RATINGS MEAN

- EXCELLENT
- VERY GOOD
- GOOD
- FAIR
- POOR

information that newbies may require some time to figure out how to use it most effectively.

\$9.99 a month. Certes Consulting, www.certes.net/AuctionIntelligence/server/home.aspx.



Auction Sentry

Auction Sentry is a popular and easy-to-use eBay sniping program that also provides a few useful sellers' tools. Despite relatively few features, it is well designed, nicely documented, and a breeze to learn.

When you launch Auction Sentry, it builds a list of auctions from your eBay Watching, Selling, and Bidding lists; you can also add entries manually. Your auctions are organized into a table that displays information such as item numbers and descriptions, bid statistics, and the remaining time of each auction. To set up a snipe, specify an auction, a dollar amount, and the time you want your bid to post.

Auction Sentry also offers handy features such as profit tracking, which projects how much money your auctions will net. And programmable alarms notify you of activity in any auction you're tracking.

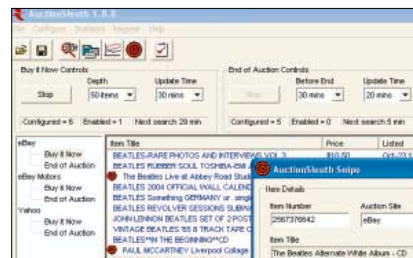
\$14.95 direct. Auction Sentry, www.auction-sentry.com. ●●●●

AuctionSleuth

Billed as an "end-to-end" online-bidding package, AuctionSleuth provides buyers with a full complement of searching, sniping, and monitoring tools.

AuctionSleuth's flexible search engine seamlessly spans multiple auction sites to help you find items to bid on, organizing results into a discrete list for each site. It can search both titles and descriptions, sort Buy It Now auctions into separate listings, and even let you save up to 100 sets of search criteria. Once a search is complete, the program updates its results, alerting you to each new entry with a pop-up window, audio alarm, or text message.

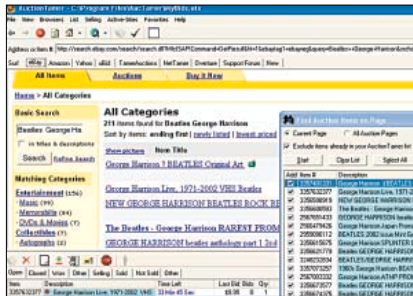
Best of all is AuctionSleuth's sniping facility. Although it works only with eBay and eBay Motors, it will nonetheless



delight modem users: It can automatically dial up, place a bid, and then disconnect without the bidder raising a finger. \$19.95 direct. AuctionSleuth, www.auction-sleuth.com. ●●●●●

AuctionTamer

AuctionTamer's brawny features include monitoring, searching, bidding, creation, and posting tools designed for both buyers and sellers. All this is shoehorned into an exhaustively documented and surprisingly easy-to-navigate multipage interface that looks like a tabbed version of Internet Explorer.



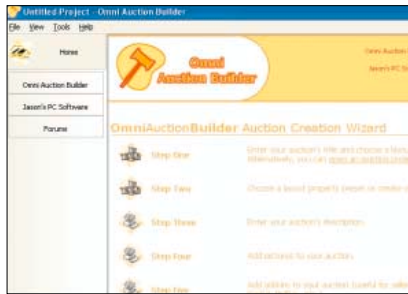
Unfortunately, some of AuctionTamer's advanced features require external modules that add complexity or expense. Creating and uploading auctions require an image-hosting service such as TamerSolutions' ImageTamer, and price checks are done through sites like Price Watch. AuctionTamer includes an integrated sniping function but can also interface directly with more elaborate sniping services. And deciphering the convoluted pricing scheme can take some work.

None of these concerns are deal breakers for such a powerful, well-designed package. If you're looking for a single program to manage almost all your auction needs, AuctionTamer will do the job. \$249.95 direct; subscription, \$15.95 for 6 months. TamerSolutions, www.auctiontamer.com. ●●●●●

Omni Auction Builder

Omni Auction Builder makes an easy task of creating striking auction pages packed with such frills as background images, bulleted lists, fancy fonts, and custom layouts and color schemes. It also lets you enhance your auctions with reusable blocks of HTML code that you can insert, including standard objects like formatted payment and shipping instructions.

Because of the way eBay handles third-party images, Omni Auction Builder must upload photographs to a host server before you can insert them into an auction page. To the program's credit, it handles this task



with aplomb by storing images on an online host maintained for this purpose.

Unfortunately, Omni Auction Builder's automated auction upload feature wasn't fully implemented in the evaluation copy we received. But we had no trouble manually cutting and pasting our work into eBay's standard auction-posting facility. \$20 to \$60, depending on the photo-hosting server space required. Jason's PC Software, www.omniauctionbuilder.com. ●●●●●

Shooting Star

Shooting Star is a general-purpose auction management program that simplifies many of the tedious aspects of buying and selling merchandise online. It downloads pertinent information about each auction in which you're a bidder or seller and formats this data into a sortable, easy-to-browse table, which can be expanded to display additional details or organized into subtables. The program also provides a feature called Open in eBay, which displays an entry's corresponding online auction page in a separate browser window.

Besides continuously displaying the status of each auction you're participating in, Shooting Star performs other useful tasks. These include generating template-driven e-mail correspondence, posting feedback, facilitating online payments, calculating sales tax, maintaining an address book of trading partners, and printing forms such as invoices, shipping lists, and even bank deposit slips. \$49.95 direct. Foo Dog Software Inc., www.foo dogssoftware.com. ●●●●●

SnipeRight Professional

SnipeRight isn't as simple to use as Auction Sentry, and it doesn't offer Auction Sleuth's search capabilities. But we know of no other application that matches the sophistication of SnipeRight's smart-bidding algorithms.

Unlike other sniping packages we tested, SnipeRight does not need to be running to place bids: They are transmitted

directly from SnipeRight's online server farm. And the program's impressive bidding agents adjust their sniping strategy on the fly, in response to the behavior of competing bidders. SnipeRight can even coordinate bids at multiple auctions for the same item and stop placing other bids when it scores a win.

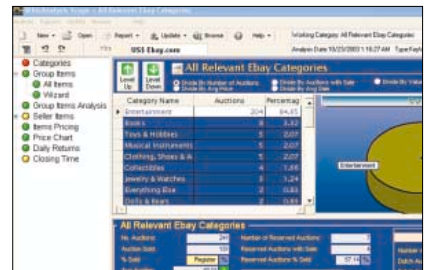
If all this isn't enough, SnipeRight also includes automated feedback, a "friendly sniping" function that conceals from other bidders that a sniping program is placing bids, and an integrated browser window that provides access to eBay's search engine. \$19.95 direct. Legendary Sniping Systems Ltd., www.sniperight.com. ●●●●●

WhizAnalysis



Like AuctionIntelligence, WhizAnalysis researches, analyzes, and identifies the many factors that can affect the success of your auctions. WhizAnalysis is by far the more sophisticated of the two programs; it uses artificial intelligence to generate an enormous and accurately cross-checked array of charts, graphs, and text reports. But the program also is harder to learn because of the sheer volume of information it produces.

Nonetheless, anyone who takes the time to master WhizAnalysis will be amply rewarded. It reports more information



than AuctionIntelligence in more ways and in greater detail. For example, the custom sector and seller analyses tell you which items are selling best in a particular eBay category and evaluate a particular seller's performance.

If your need to look before you leap into the world of online auctioneering outweighs all other considerations, then this is the program for you.

\$99 direct. WhizAnalysis, www.whizanalysis.com. ●●●●●

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The Techie's Player

This device isn't as pretty or easy to use as the Apple iPod, but when it comes to features, the **iRiver iHP-120** delivers. The 20GB player offers an FM radio tuner, optical in and out jacks, and more than twice the battery life of the iPod—for the same price. The iHP-120 also includes a digital voice recorder and an in-line remote. And with a USB 2.0 connection, we were able to load up the device with 20GB of music files in just 1 hour 51 minutes.

Once you load the drivers, you can manage music on the iHP-120 in Windows Explorer. The player supports MP3, WMA, ASF, WAV, and OGG formats. What it lacks in sex appeal the iHP-120 makes up in tech appeal.—*Dan Costa*
\$399 list. iRiver Inc., www.iriver.com. ●●●●●



No Cords, No Hands

With the money you're saving using 3-cent-a-minute long-distance service, invest in a decent cordless headset for your wired phones. The **Plantronics CS50's** 1-ounce headset clips over your ear and links directly to a 900-MHz base station placed next to the phone. Sound quality and volume are fine. During testing, the CS50 maintained a connection throughout a 4,000-square-foot house and outdoors within 100 feet. You can pair it with the Plantronics HL10 phone lifter, which automatically lifts the handset of virtually any home or office desk phone. Minor ergonomic glitches (a tippy base unit and confusing labeling) are the CS50's only drawbacks.—*Bill Howard*
CS50, \$299 direct; HL10, \$79. Plantronics Inc., www.plantronics.com. ●●●●●



Make Music like a Pro

The **Digidesign M-Box with Pro Tools LE 6.1.1** is a winner. Pro Tools LE is a multi-track audio and MIDI recording and mixing environment for musicians and producers who don't want (or need) to turn their pockets lint-side out for the professional-studio stalwart Pro Tools. Pro Tools LE also comes with the M-Box—a bus-powered stereo USB interface with two high-end mic preamps, 24-bit analog and digital I/O, and a headphone jack. Version 6.1.1 has 32 audio tracks, plenty of effects, enhanced MIDI editing, and an elegant, powerful workspace. Although MP3 export and DV support are optional, this package has rock-solid performance, a stunning interface, and ReWire compatibility.—*Emile Menasché*
\$495 list. Digidesign Inc., www.digidesign.com. ●●●●●



Surf Satellite Radio

Why stream satellite radio to your PC for \$9.95 a month when Internet radio is free? Because the **XM Radio PCR** satellite radio offers incredibly flexible channel surfing. It's a Band-Aid-box-size device with a USB jack and a separate antenna. Plug it into your PC and you can quickly scroll through listings for all 100 channels or just your favorites. The neatest trick: Flag your favorite artists and tunes and the next time, say, Leslie Gore's "It's My Party" plays on the Sixties channel, you'll jump right to it. You can also stream music to your home stereo system via an audio cable or digital media hub.—*BH*
\$50 street. XM Satellite Radio, www.xmradio.com. ●●●●●

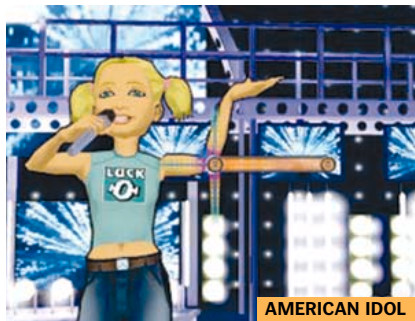


Games for the Family

By Peter Suci

"The family that plays together stays together." That old saying still rings true, even in this digital age. Although old-time favorites like Monopoly and Risk aren't currently being published for the PC, plenty of new titles offer hearty fun for the whole family. Some are multi-player, and some, like SimCity 4, lend themselves well to collaboration.

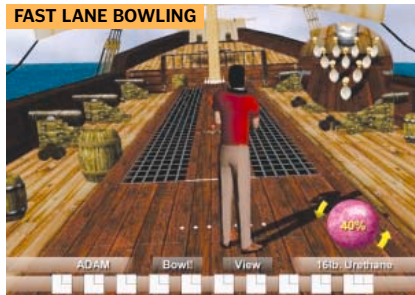
All of the games we review below have earned a rating of E (Everyone) from the Electronic Software Ratings Board.



AMERICAN IDOL

American Idol

See if you have what it takes to be a star. With this game, based on the hit reality TV series of the same name, you can now turn yourself into an *American Idol* wanna-be. The music-based game play combines elements of a rhythm-action dance game with karaoke. After your performance, you'll have to face the music—comments from virtual versions of the TV show's judges, Simon Cowell, Randy Jackson, and Paula Abdul. When you're hot, expect kudos. When you're not, brace yourself for the brutal truth. \$30 street. Codemasters, www.codemasters.com. ●●●●●



FAST LANE BOWLING

Fast Lane Bowling

Here's a title that will strike the whole family as fun in the fast lane. It's a bowling simulation that uses realistic physics and high-polygon-count characters in a fully rendered 3-D environment, combined with unlikely locations: You can hit the

lanes on a pirate ship or even in ancient Egypt. The game has six modes to test your skills and keep you in the groove. But as with a lot of other sport simulations, the fun starts to wear thin fairly soon. At least you won't have to wear rented shoes. \$20 street. Enlight Software, www.enlight.com. ●●●●●

Harry Potter: Quidditch World Cup

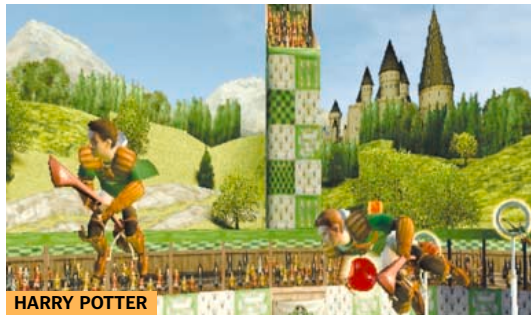
The bespectacled wizard has been absent from the big screen for a while, but that doesn't mean his adventures in the interactive world have to take a break. In this game, Harry Potter fans can go for a clean sweep in a fast-paced match of Quidditch, which, as even a muggle knows, is played on flying broomsticks piloted by young wizards. Play the part of one of numerous characters from Hogwarts or an international superstar introduced just for this game. All of the high-flying Quidditch positions are included for you to try. Once you've mastered this action/sports title, you and a friend can go head to head for a chance to win the Quidditch World Cup. \$30 street. Electronic Arts Inc., www.ea.com. ●●●●●

SimCity 4: Deluxe Edition

The king of city-building simulations is more fun than ever, with this deluxe



SIMCITY 4



HARRY POTTER

version featuring the newest expansion pack, Rush Hour. Not only can you create an entire region of cities and weave them together, you also have control over individual cars, helicopters, and ambulances to take part in missions that unlock even more buildings and vehicles for your virtual world. If the modern-era city isn't your thing, you can design your growing burg to look like 1890s Chicago or even 1940s New York for a retro feel. And of course, as in previous versions, where would the fun be without the opportunity to destroy your creation with



SPONGEBOB SQUAREPANTS

tornados, meteors, and UFOs? This is a terrific all-ages game; parents and older siblings can help younger kids. \$40 street. Maxis/Electronic Arts Inc., www.maxis.com. ●●●●●

SpongeBob SquarePants: Battle for Bikini Bottom

Even when he isn't directly responsible for havoc, SpongeBob still manages to get involved somehow. At least in *SpongeBob SquarePants: Battle for Bikini Bottom*, he and his friends can save the day after the scheming Plankton unleashes a robot army on Bikini Bottom.

This 3-D action/adventure title includes mini-games, puzzles, and trivia from the popular TV show. There are five huge worlds to explore and six playable characters (including, of course, SpongeBob), complete with the voice actors from the cartoon. With arcade-style game play and keyboard controls, this game is fun on the PC. But it's even more fun when you use a game pad on the Microsoft Xbox or the Sony PlayStation 2.

\$20 street. THQ Inc., www.thq.com. ●●●●●

BACKSPACE

IT'S PRIMARY SEASON. WRITE IN DVORAK!

Edited by Don Willmott



▲ Hey, a good man is hard to find, let alone three or four. (Cupid Junction ad)

Error

You have arrived at a location not expected by the program. This is not really a problem; we just didn't expect to see you here.

▲ Well...surprise! (www.jetsgo.net)

▼ Here's some bling-bling that blink-blinks. Get your \$2.25 glowing LED pin at Google's online store.

(www.googlestore.com)



▶ That's weird. Teacher always told us to sit up straight when we read. (Unidentified spam)

Subject

 Win the all new Lean to Read program



◀ But maybe we'll see you again someday at some other location on the time-space continuum. (SafetyBaby.com)

▶ These sponsored links are positively shocking! (Excite news)

<p>AP • Reuters • Photos</p> <p>Lightning Strikes Couple in Iron Bed Email this Story</p> <p>Jul 28, 12:14 PM (ET)</p> <p>OSLO, Norway (AP) - Trying to sleep through a storm wasn't easy for a Norwegian couple, especially since their cast-iron double bed took a direct hit from a lightning bolt that lit up the bedroom.</p>	<p>Sponsored Links</p> <p>Iron Bed Frames Headboard, Footboard, Canopy, Frame Shipped at Factory Direct Prices www.humbleabode.com</p> <p>Iron Beds On Sale Now Buy factory direct and save 50%. Free color catalog! www.brassbedshoppe.com</p> <p>Wrought Iron Bed Frames</p>
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▼ So that's how they do it in Hollywood. (LandWare GoType! ad)

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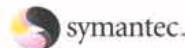


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