

SMARTPHONES!
WE NAME THE BEST
IN 7 KEY CATEGORIES



VIDEOCARD FACE-OFF!
**ULTIMATE QUAD-GPU
SETUPS COMPARED**



DSLRs!
COMPLETE BUYER'S
GUIDE AND CAMERA
SHOOT-OUT

MAXIMUM PC

MINIMUM BS • OCTOBER 2011 www.maximumpc.com

**FULL
SCOOP**
FROM OFFICIAL
SOURCES &
LEAKED
INFO!

WHAT'S BEHIND WINDOWS 8?

HOW **MICROSOFT** IS USING
ITS MOBILE OS TO REINVENT
THE DESKTOP PC



\$7.99US

1.0>

0 72440 38753 9

HOW TO TRANSFER GAME DATA
TO A NEW DRIVE—**THE RIGHT WAY**

inside

OCTOBER 2011



On the Cover
Illustration by
Maximum PC



FEATURES

32

22 WINDOWS 8

It's still a year out, but Microsoft's upcoming OS seems to be radically different from its predecessors.

32 STEP UP TO DSLR

If you take your photography seriously, you need a serious camera. Our buyer's guide and reviews will help with that.

42 SMARTPHONES

Find out which smartphone models are the best in seven key categories.

QUICKSTART

08 NEWS

The social network scene experiences a shake-up; Tom Halfhill examines Hybrid CrossFire.

14 THE LIST

10 milestones in the history of mice.

16 HEAD TO HEAD

Quad SLI vs. Quad CrossFireX



R&D

58 WHITE PAPER

The fine distinctions between server RAM and desktop RAM.

59 AUTOPSY

Deep inside a Saitek Pro Flight X-65F flightstick.

61 HOW TO

Repair corrupted system files without reformatting; transfer game data to a new hard drive.

66 BUILD IT

We explore the potential of AMD's Llano.

LETTERS

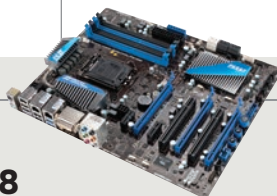
18 DOCTOR

94 COMMENTS

IN THE LAB



74 WARFACTORY IMMORTAL PC



78 MSI Z68A-GD80 MOTHERBOARD



84 RAZER HYDRA CONTROLLER



88 AOC E2243FW LCD

MORE +

MAXIMUM PC

EDITORIAL

Editorial Director: Jon Phillips
Deputy Editor: Katherine Stevenson
Senior Editor: Gordon Mah Ung
Senior Associate Editor: Nathan Edwards
Online Managing Editor: Alex Castle
Online Features Editor: Amber Bouman
Online Associate Editor: Alan Fackler
Contributing Writers: Seamus Bellamy, Michael Brown, Loyd Case, Brad Chacos, Ken Feinstein, Nathan Grayson, Tom Halfhill, Justin Kerr, Paul Lilly, Thomas McDonald, Quinn Norton, Bill O'Brien, Markkus Rovito, Robert Strohmeier
Copy Editor: Catherine Hunter
Podcast Producer: Andy Bauman
Editor Emeritus: Andrew Sanchez

ART

Art Director: Richard Koscher
Contributing Art Director: Boni Uzilevsky
Photo Editor: Mark Madeo
Contributing Photographer: Patrick Kawahara

BUSINESS

Vice President, Consumer Media: Kelley Corten, kcorten@futureus.com
Vice President, Sales & Marketing: Rachelle Considine, rconsidine@futureus.com
Publisher: Kristen Salvatore, ksaltvatore@futureus.com
Executive Director Integrated Sales: Nate Hunt, nhunt@futureus.com
National Sales Director: Anthony Losanno, alosanno@futureus.com
Associate Director of Sales: Isaac Ugay, iugay@futureus.com
Regional Sales Director: Carol Gillard, cgillard@futureus.com
Regional Sales Manager: Arthur St. Germain, astgermain@futureus.com
Regional Sales Manager: Doug Parsons, dparsons@futureus.com
Regional Sales Manager: Jen Doerger, jdoerger@futureus.com
Regional Sales Manager: Greg Ryder, gryder@futureus.com
Regional Sales Manager: Bryan Plescia, bplescia@futureus.com
Account Executive: John Ortenzio, jortenzio@futureus.com
Account Executive: Samantha Rady, srady@futureus.com
Advertising Coordinator: Austin Park, apark@futureus.com

Marketing & Sales Development Director: Rhoda Bueno
Circulation Director: Stephanie Blake
Newsstand Director: Bill Shewey
Consumer Marketing Operations Director: Lisa Radler
Renewal & Billing Manager: Mike Hill
Marketing Associate: Robbie Montinola

PRODUCTION

Production Director: Michael Hollister
Production Manager: Larry Briseno
Senior Production Coordinator: Dan Mallory
Print Order Coordinator: Jennifer Lim

FUTURE US, INC.
 4000 Shoreline Court, Suite 400, South San Francisco, CA 94080
 Tel: 650-872-1642, www.futureus.com

President: John Marcom
Vice President & Chief Financial Officer: John Sutton
Vice President, Internet & Mobile Products: Mark Kramer
General Counsel: Anne Ortel
Human Resources Director: Nancy Dubois

SUBSCRIBER CUSTOMER SERVICE
 Maximum PC Customer Care,
 P.O. Box 5159, Harlan, IA 51593-0659
 Website: www.maximumpc.com/customer-service
 Tel: 800-274-3421
 Email: MAXcustserv@cdsfulfillment.com

BACK ISSUES

Website: www.maximumpc.com/shop
 Tel: 800-865-7240

REPRINTS

Future US, Inc., 4000 Shoreline Court, Suite 400,
 South San Francisco, CA 94080
 Website: www.futureus.com
 Tel: 650-872-1642, Fax 650-872-2207



Future produces carefully targeted magazines, websites and events for people with a passion. We publish more than 180 magazines, websites and events and we export or license our publications to 90 countries across the world.

Future plc is a public company quoted on the London Stock Exchange.
 www.futureplc.com

Chief Executive: Stevie Spring
Non-executive Chairman: Roger Parry
Group Finance Director: John Bowman
 Tel +44 (0)20 7042 4000 (London)
 Tel +44 (0)1225 442244 (Bath)

©2011 Future US, Inc. All rights reserved. No part of this magazine may be used or reproduced without the written permission of Future US, Inc. (owner). All information provided is, as far as Future (owner) is aware, based on information correct at the time of press. Readers are advised to contact manufacturers and retailers directly with regard to products/services referred to in this magazine. We welcome reader submissions, but cannot promise that they will be published or returned to you. By submitting materials to us you agree to give Future the royalty-free, perpetual, non-exclusive right to publish and reuse your submission in any form in any and all media and to use your name and other information in connection with the submission.



Gordon Mah Ung

THE PC: YOUR PLATFORM FOR HARDWARE LIBERTY

FREEDOM, AS THEY SAY, ISN'T FREE.

There's always a catch. There's always a price to pay. And this *is* one of the main reasons I love the PC—because it really is all about freedom and individuality.

If you want to build an Intel-free box, you can do that. If you want to shun AMD, go ahead. Want to build your PC in a case that's the size of a Ford Econoline van, and even sounds like one too? That's your call, brother.

Got burned by system vendor A? Then go with system vendor B. Want to run half-baked drivers downloaded via a torrent that you found on a Czech website? You can do that, too.

Can all this freedom come with a few kinks? You bet your sweet ass it can—and often does. But what would your alternative be? A closed box that doesn't let you upgrade a damn thing for better gaming? Or a tyrannical company imposing its will on you? Such a company would dictate when you get your driver updates, and what color and shape your computer can be. Pretty soon, you're living in a place where every single piece of hardware looks and feels the same. Hey, and don't complain about any of this in that company's forums, or your words will be deleted. I don't know about you, but that sounds pretty grim to me. Sure, it looks like sculpted aluminum, but it *sounds* an awful lot like a totalitarian regime.

Hardware freedom doesn't just begin and end with your PC, though. Your phone can suffer from totalitarianism as well. As an official refuge from Windows Mobile 6, I find a lot

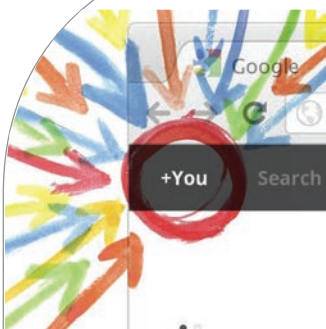
of comfort in Google's Android platform. As with the PC, Android can get messy at times with its "fragmentation." I've complained about it in the past, but recently I've come to see that fragmentation as the chaotic byproduct of the organic nature of competition and life. I recently rooted my phone and started tinkering with various ROMs and skins for it. You can customize an Android phone so thoroughly for your own particular needs that another Android user can't even use it. Yes, that can make the platform confusing, but the alternative is a single user interface for all, with all updates, all control, and all applications coming from a single, all-controlling source. To me, that sounds about as inviting as living in an Orwellian world where your freedom to customize is viewed as destructive to society.

So here's to freedom, individuality, customization and personalization. Long may it reign.

Gordon Mah Ung is Maximum PC's senior editor, senior hardware expert, and senior all-around muckraker.

⇩ submit your questions to: comments@maximumpc.com

THE NEWS



Social Network Shakeup

One week, three announcements, four major companies: The numbers add up to a full-blown social networking war

THE FIRST HALF OF 2011 was fairly uneventful for social networking—until a fateful week toward the end of June shook up the status quo. In the span of eight days, several major announcements (and a major new contender) rocked the scene, each adding fuel to the blazing social network war.

Google+

Google fired the first volley when it unveiled Google+, a new invite-only social network, on June 28. Google+'s Circles-based approach to contact groups and its RSS-like Sparks feature gained some deserved attention, but the *pièce de résistance* is Hangouts, a group video chat for your Circles of contacts. No other social network offers a similar service.



Adding friends is simple in Google+: just drag-and-drop their pictures into the desired circles.

The war got serious quickly. Just days after Google+ launched, Google stopped displaying real-time Tweets in its search results due to a lapsed contract. Google plans to reintroduce real-time results soon—starting with info from Google+ results.

MySpace

MySpace's sale on June 30 serves as a warning to companies riding high on the "social media bubble." Specific Media bought MySpace for a comparatively paltry \$35 million. Reportedly, the group wants to re-establish the network as a music-centric hangout under the creative direction of Justin Timberlake, who is one of the investors. One analyst is skeptical: "It would take a miracle to restore it

to what it once was," says Jim Tobin, president of Ignite Social Media. "They'll have to do something significant, and fairly soon."

Facebook

Facebook's "awesome" announcement on July 6 turned out to be just OK: integrated Skype video chat. Facebook's version of Skype only supports one-on-one conversations, so it isn't quite as awesome as the Hangouts feature in Google+, but it's easy to use and served to steal some of Google+'s immense thunder. A text-based group chat was also unveiled.

Tobin expects Facebook to stay strong in the face of Google+. "Google+ Circles may just be the kick they need. Just don't underestimate them. They've gotten to where they are by being faster and smarter than both Twitter and MySpace." *Ad Age* contributor Judy Shapiro thinks Facebook will survive the war for another reason entirely—money. "Facebook is horrible, but a lot of people need it to be successful," she says.

Microsoft

The dark horse in the race is Microsoft. The company already claimed a 1.6 percent stake in Facebook; the "awesome" announcement gives

it yet another toehold. Could Redmond be planning a social network of its own? Most analysts don't think so, but on July 15, a "social search" teaser page appeared on Microsoft-owned Socl.com before quickly being yanked.

The Future

With so many networks vying for your time, social media users may have some hard decisions to make. "The entry of Google+ and continued changes in Facebook will make most consumers realize that social media can only take up so much shelf life in their digital lives," says Jake Wengroff, the global director of Social Media Strategy at Frost & Sullivan. He expects the venture capital money train to keep rolling, however.

Ad Age's Shapiro expects social networks in general to thrive going forward. "I believe the Internet is evolving into a bunch of mini-webs—you have your web, and I have mine," she says.

Only time will tell how the social network war will pan out, especially with the allure of skyrocketing cash valuations stoking the fire. One thing's for certain: When companies engage in full-scale feature brawls, users emerge as winners. —BRAD CHACOS





Think Geek Minecraft Foam Pickaxe

Sure, it's not as sturdy as an iron pickaxe or a diamond one, but this rugged foam replica of the stone pickaxe from Minecraft (\$20, www.thinkgeek.com) meets with our full approval. Just a few hits and you're tearing down walls like a pro. No, not stone walls like in Minecraft itself. That'd be ridiculous. We're talking about the walls around each of our hearts. This pickaxe, instantly recognizable to the 10 million people who've played Minecraft, is both a conversation starter and a fully-functional intern discourager. **-NE**



Quad-Cores to Dominate Notebooks by 2015

According to technology researcher IHS iSuppli, quad-core processors are going to penetrate the notebook market in a dramatic fashion by 2015. While quad-core procs are currently found in about 9 percent of notebooks available today, IHS's report, titled "Desktop and Notebook PC Technology Penetration Forecast," predicts that number will rise to 49 percent over the next four years. Furthermore, the report sees six-core processors occupying 18 percent of notebooks by 2015.

But the total number of notebooks running x86 CPUs is expected to fall. A separate report by iSuppli predicts that 20 percent of all notebooks will run ARM by 2015—this due primarily to the fact that Windows 8 is expected to support ARM chips when it arrives. **-KS**

Net Neutrality One Step Closer to Becoming Law

Net neutrality's motto is simple: Hey, ISPs, don't tell us what to do with the Internet. Comcast's P2P traffic-shaping fiasco kicked the movement into high gear a few years back. The net neutrality dream got one step closer to reality, as the FCC has officially registered its hotly debated rules with the Office of Management and Budget—a vital step toward getting the new law on the books. There's still a hard road ahead, however, as pissed-off companies are expected to throw legal challenge after legal challenge at the proposed regulations.

A five-person FCC panel approved the new net neutrality order back in December in a 3-2 vote split along party lines.

The Republican dissenters included new Comcast-NBC VP and former FCC commissioner Meredith Baker, as well as Robert McDowell, who wrote a *Wall Street Journal* op-ed calling net neutrality "the beginning of a long winter's night for Internet freedom."

Verizon has already challenged the upcoming regulations, but its suit was dismissed by a D.C. Court of Appeals on the grounds that you can't sue to stop a law that isn't even technically a law yet. The proposed regulations are subject to a 30-day comment period and become legally enforceable 60 days after that. **-BC**



Tom
Halfhill
Fast
Forward

HYBRID CROSSFIRE FOR FUSION

EVER SINCE MULTICORE processors appeared a few years ago, programmers have been complaining about them. Distributing a software workload among multiple CPUs isn't as easy as running a single-threaded program on a single CPU. Now AMD is doing something even more difficult—but it's the future of computer science.

As you've heard, AMD's new Fusion processors combine multiple CPUs and a GPU on one chip, similar to Intel's "Pinview" Atom processors. In some cases, programmers can distribute workloads across all the CPUs and the GPU, and those workloads needn't be graphics. This general technique is called asymmetric multiprocessing on a heterogeneous multicore processor.

No doubt you're familiar with AMD's CrossFire technology, which boosts performance by linking multiple graphics cards together. Usually, this is symmetric multiprocessing on homogeneous processors (identical GPUs). But AMD's Hybrid CrossFire works with different graphics cards or even with a graphics card and an integrated-graphics chipset. Before, adding a graphics card usually bypassed the weaker integrated graphics.

AMD derives Fusion graphics from ATI Radeon discrete graphics, so the latest integrated GPUs aren't the weaklings they used to be. Why waste the Fusion GPU if the user upgrades to a full-fledged graphics card? So AMD will allow Hybrid CrossFire configurations using Fusion graphics and discrete graphics.

It's logical but nontrivial. The graphics driver must balance the workload across an integrated GPU and a discrete GPU that are related like cousins but not identical like twins. The GPUs use different memory and different I/O buses. In addition, some programs will try to use the GPUs and the multiple CPUs!

If you just heard a scream, it was probably a programmer. Buy the poor soul a Jolt cola. Asymmetric multiprocessing on heterogeneous multicore processors is a tough challenge, but it's the future of computing. I'm confident the programmers are ready.

Tom Halfhill was formerly a senior editor for *Byte* magazine and is now an analyst for *Microprocessor Report*.



Thomas
McDonald
**Game
Theory**

A HOLLOW VICTORY

I HATE SAYING "I told you so," but....

No, wait—I love saying *I told you so*. Last year, in this space, I predicted that not only would the U.S. Supreme Court strike down the California law criminalizing the sale of violent games to minors, but that it would draw on the *United States v. Stevens* decision in doing so. *Stevens*, you may recall, was a ban on animal snuff films created for sexual fetishists, and the court ruled 8-1 that such films were protected under the First Amendment.

This summer, in their 7-2 decision in *Brown v. Entertainment Merchants Association* (formerly *Schwarzenegger v. Entertainment Merchants Association*), the majority found that California's ban on sales of violent games to minors was unconstitutional, and they used *Stevens* as precedent.

Did you notice the fact buried in the preceding paragraph? Twice as many Supreme Court Justices found that Modern Warfare was less socially acceptable than videos of women crushing baby bunnies to death under their stiletto heels. Congratulations, game industry!

Look, this was the correct decision in this case, not only on First Amendment grounds, but also in light of the ESRB's superb rating and content descriptor system. Parents have more information about game content than about any other form of entertainment—that is, if they decide to act like parents and actually use that information to make sound decisions.

This is no time for high-fives in the halls of EA and Activision, but rather for a little soul searching. First, they need to stop creating advertising campaigns for M-rated games that are clearly aimed at minors who should not be playing those games. Second, the publishers need to pressure more retailers to refuse to sell M-rated games to unaccompanied minors, just as a movie theater would refuse them admittance to an R-rated movie.

Finally, game makers need to decide if they've taken hyper-violent content as far as it needs to go and maybe try to find some other kind of gameplay. I think I've spent enough of my life staring down an iron sight at a brownish-gray world. Violence is easy. Creativity is hard.

Thomas L. McDonald can be found online at stateofplayblog.com.

E-reader Arrives for Google E-books

Last year, Google staked its claim in the e-book business, establishing the Google eBookstore, which was accessible through any modern browser or mobile OS that supported the Google Books app. Now Google e-books have a dedicated e-reader in the form of iRiver's Story HD. Seeming very much like the Amazon Kindle, the Story HD features a 6-inch black-and-white e-ink screen, a QWERTY keyboard, and Wi-Fi connectivity. It's available through Target stores and Target.com for \$140. **-KS**



Netflix Slams ISP Bandwidth Caps

Netflix's subscriber base for instant streaming has been growing by leaps and bounds, but the rise of increasingly stingy bandwidth caps could threaten that. While Netflix has introduced new methods for adjusting video quality as a means of conserving bandwidth, the otherwise powerless company has finally decided to take its fight with the ISPs to the mass media. In an opinion piece for the *Wall Street Journal*, Netflix's general counsel David Hyman states what he thinks of bandwidth caps, and why we shouldn't put up with them.

According to Hyman, "Bandwidth caps with fees piled on top are a lousy way to manage traffic." He goes on to accuse ISPs of creating the false impression among consumers that "bandwidth is a scarce resource and that imposing caps and overage fees will relieve pressure on high-speed networks." Many high-profile ISPs have publically come out against bandwidth caps as a method of controlling infrastructure costs, and almost all network experts seem to agree that the cost of delivering 1GB of data is around one cent and falling at a rapid pace. Says Hyman, "Wireline bandwidth is an almost unlimited resource due to advances in Internet architecture. Adding more capacity is easy."

Hyman argues that, at most, ISPs should focus on finding ways to control usage during peak hours, since delivering bits outside of this short period costs next to nothing. **-JK**

Buh-Bye 3D Glasses, Hello Eye-Tracking

If you've been putting off purchasing a 3D display because you don't like the thought of having to wear 3D glasses, LG's Cinema 3D DX2000 glasses-free monitor should give you hope. In addition to ditching the shades, the DX2000 adds a new technological twist: It's the first 3D monitor that uses eye-tracking technology.

That means the webcam built into the top of the DX2000's frame will be used for more than harassing your buddies over Skype; it'll also be used by the monitor itself to track your eyes as you shift and move in your seat. The DX2000 will use the information to tweak and adjust the direction and depth of the 3D effect, so that you'll see the best possible picture no matter what angle you're viewing the monitor from.

So far, LG has only announced the South Korean release of the 20-inch monitor; you'll be able to pick it up on the streets of Seoul soon at the hefty price of 1.29m won (or around \$1,210). **-BC**





Quinn
Norton
**Byte
Rights**

WHILE YOU WERE OUT

FINALLY, RIGHTS HOLDERS and ISPs have found a foolproof way to punish you, their nefarious customer. The MPAA, RIAA, etc. have struck a deal with five of the largest ISPs in America on file sharing. It's perfect. No due process, judicial review, or evidence. It assumes you're guilty until proven innocent. And you get to pay for the whole thing! Since these ISPs cover the majority of America in markets, with no competition, you can't even go elsewhere. The new deal is enforced in the terms of service, so if you want Internet almost anywhere in this country, you have to sign away your constitutional rights.

If the rights holders send your IP to the ISP as an offender, you get dinged—no proof required. Several dings and they send all your connections to a landing page that requires you to call them. Presumably at that point you'd end up talking to incompetent customer support people who don't know a whit about BitTorrent, copyright, or possibly the Internet.

Further "mitigation" includes compulsory entertainment industry propaganda about copyright passed off as education, and legal alternatives for buying material—we're sure companies pay handsomely to have the false imprimatur of legal requirement given to their shoddy products.

Open Wi-Fi can only be used as a defense once (after which you pay a \$35 fee to be allowed to defend yourself), which makes choosing to have an open network a violation in and of itself. It's unclear what cafes and such are supposed to do, other than to stop offering Internet.

Normally I like to include some action. Call a lawmaker! Boycott DRM! But this time, there's nothing you can do. You weren't at the table. Sorry. You're going to pay overhead, but that's it. This deal isn't reviewed by the courts or written by Congress. It's just foisted upon you.

Quinn Norton writes about copyright for Wired News and other publications.

U.S. Government Opts for Cloud over Data Centers

Over the course of the next four years, the federal government will close some 800 computer data centers—which works out to around 40 percent—in order to save some shekels, and in an attempt to modernize its data management, according to a report in the *New York Times*. Most data centers don't require a large staff, but even still, analysts estimate the closures will eliminate tens of thousands of jobs.

It's part of a plan released by federal CIO Vivek Kundra called the Federal Data Center Consolidation Initiative (FDCCI). The first two phases, which include an inventory of each agency's assets and a draft consolidation plan, have been completed. The next step is to put those plans into action.

Kundra explained the plan as part of a broader strategy of moving toward more efficient computing in the cloud. As it stands, the federal government spends around \$80 billion a year on IT-related hardware, software, and services—more than any other country in the world. Kundra says there's huge potential for savings by moving to the cloud since each government agency would no longer need to buy and build its own technology systems. **-PL**



Amazon Prime Teams up with CBS

Users of Amazon Prime, the online retailer's streaming video service, can look forward to a slew of new content now that the company has signed a deal with CBS Corp.

Amazon Prime started as a program that gave Amazon shoppers special rates on shipping for an annual subscription of \$79. Then early this year, Amazon sweetened the deal by giving Prime customers unlimited access to its online library. The CBS deal, which adds 2,000 episodes of various TV shows to the mix, could make Amazon Prime more of a lure to Netflix subscribers, many of whom are smarting from an increase in fees now that Netflix is splitting disc rental and streaming into separate subscriptions. **-KS**

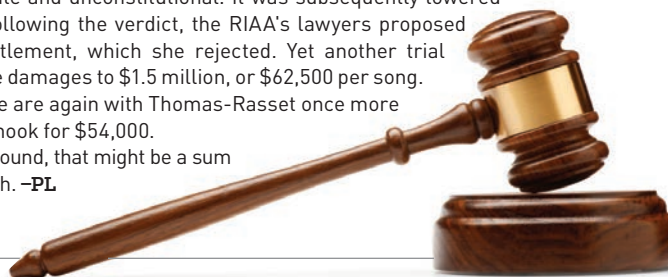
Jammie Thomas-Rasset Gets Reduced Penalty

Jammie Thomas-Rasset, the woman who made numerous headlines for taking on the RIAA in a losing battle over file sharing, may want to finally give up her fight now that a federal judge has again lowered Thomas-Rasset's penalty, this time from \$1.5 million to \$54,000.

Her case dates all the way back to 2006. Found guilty of illegally sharing 24 songs, Thomas-Rasset was first ordered to pay \$222,000 in statutory damages in a trial that ended in 2007. She was granted a request for a new trial when it was determined the jury was improperly instructed over what actually constitutes copyright infringement when it comes to sharing files. That trial resulted in a \$1.92 million dollar verdict (\$80,000 per song) against Thomas-Rasset.

In 2009, Thomas-Rasset convinced a court that the damage award was disproportionate and unconstitutional. It was subsequently lowered to \$54,000. Following the verdict, the RIAA's lawyers proposed a \$25,000 settlement, which she rejected. Yet another trial bumped up the damages to \$1.5 million, or \$62,500 per song. And so here we are again with Thomas-Rasset once more legally on the hook for \$54,000.

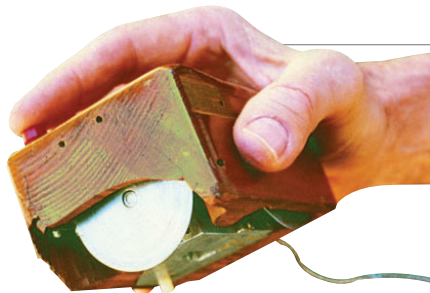
This time around, that might be a sum she can live with. **-PL**



THE LIST

10 FIRSTS FOR COMPUTER MICE

10



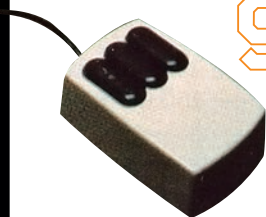
FIRST MOUSE, 1963

The first mouse, invented by Douglas Engelbart, didn't have a ball, but a pair of perpendicular wheels that turned as the mouse was moved.

9

XEROX ALTO I MOUSE, 1973

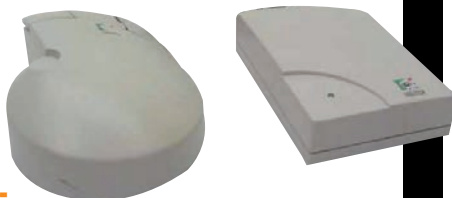
Developed at Xerox PARC, the mouse for the first Alto computer was the first to sport three buttons, and one of the first to use a ball (steel, in this case).



8

LOGITECH MOUSE-MAN CORDLESS, 1991

Believe it or not, the cordless mouse predates even the scroll wheel. Logitech introduced the MouseMan Cordless a full 20 years ago, though it would be years before wireless mice became commonplace.



7

GENIUS EASY SCROLL, 1995

The Genius Easy Scroll was the first mouse to feature a scroll wheel, although you're probably more familiar with the Microsoft IntelliMouse, which popularized the design.



6

MICROSOFT INTELLI-MOUSE EXPLORER, 1999

Microsoft's IntelliMouse Explorer, and the lower-end IntelliMouse with IntelliEye were not the first optical mice available, but they were the first to gain market share.



5

RAZER BOOMSLANG, 2000

The Boomslang—Razer's first product—was one of the first mice to make the distinction between casual and gaming varieties, with giant buttons and a unique design.



4

LOGITECH MX1000, 2004

What could possibly make a mouse better than an optical diode? Oh, that's right—frickin' lasers. Logitech brought laser illumination to the mousing mainstream with the MX1000.



STEELSERIES WORLD OF WARCRAFT MOUSE, 2009

We're not going to pretend that we loved SteelSeries' first WoW mouse, but it was important as the first mouse to cater specifically to MMO players.

3



2

APPLE MAGIC MOUSE, 2009

Not content with its previous efforts to de-buttonify the mouse, Apple released the Magic Mouse in 2009, with a minimalist design and a multitouch pad covering the whole surface of the mouse.



1

CYBORG RAT 7, 2010

Coming from console peripheral manufacturer Mad Catz (of all people), the RAT 7 is unique for its extreme customization, which allows the mouse to fit anyone's hand.



HEAD TO

BY LOYD CASE

**QUAD
CROSSFIREX**XFX Radeon HD 6990 x2
www.xfxforce.com

Quad SLI vs. Quad Cross- FireX

Now that both AMD and Nvidia have dual-GPU videocards on the market, quad-GPU CrossFireX and SLI setups are possible—that is, if you have the motherboard, the power supply, the money, and can actually find two dual-GPU cards.

Representing quad SLI, we have two relatively compact Nvidia GeForce GTX 590s. In the quad-CrossFireX corner are two of AMD's hulking, foot-long Radeon HD 6990s. Both pairs cost about the same—an astronomical \$1,500, give or take—but which is the better option?

Round 1: Standard Performance

We ran our standard game tests on a Core i7-990X six-core PC with an Intel DX58S0 motherboard and a 1,200W Corsair PSU. We used the faster CPU so that massive GPU horsepower would spend less time waiting. The 1,200W PSU is needed to drive these monster cards, which require dual 8-pin PCI Express power connectors.

Our normal gaming runs are at 1920x1200, with 4x AA enabled and all detail levels maxed out. The synthetics are there for comparison, but we play games, not benchmarks. If you just look at the numbers, the quad-GPU cards are screamers. These settings just aren't challenging.

When comparing quad SLI to quad CrossFireX, the numbers favor Nvidia, but the frame rates are staggeringly high for both systems. Clearly, Nvidia's done some work with its drivers since the initial release of the GTX 590. Paired GTX 590s won six of nine game tests.

Winner: Quad SLI

Round 2: Extreme Performance

Since neither quad-GPU setup had to work hard at 1920x1200 with 4x AA, we had to push them a little harder. After all, if you're spending \$1,500 or so for a pair of graphics cards, surely another \$1,300 for a 30-inch monitor is within reach.

We ratcheted up the pain, pushing our gaming tests (and Unigine's Heaven benchmark) to 2560x1600 and 8x AA. That's 4 million pixels at 8x AA (with 16x AF). Shaders and detail levels were also maxed out, putting tremendous stress on the overall bandwidth of the system.

At these extreme levels, we still saw stunning frame rates. The competition seemed a little more even, possibly due to AMD's larger frame buffer (2GB per GPU versus 1.5GB per GPU for Nvidia) and the higher clocks. However, AMD seems to have a problem with Dirt 3, so what might have been a tie goes to Nvidia.

Winner: Quad SLI

HEAD

QUAD SLI

Asus GeForce GTX 590 x2
www.asus.com



Round 3: Noise and Power

A good 1,200W PSU is essential for a quad-GPU setup, particularly if you plan on overclocking the CPU and GPUs. That increases the cost of your rig.

On pure power draw, the quad CrossFireX draws a little less power under full load—774W versus 800W for the dual GTX 590s. However, the idle-power draw was substantially lower for paired GTX 590s, which drew just 113W at idle versus 171W for quad CrossFireX. Since systems generally run idle most of the time, that power draw can add up.

What about noise? At full throttle, both of these setups get pretty loud. But the quad-CrossFireX cards, with smaller fans that spin up to very high speeds, sound like small jet engines throttling up for takeoff. AMD's HD 6990s are loud even in single-card setups. Paired 6990s are painfully loud.

Winner: Quad SLI

Round 4: Ease of Use

Both quad-GPU systems had trouble running Dirt 3. The Nvidia setup could run the game but not change resolution in-game, while the CrossFireX setup wouldn't run at all. Single- and dual-GPU systems run the game flawlessly.

With the AMD quad setup, you'll need to occasionally download game profiles for CrossFireX. Nvidia builds these into driver updates, but the green machine is now updating drivers on a monthly schedule to match AMD.

Flexibility of installation is a problem, too. The Radeon HD 6990s are a full 12 inches long, while the GTX 590 cards are 3/4 of an inch shorter. That 3/4-inch makes a difference in some cases. So you'll need to pay attention to your internal case dimensions.

In the end, the dual GTX 590 setup is simpler to manage, easier to install, and better mannered.

Winner: Quad SLI

And the Winner Is...

Quad-GPU setups define the extreme in graphics hardware. If you're running games on multiple displays, with stereoscopic 3D turned on, quad GPUs will give you the horsepower to hit smooth frame rates.

If you're running on a single display, though, quad GPUs might be more hassle than they're worth. Toss in the excessive power, the hot air filling your room, and the loud fan noise, and you may want to reconsider—and that's before you see the price tag.

In the end, unless you are running an extreme display configuration, a pair of single-GPU cards will give you as much performance as you need in cutting-edge games. And you can build a dual-GPU rig today without worrying about product availability.

If you decide that a quad GPU is right for you, we're pretty bullish on two **GTX 590s in quad SLI**. It uses a little more power at full load than the AMD alternative, but it's easier to manage and install and seems to have fewer issues with games. ⏻

BENCHMARKS	2 x Asus GTX 590 (quad SLI)	2 x Radeon HD 6990 (quad CrossFireX)	2 x Asus GTX 590 (quad SLI)	2 x Radeon HD 6990 (quad CrossFireX)
	1920X1200 WITH 4X AA		2560X1600 WITH 8X AA	
UNIGINE HEAVEN 2.5 (FPS)	90	84	50	54
F1 2010 (FPS)	106	95	95	89
BATTLEFORGE DX11 (FPS)	182	160	124	88
FAR CRY 2 / LONG (FPS)	157	180	137	176
HAWX 2 DX11 (FPS)	248	210	215	197
JUST CAUSE 2 (FPS)	63	80	60	67
DIRT 3 (FPS)	141	DNR (0)	94	DNR (0)

Best scores are bolded. Our test bed is a 3.47GHz Core i7-990X Extreme Edition in an Intel DX58S02 motherboard with 12GB of DDR3/1333 and a 1,200W Corsair AX1200 PSU. The OS is 64-bit Windows Ultimate.

DOCTOR

THIS MONTH THE DOCTOR TACKLES...

- > SSD Basics
- > BFG Phobos
- > OS Drive as Swap

SSD 101

I finally took the plunge and bought an SSD. I'm hearing all sorts of conflicting advice on how best to set up an SSD as a boot drive. Disable the page file, don't disable the page file, move the page file to your HDD, disable file indexing on the SSD, move the Windows .temp files to the HDD, turn off System Restore, etc. What is the optimal way to set up an SSD these days? I know if I were dealing with, say, a 40GB boot drive it'd be a bit different, but 120GB is more than enough to keep my program files and any games I'm playing on it. So far, I've moved all my documents and media files to a 1TB drive and turned off defragging on my SSD, but not much else. I know these new 25nm NAND drives are supposed to have a shorter lifespan than the last-generation drives. I'd like to make it last as long as possible, but not at the sacrifice of speed, which is the main reason I bought an SSD in the first place.

Finally, is there actually a spec for SATA 6Gb/s cables? I see they are being sold, but I hear they're functionally no different than SATA 3Gb/s cables, just tested to run at SATA 6Gb/s speeds. Am I getting the best performance from my new drive with the \$2 cable that came with my old motherboard?

—Scott Holcomb

THE DOCTOR RESPONDS: You're right, there's a lot of conflicting advice going around about the best way to optimize an SSD on Windows. Assuming you're running a modern SSD and Windows 7, the OS should recognize the device and automatically disable defragging. Leave the page file the way it is, but check to see if the OS has disabled superfetch and prefetch—your access speeds render them unnecessary and the OS should disable the features automatically. Some sources advocate turning off System Restore, but we'd only do that if you have a good backup plan that obviates the need for that service. It's up to you whether to disable indexing, but we wouldn't bother. Other than that, leave everything the way it is—especially since you've done the smart thing and moved your media to a mechanical drive.

A lot of these measures arise out of a perceived need to limit disk access as much as possible so as not to run out of write cycles on your NAND, but we think that's pretty dumb. Unless you're never, ever buying another drive again, you don't need to treat your SSD with kid gloves. You're very unlikely to wear out your drive with normal—or even constant—use, and by the time that would occur, larger, faster, cheaper SSDs will be

available, and you'll be looking to upgrade anyway. Don't be like those people who leave the plastic wrap on their furniture. Use your hardware!

To answer your last question, yes, you can run at 6Gb/s speed with a 3Gb/s cable—probably. The 6Gb/s cables are manufactured to a higher standard than are 3Gb/s cables, so while some 3Gb/s SATA cables can run your drive at its full speed, it's hardly guaranteed. Your best bet is to spring for the rated cables, but in a pinch, the 3Gb/s will do.

Am I Cursed?

I am one of the rare few who purchased one of the Phobos PCs from BFG Technologies before the company went defunct. When I bought the PC, it came installed with Windows Vista Ultimate. I have since upgraded to Windows 7 Ultimate, and when I did, I lost the ability to use the touch screen to monitor and manipulate certain functions (one-touch overclocking, temperature and fan monitoring, drive monitoring, and playing music from my iTunes library). Is there a way I can regain some of these? Is there some kind of software that would enable me to do this? My understanding is that the touch screen has its own processor and uses some form of Linux. There is a 2GB SD card



BFG's Phobos non-user-serviceable PCs promised powerful performance with in-house concierge tech service—until the company went out of business.

installed on the touch screen mainboard. As a side note, I also purchased a PC from Monarch Computer Systems, which also went out of business.

—Greg B.

THE DOCTOR RESPONDS: Perhaps it's your purchasing power that's the real monster! You are likely out of luck, Greg. And you're right, the screen wasn't just a touch screen embedded in front and hooked up to the GPU. It was a stand-alone computer running an ARM CPU and booting Linux from the 2GB SD card in the board. It's unlikely that the touch screen

submit your questions to: doctor@maximumpc.com

computer is completely custom, but the interface software certainly was. Your solution is to either go back to Windows Vista Ultimate or just live with the screen not working as it was intended. And, if we may: This is an excellent case study in why user-serviceable is a good thing.

Why the Slow Net?

I just built a new computer, and I find myself getting horrible connection speeds through the Wireless-N network in my house. The computer is connected to my Netgear WNR2000 Wireless-N router via a WN111 USB adapter. Most of the time I get around 7Mb/s download and around 2Mb/s upload, according to Speedtest.net. What should I do to increase my network speed?

—Justin Chan

THE DOCTOR RESPONDS: If you're curious about the speed of your network, you're using the wrong tool: Speedtest.net measures the speed of your

connection to the Internet, not the speed of the computers connected to your local network. From the numbers you're providing, I'd guess you have a DSL Internet service provider, but you shouldn't expect your Internet connection to saturate your router even if your ISP uses coax (e.g., a cable TV company) or fiber (e.g., FiOS).

If you want to test the speed of your network, try using the free utility Jperf (the graphical front end for Iperf). That's the tool *Maximum PC* uses to benchmark router TCP performance. Install Jperf (bit.ly/nQaL0z) on one computer that will act as a server, and install a second copy on a computer that will act as a client. It's best to use a notebook computer as the client so that you can easily measure throughput in different rooms in your home.

OS Drive as Swap Drive

I triple-boot Windows 7, Vista, and XP, and I still find myself favoring XP, which I run on a WD

Raptor drive. My Win7 install is on a 128GB Kingston SSDNow drive. Since my SSD offers the best performance, I'm using it to host the page file for my Windows XP install.

I recently had problems with my SSD. I'm wondering if it's related to Trim, which XP probably doesn't know about. Perhaps the swap file filled up whatever space was left on the drive? I lost a bunch of sectors and ran into a swirl of disk issues to the point where I couldn't load Win7. I had to fire up Vista (on yet another drive) and run chkdsk, which fixed Win7 enough to make it bootable.

Anyway, my Win7 install seems to be partially hosted right now—the system is complaining about drivers and hardware not being available; however, there are no issues with said components under XP (which is why I'm pointing to the Win7 install rather than the hardware itself).

—Bill Roberts

THE DOCTOR RESPONDS: It's not surprising that you're running into problems with your Windows 7 install, considering that you're using the same drive for your XP page file. Stop doing that, or at the very least make a separate partition on the drive for the page file.

Frankly, Bill, we're a little confused as to why you're ever booting into XP on a Raptor when you have Windows 7 on an SSD. And Vista—the less said about that, the better. If you're worried about backward compatibility for legacy apps, you can run Windows XP in a virtual machine on your Win7 install, but Win7 is faster, more secure, and (we think) easier to use than Windows XP. You're going to want to do a clean install of Windows 7 anyway to clean up lingering errors. Use this opportunity to bite the bullet and turn your triple-boot system into a single-boot system. ☺

AD

BY ROBERT STROHMEYER



WHAT'S BEHIND WINDOWS 8?

HOW MICROSOFT IS USING ITS MOBILE OS TO REINVENT THE DESKTOP PC

AFTER TWO YEARS OF RAMPANT RUMOR AND SPECULATION, RELIABLE DETAILS ABOUT THE NEXT VERSION OF WINDOWS—CLEVERLY CODE-NAMED WINDOWS 8—have finally begun to emerge. True to the rumors, Windows 8 is going to be a very different kind of operating system from its predecessors.

Touch-friendly and mobile, the next Windows will run on tablets and desktops. It'll sport a new, more dynamic file system and integrate cloud functionality directly into the OS. And those are just a few of the most dramatic changes you'll see when Windows 8 drops in 2012.

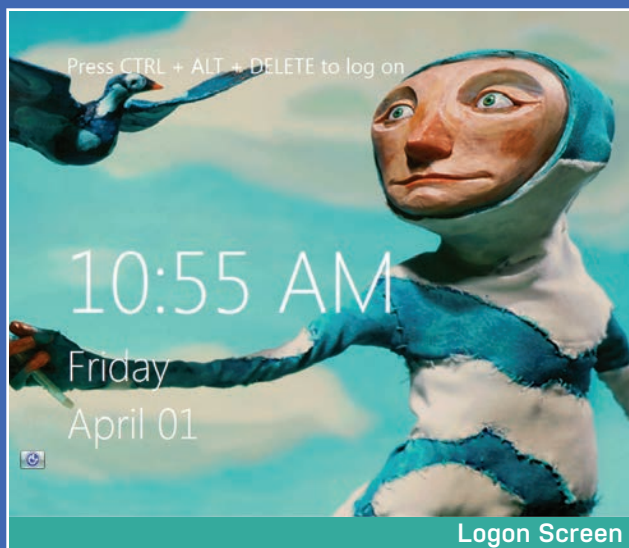
We'll fill you in on all the particulars. But make no mistake, there are still many unknowns. We'll not only analyze and dissect all the leaks and rumors that continue to swirl about the upcoming OS, but we'll also learn what industry insiders have to say about Windows 8 and its potential impact on the computing landscape.

Windows 8

What We Know for Sure

This OS is going to be different

Microsoft teased some basic details about the forthcoming operating system at the International Consumer Electronics Show in January, and in June the company showed a more complete picture of the OS's features at the D9 conference. At press time, Microsoft had promised more details to come at the BUILD conference this October. Here's what we know for sure, based on Microsoft's demos so far.



NEW LOGON SCREEN: From the moment you boot a Windows 8 PC, the user experience will be noticeably different from previous versions of the OS. Instead of a static login screen with nothing more than a profile pic and a password field, you'll see a dynamic, screen-saver-like screen with a user-selectable image as the background. The screen will prominently display the date and time, your next upcoming calendar event, how many new emails you have, and how many chat requests you've received in your absence. Click or tap past this initial screen, and you'll see a more traditional login box.

START SCREEN: Building on the Windows Phone 7 tile interface, Windows 8 will feature a new interface called the Start Screen, which represents programs as tiles. Tiles can be icons, images from the represented app, or details from within the app (such as weather or stock quotes). Some tiles will be widgets in and of themselves, while others will merely launch apps, such as Microsoft Word or PowerPoint.

TOUCH OPTIMIZATION: Consistent with our speculation over the last two years, Microsoft is making every effort to optimize Windows 8 for touch-screen control. The whole environment appears built primarily for tapping and sliding tiles around. Meanwhile, Microsoft created two kinds of onscreen keyboards: a standard half-

screen keyboard that runs across the lower half of the display and a split keyboard that places the keys at the outer edges for thumb typing on tablets.

HTML5 AND JAVASCRIPT ENVIRONMENT: Windows 8 apps built for the new Start Screen interface will consist of HTML5 and JavaScript, which should simplify app development and open up Windows 8 app creation to a broader population of coders. Apps will run full-screen, just as they do on Windows Phone 7. This approach should also enable more device-independent apps that run as well on desktop PCs as they do on phones, with no porting necessary. The interface is designed for touch, but Jensen Harris, director of program management for the Windows User Experience team says it will work just as well with a mouse and keyboard.

LEGACY SUPPORT: Windows 8 will run existing Windows apps in a windowed interface that looks very much like the current Windows 7 desktop, complete with a Start Menu and a Taskbar. This interface will run full-screen, just like a native Windows 8 app would, so all your legacy apps will run together in a single desktop screen.

SYSTEM-ON-CHIP SUPPORT: How do we know Microsoft is making Windows 8 for tablets? Because Steve Ballmer told us so back in January, and Jensen Harris mentioned it again in his June demo. And Intel's Renee James also said as much when she stated that Microsoft will release multiple versions of Windows 8 for both x86 and ARM, including four distinct builds for the latter. What this means is clear: Windows 8 will be designed to run on low-power chips from ARM, Qualcomm, AMD, Intel, and Texas Instruments.



Start Screen

Windows 8

What We Predict

Our guess as to what other features you can expect

The rumors have been coming in for the last two years and, as with any unreleased software, it's hard to be certain which of the rumored features will make it into the final product, which will wind up on the cutting room floor, and which never existed in the first place. While Microsoft has shown us a few things we can count on, there's plenty more left to wonder about. We've taken a look at all the rumors, all the leaked screenshots, and a few screens we're pretty sure were flat-out faked, and we're ready to make a few prognostications about what else to expect in Windows 8.

>>STORAGE FEATURES

In part because of its massive installed base in the business world, Microsoft has been slow to move on storage trends over the years. While power users have grown accustomed to relying on third-party tools for handling disc images and drive maintenance tasks, the company has been sitting on a new file system for years.

ISO MOUNTING: While other desktop OSes (Mac OS X, Linux) include the ability to handle disc images as a matter of basic functionality, Windows has lagged lamentably in this area. As recently as Windows Vista, users needed third-party tools to burn a disc image to a CD. And while Windows 7 can now write a disc image, it can't mount and read one. According to a variety of rumor forums, however, this feature will finally come baked into Windows 8.

ISO mounting won't mean much to the average user, but power users and system administrators will be able to use it to standardize installations across multiple systems, preserve reliable system images for posterity, and quickly deploy virtual machines. Given the gradual pace of change in recent Windows versions' support for disc images, this feature seems very likely to see the light of day in the final release.

Probability: 70%

TWEAKED DISK CLEANUP: To help users manage disk space, Microsoft appears to have revamped the Disk Cleanup utility for Windows 8. Unlike the relatively simplistic tool in Windows 7, the enhanced utility showing up in Windows 8 pre-release builds includes options that let you sort files by size and type. This should make it much easier to reclaim disk space by targeting tempo-

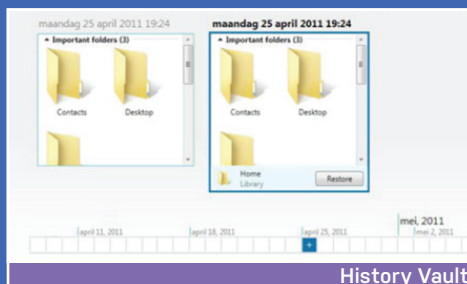
rary files and quickly spotting the biggest space hogs on your hard drive.

Probability: 70%

PORTABLE WORKSPACES: In a move that usurps the role of third-party portable workspace utilities, Microsoft seems to be integrating a new feature called Portable Workspaces into Windows 8. Based on screenshots and videos leaked from an April build of Windows 8, Portable Workspaces will let users create a portable image of their system on any USB drive with at least 16GB of available capacity (16GB drives with 15.7GB of available space don't appear to work).

From what we've seen, it appears Portable Workspaces will create a streamlined clone of your desktop, user settings, and essential apps, so you can plug your USB drive into any PC and boot quickly into a familiar Windows experience. The leaked demos look surprisingly good, and we'll be surprised if this feature doesn't make it into the final product.

Probability: 70%



HISTORY VAULT: While Windows XP SP2 introduced a useful file-versioning feature called Shadow Copy, relatively few end users ever realized this feature existed. Even now, in Windows 7, it remains obscure and mostly inaccessible to ordinary users. A leaked Windows 8 feature called History Vault appears poised to bring Shadow Copy into the light of day.

Early screenshots of History Vault look eerily similar to Apple's Time Machine feature in OS X. We're not knocking the knockoff. If History Vault's timed, incremental backups of changed files prove half as usable as Time Machine, it might finally make backup a part of everyday life for users in the real world.

Probability: 70%

THE DEVELOPERS' DILEMMA

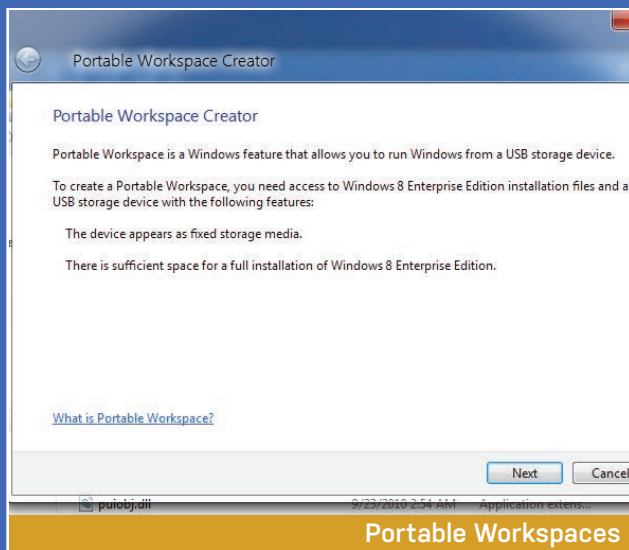
Is Microsoft forsaking legacy apps?

In addition to its various user-interface tweaks, Windows 8 appears to represent a dramatic shift away from legacy development platforms, and critics have accused Microsoft of hurting its dev community with this move. By building the new Start Screen interface as an HTML5 and JavaScript environment, is Microsoft hanging longtime Windows developers out to dry?

According to Forrester Research principal analyst Jeffrey Hammond, who focuses on the application development market, it may be premature to write off all legacy development platforms. "I certainly think Microsoft will continue to support .NET and Windows Presentation Foundation," says Hammond. "I would not be surprised to see it converge the full-featured Windows Foundation Classes and Silverlight on the Windows 8 and Windows Phone 7 platforms."

Hammond does expect to see Microsoft cut back seriously on its Silverlight platform, however, particularly since much of its functionality will be superseded by HTML5. Instead, says Hammond, "expect to see MS push to get more APIs and capabilities added to the World Wide Web Consortium and Web Hypertext Application Technology Working Group to push the envelope with respect to what HTML5 can do."

Despite the possibility that some developers might feel burned by the fact that their years of legacy Windows development expertise will have diminished value in Windows 8, Hammond says the move may actually attract more developers to Windows. "Microsoft will look to appeal to companies like Facebook, 37Signals, and the Financial Times, which are already making investment in apps based on HTML5. Its argument will be, 'Hey, it's easy to support Windows 8 slates with your existing investments.'"



WINFS: Since 2003, Microsoft has been working on a new Windows file system capable of detecting and using relationships between various chunks of data on a PC. WinFS (the “FS” stands for Future Storage) incorporates features of SQL relational database servers to intelligently find connections between files and surface them to applications. A common example of this might be a version of Windows Explorer capable of automatically discovering photos of a specific person and displaying them in chronological order.

WinFS was expected to launch as part of Windows Vista in 2006, but never made the final cut due to technical difficulties.

Microsoft has made no announcements about the file system’s chances of appearing in Windows 8, and we’ve yet to see credible evidence that it’s coming. Windows program manager Jensen Harris quixotically mentioned a file system for Windows 8, but gave no further details. If WinFS does actually surface in the next Windows, we’ll be both surprised and delighted.

Probability: 50%

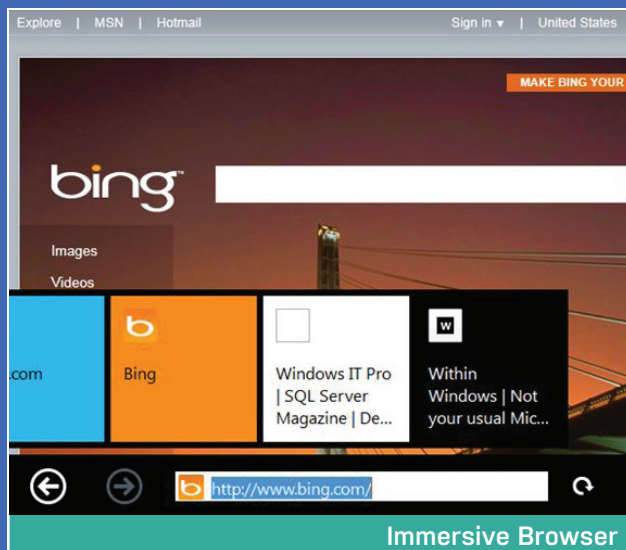
>>CONNECTED FEATURES

Windows 8 looks likely to be the most deeply Internet-connected version of Windows yet, with a barrel of new features aimed at making web browsing more central to the user experience, syncing user data to the cloud, and protecting users from malicious code.

INTERNET EXPLORER 10: Despite constant revamping over the past decade (and the fact that IE comes preinstalled on every Windows PC) Microsoft’s share of the browser market continues to decline in the face of growth for Google Chrome and Opera. So even though IE9 is barely out of diapers, development of IE10 continues at a pretty brisk pace, and developers have reported seeing it in Windows 8. Will it be ready in time for the release? You betcha.

Probability: 99%

IMMERSIVE BROWSER: The most interesting browser enhancement we’ve run across for Windows 8 is a feature Microsoft calls Immersive Browser. Apparently based on the mobile browser in Windows Phone 7, Immersive Browser will presumably use the IE rendering engine within a simplified full-screen interface that will make the most of tablet displays. To get more web onto the screen, Microsoft reduced the number of menu options to Forward, Back, Address, Reload, and Favorite.



Some leaked screens also reveal a tiled interface similar to the Metro UI in Windows Phone 7, which would display web links as tiles across the immersive browser screen for quick navigation. This feature looks like it would be more useful in a tablet than on a PC, but it may work for both. Given all the other tablet-friendly features we’re seeing in the leaked code, we suspect Immersive Browser is a lock for the gold release.

Probability: 90%

SMARTSCREEN DOWNLOAD FILTER: Internet Explorer 9 includes a reputation-based phishing filter called SmartScreen, which checks files, links, and sites against a reputation database before loading them in the browser. Early Windows 8 builds appear to be pulling this feature deeper into the operating system to give users the ability to check files against SmartScreen before allowing them to launch. These options have been spotted under the View tab in the Folder menu as user-selectable features. We have little doubt that they’ll make it to the retail product.

Probability: 90%

CLOUD STORAGE: Despite curmudgeonly resistance from a certain segment of self-described power users, the cloud is now an integral part of mainstream computing. Microsoft has been pushing hard to catch up with third-party services like Dropbox and SugarSync with its Live Mesh syncing service, which lets users sync folders on their PC to a Windows Live account.

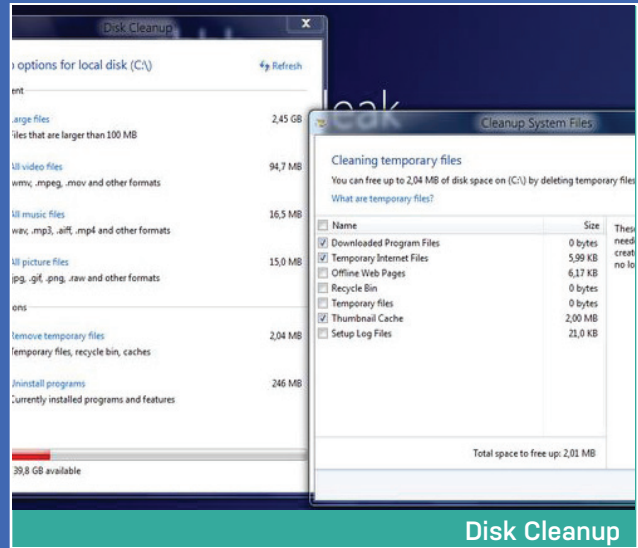
Leaked screenshots from Windows 8 alpha builds show code that apparently integrates cloud syncing directly into the operating system itself. It’s unclear whether this will simply allow users to link their LiveMesh/SkyDrive account to Windows 8, or if this kind of functionality will be extended to third-party cloud storage services, as well.

Probability: 80%

PUSH NOTIFICATIONS: Digging through DLL files in the alpha code, inquisitive minds have uncovered signs of push-notification support in Windows 8. This comes as little surprise, given the operating system’s other tablet-friendly features. Microsoft’s demo of Windows clearly shows notification icons throughout the OS, so we know this feature is in there. While we have no clear evidence about how push notifications will work in the next Windows, it seems probable that they’ll be able to do things like trigger a noise or flash a



Facial Recognition



Disk Cleanup

light when an email comes in, or announce a request for a video chat. We're looking forward to seeing more of this in the beta.
Probability: 99%

pect Microsoft hasn't stopped working on the feature, and we think there's a better than 50/50 chance it'll ship.
Probability: 60%

>>USER ACCOUNT FEATURES

So far, we've spotted few changes to the way Windows 8 will manage user accounts, but two interesting features have popped up on the rumor forums.

TEMPORARY GUEST ACCOUNTS: Guest accounts have long proven tricky for desktop operating systems. While the idea of letting just anyone log onto a PC and use it temporarily sounds nice in theory, that convenience comes with its fair share of security concerns. The Windows 7 beta included a decent stab at a temporary guest account feature, but it didn't make the final cut. Turns out it's harder than you might think to create a temporary user account with enough system access to be useful without opening up the machine to deep security threats that put the primary user's files at risk. Will Guest Mode reappear in Windows 8? We have no idea at this point, but we sus-

FACIAL RECOGNITION: There's nothing especially new about the idea of facial recognition. It helped HAL track Dave in *2001: A Space Odyssey*, and a number of PC manufacturers have shipped systems touting this feature over the past few years. In practice, however, the ability of consumer PCs to accurately spot faces has proved, well, spotty.

Back in April, Windows8Italia.com—which has been a leading force in uncovering Windows 8 features from inside the code—leaked news of a Windows 8 API called "Detect human presence," which likely integrates face recognition into the OS. If legit, this feature would be consistent with other leaked information out of Redmond, and this suggests Microsoft has been counting on the pervasive presence of webcams to power such a feature.

The big question here is not whether Microsoft is working on facial recognition. We know that it is. Our lingering skepticism centers primarily on the quality of the user experience and Microsoft's abil-

ANALYSIS: A 'BOLD MOVE' FOR MICROSOFT

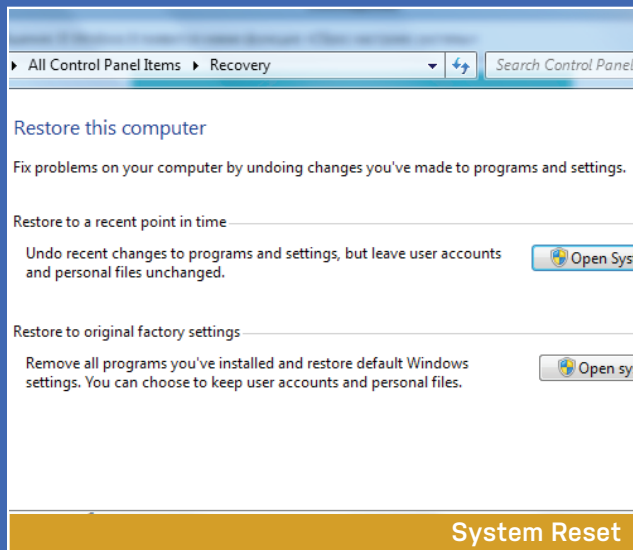
Microsoft is pitching Windows 8 as a complete rethinking of its desktop operating system, and we're certainly seeing some new and badly needed features in the previews and leaks that have surfaced to date. But lest we forget, Vista and Windows 7 both received similar hype from Microsoft's marketing arm in the lead-up to their release, and neither proved as revolutionary as initially reported. So what do the analysts say?

"It is an incredibly bold move by Microsoft," says Avi Greengart of Current Analysis. "Rather than just spin out a tablet edition of the OS or repurpose Microsoft's mobile OS for tablets, Windows 8 basically assumes that every PC is a tablet."

Maximum PC has long derided Microsoft's weak-handed tablet plays in the past, and as

Greengart points out, Windows 8 breaks that pattern by giving the tablet primacy at last. But Greengart is also quick to warn that, "This is unbelievably risky for one of Microsoft's core products: If consumers don't agree that physical interaction with the display makes sense on desktops and laptops, you end up with a disjointed user experience and stalled sales."

Most early analysis agrees with Greengart's take, but others worry that Microsoft may be muddying the waters for its business customers by aggressively shifting its focus to consumer electronics. Said IDC analyst Matt Eastwood in response to the June demo, "Windows 8 may be further evidence that Microsoft needs to fork its consumer product strategy from enterprise."



ity to make facial recognition work well enough that people will actually want to use it. If the feature's accuracy is less than 95 percent, it'll earn Windows 8 more jeers than cheers from people who can't easily log in to their PCs. So we won't blame Microsoft if this one doesn't appear on launch day.

Probability: 50%

SYSTEM RESET: Ever want to nuke your OS back to bedrock and get a fresh start with your PC? Screens leaked by a Chinese Windows site show the presence of a feature called System Reset that appears to do just this. The menu description for the feature reads, "Remove all programs you've installed and restore default Windows settings. You can choose to keep user accounts and personal files."

For those who like to occasionally reinstall windows as a way of reducing bloat, this could be a real boon. And for system administrators, it could be a huge timesaver in managing loaner systems. Whether System Reset would pose any potential security risks in administrative scenarios remains to be seen, but the feature sounds almost as plausible as it does cool.

Probability: 60%

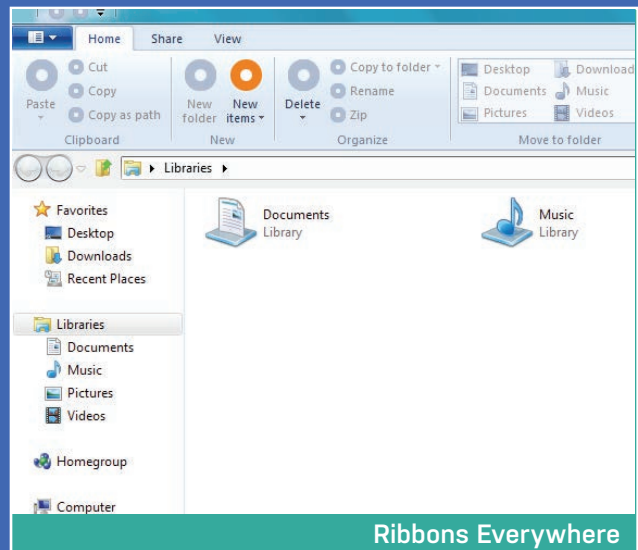
>>LEGACY INTERFACE TWEAKS

Windows 8 will constitute a complete reimagining of the Windows interface, making it more like a mobile OS than a traditional desktop OS, even for desktop users. While the Start Screen we saw in the June demo will be the most prominent change, there are two significant tweaks we expect to find in the legacy interface.

RIBBONS EVERYWHERE: One of the most noticeable interface tweaks in Windows 8 prerelease builds is the proliferation of ribbon menus throughout Windows Explorer. Already present in included apps such as Paint and Word Pad, the ribbon interface adds a host of new buttons to the Windows Explorer menu. From the screens we've seen, it looks like the new interface will put more of the classic menu options within one-click accessibility, eliminating the need to, say, click Edit and then Select All (or learn the hotkeys, for that matter).

Probability: 80%

AERO AUTOCOLOR: Of less impact to usability, but potentially more interesting to everyday users, is a leaked feature called Aero Autocolor. This simple menu option in the Window Color and Appearance control panel empowers Windows to automatically change the desktop color



scheme to match the dominant color in your wallpaper. So if you have green rolling hills as your background, Windows would auto-select a hue from the wallpaper and apply it to window borders. Will this be preferable to window transparency? We can't say.

Probability: 70%

>>CONTENT INTEGRATION

Computers and phones have long since morphed beyond the basic functions for which they were originally invented and have become, among other things, entertainment devices. So how will Microsoft respond to this trend?

WINDOWS APP STORE: The most prevalent content-related rumor in the Windows 8 universe is that Microsoft is working on an app store. This rumor appears to be substantiated by the presence of a tile labeled "Store" in the Start Screen shown by Jensen Harris in the June Windows 8 demo.

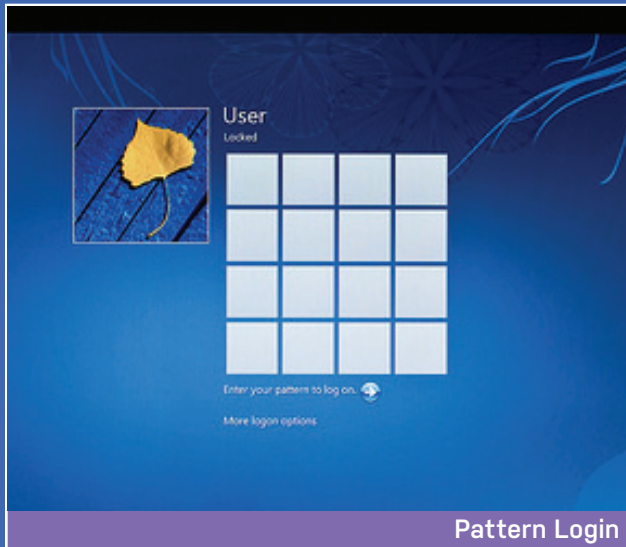
Microsoft has already attempted to copy Apple's retail store model, and nearly every major platform now supports an app market of some kind. Sometimes imitation is the sincerest form of flattery; other times it's just good business. We think a Windows app store just makes sense, and could potentially prove more successful than the Mac App Store, given Microsoft's massive installed base. Our biggest question on this one is whether Microsoft's entry into the arena could spark antitrust inquiries into the practice of first-party app markets, thereby posing problems not just for Windows 8 but for Android and iOS, as well.

Probability: 100%

PDF SUPPORT: At long last, Microsoft seems to be building PDF support directly into Windows with an app called Modern Reader. Presumably, Modern Reader will read a whole lot more than just PDFs, just as Preview does on the Mac. We're filing this one under D for "Duh, it's about time."

Probability: 90%

PATTERN LOGIN: In what clearly looks like a major concession to the tablet form factor, early builds of Windows 8 include the option of a pattern login screen similar to that of the Android OS. In YouTube videos showing the feature (most of which now appear to have been removed at Microsoft's request, a move that likely corroborates their legitimacy), the pattern screen consists of a 16-block grid, which would allow for more complex security patterns than Android's nine-block grid. As far



Pattern Login

as we're concerned, this pattern login screen is a done deal for Windows 8 and lends an air of near certainty to reports of more comprehensive touch interface enhancements.

Probability: 90%

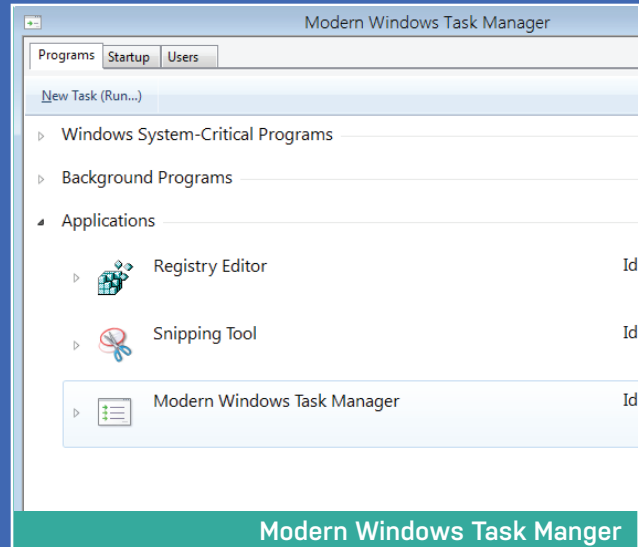
>>OTHER TWEAKS

While a great many unknowns remain in the months leading up to Windows 8's debut, there are a few more forthcoming features that we do have some good information about.

MODERN WINDOWS TASK MANAGER: Power users will get quicker access to the Windows Resource Monitor and Task Manager through a single control panel redubbed Modern Windows Task Manager. There's little in the way of new functionality here, but the merged control panels will make quicker work out of spotting resource hogs and shutting them down with one click.

Probability: 90%

HYBRID BOOT: To speed up boot times, Microsoft seems to have worked up a new method of shutting down and starting up known as



Modern Windows Task Manger

Hybrid Boot. This approach reportedly works more like hibernation than actual shutdown, leaving lots of data cached for ready retrieval when the system is fully powered up again. Leaked screens also show an option to revert the system to conventional shutdown mode for users who'd rather conserve power. Also, it looks like Hybrid Boot will not alter the way Windows restart works.

Probability: 80%

GENUINE CENTER: We know you've all been waiting for this one, so we won't hold out on you any longer: Yes, Windows 8 will have the long-awaited Genuine Center feature that will finally lay to rest all your worries about the possibility that your copy of Windows 8 might not be the real deal.

OK, so we're being sarcastic, but you had to know this was coming. Microsoft's war on software piracy has long masqueraded as a user service, and the Genuine Center looks like little more than a continuation of that trend. In this menu, you'll be able to enter or change your license key and view the status of your license's genuineness. Microsoft to users: You're welcome.

Probability: 100% 

WHAT USERS WANT FROM WIN8

We asked our Facebook fans (www.facebook.com/maximumpc) what new features they want to see in Windows 8. Here's what some of them had to say:



Steven Pangilinan How about smart file copying? To add files to the "queue" you should be able to just drag them to an already open copy dialog. And how about options for copying only nonexistent files or copying only modified files? Why do I still have to give xcopy a workout?



Lumpy Wrenches The ability to have different backgrounds on different monitors, on top of being able to put them both on random.



Jason Copeland Built-in support for PDF viewing and a completely disconnected Internet Explorer. None of this "uninstall" crap that only removes shortcuts and file associations.



Fred Kips Tabs in Explorer. I've tried third-party shell extensions, but it needs to be native and seamless.



Caleb Young More compatibility with old programs and games. I have a lot of games I'd like to play but can't because Windows 7 doesn't support them.



Shane McCook Updates without reboots. A move to a more robust copy-paste/cut-paste tool. Support for DVD and Blu-ray without third-party apps.



Branden Carlson More customization in the user interface and support for toolbar mods.

STEP UP TO A



BY LOYD CASE



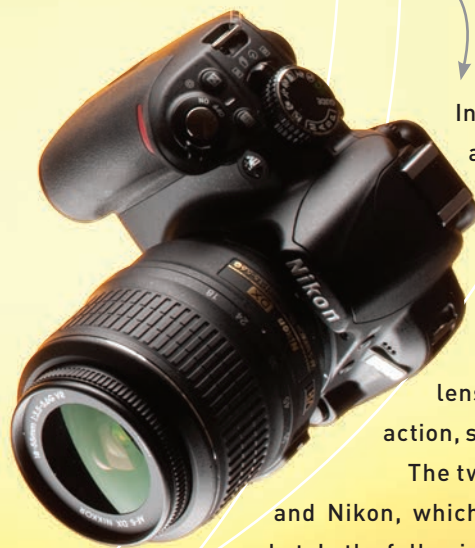
DSLR

TIRED OF MISSING THOSE ACTION SHOTS? ARE BLURRY INDOOR PHOTOS GETTING YOU DOWN? A DSLR MIGHT BE JUST THE CURE FOR YOUR POINT-AND-SHOOT BLUES

PHONES WITH CAMERAS ARE UBIQUITOUS, and point-and-shoot cameras have become practically throwaway purchases. It's the golden age of citizen photography, but as you become more serious about your images, pocketable cameras become more frustrating, and you run into the limits of physics. The tiny sensors and low-speed lenses in camera phones and point-and-shoots can't do justice to fast-action or low-light photography. Sometimes when you need that really long shot of, say, a hawk soaring above the trees, the wide-angle lens common to compact cameras reduces the graceful lines of the regal bird to a tiny dot.

Enter digital SLR (single-lens reflex) cameras, which take your photography to the next level. "SLR" simply means that a mirror or prism sits in front of the sensor and directs light to an optical viewfinder, allowing you to monitor the scene as the lens sees it.

A DSLR offers a larger sensor than you'll find in a point-and-shoot camera, and this allows it to capture more light. The larger sensor also offers greater dynamic range, which often translates to better shadow detail in photos with mixed lighting. A DSLR also gives you fine-grain control over all your picture settings—aperture, shutter speed, focus, ISO settings, and more.



Interchangeable lenses are another big selling point. For normal use, you can use a lightweight zoom that's suitable for general photography. For long shots, add a superzoom or long telephoto. The combination of bigger sensors, infinitely flexible settings, and robust lens choices allows you to capture phenomenal action, shoot in dimly lit conditions, or sometimes both.

The two leading manufacturers of DSLRs are Canon and Nikon, which together own nearly three-quarters of the market. In the following pages, we'll help you determine which DSLR features are right for you and review some of the interesting models.

BEFORE YOU BUY

Ask yourself: What kind of photographer am I?

How you plan to use your DSLR camera will inform your purchase and help you parse the myriad camera specs thrown at you by DSLR makers.

SENSOR SIZE

DSLR sensors come in two general sizes: Advanced Photo System type-C (APS-C) and full frame. "Full frame" refers to a sensor roughly the same size as a 35mm film frame. Most APS-C sensors offer crop factors of roughly 1.5–1.6x of that. Generally, a full-frame sensor offers better low-light performance, while an APS sensor offers better reach. A 50mm lens on an APS-C sensor camera is equivalent to a 75mm lens on a full-frame sensor. So if you're shooting long—say, football fields or wildlife—a 300mm lens will give you an equivalent 450mm reach. The crop factor also has an effect on depth of field: Full-frame sensors yield shallower depth of field, which often makes them desirable for portrait photography. Crop sensors are good for landscapes, providing not only more reach but deeper DOF.

BUFFER SIZE

The buffer is a temporary fast memory cache used to hold photos while they're written to much slower flash memory cards. You'll want a big buffer if you're shooting at high frame rates. It's frustrating to miss critical action waiting for the buffer to flush to a memory card, which happens with even very fast memory cards.

AUTOFOCUS POINTS

Most users tend to focus in the center of the viewfinder; it feels natural. A good DSLR will have multiple focus points, letting you focus to one side, or above or below the center. That's very handy if you want to draw attention to a part of the photo to one side.

SCENE MODES

It's tough to let go of some handholding, so most consumer and prosumer DSLRs have some automation of modes, like portrait, landscape, night, etc. The more capable DSLRs allow you to create custom settings based on your preferences, which is often better than an automated mode.



MEGAPIXELS

This is the number of effective pixels in a sensor. Modern DSLRs typically have 12MP or more. More pixels do not always mean better photos. Very high pixel densities sometimes cause less sharpness when your lens is stopped way down to $f/16$ or higher (smaller aperture). Macro photographers often want extreme depth of field and need to stop down—but not if they lose effective sharpness. Given the relatively high megapixel counts of modern DSLRs, this is one spec that's increasingly irrelevant—18 megapixels isn't better than 14.

FRAME RATE

DSLRs offer continuous shooting modes, which is a boon for shooting action photography. At a minimum, you'll want to be able to shoot at 4 frames per second. At 6fps, you miss less of the action in fast-moving sports.

ISO SETTINGS

ISO numbers refer to the light sensitivity of the sensor. All digital camera sensors have an optimal ISO that captures the scene with minimal noise. Increasing the ISO number allows you to shoot in lower-light conditions, but you'll see more digital noise in the photo. Auto ISO, long a staple of point-and-shoot cameras, is now common in DSLRs, as they let the camera pick the optimal ISO setting for the combination of shutter speed and aperture setting.

VIDEO

Most current-generation DSLRs can shoot video. The variation of video capabilities is wide, however, with some cameras capable of shooting up to 1080p/30fps while others can only manage 720p. When using a DSLR for video, you gain access to a wide array of lenses, but you also lose some features, like the fast autofocus capability used when shooting still images.

MEMORY CARDS

All the cameras we tested use SD cards (including SDHC and SDXC) for storing photos. The Nikon D7000 actually supports twin SD card slots. Pro DSLRs often use CompactFlash, which generally offers higher capacities and faster writes than SD cards, but the latest SDXC cards use UHS controllers capable of 104MB/s write speeds. The camera body needs to support UHS speeds to take advantage of the full performance of these newer cards, however.

LIVE VIEW

One of the DSLR's strengths is its ability to shoot through

the optical viewfinder, but the new generation of DSLRs can also use an LCD display on the back to show the scene. This is often the mode used to shoot video. Some DSLRs offer articulated LCD screens, which allow for more flexible shooting angles.

FLASH

Cameras in the class we tested all have built-in flash. They go a step beyond the pop-up flash built into many point-and-shoot cameras, though, allowing the camera to control multiple remote external flashes with the built-in flash. This allows for incredible flexibility in lighting.



PUTTING A DSLR TO THE TEST

Testing the performance of a DSLR can be a complex process, but we distilled our testing down to a few key parameters. We wanted to check out image quality at high-ISO settings and continuous-mode shooting performance as objectively as possible. Autofocus performance was a tougher nut, since modern DSLRs tend to offer pretty fast autofocus under normal lighting. So we settled for subjectively testing AF "hunting" in a low-contrast environment, which is probably the biggest challenge for most autofocus schemes.

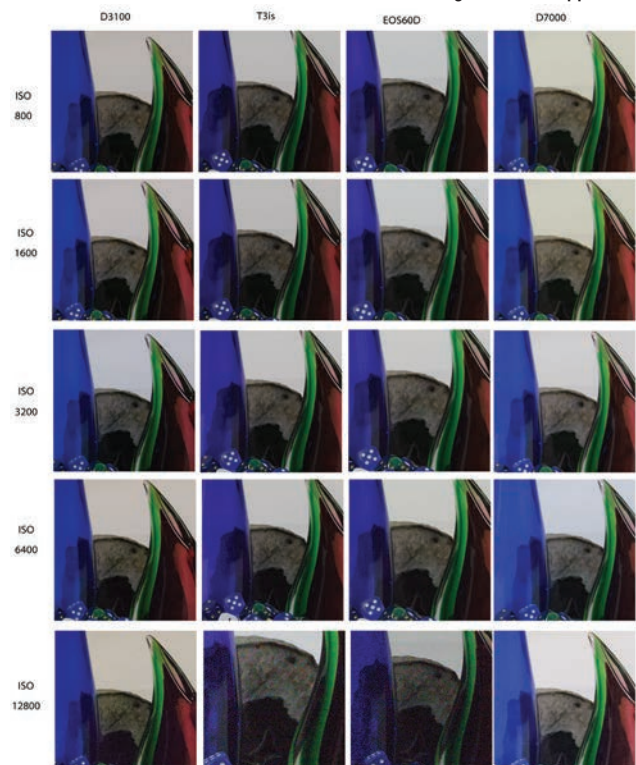
High-ISO testing was conducted with roughly equivalent, higher-quality lenses. For Nikon, we used the new Nikkor AF-S 24-120mm f/4G VR. For Canon, the test lens was the EF 24-105mm f/4 IS USM. The cameras were set to aperture priority mode and f/5.6, with the shutter speed allowed to vary. The room was moderately lit with old-style fluorescent tubes, which also gave us a chance to check out the effectiveness of the auto white-balance.

The scene used in high-ISO testing consisted of a number of colorful objects on a white background. We then cropped an 800x800 pixel region that contains a sample of most of the objects used and looked at noise levels at ISO 800, 1600, 3200, 6400, and 12800. We made sure to disable both noise reduction and sharpening in Photoshop's Camera Raw tool when we imported the images to Photoshop.

Continuous-mode testing was performed with a cleanly formatted, SanDisk Extreme SDXC card with a rated throughput of 45MB/s. The cameras were set to manual, 1/250 of a second, f/4, at the maximum continuous mode of the SLR.

We discuss the results of continuous-mode shooting in the individual reviews, but all these cameras have limited buffer sizes, particularly if you're shooting in raw mode. Getting a faster SD card helps, but only to a limited extent.

Our high ISO test shots consist of an 800x800-pixel section of a larger image. While it's hard to discern differences on the printed page, in Photoshop, variations in image noise are apparent.



NIKON D3100

Big on features, low on cost

The D3100 is a welcome update to earlier entry-level DSLRs from Nikon, which offered aging sensor technology and limited feature sets. The D3100 sports a 14.1MP CMOS APS-C sensor with very good low-light capabilities for a camera in its class.

At a shade over a pound for the body, it's also the lightest of the DSLRs in our roundup. The light weight and compact size make it easy to throw in a backpack or large purse. The 18–55mm kit lens adds another 12 ounces. The kit lens offers limited speed and isn't the sharpest lens we've tested, but at appropriate f/stop and lighting conditions, it gets the job done.

Due to its relatively light weight and small size, the D3100 feels a little unbalanced in the hand. Anyone graduating from a point-and-shoot camera might want to avoid trying to grab the left side, as there's little to grab. Attaching any lens larger than the kit lens tends to tilt the balance toward the lens.

The user interface is classic Nikon. It's easy to rotate the command dial while simultaneously depressing the shutter button. The menu structure is a little daunting, however, with many lists scrolling down below the screen bottom, although there is a scroll bar that informs you where you are in the menu.

The pop-up flash is useful for fill and occasional use. The camera can't be used to command Nikon's remote CLS flash units without having an external CLS-capable flash attached.

Continuous shooting is limited to 3fps, and the buffer fills at 12 shots in raw mode. It takes about seven seconds for the buffer to empty. Noise levels are pretty minimal up through ISO 1600. At ISO 3200 and 6400, luminance noise is visible, and when you push to H mode (ISO 12800), luminance noise kills a lot of detail. However, chroma (color) noise is noticeably absent. Auto white-balance was sometimes fooled by fluorescent lighting flicker at a range of shutter speeds, giving images a yellowish cast.

HD movie modes max out at 1080p/24fps; 1080/30 isn't supported, nor is 720/60. Other supported video modes include 720/30, 720/24, and 640/24. The D3100 uses contrast focus when capturing video, so don't expect fast autofocus performance when shooting video. We shot some video at 1080/24 using maximum quality settings and got a bit rate of about 20Mb/s. Quality looked fairly good in daylight.

Overall, the D3100 is a fine entry-level DSLR but is marred a little by awkward body balance. Like earlier entry-level Nikon DSLRs, some older lenses that lack built-in motors won't work with the camera. The unit feels plasticky in hand, and you should be careful in wet weather, as it's not well-sealed. Video settings are limited, but this camera is a good foray into the DSLR world.



Minimalist controls and a nonarticulating LCD clearly mark this as an entry-level DSLR.

SPECIFICATIONS

Sensor	14.1MP CMOS Nikon DX (APS-C)
Maximum photo size	4608x3072
Autofocus	11-point, dynamic with 3D tracking
File format	NEF (raw), JPEG
Storage	1 SD slot, SDXC capable
Viewfinder	Pentamirror (95 percent coverage)
Shutter-speed range	1/4000–30 sec
Flash sync	1/200
Maximum continuous shooting speed	3fps
Scene modes	6 (Child, Close-up, Landscape, Night Portrait, Portrait, Sports)
Maximum ISO	3200 (can push to 6400 and 12800)
Shots with battery charge	550



The D3100 is a no-frills DSLR with a good user interface, but it feels slightly unbalanced in your hand.



Nikon D3100

\$600 (online) w/18–55mm f/3.5–5.6 VR

CANON EOS REBEL T3i

Rich in features and no slouch in performance

Canon's latest Rebel T3i offers a robust feature set, a staggering 18MP APS-C sensor, good control over your photography, and an impressive array of movie modes.

At just a little more than 18 ounces, the T3i feels very good in your hand. The body design is balanced and textured rubber coats both front and back. If you attach a lens larger than the 18–55mm kit lens, the balance does tilt forward, but the body still feels natural while using it.

Autofocus seems a touch slower than on the Nikon D3100 in dimly lit conditions, but overall focus speed is good in most lighting. Auto white-balance works well, even in flickering fluorescent light, until you start pushing to higher ISOs and shutter speeds, where that familiar yellowish cast will occasionally creep in. Fluorescent lights are often a problem with auto white-balance schemes, but Canon seems to handle it a bit better than most. There's also a nifty "intelligent auto" that sets most of the exposure but lets you play around a bit with depth of field and also control the flash.

At its maximum shooting speed of 3.7fps in raw image mode, the buffer filled after six shots and took about seven seconds to empty. That's about average for a unit of this class, but you will want to manage your continuous shooting carefully or risk losing some of the action.

Video settings are very flexible and include both 1080/30 and 720/60 HD modes, plus a plethora of others. At 1080/30, the T3i generates large files with high bit rates—in excess of 40Mb/s—which is a testament to the video capture abilities of the unit.

Where the T3i falls down a bit is in the user interface. Take ISO settings, for example. If you want to push the ISO beyond the maximum 6400, you need to navigate to one of the top menu tabs, select Custom functions, click through to the second custom function, and then enable ISO Expansion. If Nikon menus are too long vertically, Canon menus have too many tabs, some of which contain nested functions. Also, rotating the main dial while simultaneously pressing other buttons can be an interesting exercise in frustration.

Once you've figured it all out, however, the T3i is a pleasure to use. Image quality is generally quite good, though the T3i suffers from serious luminance and color noise at its highest ISO setting (12800). Even at both ISO 3200 and 6400, luminance noise is still somewhat distracting (although no worse than the D3100 at ISO 3200), but color noise is minimal at ISO 6400 and below.

The built-in flash can act as a master unit if you own Canon external flash units, offering great flexibility in lighting. On its own, it's a typical pop-up flash, mostly useful for fill or when you've got nothing else.

In the end, the EOS Rebel T3i is a terrific value at about \$850 with the 18–55mm f/3.5–5.6 image-stabilized kit lens. And Canon's rich array of lens choices gives you tremendous options as you explore your own photographic inclinations.



The back of the Rebel T3i is cluttered with small icons, but the articulating LCD is neat.

SPECIFICATIONS

Sensor	18MP CMOS APS-C
Maximum photo size	5184x3456
Autofocus	9-point (cross type)
File format	CR2 (raw), JPEG
Storage	1 SD slot, SDXC capable
Viewfinder	Pentamirror (95 percent coverage)
Shutter-speed range	1/4000–30 sec
Flash sync	1/200
Maximum continuous shooting speed	3.7fps
Scene modes	5 (Portrait, Landscape, Close-up, Night Portrait, Moving Subjects)
Maximum ISO	6400 (can push to 12800)
Shots with battery charge	550



Well-balanced for its size, the Rebel is a pleasure in the hand.

VERDICT
9

Canon EOS Rebel T3i

\$850 (online) w/18–55mm f/3.5–5.6 IS II



The D-pad nested inside the 60D's control dial is a bit awkward.

SPECIFICATIONS

Sensor	18MP CMOS APS-C
Maximum photo size	5184x3456
Autofocus	9-point (cross type)
File format	CR2 (raw), JPEG, and M-RAW
Storage	1 SD slot, SDXC capable
Viewfinder	Pentaprism (96 percent coverage)
Shutter-speed range	1/8000–30 sec
Flash sync	1/250
Maximum continuous shooting speed	5.3fps
Scene modes	5 (Portrait, Landscape, Close-up, Night Portrait, Moving Subjects)
Maximum ISO	6400 (can push to 12800)
Shots with battery charge	1,600



The EOS 60D is beefy and balances well with larger lenses.

CANON EOS 60D

Flexible control plus handholding when needed

At first blush, you'd think the EOS 60D would be more capable than the older EOS 50D. That's only partially true. It's got more pixels and a more sophisticated metering engine, but it lacks the metal body and has a lower maximum continuous shooting speed. Making those changes allowed Canon to lower the price a bit: the EOS 60D body can be found for less than \$1,000, while the kit with the 18–135mm IS lens is about \$1,200.

Like the lower-end T3i, the EOS 60D offers a fully articulating LCD screen. Stepping up to the EOS 60D gives you a pentaprism-equipped viewfinder. Using a pentaprism increases the bulk of the camera slightly, but the viewfinder is brighter, making manual focus a bit easier. The EOS 60D feels beefier and more solid than the T3i, and its balance in the hand when using larger lenses is better.

The EOS 60D's user interface is similar to the T3i's, which means a fair amount of menu hunting. If you want to change any settings for video, you first need to select video with the mode dial. It's logical, given the dense structure of Canon's menus. Having the main dial vertically mounted directly behind the shutter button is a bit awkward. Also, nesting a D-pad inside the quick control dial on the back of the unit is a bit much. One nifty feature is a fully working artificial horizon visible on the LCD, which makes adjusting the relative tilt of the camera easy.

You have easy control over picking your focus point, which makes selective focus easy. But this also makes you realize how limited nine autofocus points are, though all are cross type at higher f-stops. Autofocus is fast, with little hunting in low light. Auto white-balance performance is pretty good, too, though with the usual limits, depending on lighting conditions.

The EOS 60D can shoot up to 16 shots in raw mode before the buffer fills, but that buffer takes a whopping 17 seconds to empty. Shooting at the full 5.3fps makes shooting action a real pleasure, but you need to shoot in relatively short bursts to manage the buffer in raw or switch to JPEG.

Interestingly, high-ISO shooting (ISO 3200 and 6400) seems to generate images slightly softer than the T3i. As with the T3i, if you push to ISO 12800, you start to see a lot of chromatic noise. Still, high ISO performance is pretty good overall.

Like the T3i, the EOS 60D supports full HD resolutions, including 1080/30. (None of the DSLRs tested here support interlaced resolutions, however.) Video quality is good, and shooting video is easy and straightforward, although autofocus performance is limited.

The EOS 60D costs a pretty penny, but you'll be rewarded with fine handling, Canon's superb selection of lenses, and excellent video capabilities. We wish the user interface was a little less awkward and some of the key features present in the older 50D had been retained, but you'll get great photos and videos with the EOS 60D.



Canon EOS 60D

\$1,000 for body (online), \$1,200 w/18-135mm f/3.5–5.6 IS

NIKON D7000

Caters to pros and consumers alike

Nikon built the D7000 using a partial magnesium shell (top and bottom) with dust and weather seals. It feels slightly less balanced in the hand than Canon's D60, but this is a minor inconvenience that most shooters won't notice.

The D7000's user interface is easier to navigate than the D60's, but it does fall down a bit in the mode dial. The detent is pretty light, and there's no lock, so it's easy to accidentally change modes without knowing it.

What's impressive about the D7000 is that Nikon pushed its sensor size up to 16MP while improving the high-ISO capabilities over those of past generations. In fact, even at the extreme setting of ISO 25800, there's almost no color noise, though luminance noise is quite distracting. Auto white-balance occasionally has issues with flickering fluorescent lights even at relatively low ISOs and high shutter speeds.

Nikon's LCD-based UI offers fewer choices than Canon does but also doesn't require you to scroll through long menus to find obscure settings. Like the EOS 60D, there is a flexible set of control customization options. The mode dial also has two settings, labeled U1 and U2, that let you easily recall customized settings.

The built-in flash works as expected but can also act as a master in Nikon's CLS remote flash system if you're using Nikon SB700 and higher flash units. On the consumer-friendly side, the D7000 has more scene modes than many point-and-shoot cameras—19 in all. Some of these actually work better than we expected. In particular, the Silhouette mode metered complex backlit scenes amazingly well. The D7000 also has two SDXC-capable slots, and you can designate whether to use one to mirror the other as spillover or for video.

One highly useful feature is the 39-point autofocus (nine are cross type), which is easily selectable with the D-pad. The ability to fine-tune your focus provides excellent composition opportunities. On the other hand, don't forget to move the focus point back to center when you're shooting fast action! The D7000 can shoot at a full 6fps, which makes it a great option for sports, but the buffer size is limited. If you're shooting 12-bit raw format, the buffer fills at 14 shots and takes 12 seconds to flush. If you want to shoot at a higher dynamic range, the D7000 can shoot in 14-bit mode—but the buffer fills after only a few shots.

Video is more limited than on either Canon camera. 1080p is only supported at 24fps and there's no 60fps option for 720p. Image quality is good at those resolutions, but if you plan on shooting lots of video, the limitations are worth noting.

Overall, the D7000 is a high-end prosumer camera with some professional aspirations. It's got great low-light performance, reasonably fast autofocus, and feels pretty good in the hand, though large lenses will alter the balance. The mode dial is a little problematic, and the buffer could be bigger, but overall, the D7000 offers photographers great shooting flexibility coupled with useful handholding when you need it.



The D7000 offers lots of buttons and controls, but they're cleanly laid out.

SPECIFICATIONS

Sensor	16.2MP CMOS Nikon DX (APS-C)
Maximum photo size	4928x3264
Autofocus	39-point (9 are cross type)
File format	NEF (raw), JPEG
Storage	2 SD slots, both SDXC capable
Viewfinder	Pentaprism (100 percent coverage)
Shutter-speed range	1/8000–30 sec
Flash sync	1/250
Maximum continuous shooting speed	6fps
Scene modes	19 (Landscape, Portrait, Night Portrait, Sports, and many more)
Maximum ISO	6400 (can push to 12800)
Shots with battery charge	1600



That red accent tells you it's a Nikon.

VERDICT

9

KICK ASS!

Nikon D7000

\$1,200 body (online), \$1,500 w/18–105mm f/3.5–5.6 VR



Are mirrorless cameras with interchangeable lenses, like the Panasonic GF2, the future of high-end photography or just a gateway drug to real SLRs?

TECHNICALLY, MOST POINT-AND-SHOOT CAMERAS are “mirrorless,” but the moniker seems to have stuck to cameras with (mostly) larger sensors and the capability to swap lenses. Panasonic and Olympus tried to establish a standard with Micro Four Thirds (a sensor format that’s about 40 percent smaller than APS-size sensors but much larger than most point-and-shoot cameras), but Sony and Samsung rained on their parade, coming out with different formats. The Panasonic GF2 is a Micro Four

Thirds camera; its shape is reminiscent of the rangefinder film cameras popular in the 1960s. It lacks a viewfinder, but an electronic viewfinder can be attached to the hotshoe. It shoots video at full 1080/30 (saved as 1080i) and 720/60 formats in AVCHD mode, just like a camcorder.

It handles much like a point-and-shoot, but you can swap out lenses. Panasonic and Olympus make a variety of lenses that can mount on each other’s Micro Four Thirds bodies. The Panasonic GF2 isn’t much bigger than some point-and-shoots, though it’s not something you can tuck into a shirt pocket. Panasonic also makes the more SLR-like GH3, which offers greater control and capability.

MIRRORLESS MARVELS

The smaller sensor size relative to an SLR does mean that low-light performance is limited. While the GF2 is capable of going to ISO 6400, anything above 1600 is a noisy mess.

Still, there’s something compelling about these smaller cameras that allow you to swap out lenses. Available lenses include primes as fast as f/1.4, zooms out to 300mm (effectively 600mm, due to the 2x crop factor), and even wide zooms (7–14mm, roughly equivalent to 14–28mm full frame). They look cool, can shoot great photos with good light, and the lenses allow excellent shooting flexibility. It’s very possible that a mirrorless design will be your future camera of choice over an SLR. ⏻

TIPS FOR BETTER PICS

How to make the best use of your hardware

Tip 1 Photography is all about light, so start paying attention to it even when you aren’t taking pictures. Observe the light around you and the way it interacts with subjects and environments. Quantity of light does not equal quality of light. Cameras do not have the benefit of bi-optic sight like our eyes, so shadow and highlight are your go-to tools for communicating shape and depth. Typical on-camera flash is unflattering partly because it strips the shadows and thus the shape and depth from your subjects.

Tip 2 Don’t be afraid to push into the high ISOs instead of using your flash. Modern cameras, especially full-frame models, capture phenomenal images in low light. It’s better to deal with a little sensor noise in your post-processing than to lose the shot completely to motion blur.

Tip 3 Don’t assume that upgrading the camera will improve your photography. Before buying a new body, have a list of three or four specific problems that an upgrade would solve over your current gear. If you purchased a DSLR during the last four to five years, chances are you have plenty of resolution. “More megapixels” is rarely a good reason to upgrade. If you have money to spend, first consider a new lens, or challenge yourself with off-camera lighting.

Tip 4 Dump that kit zoom lens. In addition to having a better grasp of light, you’ll also want to improve your compositions. Abandoning zooms will force you to think a lot harder about what you’re doing—what you include in the frame, and what you don’t. There’s a time and place for zooms (on a full-frame body start with a 50mm prime, for example, or

on a crop-frame body start with a 35mm prime, which on most brands will get you close to a 50mm equivalent field of view), but they won’t train you to be thoughtful about your compositions the way a fixed focal-length lens or prime lens will. Even the cheapest prime lenses will offer significantly better image quality than a consumer zoom and are typically “faster” too, allowing more light into the camera.

Tip 5 To avoid camera shake, the golden rule for people with steady hands is a shutter speed of 1/10 of a second per mm of focal length. On a 35mm-equivalent FOV, 1/35 of a second is the lowest practical handheld shutter speed. At 200mm, 1/200 is your lowest practical shutter. Again, this rule only applies to hand-shake. If your subject is moving, the rules change depending on how fast they are. I find when shooting weddings (humans moving normally about a room) at 50mm that 1/125 is the slowest I can get away with and still keep the majority of my frames sharp. Hold the camera in tight and close to your body. The closer it is to your core, the more you can use yourself as a brace. Don’t try to use live view unless you are stabilizing the camera or shooting with very high shutter speeds.

Final thought A camera is not a human eye. It “sees” light very differently. The human eye is truly an impressive instrument; next to it a camera is terribly limited. Wielding a camera skillfully is about understanding its limitations and learning to work around them, or even better, turning them to your advantage.

Gavin Farrington (www.gavinfarrington.com) is a professional photographer and longtime reader of *Maximum PC* magazine.

Gavin Farrington
Professional Photographer



WHICH SMARTPHONE IS BEST FOR YOU?

Which smartphone features do you care about most? Battery life? Camera quality? Raw performance? We survey the entire smartphone universe to name the best devices in seven key areas

BY MARKKUS ROVITO

Seems like every six weeks a new handset becomes the hot new “it” phone—the phone everyone has to have, because for some reason or another, it’s simply the “best smartphone available.” But all this is a sham. There is no single “best” smartphone—at least not a single phone that beats *all* other competitors in *all* key areas. A phone so supremely superlative would cost more than the market would bear.

And so we’re left with phones that necessarily compromise various features in deference to others. You want a best-in-class physical keyboard on your phone? Fine. Then you can’t have the thinnest phone available. You want the best handheld gaming experience? OK, cool. But forget about best-ever battery life.

See the pattern? Today’s smartphones *do* everything, but none of them are the *best* at everything.

But that’s OK, because consumer priorities vary wildly. Some people want the smallest phone possible. Others want a phone that can replace their digital camera. And some folks can’t spare a moment of idle time without playing a video game.

With all this as a backdrop, we scoured the smartphone universe to find not the best phone, but the best *features* in various phones. Many of the most intriguing models focus on a couple of different areas, catering to different user needs. This is never more clear than in those ads touting the smallest smartphone, the best camera in a phone, the best smartphone for gaming, and so on. We looked into all of these areas and also searched for the best display, longest battery life, most powerful raw performance, best keyboard, and thinnest chassis.

In the end, we verified what we already suspected: Smartphones are not a one-size-fits-all proposition. Changing desires on the consumer side, as well as technological evolution and competition on the manufacturer side, will continue to drive innovation and variation—not to mention specialization.

FEATURE BY FEATURE

Display	p44
Camera.....	p46
Battery Life	p48
Gaming	p50
Chassis	p52
Performance.....	p54
Keyboard.....	p56
The Future	p57



ROUND 1: DISPLAY

Pixel by precious pixel, we scrutinized the entire fold of smartphone displays. The old master still rules, but there's heat from the young upstarts

The display is your smartphone's most obvious, in-your-face feature, and a good one will pay off every single time you surf the web, watch videos, or view photos. A bad display, meanwhile, can actually give you a serious case of tech envy—you'll find yourself staring at your feet while all the other nerds are showing off their latest phones. You simply cannot hide from the small dimensions, low resolution, and washed-out colors of a lackluster display.

Since the dawn of the first iPhone, smartphones have swelled in display size—perhaps to one-up the 3.5-inch screen of the single most popular phone in the world. The 4-inch display has become standard, and the popularity of 4.3-inch screens is growing. Those extra few tenths make a surprisingly big difference in terms of screen real estate.

Size is ultimately superficial, however. The more time you spend with a phone, the more attention you'll pay to resolution, pixel density, power consumption, color vibrancy, color accuracy, black and white levels, and even viewing angle. To this end, when it was released in June 2010, the iPhone 4 set many standards, including an unprecedented screen resolution and pixel density (326 pixels per square inch) that other companies are still trying to approach. The Motorola Atrix 4G was the first phone to offer qHD (quarter high-definition) resolution, a new standard that will appear in many of the most anticipated smartphones this year. Offering one quarter of a full 1080p frame, qHD delivers 960x540 pixels in a 16:9 aspect ratio.

One of the more intriguing qHD phones on the horizon is the HTC Evo 3D for Sprint's WiMAX 4G network. This handset supports glasses-free 3D viewing, as well as 3D video and stills by way of stereoscopic 5MP cameras. HTC has also adopted qHD for its highly anticipated Sensation, which was hitting stores just as we went to press with this issue.

But enough about phones that haven't been released, or have been released but can't be found anywhere. In the here and now, we still have plenty of eye candy upon which our gaze can lovingly linger.



The chemically strengthened Corning Gorilla Glass of the iPhone 4 display makes it harder, more scratch resistant, and more durable.

RUNNERS-UP

Samsung's Super AMOLED smartphone screen has been one of the few displays to threaten the screen packed into the iPhone 4. Super AMOLED stands for "super active-matrix organic light-emitting diode," and without going into too much geeky detail, it's notable for integrating touch sensitivity directly into the screen, rather than slapping a separate touch layer on top of the screen. This not only reduces packaging size but increases power efficiency and relative brightness.

It's an exciting technology, and Samsung introduced the improved Super AMOLED Plus display in January. This updated "Plus" version is even thinner, brighter, and more power efficient than before. It also uses 50 percent more subpixels, which enables the

larger screen to look clearer even though it has the same resolution as a smaller one.

To illustrate that point beautifully, Samsung released the **Infuse 4G** (AT&T) as its first Super AMOLED Plus device. With a 4.5-inch screen, it's about as big as a smartphone display can be without getting ridiculous. Still, it's easy to fall in love with this one. Its liquid screensaver alone delivers a wow factor that most competitors can only dream of. Even though the Infuse 4G's resolution maintains the 800x480 standard of previous Samsungs, we believe the subpixel story. The Infuse 4G lavishes you with extraordinary detail, beautifully vibrant colors, deep blacks, bright whites, and crazy viewing angles.

If you're not sold on the almost tablet-like Infuse 4G, keep an eye peeled for the smaller, dual-core **Galaxy S II**, which also boasts a Super AMOLED Plus screen. Stay tuned for more Samsung R&D developments, as well. Word has it that a new laser manufacturing process will soon enable Samsung to achieve pixel densities on par with the iPhone 4's Retina display.

THE WINNER

The reigning and defending champion has hung onto its title as the best smartphone display for more than a year now—almost unheard of in this world of rapid product cycles. Even though we now prefer at least a 4-inch smartphone display, seeing is believing when comes to the **Apple iPhone 4**. By developing pixels that are 78 micrometers wide, Apple delivers a screen resolution that boasts exactly *four times* the pixels of earlier iPhone models—all in that same 3.5-inch screen size. The end result is a resolution that challenges the human eye to distinguish individual pixels. The iPhone 4 also delivers spectacular brightness and some of the best color accuracy you'll find in a smartphone. So, while its screen dimensions may not be perfect, it's still the best display you'll find in a smartphone—for now.

“SUPER AMOLED PLUS IS EVEN THINNER, BRIGHTER, AND MORE POWER EFFICIENT THAN BEFORE.”

ROUND 2: CAMERA

It's not time to throw out your pro-level DSLR yet, but these smartphones will make you think twice about packing a point-and-shoot for a day trip

Ever since the late 1990s, when camera wed phone in holy matrimony, we've been dreaming of the day when a camera phone would be the *only* camera we would ever need. Well, we're getting close, and for many casual shooters, the best smartphone cameras should be plenty good enough.

Today's elite phone cameras definitely eclipse early stand-alone digital cameras—if only because those early stand-alones sucked. But as dedicated, single-purpose digital cameras rapidly improve, so do our standards for smartphone cameras. For now, high-end image processing chips are still too big to wedge into the skinny-mini smartphone frames that users prefer. But that doesn't mean a few phones don't shoot well above their weight class.

RUNNERS-UP

Perhaps the two best smartphone cameras in the world don't enjoy—and may never receive—widespread carrier acceptance and U.S. distribution. One of these models, the Symbian-running **Nokia N8**, goes well beyond standard smartphone conventions to dust the competition. The N8 proudly struts a 12MP image sensor, a Xenon flash, and a Carl Zeiss lens with autofocus and mechanical shutter—all sticking a good millimeter out of the back of the N8's attractive aluminum frame. Such a component collection is still unmatched on competing phones and both the still and video image quality backs up the impressive specs. Unfortunately, no major U.S. carriers support this phone.

The same goes for the impressive **Xperia Arc** from Sony Ericsson, although in this case, the company website lists U.S. availability as "coming soon" (which could mean "soon" or "just short of never" in the tech world). To match the excellent stills and 720p HD video it takes, the 8.1MP Xperia Arc includes a wealth of useful menu options, such as a self-timer, eight scene modes, digital image stabilization, red-eye reduction, and exposure and white balance settings.

With the N8 and Arc out of contention due to ineligibility, we narrowed our best smartphone camera options down to a pair



Besides an excellent camera, the Inspire 4G's HTC Sense UI adds many features, like a social media aggregator.

of choices available right here, right now.

THE WINNERS

An 8MP camera is *de rigueur* for any marquee smartphone these days, and 12MP sensors should trickle in to a lot more hardware by the end of this year. The best all-around camera we found in the 8MP pack comes in the **HTC Inspire 4G**, a solid all-around Android 2.2 smartphone for AT&T.

The more we used the Inspire 4G, however, the more difficult it was to crown it king over the intrepid **iPhone 4**. While still wielding last year's 5MP sensor, the iPhone 4 holds up extremely well. We wrote earlier that no one single smartphone is the best at anything, and we're sticking to that statement by breaking down the individual strengths of our two smartphone camera winners.

Resolution Megapixels alone don't mean squat if a camera can't produce lush and accurate photos. Of course, the Inspire 4G has that handled, or we wouldn't be writing about it here. Its ultra-wide, 3264x1952 images give you a generous swath for panoramas. The iPhone 4's 2592x1936 images bear a 4:3 aspect ratio, mimicking a 35mm camera, but this is the digital age, and we prefer a little cropping room in the extremities of our pictures. **Winner: Inspire 4G**

Flash Both units give you an LED flash with On, Off, and Auto settings, but the iPhone 4's flash lacks the power to salvage many shots recorded in the dark. Conversely, the Inspire 4G's brilliant dual-LED flash coats your immediate area with plenty of light for taking quality shots in dim settings. It also doubles as a flashlight with three intensity settings. Downside: possible temporary blindness for your photo subjects. Upside: usable low-light images. **Winner: Inspire 4G**

Close-ups Both cameras have digital zooms that perform acceptably when used with careful moderation. However, the iPhone 4 comes with a macro lens that handles close-up shots with aplomb, rather than just skating by like the Inspire 4G (see examples). **Winner: iPhone 4**

Still Image Quality Each camera takes detailed stills, but the iPhone 4's images look a bit artificial. They err toward warm color shifts, though some images add in cool shifts to boot (as in our macro shot of the coin). The results look pleasant and almost whimsical, but aren't as accurate as they should be. If "iPhone 4" were a filter in Photoshop, we may try it, but it's not the best starting point.

Images from the Inspire 4G display noticeably more accurate colors, and that's the biggest difference between the two camera phones. Both cameras exhibit excellent contrast, but we prefer the deep blacks of the Inspire 4G just a bit more. **Winner: Inspire 4G**

Options The iPhone 4 offers very little customization. It lets you zoom, turn on flash,

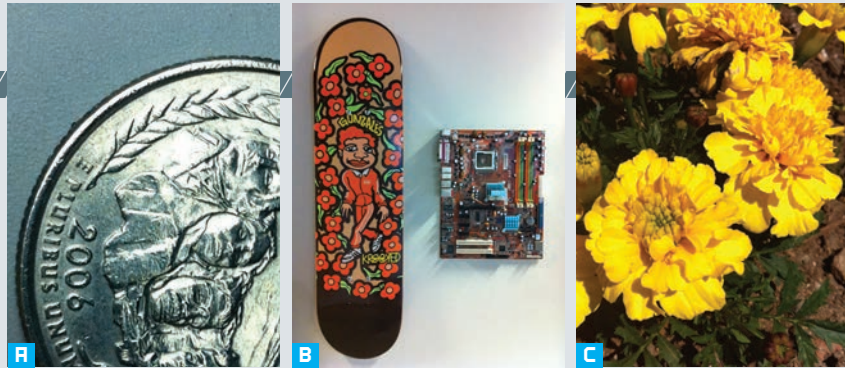
and tap the screen to focus, but it sets exposure and white balance settings automatically. That said, its HDR (high-dynamic range) setting changes the game. HDR takes three images—one underexposed, one overexposed, and one at autoexposure—and composites them together into a single image that typically delivers greater range between the darkest darks and the lightest lights. The effect doesn't always produce a better photo, and it can't be used if you or your subject is in motion. But when it does work, it can deliver exceedingly rich images and increase the whimsy of iPhone 4 photos to surreal levels.

We also appreciate the generous, if standard, options of the Inspire 4G. You get settings for sharpness, saturation, contrast, exposure, white balance, ISO, face detection, and others. You also have a self-timer and 12 obligatory effects, such as sepia, negative, solarize, etc.

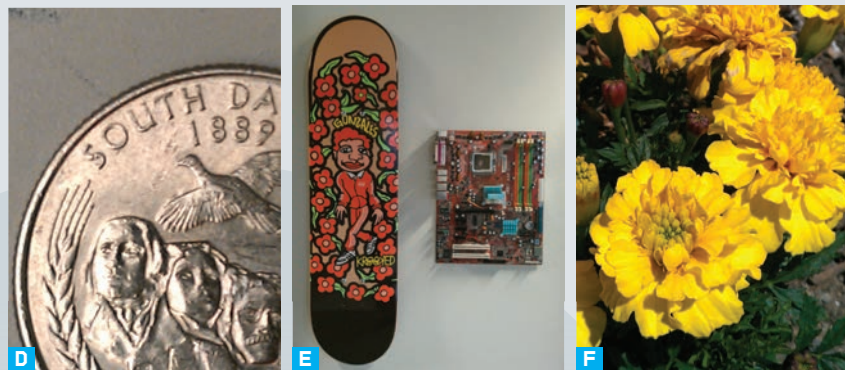
Winner: iPhone 4

HD Video Quality Our two smartphones both shoot 720p video. While the iPhone 4's video lives up to the quality of its still photos, video shot on the Inspire 4G looks less detailed and suffers from clunky auto-brightness adjustments when you move into different ambient light environments. The iPhone 4 also has tools for trimming videos on the fly.

Winner: iPhone 4



iPhone 4. The quarter itself looks crisp and color-correct, but the inaccurate, darker color of Example A's background speaks to persistent color-shift problems in all three examples. In Example B, the iPhone 4 adds a bluish tint to the shadows and a reddish hue to some outer areas of the wall. Example C looks lovely but shows darker and/or warmer yellows, greens, and browns (look at the muddy "green" leaves).



Inspire 4G. While floundering a bit with the close-up, the Inspire 4G generally presents detailed and accurate photos. Also, we noticed deeper blacks in the skateboard in Example E. The Inspire 4G's wider aspect ratio comes in handy for landscape photos.

The tiny iPhone 4 lens component isn't big enough to offer optical zoom, but you do get 5x digital zoom that will do in a pinch.



ROUND 3: BATTERY LIFE

Extra batteries, USB cables, AC adapters—we say fie on them! All we want is to leave the house with a full charge and come home with some juice left. Is that so wrong?

Battery-life tests for smartphones can confound the cleverest gadget guru simply because there are infinite ways in which to drain a full battery charge, and everyone's personal usage varies. However, the raw factors that figure into battery life essentially break down to battery capacity and the rate of power consumption.

The former is measured in milliamp hours (mAh). You can find the mAh amount for a phone's battery on most online spec pages or on the battery itself—if you can get to it. If it were as simple as comparing units of mAh, we wouldn't need to test battery life at all, but the rate of power consumption throws off everything. Particular activities (like watching movies) mow through battery capacity much faster than others (such as listening to music). Different components used in different smartphones to accomplish the very same tasks can also vary in their power consumption.

On top of that, display brightness and timeout intervals, GPS and Wi-Fi activity, background tasks, volume levels, and other factors all affect battery life.

Oftentimes, phone evaluations only test talk time to assess battery life. That's useful for comparing real-world results against advertising claims, but a more complete picture of battery life comes from measuring battery drain from a variety of activities, such as Wi-Fi browsing versus cellular network browsing, or 3G talk time versus 4G or 2G talk time.

RUNNERS-UP

Multicore smartphones represent both the future and high-end present of mobile devices. As the dual-core phones of today give way to quad-core phones down the road, that could spell trouble if battery technology can't keep up with the increased power demands of multicore processors.

All of their power thirstiness aside, which dual-core phone promises the best battery life? We bestow that honor on the **Motorola Atrix 4G**. With a 4-inch, qHD (960x540) display, a 1GHz Tegra 2 dual-core processor, and 16GB of internal storage, it has the makings of a power hog. However, a meaty 1,880 mAh battery dutifully dispens-



That the iPhone runs a display with the most pixels per inch and still has the best battery life speaks volumes.

es power to keep the Atrix humming for much longer than its Tegra 2 smartphone brethren such as the LG G2x or Motorola Droid X2. The Atrix 4G puts up respectable numbers for 3G web browsing (five-plus hours) and Wi-Fi web browsing (nine-plus hours), and it gives you the most talk time bar none at 11-plus hours.

Although bolstered by its small 2.44-inch, 480x320 color display, RIM's **BlackBerry Bold 9780** proffers impressive battery life by any standard with its 1,500 mAh battery. For both talk time and web browsing, the Bold 9780 finished just about neck-and-neck with our battery-life winner. If long intervals between charging are important to you, the BlackBerry Bold 9780

is worth a look, especially in the area of Wi-Fi web browsing, where it excels.

THE WINNER

Just beating out the BlackBerry Bold 9780, we have the **Verizon (CDMA) iPhone 4**. The AT&T (GSM) iPhone 4 also has excellent battery life and would come in just about even with the Bold 9780. However, the two iPhone 4 versions use different basebands, which factor into the transmission and reception of wireless signals, including 3G/2G, Wi-Fi, and Bluetooth.

The Qualcomm baseband (and possibly some other components) in the Verizon iPhone 4 definitely made a difference in treading more lightly on the battery, which at 1,420 mAh, doesn't exactly tip the scales for smartphones. Nonetheless, the Verizon iPhone 4 offers some of the best battery life available for 3G web browsing (almost eight hours) and Wi-Fi web browsing (more than 10 hours), whereas the AT&T iPhone 4 also performs well but peters out as much as an hour earlier.

Even though the iPhone 4's 800MHz A4 processor now seems ordinary, the phone's battery still has that pixel-packed Retina display to contend with, which at 3.5-inches and 960x640 resolution offers an industry-leading 326 ppi. We thought the iPhone 5 would have been out by now, so for the Verizon iPhone 4 to still lead the pack in battery life impresses us to no end.



The iPhone 4's 1,420 mAh battery registers as relatively puny, meaning the phone runs quite efficiently.

ROUND 4: GAMING

If you know your FPSes from your MMORPGs, then you know that a phone is necessarily a compromised gaming platform. Still, which one is best?

Between the massive popularity of iOS and Android as software platforms and the ever-increasing performance of smartphone graphics engines, one would assume that portable gaming consoles are doomed. Alas, smartphones have their own limitations when it comes to controls and gameplay, and portable gaming hardware seems to be keeping pace with any core components you'll find in a phone in coming months.

Take, for example, Sony's PS Vita, which should arrive in time for the holidays. This new handheld console will include a quad-core system-on-chip processor with PowerVR 3D graphics, a 5-inch AMOLED screen, and all the controls one would expect in a complete console gaming experience. Sounds fantastic, yes, but with quad-core chips also coming to smartphones, do you really want to burden your jacket pocket with another gadget when your phone is just as powerful? Portable game consoles may live on, but we see them becoming an increasingly niche product used by only the most hardcore devotees.

In the meantime, you've got games to play. What makes for the best gaming experience on a smartphone? The computing power of your phone can make a big difference, but you must also factor in the quality of the display, the finesse of the control set, and the depth of the software library.

RUNNERS-UP

Nothing tests the raw performance of a smartphone quite like a state-of-the-art, graphics-heavy game. Nvidia, maker of the 1GHz dual-core Tegra 2 processor, not only welcomes that test, but encourages it. Nvidia's Tegra Zone mini-store offers a growing selection of high-production-value games optimized for Tegra-powered Android devices. Many of the titles are a cut above the average mobile fare in terms of graphics and compelling gameplay.

Tegra Zone games play on any Android handset, but if you want to play them on a Tegra 2-equipped phone, you've got several options, including the **Motorola Droid X2** (Verizon) and **Atrix 4G** (AT&T). However,



A Tegra 2 processor and a brilliant screen combine to make the LG G2x a formidable phone for gaming.

we recommend the **LG G2x** (T-Mobile). It has the same Tegra 2 chip as the other two phones, yet consistently scores a bit better in benchmark tests. What really sells the G2x, though, are the vivacious colors and brightness of its 4-inch display. As a finishing touch, the G2x comes with full versions of NOVA HD, a first-person shooter, as well as Need for Speed Shift, the near-ubiquitous driving game.

Our next runner-up places simply on the strength of its amazing software library. With tens of thousands of games in the iTunes App Store, the **iPhone 4** not only gives you many more games to play, but also an eclectic variety of titles from both innovative upstart developers and big-name publishers like EA and Ubisoft. In fact, it's this crazy-deep software library that makes the iPhone 4 our first runner-up—this despite the phone's now quite outclassed 1GHz A4 processor (which just

can't compete with the dual-core Tegra 2). And while the iPhone 4's 3.5-inch display is small for a gaming phone, its 960x640 resolution still packs the greatest pixel density of any smartphone around.

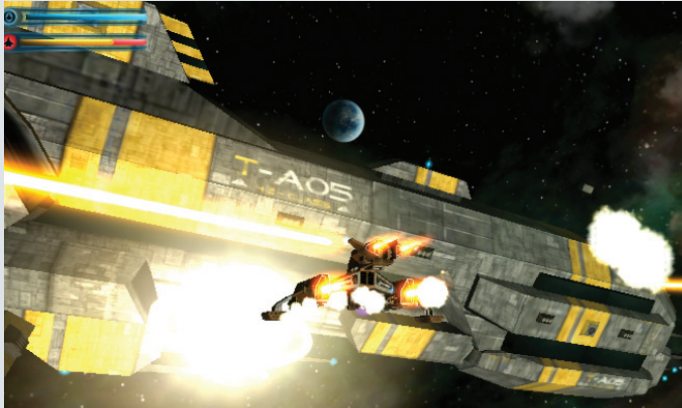
THE WINNER

For all its quirky, "casual game" awesomeness (see "Birds, Angry" and "Friends, Words With"), the iPhone just isn't compatible with traditional console game fare. And that's true for any device that eschews physical buttons for touch-screen control. This is why we give first place to the **Sony Ericsson Xperia Play** (Verizon), the first PlayStation-Certified smartphone. And it's running Android 2.3 Gingerbread, to boot.

Right off the bat, PSP-style slide-out game controls give the Xperia Play a leg up—and two thumbs!—on the competition. A full complement of familiar game controls, including left and right shoulder buttons, makes console-style shooter, sports, and fighting games much more palatable than anything you'll muddle through on a touch screen.

To get you started, the Xperia Play includes Madden NFL 11, The Sims 3, Crash Bandicoot, Asphalt 6, Star Battalion, and the Tekken-esque fighting game, Bruce Lee Dragon Warrior. A few dozen other games are available for purchase, and they vary between casual games and console-derived titles such as Splinter Cell Conviction, Assassin's Creed HD, and Brothers in Arms 2. More titles will roll in regularly, as well.

While we have our problems with the Xperia Play, it still delivers PSP-style gaming in a full-featured Android 2.3 phone. Heck, it's the only smartphone that's been expressly designed with gaming in mind. With its 1GHz Snapdragon II SoC, the Xperia Play delivers high-quality graphics and smooth gameplay, though it won't hold a candle to the power that the PS Vita will have revving under its hood. Sony must have planned it that way. Still, we think it's only a matter of time before smartphones kill off handheld consoles entirely.



Battle for outer space supremacy in Fishlabs' *Galaxy on Fire 2*, optimized for Xperia Play.



Gameloft's pirate adventure game *BackStab* for Xperia Play promises a high swash-to-buckle ratio.

To tack on console-like controls, Sony Ericsson thickened up the Xperia Arc to a 6.2-ounce, 4.7x2.4x0.6-inch chassis.



QWERTY keyboards? Not too exciting. But here's a keypad we won't nod off in front of. Including a D-pad, analog "sticks," and L/R shoulder buttons, it's the full gamut of control. Be discreet, and no one has to know you're not diligently emailing clients.



ROUND 5: CHASSIS DESIGN

It's not called mobile technology for nothing. Here we celebrate the portable becoming even portable-er

Welcome to the vanity round. When considering chassis design, there really can be no absolute winner. Sure, the maker of the thinnest and/or lightest smartphone can use those distinctions in its marketing copy, but there comes a point—and we would argue we've already reached that point—when making a phone a millimeter thinner and a few grams lighter makes no practical difference to the value of a product.

But, of course, we still care about which handset really is the thinnest or lightest. Not only are bragging rights in play (for people who must have a phone so slim it's practically nonexistent), but we're always curious to see new engineering breakthroughs. Three cheers for shrinkage!

THINNEST

"This product is not available in the U.S." Ah, yes, that old chestnut. We hear it all the time, especially within the context of mobile tech. It just so happens that if you're hell-bent on possessing the skinniest smartphone available, and you live in North America, you'll have a tough go of it, at least for now. The **NEC Medias E-04C** running Android 2.2 measures an impressive 7.7mm thin, beating the closest competitor by roughly a smidgen (a metric smidgen, not a U.S. scale smidgen). This Japan-only gadget also includes other ooh-ah features, such as a digital TV tuner and near-field communication.

Next on the skinny list, the **Samsung Galaxy S II** measures just 8.5mm at its thinnest point, making it the svelte runner-up. This phone is definitely coming to America, although a release date wasn't public at press time. More importantly, a slim chassis represents just an iota of what's notable about this phone. The Galaxy S II wields more processing power than any other handset currently on the market (see page 54) and induces drooling with its 4.3-inch Super AMOLED Plus display, 8MP camera, and 1080p HD video recording.



The Sony Ericsson Xperia Arc's curvaceous design and excellent camera give Americans Euro-envy.

LIGHTEST

We consider the obsession with handset lightness to be a legacy from the olden days when a "mobile" phone took up the better part of the passenger seat of your car. These days, does it really matter whether your blower weighs 3.5 or 4.5 ounces? Furthermore, is it even a good thing to be the lightest, or does that distinction suggest cheap, damage-prone construction? Those are questions for another time, as this discussion is all about the numbers.

Weighing in at a scant 3.26 ounces, the **Palm Pixi Plus** (AT&T and Verizon) smartphone registers as the lightest one available—unless there's a lighter one

that floated away and is hovering in the clouds somewhere above Lake Michigan. This WebOS phone is light on performance (naturally), but it still has the full complement of smartphone features, including a 2MP camera, multitouch screen, GPS, and WebOS app support.

So that's the lightest phone. But let's just say that, theoretically, you could handle another fraction of an ounce in your pocket. You've been working out, right? Well then, you could go with the 3.3-ounce **BlackBerry Pearl 3G** (AT&T and T-Mobile) or the 3.4-ounce **Sony Ericsson Vivaz** (although its days are numbered because it's running the Symbian OS, which Sony Ericsson is ditching for Windows Phone 7). And if you must have an Android phone, get ready to wince, because the **Sanyo Zio** (Sprint) tips the scales at a back-breaking 3.7 ounces.

STYLE POINTS

Going beyond raw numbers, we salute the smartphones that sidestep conventional design and throw some curve balls into the mix. For example, the diminutive new **HP Veer 4G** (AT&T) with WebOS feels light and smooth like a worry stone—sliding the physical keyboard in and out may just melt all your stress away. And, as Manny Pacquiao might tell you (if he even remembers after cashing his endorsement check), the Veer 4G is the smallest 4G smartphone available in the U.S. While not the absolute lightest phone, you'll barely notice the Veer's 3.6 ounces in your pocket or bag, and it has character aplenty.

Saving the best for last, the **Xperia Arc** ranks among the thinnest of smartphones (8.7mm at its thinnest point), but apart from that, it's also one of the most striking mobile phone designs on the Android platform. The curved body that gives the device its name also imbues the Arc with an air of sophistication that we totally dig. Its beauty is more than skin deep, too. Sony Ericsson took great pains to make the Arc one of the best smartphones for photos and video (see page 46). While Sony Ericsson claims the Arc is "coming soon" to North America, no release date was available at press time.

ROUND 6: RAW PERFORMANCE

The term 'smartphone' insults the ever-growing power of these mini-computers. Last-era handhels now tremble in the wake of multicore Android monsters

Naming a first-place winner for smartphone performance is like forecasting weather in the Midwest: If you don't like what you see, wait awhile, and it will change.

Just a few short months ago, the LG G2x for T-Mobile and the Motorola Atrix 4G for AT&T debuted the Nvidia Tegra 2 system-on-chip (SoC). With a 1GHz dual-core CPU, the Tegra 2 was the hottest thing around. But ask most former "super" models how long hotness lasts. Within three months of the Tegra 2 release, über-phones armed with 1.2GHz dual-core chips from Qualcomm and Samsung began hitting the shores of Great Britain and Europe, and are just now making it stateside.

One can't automatically assume that a 1.2GHz dual-core phone will outperform a 1GHz dual-core phone. Besides pure clock speed, processor architecture and software optimizations come into play. And when evaluating "raw performance," we have to consider not just benchmark testing numbers, but also first-hand user experience relating to graphics fluidity, opening and switching between apps, general reaction time, and so on. Nonetheless, thanks to some testing help from TechRadar.com, one of our sister publications across the pond, we can tell you that clock speed *does* matter, and the raw performance battle comes down to the big three dual-core SoCs—the Tegra 2, the Qualcomm Snapdragon MSM8260, and the Samsung Exynos 4210.

RUNNERS-UP

Benchmarks and real-use testing alike bear out that both 1.2GHz dual-core chips outperform the Tegra 2. Now, make no mistake, the Tegra 2 is no slouch. It's still a revelation over, say, a single 800MHz processor in a lot of current smartphones. So if you can't wait for the best 1.2GHz phone to arrive, the Tegra 2-sporting **Motorola Atrix 4G** (AT&T) or **Droid X2** (Verizon) deserve a shot. But these aren't even the fastest Tegra 2 handsets. The **LG G2x** (T-Mobile) with Tegra 2 edged out both Motorolas in



Samsung's own 1.2GHz Exynos 4210 dual-core processor makes an impressive debut in the Galaxy S II.

benchmark tests and gives you a superior display with the smoothest graphics. It's our high-performance choice for Tegra 2 smartphones.

If you're on T-Mobile, though, consider one of the summer's most anticipated smartphone juggernauts, the **HTC Sensation**. This spanking-new handset just hit American shelves after a critically acclaimed debut in Europe. Its 1.2GHz dual-core Snapdragon chip aids such features as an instant-capture camera, multi-window web browsing, 1080p video recording, and the eye-candy-filled HTC Sense UI that sits atop Android 2.3. TechRadar gives the Sensation a 4.5 out of 5 rating, and its benchmark scores place it at the very top of the heap, just a hair below our winner.

THE WINNER

American smartphone buyers have good news: The raw performance leader in smartphones will be making its way to AT&T, Sprint, and Verizon. The bad news is that it may take until fall for it to go on sale in the States. But even a long wait won't stop us from getting starry-eyed over the 1.2GHz dual-core Exynos processor inside the **Samsung Galaxy S II**. TechRadar awards this phone a perfect 5 rating and says, "The lightning-fast reaction time of the phone was amazing. Nothing else on the market can come close when it comes to sheer zip." For example, the Galaxy S II can open Google Maps and pinpoint your location in less than a second. Insane!

To be fair, the Galaxy S II benchmark scores only slightly beat out those of the Sensation, but the Galaxy S II has better style. Its super-thin 8.5mm chassis and brilliant Super AMOLED Plus screen make it a beauty to behold, as well as a powerhouse processor. Samsung, enjoy your view from the top while it lasts. Because, who knows, maybe even Apple will decide to get into the raw performance game.



Close, but no cigar: The HTC Sensation with a 1.2GHz dual-core Snapdragon CPU brings home the silver.

ROUND 7: KEYBOARD

When tapping directly on a capacitive screen just won't do, try some good old-fashioned button mashing

Typing on a phone: We all do it, so clearly it must be necessary. Hey, those brilliant thoughts streaming out of our noggins aren't going to tweet themselves, and texting makes the modern romantic breakup so nice and... impersonal. But, man, do our thumbs hurt.

The way we see it, if you plan on using a smartphone to do a ton of texting, emailing, or—our favorite—Evernoting, then you'll need a handset with a physical keyboard. A hardware keypad is simply non-negotiable if data entry is your top priority in a phone.

RUNNERS-UP

Physical keyboards on phones remind us of big-budget superhero movies: They often seem like a good idea before you spend money on them, but afterward they leave you with the sick feeling of being duped. Take, for example, the tiny-button

keyboards on smartphones like the HP Veer 4G and many in the BlackBerry line. These minuscule key layouts require a perfect marriage between dexterity and Zen-like calm in order to use them properly. Get one and a half beers in you, and you can forget about texting your ex.

And then you have those slide-out keyboards with full-button keys. They sound good in theory and type pretty well when you're in the showroom at the phone store, but their key action often ends up feeling unnatural and awkwardly spaced.

During the course of researching this article, we tried out pretty much every physical smartphone keyboard on the market, and the models we actually enjoyed were few and far between. But there was one we kept returning to—the Windows Phone 7–based **HTC Arrive** for Sprint. For starters, its slide-out keyboard unfolds not vertically, but at an angle, as if it were a tiny laptop. This gives it a uniquely comfortable feel in the hands. As for the keypad itself, the buttons are sized well, spaced appropriately, and (most importantly) have a soft touch that makes extended typing pleasant and less prone to errors. And unlike many slide-out smartphone keyboards, the Arrive's includes a row of numbers and symbols that adds convenience and saves time.

If Android is a prereq, we recommend the **Samsung Epic 4G** (Sprint), whose keyboard is second only to that of the Arrive. Its keyboard doesn't have quite the feel and comfortable layout of the Arrive, but its auxiliary set of four Android function keys—Menu, Home, Back, and Search—is a nice touch.

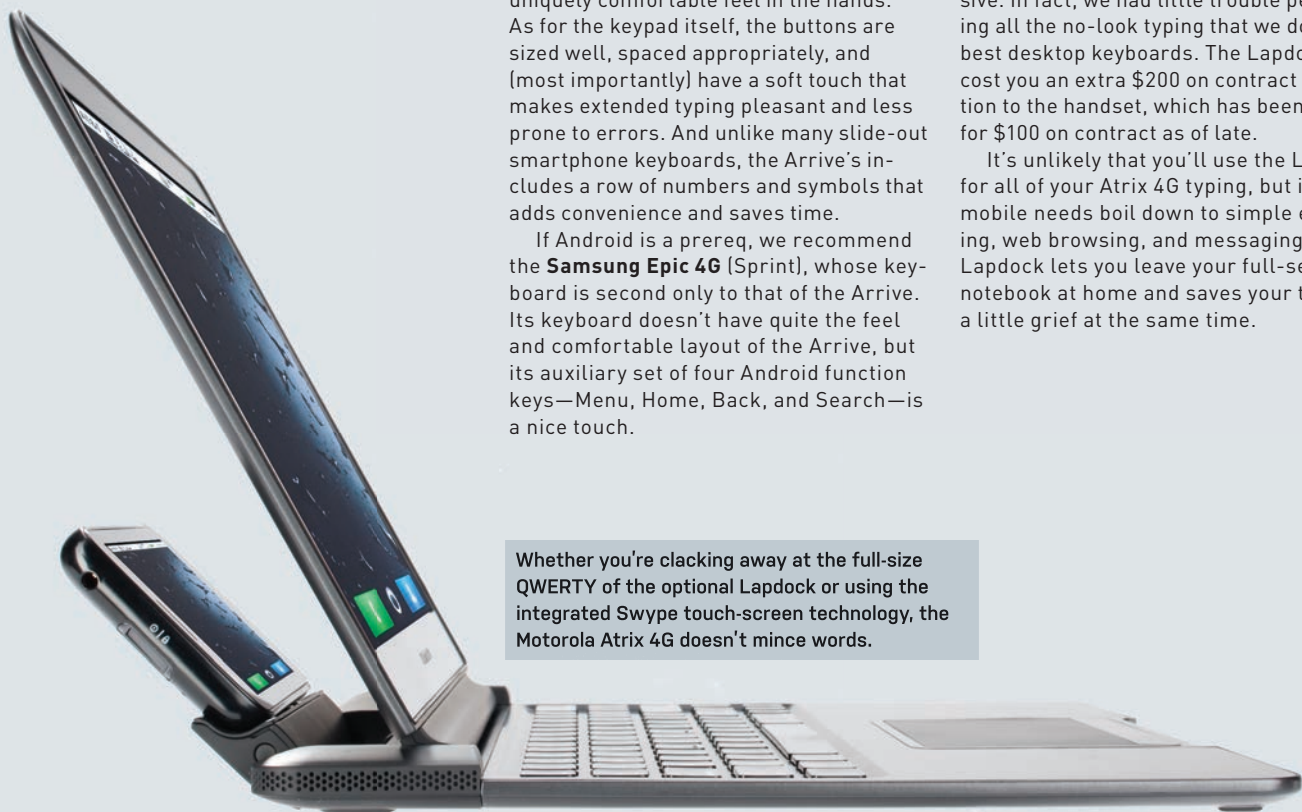
THE WINNER

Call us benders of the rules if you must, but we think the best physical keyboard for a smartphone is a full-size QWERTY keyboard.

The **Motorola Atrix 4G** works in tandem with Motorola's optional Lapdock to create an unprecedented smartphone/laptop hybrid in which the phone's 1GHz dual-core processor and 1GB of RAM supply all the computing power. Granted, we found that when running the Atrix as a laptop, lagging performance continually reminded us that we weren't working on a real notebook. Still, no one can deny the convenience factor of a full-size keyboard.

The Lapdock is super-thin at 13.9mm, making it ideal for traveling. It also provides two USB ports, speakers, a supplementary battery, a touchpad mouse, and an 11.6-inch, 1366x768 screen for working with the full version of Firefox. The keyboard itself is spacious and very responsive. In fact, we had little trouble performing all the no-look typing that we do on the best desktop keyboards. The Lapdock will cost you an extra \$200 on contract in addition to the handset, which has been going for \$100 on contract as of late.

It's unlikely that you'll use the Lapdock for all of your Atrix 4G typing, but if your mobile needs boil down to simple emailing, web browsing, and messaging, the Lapdock lets you leave your full-service notebook at home and saves your thumbs a little grief at the same time.



Whether you're clacking away at the full-size QWERTY of the optional Lapdock or using the integrated Swype touch-screen technology, the Motorola Atrix 4G doesn't mince words.

FUTURE PHONE TECH: 2012 AND BEYOND

BY ROBERT STROHMEYER

As smartphone tech accelerates at a blistering pace, these killer advances will transform your handsets over the next two years

That phone you've been carrying around is about to become a relic. Its power-hogging display, rigid case, and minuscule memory capacity are as good as obsolete. While the pace of innovation makes it nearly impossible to predict exactly what our phones will look like two years hence, there are plenty of incredible new technologies on the horizon. What's clear is that our current phones will look quaint by 2014.



It's a smartphone. It's a camera. It's a smamera. The new Altek Leo breaks new ground with a 3x optical zoom lens built into the chassis of an Android phone.

DISPLAYS

The most substantial changes in phone technology will almost certainly be in displays. Right now, Apple's iPhone Retina display is about the best thing going on smartphones. Measuring 3.5 inches diagonal with a resolution of 960x640, it packs 326 pixels per inch. But just this May, Toshiba unveiled a new display that raises the bar handily.

The new Toshiba display measures 4 inches diagonally with a pixel density of 367 ppi. That's a true 1280x720 high-def screen, and you can count on seeing it in phones next year.

Expect power consumption in displays to improve, as well. While OLED screens have made dramatic strides in power efficiency, displays still rank as the single biggest power hog on smartphones. University of Florida researcher Andrew Rinzler may have discovered the breakthrough that will solve this problem in the near term. Rinzler's carbon nanotube vertical organic light-emitting transistor (CN-VOLET) is about eight times more energy-efficient than existing OLED technologies, which should make it an obvious choice for future phones.

As conventional smartphone displays get thinner, finer, and more energy efficient, the long-awaited introduction of flexible displays could take phones in new directions

as soon as 2013. Sony, NEC, HP, and a host of other companies have been prototyping the technology for nearly a decade now, and it seems—at long last—that rollable touch screens are finally about to arrive.

CAMERAS

While 8MP cameras have become available on phones, the biggest problem these devices face isn't limited megapixels but crappy lenses, inadequate flashes, and poor focus tech.

Dedicated cameras—even really tiny ones—are packed with hardware to handle every facet of image capture. By contrast, smartphones depend on software to do all the work, sharing the phone's limited processing resources with the rest of the phone's apps. Gradually, though, the cost and size of that hardware is coming down to phone-friendly proportions.

A few companies have begun building camera-centric phones that are raising the bar for image quality. Most notably, the Taiwanese camera maker Altek, which also produces camera modules for smartphones, has released the Leo, a 14MP Android handset with an integrated 3x optical zoom lens and a xenon flash. While the Altek Leo is unlikely to capture much market share, it portends good things for the future of smartphone cameras.

PERFORMANCE

On the handset side, system-on-chip (SoC) processors will move to a 28nm architecture in 2012, increasing the number of cores that can fit onto a single chip. By early next year, Qualcomm is expected to release its 2.5GHz quad-core Snapdragon. Nvidia, meanwhile, has revealed its design roadmap through 2014: That year, its Stark-series Tegra chips will purportedly deliver 100 times better performance than current Tegra 2 chips.

On the network side, 4G continues to spread rapidly as most carriers move to LTE technology. Verizon has promised network-wide 4G by the end of 2013. Sprint, which owns Clearwire and is now buying out T-Mobile, is expected to transition from WiMAX to LTE in 2012. And AT&T is playing catch-up as it moves from HSPA+ to LTE.

I/O

As phones gain increasingly PC-like capabilities, they'll accrue more connectivity features. With the notable exception of Apple, most of the industry is moving toward standard connectors, with Micro USB leading the way for power and data, and Mini HDMI for video output.

Chances are good that the newly launched Thunderbolt interface could make its way onto phones within the next two years, possibly even replacing both USB and HDMI with a single, high-bandwidth connector for charging, data, and video connections. But as a proprietary Intel technology, Thunderbolt is unlikely to win widespread adoption from competing chipset makers in the near term.

BATTERIES

Over time, a new carbon compound called graphene could eventually allow for the creation of circuits that store their own power within the structure of the transistor itself, but that possibility is still a distant glimmer.

In the near term, expect universal wireless charging to emerge as a standard feature on most phones. Pending what will likely prove a brief standards battle between inductive and conductive product offerings, universal charging pads will ease our pain by automatically charging our phones every time we set them down. ☺

WHITE PAPER

by BILL O'BRIEN

Server Memory vs. Desktop Memory

Everybody needs error correction, right? Not necessarily

Understanding the difference between desktop memory and server memory might not be as emotionally gratifying as divining the technology that separates toaster ovens from toasters (after all, you really need to know whether toppings can be applied pre- or post-toasting), but getting the straight scoop about the memory types will save you money, help keep your data intact, and make sure your computer—whether it's a desktop system or a server—is running at its peak.

DESKTOP MEMORY

At the risk of being overly simplistic, the memory you stick in your desktop or notebook computer can be anything short of a fiberglass rectangle with embedded Chiclets. The typical desktop environment places few demands on memory as it goes about its daily tasks of word processing, web browsing, and email correspondence.

While most of the credit has been given to gaming as the *force majeure* that elevated the personal computer from a simple adjunct of communications to a power of its own, the truth is that applications involving graphics and video rendering, numeric calculations, and even data retrieval were the underpinnings that suggested there was a gaming potential at all. Once those floodgates opened, the evolution of desktop memory took off like a bullet.

Each of those applications—gaming in particular—required faster memory. That meant higher bandwidth, lower latency (CAS latency of 9 or less), and the manipulation of the memory itself to multiple data rates. The goal was to shuttle data back and forth across the memory bus like a Bonneville racer speeding from here to there and back again across the salt flats.

In the meantime, memory meant for servers eschewed the glory of speed

and power (well, mostly) and struck out across the road to data security and your peace of mind.

SERVER MEMORY

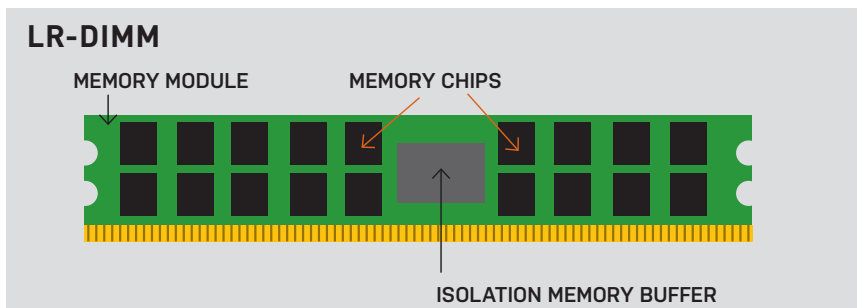
Back when the world was young, memory chips and modules were not known for exhibiting unflinching stability. And as memory chip densities increased, worries about individual bit failure—a memory bit spontaneously flipping to its opposite state—scaled with them. To counter this fear, extra memory chips were added to record parity and to support error-correcting code (ECC). Memory controllers were tweaked to support the same. If you're unsure which type of memory your computer is using, count the number of chips in one of its memory modules: If that number isn't evenly divisible by 3 or 5, then it doesn't support ECC or parity and it wasn't designed to be used in a server.

IBM's early desktop computers are an exception to this rule: They were outfitted with ECC memory, but IBM has always been accused of being paranoid about data security. Modern desktop PC motherboards don't support ECC memory, because it's

considered unnecessary for the application and because it typically inflicts a roughly 2 percent speed penalty. The few desktop motherboards that support both types of memory typically ship with ECC memory support disabled in their BIOS by default.

Most ECC memory is also registered (that which isn't is called "unbuffered" rather than "unregistered," even though the terms "registered" and "buffered" are used interchangeably). Buffering the signals traveling over the Command/Address bus (the signals routed to each DRAM component on the DIMM) enables the DIMM to deliver higher capacity and faster speeds. On the other hand, adding this logic component to the DIMM also imposes a one-clock-cycle delay on each read and write sequence between the memory bus and the memory itself. Data signals, meanwhile, must still be sent from the memory controller directly to the memory chips and so are not buffered at all.

FB-DIMM (the FB stands for "fully buffered") architecture takes a different approach to increasing memory reliability. Instead of sending data directly to each memory module over a parallel interface,



Inphi developed the Isolation Memory Buffer (iMB) to enable load-reduced (LR) DIMMs to host significantly more memory modules—by a factor of two to four—than earlier registered memory designs could handle.

the memory controller on a motherboard outfitted with FB-DIMM slots sends data over a serial interface to an advanced memory buffer (AMB) on the DIMM. In addition to offloading error correction from the CPU or the memory controller, the AMB can also compensate for signal deterioration by buffering the data and resending it as necessary. And since reads and writes are buffered, the memory controller can perform them in parallel.

The downside to this approach is that it introduces latency to memory requests. This architecture also requires more power—and produces more waste heat—than unbuffered memory designs. Lastly, contemporary designs use a memory write channel that is significantly narrower than the corresponding memory read channel (10 versus 14 bits wide). This renders FB-DIMMs unsuitable for workloads involving frequent write operations, but well optimized for workloads involving frequent and rapid write operations. As with other types of buffered memory, you'll typically encounter FB-DIMM only in server architectures (although Intel did incorporate it into its enthusiast dual-CPU Skull-trail platform in early 2008).

A newer type of server memory, known as "load-reduced" DIMM further builds on the register concept. LR-DIMMs are outfitted with a large memory buffer that's capable of buffering *all* the signals coming from the memory controller: C/A and data. This buffer interfaces in turn with the memory chips on the DIMM. LR-DIMM draws its "load-reduced" moniker from the fact that the memory controller needs only a single interface to the buffer. A company known as Inphi has come up with a buffer architecture (known as Isolation Memory Buffer, or iMB) that can scale the DIMMs' capacity by a factor of two to four, so that a single DIMM can host many more memory modules than were possible in previous designs.

WHAT'S RIGHT FOR YOU?

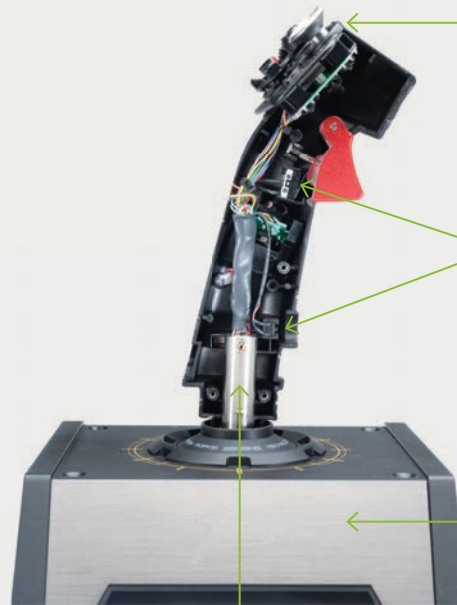
If you're building a desktop rig, there's no good reason to use ECC, registered, FB-DIMM, or LR-DIMM memory. It's very unlikely that you'll ever encounter the problems these types of memory are designed to guard against. In fact, you probably don't even need it in a machine you might be running as a home server.

On the other side of the coin, if you're looking to deploy a multitude of thin clients and/or workstations that can't be counted on both hands, then you'll probably want to avoid the usual run-of-the-mill desktop DDR memory in favor of the higher-priced, slower, server spread. ⏻

autopsy

SAITEK PRO FLIGHT X-65F

Once a necessary weapon in any PC gamer's arsenal, the joystick has seen its popularity decline in the last decade. These days, the only major use for joysticks is in the hardcore simulation community, but that doesn't mean innovation in the market has stopped—quite the opposite. The Saitek Pro Flight X-65F is a top-of-the-line flightstick with features you couldn't have imagined back in the days of X-Wing vs. TIE Fighter. Here's how it works.



MAIN BUTTON PANEL

A printed circuit board provides support for all the thumb controls on the flightstick, including four multi-direction hat switches and a thumb button.

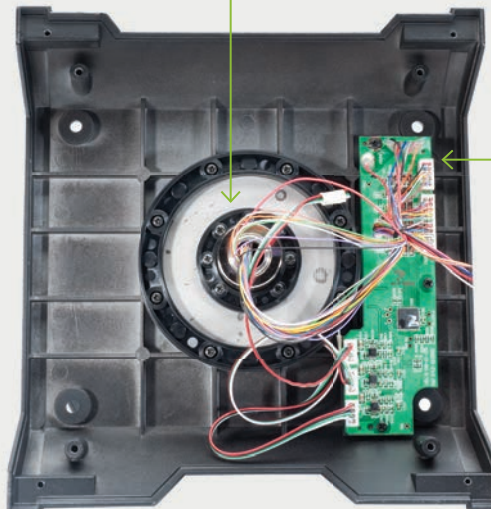
MICROSWITCHES

Several buttons are mounted along the shaft of the flightstick, including the all-important trigger. Pressing the trigger depresses a microswitch mounted on the interior of the X-65F.

METAL CONSTRUCTION

Nearly every part of the X-65F is made of metal, providing extra weight to keep the stick still while you use it. Combined with minimal moving parts, the metal construction makes for an incredibly durable controller.

STEEL CORE The X65-F isn't like the joysticks you grew up with. Like the flightsticks found in a modern fighter jet, the X65-F is completely stationary—it doesn't move at all when you use it. Instead, a steel rod transfers force on the stick to a sensor, which allows you to control roll, pitch, and yaw without actually tilting or twisting the stick.



CIRCUIT BOARD

A circuit board in the base of the controller collects input from all of the microswitches and sensors on the X-65 and sends that information to the X-65F's throttle controller, which connects via USB to a computer.

HOW TO

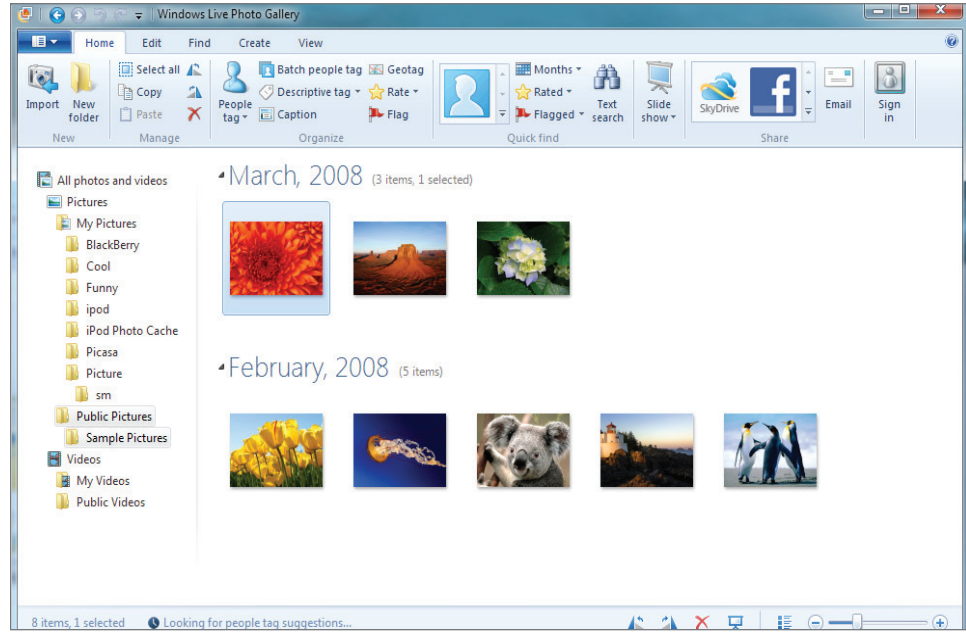
STEP-BY-STEP GUIDES TO IMPROVING YOUR PC

WINDOWS TIP OF THE MONTH



ALEX CASTLE
ONLINE MANAGING EDITOR

TWO QUICK WAYS TO A BETTER WINDOWS UI



THE TASKBAR GOT a big improvement in Windows 7, but it's still not quite perfect. Here are two quick changes you can make right now that'll improve your taskbar.

CHECK OUT WINDOWS LIVE ESSENTIALS

MICROSOFT HASN'T ALWAYS BEEN KNOWN FOR ITS FANTASTIC FREE APPLICATIONS, BUT WINDOWS LIVE ESSENTIALS IS REALLY WORTH A LOOK. PHOTO GALLERY AND MOVIE MAKER AREN'T GOING TO BE ENOUGH FOR PROFESSIONALS, BUT THEY AREN'T HALF BAD FOR YOUR HOME MOVIES. IF YOU'RE A PARENT, THE FAMILY SAFETY TOOLS IN LIVE ESSENTIALS ARE EXCELLENT.

1. IMPROVE THE AUDIO ICON

You know the little volume button on the right side of the taskbar? Very inefficient. Go to bit.ly/aiNOBI and download the SndVol-Plus utility to your startup folder. Now remove the old volume icon from your taskbar, and start the application. The improved volume button allows you to middle-click to mute or unmute and double-click to open the mixer.

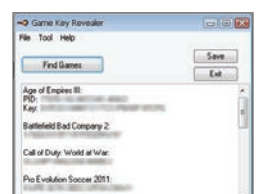
2. USE THE RIGHT-SIZE ICONS

If you're not rocking a monitor that's 24 inches or bigger, you don't need inch-tall icons taking up screen space. Right-click the taskbar, choose Properties, and select Use Small Icons.

MAKE - USE - CREATE



62 Repair Corrupted System Files without Reformatting



64 Transfer Your Game Data to a New Hard Drive

submit your How To project idea to: comments@maximumpc.com

Repair a Faulty Windows Installation without Reformatting

Corrupted system files don't have to ruin your day –Alex Castle

NOTHING WILL PUT A CRIMP in your computing style quite like a Windows error. Although Microsoft's OS has gotten exponentially more stable over the years, it's still very possible for Windows system files to become corrupt, which can cause your system to slow down, freeze, or (in the worst case) refuse to load your operating system at all.

When you encounter a Windows error, your first instinct may be to back up your data, grab the ol' installation disk, and weep silently as you press the Reformat button. We're here to tell you there's another way. Still back up your data, of course, but by following this guide, you might well be able to repair your Windows install without dropping the nuke.

Note: Though these guides are written for Windows 7, a very similar process will work for Vista or XP.

METHOD 1: REPAIR WINDOWS EVEN IF YOU CAN'T GET TO YOUR DESKTOP

This first method will allow you to repair corrupt system files, even if the problem is so severe that you can't boot all the way to your desktop. For this method, you'll need a Windows installation DVD, so track down yours or borrow one from a friend—it doesn't matter if the DVD's version matches your license, as long as it's the correct bit count.

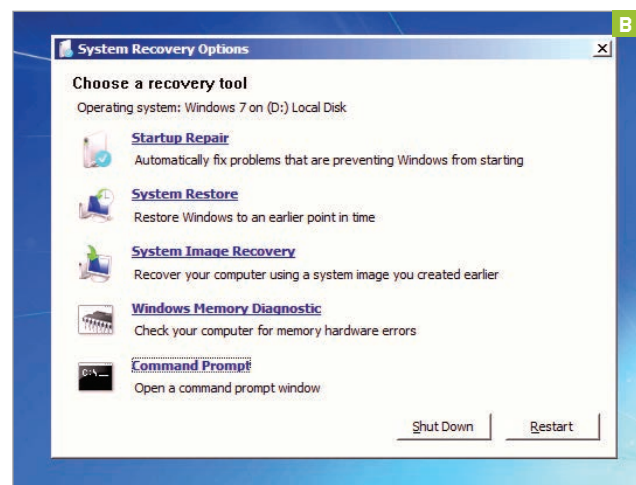
1 INSERT THE INSTALL DISC AND REBOOT If your system won't boot into Windows, you'll need to boot from somewhere else—in this case, the installation DVD. Your computer should be set up to boot from your optical drive before your hard drive, but if it's not, you can always change the boot priority in the BIOS. When the system starts up, make sure you press a key when prompted to boot from the Windows installation disc. When you do, you'll see the familiar Windows installation language-selection screen (**image A**).



The Windows 7 install DVD can be a great tool for fixing your system.

2 GET TO THE COMMAND PROMPT The recovery tool we're going to use is run from the command prompt, which can (thankfully) be accessed through the Windows installation disc. To get there, don't click Install Now in the middle of the screen, but instead click Repair Your Computer in the lower left. Click Next on the first menu that pops up.

» The next menu will have two radio buttons. Make sure the first one is selected, and note that in the text box, your System drive might not have the drive letter C. If that's the case, make a note of the drive letter used. Click Next, and on the following screen (**image B**), select the bottom option, marked Command Prompt.



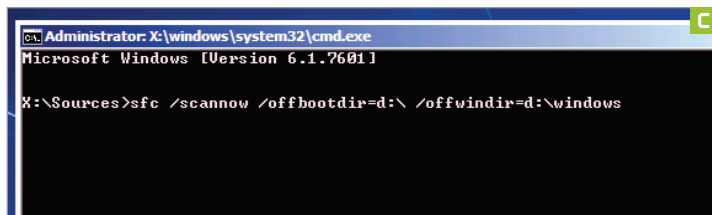
3 SCAN YOUR SYSTEM Finally, you're ready to scan your system files for errors. To do that, simply run the following command:

```
sfc /scannow /offbootdir=[DRIVELETTER]:\ /  
offwindir=[DRIVELETTER]:\windows
```

» Substitute the drive letter you noted earlier for [DRIVELETTER]. There should be no square brackets in the command (**image C**).

» Windows will now attempt to find and repair any errors in your system files.

If the scan finds errors, you may need to repeat the steps in this guide until it finds no more errors. To restart your computer, enter the `exit` command, then click the Restart button. When you're ready to try booting into Windows again, remove the install disc and restart one final time.



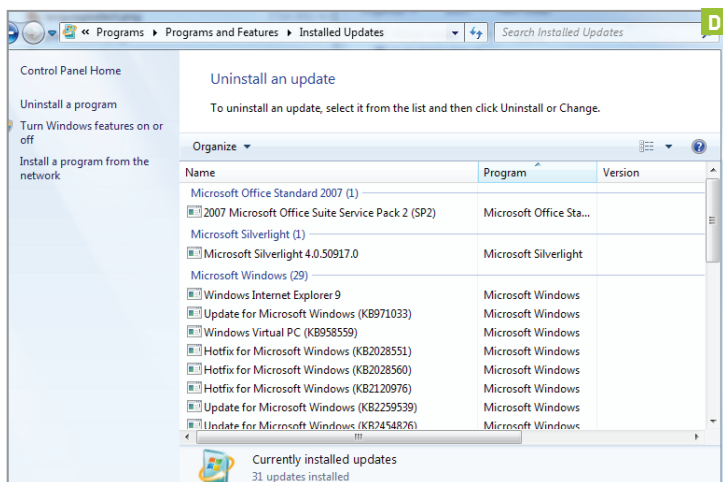
METHOD 2: REINSTALL WINDOWS WITHOUT LOSING ANY DATA

If you are still able to get to your desktop, you've got additional options. You can still use the command prompt to scan as in the previous method, but there's another way that may be more thorough: reinstall Windows.

» Wait, didn't we say you wouldn't have to reformat? We did, and you don't. It's possible to do an in-place, nondestructive reinstall of Windows, which will restore all your system files to pristine condition without damaging any of your personal data or installed programs. All you'll need is a Windows install DVD and your Windows CD key. Hopefully you still have your key written down somewhere, but if you don't, you're not out of luck. You can use a program like ProduKey, available for free at bit.ly/9OR9rp to quickly recover your Windows product key from the registry.

» Important: Before continuing this process, note that it can cause problems with your installed programs, so don't do it just for fun, and make sure to back up your important data and create a restore point before continuing.

DO SOME PREP WORK Before you can get started, there's one important consideration: You can't repair a Windows 7 SP1 install with a pre-SP1 install disc. The ideal solution is to borrow a newer install disc with SP1 included (or download it, if you have access to a TechNet account), but it's also possible to uninstall SP1. To do this, open the Control Panel, select Uninstall a Program, and then choose the option to view updates (**image D**). You can right-click the Service Pack update to uninstall it.



2 INSERT THE INSTALL DISC We're once again using the Windows install disc, but this time we're not going to boot from it. Simply insert the disc, and when the autorun menu pops up, choose to run `setup.exe`. Once again, you'll find yourself staring at the Windows 7 install screen. This time, do click the Install Now button (**image E**).

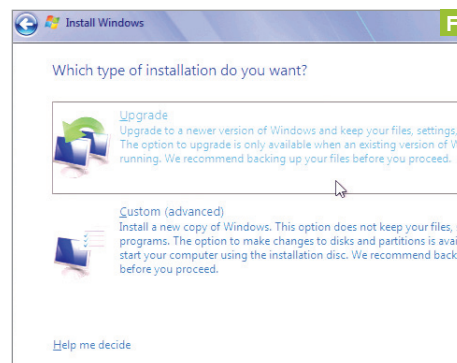


3 REINSTALL WINDOWS Finally, it's time to get down to business. After the installer gets past the Copying Temporary Files... screen, you'll be asked about getting updates for installation files. Go ahead and do this, as long as your computer's network connection is still working.

» When the installer asks what sort of installation you'd like to perform (**image F**), ignore your natural instinct to choose Custom, and instead click Upgrade. Sure, you're not technically upgrading from one version of Windows to another, but we do want to do the kind of nondestructive install that the update option performs. Think of it as upgrading from a broken version to a nonbroken version, if you must.

» After that, all that's left is to sit through the usual Windows 7 installation process, with its multiple reboots and endless progress bars. When it's done, you'll have to reactivate Windows by entering the product key that you found or wrote down earlier.

» All that's left to do is to let Windows install any security updates or service packs that it's missing, and reboot. All your system files should now be fully restored!



Transfer Your Game Data to a New Hard Drive

DON'T LEAVE THE PAST BEHIND —Seamus Bellamy

GETTING A NEW COMPUTER can be one of the most refreshing experiences there is—you get to start over with a clean slate, free of the junk data you’ve accumulated over however many years of service your last PC saw. Resist the temptation to get all Zen on us and let everything go—

there’s some stuff that’s worth saving. You’ve (hopefully) already transferred over your personal documents, but don’t forget your game data. A little prep time now will save you the heartbreak of lost saved games and repeated reinstalls down the road.

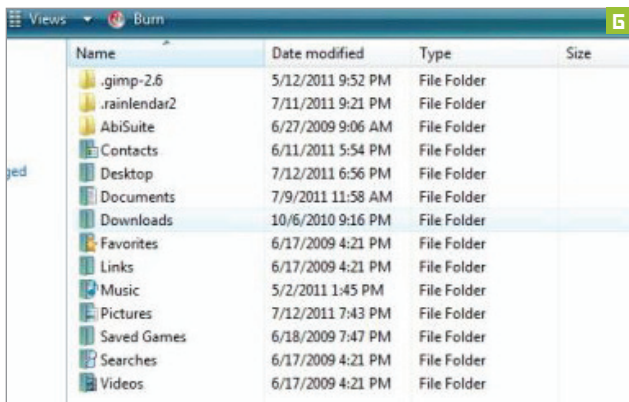
FIND YOUR SAVE Backing up a saved game file is easy—the hard part is finding out where the developers hid it. Game makers just can’t seem to settle on a common saved game spot. There are some common locations for saved games in Windows 7 and Vista, though, including several in the Users folder (**image G**). Try these common locations:

- C:\ProgramFiles\[game name]
- C:\Users\[user name]\SavedGames\[game name]
- C:\Users\[user name]\Documents\[game name]
- C:\Users\[user name]\Documents\My Games\[game name]
- C:\Users\[user name]\Appdata\[either Local or Roaming folder]\ [game name]
- C:\ProgramFiles\Steam\steamapps\common\[game name]
- C:\ProgramFiles\Steam\steamapps\[Steam user name]\ [game name]

» Sometimes, game developers like to get tricky by hiding a game’s folder inside a folder named after the publisher, changing the filepath from, say, Appdata\Assassin’s Creed to Appdata\Ubisoft\Assassin’s Creed—so make sure you know who published any games you’re looking for. Also, games that save to Steam’s cloud service, such as Left 4 Dead, save to numbered folders in the C:\ProgramFiles\Steam\userdata\[Steam user ID number]\ folder.

» Once you’re inside the folder for your game, look for a folder entitled “Save Games,” “Userdata,” or something along those lines. Back up the saved files using the standard methods—flash drive, CD, Dropbox, whatever. When you get on your new computer, you’ll need to install the game, and you may need to run it once in order to create the saved game folder on your new hard drive.

» Remember: If you can’t find saves for a specific game anywhere, Google will almost always have your back.

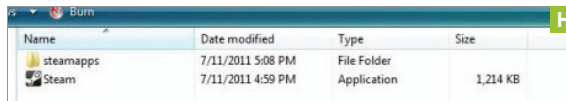


ton of wasted time and bandwidth. Fortunately, moving your Steam games to another hard drive is straightforward.

» Basically, you want to transfer your entire steamapps folder to the new PC. Before you try it, go ahead and back up the contents in the folder. Not that we think you’re going to screw this up or anything, but Valve recommends you do it, and so do we. Next, exit Steam and delete everything in the main Steam folder except for Steam.exe and the steamapps folder (**image H**).

» Afterward, transfer the entire Steam folder to your new PC using your method of choice (though if you’ve got scads of 10GB-plus games, an external hard drive may be your only option). All you have to do now is run Steam.exe on your new PC and sign in; after some quick updates, you’ll be back to fragging box-hopping creeps in Brink in no time.

» Take note: This transfers your game data, but not your saved games themselves. You’ll still need to move those over separately.

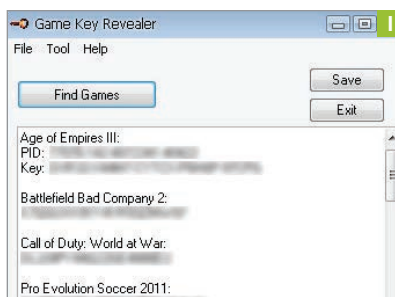


RECOVER YOUR OLD CD KEYS If you’ve lost the CD keys that came with your non-Steam games, you’ll want to recover them before you leave your old drive behind. You could hunt around in your registry for them, but we suggest an app called Game Key Revealer, which automatically extracts your installed games’ CD keys. Game Key Revealer’s a bit slow to add updates for new games, but its list of supported games is second to none—it can find the CD keys for more than 1,000 games.

Using it is simple: Download Game Key Revealer from bit.ly/a0M6hP, and then unzip the archive. Boot the Game Key Revealer and click the Find Games button. Boom! Done. Game Key Revealer will display the CD keys of any supported games it finds on your computer (**image I**). Jot those keys down and be more careful with them this time!

And that should do it. The new computer smell hasn’t even worn off, and all your games are right where you left them. ☺

MOVE STEAM GAMES Transferring your Steam games themselves is almost as important as transferring your save data. Sure, you could log into Steam on your new computer and redownload your entire collection, but that involves a





BUILD IT

GORDON MAH UNG SENIOR EDITOR



We Explore Llano's Potential

Can AMD's Llano offer decent gaming with integrated graphics? We aim to find out

LENGTH OF TIME: 1 HOUR

LEVEL OF DIFFICULTY: EASY

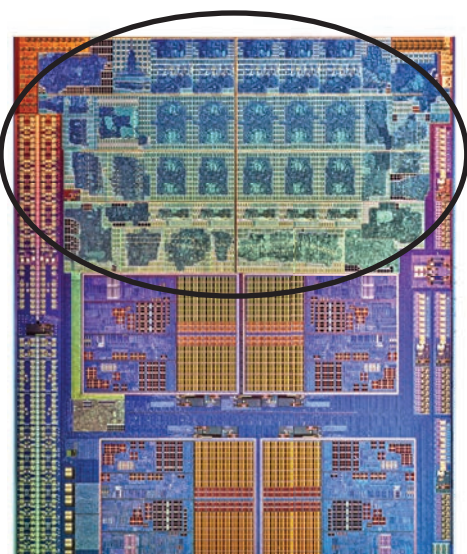


THE MISSION Ever since Intel's 810 "Whitney" chipset hit the streets in the late '90s, integrated graphics have been synonymous with suckage. This year, though, integrated graphics have been making a comeback as Intel and AMD have put their might toward offering game-worthy graphics alongside the CPU.

Intel's Sandy Bridge kicked off the trend earlier this year, but the best Intel has offered up is still lacking for gamers, even budget-constrained gamers. Enter AMD's A-series chip. Code-named "Llano," this chip merges a quad-core CPU with a discrete GPU to make AMD's second-gen "APU." To see just how well Llano performs, we took the parts from the \$667 PC that we built in our August issue and paved over the Sandy Bridge board and processor with an AMD A8 X4 3850 CPU and A75 motherboard.

AMD's Llano Exposed

THE A-SERIES IS AMD'S SECOND PART to sport the Fusion moniker. In this case, Fusion means the fusing of graphics and compute power into the CPU. The first product was AMD's E-Series, the basis of our \$340 rig in last month's Build It. That part sips power and is extremely low-cost, but it's also a bit soft on both compute and graphics. By using what's essentially an Athlon II X4 core and a Radeon HD 6550D in the A8 Llano chip, AMD believes it has the antidote to Intel's Sandy Bridge chips on the low-end. While both chips feature integrated graphics, the vast majority of Intel's Sandy Bridge chip is dedicated to x86 while AMD devotes more than half of its core to graphics. The x86 side of the chip uses the well-known K10 cores. For graphics, the top-end part features 400 cores, 20 texture units, and a core clock running at 600MHz. Llano is also AMD's first chip built at a 32nm process, which helps keep the thermals to manageable levels. Overall, Llano may truly be the first CPU with integrated graphics that will satiate gamers—gamers on a tight budget, that is.



The A8 X4 3850 spends more than half of its transistors on graphics, while Intel uses less than a quarter on graphics.

The Same but Different

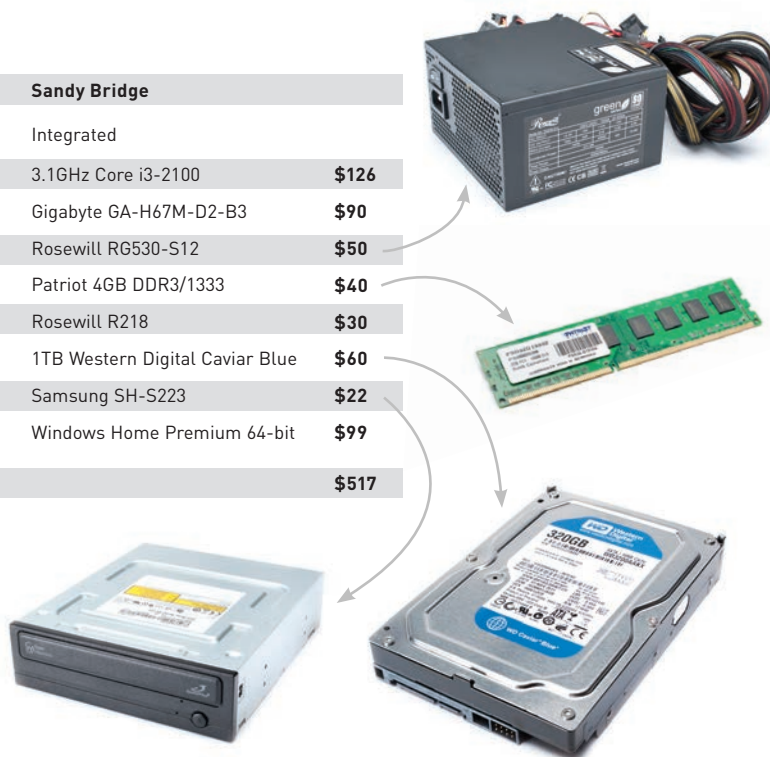
FOR OUR BUILD, we took our August 2011 \$667 PC and removed two parts: the Gigabyte GA-H67M-D2-B3 motherboard and the Intel 3.1GHz Core i3-2100. To ensure maximum comparability, we opted for a Gigabyte AMD motherboard, the A75M-S2V. Like the GA-H67M-D2-B3, the Socket FM1-based A75M-S2V is micro-ATX, sports but

two DIMM slots, and costs just \$90. For the CPU, we used the 2.9GHz A8 X4 3850. At \$139, it's slightly more expensive than we expected, but you get better graphics and a quad-core processor versus the dual-core in the Sandy Bridge, so it's worth it—right? We're also deleting the discrete Radeon HD 6790 card from our \$667 rig. Because

this box is aimed at entry-level gaming, we wanted to see which platform yields better integrated graphics results; we figured that a person going this route would eventually upgrade to discrete graphics. The rest of the components are identical to our build from August. For comparison, we're showing both configs in the ingredients list.

INGREDIENTS

	Llano		Sandy Bridge	
GPU	Integrated		Integrated	
CPU	2.9GHz A8 X4 3850	\$139	3.1GHz Core i3-2100	\$126
Motherboard	Gigabyte A75M-S2V	\$90	Gigabyte GA-H67M-D2-B3	\$90
PSU	Rosewill RG530-S12	\$50	Rosewill RG530-S12	\$50
RAM	Patriot 4GB DDR3/1333	\$40	Patriot 4GB DDR3/1333	\$40
Case	Rosewill R218	\$30	Rosewill R218	\$30
HDD	1TB Western Digital Caviar Blue	\$60	1TB Western Digital Caviar Blue	\$60
ODD	Samsung SH-S223	\$22	Samsung SH-S223	\$22
OS	Windows Home Premium 64-bit	\$99	Windows Home Premium 64-bit	\$99
Total		\$530		\$517



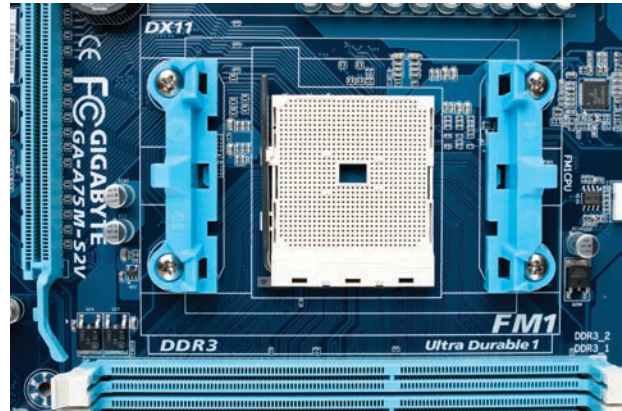
Building Tips

Llano builds aren't so different from standard configs, but here are some useful tips

WITH THE INTRODUCTION OF LLANO, AMD is breaking from the single-socket philosophy it has held since Socket 939 was introduced in 2004. For now, at least, two sockets will be supported: the new Socket FM1 and the newish Socket AM3+. Socket AM3+ will primarily support the existing Phenom II and Athlon II chips, as well as the upcoming FX processors aimed at enthusiasts. Socket FM1 is geared toward entry-level users, all-in-one machines, and home theater PCs. Although the Llano CPUs look exactly the same as an older Phenom II on the heat-spreader side, the newer chip is physically incompatible with the latter's socket. The good news is that AMD kept the same cooler design, so most Socket AM2+/AM3 coolers will work with FM1 boards. Installing the new FM1 chip is the same as installing a Phenom II or Athlon II, so if you've previously built such a rig, FM1 will offer no surprises in CPU or heatsink installation.

AMD has two FM1 chipsets: A75 and A55. The higher-end A75 has six SATA 6Gb/s ports and four native USB 3.0 ports. The lower-cost A55 chipset sheds the USB 3.0 ports, and its SATA ports are limited to 3Gb/s. Both APU/motherboard combos support dual-channel RAM up to DDR3/1866. While we kept the RAM costs low in our build by using DDR3/1333, folks hoping to get the most performance out of Llano's GPU should consider paying for faster DDR3/1866 as it greatly increases performance of the chip. That's because unlike discrete graphics, which have their own local frame buffers, Llano (and Sandy Bridge, too) rely on main system memory. Generally, graphics can use as much bandwidth as you can throw at them, so DDR3/1866 or higher is recommended.

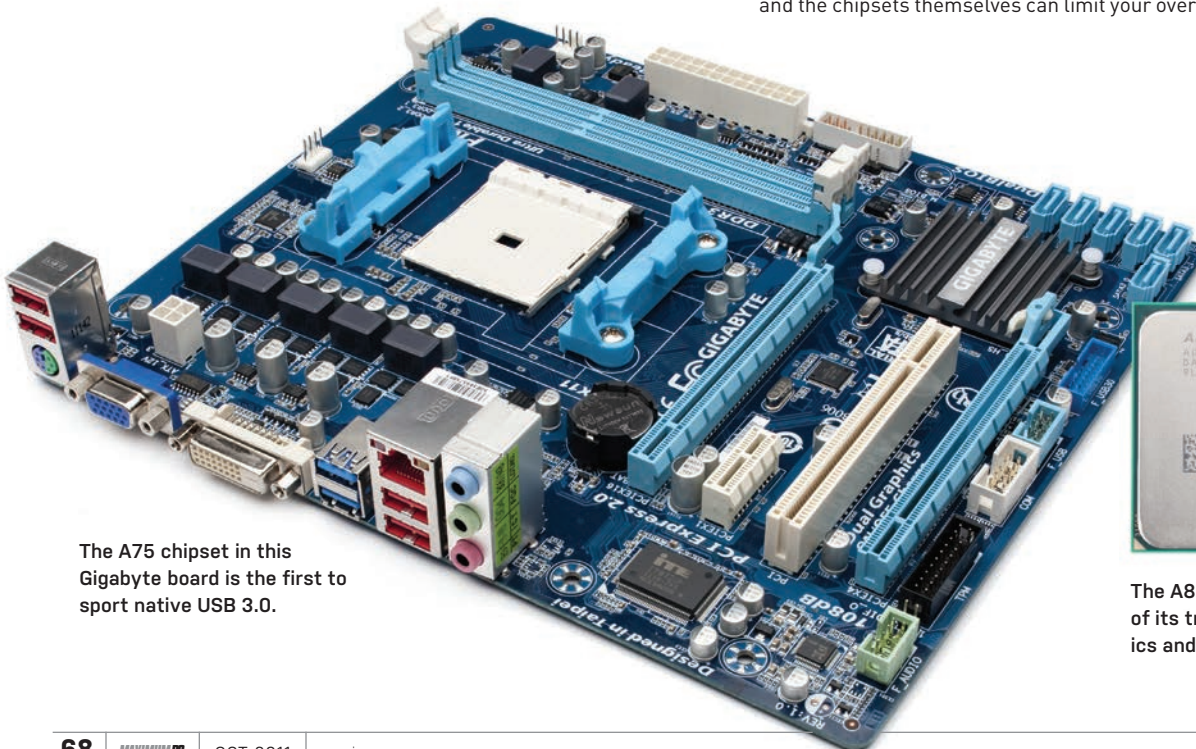
As we said earlier, the A75 chipset features all SATA 6Gb/s ports, so you don't have to spend five minutes flipping through the manual to find the correct SATA ports. That's a big improvement over Intel's weak-sauce implementation of just two 6Gb/s ports.



Socket FM1 is physically incompatible with Socket AM2/AM3 processors.

A75 and A55 also support UEFI underpinnings to support booting from drives larger than 2.1TB. Not all boards will sport fancy UEFI interfaces, though; many will continue to support BIOS interfaces despite the UEFI underneath.

Overclockers hoping to get a free gigahertz of performance should prepare to be disappointed. Despite the new 32nm process, AMD has clock-blocked you by locking the multipliers. The only option for overclocking is bumping up the reference clock (AMD's equivalent of Intel's base clock.) Overclocking by raising the reference clock, however, will goose other components, which may cause instability. It's not great, but it's slightly better than the Intel Sandy Bridge side, where B-clock overlocks are extremely difficult and the chipsets themselves can limit your overclocking capability.



The A75 chipset in this Gigabyte board is the first to sport native USB 3.0.



The A8 X4 3850 spends half of its transistors on graphics and it shows.

Llano vs. Sandy Bridge

AFTER WE BUILT OUR LLANO RIG, we benchmarked it using a subset of our standard system benchmark suite, as well as a few additional benchmarks to stress the capabilities of Llano and Sandy Bridge. For gaming, we threw out our standard über-tests, which are made to stress \$5,000 PCs with multiple GPUs. Instead, we ran 3DMark Vantage at the Performance setting. We also ran vReveal, which leverages the GPU to enhance video. It's one of the showcase apps used to illustrate the power of the GPU. We took a 1080p video shot on a Canon Rebel T1i, applied image enhancements, and corrected the orientation. We also used the APU/GPU/CPU-dependent CyberLink MediaEspresso 6.5 and converted a large MPEG-2 file to a portable format for use in a tablet device. The benchmark is one of the tests that taps Intel's hardware transcoding QuickSync circuits in Sandy Bridge.

The results speak for themselves. Where the benchmarks rely on the x86 side of the equation, the state-of-the-art dual-core Sandy Bridge processor easily spans the antiquated quad-core Athlon II X4 processor. Even in benchmarks where multithreading is a heavy influencer, the Core i3-2100 smokes the A8 X4 3850 despite the A8 having double the cores of the Core i3-2100. That speaks to the efficiency of the Sandy Bridge cores and Intel's Hyper-Threading. In graphics, the roles are reversed: AMD's A8 X4 3850 absolutely destroys the Sandy Bridge integrated graphics across the board. For VReveal and MediaEspresso, it's really about choosing your poison.

We also tried a few games—Left 4 Dead, Team Fortress 2, and The Sims 3—at small-panel resolutions of 1680x1050. The Sandy Bridge part was disappointing in all but Team Fortress 2. Llano was the opposite, with satisfactory performance across the board. In other words, it's a mission accomplished for Llano. If you're looking to build a low-cost machine that'll give you reasonable gaming on your small panel, the A8 X4 3850 is a pretty damn good chip.



The A8 X4 3850 easily eclipses Core i3 in graphics chores but takes a back seat in compute chores.

But that's not the whole story. The weakness of the compute side can't be overlooked. That a dual-core can badly trounce a quad-core in some multithreaded tasks tells you how creaky the K10 core is. What's worse, upgraders looking forward may see the Sandy Bridge as a better part if they plan to drop in a midrange GPU. After all, with Sandy Bridge, you retain the better x86 performance, while on AMD you lose the strong integrated graphics but retain the weaker K10 cores. One setup, albeit limited, does favor Llano, though: A-series chips feature a hybrid CrossFire mode where the integrated GPU can work in CrossFire with a low-end card such as the Radeon HD 6670.

The upshot is that it really depends on where you hope to take your ultra-budget rig. Llano's strength is in entry-level gaming for folks with modest aspirations for discrete graphics. CPU upgrades will continue to be supported, as AMD is committed to its new FM1 platform. Sandy Bridge is weaker in graphics, but it has far stronger x86 performance. It also has the stronger upgrade path, as the LGA1155 boards will support the über-fast Core i7-2600K and next year's Ivy Bridge chips. We do have to question if that's a realistic goal, though. Will anyone building a \$500 PC today ever consider installing a \$300 CPU next year? Probably not.

Overall, we like the Llano platform. The gaming performance you can get from a \$500 PC these days is truly impressive. We're not entirely sure Llano makes sense for desktop duties at this point, but in HTPCs, all-in-ones, and notebooks, AMD seems to have a winner. ☺

BENCHMARKS: CORE i3-2100 VS. A8 X4 3850			
	CORE i3-2100		
VEGAS PRO 9 (SEC)	6,007	5,770	
LIGHTROOM 2.6 (SEC)	435	757	[-43%]
PROSHOW 4 (SEC)	1,749	2,152	[-19%]
REFERENCE 1.6 (SEC)	3,840	3,767	
3DMARK VANTAGE	1,073	3,702	[245%]
3DMARK VANTAGE GPU	827	3,066	[271%]
3DMARK VANTAGE CPU	9,954	9,810	[-1%]
VREVEAL 3.0 (SEC)	151	76	
MEDIAESPRESSO 6.5 (SEC)	311	411	[-24%]

REVIEWS

TESTED. REVIEWED. VERDICTIZED.

INSIDE

- 74** WarFactory Immortal PC
- 75** MSI R6950 Twin Frozr III Power Edition Videocard
- 76** Solid-State Drives: Patriot Wildfire 120GB and Corsair Force GT 120GB
- 78** Z68 Motherboards: MSI Z68A-GD80 (B3) and Gigabyte Z68X-UD3H-B3
- 80** Corsair 600T Case
- 82** Gaming Notebooks: Origin Eon17-S and Maingear Titan 17
- 84** Razer Hydra Motion Controller
- 86** Genius SW-G2.1 1250 2.1 Speakers
- 88** AOC e2243Fw LCD Monitor
- 89** Plextor PX-LB950SA Blu-ray Drive
- 90** Frozen Synapse
- 92** Lab Notes



WARFACTORY
IMMORTAL PC
PAGE 74

WarFactory Immortal

Capable-but-unexciting budget box

YOU WANT TO KNOW A SECRET? Building a high-end PC on an unlimited budget ain't that hard. You just click the "Bestest" button and add to cart.

What's hard is building a PC on a strict budget. Do you sacrifice CPU, GPU, or storage? Do you cheap out on the case or the PSU?

So when WarFactory decided to ship us its Immortal budget box instead of the usual shoot-for-the-moon rigs we test, we thought it would be interesting to see how the more modest PC would measure up.

The Immortal is wrapped in Cooler Master's Storm Enforcer case. Some of the staff thought the Enforcer was fugly, while others thought it was surprisingly good-looking and well-constructed for a budget enclosure. Inside the Enforcer is a 3.3GHz Core i5-2500K and 8GB of G.Skill DDR3/1600 RAM on an Asus P8Z68-V Pro board. Graphics come courtesy of a Radeon HD 6950 card and storage consists of Corsair's new 120GB Force Series 3, a WD 1TB Caviar Black, and an Asus DVD burner. In the PSU department, WarFactory didn't cut corners and used a Corsair TX650 unit.

As we've observed with our own budget builds, everyone has an opinion about how they'd do it differently, and we're no exception. We have no quarrel with the 2500K part, as it's an awesome chip for the price.

However, why go with a stock heatsink and not overclock it? Few vendors offer budget overlocks, and we suspect it's because there's simply no money in it. Overclocking is far safer than ever before, but when things do break, someone has to make good on it, and the cost of a budget box wouldn't support that. Still, we do think the rig could be improved by going with, say, a Cooler Master Hyper 212 Plus cooler, so the machine is at least overclock-ready should the buyer want that.

A little overclocking would have helped the Immortal in our benchmarks, where the PC had a tough time against our zero-point rig, which sports an overclocked 3.5GHz Core i7-920 part and a Radeon HD 5970 card. The Immortal lost in gaming and in two of our four application tests. It also took a back seat to the diminutive CyberPower LAN Party Evo box that we reviewed in July 2011. That small form factor rig packed a 2600K part and a GeForce GTX 580, so its performance is no surprise. The CyberPower machine also costs about 25 percent more. The Immortal also lost the applications battle to the silent Puget that we reviewed in August.



The Immortal can't win any benchmark battles but it's a decent PC for the price.

That machine is also more expensive by \$1,000, but dead silent.

Overall, the War Factory Immortal is a decent machine for the money. It's quite capable of playing today's games at 1920x1080 resolutions and its 2500K does an admirable, but not exceptional, job of cutting through applications. Is it the best machine for the price?

Probably not. But as we said, when you're working in this price range, everyone has an opinion about what alternative gear you should be running in your box. —GORDON MAH UNG

VERDICT

8

WarFactory Immortal

WAR OF THE WORLDS (1953) Surprisingly fast stock box.

WAR OF THE WORLDS (2005) Bland; could use some overclocking pep.

\$1,634, www.warfactorypcs.com

BENCHMARKS

	ZERO POINT	
VEGAS PRO (SEC)	3,049	3,585 [-15%]
LIGHTROOM 2.6 (SEC)	356	322
PROSHOW 4 (SEC)	1,112	1,030
REFERENCE 1.6 (SEC)	2,113	2,372 [-11%]
STALKER: CoP (FPS)	42	29.1 [-31%]
FAR CRY 2 (FPS)	114.4	90 [-21%]

Our current desktop test bed consists of a quad-core 2.66GHz Core i7-920 overclocked to 3.5GHz and 6GB of Corsair DDR3/1333 overclocked to 1,750MHz on a Gigabyte X58 motherboard. We are running an ATI Radeon HD 5970 graphics card, a 160GB Intel X25-M SSD, and the 64-bit version of Windows 7 Ultimate.

SPECIFICATIONS

PROCESSOR	3.3GHz Core i5-2500K
MOBO	Asus P8Z68-V Pro
RAM	8GB G.Skill DDR3/1600
VIDEOCARD	Radeon HD 6950
SOUNDCARD	Onboard
STORAGE	Corsair 120GB Force 3 SSD, WD 1TB Caviar Black
OPTICAL	Asus DVD burner
CASE/PSU	Cooler Master Storm Enforcer/Corsair TX650

MSI R6950 Twin Frozr III Power Edition

Just how far can you overclock the Radeon HD 6950?

THE RADEON HD 6950 often gets overlooked, because it falls into an in-between netherworld of pricing. Typical cards cost anywhere from \$240–\$300, but most seem to hover around the \$270 mark. This MSI overclocked card, built using the company's Twin Frozr III dual-fan cooler, sits at around \$280. So high-end buyers overlook this price category and budget buyers feel like it's a little too much.

In doing so, they're overlooking a speedy card. MSI took the Radeon HD 6950 GPU from the relatively staid 800MHz and pushed it to 850MHz. It also added 50MHz to the GDDR5 clock, running the frame buffer at 1,300MHz (versus the 1,250MHz reference.) The card's new cooling system offers a switch-based fan profile, which lets you set it to quiet or cooler mode. We ran the card in its quiet mode. The cooler is built using a pair of high-blade-count fans, which seem to be the "in" thing in GPU cooling systems these days. MSI also supplies its Afterburner software, which lets you overclock the card to even higher speeds if you're inclined.

We've always maintained that increasing only the GPU core clock nets you minimal gains. Boosting both memory and core clocks gives more of a performance lift. The Twin Frozr III dual-fan cooler likely

BENCHMARKS

	MSI R6950 Twin Frozr III	MSI N560GTX-Ti Twin Frozr II	XFX Radeon HD 6950
3DMARK 2011	5,243	4,519	4,816
UNIGINE HEAVEN 2.1 (FPS)	26	26	24
CRYSIS (FPS)	35	29	32
BATTLEFORGE DX11 (FPS)	52	54	42
FAR CRY 2 / LONG (FPS)	97	102	105
HAWX 2 DX11 (FPS)	88	127	70
STALKER: COP DX11 (FPS)	48	44	46
ALIENS VS. PREDATOR (FPS)	40	32	36
DIRT 3 (FPS)	59	58	56
POWER @ IDLE (W)	133	130	138
POWER @ FULL THROTTLE (W)	277	305	270

Best scores are bolded. Our test bed is a 3.33GHz Core i7-975 Extreme Edition in an Asus P6X58D Premium motherboard with 6GB of DDR3/1333 and an 850TX Corsair PSU. The OS is 64-bit Windows Ultimate. All games are run at 1920x1200 with 4x AA unless otherwise noted.

pushes AMD's PowerTune technology limit just a little higher, as well, allowing the GPU to run just a little harder before throttling back.

Using our updated suite of benchmarks, we compared the performance of MSI's Twin Frozr III against the XFX Radeon HD 6950, running at stock clock speeds, and MSI's own GTX 560 Ti Twin Frozr II

card, in our standard test system. Overall, MSI's souped-up HD 6950 presents very well, indeed, winning the majority of game tests. Noise and power levels were acceptable, too. In fact, the card is quieter at full load than the XFX HD 6950, which uses the reference single-fan cooling system.

Our main concern, though, is still price. The XFX card and MSI's own GTX 560 Ti tend to cost a little less—as much as \$20–\$30 less, depending on where you shop. And the kicker is that for \$30–\$40 more, you can score a very-much non-budget Radeon HD 6970 card. That leaves us torn on the R6950 Twin Frozr III. Still, we have to give the card some points for being quieter than a 6970 and within striking distance of that GPU in performance. —LOYD CASE



Frozr III's dual fans keep it cool and exceptionally quiet for its class.

VERDICT **8** MSI R6950 Twin Frozr III Power Edition

BATTLESTAR Solid performance; improved noise level; free Dirt 3 game included.

BASESTAR Priced a little on the high side for its class.

\$280, www.msicomputer.com

SSD Showdown

Yet more second-gen SandForce drives hit shelves

HERE COMES THE FLOOD. A few months ago, we couldn't get a second-gen SandForce drive without OCZ's imprint for love or money. Now we're drowning in them. Last month we took a look at OWC's Mercury Extreme Pro 6G—which was just as fast as OCZ's Vertex 3—and OCZ's Agility 3, which was at a slight disadvantage thanks to its use of cheaper asynchronous NAND. This month, we test new SF-2281-powered drives from Patriot and Corsair to see what those manufacturers can make with SandForce's speed demon controller. **—NATHAN EDWARDS**

PATRIOT WILDFIRE 120GB SSD

This isn't Patriot's first rodeo. The company's Torqx drive (reviewed September 2009) was one of the best Indilinx SSDs on the market for a while, and the Inferno (October 2010) was a perfectly cromulent first-gen SandForce drive, only lagging behind those SF-1200-based SSDs with specially tweaked "Max IOPS" firmware. The Wildfire (a name that actually seems like a step down from Inferno) is Patriot's first SF-2281-based drive, and we put the 120GB version through its paces.

The 120GB Wildfire SSD consists of an SF-2281 controller and eight 128Gb (that's gigabits, not bytes) Toshiba 32nm NAND flash packages on a 6Gb/s SATA bus. In our tests, the Wildfire performed nearly as well as the OWC Mercury Extreme Pro 6G and OCZ's Vertex 3, the two fastest SandForce drives we've tested. In AS SSD's synthetic SSD benchmark, in fact, the Wildfire's sustained read speeds were neck-and-neck with the Vertex's, while sustained writes were around 40MB/s

slower, at 240MB/s. The only place we've ever seen a SandForce drive hit near the 500MB/s sustained writes that the manufacturers tout is in ATTO's large-block writes, at 64KB and above.

In high-queue-depth 4KB read and write tests in CrystalDiskMark and Iometer, the Wildfire can't quite match OWC or OCZ's drives, but it still tops all non-SandForce drives in Iometer with 71,000 IOPS. Premiere Pro encode times were in line with the best, although PCMark 7 and Vantage scores—which are designed to simulate real-world application loads—lagged a bit behind the front-runners.

At \$300 MSRP, the Wildfire is slightly more expensive than OCZ or OWC's drives, though its street price will likely drop to match the competition. While we have to give the edge here to the OCZ and OWC drives, Patriot's Wildfire runs a close second.



Patriot Wildfire 120GB SSD

\$300, www.patriotmemory.com

CORSAIR FORCE GT 120GB SSD

Corsair's Force GT comes in a bright red chassis, which by Ork logic (in the Warhammer 40K universe) would make it the fastest SSD ever. So is it?

The Force GT consists of a 6Gb/s SATA bus, SF-2281 controller, and 16 64Gb Micron 25nm synchronous NAND modules (as opposed to the eight 128Gb modules on the Patriot Wildfire). This is the same Micron NAND found in the 240GB OWC Mercury Extreme Pro 6G, except that drive had 128Gb modules instead of 64Gb.

(Corsair is also shipping the Force 3, which bears the same relationship to the Force GT as OCZ's Agility 3 bears to the Vertex 3—the Force 3 uses asynchronous NAND and is slightly slower and cheaper than the Force GT.)

In CrystalDiskMark and AS SSD's sustained read tests, the Force GT is as fast as any SSD we've ever tested. Its ATTO 64KB read and write scores, single-queue-depth 4KB read and writes, and Iometer random write speeds are likewise nearly identical to OWC and OCZ's drives. It's in incompressible write tests, like CrystalDiskMark's and AS SSD's, that the Force 3 doesn't quite match the rest of the field. It's slower than all the 240GB drives we've tested, as well as Patriot's 120GB Wildfire, by significant margins. In our Premiere Pro encoding tests, though, in which we write a 20GB uncompressed .avi file to the disk, the Force GT was only around 10 seconds slower than the rest of the field—around a 5 percent difference. In other real-world-emulating tests, the Force GT outstripped the Patriot Wildfire but was slower than the OCZ and OWC drives.

The Corsair Force GT has an MSRP of \$300, but can be found for the same price as OCZ's Vertex 3 on the street. It's very nearly identical in real-world performance—incompressible synthetic benchmarks aside—but OCZ's drive has a slight edge in real-world testing.



Corsair Force GT 120GB SSD

\$300, www.corsair.com

BENCHMARKS

	Corsair Force GT	Patriot Wildfire	OWC Mercury Extreme Pro 6G	OCZ Agility 3	OCZ Vertex 3
CRYSTALDISK MARK					
SUSTAINED READ (MB/S)	493.0	473.5	479.8	213.8	485.5
SUSTAINED WRITE (MB/S)	169.9	252.7	297.6	248.8	289.8
AS SSD					
SEQ. READ (MB/S)	505.4	506.1	505.7	211.6	506.2
SEQ. WRITE (MB/S)	164.1	240.5	290.95	237.4	280.19
4KB READ (IOPS)	5,242	4,656	5,158	4,782	5,539
4KB WRITE (IOPS)	12,800	12,712	12,966	12,767	14,263
READ ACCESS (MS)	0.14	0.17	0.15	0.09	0.16
WRITE ACCESS (MS)	0.26	0.29	0.26	0.27	0.22
ATTO					
64KB FILE READ (MB/S)	453.09	453.09	462.17	422.81	446.47
64KB FILE WRITE (MB/S)	477.2	473.75	483.07	479.53	505.38
IOMETER					
4KB RANDOM WRITE, 32QD (IOPS)	88,666.13	71,524.25	87,968.52	90,267.67	85,144.43
MAX ACCESS TIME (MS)	59	95	39	57	61
PREMIERE PRO ENCODE/WRITE (SEC)	435	426	423	426	422
PCMARK VANTAGE X64 HDD	52,837	50,505	60,683	61,403	59,978
PCMARK 11 X64 SECONDARY STORAGE TEST	5,070	4,751	5,302	4,859	5,285

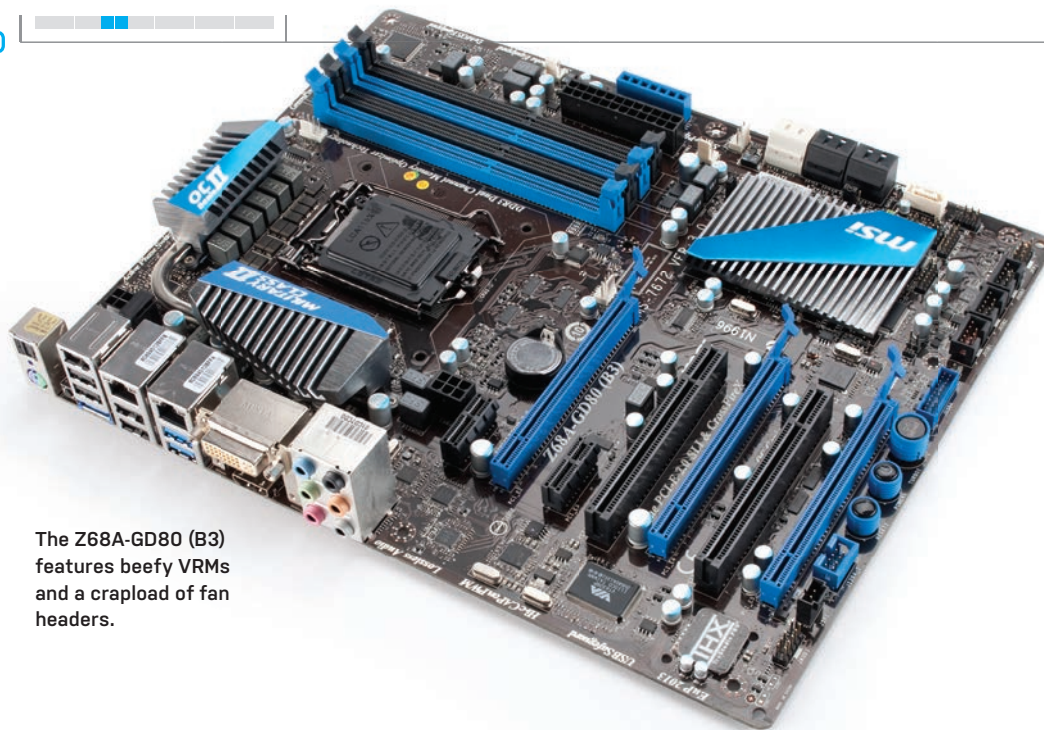
Best scores bolded. Our current test bed is a 3.1GHz Core i3-2100 processor on an Asus P8 P67 Pro (B3 chipset) running Windows 7 Professional 64-bit. All tests used onboard 6Gb/s SATA ports with latest Intel drivers.



The Corsair Force GT uses Ork logic—the red ones go faster.



Patriot's Wildfire isn't all that wild.



The Z68A-GD80 (B3) features beefy VRMs and a crapload of fan headers.

Battle of the Z68 Boards

Budget and midrange Z68 boards square off

IS THERE ROOM FOR P67 chipsets at the inn? Apparently not. We haven't seen the introduction of a board using Intel's original Sandy Bridge chipset since the Z68 came out. And despite at least one board vendor saying that the P67 still has life, we ain't seen none. So to celebrate the life of P67, we're going to dance on its grave by reviewing a pair of Z68 boards with very different points of view—one budget, the other not so much. —GORDON MAH UNG

MSI Z68A-GD80 (B3)

You know what we love about the LGA1155 platform? Besides the ass-kickingly cheap Core i7-2600K, the boards themselves are actually affordable.

Take MSI's enthusiast-focused Z68A-GD80 board. It gives you such bonus features as surface-mounted power, reset, and overclocking buttons; the ability to check voltage levels on various rails using a multimeter; support for SLI, CrossFireX, and Virtu; Intel's SRT; beefy voltage regulation; and a bunch of fan headers. If this were an X58 board, we'd already be well into \$300 territory.

But as this is on the affordable LGA1155 platform, it costs only \$240 (\$220 on the street). Still, what exactly makes this board worth \$60 more than the Gigabyte board (reviewed next)? For one thing, the aforementioned extra amenities. Gigabyte gives you two extra fan headers (including the CPU header), while MSI gives you five. The MSI board is also clearly built for overclocking. It also features other niceties, such as support for Creative's THX TruStudio Pro and dual NICs.

The MSI board sports the company's new UEFI interface, which we've already seen on its P67 boards. It's not as pretty as some implementations, but it's certainly workable, and not as gimmicky as the "Touch BIOS" in the Gigabyte board.

The physical layout is fine, with no major gaffes apparent to us. There's a nice wide gap between the first x16 PCIe slot and the second to provide airflow for GPUs, and the surface-mounted buttons always come in handy. We do take issue with the documentation, though. The manual was sparse on critical information such as at what speeds the various PCIe slots run. MSI says it has corrected this in newer versions of the manual.

We're normally very big fans of MSI's software suite (especially Live Update), but this revision proved problematic. We had problems getting Live Update 5 to actually update the software, and two of the board's applets kept tripping UAC alerts. The Audio Genie applet was also unimpressive. We couldn't tell if it was an ad popup or an application window.

Performance was generally good, with

the board showing a mild advantage over the Gigabyte board in memory bandwidth and 3DMark 11 scores. Storage I/O was also good and we had no issues with our USB 3.0 devices.

The main problem the MSI board faces is getting consumers to spend the extra dough over a more pedestrian offering, such as Gigabyte's board. Sure, it offers more enthusiast overclocking features, but if you're not interested in extreme overclocking, why bother? What's more, the comparably priced Asus P7Z68-V Pro board (reviewed August 2011) also overclocks handily, and gives you a prettier and easier-to-navigate UEFI and Bluetooth, to boot.

VERDICT



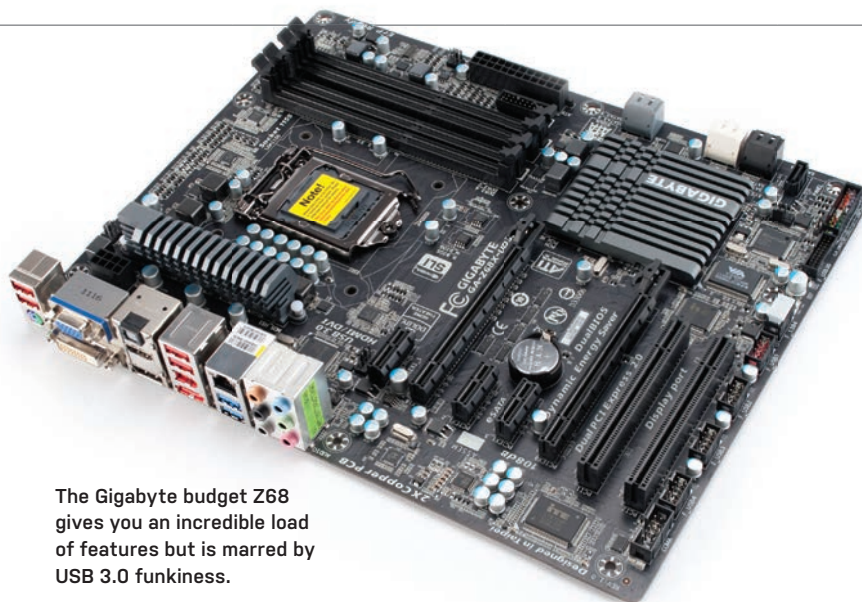
MSI Z68A-GD80 (B3)

\$220 (street),
www.msicomputer.com

GIGABYTE Z68X-UD3H-B3

Sometimes it's hard to believe what you can get in a budget motherboard. That's the case with Gigabyte's Z68X-UD3H-B3. For \$160, you're getting a hell of a lot of features. Besides the Z68 chipset with Intel's SRT SSD-caching goodness, you also get Virtu support, CrossFireX, SLI, and even a specialty Touch BIOS.

If it sounds like the board is pretty much



The Gigabyte budget Z68 gives you an incredible load of features but is marred by USB 3.0 funkiness.

on par with the MSI board that costs about 30 percent more, you're right. So where did Gigabyte cut corners? The most obvious place is in voltage-regulation modules. As this is not a board intended for hardcore overclocking, Gigabyte shaves off cost by reducing the number of VRMs. For an extreme overclocker, this will matter. For Joe Twelvepack, it won't.

The other area where Gigabyte cuts back is in USB 3.0. Gigabyte has been pushing the USB 3.0 message for some time, using the Renasys/NEC controller combined with a VIA USB 3.0 hub chip. On this board, Gigabyte switches to the cheaper—and supposedly faster—Etron EJ168A chip. In performance, we've seen the Etron trump NEC-only boards in the past. That's not the case anymore, as both

parts offered about the same sequential write and read speeds. One big problem with the Etron, though: sporadic BSODs and failures to boot Windows. We've actually heard complaints about the Etron in the past but didn't experience them personally. We have now. With both an OCZ Enyo USB 3.0 and a generic 16GB USB 3.0 stick inserted into the board's rear ports, the system would hang on Windows and BSOD or reset on occasion. With the USB 3.0 devices removed, the problems went away, and the board was perfectly stable. We had no such issues with the MSI's NEC ports and the same two drives. Running the latest drivers from Gigabyte didn't fix the situation, either. Gigabyte said it was unable to duplicate the issue and had no problems booting the board with a USB

3.0 enclosure and USB 3.0 flash drive in its ports. So is the problem the OCZ Enyo and our generic USB 3.0 stick, or what? We don't know, but again, we had no issues with the MSI board here.

Generally, the layout of the board is fine, but we have two issues with it: The RAM is too close to the CPU by about 1 or 2 millimeters, and the CPU fan header is oddly placed in the middle of the board. The labeling of the RAM slots is also whacky, as it encourages you to place the DIMMs in the channels farthest from the CPU. With Sandy Bridge chips, it's not a deal-breaker as it was with Bloomfield chips because it'll boot either way. Performance, for what it's worth, didn't seem hurt.

The board's so-called Touch BIOS is a bit of a misnomer. Yes, you can use a touch screen to interface with the BIOS settings, but you don't do it from the BIOS. Instead, you boot into the OS and use the Touch BIOS utility to manipulate BIOS settings from Windows.

Performance of the board was fair when compared to the MSI. We saw some slightly lower bandwidth scores using our DDR3/1333 modules, but PC Mark 7 scores were good. The SATA 6Gb/s and USB 3.0 (when it worked) were also fine.

In the end, we'd be impressed by the rich feature set from the budget-priced Z68X-UD3H-B3 board if it weren't for that show-stopping USB 3.0 issue.

VERDICT
6
Gigabyte Z68X-UD3H-B3
\$165 (street), www.gigabyte.com

SPECIFICATIONS		
	MSI Z68A-GD80	Gigabyte Z68X-UD3H-B3
SOCKET	LGA1155	LGA1155
CHIPSET	Z68	Z68
PCI-E	3 PCIe x16 (x16/x8/x4), 2 PCIe x1	2 PCIe x16 (x16/x8), 3 PCIe x1
PCI	2 PCI	2 PCI
USB CONTROLLER	Renasys/NEC D720200	Etron EJ168A
USB 3.0 PORTS/HEADERS	2/1	2/1
USB 2.0 PORTS/HEADERS	4/2	3/4
OTHER I/O	IEEE-1394 port + header, eSATA, combo PS/2	IEEE-1394 port + header, eSATA, combo PS/2
VIDEO PORTS	Single-link DVI, HDMI	Single-link DVI, HDMI, DFP, VGA
AUDIO	Realtek ALC892	Realtek ALC889
SATA 3GB/S PORTS	3	3
SATA 6GB/S PORTS	4	4
STORAGE CONTROLLERS	Marvell 88SE9128	Marvell 88SE9128
NETWORK	2x Gigabit Ethernet using Realtek RTL811E	1x Gigabit Ethernet using Realtek RTL811E
FAN HEADERS	5	2

BENCHMARKS		
	MSI Z68A-GD80	Gigabyte Z68X-UD3H-B3
PCMARK 7 OVERALL	3,330	3,431
PCMARK 7 STORAGE	1,750	1,893
3DMARK 2011	6,424	6,072
VALVE PARTICLE (FPS)	178	177
AIDA64 READ (MB/S)	16,420	15,809
AIDA64 WRITE (MB/S)	18,631	17,940
AIDA64 COPY (MB/S)	18,431	17,710
AIDA LATENCY (NS)	54	55.1
SISOFTWARE SANDRA (GB/S)	17.6	17.6
SATA6 READ (MB/S)	489.9	493.5
SATA6 WRITE (MB/S)	306.5	305.3
USB 3 READ (MB/S)	198	203.3
USB 3 WRITE (MB/S)	175	178
SLI COMPLIANCE	Pass	Pass
16GB RAM COMPLIANCE	Pass	Pass

Best scores are bolded. For testing, we used a 3.4GHz Core i7-2600K, 4GB of Corsair DDR3/1333, Western Digital Raptor 150, GeForce GTX 580, and Windows 7 Professional SP1. Performance scores for SATA6GBs and USB 3.0 were attained by using Crystal Disk Mark 3 run against an OCZ Enyo USB 3.0 drive and an OWC Mercury Extreme Pro SSD.

Corsair Special Edition White Graphite 600T

Roomier than the average mid-tower

WE'VE ALREADY REVIEWED Corsair's 600T once, in the January 2011 issue. We loved the case, but bemoaned the lack of side air intakes. The Special Edition White 600T is virtually the same as the regular edition, with a new paint job and one major tweak: the addition of a side-panel cutout that can be fitted with either an acrylic window or a mesh screen with fan mounts. At 20 inches tall by 10.4 inches wide by 22.7 inches deep, the 600T is not a small case, but once the steel side panels are removed you're greeted with a vastness that seems bigger inside than out.

The Special Edition 600T's steel frame is painted matte black, but the whole case is covered with a curved, white plastic shell—in direct contrast to the sharp right-angle edges of the Obsidian 650D (reviewed August 2010). Inside, this 600T is virtually identical to the previous model. The front panel and top exhaust areas of the 600T are covered with black mesh—the panels housing the top and front 20cm fans can be lightly pressed to flip open or removed altogether for cleaning. The six flex-til-they-fit hard drive trays and four toolless optical drive bays didn't impede our build in the slightest—we were able to fit a 12.2-inch GPU as easily as a standard-size one without having to remove either of the drive bays.

The CPU backplane cutout and eight grommets cable-routing cutouts are large and easy to use, and there's plenty of space between the walls of the case and the motherboard tray for easy cable management. There's also a small cutout for an 8-pin power cable in the top left corner of the motherboard tray. We came away with one of the cleanest builds we've put together in recent memory, and one which was accomplished in a very small window of time.

Speaking of windows, we're pleased the Special Edition 600T finally gets one! We also rather enjoy the new color scheme—the 600T has gone from gray with black trim and blue LEDs to white with black trim and white LEDs, and it looks simply phenomenal. Cooler still,

the LEDs on the 20cm top and front fans brighten and dim in relation to fan speed. Neat stuff.

Given that the 600T comes with only three fans (albeit two massive ones), we were a little concerned that things would get hot, especially under load, which was our only gripe with the original 600T. We're pleased to report that this isn't the case. Under load, system temperatures hovered around 57 degrees Celsius with the plastic side window installed. Idling, the three fans kept the temperature right around 35 C. If you're running a powerful videocard, you can mount up to four 12cm intake fans on the mesh window panel and cool your system further.

Above the front panel, the 600T features the aforementioned fan controller knob, a single USB 3.0 pass-through and four USB 2.0 inputs, power and reset switches, headphone/mic jacks, and a FireWire port—but no drop-in SATA dock.

The Special Edition 600T really hits all the right notes. It's big, beautiful, and super easy to use—we love to see manufacturers applying user feedback to new designs. The white finish with black trim makes it a real eye-grabber, and the inclusion of both acrylic and mesh side-window panels shows Corsair's attention to detail. The first 600T was an awesome case. But the Special Edition 600T kicks ass. —ALAN FACKLER



Corsair Special Edition White Graphite 600T

CUTTING EDGE Tremendous amount of room; very sharp-looking; onboard fan control.

CUT MY HEDGE Cooling is merely decent with the acrylic window; plastic case accents.

\$180, www.corsair.com



With so much space on the inside, it's hard for your build *not* to be easy (take it from us—we use extremely large components, just to be sure).



The 600T's onboard fan controller is an awesome addition—the white LEDs on the fans actually brighten and dim depending on how much throttle you give it.



The two jumbo 20cm fans are placed behind mesh panels, which can be easily removed by pressing lightly.



Who knew that something as simple as a new paint scheme and side window could make such an aesthetic difference?

No-Limits Laptops

Overclocking vs. SLI—which dominates?

IF YOU WANT TO CREATE the fastest possible gaming laptop, which is the best route to go? Forget about size, weight, and battery life and use a desktop CPU and two graphics cards? Or keep within the traditional notebook constraints, with a mobile CPU and one graphics card, but overclock both? This month we look at both approaches to see how you should spend your luxury-laptop dollars. —KEN FEINSTEIN

ORIGIN EON17-S NOTEBOOK

When the large, wooden crate branded “Origin” arrived at our Lab, we got out our crowbar and a shotgun—one to open the dang thing and the other just in case an alien predator was lurking inside. Once we blasted the box apart, we were not just relieved, we were also a bit disappointed to find an average-looking 17-inch notebook inside. After a bit of testing, though, there was no question—the cleanup of shell fragments was worth it.

There’s nothing extraordinary about the CPU used in this system. The Intel Core i7-2920XM Extreme Edition isn’t different from what you’d find in any high-performance laptop. What’s different is that Origin overclocks the Sandy Bridge proc from its stock 2.5GHz to 4.7GHz. That’s quite a boost, and it showed in our CPU-intensive benchmarks, like Photoshop and Premiere. In these tests, it beat Maingear’s much heavier and more expensive Titan 17, even with its six-core Gulftown processor.

The graphics card, though, is only overclocked from the standard 575MHz core to 605MHz. That’s not enough to make a substantial difference, and the 2GB GDDR5 Nvidia GeForce GTX 485M performed pretty much as expected in our

graphics-intensive benchmarks. It was no match for Maingear’s SLI configuration—when it comes to gaming graphics, one graphics card can’t compare to two.

Origin is relatively new to the market. It was founded by refugees from Dell’s acquisition of Alienware, and the high price of the system can only be justified by the company’s promise of service and support. You’re not just buying an overclocked system, you’re buying an overclocked system tested by the manufacturer and backed by a warranty. The way semiconductor fabrication works, each individual CPU has a different potential for overclocking, and Origin runs a battery of tests to pick procs with the best overclocking possibilities. This may take some of the Weird Science fun out of overclocking, but should also lower the risk. The company offers some cool customization options, including laser etching of the top of the notebook.

In other regards, the system is a pretty standard high-end gaming laptop. There’s



A cranked-up CPU lets the Origin EON17-S blow through computation-intensive tasks.

a 17.3-inch, LED-backlit screen running at 1920x1080 resolution. In our side-by-side testing, we found this screen to have somewhat richer and more vibrant colors than its archrival from Maingear. The 6x BD-R drive lets you burn your own Blu-ray discs, something that is likely to come in handy. Also included are two storage drives: one 128GB solid-state drive and a 750GB, 7,200rpm hard drive.

BENCHMARKS

	ZERO POINT	
PREMIERE PRO CS3 (SEC)	899	471 (101.5%)
PHOTOSHOP CS3 (SEC)	131	65 (101.5%)
PROSHOW PRODUCER (SEC)	876	436 (100.9%)
MAINCONCEPT (SEC)	1,782	1,035
FAR CRY 2 (FPS)	48.5	83
CALL OF DUTY 4 (FPS)	62.2	184 (195.8%)
BATTERY LIFE (MIN)	96	122

Our zero-point notebook is an Asus G73Jw-A1 with a 1.73GHz Intel Core i7-740QM, 8GB DDR3/1066, two 500GB Seagate 7,200rpm hard drives, a GeForce GTX 460M, and Windows 7 Home Premium 64-bit. Far Cry 2 tested at 1680x1050 with 4x AA; Call of Duty tested at 1680x1050 with 4x AA and 4x anisotropic filtering.

SPECIFICATIONS

CPU	2.5GHz Core i7-2920XM OC'd to 4.7GHz
RAM	8GB DDR3/1333
CHIPSET	HM67
DRIVES	128GB SSD, 750GB HDD (7,200rpm)
OPTICAL	6x BD-R burner
GPU	OC'd Nvidia GeForce GTX 485M 2GB GDDR5
CONNECTIVITY	HDMI out, DVI out, Ethernet, two USB 3.0, two USB 2.0, one eSATA/USB, FireWire, fingerprint reader, Wi-Fi, headphone, mic, line in, S/ PDIF optical out, media reader, webcam
LAP/CARRY	8 lbs, 8.6 oz / 11 lbs, 1.6 oz

If you dream of the performance boost you can only get by overclocking but are afraid of a DIY approach, Origin's laptop provides an excellent solution.

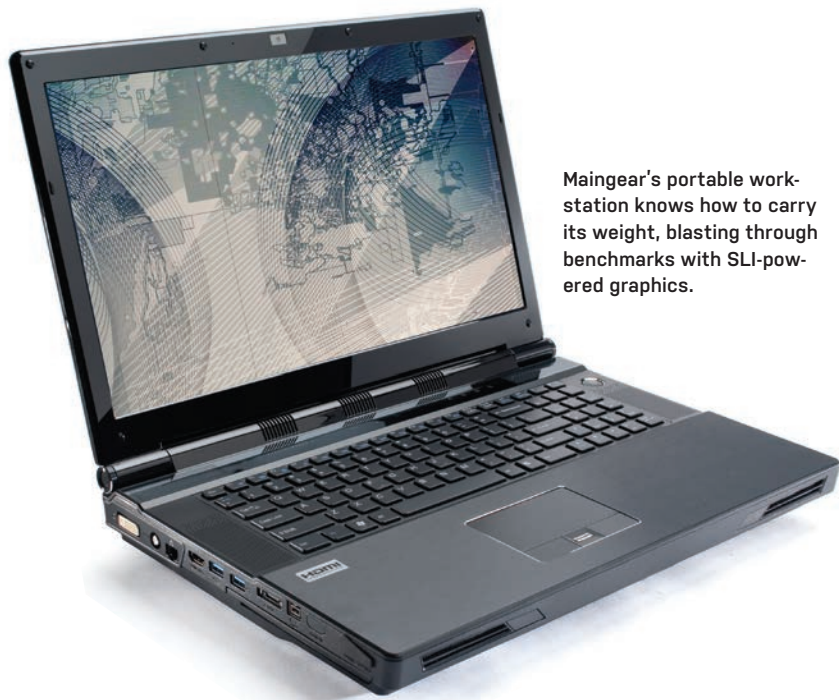
VERDICT
9 **Origin Eon17-S Notebook**
 \$3,600, www.originpc.com

MAINGEAR TITAN 17

Someone tell the boss we need an in-house masseur. Maingear's Titan 17 is the third supersize notebook we've reviewed in the past few months, and our backs are paying the price. We're so beaten down by these behemoths that the sight of the enormous power brick alone makes us cringe in terror. The graphics performance of this SLI powerhouse, however, makes all the hardship worth it.

The philosophy behind the Titan 17 is simple. Take a complete high-end desktop PC and cram it into a notebook form factor. Price and weight and size aren't the limiting factors—all that counts, in the end, is speed. In our tests, the Titan lived up to this guiding principle. The two Nvidia GeForce GTX 485M graphics cards with a total of 4GB GDDR5 memory showed the power of an SLI configuration, running so fast on our usual gaming benchmarks we had to go looking for something extra to throw at it. Unigine's Heaven 2.5 benchmark fit the bill, and the system still managed to crank out 52.5fps at 1920x1080 resolution compared to 28.1fps for Origin's overclocked single graphics card. There's no denying that SLI rules for more intensive games.

The six-core Intel 3.46GHz Core i7-990X Extreme Edition is what you'd find on a high-end desktop. Combined with 6GB of Kingston DDR3/1333 and a solid-state 120GB SATA 6Gb/s hard drive, the system also performed exceptionally well on our CPU-intensive photo and video editing



Maingear's portable workstation knows how to carry its weight, blasting through benchmarks with SLI-powered graphics.

tests. All that size and weight, though, couldn't beat the Origin Eon17-S's Sandy Bridge CPU overclocked to 4.7GHz. Admittedly, in apps optimized for its 12 threads, the Gulftown would shine, but an overclocked Sandy Bridge CPU makes it a tough battle. For games, on the other hand, it's really all about the GPU, or in the Titan's case, the GPUs.

Maingear touts its no-frills installation, and takes this to a new level of minimalism with the Titan 17. For instance, while the builders install and test the driver for fingerprint reader integration into the touchpad, they remove the driver before shipping the system. You can install it yourself—if you want it. The company also offers lifetime free labor and phone support, a nice feature for a laptop that you're likely to purchase as a long-term investment.

Of course, Maingear's offering suffers from all the drawbacks we've noted in

testing similar systems. For one thing, it is extremely heavy, weighing 17 pounds with the power supply. It also has extremely short battery life, lasting only 36 minutes in our DVD playback test. These are the trade-offs you'd expect from cramming what is essentially a desktop system—with all its power and cooling requirements—into a portable platform.

On the other hand, you have all the power of a desktop in a relatively compact form factor. We'll let you judge whether the undeniable performance justifies the limited luggability and high price. But this laptop has proved yet again that no matter how overclocked the competition, it's no match for a laptop with two graphics cards.

VERDICT
9 **Maingear Titan 17**
 \$5,385, www.maingear.com

BENCHMARKS

	ZERO POINT	
PREMIERE PRO CS3 (SEC)	899	444 (102.5%)
PHOTOSHOP CS3 (SEC)	131	80
PROSHOW PRODUCER (SEC)	876	467
MAINCONCEPT (SEC)	1,782	582 (206.2%)
FAR CRY 2 (FPS)	48.5	143 (194.8%)
CALL OF DUTY 4 (FPS)	62.2	217 (248.9%)
BATTERY LIFE (MIN)	96	36 (-62.5%)

Our zero-point notebook is an Asus G73Jw-A1 with a 1.73GHz Intel Core i7-740QM, 8GB DDR3/1066, two 500GB Seagate 7,200rpm hard drives, a GeForce GTX 460M, and Windows 7 Home Premium 64-bit. Far Cry 2 tested at 1680x1050 with 4x AA; Call of Duty tested at 1680x1050 with 4x AA and 4x anisotropic filtering.

SPECIFICATIONS

CPU	3.46GHz Intel Core i7-990X
RAM	6GB DDR3/1333
CHIPSET	Intel X58
DRIVES	120GB SSD SATA 6Gb/s, 750GB HDD (7,200rpm)
OPTICAL	Blu-ray ROM combo drive
GPU	2x Nvidia GeForce GTX 485M in SLI
CONNECTIVITY	HDMI out, DVI out, Ethernet, two USB 3.0, three USB 2.0, one eSATA, FireWire, fingerprint reader, Wi-Fi, Bluetooth, headphone, mic, line in, S/PDIF out, media reader, webcam
LAP/CARRY	13 lbs, 3.2 oz / 17 lbs

Razer Hydra

Is the PC ecosystem ready to support a dedicated motion controller?

TRADITIONALLY, MOTION CONTROL has been the domain of the consoles. Between the Wii, Xbox Kinect, and the PlayStation Move, the tech has developed a reputation as an arm-wagging, casual experience—emblematic of the overall shift away from the kind of deep, demanding, rewarding gameplay that the PC as a platform is known for.

With that in mind, you can imagine that we were a little surprised when we heard that Razer—a company associated with competitive, hardcore gaming—was releasing a motion controller for the PC. Is this the beginning of the end?

In a word, no. Whether or not the Hydra is the beginning of anything at all is debatable, but it's definitely not trying to dumb down PC gaming.

When you first lay hands on the Hydra, you can tell that this is a motion controller designed for a more serious audience. It includes two "nunchuk"-style handheld controllers, each with an analog thumbstick and seven buttons. That's right, seven buttons. By comparison, the Wii's nunchuk has only two buttons, the PlayStation Move has plenty of buttons, but only a single joystick, and the Kinect—well, don't talk to the Kinect about buttons. The Hydra is, in other words, equipped to play even very complicated games.

Each of the controllers is ergonomic and significantly larger than the Wii nunchuk, which they otherwise resemble. They're lightweight—a product of not having any internal batteries, and they have to be used within a 2–3-foot radius of the Hydra's magnetic sensor—a small, glowing orb that connects to your computer with a USB cable. Even if you

wanted to test the limits of the Hydra's range, you're constrained by the braided cables that tether the handsets to the sensor. Although we're glad that the Hydra's corded design will dissuade anyone from making yet another motion bowling game for it, we didn't care for the mass of cables it left on our desk.

In all, the Hydra's hardware is designed nicely. What's going to make or break it as a successful motion controller is the software support. To get things started on the right foot, Razer enlisted the help of one of PC gaming's most respected developers—Valve.

Bundled with every Hydra is a copy of Portal 2, Valve's hit first-person puzzler. The bundled version includes the full game, with support for Hydra motion control, as well as a set of 10 all-new levels specifically designed to take advantage of the peripheral. The added features are a lot of fun and add some extra depth to an already amazing game. With motion control, you can manipulate objects in three dimensions, moving the controller toward or away from your body to do the same in game. You can also rotate portals and stretch certain objects, making for some fun puzzles.

Playing Portal 2 with the Hydra is a lot of fun, but for \$140, the Hydra had better work with more than just one game. Razer claims support for more than 125 games, but of course this just means that the Hydra has profiles that allow you to play any of those games without having to configure it manually. There's a big difference between a game that *can* be controlled with the Hydra and one that's *meant* to be.

For single-player shooters, the controller works fairly well. The motion-

based aiming is a bit less precise than using the mouse, so we doubt many people will want to go online wielding the Hydra. Any game that is best played using a gamepad can be played using the Hydra (which, if you take out the motion functionality, is just a gamepad split in half) though the button layout isn't nearly as comfortable as a dedicated gamepad. Pointer-heavy excursions like real-time strategy games? Forget about playing those with the Hydra—it just doesn't work.

And that's really the problem with the Hydra—for an expensive peripheral, the software support just isn't there. Portal 2 is a great title to launch with, but Razer hasn't done enough to prove that there's going to be a large body of software to support the system in the future. Sure, you can use it to play games that weren't designed for motion control, but that is—by definition—unfulfilling.

Unless you're a motion-control aficionado, we recommend that you hold off on the Razer Hydra until more games are released that take advantage of its specific capabilities. —ALEX CASTLE



Razer Hydra

■ **NUNCHUK** Ergonomic design; sensitive motion control; plenty of buttons; excellent Portal 2 support.

■ **WOODCHUCK** Lacking in software support; lots o' cables; button layout is cramped when used as a gamepad.

\$140, www.razerzone.com



The Hydra's controllers are tethered to the sensor by hardwired cables.



The Hydra packs enough buttons for even the most complicated games.



That glowing whiffle ball is the Hydra's magnetic base station. The controllers must be used within three feet.

Genius SW-G2.1 1250 2.1 Speakers

You have to kiss a lot of frogs to find a prince

WE DON'T BRING PRODUCTS into the Lab just to beat them up, so we almost didn't bite when Genius pitched these speakers. We also try not to prejudge products, but we didn't have high expectations for this 2.1-channel speaker system: It looks cheesier than a wedge of Vermont cheddar and sells online for less than 50 bucks. We were fully prepared for a craptastic audio experience. Wow, were we ever off base.

Corsair needn't worry that Genius will bump its exceptionally good SP2500 speakers off our Best of the Best list—the SW-G2.1 1250 isn't *that* good—but it *is* better than we thought any \$50 speakers could be. We're not sure if the weird hourglass shape of the ABS plastic satellite cabinets is supposed to serve a function or is just an odd design decision, and we hate the hardwired speaker cables that connect them to the subwoofer. But we have no complaints about how they sound.

We're also not sure what Genius sprayed on the one-way drivers to achieve that shiny red finish. These are simple 3-inch paper cones with inexpensive foam surrounds, so we were quite surprised with their capacity for reproducing both midrange and high frequencies without dedicated tweeters. While listening to "He Was a Big Freak," from funk diva Betty Davis's *They Say I'm Different*, we found that the satellites rendered the drummer's high hat unexpectedly tight and crisp without compromising Davis's lusty screams and guttural growls.

The compact subwoofer's design is equally simple: a 5.25-inch paper cone driver with a foam surround housed inside a 9mm MDF cabinet. This isn't the tightest sub we've heard, and it's easily driven to distortion if you crank the bass dial much farther than the halfway point, but it does move an incredible amount of air through its rear reflex port. We thought the bar across the face of the compact sub might be there to protect the woofer, but Genius tells us it's just for decoration.



The SW-G2.1 1250's amp has a 1/8-inch headphone output and a 1/8-inch mic input in front (with a mic output in back). There's also a 1/8-inch aux input in back, which is handy for plugging in an MP3 player.

Most 2.1-channel speaker systems tuck the amplifier inside the subwoofer cabinet, but Genius houses this one in its own enclosure. And we suspect the amp is the component most responsible for this system's better-than-average sound. Most inexpensive active speaker systems utilize class D amps, but a more sophisticated class AB amp drives this system. The amp delivers just 9 watts RMS per channel to the satellites and 20 watts RMS to the subwoofer, though, so don't expect to fill a large room with sound using this system. It's plenty loud for near-field listening—including gaming—and the satellites don't distort, even with the volume control pegged.

The aforementioned hardwired speaker cables limit your options when placing the components, and having the

amp in its own enclosure will add to your desktop clutter, but we like its large primary volume knob, and we doubly appreciate having a discrete bass control. This is no audiophile system, but we predict we'll kiss a lot more frogs before we find another set of cheap speakers that sound this good. —MICHAEL BROWN



Genius SW-G2.1 1250 2.1 Speakers

■ **FROGS** Class AB amplifier; discrete bass control; off-the-hook price/performance ratio.

■ **TOADS** One-way satellites; hardwired cabinets; sub distorts when driven too hard. \$50 (street), www.geniusnet.com

AOC e2243Fw

This super-thin display also has a super-thin price

AOC'S E2243FW MADE A STRONG first impression on us: A glossy, piano-black frame houses this remarkably thin, 21.5-inch LCD monitor. In addition to being only 1/2-inch from front to back, it's also extremely lightweight and flexible—and has a budget price, too. The entry-level price of \$150 gets you TN technology and a WLED-backlit screen with a standard 16:9 aspect ratio and 1920x1080 resolution. It doesn't, however, get you HDMI or DisplayPort.

The six-pound display has a round base holding sensors that, when touched, activate an onscreen display—a neat trick if it weren't so clunky. Attempting to navigate the menu was an unwieldy experience, as the buttons on the base are unintuitive and lack the ability to move up and down through the menu. Even worse, the OSD menu consists of large, confusing icons, and it's frustratingly easy to press the wrong button or to accidentally take a step back to the previous submenu.

One of the notable things about the display is its ability to tilt back to a 90-degree angle for easy wall mounting via VESA mounts. However, the e2243Fw requires a power brick—something that's unlikely to look good dangling down your wall. Also, despite the 90-degree tilt, there is no ability to move the display from left to right, which comes in handy for desktop use. And frankly, we'd be much more likely to use a 21.5-inch panel on our desktop than our wall.

When moving the display on its base, not only did we find ourselves accidentally pressing the base (and therefore the menu buttons), we also noticed that



Only 1/2-inch thin, the e2243Fw weighs a mere six pounds.

the neck of the stand put pressure on the display, causing strange pressure-point patterns to warble across the screen. Moving the display also often caused it to flicker off for a moment before springing back to life.

Chassis attributes aside, the display produced clear details and colors that were comparable to our zero-point display, a Dell U2410, albeit a shade darker. Adjusting the brightness and settings in the menu helped some, but the reds and greens didn't quite pop like we wanted: The e2243Fw was still a few shades cooler than our zero-point. During our DisplayMate testing, the e2243Fw suffered in the Pixel Tracking screens, where it produced some digital noise in images, as well as in the White-Level Saturation tests, where it produced some compression artifacts. It also struggled to produce accurate colors, and to render those colors smoothly and consistently—as well as to produce the full spectrum of grays seamlessly. It also experienced difficulty with the Video Bandwidth Index and Gamma Correction tests, where there was evidence of over-peaking and inaccuracy in the gray-

scale and color mixtures, respectively.

However, during our Blu-ray watching/gameplay testing, the e2243Fw did a solid job. In our viewing of *V for Vendetta*, it matched the zero-point monitor nicely. The only discrepancy was the level of detail in shaded or dark backgrounds, where the e2243Fw was a little weak, although adjusting the brightness did alleviate the issue some. Similarly, while playing *Arkham Asylum*, the e2243Fw consistently displayed clear images and solid colors. We didn't experience any lags, artifacts, or ghosting and were pleased overall with the display's real-world performance. Despite its awful menu and budget feel, the e2243Fw does a decent job where it really counts. —**AMBER BOUMAN**

VERDICT

6

AOC e2243Fw

■ SUPER 8 Great price point; super thin.

■ BMM Awkward OSD menu; trouble with digital noise, grays, and compression.

\$150, us.aoc.com

Plextor PX-LB950SA

'Upgrade' would be an overstatement

WE'VE BEEN RECOMMENDING Plextor's B940SA 12x drive on our Best of the Best list for more than a year now, so we were delighted to receive a challenger that could shake things up—even if it was another Plextor drive. Hey, why not build on that good track record?

Our excitement waned, however, when the drive we received—Plextor's PX-LB950SA—bore the exact same specs as its predecessor. Granted, a BD-R write speed of anything greater than 12x is somewhat pointless given that BD-R media is currently capped at 6x, but still, throw us a bone here. Plextor says improvements come in the form of upgraded mechanics that make the drive quieter and cooler. That's all well and good, but we hadn't actually noticed the predecessor being particularly noisy or hot. Presumably, though, these mechanical tweaks will add to the drive's lifespan. Plextor also touts this drive's support for Blu-ray 3D, but that only means that the bundled CyberLink

PowerDVD 9 offers such support—*any* Blu-ray drive faster than 2x is capable of supporting 3D on the hardware side.

Such improvements were of little consolation to us when we discovered that the PX-LB950SA's Blu-ray burning performance was actually a bit weaker than the drive it's replacing. As many optical drive owners know, manufacturers are able to push a drive's write capabilities beyond the media's rating by tuning the hardware to hit top speeds with a particular brand of discs. For the PX-LB950SA drive, that brand is Sony. And sure enough, the drive hit speeds of 12.07x during the course of filling a 25GB Sony BD-R with data, resulting in a completion time of 11:48 (min:sec). That's brisk, but it's almost a full minute slower than the earlier B940SA took to fill a Sony disc. What's more, the older drive could also hit 12x speeds with Panasonic discs, and even 10x speeds with Verbatim discs, the media we typically use to test burners. Plextor says that over time the drive may be tuned for media other than Sony's, but for now, that's it.

To be fair, these are still decent Blu-ray burn times, and Sony media is easy enough to come by. We also can't complain about the drive's 16x DVD+R writes or its capable DVD ripping performance—11 minutes to rip the contents of a double-layer movie disc. But the sad fact is, after waiting so long for a new product, this just feels like too little, too late.

—KATHERINE STEVENSON

BENCHMARKS

	Plextor LB950SA	Plextor B940SA
DVD WRITE SPEED AVERAGE	11.81x	11.73x
DVD READ SPEED AVERAGE	12.07x	11.97x
ACCESS TIME (RANDOM/FULL)	112/226ms	163/361ms
DVD RIPPING (MIN:SEC)	11:02	10:09
TIME TO BURN 22.5GB TO BD-R (MIN:SEC)	11:48	10:57
TIME TO BURN 22.5GB TO BD-RE (MIN:SEC)	45:03	43:00

Best scores are bolded. All tests were conducted using Nero DiscSpeed. Our test bed is a Windows 7 machine using a 2.8GHz Intel Core i7 930, 8GB of Corsair DDR3/1600 RAM on an Asus P6X58D Premium motherboard, a Radeon HD 5860 videocard, a Western Digital 500GB Caviar hard drive, and an Antec 850W PSU.

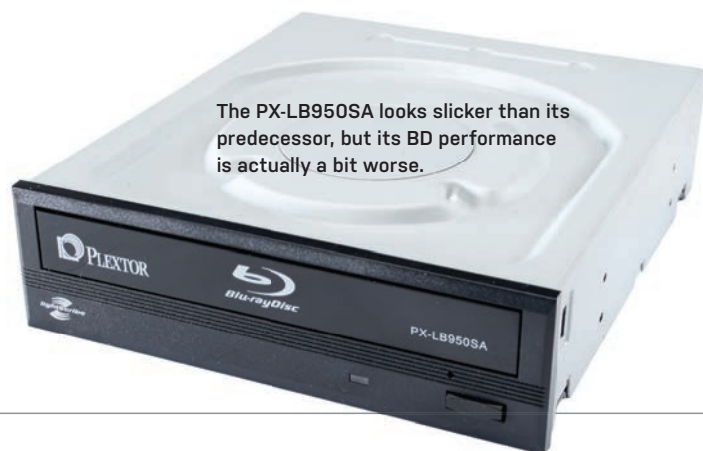
VERDICT



Plextor PX-LB950SA

\$180, www.plextor.com

AD



The PX-LB950SA looks slicker than its predecessor, but its BD performance is actually a bit worse.

Frozen Synapse

Simple and simultaneously brilliant gaming that you can't miss

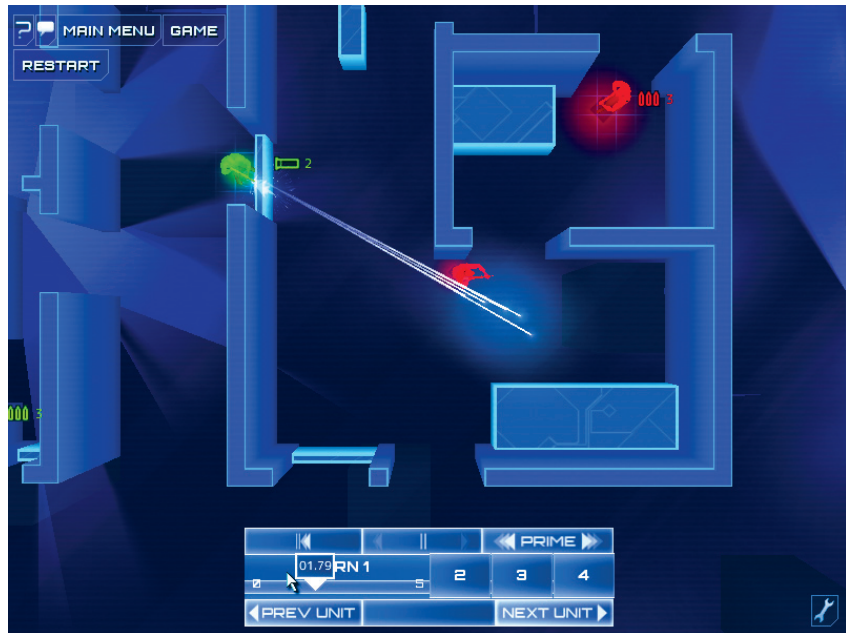
FOR US, STRATEGY GAMES tend to be never-ending spirals of regret and woe. Don't get us wrong—we love the genre. But our approach to tactics usually goes something like this: "OK, now you go here and... oops. *Everything we love is on fire.*" Put simply, mistakes happen. Frozen Synapse, however, allows us to make informed mistakes. In a nutshell, the game lets you see the outcome of your moves before you make them. It's an absolutely brilliant tweak, and—if you're a perfectionist—both a dream come true and your greatest nightmare.

The not-quite-turn-based, not-quite-real-time strategy encourages you to shove your every move under the microscope, painstakingly playing out every situation you can dream up. Your opponent, however, can do the same. Obsess, tweak, rethink, rewatch—sometimes for hours. Then give your stamp of approval to a plan, hit the "f'reals this time" button, and watch it fall to pieces in mere seconds. And it's amazing.

To ensure that your poor brain doesn't overheat, Frozen Synapse's basic mechanics are actually incredibly simple. There are no tech trees, hero units, or supply lines to micromanage here. Typically, you're given a tiny squad of glowy green men, and that's it. Combat, then, is a piece of neon-colored cake. Using nothing but clicks and one drop-down menu, you tell your men where and when to move, aim, take cover, fire, and even ignore enemies. It's not brain surgery on a rocket scientist while aboard an actual rocket. Hell, your



Campaign missions throw in extra wrinkles—like civilians caught in the crossfire.



Lesson one of cover-taking. Incidentally, this is the only lesson.

kids probably wouldn't have a problem picking it up. Mastering the game, however, is another story entirely.

Staying a step ahead of your opponent is absolutely crucial, but it never ceases to feel like you're about to step off a cliff. Committing to a plan is downright nerve-racking. After all, you've run yourself ragged testing it. Thanks to your hard work, it's airtight. Foolproof. But most of all, it's *yours*. Then your opponent bulldozes it with brilliant strategy, dumb luck, or (usually) some combination of the two, and you're back at square one. For reference, square one is "Oh goodness, there are a million knives against my throat, and I'm going to lose in one turn." But you find a way to survive, and it's so damn satisfying.

That balance of psychological posturing and swift, brutal chaos holds up quite well in both the single-player campaign and multiplayer. Single-player, while a bit confusing on the story side, does a great job of gradually easing you into deeper tactical waters, and multiplayer makes use of a Words With Friends-style "take as long as you want per turn" approach.

Really, Frozen Synapse only thaws into ugly gray mush when its random level generator decides to commit horrific crimes against balance. Occasionally, you may find yourself in an unwinnable uphill battle because the gods of wall placement didn't smile in your favor. It's frustrating, sure, but hardly a deal-breaker. That aside, Frozen Synapse is a fantastic step outside strategy gaming's typical box—not to mention an absolute steal at \$25. There's no need to test and tweak the outcome of this one: Buy it and don't look back. —NATHAN GRAYSON

VERDICT
9
KICK ASS!

Frozen Synapse
BRAINSTORM Excellent mix of turn-based and real-time strategy; easy-to-learn mechanics; incredibly satisfying multiplayer.

BRAIN FREEZE Randomized levels can throw off balance; a few less-than-stellar campaign missions.

\$25, www.frozensynapse.com, ESRB: not rated

LAB NOTES

NATHAN EDWARDS SENIOR ASSOCIATE EDITOR



Meet My New Thermal Test Bed

I'm leaning on the older, but hotter, LGA1366 until 2011—LGA, that is

ONE OF THE GREAT THINGS about the continuing evolution of the CPU is that the cores get smaller, faster, and cooler. As they require less wattage to produce the same clock speeds, even overclocked parts don't need the hefty coolers of yesteryear. But that doesn't mean we can just hang up our cooling hats (which have fans on them). Virtually any aftermarket cooler will cool any stock-clocked CPU, but we've recently received a batch of "overclocker" coolers, and that sounded like a challenge to us.

Starting next month, and until LGA2011 comes out, we'll be testing CPU coolers targeted at overclockers using an Intel Core 2.8GHz i7-930 cranked up to 3.9GHz. We're using Intel's internal testing utility, cranked to a setting *just under* what the Hyper 212 Plus (our favorite budget cooler) can handle without throttling the CPU back from heat. You'd be surprised how much heat an overvolted i7-930 puts out, and how much of a difference there can be between high-end coolers. Once LGA2011 comes out, we'll do a big roundup of the top-tier air and water coolers for overclocked X79 systems. But until then, we'll warm up (as it were) with this.

Sensor	Value	Min
COOLING-TEST		
ASUSTeK Computer INC. P6X...		
Voltages		
CPU VCORE	1.42 V	1.41 V
+5V	5.12 V	5.12 V
+3.3V	3.17 V	3.17 V
VIN3	1.58 V	1.58 V
+12V	11.80 V	11.80 V
VIN6	1.58 V	1.22 V
Temperatures		
SYSTIN	25 °C (77 °F)	25 °C (77 °F)
CPUTIN	64 °C (146 °F)	26 °C (77 °F)
AUXTIN	4 °C (38 °F)	1 °C (33 °F)
Fans		
SYSFANIN	1028 RPM	1028 RPM
CPUFANIN0	2220 RPM	2109 RPM



Amber Bouman
Online Features Editor

Like 2 million other people, I'm trying out Google+, but so far, I'm not really digging it. Perhaps it's the layout, or that not enough folks have migrated over, or that I resent having one more status bar to update, but I'm just not thrilled. Maybe I'll change my mind—after all, I hated Facebook the first few months I used that, too—but so far I'm underwhelmed.



Michael Brown
Reviews Editor

I've reviewed a lot of great speakers, but I've also reviewed more than my share of turkeys. Having shredded an absolutely dreadful gaming headset that Genius sent us several years ago, I almost ignored its new 2.1-channel speaker system (read my review on page 86). Who'd have thought you'd find a class AB amp in a pair of \$50 speakers?



Gordon Mah Ung
Senior Editor

With AT&T's pathetic new bandwidth cap, I'm seriously looking at jumping ship to Sonic.net's 20Mb/s Fusion product. That would give me no broadband cap and none of the "traffic-shaping" shenanigans that Comcast and other cable providers are known for. Once I get my alarm system on cellular, I'm gone, baby!



Alex Castle
Online Managing Editor

This month I've been dealing with some instability issues with my rig at home. It was running fine, even under load, but freezing up whenever I left it idling for more than a few hours. Using the old "replace parts until the problem goes away" strategy, I finally figured out that the problem was a corrupt hard drive.



Katherine Stevenson
Deputy Editor

I recently discovered a program that would have fit right in to our "49 Lil' Apps" story from August. It's a free, sub-1KB utility called Start Menu XP that lets you enjoy the WinXP drop-down-style Start menu on Vista and Win7 machines. Plus it adds other enhancements, like Groups, for improved organization. Get it at www.startmenuxp.com.

LETTERS

WE TACKLE TOUGH READER QUESTIONS ON...

- > FinFET Debate
- > Teenage Computing
- > Budget Procs

Fur Flies over FinFET

I think Mr. Halfhill must have run out of interesting things to write about ("Another Leap Forward for Intel," August 2011). While FinFET is an interesting technology, it is not by any means a leap forward. At best, it is an evolutionary step forward and, in fact, shows Intel's desperate desire to compete in the mobile low-power marketplace.

This is also not "new" technology, as it has been studied now for quite a few years and was first proposed around 1999–2000 at UC Berkeley.

Intel needs this technology now in order to compete with others in the marketplace. But I assure you, every other chipmaker has this in their plans for when they need it.

What this does for Intel is possibly bring the company within range of its competitors in the low-power segment of the marketplace, but make no mistake, it does not

bring them to parity. With this technology Intel will be able to bring processors to market (in the Atom product range) that have a TDP of 1.26–8.19 watts. The current-generation dual-core A5 ARM processor used in the iPad 2 has a TDP of .5 watts.

Many press hacks have put out stories about this being a leap-frogging by Intel over the rest of the industry. This is just nonsense and I can't believe *Maximum PC* let this one get through.

—Jon Moody

CONTRIBUTING WRITER TOM HALFHILL RESPONDS: Congratulations on using Google, Jon. Now let's discuss how to interpret search results.

Almost all new technology is researched for many years before it's ready for mass production. You found numerous references to FinFET research because modern science is highly collaborative. Scientists and engineers often share their knowledge and progress at technical conferences. It's rare for a lone-wolf inventor to stun the world with a surprising breakthrough.

So, of course, I was aware that Intel engineers and other researchers have been working on FinFETs (tri-gate

transistors) for many years. In fact, I noted that research in my October 2003 and April 2007 columns in this very magazine, not to mention articles I've written on my day job at *Microprocessor Report*. But there's a huge difference between lab experiments and mass production. Intel deserves credit for being the first company to move FinFETs from the lab to the fab.

Intel's competitors probably won't get their own FinFETs into mass production for about four years. In addition, as my August column pointed out, Intel already has an 18- to 24-month lead in lithography by starting 22nm production this year, while everyone else is just starting 32nm or 28nm production. So it isn't "nonsense" to estimate that Intel has a four-to-five-year lead.

Your comparison of Atom versus ARM power consumption omits two important trends: Intel is moving toward lower power consumption while ARM is moving toward higher performance. Someday, they may reach parity. Regardless, Intel's clear lead in process technology is a big boost. If ARM-based processors continue to enjoy superior power efficiency, it will be in spite of their infe-

rior fabrication technology. ARM and its licensees must beat Intel with superior designs, and Intel has pretty good designers. My point was that FinFETs give Intel a technological advantage that no one else will match for years.

In Defense of ICE

In "9 Technologies That Need an Instant Upgrade" (The List, August 2011), you guys write that the internal combustion engine is old news. Sorry, it isn't. If it were, something would have replaced it. ICEs are cheap to build, reliable, emit few toxic substances, can be easily recycled, use common materials, and are ubiquitous.

If you think electric or hybrid cars are "green," look at all the three-eyed Chinese kids outside the strip-mining pits, which take rare earth elements from the ground and pour highly toxic substances into the ground water so the latte set can think they're better than everybody else. Or how about Toyota mining minerals in Canada for the Prius and shipping them (via diesel-powered freighters) back to Japan, only to have them turned into batteries and then shipped (again via

CUT, COPY, PASTE

We published the wrong optical drive model number for the \$667 PC in our August issue. We used model SH-S223.

↘ submit your questions to: comments@maximumpc.com

diesel-powered freighters) back to the U.S. for sale?

Better stick to the whole computers and Internet thing in the future, because you guys know squat about engines.

—Price Jessup

Teenage Computing

I read your \$667 PC article (August 2011) with a great deal of interest as I have two teenage boys and, like my dad before me who taught me the basics of my '64 VW, I want them to know what's under the hood of a computer. I am writing because in the same issue there's an ad for a CyberPower gaming laptop for \$769. So aside from the obvious build or buy conundrum, which system is better for entry-level gaming?

—Dave Jensen

SENIOR EDITOR GORDON MAH UNG RESPONDS: It very much depends on your definition of entry-level gaming. The

CyberPower notebook is indeed a great deal for the cash, but its 2.1GHz Core i3-2310M and GeForce 540M will take a backseat to our rig's 3.1GHz Core i3-2100 and Radeon HD 6790 in gaming performance. But again, this comes down to what your needs are. If you want me to pick for you, I'd pick the desktop, because it's a great way to introduce your boys to the joys of building a machine. It'll also have stronger legs for the kind of gaming that teen boys like, and it's unlikely to get smashed to bits, which tends to happen anytime teens are involved.

Why No Quad Love?

In the \$667 PC story in your August 2011 issue, you folks used a low-end Intel dual-core processor as the computing power of this budget PC. I recall that the "secret sauce" of the last budget system from your February

2010 issue was a quad-core processor. Considering how well that system performed, I'd like to know why a quad-core wasn't selected for this budget PC? Also, since we're already comparing the two, I'd like to know how well the August 2011 budget PC would benchmark against the February 2010 budget PC.

—Abraham Chapman

SENIOR EDITOR GORDON MAH UNG RESPONDS: Abe, it was very much about the cost-to-performance ratio. Stepping up to a quad-core in Intel land bumps the cost up another \$50 or so that I didn't have in the budget. As to how well it performs against the Athlon II box we ran last year, you can glean that from this month's Build It rig on page 66. In CPU-heavy benchmarks, the Core i3-2100 dominates AMD's A8 X4 chip, which offers very similar performance to a quad-core Athlon II X4. ☺

[NOW ONLINE]

DOES NOT COMPUTE: 10 PC MYTHS FROM MOVIES AND TELEVISION

For more than half a century, Hollywood has been making computers do whatever they damn well please. Routinely featured on television and in movies, supercomputers, desktop rigs, and laptops are all too often imbued with near-magical capabilities. From computers that explode when asked an impossible riddle to the classic zoom-enhance trick, we examine 10 of the worst examples of Hollywood's PC make-believe. bit.ly/qaGLui



[NEXT MONTH]

COMING IN **MAXIMUM PC'S** BETTER THAN A BUTTERBALL **NOVEMBER** ISSUE



Power User's Guide to Social Networking

Our essential tips will have you rubbing elbows on Facebook, LinkedIn, Google+, Twitter, and YouTube like a pro.



NAS Roundup

If you've been contemplating a move to network-attached storage, tune in next month for reviews of four fully loaded NAS boxes.



The Ultimate Star Trek PC

Think Dream Machine was crazy? Next month we'll beam aboard a precision modded, aluminum-billet Star Trek PC that will have you as worked up as an Orion slave girl.



HARDWARE



MID-TOWER CASE

Corsair Special Edition White Graphite Series 600T

The 600T Special Edition just kicks ass, plain and simple. It features a truly groundbreaking design—the white-with-black-trim chassis is glorious-looking, and the interior spaciousness is unparalleled for a mid-tower. Minor inclusions like two LED fans (that glow brighter depending on how high you tune the onboard fan controller), snap-off mesh fan mounts, and a plethora of tool-less components really help seal the deal. What's that, you say? Must cost a fortune? This piece of class could be sitting in your office for 200 bucks. Hot damn! www.corsair.com



GAMES WE ARE PLAYING

The Witcher 2
www.en.thewitcher.com

Frozen Synapse
www.frozensynapse.com

Portal 2
www.thinkwithportals.com

Team Fortress 2—Free-to-Play
www.teamfortress.com

THE REST OF THE BEST

High-End Processor
Intel 3.46GHz Core i7-990X
www.intel.com

Midrange Processor
Intel 3.4GHz Core i7-2600K
www.intel.com

Budget Processor
Intel 3.3GHz Core i5-2500K
www.intel.com

LGA1155 Motherboard
Asus P8Z68-V Pro
www.asus.com

LGA1366 Motherboard
Asus Rampage III Extreme
www.asus.com

AM3 Motherboard
MSI 890FXA-GD70
www.msi.com

Price-No-Object GPU
Asus GeForce GTX 590
www.asus.com

Performance GPU
XFX Radeon HD 6970
www.xfxforce.com

Midrange GPU
MSI N560GTX Ti Twin Frozr OC
www.msi.com

Budget GPU
XFX Radeon HD 6870
www.xfxforce.com

Performance Hard Drive
OCZ Vertex 3 100GB
www.ocztechnology.com

Capacity Hard Drive
Hitachi Deskstar 7K3000 3TB
www.hitachigst.com

Air Cooling
Cooler Master Hyper 212 Plus
www.cooler-master.com

High-End Cooler
ProLimaTech Armageddon
www.prolimatech.com

Blu-ray Drive
Plextor B940SA
www.plextor.com

Full-Tower Case
Corsair 800D
www.corsair.com

Speakers
Corsair SP2500
www.corsair.com

For even more Best of the Best entries, such as more speakers and budget components, go to www.maximumpc.com/best-of-the-best.

MAXIMUM PC (ISSN 1522-4279) is published 13 times a year, monthly plus Holiday issue following December issue by Future US, Inc., 4000 Shoreline Court, Suite 400, South San Francisco, CA 94080. Phone: (650) 872-1642. Fax: (650) 872-2207. Website: www.futureus.com. Periodicals postage paid in South San Francisco, CA and at additional mailing offices. Newsstand distribution is handled by Time Warner Retail. Basic subscription rates: one year (12 issues) US: \$14.95; Canada: US\$19.95; Foreign: US\$29.95. Basic subscription rates including monthly CD, one year (12 issues/12 CD-ROMs) US: \$30.00; Canada:

US\$34.95; Foreign: US\$39.95. Canadian and foreign orders must be prepaid. Canadian price includes postage and GST (GST #R128220688). PMA #40612608. Subscriptions do not include newsstand specials. POSTMASTER: Send changes of address to Maximum PC, PO Box 5159, Harlan, IA 51593-0659. Standard Mail enclosure in the following editions: None. Ride-Along enclosure in the following editions: B1, B2, B3. Returns: Pitney Bowes, PO Box 25542, London, ON N6C 6B2, Canada. Future US, Inc. also publishes @Gamer, Crochet Today!, Guitar Aficionado, Guitar World, Knitting Today!, MacLife, Nintendo Power, The Of-

ficial Xbox Magazine, PlayStation: The Official Magazine, PC Gamer, Revolver, Windows: The Official Magazine, and World of Warcraft Official Magazine. Entire contents copyright 2011, Future US, Inc. All rights reserved. Reproduction in whole or in part is prohibited. Future US, Inc. is not affiliated with the companies or products covered in Maximum PC. Reproduction on the Internet of the articles and pictures in this magazine is illegal without the prior written consent of Maximum PC. Products named in the pages of Maximum PC are trademarks of their respective companies. PRODUCED IN THE UNITED STATES OF AMERICA.