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What Exactly Is a Personal Computer?

If I asked you in 1993, "What's a PC?", you'd probably have pointed to the beige box sitting under your desk at work. In 1999, if I asked you the same question, the odds are good that you'd have shown me a grey box in your den. In 2005, you would probably have shown me a shiny new notebook. But, as I sit here in 2009, I'm finding it difficult to answer this seemingly simple question.

Sitting on my desk, I have four extremely powerful computing devices, each with its own strengths and weaknesses. Let's decide which of these are personal computers together.

Machine A features four CPU cores, and a host of GPUs and coprocessors. Machine B is more modest, with three CPU cores and a decent GPU. Machine C is even more modest, with a dual-core CPU, but a woefully inadequate GPU. Machine D pushes a lot of its workload onto dedicated processors, but still sports a dedicated GPU.

BRINGING THE AWESOME

So, what's all this powerful hardware? A home-built gaming PC, an Xbox 360, a Lenovo X200s notebook, and an iPhone 3GS.

The gaming rig and the notebook clearly fit the classical definition of a PC, but what about the iPhone and Xbox 360? I'm not sure. Let's see if we can figure out what gives a device its essential PC-ness.

AMD's $99 Quad-Core CPU page 54

In the old days, it was safe to say that an Intel CPU and a Microsoft OS made your computer a PC. But now other types of hardware and software are gaining ground on the WinTel duopoly. What makes my machines PCs is that they're *platforms*—constructs that allow me to run software that does what I need, assuming it follows the basic rules of the platform. Network connectivity is key, as well. Without a connection to the net, computers are much less valuable. For the most part, I use my four PCs to browse the web, communicate with friends, play games, and work.

Does the Xbox 360 meet my essential PC-ness test? It's definitely a platform that I use to play games and watch video, and it's connected to the Internet. However, it's a locked system, so I can only run Microsoft-authorized software on it and connect Microsoft-authorized hardware to it. I can't write a word processor for Xbox 360 because Microsoft wouldn't let me run it. Clearly, the Xbox 360 isn't a personal computer.

The iPhone is a tougher question. It's a closed platform, but there are mechanisms that let me run apps from a finite, but very large pool. The device is net-connected 24/7, and I find myself using my iPhone for many of the tasks that I once exclusively used a PC for. This is a new class of device that we call the smartphone—but I'd be hard pressed to describe a more personal computer than the one that I carry in my pocket with me everywhere.

Could you?

Will Smith

LETTERS POLICY Please send comments, questions, and tapioca pudding to will@maximumpc.com. Include your full name, city of residence, and phone number with your correspondence. Unfortunately, Will is unable to respond personally to all queries.

THE NEWS

Windows Mobile Is Still Alive

Will the Rodney Dangerfield of phone OSes make a run at the top or settle for mediocrity? —GORDON MAH UNG

Whip out the typical Windows Mobile phone among a group of iPhone, Pre, and Android users, and you're likely to draw comments such as, "Damn G, you're kickin' it old-school!"

That's the problem, according to IDC analyst Ramon Llamas.

"[Windows Mobile] is seen as kind of a utilitarian thing. It doesn't make people drool with envy," said Llamas. Whereas people were happy just to have email access and PDA functionality on their phones when Windows Mobile first launched in 2003, today a phone is a style statement. And using Windows Mobile is a bit like wearing bell-bottom jeans and tie-dye at a Devo concert.

Despite their janky looks, Llamas said, Windows Mobile phones continue to ship at a respectable pace. Worldwide, Symbian controls the smartphone OS market with 46 percent of the game, RIM's BlackBerry has 20 percent, and Apple's iPhone has 12 percent. Windows Mobile comes in next at 11 percent, with the rest of the pack, including Palm and Google's Android, bringing up the rear at less than five percent.

In the U.S., Windows Mobile has a far stronger presence. A recent comScore study shows Windows Mobile with a 21.6 percent install base, just ahead of the iPhone's 21.4 percent. BlackBerry OS phones are the 900-pound gorilla with 42.3 percent of market share.

Still, there's no denying that WinMO is the least sexy of the current phone OSes. That's an issue phone maker HTC hopes to counter with many of its new WinMo handsets and its much-lauded TouchFlo interface.

"Windows Mobile is actually very powerful," said HTC's Keith Nowak, "we've just combined that power with our custom interface and made it very usable." Up until recently, the bulk of HTC's phones have been Windows Mobile. But after rolling out Google's G1 phone and following that with three subsequent Android handsets, some folks figured HTC was bailing on WinMo. Nowak said no way: "We're excited with Microsoft and whatever iterations (of Windows Mobile) come next."

Less excited is mobile analyst James Faucette of Pacific Crest Securities, who doesn't see Windows Mobile really getting any better in perception or market share anytime soon. That's because while Windows Mobile has been a moderate success and ran on about 20 million phones sold last year, it's immaterial to Microsoft's bottom line.

"Windows Mobile makes no difference to Microsoft. If it doesn't make any difference to Microsoft, it's not going to receive any attention and emphasis," Faucette told us.

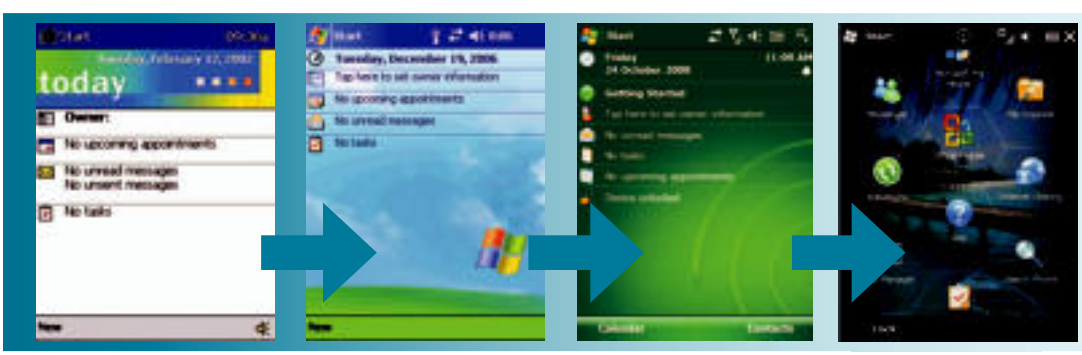
If Microsoft has to decide between throwing a genius engineer at Microsoft Windows or Office, which both generate billions in revenue, or at Window Mobile, which side do you think is going to win? According to Faucette, even if Windows Mobile doubled in sales, it still wouldn't move the needle much on profit, so why would Microsoft care?

Faucette thinks that it's that attitude over the years that has led to a high turnover of senior management and lack of motivation in the Windows Mobile division.

HTC's Touch Pro 2 is among the new breed of phones that will use Windows Mobile 6.5.

For Microsoft to increase its profits on phones, it would have to get into the hardware business. And if Microsoft does somehow create a wildly successful phone that smashes RIM, Apple, and Google, it'll probably end up with a $200 million antitrust suit.

"Are they going to make improvements on (Windows Mobile)?" Faucette posed. "I'm sure they will. Are they likely to trail everybody else? Yeah, probably. There's nothing wrong with that. It's a rational business decision."



Sadly, the evolution of Microsoft's phone OS has moved at a glacial pace since Pocket PC hit the beaches in 2000 (left). Little changed moving to Windows Mobile 2003 (middle) or even to Windows Mobile 6.1. Windows Mobile 6.5, due in 2010, will be finger-friendly and finally offer a retuned interface.

Vue Personal Video Network

GEEK TESTED & APPROVED

There's a big problem with most networked surveillance cams: the power and network wires. That's why we were instantly intrigued by the Vue Personal Video Network ($300, www.vuezone.com)—it's completely wireless. The two cameras are powered by CR123 lithium-ion camera batteries and deliver a 640x480 video signal. The quality isn't great but it's more than sufficient for remotely keeping tabs on your property or pet. **–WS**

Beware the Facebook Quiz

ACLU warns of privacy concerns

Taking Facebook quizzes and posting your results for the world (or at least your network of friends) from "What Sex and the City Character Are You?" or "What is Your Vampire Power?" is more than just incredibly lame. It's also risky, according to the Northern California chapter of the American Civil Liberties Union (ACLU).

"Millions of people on Facebook who use third-party applications on the site, including the popular quizzes, do not realize the extent to which developers of quizzes and other applications have access to personal information. Facebook's default privacy settings allow nearly unfettered access to a user's profile information, including religion, sexual orientation, political affiliation, photos, events, notes, wall posts, and groups," the ACLU warns.

The ACLU thinks Facebook should be doing more to protect its users and suggests that the social networking site upgrade its privacy controls so that quizzes can only see what people want them to see. One way to do this, the ACLU says, is to make the process for apps to access a user's friends' data opt-in rather than opt-out. **–PL**

NETBOOK SALES SOAR

Mini notebooks grab one-fifth of mobile PC market

Whoever claims netbooks are just a fad clearly isn't paying attention. Driven in large part by Intel's Atom platform, the low-power, ultra-portable formfactor has been responsible for sustaining both worldwide PC market growth and worldwide processor sales, and continues to climb the portable-PC shipment charts.

According to DisplaySearch, part of the NPD group, netbooks accounted for 22.5 percent of all global mobile PC shipments in the second quarter, representing an increase of 5.6 percent from a year ago, and leaping 17.8 percent over first-quarter 2009 numbers.

Indeed, netbooks are on pace to seriously challenge notebooks in the not-too-distant future, particularly in Europe, where they had a 32.9 percent share in the second quarter. Such strong growth presents a double-edged sword for both PC makers and Intel, all of which see lower profit margins with netbooks compared to traditional notebooks. **–PL**

Parallelism

After decades of fitful progress, parallel processing is suddenly hot and will soon be commonplace on ordinary PCs. For applications rich in data-level parallelism, performance is soaring by leaps and bounds.

Multicore CPUs from Intel and AMD are all good, but the game-changers are the next-gen GPUs from Nvidia and AMD/ATI. These chips are evolving from highly specialized 3D-graphics processors for games into broader computing engines for nongame software. Nvidia is leading the charge with a new GPU architecture that, for the first time, supports general-purpose computing as strongly as it supports graphics.

Nvidia's new Fermi GPUs will support error-correction codes (ECC), one terabyte of memory, concurrent kernels, and faster double-precision floating-point math. These features are largely unnecessary for 3D graphics but vital for high-performance general-purpose computing. (In fact, ECC slows down graphics processing, which is why it can be disabled in Fermi chips sold for the consumer market.)

With Nvidia's CUDA development tools, programmers are accelerating some tedious media-processing tasks, such as video transcoding. CUDA uses the GPU's programmable 3D-graphics shaders as massively parallel processor cores, delivering performance that today's PC processors can't match. In addition, GPUs are finding new applications in scientific computing, financial analysis, medical imaging, energy exploration, and engineering.

Other developments are equally exciting. Microsoft's DirectCompute brings a parallel-processing API to millions of mainstream PCs running Vista and Windows 7. The new OpenCL standard makes parallel programming easier and less proprietary. Apple's Snow Leopard (Mac OS X 10.6) supports OpenCL and Apple's Grand Central Dispatch technology (now open source), allowing programmers to distribute workloads across multicore CPUs and GPUs.

Intel is busy, too. With its own new GPU (Larrabee) on the way, Intel has acquired two small companies specializing in software tools for parallel programming—RapidMind and Cilk Arts. RapidMind is especially cool, because its software bridges GPUs, multicore x86 processors, and even IBM's Cell Broadband Engine.

Parallel processing is spreading to the masses, and parallel-programming tools are catching up with parallel-processing hardware. When these trend lines finally converge, we'll wonder why it took so long.

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

DRAM Prices on the Rise

It's only a matter time before you'll no longer be able to buy DRAM with the loose change in your pocket, according to new data by DRAMeXchange.

As it currently stands, 1Gb of DDR2 runs $1.53 while 1Gb of DDR3 costs $1.66. That doesn't sound like much (and it isn't), but those prices represent increases of 8.5 percent and 5.1 percent, respectively.

Meanwhile, contract prices for 2GB DDR2 and 2GB DDR3 sticks have shot up to $27.50 and $29.50, respectively, in just the first half of September.

So, if you've been eying a memory upgrade, you may want to bite the bullet rather than continue to play Russian Roulette with market prices. –PL

IRS Tracks Deadbeats Online

Social networking sites like Facebook, MySpace, and Twitter are proving to be useful tools for the IRS.

Scouring through posted information such as relocation announcements, professional profiles, and news of financial gains, agents with the IRS have been able to collect all sorts of bucks from would-be tax dodgers. One Nebraska agent was able to collect $2,000 from a disc jockey after he advertised on MySpace that he'd be working at a big public party. Another agent collected $30,000 of unpaid taxes after a Google search led him directly to his target.

With so many people now sharing information online, the web has become a far more efficient means of investigation than the tactics previously used by agents, such as reading the local newspaper or making inquiries at local businesses or churches. –AS

The Future of Search

In an interview with TechCrunch.com, Google CEO Eric Schmidt shared an idea he and cofounder Sergey Brin have talked about internally: direct brain implants.

Say what?

Naturally, the two aren't completely serious about wiring Google's search technology to your brain, but, according to Schmidt, Google is striving to better understand search queries so it can spit out more relevant results. For example, rather than return a list of sites for a question like "What percentage of Americans have passports?", Google would read the appropriate site, summarize it, and answer the question directly.

With Microsoft positioning Bing as a decision engine, the search wars look to get very interesting in the coming years. –PL

GAME THEORY

Offer I Can Refuse

Facebook is the answer to a question no one asked: "How can I waste more of my time?" Compared to social network gaming, however, Facebook itself is as useful an invention as the cell phone.

Actually, I do like Facebook. I've used it to reconnect with dozens of people I used to know. Two of them are even people I like. A year after I first joined Facebook for the sole purpose of sharing pictures of a new puppy, I find myself updating my status, making comments, and listing things like the "Five TV Characters I Wish Were Real So We Could Hang." (Dr. McCoy, Emma Peel, Hurley Reyes, Simon Templar, and Gomez Addams: another answer to a question no one ever asked sober or outside of a college dorm.)

I used Facebook for a year before I caved in and tried any social gaming. It held no appeal at all. I ignored the messages from friends asking me to join their Mafia, become part of their vampire clan, move in next door to their rutabaga farm, or contribute to efforts to elect Ron Paul president. (Oh, you mean *they were serious* about the Ron Paul thing?)

Since I'm Jersey born and bred, Mafia Wars seemed like the right fit. It's actually an elegant little piece of work: a role-playing game stripped down to pure stats and wrapped in a simple graphical interface. It has a balanced risk/reward system and a satisfying initial arc driven by leveling, establishing and expanding an income stream, and accumulating bits of stuff.

But it loses steam rather quickly. The leveling cycle becomes rote, and the game reaches a point where risk vanishes, rendering the rewards hollow. It's also an oddly unsocial social game, with minimal personal interaction.

Yet it retains one important appeal: It's undemanding. You can perform all of your duties for the day with a few clicks over the morning coffee, making it one of the most coldly efficient games I've ever seen. It's like we're even outsourcing our gameplay. That's really not what I'm looking for.

And, no, I don't want to join you mafia, but thanks for asking.

Thomas L. McDonald has been covering games for 17 years. He is an editor at large for *Games* Magazine.

The Ebook Economy

A deluge of digital readers are on the way

Amazon's Kindle may be the current king of the ebook reader hill, but its reign may soon be coming to an end. The only question is: Who presents the biggest threat to Amazon's lucrative business model? Some would say Sony, which recently announced plans to embrace the open EPUB format for its ebook store shortly after unveiling a pair of low-cost ebook readers, including the sub-$200 Reader Pocket Edition.

And then there's Asus, which turned the netbook hype into hysteria with its wildly popular Eee PC and will look to replicate that success in the ebook market. According to Asus president Jerry Shen, his company will market its upcoming digital reader under the Eee brand and shoot for the $150 price range. Combined with a full-color display, the EeeBook, or Eee-whatever, could be the next must-have device among trendy technophiles and penny-pinchers alike.

Sony's distribution model, open EPUB format support, and new low-cost readers pose a threat to Amazon.

Meanwhile, MSI, another major player in the netbook market, is rumored to also be mulling a digital reader of its own, but the company isn't saying much. Time, Inc. also sparked rumors of ebook plans when, in an internal presentation titled "New Platforms & Business Models for Publishers," the media conglomerate revealed it has been speaking with hardware, software, and content companies about "various projects."

An interesting side note to all of this is the impact an ebook explosion might have on Mother Nature. According to a study by the Cleantech Group, tree huggers have nothing to worry about; the carbon emissions from electronic books are significantly lower than traditional book publishing, and that includes the environmental impact of producing the hardware. –PL

STORAGE

WD Ships 640GB Notebook HDD

Western Digital has commenced volume shipments of its 2.5-inch WD Scorpio Blue 640GB hard drives for notebooks. The tiny drives pack 640GB into a single unit by way of 320GB-per-platter technology, making them the highest-capacity 2.5-inch hard drives in the industry-standard 9.5mm, two-platter formfactor yet available. MSRP is set at $150. –PL

BYTE RIGHTS

Show Business Blues

This may seem odd, but I'd like to recommend a movie this time. It's called *Sita Sings the Blues*. It's an animated retelling of the Hindu Ramayana interwoven with commentary about the story and the creator's real life troubles, set to the 1920s-era songs of Annette Hanshaw. I know, not what you were expecting, but trust me. It's in turns hilarious, lush, sad, and beautiful. It's worth your time, and it's free at Sitasingstheblues.com. Go ahead. The rest of the column will still be here when you're done.

See, wasn't that great?

Most talk of whether copyright is restricting free expression is theoretical, but for film makers like *Sita*'s Nina Paley it's a real and common problem. Paley read the Ramayana and discovered Hanshaw's jazz singing around the same time that she lost her relationship, and got inspired. It's often a bit of music or a shot with something in the background that gets indie filmmakers in trouble, but Paley was particularly stuck.

It's obvious when you see the film that Hanshaw's songs are vital. A different movie could have been made, but not *Sita Sings the Blues*. Hanshaw is older, but not public domain. Paley went ahead anyway, unsure how it would turn out. "If I kill my own art out of fear of them, then I've really lost," she told QuestionCopyright.org. Turned out she couldn't afford the rights. It could cost up to $200,000 to ever show *Sita* commercially.

So, more than $80,000 into making *Sita* with her own money, Paley Creative Commons licensed it and gave it away. As I write, the archive alone had 113,629 downloads, plus who knows how many on the torrents and from other sites. Paley also released the source files for *Sita* as well as posting it, and others have started to remix her scenes into new things, which she posts on her blog. She says her next project will be inspired by the copyright troubles in her life right now.

I know it's selfish, but I'm glad Paley ran into trouble. We got a great movie, and the copyright reformers got a great auteur on their side.

Quinn Norton writes about copyright for Wired News and other publications. Her work has ranged from legal journalism to the inner life of pirate organizations.

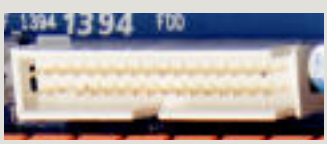
THE LIST

9 Legacy Technologies We Want to Kill

9 SCROLL LOCK It's like an appendix, except the appendix actually does something.

8 WEP This Officer Barbrady of security couldn't secure a paper bag.

7 FLOPPY PORT



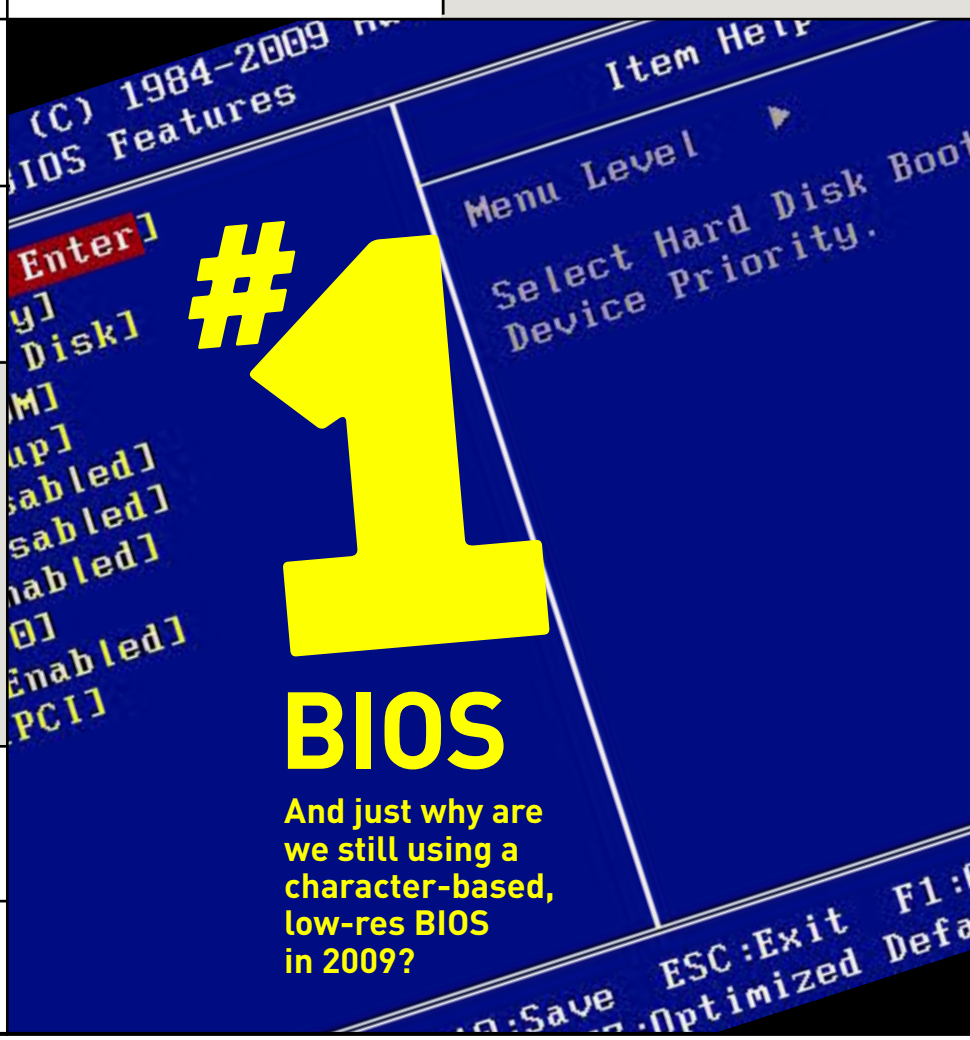
6 PS/2 Why must this continue to vex us?

5 VGA Take your analog, interference-inducing ass home.

4 PCI LOCAL BUS The party is over. The hosts are yawning. Can you *puh-lease* get a clue and leave?

3 IDE 100MB/s in the age of SATA says: Die, already!

2 FIREWIRE



#1 BIOS

And just why are we still using a character-based, low-res BIOS in 2009?

This month the Doctor tackles...

- Old Tech: BTX & AGP
- Resizing Partitions
- Mismatched Monitors

USB Slowdown

I recently reformatted my computer after a failure with an old Seagate 7200.11 1TB. Lately, though, I have been noticing problems with my USB ports. Whenever I connect my iPhone 3G, it is very hard for iTunes to recognize it and the popup tells me that the iPhone isn't plugged in to a high-speed port, even though all my USB ports should be 2.0. This has raised even bigger concerns about my other devices connected via USB.

My motherboard is an Asus P5Q-E. The CPU is an Intel Q6600. My initial thought is that an upgrade to my mobo's BIOS or other utilities might fix the problem, but I'm wary of undertaking such a feat without knowing for sure what the problem is, because I've heard updating the BIOS can be dangerous. If a BIOS update is necessary, what sorts of precautions should I take?

—Taylor Sabbag

The Doctor suspects the solution may be much simpler than you think. You're probably plugging your iPhone into your PC's front-panel USB connectors, as most of us do. Front-panel connectors tend to be flakier than your motherboard's onboard USB ports, because they're connected by cables rather than directly attached and many low-cost vendors use similarly low-cost cables. Our guess is that when you replaced your hard drive, you dislodged the front-panel USB connector from the motherboard. Power down and unplug your computer, then reseat the front-panel USB connectors on the motherboard. If it is a problem with the rear ports, the issue could be OS support (you are running at least Windows XP with SP1, right? SP1 added USB 2.0 support.) Besides making sure that you have at least SP1 installed (SP3 is recommended), you should also download and install the latest chipset drivers from either Asus.com or directly from Intel.com for the P45 chipset, which is used in that motherboard.

Finally, while the Doctor understands your fear of BIOS updates, it's quite painless and generally quite reliable these days. A BIOS update is unlikely to fix your problem, though.

Mismatched Monitors

I've got two monitors: a slightly older 24-inch Samsung SyncMaster 2443 BWX and a brand-new 22-inch Samsung SyncMaster 2233 RZ. I am attempting a dual-monitor setup for Illustrator/Photoshop purposes (as well as animation and other forms of graphic design) on a Radeon HD 4850 X2 with Catalyst 9.8 drivers. Out of the box the color representation couldn't be worse. The new monitor is extremely blue and the old one looks better, but is still a tad red. Nothing I do can get these monitors to look even remotely close. I've fussed with the built-in controls on both for a good hour, and nothing. I even used the calibration tool in Windows 7 and still can't get these monitors looking good. I'm sure that since they are different monitors, I can't get them "perfect," but they should at least have accurate enough colors for printing purposes.

—Joe

We wish we could suggest an easy DIY method for getting accurate color from your two monitors, but we've had the best success using Pantone's HueyPro color calibrator ($130, www.pantone.com). The nice thing about the Pro version is that it works for multi-monitor setups. You stick the USB calibrator to each screen and it measures the color temperatures and makes adjustments accordingly. Once adjusted, you can choose from a few different white-point profiles, which should help you find a good middle-ground between your warm and cool screens. If you don't want to shell out for a hardware calibrator, see the free alternatives we suggest on page 53.

A color calibrator like the Pantone HueyPro will help match your monitors' color temperatures, even if they're from different manufacturers.

Turn the Screws

I have a Thermaltake DuOrb CPU cooler and when I installed it, I tightened the screws until I felt some tension, but I'm not sure that was the right thing to do. I have a Q6600 CPU and the temp was

SUBMIT YOUR QUESTION Are flames shooting out of the back of your rig? First, grab a fire extinguisher and douse the flames. Once the pyrotechnic display has fizzled, email the doctor at doctor@maximumpc.com for advice on how to solve your technological woes.

34-36 C at 2.4GHz (stock). I overclocked my CPU to 2.8GHz and the temp went up to 38-42 C (idle). If I overclock to 3.0GHz the CPU gets too hot—55-65 C idle. Is there a proper way to tighten a CPU cooler for optimal performance?

—Sam Torres

A properly mounted CPU cooler can mean the difference between a cool, fast machine and an overheating, crashing mess. CPU coolers require as much contact with the CPU as possible for maximum heat transference. That's why you should always use thermal grease (or paste) between the CPU and cooler—it fills in the little bumps and valleys on the surface of the CPU and heatsink to ensure maximum heat transference.

You should follow the instructions in the DuOrb's installation manual, tightening the screws as much as the manufacturer recommends to ensure a snug fit. We always tighten screws using a crisscrossing pattern, similar to how you tighten the lug nuts on a car's wheel. Start with one corner, then tighten the opposite corner a bit. Then tighten the other two corners a bit, and then go back to the first corner and repeat the pattern again.

Your high temps—which aren't actually that high for an overclocked Q6600—could be related to poor contact between the CPU and heatsink (not tight enough or just off kilter), an improper amount of thermal paste (too much or too little), or too much core voltage for your overclock. And remember, not every CPU overclocks perfectly; it's possible you have a Q6600 that just doesn't like to clock up without the heat.

64-Bit Partition Resizer?

I just got a new computer (64-bit Vista) with a 1TB hard drive. It has only one partition, the factory image. Is there any way to add another partition to this drive without installing Windows again?

—Kevin

Though there are plenty of free partition managers for 32-bit versions of Windows (we prefer Easeus Partition Master), 64-bit owners have fewer third-party options. Fortunately, Kevin, you've got a built-in tool in Vista that will do the trick nicely.

First, defragment your drive to maximize the amount you'll be able to shrink it. Then, go to your Start menu and type Disk Management into the search box (alternately, you can get there via Control Panel > Administrative Tools > Computer Management > Disk Management). Click Storage, then find your drive in the list. Right-click your 1TB partition and select Shrink Partition. Disk Management will calculate how much your disk can be shrunk, and then you can choose how small you want to make it. It's a good idea to leave some extra space on the C: drive, though. Once Windows has shrunk the partition, right-click the empty space in the drive (in the Disk Management window) and click Create Partition. Presto!

The Missing Keys

I bought two laptops for my two granddaughters about a year and a half ago. Now both have missing keys. Is there a way to purchase replacement keys, or do I need to buy a whole new keyboard? These two laptops are both Compaqs sold by HP. If I give HP the model number can I get a kit with all the key caps and a procedure for installation?

—Bill Calkins

Key replacement will vary based on the keyboard type used in the notebook. Some keys can be replaced by pressing replacements into the socket; others, however, once broken, cannot be easily repaired. In that case, the best way to repair them is to buy a new keyboard. The HP Parts Store (http://bit.ly/2bQhQv) carries replacement keyboards for $30–$60. Obviously, prices vary greatly, but a new keyboard for a notebook on eBay can fetch from $20 to $100 or more depending on the model and make. Switching the keyboard is usually a pretty painless affair, so long as you can locate the service manual for your notebook. You can find Compaq service manuals at HP's Customer Care site.

GOOGLE GAVE ME THE BASICS ON TRIM, BUT HOW IMPORTANT IS IT, REALLY?

SSDs with TRIM Support

I'm looking to get a new SSD for my laptop when Windows 7 comes out, and I just read a review on Newegg warning about a drive not supporting Win7's TRIM feature. A Google search gave me the basics on TRIM, but how important is it, really? I'm having trouble finding which drives support it and am wondering if I should wait before pulling the trigger.

I use my laptop for home and work, so I'd really like to do a clean install on a new drive (for restoration purposes when I really screw something up) and it seems like a perfect time to make the switch. I'm also moving from 32-bit Vista to 64-bit Windows 7, so—as I understand it—I need to wipe regardless.

—Steve Wale

Think of TRIM as a garbage collector for your SSD. Normally, when you delete data on a disk, whether SSD or standard magnetic hard drive, the data isn't immediately scrubbed. Instead, it's marked as overwriteable, so when the disk runs out of fresh blocks to write to, it goes back and writes over deleted files. But given the way SSDs store data, this can decrease your drive's perfor-

mance once there are no more fresh blocks to write to. To write data to a block, an SSD first has to copy the entire block to cache, wipe it, delete the overwriteable sectors in cache, write in the new data (in cache), and rewrite the entire block to the disk. This can lead to slowdowns. Essentially, TRIM scrubs blocks of deleted data when it's deleted, and makes sure the disk controller knows they're blank, speeding up the whole process and making sure your drive's performance doesn't degrade over time.

At press time, only a few SSDs have TRIM support (including the OCZ Vertex and Patriot Torqx) but several ship with wiper.exe, a TRIM-like command that helps restore performance. We expect more SSD vendors to release TRIM in firmware upgrades as Windows 7 gets closer to release.

AGP Aperture Size

I am currently running a semi-old computer: a 3GHz Pentium 4 on an Asus P4C800-E with an AGP expansion slot. It has 4GB of PC3200 DDR, a 500GB hard drive, and a BFG GeForce 7800 GC 265MB videocard on the AGP slot.

I'm getting ready to upgrade to a newer AGP card: the HIS Radeon 4670 1GB, to be exact. What size should I set my AGP aperture to? I know the basic concept behind the tech—the aperture sets the maximum size of system memory that can be used for an additional frame buffer by the videocard. So if I'm moving to a card with more GDDR, should I set the aperture smaller or larger?

—Bill Walker

Bill, in the Olden Days, AGP aperture let you use system resources for video memory if you were running out of videocard RAM, and the common advice was to set your aperture size to half your available system memory.

Newer videocards, however, have much more memory than earlier models. With 1GB of GDDR on your new card, you should be fine with an aperture of 64MB to 128MB. You might want to try running 3DMark with varying aperture sizes to see where your system performs best. It could be as low as 16MB; it probably won't be higher than 64MB.

We should mention, however, that most of our editors advise against spending any more money on an AGP system. We'd suggest saving the $130 or so that that card will run you and putting it toward a new machine; $600 will build a significantly faster rig.

BTX Hair Dryer

I built a home theater PC from scratch a while back. It has an Intel D945GCZLR motherboard with a Pentium D 925, a passively cooled GeForce 6600, and an Avermedia PCI-e Combo TV Tuner, all inside an Evercase ECE1341 case. I went with the best BTX CPU cooler I could find: the Thermaltake CL-P0191. This thing sounds like a lawn mower.

Even with plenty of airflow into the case and plenty of room in every direction on my entertainment system, the cooler is far louder than the 14-28dBA its marketing materials claim. I have already replaced the cooler's fan once, but the new one was just as loud.

What can I do to quiet this thing down? Would upgrading to a cooler Core 2 Duo or Quad make a difference? What about upgrading to an actively cooled GPU? Even stock ATX coolers are cooler than this thing—can I just use one of those?

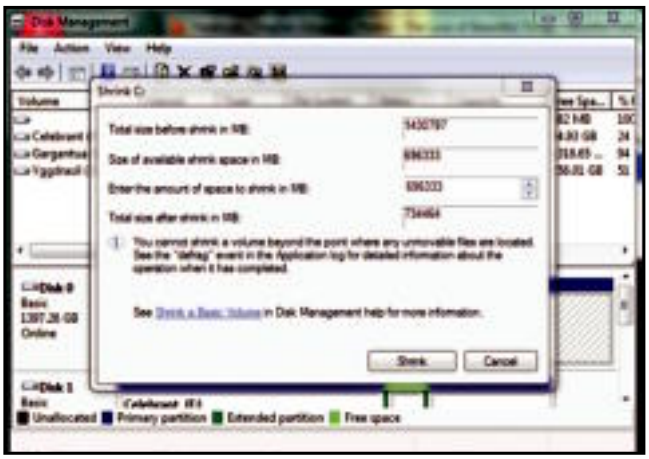
—Frank Durocher

Frank, your motherboard doesn't support Core 2 CPUs, and you can't just mount an ATX CPU cooler on there, either. Oh, and nobody makes BTX CPU coolers anymore, though you can still find old ones online.

The Doctor thinks your best bet is to replace the 9.2cm fan on your Thermaltake CL-P0191 with a quieter one. Noctua makes a quiet 9.2cm fan that should do well, but beware: It puts out about 30CFM, roughly half what the stock fan puts out. If your current fan rarely goes above half-speed, you might be OK, but those old Pentium Ds put out a ton of heat, so you should test the new fan thoroughly to make sure it can handle your processor.

Upgrading your graphics card to one with a fan might help cool your case, but there's a reason they have fans: They heat up. We're not convinced that the added airflow would compensate for the greater heat output.

Ultimately, you'll probably want to move away from BTX. A low-power Core 2 or Phenom in a mini-ITX or micro-ATX board with a PCI-e slot will run cooler and quieter, and with a smaller footprint. And unlike BTX, both specs are in wide use.



The Disk Management tool in Windows 7 and Vista lets you resize and add partitions.

Make Windows Soar

Improve your OS with these outstanding tips, tricks, and hacks that turbocharge XP, Vista, and even Windows 7

BY THE MAXIMUM PC STAFF

That stock Windows install may be OK for your mom, but is it good enough for you? Never! You deserve a Windows that soars above the clouds, swift and strong. That's why we collected our team of Windows experts and spent countless hours mucking around in the registry, downloading little-known tools, and searching for new keyboard shortcuts to bring you this, our finest Windows tips guide of all time.

Dig it: First, we show you the right way to install Windows 7 and tell you exactly what you should do the moment your install completes. Then, on page 26, you'll find the definitive list of kick-ass, *Maximum PC*–approved tips and tweaks for Windows, whether you run XP, Vista, or Windows 7. While some are specific to Microsoft's latest OS (you've upgraded, right?), many will work on XP and Vista, as well. Finally, we wrap up on page 33 with a list of five applications we think should be installed on every single Windows machine—heck, we think Microsoft should just integrate these handy tools in the OS!

So sit back, relax, and get ready to make Windows better.

PHOTOGRAPHY BY MARK MADEO

Windows 7 Install Guide

How to get Microsoft's new OS up and running on your rig

1 Back Up Your PC

Before beginning a new OS installation, it's crucial that you back up your documents and media—after all, we recommend a clean install to minimize cruft and maximize performance. The safest, easiest way to do this is to buy a new hard disk and replace your old one. With speedy 1TB drives around $100, it's never a bad time to upgrade your storage, and using a clean drive to install your OS means all your files are already backed up; just connect your old hard drive when you're done and transfer over what you need. If you've updated recently, or don't want to spend the cash, you'll want to make sure to back up the files you need to a different partition or physical drive. The most important place to look for files is in your user profile directory, which contains your Documents, Desktop, Pictures, and Application Data folders. We generally recommend backing up the entire C:/Users/<your user name> path. Remember to grab any needed program data or game saves from your Program Files folder, and also make sure to grab any other important directories you've created on the disk that are outside these standard paths, such as C:/Download.

2 Start the Installer

Microsoft has made installing Windows 7 simpler than with any previous version of Windows. You just drop the DVD in the tray, and restart your system. At some point during the boot, you'll be given the option to "Press any key to boot from CD/DVD," or something along those lines—do so. (If you don't get this option, go into the BIOS and move the DVD drive ahead of the hard drive in the boot order). Windows will load files from the disk for a moment, then the installer will launch. Select your language preferences, then click Install Now. Accept the Windows license agreement and choose to do a Custom install. Now, select the system partition you want to install to. (If you're installing onto a new drive, you may need to create a partition by pressing the New button). If you're installing over an old partition, it's a good idea to format it to remove the remnants of the old OS before you install Win7. **WARNING:** Formatting removes all data from a drive, so make sure you've backed up everything. This is the point of no return. That's all Windows 7 needs to know, so go make yourself a sandwich while your new OS is installed.

3 Finish the Install

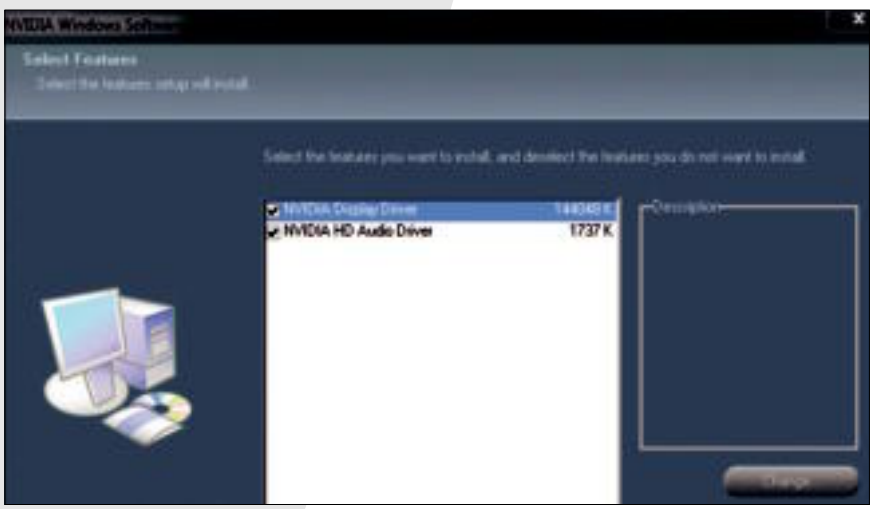
Once the install is complete, you'll be asked for a user name and computer name. We generally recommend using a more creative name than "PC" or "Laptop" for your computer name, to make networking easier. You'll be given the option to create a password for your account, but you can skip this if you want to. You'll then be asked for your activation key, although you can skip this step as well—Windows 7 will run for 30 days without a key or activation. Next, you'll be prompted to choose Windows update settings; we recommend "Use recommended settings." Set the clock and choose your time zone, and you're ready to start using your new system.

Post-Install Guide

It's time to get your new OS in order

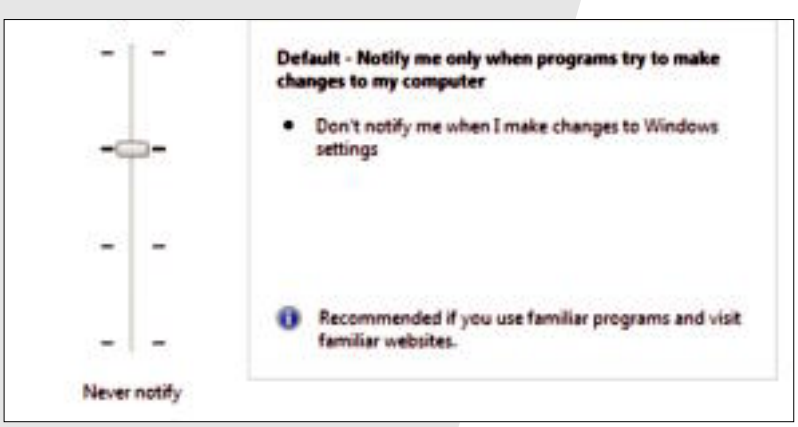
1 Install Drivers

Windows Update does a pretty good job of automatically downloading and installing the drivers your system needs, but that doesn't mean you'll never need to manually download a driver again. We recommend that you start (as always) by installing your motherboard's chipset/NIC drivers. It's also worth it to manually install the latest drivers for your videocard. Even though Windows update will most likely find drivers for your GPU, it probably won't be the most up-to-date version available. Use Windows 7 drivers whenever they're available, but if they aren't, we've had good luck using Vista drivers on Windows 7.



2 Configure User Account Control Settings

In Vista, one of the first things you had to do with any install was disable UAC to prevent those incessant "Do you really want to install this?" prompts. Fortunately, Microsoft has tweaked the default UAC setting in Windows 7. Now, it strikes an excellent balance of keeping you safe with minimal annoyance, popping up alerts only when programs attempt to install software or alter your settings. If you want a higher level of security, you can open the UAC manager (in the control panel under Security) and raise the UAC to the maximum level, which is similar to Vista mode and will trigger an alert for pretty much anything. Alternately, you can disable notifications entirely by setting UAC to its lowest setting.



3 Restore Your Data

If you took our advice and started with a fresh hard drive, all you'll have to do to restore your old data is connect your old HDD to a secondary SATA port and transfer over all your old files. Copy over all the important data we mentioned earlier, but be sure not to simply copy your old user profile directory over to your new one. Instead, fish out all the documents and media you need, remembering to collect important files from the hidden AppData folder, which usually includes your browser profiles and Outlook data.

On with the Windows Tips

Don't have Windows 7? Never fear, we've got a boatload of tips for XP and Vista users. Psst, most work in Win7, too!

SEARCH NETWORK SHARES

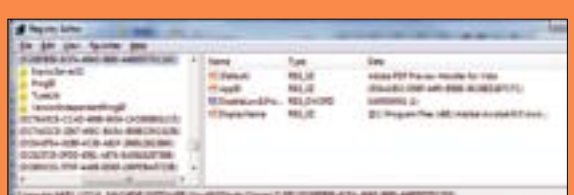
Searching network shares is easy, if you have access to the machine that's hosting those shares. Installing Windows Desktop Search 4.0 on a Windows machine that supports it will make any shares hosted on that machine searchable by the user. That applies to XP, Vista, and Home Server. If you want to search non-Windows network shares, you'll need to install a third-party tool, such as Copernic Desktop Search Professional ($50, www.copernic.com).

'Run As' a Different User

This tip is a little bit of a cheat, since it's not something totally new to Windows 7, but actually a feature that existed in Windows XP, was removed in Vista, then reintroduced in Microsoft's latest OS. To run a program as a different user, with access to that user's settings and documents, hold shift and right-click an executable, then choose Run as Different User.

Make 64-bit Windows Handle PDF Previews Properly

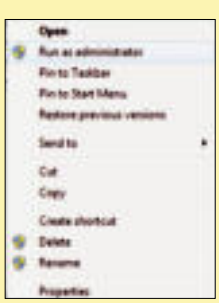
PDF previews have been a perennial hassle to get working properly in 64-bit Windows, but luckily, it's easy to fix that. Open Regedit and go to HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Classes\CLSID\{DC6EFB56-9CFA-464D-8880-44885D7DC193}, where you should see an existing AppID value. Change that to {534A1E02-D58F-44f0-B58B-36CBED287C7C} and reboot. Then Windows (and Outlook) will properly display PDF previews.



Make 64-bit Windows Show Photoshop Previews

On the subject of proper preview-handling, files associated with Photoshop typically don't show up in 64-bit Windows. We're talking about PSDs, TIFFs, and TGAs, for the most part, but there are some other, even more esoteric formats that are omitted by default. Luckily, there's a little utility called MysticThumbs (donateware, http://bit.ly/3EtfPk) that fixes the problem. Install it, reboot, and bask in the glory of the thumbnail preview revolution.

Run Programs as an Administrator



In Windows XP and later, some operations—such as those that change core system or user account settings—can only be performed by the Administrator account. However, it's bad form to run using the Administrator account all the time. You can use the Run as Administrator function to get the privileges you need, when you need them, without constantly switching user accounts. In Windows XP, right-click a program and choose Run As. In Vista or 7 just right-click an executable and choose Run as Administrator.

Use Shadow Explorer to Save Your Bacon

The low-rent versions of Vista don't allow you to go back in time for older versions of files the way Ultimate does. Fortunately, although Microsoft disabled your access to the shadow copy feature, it didn't actually remove it. The OS is always secretly making backups, you just can't access them. To get around this, use the free Shadow Explorer from Shadowexplorer.com to reach back in time for that tax return from two months ago.

Got another amazing Windows tip? Send it to comments@maximumpc.com and we'll print the best ones in an upcoming issue of **Maximum PC***!*

MAKE WINDOWS KEEP CUSTOM FOLDER VIEW SETTINGS

Windows will often assume certain folders contain photos or music—even if they don't—and change your folder view options. You can overwrite Windows' view preferences by setting a custom default view. Open any folder containing files, access the Properties menu, and head to the Customize tab. Under folder templates, select Documents to change back to the default view. Next, right-click within the folder again and change the View option to Details. You can add, remove, or change the order of the Details categories shown by right-clicking the category labels and choosing the More... option. Once you have a Details setting to your liking, make this the standard view for all folders by going to the Folder Options menu under Tools, the View tab, and then clicking Apply to All Folders.

MASTER YOUR FILE SYSTEM WITH SYMBOLIC LINKS

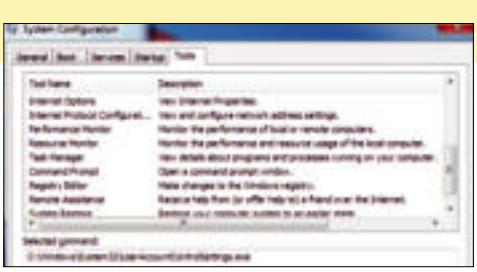
Symbolic links allow you create a sort of "super shortcut"—a folder that exists in two places in the file system at once. Why is this useful? Because it means the file system is finally totally under your control. A game doesn't let you choose where you store save files? Replace the default directory with a symbolic link to whatever location you want. Learn how to set up symbolic links, and how to use them with Dropbox to take all your apps online at MaximumPC.com (http://bit.ly/173G06).

Create a Custom Keyboard Shortcut to Launch Any Program

To avoid cluttering up your Desktop with shortcut icons, you can assign unique keyboard shortcuts to any application (or even document). First, you'll need to create a normal shortcut to your target program if one doesn't exist already. Right-click the executable and click Create Shortcut. Next, right-click the new shortcut file and select Properties. Type your desired keyboard shortcut in the Shortcut key field. The keyboard shortcut has to either be prefaced with "Ctrl+Alt" or you can assign it to a key on the numpad. This shortcut will work on your Desktop, while you're in Windows Explorer, and even if you're in other programs.

Use msconfig to See What's Running on Your PC

One of the handiest tools for keeping your computer booting and running smoothly is the System Configuration client. With it, you can view and edit the list of programs and services that start with your computer (including the hidden ones), as well as access a list of useful tools for administering your system. You can find it three layers deep in the control panel, or you can open the Run dialogue and type msconfig.

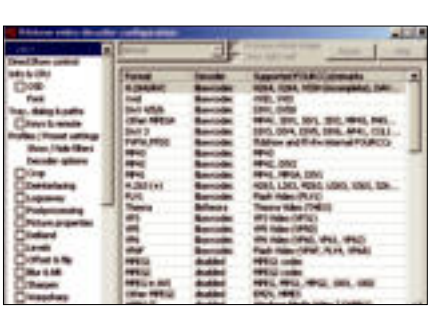


Open a Command Line in Any Folder

The days of typing long folder addresses in Command Prompt are over, at least if you run Vista or Windows 7. Rather than opening a command prompt and typing cd Desktop\Cat Pictures\Cats on a Skateboard\Two Cats One Skateboard\, just Shift+right-click to add "open command line here" to your right-click context menu.

Supercharge Windows Media Player with FFDShow Tryouts

While some editions of Windows 7 come preinstalled with Divx and H.264 video codecs, Vista and XP users who use Windows Media Player are stuck with limited playback support. To play more than just WMV-encoded files, download FFDShow Tryouts (http://bit.ly/1xKDVP), an all-inclusive DirectShow filter that plays an expansive range of video and audio codecs, along with robust configuration options.



Windows 7 Secrets Unveiled!

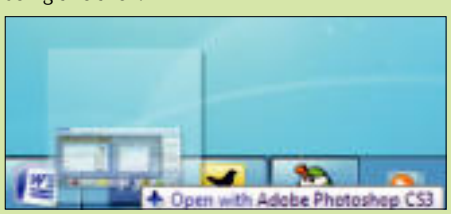
As good as it is, Windows 7 can be made even better with these nifty tricks

Supercharge Your PC with HomeGroups

HomeGroups make it really easy to share files and printers between your computers, but unfortunately you can only connect to a HomeGroup if you're using Windows 7. Set up your HomeGroup in the networking control panel, then your music, photos, video, and documents will all be shared with other machines in the HomeGroup. If you want to share individual files you can by right-clicking them, and choosing the appropriate option from the Share With menu.

Launch Apps By Dragging Files to the Taskbar

We've already talked about pinning frequently used files to the Taskbar, but what if you want to open a file in a particular application by drag-and-dropping it in on the Taskbar icon OS X–style? All you need to do is hold down Shift when you drop the file on the Taskbar icon. You can even open files with applications that aren't associated with that particular file type using this trick!



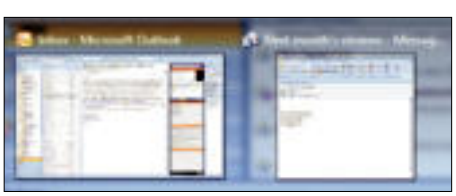
Using Libraries

Libraries are virtual folders that let you collect similar files in one handy location. Windows 7 ships with several default Libraries for music, photos, and documents, but you can supercharge them by adding additional files and directories. For example, we add commonly used network shares to the documents Library. The machine hosting the share will need to have Windows Desktop Search 4.0 or higher running on it, or you'll need to right-click on the folder you want to add and select Always Available Offline.

HARNESS THE POWER OF THE JUMP LIST

Jump lists are another new Windows 7 feature. You can use them to keep shortcuts to commonly used files—not apps—easily accessible, one click away from the shortcut you use to launch the app. To add a file to a Jump List, all you need to do is drag it onto the appropriate app's Taskbar icon. To access the Jump Lists you can right-click any Taskbar shortcut, once you (or the app) have added items.

Use Keyboard Shortcuts to Launch Apps



With the new Windows 7 Taskbar comes a whole host of new keyboard shortcuts. You've probably heard of the Windows key + 1–0 shortcuts, which launch the apps on your taskbar (if they're closed) or bring them to focus (if they're running), but there are some other kick-ass hotkeys as well. Win+T cycles through all the Taskbar apps. Win+Shift+right arrow and Win+Shift+left arrow let you move the currently focused window from monitor to monitor. Finally, Win+Space gives you a quick look at the Desktop.

Three Reasons Why Mouse Gestures Are Your Friend

We love having the option to activate core UI tasks using mouse gestures in Firefox, and now Window 7 adds a handful of gestures for window management. Grab a window and drag it to the top of the screen to maximize it, drag it to either side to make it fill half the screen, or shake the window to minimize everything else. Finally, you can access an application's Jump List by clicking on its Taskbar icon and dragging up. That's just dandy!

EASILY CHECK YOUR PC FOR WINDOWS XP MODE SUPPORT

Don't know if your PC has what it takes to support Win7's Windows XP mode? Besides needing Win7 Pro, Ultimate, or Enterprise, you'll also need a CPU with hardware virtualization support. To query your system, download Steve Gibson's free utility Securable at http://bit.ly/3cS9M. Once you've downloaded it, fire it up and it will tell you if your CPU supports 64-bit or not, if hardware DEP is supported, and if hardware virtualization is in the proc.

Access the True Power of the Windows 7 Calculator

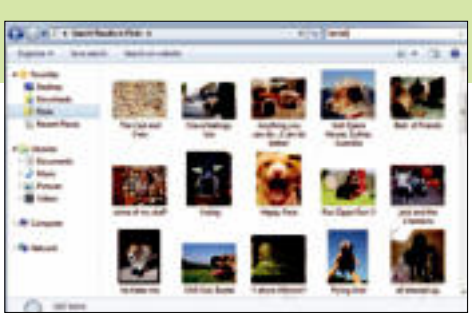
With Windows 7, a couple of the old staples like Paint, Notepad, and Calculator have gotten a graphical facelift. With the calculator, though, the improvements go beyond skin deep. In addition to the standard arithmetic calculator, Windows 7 brings Statistics, Scientific, and Programmer modes to the calculator, along with specialized functions for calculating fuel economy, leases, and even your mortgage. Does the calculator still look like it always did to you? Check out the View menu—that's where all the goodies are hidden.

Order Win7 to Generate an Energy Report

Windows 7 adds functionality to powercfg.exe to help you better analyze power consumption issues on your PC. To create a report, spawn a command-line box with administrator privileges. To do this, press the Windows key, and type cmd in the search box. Right-click on cmd and select Run as Administrator. Now select the box and type `powercfg -energy`. Powercfg will run for about 60 seconds, then generate a report called energy-report.html in C:\Windows\system32. This report will notify you of anything in your computer that is keeping the CPU turning, which in turn means burning more power and sucking down more battery life. For example, if you want to save power, don't run Sidebar gadgets. From the runs we've tested, most of the problems are due to USB devices that don't properly shut-off to save power. While you might think the power consumption of a USB doohickey is pretty insignificant, if it prevents the CPU or south bridge from switching off, a trickle of power can add up to a significant hit where it hurts—your battery life. The energy report won't fix the problem, but it's a great tool to help you get started.

Add Websites to Native Windows Search

New to Windows 7 is Search Federation, which allows Windows 7 to add remote sources of documents (such as Flickr or YouTube) to Windows' native search interface. Simply find an .odsx "connector" file for a service you want to search (Google "Windows 7 Flickr search connector," for instance), download and run it. The search will be added to your User > Searches directory.

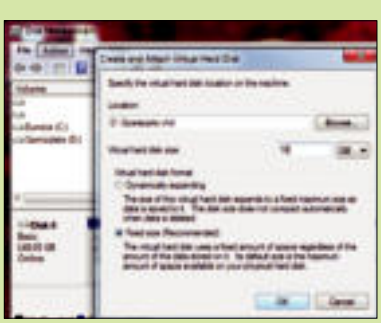


Make ISO Burning Simple and Fast

With Windows 7, Microsoft finally introduces native support for burning disc images. Just right-click an ISO file and select Burn Disc Image to bring up the Windows Disc Image Burner. It's pretty bare-bones, but how much chrome do you really need here?

MOUNT VIRTUAL HARD DRIVES WITH EASE

Got virtual machines? Now you can mount your virtual hard drive (.vhd file) and access it via Explorer just like you would any other drive, so you can pull data from it, or even transfer it easily between computers. Create, attach, and format VHDs from Disk Management. Just go to Disk Management, click a disk, and go to the Action menu, where you can create a new VHD or mount one from hard drive.

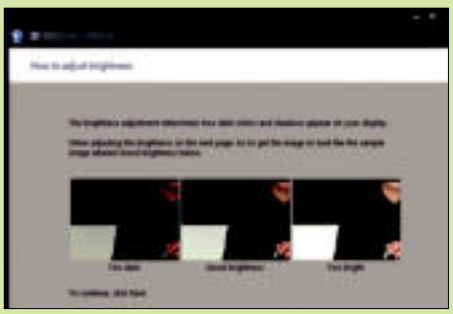


Easily Switch Between Displays with Win+P

Connecting your laptop to a projector or external monitor has never been easier. Just hook up the device to your computer, and hit Win+P. This brings up a display menu: You can choose to show your desktop on either the computer or the projector, duplicate your desktop on both, or extend it to the external monitor. It's perfect for playing movies or giving that all-important PowerPoint at work.

CALIBRATE YOUR SCREEN WITH DISPLAY COLOR WIZARD

Whether you're using a wall projector or small LCD, we recommend running the Display Color Calibration tool to optimize Windows 7's color rendering. Launch the app by typing dccw in the Start Menu. The wizard will run you through a series of steps where you can adjust the gamma, brightness, contrast, and color of the screen to make images look their best.



Change Windows Explorer's Default Launch Folder

By default, launching Windows Explorer (the shortcut for which is Win+E) takes you to the Libraries directory, but you may be more comfortable with My Computer as the starting node, especially if you want to browse multiple hard drives or network drives. To change the launch folder, access Windows Explorer by typing explorer in the Start Menu search field, right-clicking the first result, and selecting Properties. Under the Shortcut tab, change the Target field to %SystemRoot%\explorer.exe /root,::{20D04FE0-3AEA-1069-A2D8-08002B30309D}

Create a Wallpaper Slide Show from RSS

Windows 7 supports creating wallpaper slide shows via RSS, but it's hardly simple. Go to C:\Windows\Resources\Themes and make a copy of one of the themes (we picked aero.theme) to your Desktop. Open it in Notepad and add the following code to the file:

```
[slideshow]
Interval=1800000
Shuffle=1
RssFeed=(your RSS feed goes here)
```

Then save it, and double-click to install your theme. Only RSS feeds that include images as enclosure items will work.

Search the Internet from the Start Menu

The search prompt in the Start Menu normally finds files only on your computer, but you can enable it to launch your default browser to search the Internet. Open the Group Policy Editor by running gpedit.msc in the Start Menu. Go to User Configuration/Administrative Templates/Start Menu and Taskbar. Right-click the "Add Search Internet link to Start Menu" setting and set it to Enable. Unfortunately, this works only on versions of Windows that include the Group Policy Editor, so Home Premium users are out of luck.

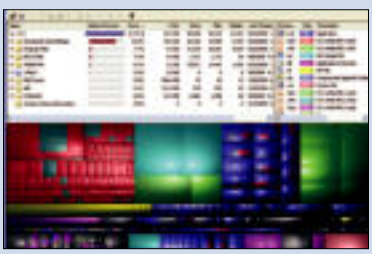
Bring Back the Vista-Style Taskbar

If you prefer Vista's Taskbar to Windows 7's, you can bring it back. Right-click the Taskbar and select Properties. Check the "Use small icons" box and select the "Combine when taskbar is full" option under the Taskbar Buttons drop menu. Launched programs will now display their full names in the Taskbar, and multiple instances of a program won't group into one icon until the Taskbar is full. You can also bring back the Quick Launch toolbar by adding a new toolbar with the following string: %userprofile%\AppData\Roaming\Microsoft\Internet Explorer\Quick Launch

Five Free Utilities that Should be Included in Windows

C'mon, Microsoft, save us some time and just fold these must-haves into the OS

5 4 3 2 1

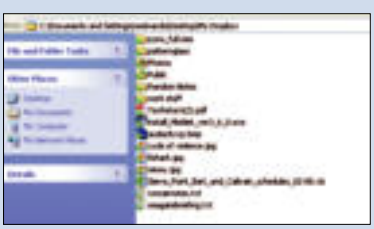


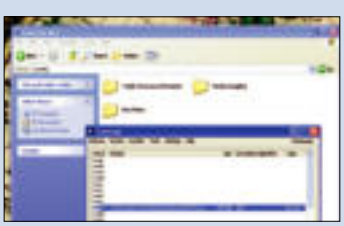
WINDIRSTAT

WinDirStat (http://windirstat.info) creates a graphical representation of the files on your hard drive. Bigger blocks represent larger files, and the different colors equate to different file types. What does this mean? WinDirStat is essential for figuring out why your hard drive is full. Clicking a block takes you to its location in the file tree, allowing for easy cleanup. Intuitive navigation and easy "open in Explorer" options make this a must-have.

DROPBOX

What if you could drag any file to a folder on your computer, and a magical app immediately syncs that file to every machine you own? What if that magical app also made up to five older versions of those files available via a web interface? Dropbox (www.getdropbox.com) does both of those things, and it has the added bonus of being cross-platform and free for up to 2GB of storage, with more storage available for fees between $8/month and $20/month.



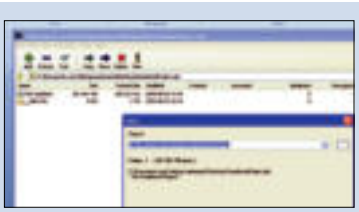


TRUECRYPT

Windows Ultimate and Enterprise editions have BitLocker for encrypting volumes, but what about other editions of the OS? TrueCrypt (www.truecrypt.org) can hide a virtual partition inside a file, encrypt entire disks (even boot disks), and even create a hidden volume within another TrueCrypt volume. Real-time encryption works entirely in RAM without slowing down your system. Plus, it's portable and uses AES-256 (and stronger) encryption. Why pay for something that does less when you can get TrueCrypt for free?

7-ZIP

Windows' Compressed Folders Extraction Wizard is so last century. Instead, we wish Microsoft would package something as useful as 7-Zip (www.7-zip.org), which can unpack practically any compression format, from TGZ to RAR. It even opens image files, including ISO and UDF. It also creates encrypted and self-extracting ZIP archives, and includes a command-line version for scripting wizards.



SECUNIA PSI

Hackers and malware writers routinely discover new security flaws in software. Most companies are quick to update their programs to close the loop, but users aren't always quick to install these updates. The Conficker worm spread through a Java exploit that had been patched long before, but millions of users with out-of-date software were affected. Secunia (http://secunia.com) shows your unpatched and exploitable programs so you can get them up to date. If Microsoft cares about security, it should include the same functionality in Windows.

Speed, thy name is Radeon

Killer performance you can actually afford

BY LOYD CASE

AMD's graphics division loves a good surprise. The company has been a perennial also-ran in the graphics performance arena, but every now and then, it one-ups the competition in a big way. That happened back in 2002 with the launch of the original Radeon 9700, which stole the performance lead from archrival Nvidia. It happened again last year with the Radeon HD 4800 series. The 4850, 4870, and 4890 weren't always faster than the competition, but they were small, efficient chips that forced Nvidia into a price war that was good for users but bad for Nvidia's bottom line.

Now AMD's doing it again, putting serious hurt on the competition with the first GPU to support Microsoft's upcoming DirectX 11 API. AMD's also been paying close attention to the emerging market for non-gaming apps accelerated by GPUs, such as video transcoding and digital photography, fully supporting DirectCompute 11 and OpenCL standards for general-purpose computing on graphics cards.

This new chip is no shrinking violet in the numbers department. The new 5870's spec sheet is staggering: 2.15 billion transistors, 2.7 trillion floating-point operations a second, more than 20 gigapixels-per-second throughput, and 1,600 shader units. Other numbers impress because of their smallness. One example: The idle power is a scant 27W—lower than many entry-level GPUs.

Given the sheer scale and ambition of this GPU, does it deliver in the performance realm? And will it deliver at a price normal humans can afford? Let's find out.

Digging into the Radeon HD 5870

At its core is a no-compromise GPU more efficient than any in graphics history

Two years ago, AMD's ATI division decided to bow out of the game of building huge, hot chips that were expensive to make, ceding the high-end glory to Nvidia's GT200 chip. That's not to say AMD gave up on performance; it instead adopted the goal of building the best performance GPU within a certain cost and power envelope. The Radeon HD 5800 series, originally code-named RV870, is the fruit of that approach. Taking advantage of Moore's Law, ATI's designers were able to build a GPU with few compromises using a 40nm manufacturing process.

POWER AND PERFORMANCE

The new GPU is just 334mm^2—30 percent larger than the earlier 4870 GPU, but packing more than twice the number of transistors.

At 27W, the idle power is astonishingly low for such a large chip. The key factor was enabling lower memory clocks and voltages during idle, a feat made possible because of significant improvements in the 40nm manufacturing process. The net result is very low power when the board is just rendering your Windows desktop. At the same time, the VRM (voltage regulator module) interface has been improved, preventing overheating while allowing somewhat higher power consumption when performance is actually needed.

So, the HD 5870 can draw less power while it's doing nothing. But we also expect to see better performance, particularly given some of the other specs listed by ATI. The faster memory gives the 5870 overall memory bandwidth of 153GB/s. Feeding that huge pipe is a GPU with twice as much hardware where it matters—stream processors, ROPs, and texture units.

The graphics engine itself sports some new features—particularly the hardware tessellation engine. While past ATI products have offered hardware tessellation, the new engine fully supports Microsoft's DirectX 11 tessellation API. ATI is fond of pointing out that this is actually its sixth-generation tessellation hardware.

TEXTURE UNITS AND CACHES

Having a robust set of shaders gives the Radeon 5870 unparalleled computational performance, but games still make heavy use of textures. Previous Radeons have been criticized for having fewer texture units and ROPs (raster operations in the render back-ends) than the competition. ATI has responded by doubling the number of texture units, from 40 to 80. The ROPs have also been doubled. The result is a theoretical doubling of throughput to 68 billion bilinear filtered texels per second.

RADEON GPUS COMPARED

	Radeon HD 4890	Radeon HD 5870
Die Size	263mm^2	334mm^2
Transistor Count	956 million	2.15 billion
Manufacturing Process	55nm	40nm
Stream Processors	800	1,600
Maximum Board Power (TDP)	160W	188W
Idle Power	90W	27W

MULTI-MON MADNESS

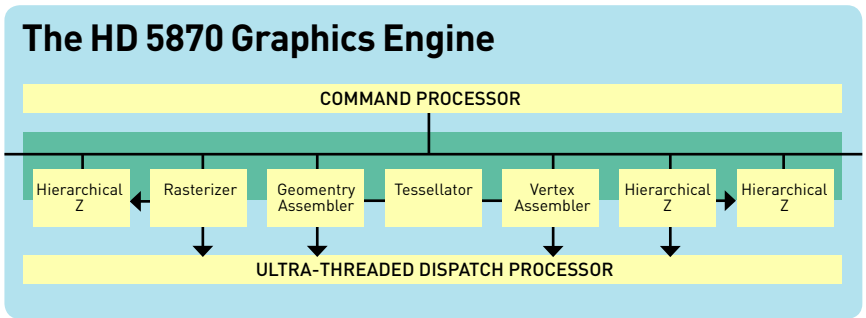
Six Monitors, One Card

One of the more intriguing aspects of the Radeon HD 5870 is its multiple-display capabilities, something AMD dubs "Eyefinity." The first shipping HD 5870 comes with four display connectors: two DVI, one DisplayPort, and one HDMI. Up to three monitors can be connected to any three of the four connectors. (Due to timing limitations, all four connectors can't be used simultaneously.) Later this year, AMD will ship a card with six DisplayPort adapters, capable of connecting up to six DisplayPort-equipped monitors at the same time.

For cards supporting up to three displays, usage scenarios might include three widescreen displays in portrait mode, side by side. Cards capable of driving six simultaneous digital monitors could support a variety of display options: 3x2 landscape, 2x2, or oddball scenarios such as 3x1 with another on top as an extended display (for flight sims, for example).

One underlying technology making a six-display configuration possible is DisplayPort. The display controller in the RV870 generates only two timing signals, suitable for DVI or VGA. DisplayPort can source external timing signals, and DisplayPort-equipped monitors can act as timing sources.

The L2 cache sizes have been increased to 128KB to facilitate the additional throughput generated by the increased number of texture units. Raw cache performance has also been improved, upping the L1 texture fetch bandwidth to one terabyte per second. Each SIMD engine has dedicated L1 cache, and the bandwidth between these exclusive caches and the shared L2 cache is 435GB/s. Also, maximum texture size has been increased to 16Kx16K, to support DirectX 11.



The Radeon 5870 graphics engine supports the longer graphics pipeline of DirectX 11, including hardware tessellation.

IMAGE QUALITY

In the past, there were complaints that Radeon GPUs' texture filtering was inferior to the equivalent Nvidia GPUs'. AMD's graphics architects took those criticisms to heart and redesigned the texture filtering units. The key is a new anisotropic filtering algorithm that no longer depends on the angle of view. This new, high-quality anisotropic filtering comes with no performance hit when compared to the older method.

The combination of raw compute horsepower, improved filtering algorithms, and double the texture units also gives the RV870 incredible antialiasing performance. AMD estimates the performance hit from going to 8x AA from 4x AA ranges from just a couple percentage points to less than 20 percent. All that graphics performance on tap has allowed AMD to implement supersampling antialiasing, a feature it actually removed a few years back.

DIRECTX 11 ON TAP

The Radeon HD 5800 chip implements all of DirectX 11 in hardware. This includes:

- **Hardware tessellation** This is the ability to generate geometry from an abstract description of the object defined by patches. Triangles can be interpolated within the patches, adding large amounts of geometric detail without the artist needing to explicitly create new artwork.
- **Shader Model 5.0** DirectX 11 now sports a unified shader language across all types of shaders: vertex, hull, domain, geometry, pixel, and the new compute shaders.
- **Object-oriented programming model** The era of writing huge shader programs may be past. Instead, programmers can work in more familiar ways, creating shader objects that can be called by parent programs. It's easier to write,

GPGPU

GPU Compute Comes of Age

Using graphics chips for general-purpose computing is still a pretty new concept. But there's growing interest in apps that operate on large amounts of data in parallel, and traditional CPUs are geared toward high performance with applications that crunch data serially.

Video transcoding, photo and video effects filters, plus tools like noise reduction and image cleanup have a ravenous appetite for parallel floating-point compute power. The HD 5870 offers up to 2.7 trillion single-precision floating-point operations per second and up to 544 billion double-precision FP operations every second. To put that in context, Intel's fastest CPU today, the Core i7-975, is capable of about 85 billion FLOPs. Floating-point calculations are now IEEE 754–compliant, which makes life easier for application developers and end users.

AMD built in the hooks to make the 5800 series a better general-purpose compute engine than past Radeons. This includes full hardware implementation of OpenCL and DirectCompute 11, IEEE 754-2008 floating-point compliance, better memory handling for general applications, and global synchronization and data sharing.

While Nvidia has been pushing its proprietary CUDA architecture hard over the past several years, only a handful of consumer-level applications have really taken advantage of GPU compute. But now we have two emerging standards, both with strong organizations backing them: OpenCL and DirectCompute.

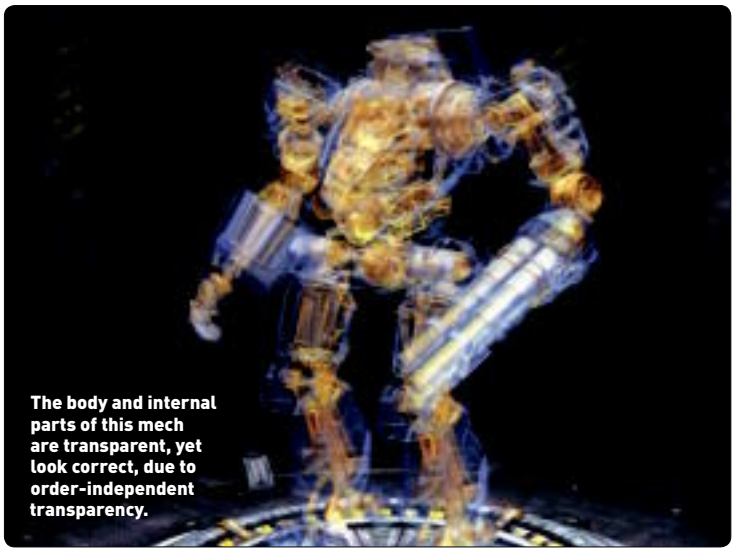
OpenCL, backed by the Khronos Group, which is also responsible for the OpenGL graphics standard, is available on a variety of operating systems, including Windows, MacOS, and Linux. DirectCompute is part of Microsoft's DirectX 11 API and fully supports the unified Shader Model 5 language.

Now that two strong standards have taken root, we'll likely see GPU computing gain traction. Upcoming DirectX 11 games will use DirectCompute for physics, deferred shading, and graphics post-processing. Companies like CyberLink are building consumer video and photo editing applications around OpenCL, moving away from CUDA and embracing standards.

document, and debug.

- **Order-independent transparency** Previously, transparency was handled by alpha blending, or by the application doing expensive traversal of the geometry to understand the order of the triangles. Order-independent transparency makes creating complex subjects with many transparent elements easier.
- **Multithreading** The DirectX API is fully multithreaded, and the drivers can now be more fully multithreaded, taking advantage of multicore CPUs. This feature will actually help speed up applications on older-generation GPUs, once DirectX 11 and new drivers are released.
- **DirectX 11 Compute** This is the new term for compute shaders. Now DirectX programmers have a standard interface for adding general-purpose compute elements to games, such as physics, post-processing, and even alternative renderers, like ray tracing and radiosity rendering.

All these features are enabled in the RV870 hardware, making the new GPU the first fully compliant DirectX 11 graphics chip available.



The body and internal parts of this mech are transparent, yet look correct, due to order-independent transparency.

GDDR5 MEMORY

Since the Radeon HD 5870 essentially doubles the computational power available for graphics, ATI needed a very fast memory subsystem. The new card uses GDDR5 memory running at 1,200MHz (effective), 225MHz faster than the same type of video RAM used on the older HD 4890. According to ATI, this now results in a balanced graphics card; the 4890 often was shader-bound, meaning that available memory bandwidth went unused. The card itself also makes use of a GDDR5 feature called lower power strobe mode. This is part of what enables the 5870 to idle at a miserly 27W.

THE PRICE OF GLORY

The best news about the Radeon HD 5800 series is the pricing. AMD's target price for the Radeon HD 5870's target price is $380. That's an incredible price for a card this fast.

While $380 is a lot of money for a high-end board, the era of shipping the most capable GPU on the planet in a $600 board seems to be over.

UNDER THE HOOD

Anatomy of a Shader Processor

With each succeeding generation, games are making heavier user of programmable shaders. It's no wonder AMD and its competition are increasingly focusing on this key aspect of the GPU. At the heart of the beast that is the HD 5870 programmable engine are thread processors.

The thread processors (consisting of four stream cores and support units) were redesigned, streamlining some key instructions, adding DirectX 11 bit-level operations, and implementing a fused multiply-add capability. All of these increase the number of instructions per clock cycle for each thread processor; the 5870 has five stream cores (including the special functions core) for each thread processor, 16 thread processors per SIMD engine, of which there are 20, for a total of 320 thread process and 1,600 stream cores. The SIMD engine is the smallest logic functional unit, and it's likely that future DirectX 11 GPUs wil pare the GPU at the SIMD engine level to build lower-cost ca

Each thread processor consists of four stream cores an special function core, a branch unit, and a number of gene purpose registers. The four stream cores together can pu out four 32-bit floating-point multiply-adds per clock cyc generate a pair of FP multiplies. AMD also implemente feature called Sum of Absolute Differences, which is us video encoding and computer vision applications. A va DirectX 11 bit-level operations are also built in.

Radeon HD 5870 Crushes Nvidia's 285 GTX

In our GPU cage match, AMD's new graphics processor delivers a stunning KO against the heavily overclocked competition

It's a classic graphics-card cage match. In one corner, the feisty but unproven newcomer; in the other corner glowers the grizzled veteran. The newcomer, of course, is AMD's shiny new Radeon HD 5870, weighing in at 2.15 billion transistors. The grizzled veteran is Nvidia's 285 GTX. But this is no ordinary 285 GTX. We pitted the Radeon against a souped-up EVGA 285 GTX SSC.

The 285 GTX SSC runs its core [illegible] more than eight [illegible] 648MHz; progeny looks like it has the chops to take on Nvidia. But we've been disappointed by promising GPUs from AMD's graphics division in the past.

NOT THIS TIME

We tested three cards (also tossing in AMD's previous best, the Radeon HD 4890) in a Core i7-975 system with 6GB of RAM, running on an Asus Rampage II X58 motherboard. All that CPU horsepower is to ensure that the benchmarks stress the graphics card, [illegible] be held back by CPU or [illegible] 7 Ultimate

performance differences aren't minor, they're huge: The Radeon HD 5870 was 63 percent faster in Crysis, 32 percent faster in Far Cry 2, 33 percent faster in STALKER, and even 24 percent faster in BattleForge, an RTS that's arguably more dependent on CPU than graphics.

This round of the endless GPU wars, then, is clearly owned by AMD, at least for single-GPU cards. And with performance like this, who wants the heat and power consumption of a dual-GPU card?

On the other hand, we won't count Nvidia out. While Nvidia's current high end is now relegated to the status of also-rans, the company is slaving [illegible] on its DirectX 11 GPU, code-[illegible] match.

BENCHMARKS

	Radeon HD 5870	Radeon HD 4890	EVGA 285 GTX SSC
Crysis (fps)	**36**	22	22
Far Cry 2 (fps)	**74**	51	56
STALKER Clear Sky (fps)	**36**	24	27
BattleForge (fps)	**57**	36	46
3DMark Vantage Performance	**17,032**	12,128	13,941
3DMark Vantage Extreme	**8,252**	6,276	4,955
Idle System Power (W)	**119**	160	142
Full Load System Power (W)	**293**	363	307

Best scores are bolded. All benchmarks run at 1920x1200 with 4x AA enabled and all graphics settings maxed out unless otherwise specified. Full load system power was taken during a 3DMark Vantage run at 2560x1600 with extreme settings.

Through the looking glass

Trying to choose an LCD monitor from the ever-growing, ever-affordable selection available can be maddening. Our reviews of eight new panels help make sense of it all

BY MICHAEL BROWN

Imagine a Wonderland where the most powerful components in existence are free for the asking. You'd have the speediest CPU on the market; two or three of the newest, most outrageous videocards; the fastest, most capacious drive available; as much top-drawer memory as your operating system of choice could address; and, of course, multiple 30-inch flat-panel displays.

Now, grow up and face life, Alice. The state of the economy is no fantasy, so you'll probably need to make more realistic component choices. The good news on the display front is that manufacturers haven't been sitting on their mushrooms smoking hookahs; they've been innovating and driving down costs to the point where 23- and 24-inch widescreen LCDs are the new sweet spot.

Before you set out on your next monitor-shopping adventure, however, make sure you have a firm understanding of the most important specifications, features, and quality and performance criteria, lest you fall prey to the industry's Jabberwocky. Rest assured, we'll guide you through the thicket. We've also dug up a number of specifications that manufacturers have taken to omitting from their published data sheets.

Even the most thorough checklist can't reveal how a monitor will perform in the real world, so we gathered eight of the top manufacturer's latest models and put them through a benchmark wringer. Our test bed consisted of an Intel Core 2 Duo E8600 running at 3.33GHz, an Asus P5Q3 Deluxe motherboard, and an Nvidia GeForce GTX 285 videocard. We relied on DisplayMate Multimedia with Test Photos Edition (www.displaymate.com) for diagnostic testing and analysis. And since we use our monitors for entertainment as much as anything else, we also used Fallout 3 to test gaming performance and the Blu-ray edition of *Watchmen* for movie performance.

Let's head down the rabbit hole.


LG

Spec Speak

It pays to understand the features manufacturers tout as well the ones most don't disclose in their spec charts

BACKLIGHT

All LCD monitors require a source of illumination, with cold-cathode fluorescent lamps (CCFL) being the most common (every display in this roundup uses one). White LED backlights are one alternative solution, found most commonly in mobile displays. Some high-end displays use RGB LEDs, which enable them to deliver a wider color gamut. CCFL and both types of LED backlights have drawbacks: CCFL backlights deliver a narrower color gamut, while LEDs can age at different rates, causing color and white-point shifts over time.

COLOR DEPTH

Color depth indicates the number of bits the panel uses to represent the color of one pixel. A display that uses eight bits each for the red, green, and blue channels (2^8) can produce 256 shades of each color for a total of 16,777,216 colors (256x256x256). Most LCD monitors based on twisted nematic (TN) technology, however, cannot transition eight bits per pixel quickly enough to compensate for fast motion, resulting in unacceptable blurring and smearing while displaying movies and games. To get around this problem, mass-market LCD panels use six bits per pixel (2^6) to represent the RGB color space. Since this reduces the total number of displayable colors to just 262,144 (64x64x64), many panels use frame-rate control (a dithering method) to have each pixel display a slightly different shade with each successive screen refresh. Frame-rate control can enable a six-bit panel to simulate 16,194,277 colors.

COLOR GAMUT

Color gamut describes a subset of a defined color space that a display is capable of producing. For the purposes of this comparison, we asked each manufacturer to report its display's color gamut as a percentage of the NTSC color space. Most of the manufacturers claimed their displays delivered 72 percent of the NTSC color space.

CONTRAST RATIO

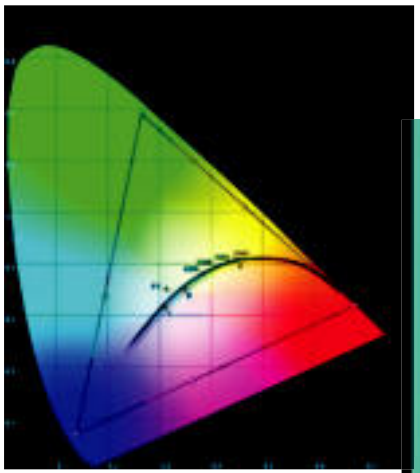
Contrast ratio is supposed to measure the relative magnitude between the brightest (white) and darkest (black) colors the display can produce. Unfortunately, the manufacturers' propensity for using different methodologies and unstated variables in their measurements has effectively rendered this specification meaningless. The industry has further muddied the waters by introducing entirely new variations of this measurement, such as dynamic contrast ratio. We recommend you ignore this spec when comparing LCD monitors.

INPUTS

Nearly all the monitors in this roundup support the two most common digital video interfaces, DVI and HDMI (with HDCP copy protection, so you can watch Blu-ray movies at full resolution using either one). None of them, however, use the DisplayPort digital interface. In terms of analog display interfaces, every monitor has an old-school VGA port, but the Samsung P2370HD is the only monitor to also feature composite and component video inputs (useful for connecting such analog sources as VCRs and older set-top boxes and DVD players). None has an S-Video input.

PANEL TYPE

Virtually every consumer LCD monitor uses thin-film transistor (TFT) technology these days, but it's important to consider the subsets of that classification. Twisted nematic (TN) is the most common because it's the easiest and least expensive to produce (all the displays in this roundup are TN panels). TN panels boast very fast response times, but are typically limited to six-bit color depth. The next two most common subsets are super in-plane switching (S-IPS, developed by Hitachi, although LG also uses it) and super patterned vertical alignment (S-PVA, jointly developed by Samsung and Sony). Both S-IPS and S-IPA panels support eight-bit color, but have much slower response times than TN panels.



The triangle in the center of this chromacity diagram represents the NTSC color gamut, used to measure the color output of LCDs.

RESPONSE TIME

Response time measures how long it takes an LCD monitor's pixels to transition from one state to another and is measured in milliseconds. A monitor with a low response time will display fewer motion artifacts with movies and games. In order to make apples-to-apples comparisons, we asked each manufacturer to report its display's gray-to-gray response time, because that is the most common real-world transition.

STAND FUNCTIONS

The LCD monitor manufacturers in this roundup have all but abandoned ergonomic considerations. Each display in this roundup has a stand that tilts, but only three of the eight swivel left to right and only two offer a height adjustment. NEC's EA241WM is the only monitor we reviewed that pivots to enable you to switch between landscape and portrait modes.

Acer H235H

It's pretty; pretty vacant

The Acer H235H is typical of this class of displays: It's based on a six-bit TN panel that uses frame-rate control to augment its color depth. The screen delivers 23 inches of viewable area at a native resolution of 1920x1080.

As with nearly all the monitors we tested, we found it necessary to make significant adjustments to the display's brightness and contrast settings to make the monitor look its best with our DisplayMate benchmark software. But the five touch-sensitive buttons in the Acer's glossy black bezel and the obtuse icons in its onscreen display make this process extremely frustrating; the onscreen icons don't line up precisely with the physical buttons and it takes too many button presses to drill down into each menu choice. It takes five button presses, for instance, to make a single brightness adjustment.

The H235H performed well in DisplayMate's dark-screen test, with almost no backlight leakage around the perimeter of the display, but we noticed significant banding in the 128-step grayscale test. It also did a poor job of reproducing low-saturated colors against light-gray backgrounds.

The display had no problems with smearing or blurring in our Blu-ray movie and game tests, but poor contrast resulted in a significant loss of visual detail in the opening scene of *Watchmen*.

The Acer H235H's features and performance put it in the middle of the pack, but its three-year warranty is unusual in that it does not cover the backlight.

H235H display looks as attractive in back as it does in front, with a removable panel to hide the ports.

SPECS

Viewable Area	23 inches
Native Resolution	1920x1080
Color Gamut	72 percent of NTSC
Color Depth	Six-bit with FRC
Gray-to-Gray Response Time	2ms
Inputs	DVI, HDMI, VGA

VERDICT 5
$240, www.acer.com

Asus VH242HL-P

Up, down, and almost all around

The Asus VH242HL-P is one of only two monitors we tested with a stand that tilts, swivels, and is height-adjustable. The 23.6-inch display is based on a six-bit TN panel with FRC and a native resolution of 1920x1080.

The monitor's default setting prevents changes to brightness and contrast, so we switched to User Mode to tune the monitor when using DisplayMate. Red, green, and blue were all set to 100 percent here, but the entire display nonetheless overemphasized blue. We also ran into a problem with the gamma measurement test, which indicated a serious color-tracking error. We finally put the monitor into sRGB mode and sacrificed brightness control in the interest of color accuracy.

The VH242HL-P exhibited a nicely uniform black level with very little backlight intrusion, but we observed blooms of intensity in the corners and in the middle of the screen while displaying high-intensity blue and cyan as well as low-intensity green. Compared to the rest of the field, DisplayMate's high-resolution digital photographs looked markedly more subdued on the Asus display. But the VH242HL-P did a spectacular job of displaying text; even nine-point serif fonts were clearly legible.

We didn't encounter any dead or discolored pixels in our review, but buyers should note that Asus's three-year warranty kicks in only if there are more than five of the former or three of the latter.

Call us old-fashioned, but we like the reassuring tactile feedback that the Asus VH242HL-P's mechanical switches provide.

SPECS

Viewable Area	23.6 inches
Native Resolution	1920x1080
Color Gamut	72 percent of NTSC
Color Depth	Six-bit with FRC
Gray-to-Gray Response Time	5ms
Inputs	DVI, HDMI, VGA

VERDICT 7
$220, www.asus.com

Gateway FHX2300

Mirror, mirror on my desk

Gateway's 23-inch FHX2300 truly is a looking glass: The glossy screen produces extremely distracting glare and specular reflections. Don't use this monitor if there's a window or any other strong light source directly behind your seat.

The panel we used for our evaluation had a discolored pixel that glowed green when DisplayMate was producing solid black, gray, or low-intensity cyan and magenta backgrounds; it glowed yellow when the background was solid red. Gateway sent us a replacement unit, but consumers might not be so lucky: The company's one-year warranty covers dead pixels (meaning pixels that don't function at all), but it expressly does *not* cover discolored pixels.

Once we positioned the Gateway to minimize its glare problems and ignored the discolored pixel on the solid-black background, we noticed significant backlight leakage on the bottom and left-hand sides. Apart from those issues, the FHX2300 delivered solid performance with the rest of our DisplayMate tests, particularly in the areas of grayscale production and screen uniformity. The display delivers six-bit color depth with frame-rate control and five-millisecond response time, so we didn't encounter any significant motion-blur or other visual artifacts in our game and Blu-ray movie tests.

The Gateway FHX2300 did a superb job of rendering skin tones in DisplayMate's high-resolution digital photos.

SPECS

Viewable Area	23 inches
Native Resolution	1920x1080
Color Gamut	72 percent of NTSC
Color Depth	Six-bit with FRC
Gray-to-Gray Response Time	5ms
Inputs	DVI, HDMI, VGA

VERDICT 5

$230, www.gateway.com

HP 2709m

Meaty, beaty, big, and bouncy

HP's new 27-inch 2709m is considerably larger than the rest of these displays; it's also more expensive ($400).

The 2709m offers the same native resolution as the rest of the field, so it spreads the same number of pixels over a much larger area. As a result, DisplayMate's high-resolution sample photos looked just a bit softer than they did on the smaller monitors. The HP also did a poor job of rendering very small text.

Those criticisms don't matter when you're watching a Blu-ray movie or gaming—this big screen shines here, and you needn't worry about your videocard supporting an insanely high resolution as you would with a 30-inch display. Unfortunately, the 2709m suffers from the same specular reflection problems as Gateway's mirror-like FHX2300.

HP tells us the 2709m is outfitted with a wider color-range backlight and color filter, which enables it to produce 92 percent of the NTSC color gamut (compared to the rest of the field's 72 percent) but we didn't perceive any significant difference. We didn't encounter any backlight leakage, but DisplayMate's Screen Uniformity and Color Purity tests revealed a dark band across the top of the display with light grays and colors at mid-range intensity.

We also found a discolored pixel on the 2709m (HP calls this a "bright sub-pixel defect" and doesn't cover it under warranty unless there are two or more).

In addition to being the largest display we tested, HP's 27-inch 2709m was also the only monitor to feature two HDMI inputs. And its stand swivels as well as tilts.

SPECS

Viewable Area	27 inches
Native Resolution	1920x1080
Color Gamut	92 percent of NTSC
Color Depth	Six-bit with FRC
Gray-to-Gray Response Time	3ms
Inputs	DVI, HDMI (2), VGA

VERDICT 7

$400, www.hp.com

LG W2353V-PF

You sure about that?

LG insists its W2353V-PF is based on a true eight-bit TN panel, a feature that would make it unique in this roundup, so we were surprised at how poorly the display performed with several of our DisplayMate benchmarks. We were also irritated by the display's gimmick of rendering a black screen by turning off its backlight. This might be acceptable if the transition was instantaneous—after all, there's no better way to achieve true black—but the fade takes at least two seconds, which exposes the trick.

The LG produced inconsistent color uniformity, with colors near the top of the display appearing significantly darker than the same colors shown in the middle and bottom of the screen. This same flaw also manifested itself in DisplayMate's graduated grayscale tests.

The monitor had trouble with our other grayscale tests, as well, with peak white exhibiting a pinkish tinge. We noted a similar shift toward pink in facial skin tones when we studied high-res digital photographs of faces. And we encountered color-tracking errors, with red hues shifting toward orange as they increased in intensity.

LG's W2353V-PF was the only monitor in this roundup that didn't come with a digital video cable (neither DVI nor HDMI).

The W2353V-PF did perform well in our game and movies tests, thanks to its two-millisecond gray-to-gray response time.

SPECS

Viewable Area	23 inches
Native Resolution	1920x1080
Color Gamut	72 percent of NTSC
Color Depth	eight-bit
Gray-to-Gray Response Time	2ms
Inputs	DVI, HDMI, VGA

VERDICT 4
$240, www.lge.com

NEC MultiSync EA241WM

You don't always get what you pay for

NEC's EA241WM has a number of features that set it apart from the rest of the displays in this field: It's the only model to support a full complement of ergonomic features (tilt, swivel, pivot, and height adjustment); it's the only model with an integrated USB 2.0 hub; and compared to its competition's flimsy construction, this monitor is built like a Mack truck.

It's also the most expensive and least consumer-oriented model we tested, with an MSRP of $450 and native resolution of 1920x1200 (versus 1920x1080). And while the monitor does support HDCP, it's not equipped with an HDMI port (NEC will provide a free DVI-to-HDMI adapter, but doesn't put one in the box).

The EA241WM's tiny thumb-stick controller is one of the best tools we've used for making minute adjustments to a display's brightness and contrast levels. The NEC performed better than any of the other monitors in DisplayMate's black-level test, with virtually no backlight contamination of a black screen. In spite of its precision controls, this monitor performed poorly when it came to differentiating between black and dark shades of both gray and colors. This was particularly bothersome in the opening scene of *Watchmen*, because important details were lost in the dark shadows.

The NEC EA241WM comes with NEC's NaviSet software, which provides a graphical user interface for controlling the monitor's brightness, contrast, and color environment.

SPECS

Viewable Area	23 inches
Native Resolution	1920x1200
Color Gamut	72 percent of NTSC
Color Depth	6-bit with FRC
Gray-to-Gray Response Time	5ms
Inputs	DVI, HDMI (via adapter), VGA

VERDICT 6
$450, www.necdisplay.com

Samsung P2370HD

Do we *have* to buy the tuner?

Samsung's heritage as a consumer-electronics manufacturer is readily apparent in its P2370HD monitor. This is the only display we looked at that included not only an integrated HDTV (ATSC) tuner, but also composite and component video inputs, S/PDIF audio output, and support for Dolby Digital Plus.

The P2370HD was also the easiest display to set up and configure, thanks to a very useful remote control, a built-in graphical user interface that steps you through the process, and input ports that are set at right angles, instead of parallel, to its back. The port configuration lets you see how the DVI and HDMI ports are oriented without having to turn the entire monitor upside down.

Samsung claims its proprietary frame-rate control technology (Hi-FRC) enables this six-bit panel to produce the same number of colors as an eight-bit panel (16,777,216), and that it covers a broader swath of the NTSC color gamut (80 percent). We found the difference just barely perceptible: It did render DisplayMate's high-res digital photos slightly warmer than the rest of the field, but we really had to stare.

Don't need the TV tuner? Don't buy Samsung's P2370 model thinking you'll get everything but. That model is limited to DVI and VGA video inputs (no HDMI), and it has no speakers, headphone jack, or remote.

The interior edge of the Samsung P2370HD's bezel has an unpleasant propensity to reflect objects appearing at the display's outermost edges.

SPECS

Viewable Area	23 inches
Native Resolution	1920x1080
Color Gamut	80 percent of NTSC
Color Depth	six-bit with Hi-FRC
Gray-to-Gray Response Time	5ms
Video Inputs	DVI, HDMI, VGA, Composite, Component

VERDICT 8

$350, www.samsung.com

ViewSonic VX2433wm

A steaming pile of mediocrity

None of the monitors we examined was flawless, but the ViewSonic VX2433wm surprised us with how poorly it fared in many of our DisplayMate benchmarks, even after an intense round of button-mashing. In the color-uniformity test, for instance, the monitor should have displayed a consistent wash of color from edge to edge; what it delivered instead was a mottled, blotchy mess.

The VX2433wm had trouble with all four test colors (red, green, blue, and gray), but the distortion was particularly objectionable with green and blue—it was almost like staring at a Rorschach inkblot (ironic, considering we used *Watchmen* for our Blu-ray movie test). The ViewSonic turned in another poor performance when displaying low-saturated colors against the high end of the grayscale, with red, green, and blue at two-percent saturation disappearing into the background.

The digital photos we examined appeared washed out and subdued, as though they'd been drained of their color and vibrancy; the display's Blu-ray performance was equally bland. Our results finally improved with our gaming tests, thanks to the panel's two-millisecond response time (among the fastest of all the monitors tested), but that one bright spot doesn't compensate for this display's otherwise lackluster qualities.

We had difficulty associating the ViewSonic VX2433wm's side-mounted controls with its onscreen display.

SPECS

Viewable Area	23.6 inches
Native Resolution	1920x1080
Color Gamut	72 percent of NTSC
Color Depth	Six-bit with FRC
Gray-to-Gray Response Time	2ms
Inputs	DVI, HDMI, VGA

VERDICT 4

$300, www.viewsonic.com

Calibrating Your Monitor

Even the best screens can use a little help in achieving peak performance

Calibrating your monitor will make certain your photographic prints match what you see on your display. It will also ensure that the games you play and the movies you watch will look as their creators intended. The most foolproof means of calibrating your monitor is to use a colorimeter, an instrument you attach to the front of the display and control with related software running on the host PC. The software sends various colors, shades of gray, and brightness levels, to the display, and the sensor analyzes and evaluates them. These devices used to be quite costly, but we've achieved terrific results with Pantone's inexpensive HueyPro (you can read our review online at http://bit.ly/4gmAq2). This colorimeter/software combo is currently street-priced at less than $100.

Flatpanelshd.com has a very useful online collection of test images for calibrating and measuring the performance of your display for free.

FREE ALTERNATIVES

If only a free solution will do, there are several excellent options. Tom Niemann, of ePaperPress.com, has produced an online application that can step you through the monitor-calibration process by making adjustments to your display's brightness and contrast settings. He's also developed a tool for determining your monitor's gamma setting. Niemann has also developed a free tool for calibrating your printer. You can find his tools at http://bit.ly/18eFYu.

Torben Rasmussen, of Flatpanelshd.com, has developed a larger collection of test images for evaluating backlight contamination, defective pixels, color uniformity, banding problems, text reproduction, and lots more. You'll find his online monitor tests, including a downloadable executable version, at http://tft.vanity.dk.

CALIBRATION PREPARATIONS

Whether you calibrate your monitor using a hardware colorimeter or one of the free alternatives we've described above, it is essential that you first prepare your display and your work area to achieve the best results.

1 Set the monitor to its native resolution, and make sure your videocard is operating in either 24- or 32-bit mode.

2 Clean your monitor thoroughly. If the manufacturer doesn't provide cleaning instructions, try this: Turn it off and let it cool. Remove any surface dust and loose contaminants with a can of compressed air, and then wipe the surface with a soft, clean cloth. Now, mix a little isopropyl alcohol with tap water (the alcohol will help dissolve grease and fingerprints), sprinkle a little onto the cloth, and wipe the screen. Never spray liquids directly onto the display.

3 Turn the display back on and let it warm up for 15 to 30 minutes, but turn off any screensaver or energy-management utilities you might be running, so that the calibration process won't be interrupted.

4 Remove any color profiles you might have previously created for the display. In Vista, right-click on the desktop, select Personalize, choose Display Settings, and then Advanced Settings. Click the Color Management tab and then the Color Management button, select any color profile listed, and click Remove. Restart the computer.

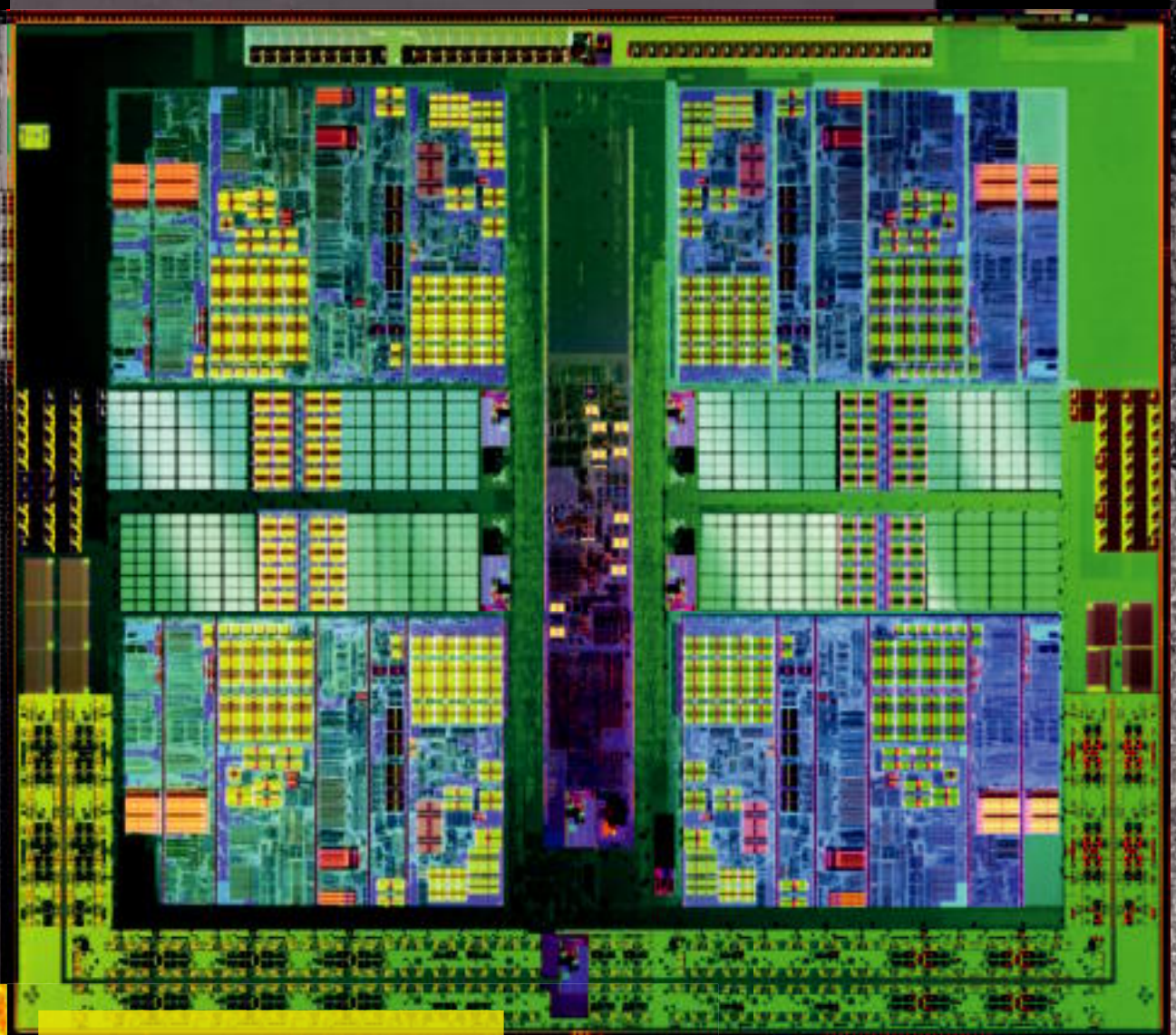
5 Set up your ambient lighting so that it's consistent with the environment you typically work in. Make sure the display is not reflecting light from a window or other strong source of illumination. Close any drapes or angle the monitor to eliminate reflections.

Move any brightly patterned, shiny, or colorful objects off your work surface, or at least out of your direct line of sight, so they won't compete with the display for your attention.

6 Launch your calibration tool of choice and follow its instructions.

7 Primarily interested in calibrating your display so that the colors in your digital photos match those you print out? Here's one quick-and-dirty solution: Find a photo you really like, print it out as an 8x10, and place it next to your display. Tweak your monitor's brightness, contrast, and color values until the image on your screen looks as close to the print as you can make it.

Winging it this way won't produce results as accurate as you'd achieve with a colorimeter, but it's certainly better than nothing. You should also be aware that your monitor's performance will change over time and decline as it ages, so you can't just set it and forget it. A good rule of thumb is to recalibrate your display once each month.



AMD's new 45nm Propus core is at the heart of the new $99 Athlon II X4 quad-core.

Attention smart shoppers

One Cheap Chip

Athlon II X4 breaks the $100 quad-core barrier

BY GORDON MAH UNG

Even the Intel fanboys have to hand it to AMD once in a while. After Intel deftly dropped a Core i5 anvil on Phenom II's head, AMD did a quick drop to floor and now fires back slo-mo style with its own chip: a $99 quad-core.

Dubbed the Athlon II X4 620, this 2.6GHz quad-core isn't just leftover parts swept off the factory floor, either. The Athlon II X4 is based on the familiar K10 microarchitecture in the Phenom and Phenom II, but it's actually a newer, smaller die. In fact, the new chip has fewer than half the transistors of a Phenom II X4 processor. Much of the shrinkage comes at the expense of cache. While the Phenom II packs 6MB of L3, the budget Athlon II X4 features none.

The TDP of the new Athlon II X4 chips (there are two, but only one is sub $100) is also considerably lower than the top-end Phenom II X4 965 Black Edition chip at 95 watts versus 140 watts. Other than the TDP and lack of L3 cache, the CPUs are essentially the same as their Phenom predecessors.

In fact, some Athlon II procs may actually be the same as Phenom II. Although the majority of Athlon IIs will be the smaller Propus cores, AMD will double-source the chips by taking some cores that might have been turned into Phenom II X4s and switching off the L3. Other than that, these chips will be virtually the same as a Propus—same TDP, same L2 cache, same clocks. While it might seem unusual, AMD says the practice is not unprecedented and happens quite often with budget CPUs. Because both the would-be Deneb and Propus cores are 45nm and essentially the same microarchitecture, it's unlikely this will have any practical impact on the end user, the company says.

Still, the breakthrough here is not technology, but price. Up to now, the closest a budget user could get to a quad-core was the stale Phenom X4 9650. At one time restricted to OEM sales, these elderly parts are now available to consumers for about $110. The Phenom X4 9650 has 2MB of L3, but its slower Hyper Transport speed (3.6GHz vs. the Athlon II X4's 4GHz), lack of AM3 support (and thus DDR3), and its use of the older 65nm process technology make it a less attractive option.

In Intel land, the Athlon II X4's main competition

isn't even close. Intel's cheapest quad-core part today is the Core 2 Quad Q8200. Like the Athlon II X4, the Q8200's low price is the result of a shrunken die size made possible by cutting cache. While the $220 Core 2 Quad Q9550 has 12MB of L2 cache, the $150 Core 2 Quad Q8200 has but 4MB of L2 cache.

Higher up the food chain, Intel made a significant technology and price breakthrough with the Core i5-750, but at $200 for the chip itself, it's for folks with richer tastes. The extra $100 you can save with an Athlon II X4 is enough to buy an entry-level motherboard and the RAM to go with it.

TO QUAD OR NOT?

The budget buyer's toughest question is whether to even opt for quad. Since price is the primary concern for the budget buyer, it's tough to ignore all the various dual-core options. You could, for example, skip the Athlon II X4 620 in favor of the Athlon II X2 250. This would give you a 3GHz dual-core instead of the 2.6GHz quad-core and save you about $13. Even cheaper, there's AMD's Athlon II X2 240, a 2.8GHz dual-core that's listed at $60.

We didn't run the performance numbers on these chips as we already know the answer: Which chip you buy should depend on what you do. Since the vast majority of games are not optimized for quad-core, a 3GHz dual-core will actually outperform a 2.6GHz quad-core in gaming. The same can be said if you spend the bulk of your day in a browser or Microsoft Word: The two additional cores just don't get you anything. On the other hand, if you encode media, edit photos, or you're even an advanced Microsoft Excel user, a quad-core is well worth the dough. You don't get double the performance everywhere, but for well-optimized apps, you could see substantial gains. How substantial? If an encoding job takes three hours on your 3GHz dual-core, it could take 1.6 hours on a 2.6GHz quad-core.

Quad-cores will also pay dividends if you're a heavy multitasker running more than one compute-intensive application at a time. Our final message to you on the topic is that a quad-core machine might actually get faster over time. That's because apps are being continually upgraded and coding for four or more cores is a factor on most developers' radar. That translates into faster performance on your quad-core as the apps get updated.

PERFORMANCE

We don't want to telegraph the winner of this budget grudge-match, but the Athlon II X4 accomplishes what AMD wanted: It's not the fastest game in town, nor the sexiest, but it's certainly the cheapest and it can hold its own against Intel's current offerings. Of course, that's if you factor in price as a big component. We can tell you this: There isn't one single thing the Athlon II X4 is faster at than the Core i5. Not one. However, the Athlon II X4 is half the price, and in this economy, well, that can mean a lot.

QUADS COMPARED

	2.66GHz Core i7-920	2.66GHz Core i5-750	2.33GHz Core 2 Quad Q8200	3.4GHz Phenom II X4 965 BE	2.8GHz Athlon II X4 630	2.6GHz Athlon II X4 620
Socket	LGA1366	LGA1156	LGA775	AM3	AM3	AM3
Price (volume)	$284	$199	$163	$245	$122	$99
Street Price August '09	$280	N/A	$150	$245	$122	$99
TDP	130 watts	95 watts	95 watts	140 watts	95 watts	95 watts
Code-name	Bloomfield	Lynnfield	Yorkfield	Deneb	Propus*	Propus*
QPI/HT	4.8GT/s	4.8GT/s	N/A	4GHz	4GHz	4GHz
Core Clock	2.66GHz	2.66GHz	2.33GHz	3.4GHz	2.8GHz	2.6GHz
Turbo Boost (max one core)	2.93GHz	3.2GHz	N/A	N/A	N/A	N/A
HyperThreading	Yes	No	N/A	N/A	N/A	N/A
Cores/Threads	4/8	4/4	4/4	4/4	4 /4	4 /4
L1 Cache	256KB	256KB	256KB	512KB	512KB	512KB
L2 Cache	1MB	1MB	4MB	2MB	2MB	2MB
L3 Cache	8MB	8MB	N/A	6MB	N/A	N/A
Memory Controller	Tri-channel	Dual-channel	N/A	Dual-channel	Dual-channel	Dual-channel
Die Size (mm²)	263	296	164	258	169	169
Transistor Count (million)	731	774	456	758	300	300
Process (nanometer)	45	45	45	45	45	45

**Some Athlon II X4's will use Deneb cores with L3 cache disabled.*

Ménage à Quad

Three cheap chips do battle in the benchmark arena

For our benchmark analysis we tested three of the relevant CPUs: Intel's $150 Core 2 Quad Q8200, AMD's $99 Athlon II X4 620, and Intel's $200 Core i5-750. All three platforms used an EVGA GeForce GTX 280 card, Windows Vista Home Premium in 64-bit flavor, and a 150GB Western Digital Raptor drive. We used an Asus Maximus II Formula board with 4GB of DDR2/1066 for the Core 2 Quad, a Gigabyte GA-MA790FXT-UDF5P with 4GB of DDR3/1333 for the Athlon II X4, and a Gigabyte GA-P55-UD6 for the Core i5-750 processor. Our benchmark suite ran the gamut, from bandwidth-intensive to compute-limited to real-world performance tests.

First: There's simply no comparison between the Core i5 and either the Core 2 Quad or Athlon II X4. There's not a single benchmark among those we ran where the Core 2 Quad or Athlon II could outgun the Core i5. The Core i5 is easily faster than those two chips by double-digit percentages, generally around 30 percent faster. But you knew that. After all, it costs twice as much as the Athlon II and about 25 percent more than the Core 2 Quad.

Between the Core 2 Quad and Athlon II X4, it's an interesting mix. Generally, the Athlon II X4 is significantly faster in encoding than the Core 2 Quad. But in gaming, it's significantly slower. However, that's based on running the game at low resolution and with features turned off to take the GPU out of the equation. At normal resolutions or with a dual-GPU setup, you'd likely see little difference between the two chips.

Considering the Athlon II X4's advantage in encoding tasks we're going to declare it the winner. Even taking into account that it was slower in our two photo-oriented tasks—ProShow Producer and Photoshop CS3—we still think the Athlon II X4 has the edge. Besides, it's 50 percent cheaper than the Core 2 Quad. And at half the price of the Core i5, this one is an easy win for AMD.

BENCHMARKS

	2.6GHz Athlon II X4 620	2.33GHz Core 2 Quad Q8200	2.66GHz Core i5-750*
Main Concept Reference 1.0 (sec)	**1,772**	1,976	1,337
Premiere Pro CS3 (sec)	899	**888**	620
Cinebench 10	9,941	**10,184**	14,442
HandBrake (sec)	**1,559**	1,681	1,198
PCMark Vantage Overall	**5,792**	5,299	7,208
POV Ray	**2,334**	2,191	2,773
Photoshop CS3 (sec)	165	**146**	128
ProShow Producer (sec)	1,224	**997**	700
Everest Ultimate MEM Read (MB/s)	**8,544**	7,511	12,867
Everest Ultimate MEM Write (MB/s)	6,960	**7,059**	9,881
Everest Ultimate MEM Copy (MB/s)	**10,028**	7,397	14,684
Everest Ultimate MEM Latency (ns)	**52.5**	66.7	31
Sandra RAM Bandwidth (GB/s)	**12.3**	7.2	16.8
Fritz Chess Benchmark	12.93	**13.79**	17.38
3DMark Vantage Overall	13,727	**14,260**	14,947
3DMark Vantage GPU	11,371	**11,840**	12,249
3DMark Vantage CPU	36,269	**36,863**	44,066
Valve Particle Test (fps)	71	**81**	124
Valve Map Compilation (sec)	**157**	163	121
Crysis (fps)	83.1	**99.5**	147
Resident Evil 5 (fps)	70.7	70.3	109
World in Conflict (fps)	137	**155**	266
WinRar 3.20 RAW files (sec)	**1,067**	1,110	706

**Bold score denotes the winner, but only between the Core 2 Quad and Athlon II X4. The Core i5 trounces both the Athlon II X4 and Core 2 Quad in every benchmark but we included it for reference.*

WHITE PAPER

OLED Screens

Organic light-emitting diode (OLED) screens offer better picture quality and draw less power than traditional LCDs. But what are OLEDs? -NATHAN EDWARDS

Organic light-emitting diodes, or OLEDs, are often touted as the next big thing in display technology, offering brighter colors, true black, lower power consumption, and off-axis viewing than traditional LCD screens. They've popped up in gadgets from high-concept to mundane: The infamous Optimus Maximus keyboard, for example, utilizes many tiny OLED screens in its programmable and customizable keycaps, and both Sony's new X-series Walkman and Microsoft's new Zune HD have OLED screens. OLED technology has made great strides in the past 10 years, and cheaper and better manufacturing processes mean they've started appearing in everything from media players to phones to high-definition televisions—even keyboards. But what are OLEDs?

WHAT'S INSIDE

In the simplest terms, LEDs (light-emitting diodes) emit light by running an electrical current through a diode. Diodes create unidirectional electric flow, moving electrons from the negatively charged cathode to the positively charged anode, creating electron holes, or spaces where electrons could be. Electrons flowing in drop into these holes and emit light. An organic light-emitting diode uses the same principle, but between the cathode and anode are two layers of organic semiconductor compounds: the emissive layer, near the cathode, and the conductive layer, near the anode (organic compounds are chemical compounds that contain carbon). The cathode sends (negatively charged) electrons into the emissive layer, while the anode draws electrons from the conductive layer, leaving positively charged "electron holes." This creates a negatively charged emissive layer and a positively charged conductive layer, which attract each other, drawing electron holes to the emissive layer. The positive-charged holes and negative-charged electrons recombine, lowering the energy levels of the electrons, emitting light as a by-product. Simple, right?

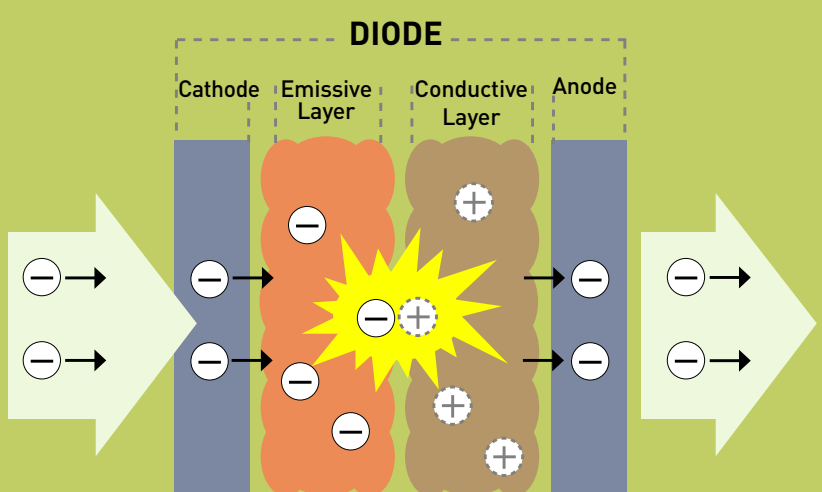
From a development standpoint, OLEDs have a lot of potential. Organic chemistry is a fairly well-understood science—reds, blues, and greens were developed in a much shorter time frame in OLEDs than in regular LEDs. And new molecules that can be used in the layers, which have longer lifetimes and produce brighter colors, are being discovered frequently.

It turns out that OLEDs are great for use in displays, because the organic molecules that comprise the emissive and conductive layers can be deposited in very thin, large sheets onto a variety of substrates—from glass to metal to fiber—so that millions of individual OLEDs can be crammed together, row by row and column by column, into a very small space. Each of these OLEDs becomes one pixel of the display. The organic compounds can be deposited using several methods, depending on the type of organic molecule used in the display.

There are two types of OLEDs currently in production and development, differentiated by the size of the molecules in their organic compounds. Small-molecule OLEDs are usually manufactured via organic vapor phase deposition (OVPD)—the organic molecules are evaporated and carried via inert gas, then deposited on a substrate through a series of very small nozzles held near the substrate's surface. Large-molecule, or polymer OLEDs, can be created via a process similar to inkjet printing—the polymers are dissolved into a solution and "printed" onto the substrate.

HOW IT WORKS

Anatomy of an OLED



In an OLED, an electrical current causes electrons (-) to move from the cathode to the emissive layer, creating a negative charge in the emissive layer. The positively charged anode attracts electrons from the conductive layer, creating a positive charge in the conductive layer. Electron holes (+) in the conductive layer attract electrons from the emissive layer, which recombine with the electron holes, lowering the energy level of the electrons and emitting light as a by-product.

ADVANTAGES & DISADVANTAGES

The advantages of OLEDs over traditional LCDs are many. First, unlike liquid-crystal displays, OLED pixels actually emit light, so they don't require backlighting. Traditional LCD screens often utilize traditional LEDs or CCFLs for backlighting, which—in addition to increasing the thickness of the display to accommodate a light source—prevents the display from rendering true black, as even "black" LCD pixels are backlit. Since OLED pixels produce light when on and don't produce light (or draw power) when off, a darker, richer black can be created. Having light-emitting pixels also enables richer colors, a broader color gamut, higher contrast, and a greater viewing angle than an LCD screen. Because "off" pixels don't draw power, and because there's no need for a separate light source, OLED displays require less energy to run. And because the organic molecules can be printed onto a variety of substrates, flexible displays are possible.

OLEDs, however, are not without their disadvantages. The manufacturing process is still expensive, so large OLED displays are rare—most OLEDs are used in small-screen applications, such as media players and smartphones, though HD displays up to 40-inches have been demonstrated. And the materials used in OLEDs don't necessarily last as long as regular LCD displays—another reason they're more frequently found on phones and media players, rather than computer monitors and televisions. Monitors are typically turned on for much longer stretches of time. And finally, the organic materials in OLEDs are extremely susceptible to water damage, so displays must be well-sealed.

OLED TO THE FUTURE

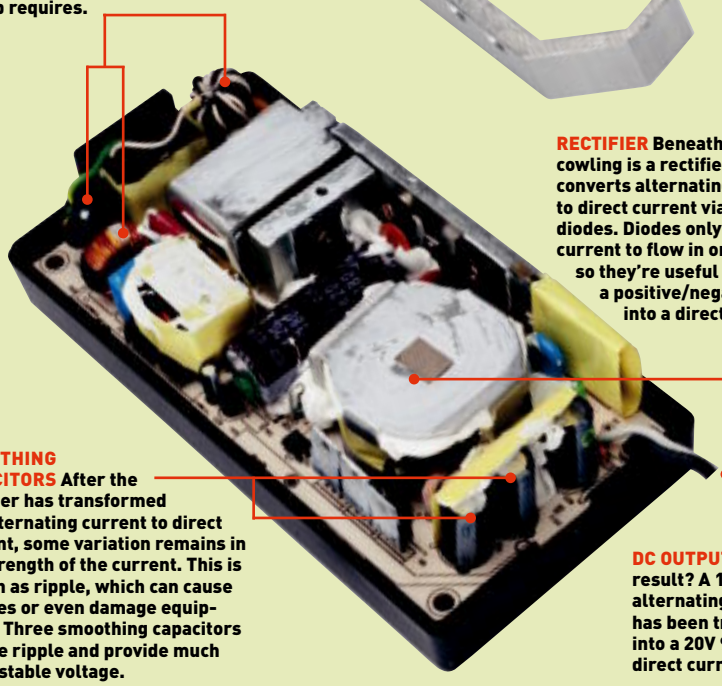
What's next for OLED technology? The European Union, among others, is investigating the use of OLEDs as cheap solid-state lighting to replace incandescent bulbs. Their stated goal is to create a 100x100cm square of OLED material that creates 100 lumens per watt of power, has a working lifespan of at least 100,000 hours, and costs less than 100 euros per square meter to produce.

OLEDs have found their way into concept cars, lighting fixtures, PMPs, and laptop prototypes, with the latter expected to enter production by Q3 2010. As manufacturing processes become less expensive, OLED displays could start to replace LCDs, not just in media players and phones, but also in notebook computers, monitors, and televisions, on a much larger scale.

AC Power Adapter

Your gadgets run on direct current, but your power outlet delivers only alternating current, so you rely on AC power adapters to give your gear the juice it needs. We took apart a dead laptop's power brick to see where the magic comes from. Warning: Don't do this at home—you could get fried.

TRANSFORMERS Transformers use copper wire wrapped around iron cores to raise or lower AC voltages, exploiting electromagnetic principles. These transformers begin the work of turning the 120V AC coming in to the 20V DC the laptop requires.



RECTIFIER Beneath this metal cowling is a rectifier, which converts alternating current to direct current via a series of diodes. Diodes only allow electric current to flow in one direction, so they're useful for converting a positive/negative AC wave into a direct current.

SMOOTHING CAPICITORS After the rectifier has transformed the alternating current to direct current, some variation remains in the strength of the current. This is known as ripple, which can cause crashes or even damage equipment. Three smoothing capacitors reduce ripple and provide much more stable voltage.

DC OUTPUT The final result? A 120V 3.9A alternating current has been transformed into a 20V 9A (180W) direct current.

SUBMIT YOUR IDEA Ever wonder what the inside of a power supply looks like? Don't take a chance on destroying your own rig; instead, let us do the dirty work. Tell us what we should crack open for a future autopsy by writing to comments@maximumpc.com.

HOW TO

Step-by-Step Guides to Improving Your PC

THIS MONTH

CHROME IS STILL NOT GOOD ENOUGH

NORMAN CHAN
ONLINE EDITOR

The recently unleashed 3.0 version of Chrome marks the 15th official update Google has made to its minimalistic browser. Color me unimpressed. Sure, Chrome 3.0 touts a 25 percent speed boost in its Javascript engine and includes a newly redesigned Tab page, but these updates alone won't convince me to abandon Firefox. The major feature we're all waiting for from Chrome, of course, is extension support. That isn't to say it's not in the works—the publicly available Chrome developer builds have supported extensions for months. But until this feature goes mainstream, we won't see an explosion of extensions from the community to match Firefox's massive Add-on library.

So, where do the Chrome faithful go to get their custom-features fix? Since Chrome is open source, we recommend trying out third-party builds of the browser. ChromePlus (www.chromeplus.org), for example, is a custom-developed version of Chrome that includes built-in support for mouse gestures, an IE tab, and other interface tweaks. Like its name implies, it's everything that's great about Chrome, plus more.

SUBMIT YOUR IDEA
Have a great idea for a How To project? Tell us about it by writing to comments@maximumpc.com.

WINDOWS TIP OF THE MONTH

Kill the Windows Key

Keyboard shortcuts can occasionally be inconvenient; accidentally hitting the Windows key while gaming can kick you back to the Desktop. Disable the effects of the Windows key by downloading and running the following registry file: http://bit.ly/10pZHI. To re-enable the shortcut, download and run this registry file: http://bit.ly/GwfMV. You'll need to restart your computer after running either file.

Automate Photoshop Tasks

You know the story: After a whirlwind vacation around the world, you have too many photos to color-correct, resize, and publish to the web. Though there are numerous photo-editing programs that can batch-process files with basic actions, none are as customizable as the Actions feature in Adobe Photoshop.

Actions is perhaps one of the most useful Photoshop features, allowing you to customize and automate most of the program's image-manipulation tools. These prerecorded macros perform the monotonous tasks for you, allowing you to step away while your computer does the image-editing dirty work. We'll show you how to record your own Actions in Photoshop, and help you prep your photos for viewing in less time than it takes you to get over your jet lag.

–FLORENCE ION

1 PREPARE PHOTOSHOP TO RECORD AN ACTION

Open an image file in Photoshop. We're going to use this image to teach Photoshop the individual steps of the new Action. Since this image is only going to be used to create the Action, it doesn't need to come from the photo gallery you want to eventually batch process.

Under the Window menu option, make sure that the Action tab is open, or bring it up by pressing Alt+F9. At the bottom of the

Action tab, click the Create a New Action button. A dialog box will appear asking you to give it a name. You also have the option of giving this Action its own shortcut key, which is useful if you plan on using the macro frequently.

After naming your Action, be prepared to start recording. From this point on, every tool and menu selection you make will become programmed into the Action, so it's a good idea to plan out what you want to beforehand.

2 RECORD YOUR ACTION

For the first step of our Action, we're going to resize our photo. Find the image resizing tool under Image > Image

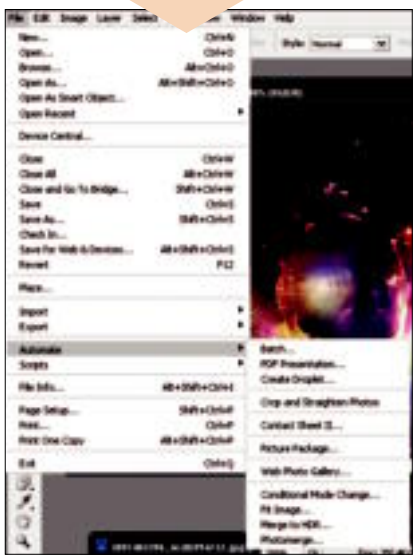
Size, or hit Ctrl+Alt+I. A box will pop up with resizing options; make sure your measuring point is in pixels and that the Constrain Proportions box is checked. Photoshop will automatically resize your photo to fit the height based on the width input. If you plan on uploading your images to a photo-sharing site like Flickr, we suggest keeping the width and height below 600x400 for quicker uploads. If you're going to process a batch of photos with varying aspect ratios (i.e., both portrait and landscape), the Action will maintain the original aspect ratios and just scale all photos to the new image width.

Next, we want to enhance the contrast and colors of each photo. We could adjust each image individually, but that is usually very time-consuming and sometimes ineffective. Go to Image > Adjustments and select Auto Levels. This will automatically set the input and output levels for all color schemes of the photo based on its histogram. Auto Levels combines the Auto Contrast and Auto Color features, so you don't need to add those individually.

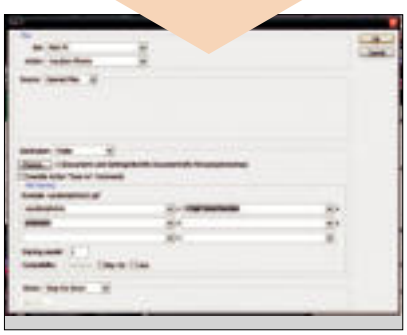
When you're finished, save this image to your Desktop using the Save As command, Ctrl+Shift+S. Choose the file format you want to save the image in, such as web-friendly JPEGs or PNGs, and choose your desired save-quality settings. We want the Action to record this so it knows how to save each file after its done processing the photo. Finally, press the Stop button in your Actions menu window.

3 EXECUTE YOUR ACTION

Click File > Automate > Batch to begin your batch process. A new window



will pop up with many batch processing options. Find your saved Action under the Action dropdown menu. Under the Source option, choose Folder, and click the Choose button to select the original file location. Alternatively, you can open all the images beforehand in Photoshop and choose the Opened Files source option. Importing files

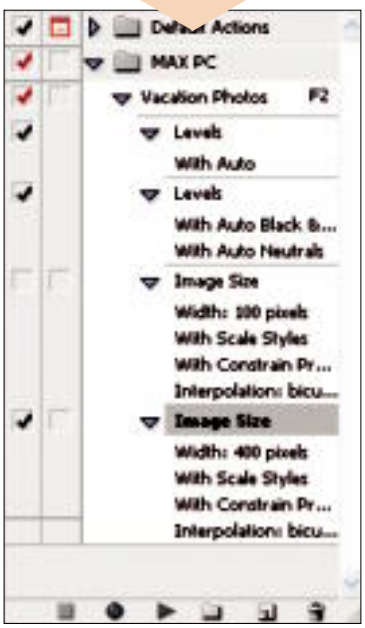


from an attached digital camera or Adobe Bridge works, as well.

Under Destination, choose Folder and select a destination folder to hold the newly processed images. Make sure that the Override "Save As" Commands box is checked—we want to use this since we included a "Save As" step in our macro.

To give your new photos more identifiable monikers, you can set up Photoshop to automatically name them for you, adding a sequential serial number as well. For this project, we created the name "vacationphotos," chose 2 Digit Serial Number, and opted for a lowercase file extension, which output files named vacationphotos01.jpg, vacationphotos02.jpg, etc.

Choose "Stop for Errors" in the Error field and then click OK to begin the batch process. You can watch as Photoshop glides through your photo gallery, or you can minimize the

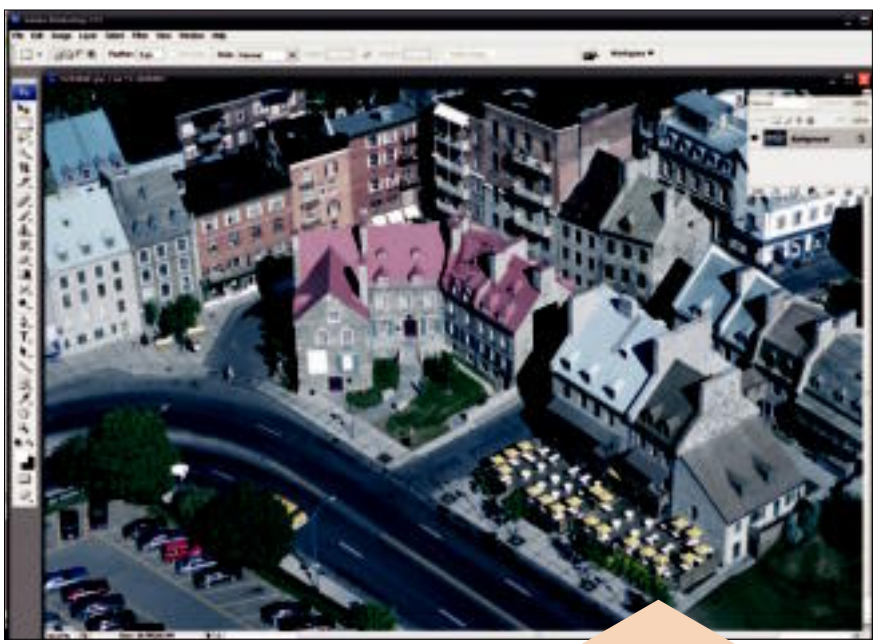


program to multitask while your photos are being color-corrected and resized.

There are a few tricks that are useful to know when creating Actions. One is that you can add the same steps with different settings, that can then be selectively enabled or disabled. You can also record new steps into an Action after its original creation. For example, using the Record button in the Actions menu, you can insert another Save As step, this time choosing to save as a bitmap. Now, you can switch between the two Save As steps depending on which file type you prefer. Additionally, you can double-click individual steps to tweak their details.

The Actions feature can yield powerful macros and save you a lot of time—we encourage you to experiment with it!

Make a Tilt-Shift Picture



Tilt-shift photography produces images that have a sharp focus but also have a very shallow depth of field, making the landscape, buildings, and figures in the photo look like a miniaturized toy representation of its actual-size counterpart. To shoot genuine tilt-shift photos, you need a small- or medium-format camera with special lenses, and the image composition requires precise rotation of the lens parallel to the image plane and a proper orientation of the plane of focus—in other words, you need to be a professional photographer with some pricey equipment.

Fortunately, it is still possible for novice photographers to emulate this look on the cheap using Photoshop. With the right source photo and the application of a few filters, you'll be able to simulate the tilt-shift look, making cars look like Micro Machines and houses look like miniature-scale models made out of cardboard and toothpicks. —FLORENCE ION

1 CHOOSE AN APPROPRIATE PHOTO

Choosing the right photo for this faux-miniature model is perhaps the most important step in this process. When you select your photo, make sure it has an elevated viewpoint—more than 30 degrees—and that it has a reasonably wide-angle field of view. Additionally, tilt-shift images look best when they're populated with lots of small figures such as cars, pedestrians, and foliage.

2 ENTER MASK MODE

Enter Quick Mask mode by pressing Q; you will notice that the top of your photo's status bar window will now display Quick Mask Mode. Press G to select the Gradient tool and check to see that the Paint Bucket tool is not selected on the tool bar (they share the same shortcut). In the toolbar at the top of your screen, make sure the Reflected Gradient option is selected, which is the fourth icon from the left. For your gradient color scheme, choose the first gradient style selection, which should say Foreground to Background Color when you hover your mouse over it.

Next, choose a point on your image where your want the final photo to be fo-

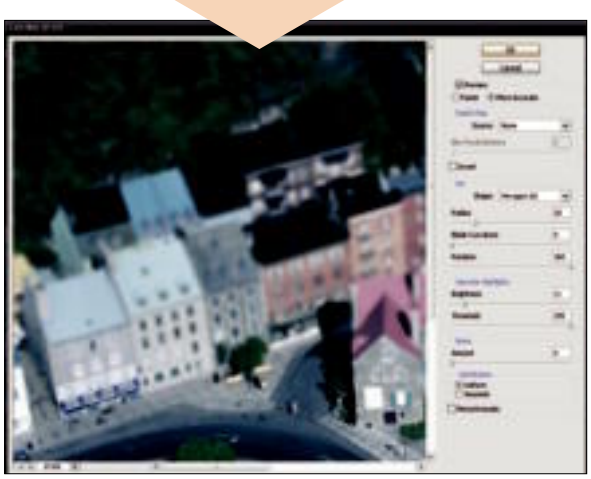
cused. Starting from that point, draw a vertical line, ending where you want the photo to transition out of focus. The area of focus should now have a red overlay. The gradient scheme you chose will ensure that the parts that aren't red will be blurred, and your focus area will be the foreground. To get the focus area just right, you may have to try drawing the gradient line several times. For most tilt-shift photos, the in-focus space should take no more than a third of the entire image.

3 BLUR YOUR PHOTO

Exit Quick Mask mode by pressing Q; Photoshop will convert your gradient into a selection path. Leaving it active, point your cursor to Filter > Blur > Lens Blur; a window will pop up with a preview of your photo with options on the right side. Below the Preview checkbox, select More Accurate, and under Iris, the shape should be Hexagon, with a Radius of 20, zero Blade Curvature, and 360-degree Rotation. Under Specular Highlights, set Brightness to 11 and Threshold to 255, with no Noise. Photoshop may have already defaulted to some of these figures for you. Click OK to apply these changes and apply the blurring effect. You'll notice that your area of focus is perfectly visible, while the surrounding area is blurred.

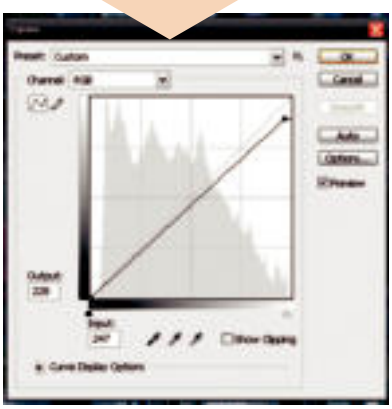
4 INCREASE SATURATION

Deselect the photo and open the Hue/Saturation menu under Image and Adjustments, or by hitting Ctrl+U. You'll want to amp up the Saturation so your photo looks more vibrant, matching the tone of tilt-shift photos. For this particular image, we set the Saturation to 40.



5 TWEAK THE CURVE

Almost done! The last step is to adjust the tone and contrast of the photo with the Curves tool, accessed with Ctrl+M. In our example, we tweaked our settings only slightly at the top to increase contrast and darken the photo. Follow the underlying histogram to determine how to set your curve. Again, this setting depends on the photo that you're working with and your own preferences. When you're finished, accept the changes and save your photo.



Composite a High Dynamic Range Photo

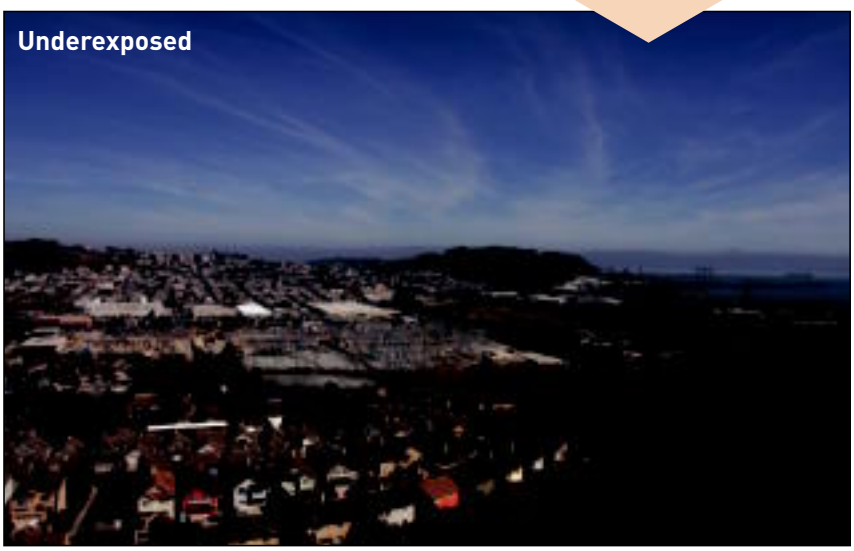
High Dynamic Range (HDR) is a photography technique that expands the range of luminance and contrast in a photo outside of what would be possible with a standard digital camera. Even with a high-end DSLR, fixed contrast forces your photos to sacrifice tonal quality in the highlights or shadows of a scene. With HDR enhancements, your photos look more like how the naked eye sees a scene, as opposed to the limited tones of a fixed camera exposure setting. Photoshop includes a plugin to create HDR images, and we'll show how to properly shoot photos and utilize this feature, even without an expensive camera.

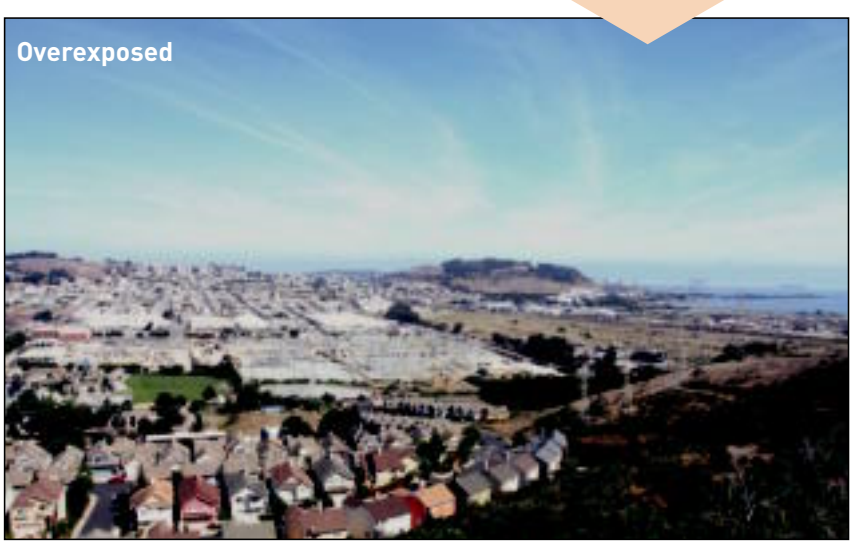
–NORMAN CHAN

1 PHOTOGRAPH A RANGE OF EXPOSURES

Photoshop's HDR utility works by merging photos of the same scene with varying exposure settings. You'll need a digital camera that will let you manually adjust at least two stops of exposure range. Most DLSRs have an exposure bracketing mode that will shoot three photos of varying stops in succession, but we can simulate that mode on a point-and-shoot by using a tripod.

Affix your camera to a tripod and point it at your target scene. The scenes that work best for HDR imaging have a good balance of deep shadows and bright highlights, like a cityscape at sundown. Take at least three photos, each one stop apart. You should have at least one underexposed photo and one overexposed photo. The underexposed image captures the details lost in the highlights and the overexposed shot captures details lost in shadows. Saving your photos as RAW images is recommended, but JPEGs work, as well.





2 IMPORT INTO PHOTOSHOP

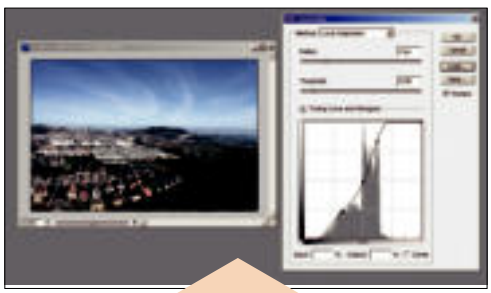
Put all your photos in a folder and open Photoshop. Go to File > Automate and select Merge to HDR. A window will pop up asking for you to locate source files. Locate the photos you took and import them into this window, then click OK.

If you didn't use a tripod, check the Attempt to Automatically Align Source Images checkbox and Photoshop will try to compensate for any minor differences in your series of photos. As long as they're not wildly different and don't

have large moving objects, the photos should merge without any problems.

3 WEED OUT THE BAD SOURCE IMAGES

After the photos are merged, you'll see a window with the new 32-bit composite image. The individual source files will show up on the left in a filmstrip—use the checkboxes here to exclude any source photos that add blurriness to your composite (such as from camera shake). The White Point Preview slider on the right lets you make tonal adjustments, but it's also very sensitive to any changes. Save your changes now in the .psd format.



4 DOWNSAMPLE YOUR COMPOSITE TO 8-BIT

To be able to share your image online, you'll need to convert it to eight-bit. Click Image > Mode > 8 bit to begin the conversion, which will open up an HDR Conversion window. Here, you're offered four ways to adjust the tonal quality of your image: Exposure and Gamma, Highlight Compression, Equalize Histogram, and Local Adaptation. Only the first and last options give you configurable settings. Exposure and Gamma, the default method, is the simpler of the two to use. Move the slider bar for Exposure to adjust the image brightness, and change the Gamma value to adjust the image contrast. There isn't one set of settings that works best for all images, so you'll have to experiment a bit. A desirable HDR image will have highlights that don't look washed out and shadows that don't obscure details.

Local Adaptation is a little trickier. The toning curve is mapped on top of a histogram, which you should use as a guide to make your adjustments. Click on points of the curve to create anchor points, shifting them up and down brings out details from the dark part of the photo and accents the contrast between the foreground and background.

Use the Radius and Threshold sliders to reduce the glow around bright edges. Once again, there is no setting that fits all photos, so be patient with trial and error.

When you're satisfied with how your photo looks, click OK. Depending on how well the source images were aligned, the result may look a little blown out. As a final tweak, apply the Sharpen Filter to remove any blurriness. Now you're done!

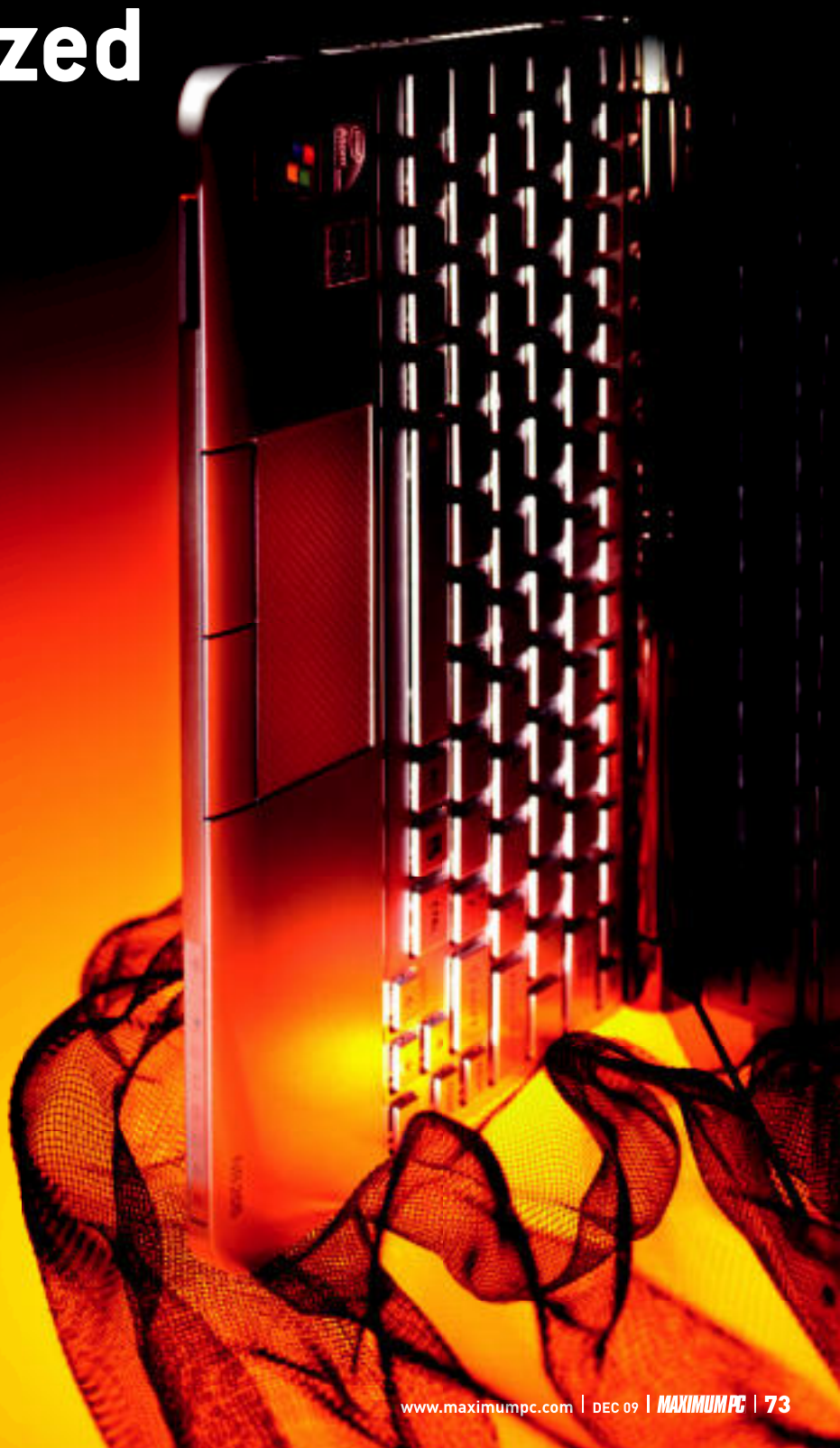
REVIEWS

Tested. Reviewed. Verdictized

INSIDE

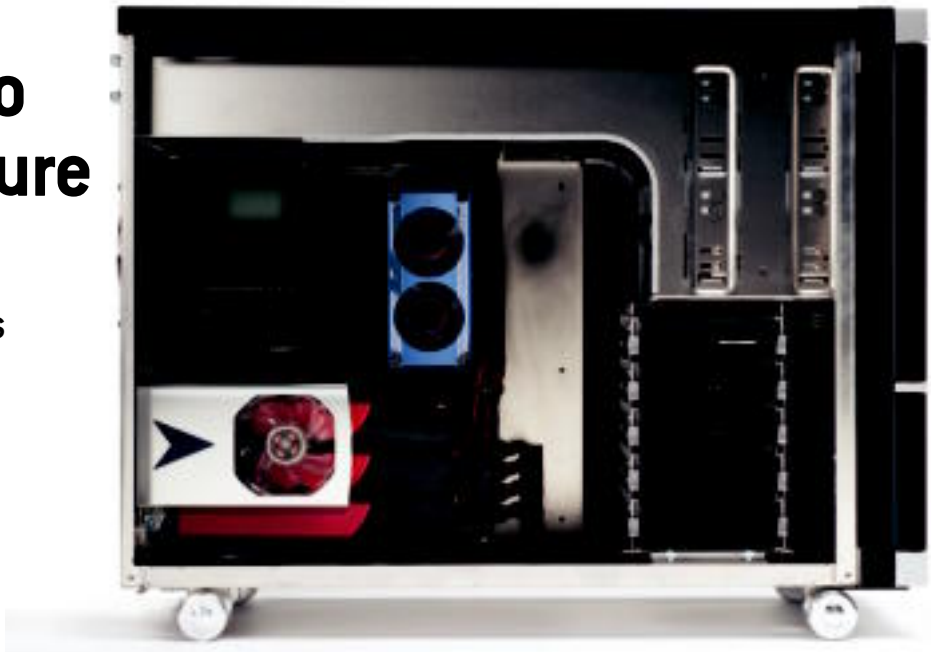
ONLINE

- EVEN MORE REVIEWS!
- BEST OF THE BEST
- EDITORS' BLOGS
- NO BS PODCAST



Velocity Micro Raptor Signature Edition

First Windows 7 rig makes a smashingly fast, and pricey, debut



Quad-core, quad SSDs, and tri-SLI make the Raptor SE one fast—and expensive—machine.

It is, perhaps, fitting that Velocity Micro's new rig is called a Raptor.

That's because anyone who has ever seen the Air Force's F-22 Raptor in person and on afterburner knows just how overkill the F-22 is.

The same can be said of Velocity Micro's Raptor Signature Edition. With people overjoyed just to have a $99 Athlon II X4 620, Velocity Micro decided to go shock-and-awe on the spec lists—and the wallet.

First up is Intel's stellar Core i7-975 Extreme Edition. With a stock speed of 3.33GHz, Velocity Micro uses a custom CoolIt Domino ALC to get the processor to a very stable 4.2GHz. To "balance" this $1,000 CPU, Velocity Micro throws in probably $1,500 in GPUs in the form of three EVGA GeForce GTX 285s. Still not impressed? How about four SLC-based Intel X25-E Extreme 64GB SSD drives in RAID 0?

Mind you, these are not the pedestrian X25-M consumer drives; they're enterprise-class drives that offer more than twice the write performance of the X-25M version and peg the read speeds at the SATA 3Gb/s limit. If you're afraid of a four-drive RAID 0, you might feel better that the X25-E's are designed for server use and should have 10 times the life of a consumer drive.

Storage is handled by a single 1.5TB Seagate and two optical drives, one a Blu-ray burner. The entire rig is based on EVGA's X58 SLI Classified motherboard. RAM is left to 6GB of Kingston DDR3/1600 modules. And, of course, there's Windows 7 Ultimate in 64-bit mode, to boot. We've been taking a drubbing from the Mac fanatics for some time over Vista, but Win7 fixes all that and may even plant a Windows logo'd boot up OSX's rear.

As much love as we have for Win7, it made comparisons with other systems difficult—up to now all the desktops we've reviewed have used Vista. On the other hand, the comparisons are valid as a PC purchased four months ago is likely still running Vista. If you buy into that line of reasoning, we can tell you that the Raptor SE is now the benchmark king in five of our six benchmarks. For a more direct comparison, we looked at the numbers from our September Dream Machines, which ran Windows 7, and as expected, those three boxes couldn't touch the Raptor SE. For example, our midrange Core i7 Dream Machine (our new desktop zero point) puts out 37fps in Crysis at 1920x1200—the Velocity Micro pushes 70fps. The Raptor SE turns in no less than double-digit percentage gains in every test.

So, what's the problem? Just like the F-22, which just got its ticket punched by a penny-pinching Pentagon and Congress—the price. At $9000, this is one of the most expensive rigs we've ever tested. With the 64GB X25-E drives each costing $800, a $1,000 CPU, and $1,500 in GPUs, the stratospheric price of the Raptor SE is enough to make even a DoD procurement clerk with use of the never-ending government Visa card cringe.

Still, we understand the need to be on top of the benchmarks, and respect that. We just wish it didn't have to cost as much as a small nation's GDP. **–GORDON MAH UNG**

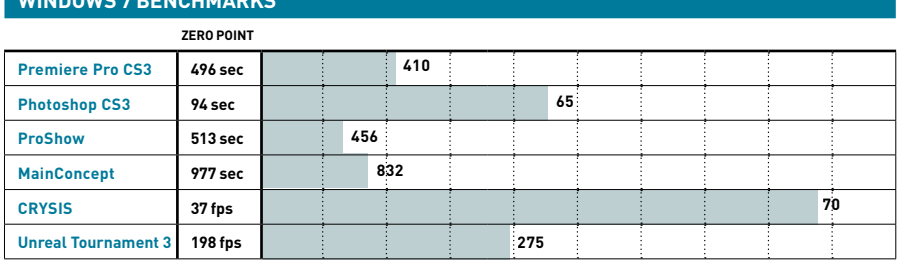
VERDICT 9

VELOCITY MICRO RAPTOR SIGNATURE EDITION

AFTERBURNERS	SUNBURN
This rig is built for bear and breaks nearly every benchmark.	Price that's as easy to pass as a gallstone.

$9,000, www.velocitymicro.com

WINDOWS 7 BENCHMARKS



Our current desktop test bed consists of a quad-core 2.66GHz Intel Core i7-920 overclocked to 3.66GHz, 6GB of Patriot DDR33/1333, a Radeon HD 4870 X2, and a 1.5TB 7,200rpm Seagate 7200.11 hard drive. The motherboard is a Gigabyte GA-EX58-UDR3 motherboard and a Corsair TX850 PSU. OS is Windows 7 in 64-bit mode.

SPECIFICATIONS

Processor	Intel 3.33GHz Core i7-975 Extreme Edition@4.2GHz
Mobo	EVGA X58 SLI Classified
RAM	6GB Kingston DDR3/1600
Videocard	Three EVGA GeForce GTX 285 in tri-SLI
Soundcard	N/A
Storage	Four 64GB X25-E Intel SSDs in RAID 0, Seagate 1.5TB Barracuda 7200.11
Optical	LG GGW-H20L, LG GH22LS40
Case/PSU	Custom Lian Li, 1,200W modular PSU

Western Digital Caviar Black 2TB

Faster than a VelociRaptor, and six times the capacity

After months of making do with 5,400rpm and 5,900rpm 2TB drives and odd-bird 1.5TB drives, it's finally happening: 7,200rpm two-terabyte hard drives are coming to rigs near you. First out of the gate and into our greedy arms is Western Digital's 2TB Caviar Black, the performance cousin to the 2TB Caviar Green we reviewed in May (http://bit.ly/3wKLRl). And brother, it's just what we've been waiting for.

The 2TB Caviar Black is spec'd to impress, with four 500GB platters, two processors, 64MB of cache, and a dual-stage actuator system that puts a fine-tuned piezoelectric actuator head at the end of the standard magnetic actuator, enabling fine-tuned tracking for speedy seek times. The Caviar Black also comes with WD's standard No-Touch ramp loader, so the read/write head never comes in contact with the platters, increasing the drive's lifespan.

All these little extras add up, and the 2TB Caviar Black offers the speediest sustained reads and writes—exceeding 112MB/s each—of any consumer magnetic hard drive we've ever tested. That's 15 percent faster than the Seagate Barracuda 7200.11 1.5TB's read speeds. The 1.5TB Barracuda, previously our high-capacity speed champion, couldn't keep up in sustained writes, either—here the Caviar was nearly 30 percent faster. And thanks to the greater areal density of the Caviar drive, its random-access read and write times are just 7.6ms and 5.0ms, respectively. You won't find faster seeks short of a VelociRaptor or solid state drive. Of course, solid state drives offer the best performance—the $370 Patriot Torqx, our Best of the Best SSD, achieves sustained reads of over 200MB/s, sustained writes of over 175MB/s, and seek times measured in the tenths of milliseconds.

The 2TB Caviar Black has an MSRP of $300, the same price that low-powered 2TB drives like the Caviar Green and Barracuda LP debuted at earlier this year. Street prices, of course, will be lower, and keep falling—the first waves of 2TB drives, the "green" ones, are already selling for as low as $200. And the Caviar Black's sustained reads and writes trump the fastest of those green drives by 20MB/s.

The 1.5TB Barracuda held a spot on our Best of the Best list for more than a year, but now it's been firmly supplanted—the 2TB Caviar Black is officially our favorite hard drive.

Expect 7,200rpm 2TB drives from Hitachi, Seagate, and others in the next few months as well, with the aim of high performance. But if you buy a capacity hard drive today, next week, or even half a year from now, you can't go wrong with this Caviar Black. It has the fastest sustained read and write speeds of any consumer magnetic hard drive we've ever tested. It's faster in any benchmark than all standard hard drives save the WD VelociRaptor, which still holds the edge in burst speeds and random-access times—*barely*. Think about that for a second: You can get VelociRaptor-busting speed and six-and-a-half times the capacity for $300. We're sold.

—NATHAN EDWARDS

MAXIMUM PC KICK ASS!

VERDICT **9**

WESTERN DIGITAL CAVIAR BLACK 2TB

+ LENNON	− LENIN
Stupid-fast; heaps of cache; dual-action actuator arm.	Random-access writes; burst speeds still slightly slower than VelociRaptor.

$300, www.wdc.com

BENCHMARKS

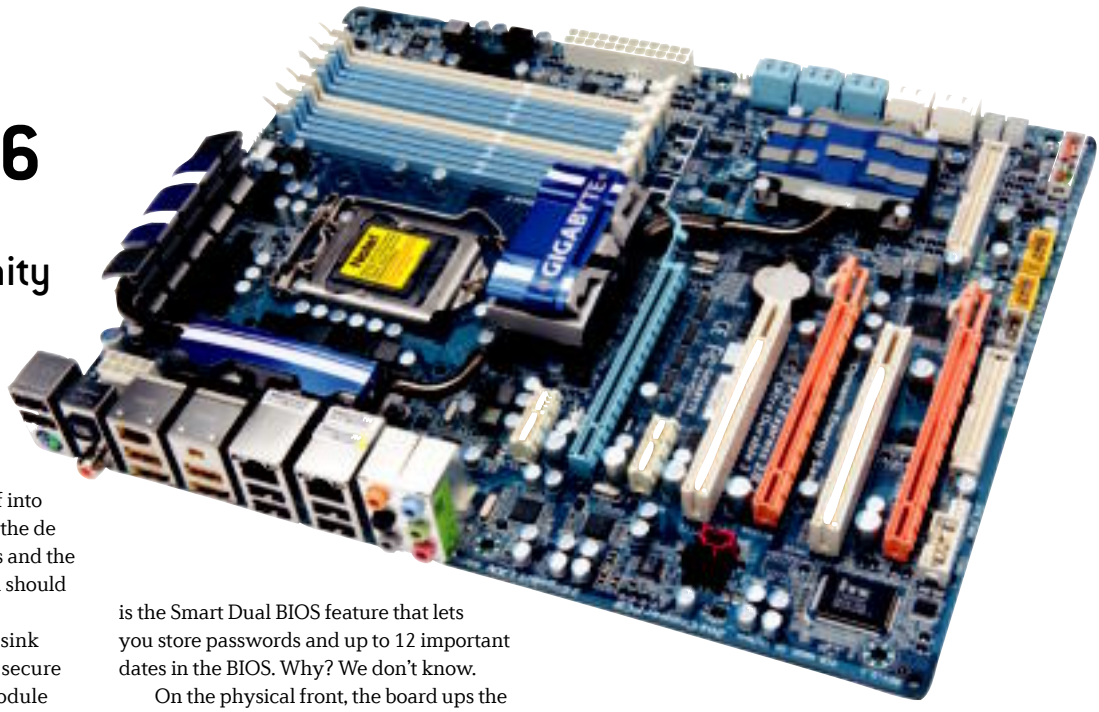
	WD Caviar Black 2TB	Seagate Barracuda 7200.11 1.5TB	WD VelociRaptor 300GB	Patriot Torqx 128GB
h2benchw Average Sustained Transfer Rate Read (MB/s)	112.3	98.2	98.31	**205.4**
h2benchw Average Sustained Transfer Rate Write (MB/s)	112.2	85.7	98.22	**175.1**
h2benchw Random Access Read (ms)	7.6	12.5	7.24	**0.11**
h2benchw Random Access Write (ms)	5.0	5.3	3.42	**0.31**
HDTach Burst Read (MB/s)	213.7	209.3	**249.7**	163.0
PCMark Vantage Overall Score	6,452	5,241	6,082	**21,247**

Best scores are bolded. All drives were tested on our standard test bed using a 2.66GHz Intel Core 2 Quad Q6700, EVGA 680i SLI board. HDTach 3.0.1.0, h2benchw, and Premiere Pro CS3 scores were obtained in Windows XP; PCMark Vantage 2005 scores were obtained in Windows Vista Home Premium 32-bit.

If this is the shape of 7,200rpm drives to come, we're wetting ourselves with excitement.

Gigabyte GA-P55-UD6

A P55 motherboard that spares no amenity



Gigabyte's P55 board is the first to sport six DIMM slots for the Core i5.

If you thought Intel's new budget Nehalem meant rock-bottom, feature-stripped motherboards to match, think again.

Gigabyte's GA-P55-UD6 jams just about every feature you could think of into the new LGA1156 platform. There are the de rigueur updated power-saving utilities and the dual BIOS, which can save your bacon should your BIOS get corrupted.

And then there's a whole kitchen sink of new features, such as the ability to secure the system using the onboard TPM module and then have it unlock when the computer detects your Bluetooth phone nearby. The same Bluetooth phone can also be used to put the system in standby or hibernate if you walk away, to save power.

Two other features are probably a bit more useful: As part of the board's Smart Six apps, the BIOS QuickBoot feature allows you to set the BIOS to initialize much faster if no hardware has been changed. With the feature turned on, we saw the system go from a 30-second POST-to-OS load to 15 seconds. That's pretty spectacular. The OS QuickBoot promises faster boots, too, but as far as we can tell, it's simply a different way to invoke Vista's Hybrid Sleep mode.

In the odd-feature department, the Smart Recorder function can log power ons and offs and which files are moved off of the computer. (Not trustful of your roommate?) Even odder is the Smart Dual BIOS feature that lets you store passwords and up to 12 important dates in the BIOS. Why? We don't know.

On the physical front, the board ups the arms race in power regulation with a 24-phase power feature. A typical budget board features four-phase power circuits—Gigabyte says the 24-phase helps keep the board cooler by spreading the workload among more components and can also aid in delivering higher and more reliable voltage. Gigabyte also says it used two ounces of copper to build the traces in the board instead of the typical one ounce in budget boards. In theory, this should lower the resistance and also thermals.

Of course, there's also 12 SATA ports (but no SATA 6) and eight USB ports (no USB 3.0), as well as SLI and CrossFire X support. Oh, and did we mention the six DIMM slots? That's the feature that will get the most attention. Since Lynnfield is dual-channel, the majority of boards for the CPU feature four DIMM slots. The six-slots, though, aren't as useful as you would think, right now. To populate all six, you must include four single-sided DIMMs. What that translates to with today's RAM is four 1GB DDR3 sticks combined with, say, two 2GB DIMMs, for a total of 8GB. That's the same as you would get from a four-slot board. The extra slots might be handy in 12 to 18 months, when RAM density has increased, but not today. We tested the GA-P55-UD6 with six DIMMS to see if populating all of the slots would hurt performance, and it didn't. In fact, we saw slightly better performance with 8GB using six DIMMs than 8GB using four DIMMs.

We used the GA-P55-UD6 for the majority of our Lynnfield testing (November) and didn't experience any issues, and performance was quite good when compared to X58 and i920.

Even the cost of the board is quite acceptable. If this were an X58 board, it would push $350, but at $240 MSRP the GA-P55-UD6 is a decent value. The fact that the board is currently selling for more than it lists tells you how hot is right now. —GORDON MAH UNG

P55 VS. X58

	2.66GHz Core i5-750 on P55	2.66GHz Core i7-920 on X58
Everest Ultimate MEM Read (MB/s)	12,867	**14,387**
Everest Ultimate MEM Write (MB/s)	9,881	**11,639**
Everest Ultimate MEM Copy (MB/s)	14,684	**15,790**
Everest Ultimate MEM Latency (ns)	**30.9**	61
PC Mark Vantage	**7,208**	6,929
3DMark Vantage Overall	14,947	**15,008**
3DMark Vantage GPU	12,249	12,306
3DMark Vantage CPU	44,066	44,002
Crysis CPU (fps)	147	146
Resident Evil 5 fixed DX9 (fps)	109	114
World in Conflict (fps)	**266**	221

Our Core i7 rig used a GA-EX58-UD5R with 6GB of DDR3/1066 in tri-channel mode. Our Core i5 rig used a GA-P55-UD5 with 4GB of DDR3/1333 in dual-channel mode. Both systems were running a GeForce GTX 280 card, a WD Raptor 150 hard drive, and 64-bit Windows Vista Home Premium.

VERDICT 9

GIGABYTE GA-P55-UD6

+ GIGABYTE	− GIBIBYTE
Short POST times and SATA and USB ports for days.	Can't access reset button with two GPUs installed.

$240, www.gigabyte.us

Scythe Mugen 2

Bulky, but it gets the job done

They just keep getting bigger and bigger. Now that CPU air-cooling manufacturers have seemingly settled on the skyscraper school of heatsink design, there seems to be a competition over who can cram the most cooling fins into the largest area. Scythe's Mugen 2 air cooler, the follow-up to its popular Mugen series, is one of the largest coolers of this type that we've ever tested. But can it match the cooling power of its slightly smaller cousins, such as Thermalright's U-120 eXtreme?

The Mugen 2 is a hefty hunk of a cooler, at 5.1 inches wide, 5 inches deep (with the included 12cm fan), and 6.2 inches high; it weighs nearly two pounds. It's not the heaviest cooler we've ever tested, nor the most unwieldy, but its girth could certainly prevent you from installing it in all orientations on all motherboards. We had trouble fitting it in some orientations on our EVGA 680i SLI board—our usual preference being to install the cooler fan parallel with the rear exhaust fan. On our board, though, there wasn't room; we resorted to attaching the cooler fan perpendicular to the rear exhaust fan. Thankfully, this didn't seem to impact performance, as the Mugen 2 performed slightly better in our tests than the Thermalright U120-eXtreme—about 2.25 C cooler at both idle and full CPU burn.

BENCHMARKS

	Scythe Mugen 2	Thermalright U120-eXtreme	Stock Cooler
Idle (C)	**27.75**	29.75	33.75
100% Burn (C)	**43**	45.25	61

Best scores are bolded. Idle temperatures were measured after an hour of inactivity; load temperatures were measured after an hour's worth of CPU Burn-In (four instances). Test system consists of a stock-clock Q6700 processor on an EVGA 680i motherboard inside a Cooler Master ATCS 840 case with stock fans.

The Mugen 2 ships with mounting brackets for LGA1366, 775, and AMD boards; the first two use the same bracket and backplate but different screw holes. Support for the new LGA1156 socket wasn't available at the time of this review, but the company states it is in the works. Installation requires motherboard removal or a motherboard tray with a backplane cutout. Each of its five copper heat pipes rises into its own separate stack of cooling fins, allowing airflow between the stacks.

If you opt to use the included 12cm fan, you might have to tweak your motherboard fan control settings due to its four-pin PWM connector. We manually set the fan control to 100 percent for testing, after the motherboard's fan control resulted in significantly higher temperatures.

You can attach up to four 12cm fans to the Mugen 2—one to each face of the fin array—using the familiar thin wire clips found on similar coolers. Whether this actually helps, of course, is up for debate. We didn't see any performance gains when we experimented with multiple fans on the Noctua NH-U12P and Thermalright U-120 eXtreme.

For laudable performance, a relatively easy install compared to its peers, and a lower price point, we're awarding the Scythe Mugen 2 our Kick Ass Award. However, this is clearly the upper limit of how big a cooler can be and still earn a high recommendation. Hear that, vendors? Scale 'em down a bit. **–NATHAN EDWARDS**

MAXIMUM PC KICK ASS!

SCYTHE MUGEN 2

VERDICT 9

+ MUGISON	– MURGATROYD
Kick-ass cooling at a kick-ass price. Relatively easy installation for a cooler of this type.	Manual mode gets best results; massive.

$50, www.scythe-usa.com

The Mugen 2 pushes the upper limit on air-cooler size, but we'll allow it. This time.

Toshiba NB205

Getting it right the first time

The NB205 looks good and runs well. But why is the tilde key down between the Alt key and the space bar?

Toshiba waited a long time to enter the netbook market, but as the NB205 proves, taking some time to learn from your competitors can be a good thing. The NB205 offers everything we expect from a netbook, as well as some unexpected bonus features, and does so for less than $400. We liked the NB205 when we used it in our netbook upgrading feature (October); here we give it a full review.

The NB205 has a matte-silver plastic chassis and a textured matte lid, available in blue, pink, black, white, or brown. We appreciate that Toshiba has bucked the glossy fingerprint-magnet trend here. The netbook is solidly constructed, with a color-matched glossy bezel and hinge. The included six-cell battery protrudes about a half an inch beyond the back of the netbook, and is slightly wobbly to the touch, but given the 6:45 (hr:min) battery life, a little wobble doesn't bother us.

As we discovered in our netbook upgrading feature, both RAM and hard drive are easily accessible, although the hard drive panel uses TORX-6 fasteners rather than the more common Phillips head screws found on the RAM compartment. Still, if you're ponying up for an SSD or larger hard drive for your netbook, you can probably spare a few bucks for a TORX-6 driver, too.

The NB205 sports the standard array of ports: three USB 2.0, VGA, audio jacks, 10/100 Ethernet, and an SD card reader. Remember the bonus features we talked about? One of the USB ports is a Sleep-and-Charge port, so you can charge your phone or other USB-powered gadget even when the computer is off. It's an addition so obvious we wish more netbook makers included it. We also appreciate the hard drive movement sensor.

The chiclet keyboard is easy to type on—the keys are more widely spaced than most, so you're less likely to hit the wrong key. It's not perfect, though—some keys are in strange places (for example, the tilde key is between Alt and the space bar), and pushing too hard on a center key causes the whole keyboard to flex slightly. The touchpad is textured, and as wide as the space bar, while the buttons are responsive and clicky, albeit identical in texture to the chassis.

Because the NB205 has the same guts as every other non-Ion Atom N280 netbook out there, we expected it to perform at least as well as our favorite 10-incher, the Asus Eee 1000HE, and slightly faster than our N270-bound zero-point system, the 12-inch Lenovo S12 (reviewed last month). And it did perform between three and five percent better than the zero point in our Photoshop, MainConcept, and Quake III tests. It's a nice (if small) boost; the equivalent of winning a 100-meter dash by a hundredth of a second—the netbook world has yet to find its Usain Bolt.

With a lap weight of two pounds, 15 ounces, the NB205 is firmly in the middle of the netbook weight class. Its price, battery life, aesthetics, and performance put it near the top of the current generation, and we appreciate perks like Sleep-and-Charge. It's one of the best netbooks on the market today. But TORX screws on the hard drive compartment? Toshiba, you were so close. –NATHAN EDWARDS

SPECIFICATIONS

Display	10.1-inch TruBrite Backlit LED@1024x600
Processor	1.66GHz Intel Atom N280
Chipset	Intel 945GSE
Graphics	Intel GMA950
RAM	1GB DDR2/553
Storage	160GB HDD (5,400rpm)
Ports	Three USB 2.0 (one w/ Sleep & Charge), audio in/out, SD card, VGA, 10/100 Ethernet
Wireless	802.11b/g, Bluetooth 2.1
Lap/Carry	2 lbs 15 oz / 3 lbs 10 oz

BENCHMARKS

	ZERO POINT	
Photoshop CS3	708 sec	673
MainConcept	251 min	241
Quake	60.9 fps	63.1
Battery Life	255.0 min	405

0 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero point netbook is a Lenovo IdeaPad S12 with a 1.6GHz Intel Atom N270, 1GB of DDR2/667 RAM, 160GB hard drive, Intel GMA950 integrated graphics chipset, and Windows XP Home (SP3).

VERDICT 8

TOSHIBA NB205

+ NOTABLE

Excellent battery life; good looks; good performance; competitive price; Sleep-and-Charge USB.

– NO THX

Totally unnecessary use of TORX screws; slightly odd keyboard.

$400, www.toshiba.com

Zune HD

If at first you don't succeed...

Previous Zune devices were pretty good music players, but lacked the "wow factor" necessary to lure the masses away from the iPod juggernaut. With the Zune HD, Microsoft has finally delivered the kind of exciting device that should make even the most ardent iPod fan take notice. It's sleek, small, thin, and surprisingly light, with the rare quality of looking as good as an Apple product without looking like an Apple knockoff.

It's also the first product to hit the market with Nvidia's Tegra system-on-chip, which packs a pair of ARM11 CPU cores with lots of individual processors for audio and video encoding and decoding, 3D graphics, etc. This is paired with a 3.3-inch, 16:9, multitouch OLED screen that is as accurate and responsive as any we've tested, and downright gorgeous. It's the first mainstream portable with support for HD Radio, which you can pump out over HDMI to your home theater along with 720p video. It's an impressive and surprisingly energy-efficient hardware package. The specs say 33 hours of music or 8.5 hours of video, but like all battery specs, this is a pipe dream that doesn't reflect real usage scenarios. Our battery lasted for just over 10 hours of heavy and varied use with Wi-Fi enabled, which is better than most devices of this type.

Is this yet another impressive piece of hardware with a mediocre interface? Anything but! The Zune HD interface is fast, smooth, artful, and intuitive, but it does require a short period of adjustment if you're used to an iPod Touch or iPhone. The incredibly useful Quickplay menu is a simple and elegant solution to a big problem with multifunction portable devices: getting to your most frequently used stuff quickly. If you've ever used the abomination that is IE for Windows Mobile, you'll be surprised and delighted to hear that the Zune HD browser is way better, and almost the equal of Safari on iPhone.

If there's an Achilles' heel to the Zune HD, it's apps. There are only nine apps in the marketplace at launch, seven of them games and all of them free. They're nice for the price, but pale in comparison to what you can get in Apple's App Store. Others are due soon, including Project Gotham Racing, Vans SK8, and Audiosurf Tilt, in addition to Facebook and Twitter. That's good, but this is a device that desperately needs a real app marketplace.

Version 4.0 of the Zune desktop software is spruced up with a clean library and marketplace interface that organizes content better than iTunes 9.

So, is the Zune HD better than the iPod Touch against which it competes? It all depends on what you're looking for. If you want a portable player primarily for media, the Zune HD trounces the iPod Touch with similar music, video, and podcast offerings, but a host of additional features and an honest-to-goodness superior interface. If you want a pocket computer to run apps and play games, with just occasional music or video playing, the robust App Store on the iPod Touch still makes it the obvious choice. —JASON CROSS

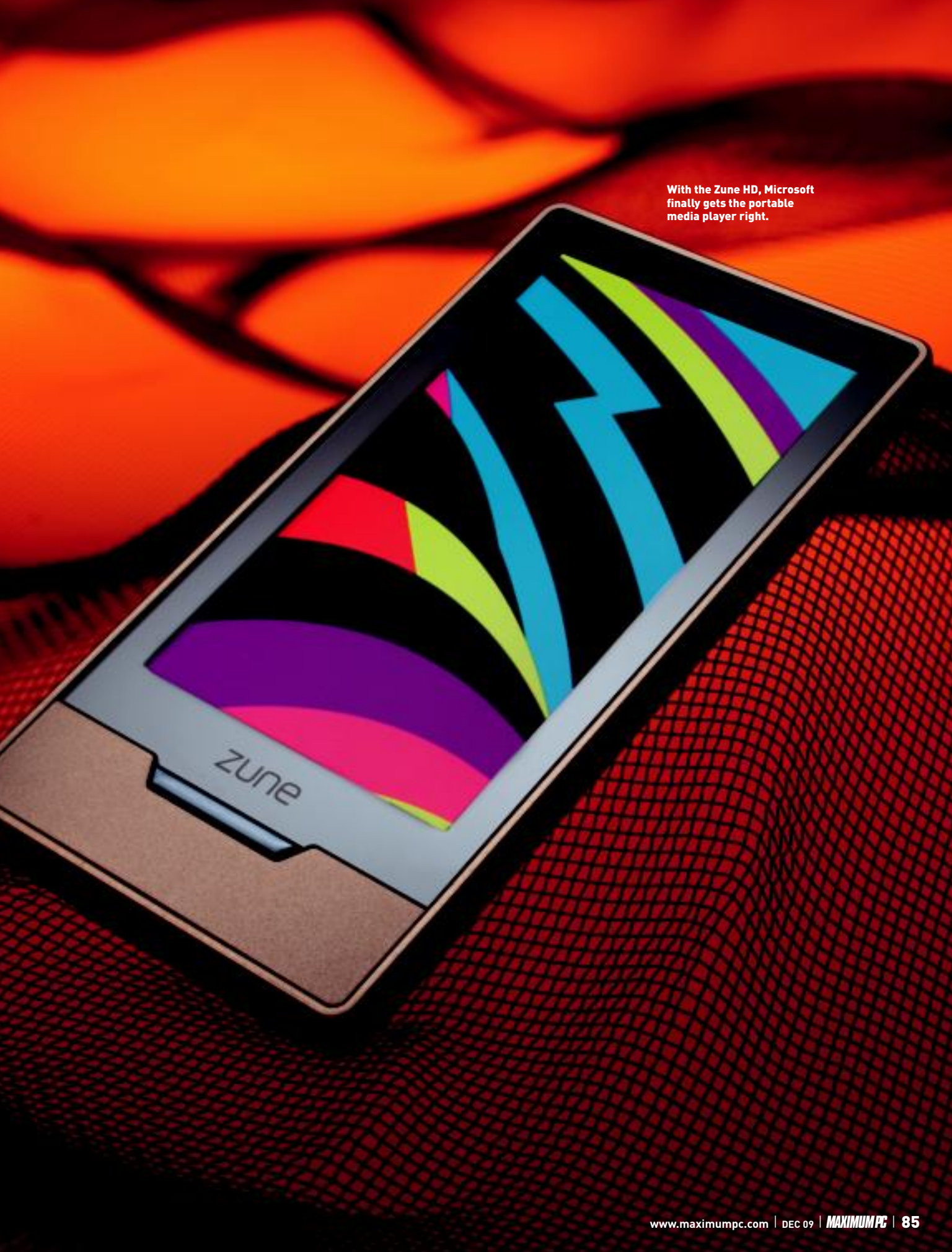
MAXIMUM PC KICK ASS!

VERDICT 9

ZUNE HD

+ JOHN COLTRANE	− KENNY G
Awesome interface; gorgeous OLED screen; HD Radio; Zune Pass; 720p video.	MS Points; no app marketplace; no camera or microphone built in.

$230 (16GB), $290 (32GB), www.zune.net



With the Zune HD, Microsoft finally gets the portable media player right.

Plextor PX-B320SA Combo Drive

Burn DVDs and watch Blu-ray movies

Blu-ray has yet to prove itself as a sensible storage medium—there are just too many less-costly solutions for backing up data. But just because you're satisfied with a standard DVD drive for your burning chores, doesn't mean you should be denied the enjoyment of watching Blu-ray movies on your PC—especially now that large 1920x1080 monitors are so affordable.

Enter Plextor's PX-B320SA DVD burner/BD-ROM combo. We can't say it offers the best of both worlds, but it strikes a nice balance. The drive's DVD speeds aren't up to the likes of, say, Samung's SH-S223 performance DVD drive. For example, the Plextor is rated at 16x for DVD+R writes compared with the Samsung's 22x. In our tests, that amounted to a 5:20 (min:sec) time to fill a single-layer disc vs. 4:46—not such a big deal. With double-layer media, the Plextor took 16:58 vs. the Samsung's 13:16—yes, over time those minutes can add up.

Of course, Samsung's drive won't play your Blu-ray movies. In the realm of combo drives, Plextor's PX-B320SA trumps LG's GCC-H20L, the combo drive in our Lab test beds. Single-layer DVD+R write times for the two drives were virtually the same, but Plextor's drive was more than 50 percent faster at writing to dual-layer discs, where the LG drive took 27:27. The Plextor drive also surpassed the LG drive in our DVD ripping test by nearly 50 percent, taking just 10:47 to copy a dual-layer movie disc to our hard drive, versus the LG's 15:17.

Now, LG has since replaced the GCC-H20L with the GBC-H20L, which lacks the former's support for also reading HD DVD discs (for obvious reasons) but otherwise boasts the same specs. We can't say for certain that that drive performs the same as its GCC predecessor, but even so, we're inclined to favor the Plextor PX-B320SA. After all, at $230, the LG GBC-H20L is a mere $20 less than our favorite full-fledged BD burner (Pioneer's BDR-2203).

Even if you don't have any interest in that functionality, it would be tough to turn down the added value for such a measly savings. At $180, Plextor's drive at least saves you $70—money you could actually do something with. **—KATHERINE STEVENSON**

BENCHMARKS

	Plextor PX-B320SA	LG GGC-H20L
DVD+R Write Speed Average	11.99x	**12.09x**
DVD+R Read Speed Average	**12.07x**	9.24x
Access Time (Random/Full)	111/210ms	**100/178ms**
DVD+DL Write Speed Average	**6.86x**	3.95x
DVD Ripping (min:sec)	**10:4**	15:17

Best scores are bolded. Our test bed is a Windows XP SP3 machine using a 2.66GHz Intel Core 2 Quad Q6700, 2GB of Corsair DDR2/800 RAM on an EVGA 680 SLI motherboard, one EVGA GeForce 8800 GTS card, a Western Digital 500GB Caviar hard drive, and a PC Power and Cooling Turbo Cool PSU. All tests were conducted using Verbatim media and Nero DiscSpeed, except the ripping test, wherein we time how long it takes to copy the contents of a dual-layer DVD to a VelociRaptor hard drive.

VERDICT 8

PLEXTOR PX-B320SA COMBO DRIVE

+ FEASTING	− FASTING
Respectable DVD writing and ripping times; competitive price for a combo drive.	Forgoing BD burns doesn't save you as much as you might expect.

$180, www.plextor.com

Plextor adds a bit of splash to its PX-B320SA with a glossy front bezel.

Logitech G500

This throwback laser mouse is sure to please fans of the classic MX518

At first glance, Logitech's new G500 mouse looks like yesterday's model. Its chassis is almost identical to the classic G5, which was in turn a slight redesign of the MX510/518 series. The G500 takes the classic hump design of the MX510/518 and updates the sensor with one similar to the sensor used in the newer G9x line of mice. That's very nice.

When we say the same laser sensor as the G9x (reviewed June 2009), we really mean that Logitech included an ever-so-slightly upgraded version of the G9x's sensor. The G500's adjustable sensor lets you select a setting from 200–5,700dpi, while the G9x limits you to 200–5,000dpi. This isn't really a significant upgrade, as even the 5,000dpi setting is unplayable outside the small subset of games that let you set an incredibly low sensitivity. Still, we love the silky-smooth action of this mouse.

With five programmable buttons, plus the clicky mouse-wheel, there are plenty of options for the button-crazed gamer. We're not necessarily fans of the triple thumb-button cluster, though; it sacrifices simplicity and the ability to instantly know which button you're pressing for an extra button that we rarely use. Still, players of macro-friendly games—like RTSes and World of Warcraft—will find that it's simple to program, although getting the timing perfect can be tricky. We absolutely love that the switch that alternates the mouse wheel between its detente-less smooth scroll setting and the more traditional one-click stop setting is squarely front and center—on top of the mouse, directly below the scroll wheel. However, its placement does mean that it's possible to accidently click should you lose your grip.

Like the other G-series mice from Logitech, the G500 includes a weight tray, allowing you to customize the weight of your mouse in increments of 2g or 5g. Additionally, like the G9 and G9x, you can store profiles containing everything from button assignments to dpi and mouse polling settings on the mouse. This lets you utilize your custom profiles on whatever computer you're playing on. This is perfect for LAN parties, where you may or may not be competing on a computer you built. While you can save multiple profiles on the G500, you can't manually switch between them on the mouse itself. It's a minor feature, but something we liked with the G9-series mice. We were able to set as many as five different sensitivity settings in the Logitech control panel app, but we couldn't access more than three in our tests with the actual hardware. Which three could we use? No idea, the mouse simply tells you whether you're using the slow, medium, or fast setting, without displaying the actual dpi setting you're using.

Where does that leave the G500? While we love the classic shape of the G500, we miss the G9-series' ability to switch between profiles using just the mouse. If you absolutely detest the shape and interchangeable bodies of the G9 mice, this is an acceptable rodent. However, if you can adjust to the G9x, it's a superior product. —WILL SMITH

LOGITECH G500

VERDICT 8

+ GEEKS	- FREAKS
Great sensor; classic shape; quick-switch dual-mode scroll-wheel.	Requires software to change profiles; expensive; too many thumb buttons.

$70, www.logitech.com

Logitech's G500 gaming mouse takes the gamer-friendly sensor of the G9x and puts it in a mouse reminiscent of the classic MX518.

Kingston SSDNow V+ 256GB

A Samsung SSD by any other name...

You might think GPU and CPU upgrades happen quickly, but they're practically glacial compared to the SSD market, where a platform can go from Kick Ass Award–winning performance to merely good in a few months.

Witness Kingston's SSDNow V+ 256GB, essentially a rebadge of Samsung's 256GB drive, to which we gave a Kick Ass Award back in July. The Samsung and Kingston drives, as well as Corsair's P256 rebadge, all use 256GB of Samsung NAND chips, with the Samsung S3C29RBB01 controller and 128MB of onboard DDR cache to prevent random-write stuttering.

The SSDNow's sustained average read speeds clocked in at 193.8MB/s, slightly higher than the OEM Samsung version but not quite up to the 209MB/s established by the 160GB Intel X-25M we reviewed in November. Its average sustained writes of 153MB/s trailed behind Indilinx-controlled devices like the Patriot Torqx, with its 175MB/s sustained writes, while the X-25M's mere 79MB/s seem positively prehistoric by comparison.

Random-access read and write speeds on the SSDNow are similar to those of the OEM Samsung drive and Patriot Torqx at .16ms latency for random reads and .24 for random writes. Here, the Intel drive remains king, with .11ms reads and blistering-fast .08ms writes. Premiere Pro scores were similarly middle-of-the-pack for the SSDNow.

The most unusual aspect of the Kingston drive's benchmarks involved PCMark Vantage HDD, which tests the drive's performance running Windows-based applications, such as Windows Defender, Media Player, application launches, etc. The first time we ran PCMark Vantage on the drive, we were confronted with a stunningly low score of 5,303 PCMarks—barely higher than a traditional 2TB drive. The second time, much to our surprise, the score jumped to 13,289. After a few more runs, it settled comfortably into a range around 18,400—a little lower than some of its peers, like the first-gen Intel X-25M and Patriot Torqx, but at least in the same neighborhood. None of the other drives we've tested that house this Samsung controller showed similar symptoms, and at press time Kingston's techs were still trying to duplicate the problem.

The Kingston SSDNow V+ 256GB is a good SSD, built on a solid controller, with excellent performance. But we're not granting this drive a Kick Ass Award, as we did its predecessors. Why? Well, first, the Indilinx-controlled drives we've reviewed since July offer slightly better performance, despite their smaller cache size. And Corsair's P256 SSD, which is virtually identical to the Kingston drive, is $30 cheaper. And considering the still-high price-per-gigabyte that remains the biggest hurdle in SSD adoption, every penny helps. —NATHAN EDWARDS

VERDICT **8**

KINGSTON SSDNOW V+ 256GB

+ JAMAICA	− JICAMA
The same blistering sustained reads/writes as the Corsair P256...	...Because it's the same drive—except the Kingston is more expensive.

$700, www.kingston.com

BENCHMARKS

	Kingston SSDNow V+	Patriot Torqx	Intel X25-M G2
Capacity	256GB	128GB	160GB
Average Sustained Transfer Rate Read (MB/s)	193.8	205.4	**209.1**
Average Sustained Transfer Rate Write (MB/s)	153.7	**175.1**	79.5
Random Access Read (ms)	0.16	**0.11**	0.13
Random Access Write	0.24	0.31	**0.08**
Premiere Pro	696	**674**	696
PCMark Vantage Overall Score	18,393*	21,247	**23,288**

*Best scores are bolded. All drives were tested on our standard test bed using a 2.66GHz Intel Core 2 Quad Q6700 and EVGA 680i SLI board. HDTach 3.0.1.0, h2benchw, and Premiere Pro CS3 scores were obtained in Windows XP; PCMark Vantage 2005 scores were obtained in Windows Vista Home Premium 32-bit. *Results after multiple runs; see review.*

The Kingston SSDNow V+ 256GB is a rebadged version of the Samsung drive we reviewed in July.

Batman: Arkham Asylum

The Bat is back

Sonar's for wimps. Detective vision can see henchmen's tiny brains.

We've been saying it for years: The moment they stop messing around with rushed, under-funded movie tie-ins and make a real Batman game, we'll have a huge hit on our hands. With Arkham Asylum, Rocksteady has proved us right—this game finally does justice to the Dark Knight by recreating the monstrous foes, the dark, gritty atmosphere, and Batman's legendary fighting skills to near perfection.

Arch nemesis Joker, in particular, is a masterpiece. Voiced by Mark Hamill (reprising the role from *Batman: The Animated Series*) and modeled and animated with some astonishing detail and lighting, he's genuinely convincing as the deranged, murderous clown who turns the tables on Batman by seizing control of Arkham, Gotham's supervillain lock-up.

Arkham itself is a joy to explore. It's a semi-open world that grows as new areas are unlocked by the story and by Batman's expanding array of gadgetry; each section is loaded with unique details and secrets planted by the Riddler, and subtle (and some not-so-subtle) changes every time you pass through prevent it from ever getting dull. With PhysX turned on, cosmetic improvements like loose papers picked up by the wind, swaying cobwebs, and crumbling stone walls enhance the atmosphere noticeably.

The single best part of the game—the one that will have you playing over and over in challenge mode—is its amazing fighting system. Anyone can jump in right away and feel like a great fighter taking on a group of five or six of Joker's thugs, with some basic button-mashing resulting in surprisingly smooth and flowing combat animations. With practice, you'll get the hang of the finer points of combos and timing, turning you into an unstoppable fighting machine capable of beating the crap out of a dozen or more opponents without them laying a hand on you. Rarely does a game make you feel like this much of a badass.

Being a bullet-permeable hero, Batman takes an entirely different approach to armed thugs. Using stealth (and convenient stone gargoyle perches) the goal is to isolate and pick the baddies off one at a time. It can be frustrating for players who prefer a direct approach, but Batman has a secret weapon to speed up the process considerably: Detective Mode. Switching this on allows you to see all nearby enemies through walls, so as long as you look before you leap you'll never be caught with your pants down when you make your move. It's so effective, in fact, that we felt guilty using it and left it switched off most of the time. It makes a gorgeous game look ugly, anyway.

If not for some repetitious mini-boss fights, the barely interactive "detective work," and the checkpoint save system, we'd have virtually nothing negative to say about Arkham Asylum. Even the mouse and keyboard controls, often a weak point of cross-platform third-person action games, are elegantly done and arguably better than the gamepad. This is Batman at his best, and you don't get much better than that. **—DAN STAPLETON**

Fights against these 'roid-raging thugs are exciting, but the game goes back to this well a few times too often.

MAXIMUM PC KICK ASS!

VERDICT 9

BATMAN: ARKHAM ASYLUM

+ CHRISTOPHER NOLAN	− JOEL SCHUMACHER
Awesome voice acting, graphics, atmosphere, combat, and controls.	Checkpoint saves; repetitive mini-bosses.

$50, www.batmanarkhamasylum.com, ESRB: T

LAB NOTES

Athlon II, or Phenom II in Disguise?

Gordon digs into the upsides of having a pre-Propus core

GORDON MAH UNG
SENIOR EDITOR

AMD's late news that it would use both the new, smaller Propus cores as well as some would-be Deneb/Phenom II cores for the budget Athlon II X4 has certainly piqued the interest of hardware hackers.

That's because just as AMD didn't make it difficult to unlock the fourth core on its tri-core CPUs, the company might be just as Barney Fife about stopping you from unlocking the disabled L3 cache on these pre-Propus, aka Deneb, cores. By unlocking the disabled L3 cache, you essentially get yourself a $99 Phenom II. Who can complain?

Over at the ultra-tweaker site, Xtremesystems.org, user Chinook has posted a shot of a "Propus" with its L3 unlocked (see the accompanying screenshot). We had no such luck with our Athlon II X4 620.

AMD, of course, says it does not recommend overclocking or unlocking cores or cache on procs that have them disabled—but the company's not exactly going to sic the attack dogs on you. AMD is essentially giving the wink-wink, nod-nod to hardware hackers who like to tweak their procs, as it knows the vast majority of people who buy these CPUs will never actually unlock the locked features.

KATHERINE STEVENSON
DEPUTY EDITOR

I'm looking forward to getting my hands on HP's new Envy notebooks, particularly the 15-inch model, which not only looks sharp, and very slim, but also features Intel's just-released Clarksfield CPU, a mobile version of Core i7 that boasts a 45W TDP—half the heat output of any desktop i7. And from what I'm told, Turbo Mode figures prominently in the mobile i7's performance.

WILL SMITH
EDITOR-IN-CHIEF

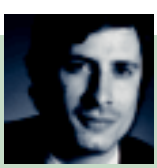
With the holidays just around the corner, that can mean only one thing—that everyone's launching new products. We've seen new thin-and-light notebooks, monitors, netbooks, videocards, and even a $99 quad-core CPU. It's a glorious time of year if you're a hardware nerd, and it's the perfect antidote to the drought of new gear that hits every June and lasts 'til September.

NORMAN CHAN
ONLINE EDITOR

Having to wait the 20 days between Batman: Arkham Asylum's console and PC release turned out to be worth it, but I can't help but still be irked that more publishers are increasing the delay period between console releases and Windows ports (as with Resident Evil 5 and Red Faction: Guerilla). Delays to add extra gameplay content is OK, but the value of trivial add-ons like proprietary physics is debatable.

ALEX CASTLE
ASSOCIATE ONLINE EDITOR

This month, I learned to use Excel so I could keep track of the scoreboard for the office's classic-games tournament. And you know what? As I was figuring out how to do all manner of sorting, coloring, and graphing tricks in Microsoft's spreadsheet program, I actually started to have fun. I'm starting to worry that my true calling in life is to be an accountant.



NATHAN EDWARDS
ASSOCIATE EDITOR

This month I've discovered several new things: first, I'm miserably bad at both Galaga and Donkey Kong. Second, playing Batman: Arkham Asylum is more important than sleeping. And third, the only thing that consistently crashes my Windows 7 machine is iTunes. Oh, and OLEDs are awesome. I'm getting them implanted beneath my skin as soon as feasibly possible. Nothing could possibly go wrong.

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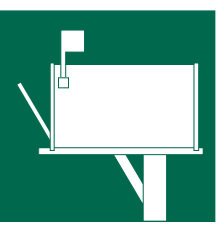
We tackle tough reader questions on...

Windows 7 Verdict
Fanboys
The Rotten Egg



The Best Windows Ever?

So, you guys call Windows 7 "unquestionably the best version of Windows that Microsoft has ever released" (November 2009, page 56), yet you give it a lower rating than you gave Windows XP back in 2001? Good luck explaining that one away.

—George Harris

Editor-in-Chief Will Smith responds: I actually discussed that very issue at length with the other editors before we published the review, and there are a few things that helped me settle on the 9/Kick Ass score (versus a 10/Kick Ass) for Win7. First, Windows XP represented a HUGE improvement over the 16-bit 95/98/ME generation. While Windows 7 is a significant step forward, it is still an incremental update to Vista. Additionally, I remain unhappy enough with the unnecessary differentiation of product SKUs in Windows 7 and the increasingly annoying activation process that I decided to dock Windows 7 that final point for those shortcomings.

You also need to realize that products evolve over time. Would XP w/SP3 rate a 10/Kick Ass if I were to review it today? Probably not. It was great in 2001, but compared to other more modern OSes, it lacks support for key technologies. Besides, if every product that supplants its predecessors gets a higher score, we'd be handing out 10/Kick Asses to virtually everything we review, instead of a half-dozen or so a year.

Netbook Identity Crisis

When netbooks came out a couple years ago, they were tiny—something like seven inches across. Now we're seeing "netbooks" with screens that are 11.6 inches or 12 inches. I thought the whole point of netbooks was that they were small and portable? Why get a netbook when it's gonna be the same size as a regular notebook? Are 12-inch netbooks just cheap, low-powered portables?

—Logan Baldwin

Associate Editor Nathan Edwards responds: We've often wondered the same thing ourselves. And though we're big into netbooks, we've noticed that we get a lot more work done on a machine with a slightly bigger screen. The Lenovo S12 we reviewed in November, for example, has a resolution of 1280x800, and we found the extra screen space vital. Considering it didn't weigh much more or cost much more than your average 10-inch netbook, we can definitely see the appeal. But you're right, the lines are definitely blurring, especially as we move away from Atom N270- and N280-based models and into "netbooks" and cheap ultraportables powered by VIA Nano, Ion, or Intel CULV chips. Deciding what is and what is not a netbook will get even more difficult. But ultimately, the legacy of the netbook will be that it introduced the sub-$500, sub–three pound, ultraportable. Cheap, tiny, and reasonably powerful computers are here to stay, even if a 12-inch screen isn't exactly tiny anymore.

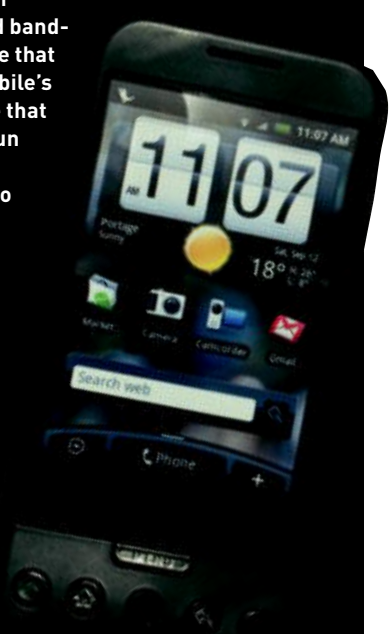
The Form also has a Function

I just read your review of the Vantec ezShare adapter (October). Really? A rating of a 9? And the reason for withholding a 10 verdict or a Kick Ass Award was, "Has all the style and grace of a plain white USB cable." So, you

NOW ONLINE

Hack Your Android G1

If you've jumped on the Google Android bandwagon, chances are that you're using T-Mobile's G1—a smartphone that can be hacked to run custom software. We show you how to easily root your phone to install community-developed Android interface ROMs and add features like storing and running Android apps off of a SD memory card. Read our guide at: http://bit.ly/1S6d0I



guys are all about "style" now, instead of function and cost in your reviews? This from the same issue that shows you how to make a USB charger from an Altoids tin. Man, that's funny. I will be getting one of these despite its lack of style. If you ask me, this is a kick-ass product. It does everything I need it to do and the kicker is, it's 27 bucks! Get a grip over there, guys, it's what's underneath a product and not always how shiny and stylish it is.

—Wayne

Senior Editor Gordon Mah Ung Responds: We, more than anyone, know the value of function over form, but that doesn't mean form is meaningless. If you're like me, you shove 10 cables into your bag and when you need one, you pull out a massive snarl of cables and spend 10 minutes trying to extract the one you want. I don't think it's asking too much of a product that it be a bit easier to carry and use, particularly when a competing product has done just that by including a handy retractable cable. But even while there's some room for improvement in the ezShare, we nevertheless agree that it's an awesome product and awesome deal.

SO, YOU GUYS ARE ALL ABOUT 'STYLE' NOW, INSTEAD OF FUNCTION AND COST IN YOUR REVIEWS?

Fanboy Fatalism

I liked your column on fanboys (November). You asked, "Where do we fit in?" I think we, the readers of *Maximum PC*, are just like you. We just want to buy hardware that's faster/better when we need it. That's why we read this mag. I am just curious as to why you even asked the question, though. Aren't we all just a bunch of power users in the first place? That's why we all congregate at the same cooler! Power user is the anti-fanboy!

—Kevin Buck

Editor-in-Chief Will Smith Responds: Thanks for your feedback on the fanboy problem. After getting one too many letters from Vista superfans, I started to worry that *Maximum PC* readers were all afflicted with the condition. But letters like yours help me sleep easier knowing that most of you, like me, simply worship at the altar of pure PC power.

A Method to the Madness

I'm a designer who loves *Maximum PC*. I really dig the design of the magazine but there's something I can't figure out. Every month, the editors' columns in the Lab Notes section seem to rotate randomly. I've looked through a few issues and there doesn't seem to be a pattern to it. Sometimes Norm is first, and other times Katherine is first or Nathan. Is this just something done last minute or is there actually something dastardly going on?

—Dennis Johnson

Senior Editor Gordon Mah Ung Responds: As the editor of the section, I have to confess that you've stumbled onto our secret Gozerian plot to encode information that will be used to summon the ancient Sumerian God to destroy all of society! Actually, the order is based on when the editors turn in their columns. Thus, the last position is occupied by the "rotten egg."

What Did WHS Do with My Media Files?

I followed your guide to build a Windows Home Server (November) for my home network. But after running the Home Server client to back up my PC, I couldn't find any of my videos or music to stream to my Xbox 360. I even used Remote Desktop to get into the server and ran a search to find my media files, but couldn't find any. Did Windows Home Server not back them up?

—Chester

Online Editor Norman Chan Responds: Windows Home Server uses a form of image-based backup to back up your client machines. Its built-in media server software doesn't index your backup images to find media—instead, it looks to your sever's shared and public folders, which have to be populated manually. If you're hurting for storage space on your server, we recommend excluding your media libraries from the normal backup and just syncing them to appropriately categorized folder shares.

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COMING IN

MAXIMUM PC's WE SHOULD'VE CALLED IT SMARCH HOLIDAY ISSUE

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VIDEOCARD

ATI Radeon HD 5870

There's a new GPU king and its specs are astounding. With 2.15 *billion* transistors and 1,600 stream processors, the Radeon HD 5870 sports more than twice as much power as AMD's last-generation card, while actually drawing significantly less idle power than the HD 4890. Topping off this boost in raw horsepower is full hardware support for DirectX 11, including Shader Model 5.0 and hardware tessellation. In real-world performance testing, the 5870 stomps Nvidia's GTX 285, besting it with double-digit percentage performance deltas. And with a $380 price tag, the 5870 handily seizes the GPU crown.
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Logitech G9 Laser Mouse
www.logitech.com

Games we are playing

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www.batmanarkhamasylum.com

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www.arma2.com

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Spelunky
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