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MAXIMUM PC

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Why Microsoft Needs PC Gaming

I love playing games on the PC, but let's face the truth: PC gaming is in a much worse place than it was three short years ago, and it shows no signs of getting better. While most developers and publishers haven't yet abandoned the platform, the vast majority of releases are Xbox 360 ports that don't really show off the capabilities of *Maximum PC*–caliber PC. With just a handful of triple-A PC-exclusive titles to look forward to each year and the consoles usurping our favorite franchises, things are looking grim. After all, man cannot live on Diablo 3 alone.

As we approach the 10th anniversary of the first Xbox, I still think Microsoft was smart to try to break into your living room. What I don't understand is why, at the same time, the Redmond juggernaut backed away from PC gaming, which has traditionally been one of the key factors that keeps Windows users on Windows. If you want to play games on your computer, OS X and Linux aren't viable options—PC games come to Windows first, and in most cases exclusively. There just aren't that many compelling PC games anymore.

At some point, someone in Redmond will wake up and realize that as Microsoft's other core product, Office, makes the transition from expensive client-side application to commoditized cloud app, Windows will become even less important. After all, if your apps are in the cloud, Windows is just the software that runs your browser, and without a huge investment in software tying users to Windows, it's easier than ever before to buy a Linux-powered netbook or a MacBook to replace an aging PC.

And vulnerability to the cloud isn't just limited to Office. My father has an entry for every customer and business prospect he's ever had in a massive ACT! database. Over the last 20 years, he's spent tens of thousands of dollars on upgrades for ACT!, a dedicated server to store the database, and support costs to keep the whole cobbled-together mess working well. He's moving the whole thing over to a web-based product that someone else will maintain (that's great) and that will run on pretty much any computing device with a web browser—from Windows to BSD to Blackberry (even better).

So, what does all of this have to do with games, Microsoft, and Windows? Well, Microsoft should be encouraging every single one of its Windows customers to use his or her PC for tasks that aren't naturally suited to life in the cloud—including photo editing, video production, and most importantly, PC gaming. And while not everyone edits photos or video, thanks to the current generation of consoles, the rise of kick-ass browser games, and Farmville, nearly everyone under the age of 70 is playing games.

It's clearly in Microsoft's best interest to bring as many of those potential gamers into the PC-gaming fold as soon as possible, both by funding development of games that appeal to a wider audience and by encouraging users to seek out PC games. Just remember, guys, it's for the good of Windows.

Will Smith

THIS MONTH'S AWESOME

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Kick-Ass Casual Games page 56

ATI's Radeon HD 5970 page 86

LETTERS POLICY Please send comments, questions, and boxes of chocolate to willl@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

Intel Scraps Plans to Sell Larrabee

Why you can't buy the massively parallel x86-compatible GPU—at least, for today —GORDON MAH UNG

Intel's entry into the graphics market in 1998 was supposed to wipe out a dozen small graphics companies. Instead, Intel's i740 bombed and was gone within a year and a half.

Fast forward more than 10 years, and it appears the same pattern is emerging. In late 2009, Intel stunned everyone by announcing that its highly anticipated multicore GPU code-named Larrabee would be used solely as a development part instead of being sold on store shelves.

"Larrabee silicon and software development are behind where we had hoped to be at this point in the project," an Intel spokesman said in a statement. "As a result, our first Larrabee product will not be launched as a standalone discrete graphics product, but rather be used as a software development platform for internal and external use."

In plain English, the first-generation Larrabee graphics card would be too much of a dog to compete, so Intel will use it to develop code.

How could a company that flubbed it so badly the first time around do it again? Jon Peddie of Jon Peddie Research said that's exactly what Intel is hoping to avoid right now.

"Somebody at Intel said to me: 'We're not going to let another i740 happen here. We will kill the project before we do that.' " But Peddie said, while many interpreted Intel's announcement as the scuttling of Larrabee, the exact opposite is the truth. "[The Larrabee project] is not killed," Peddie said.

What likely happened is that Intel realized it was too far away from satisfying the enormous demands of a consumer product and instead decided to take a different tack with the hardware. Rather than running Crysis, the card will likely be pushed toward high-performance computing, such as that used in super computers.

Intel confirmed as much to *Maximum PC*, saying that no resources have been cut from Larrabee and the company will spend as much or more on graphics R&D in its commitment to "multicore graphics for consumers."

Despite exhibiting real-time ray tracing in a Quake Wars demo, Larrabee's consumer release is being cancelled due to poor graphics performance.

Peddie said the hardware is actually performing OK. Intel recently demonstrated the card running a super-computing benchmark at one teraflop. While that might sound pathetic since the 2-year-old Radeon HD 4870 can hit 1Tflop, Peddie said Larrabee hit its mark with a real benchmark, not a theoretical one. On the same compute benchmark that Intel used, he said, the RV770 core produces closer to 300 gigaflops. A GeForce GTX 285 is around 425Gflops and a Tesla C1060 produces 370Gflops. More impressive, he said, Larrabee is actually producing the benchmark numbers Intel set as a goal for the part years ago.

While the compute performance is good, Peddie suspects the graphics performance is not as impressive. That's what likely helped convince Intel not to sell Larrabee as a consumer graphics card—game frame rates drive sales, not compute performance. At least, not yet.

Over at Nvidia and AMD, the news wasn't greeted with cheers, but both companies are spinning the story to support their own efforts.

"The fact that a company with Intel's technical prowess and financial resources has struggled so hard to succeed with parallel computing shows just how exceptionally difficult a challenge this is," an Nvidia spokesman said. And according to AMD, "With only CPU, or GPU, a company is limited in its ability to respond to the needs of the industry. AMD is the only company in command of both GPU and CPU IP portfolios, and in response to the clear direction of the computer industry we're bringing CPU and GPU together in Fusion."

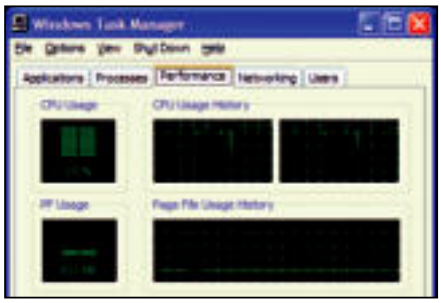
Firefox Saps CPU

Mozilla addresses the browser's resource issues

Is your ultraportable overheating while surfing the web? As odd as it sounds, the culprit could be Firefox rather than a hardware issue. That suggestion comes straight from Mozilla's Knowledge Base. In a document titled "Firefox Consumes a Lot of CPU Resources," Mozilla states that, "At times, Firefox may require significant CPU resources in order to download, process, and display web content."

So what's the solution? Short of switching to a different browser, Mozilla recommends downloading and installing the latest version of the Flash plugin, which might help with Flash-heavy sites like YouTube, and installing the Flashblock add-on, which allows end users to selectively enable and disable Flash content.

Depending on when and where the high CPU usage kicks in, Mozilla also recommends updating the Adobe Reader plugin, configuring Firefox to open PDF documents outside of Firefox, and installing NoScript. –PL



Google: Now with DNS

Google provides us with a search engine, email, web apps, phone service, and other goodies. Now, to further envelope you in its universe, Google is unveiling a public DNS resolution service.

The Domain Name System, or DNS, translates URLs into binary identifiers, or IP addresses. Rather than use your default DNS (the one your ISP offers), you can configure your browser to go through Google's system instead. Google promises faster look-ups, as well as better security.

All of which comes at a price. Google, like others, will track your DNS look-up requests. Google swears it will keep the information confidential, and in particular, not link it to any other Google service. Personally identifiable information will be deleted within 48 hours; a subset of all other data will be stored permanently (with marketing its most likely destination). –BS

Bing Maps Beta Earns Praise

Microsoft's refreshed map app poses a serious challenge to Google's dominant product

Bing Maps Beta (www.bing.com/maps) utilizes Microsoft's own Silverlight multimedia plugin to provide smoother zooming and redraws. It also allows some nice-looking 3D building maps. It certainly feels like a very polished experience in contrast to Google Maps' more utilitarian aesthetic. –RW

Running Out of Air

Smartphones are the next step in personal computing, and broadband wireless networking is the next step in communications. Everyone can have instant access to email, text messaging, telephony, GPS navigation, and the Internet at any time, any place. It's a great vision, but there's one snag: We're running out of air.

Without major changes, there won't be enough radio-frequency spectrum to make the vision come true.

The problem is twofold. First, useful spectrum is a finite resource, already allocated. Second, the rich applications we want to use on wireless networks tend to be bandwidth-intensive, gobbling up too much spectrum to be shared by millions of people.

Keep in mind that all radio spectrum is not created equal. Lower frequencies tend to have greater range and penetration. Higher frequencies have less range and are easily thwarted by walls and other obstructions. That's partly why lower frequencies are allocated for radio and TV broadcasting, while higher frequencies are allocated for things like Wi-Fi and cellular telephony.

The recent switch from analog to digital TV broadcasting in the United States freed some of that valuable lower-frequency spectrum. The FCC took UHF channels 52 to 69 away from TV broadcasters and auctioned it off for other services. Each TV channel is 6MHz wide, so the DTV transition freed 108MHz.

It was a huge reallocation, but now the communications industry says it's not nearly enough. By some estimates, we'll need 700–800MHz of additional spectrum to support all the voice and Internet users who will buy smartphones and other mobile computing devices.

Although the DTV upheaval is barely behind us, industry lobbyists are already casting hungry eyes on the remaining TV spectrum. One proposal is to reallocate channels 40 to 51, or even channels 20 to 51. A more surprising suggestion is to end terrestrial TV broadcasting altogether and reassign all the channels to new services. Even this drastic action would free less than half the spectrum we supposedly need. And 20 percent of Americans still rely on terrestrial broadcasting instead of cable or satellite TV.

It's shaping up as quite a battle. Next month, I'll review some less drastic solutions.

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

GEEK TESTED & APPROVED

Thermaltake BlacX Duet

Need to retrieve files quickly from a SATA drive or two but don't have accessible SATA ports? Thermaltake's external SATA dock BlacX Duet ($70, www.thermaltake.com) can read/write to two SATA drives at once over USB 2.0—or eSATA, if your computer has an eSATA port and its chipset supports SATA port multiplying. Otherwise, you have to choose between docking one drive and getting SATA transfer speeds, or docking two at USB 2.0 speeds. –NE

MS Joins Digital Distribution Game

Will it save Games for Windows Live?

On December 15, Microsoft finally hopped on the digital distribution bandwagon by adding Games on Demand to its Games for Windows Live platform. Like other digital distribution platforms, Games on Demand will let gamers buy and download games and tie those game purchases to a username rather than to a computer, so users can reinstall their games on any computer. Sound familiar?

Why did Microsoft wait until the tail end of 2009 to offer digital distribution? Can Games on Demand rescue some of Games for Windows Live's lost promise? Most importantly: Will gamers, who already have a plethora of digital distribution options, spring for Microsoft's version? We can only wait and see. –NE

Red Faction: Guerrilla is one of Games on Demand's launch titles.

Intel Demos 48-Core Monster

At a recent press event, Intel Research showed off a 48-core, x86-compatible CPU. The processor is part of a research initiative to understand what it will take to develop software for many-core CPUs.

Intel Chief Technology Officer Justin Rattner dubbed the CPU a "single-chip cloud computer," which mimics the way servers in large data centers communicate. The chip is divided into 24 tiles of two processors each. The tiles communicate via an on-chip mesh network. Each tile sports two Pentium-class, in-order processors, exclusive L2 caches, a message buffer, and a router. The 1.3 billion–transistor chip is designed to run within a 25–125W thermal envelope.

Intel is building a number of the chips to share with partners, including universities, Microsoft, and other entities. The current spin of the CPU is booting various operating systems, and Microsoft showed off a version of Visual Studio capable of generating code to take advantage of the architecture.

There's no word on whether this research chip will ever become a real product, but its very existence points to the direction Intel is considering long-term –LC

GAME THEORY

Hanging Up on Call of Duty

The sole dissenting voice in a chorus of universal praise risks being dismissed as an attention-hungry crank. So be it: Call of Duty: Modern Warfare 2 is a damn mess, and a rankly offensive one, at that.

Although the multiplayer component remains strong (even with the PC-specific problems), the campaign is so completely fragged that it's hard to know where to begin.

It seems to have been written by rather dim and sadistic 14-year-olds taking a break between setting the neighbor's cat on fire and a 24-hour Bruckheimer marathon. The story is simply gibberish, and amounts to little more than tenuous and absurd links between grand action set pieces. The dialog is so bad that I began to suspect it was some kind of sly parody. Who opens the most anticipated sequel of the season with creaking lines like, "The more things change the more they stay the same," "History is written by the victor," "Same ****, different day," and "Stay frosty"?

The levels themselves are almost incoherent, amounting to little more than action-movie pastiches (*Black Hawk Down*, *Red Dawn*, *The Rock*) with absurd numbers of virtually identical foes. You're channeled forward from one event to the next, with little sense of what you're doing or why you're doing it as you chase the little floating "Follow" dot.

The "No Russian" level is completely repellent and utterly gratuitous. Is the massacre of innocent civilians really an experience on the human emotional spectrum that we need not only witness, but *simulate*? Of course not. It's simply there to gin up controversy and make the point that there are no good guys and bad guys: only competing ideologies. The entire narrative is mired in a murky moral relativism.

Yet the designers are so bold and daring that the main bad guys are Russian, not jihadists. If Infinity Ward was really so committed to depicting the moral ambiguities and horrors of the modern battlefield, then it wouldn't be so damnably politically correct.

No matter: MW2 had the biggest single day of any entertainment launch in history, and its multiplayer will have a long life. It's a shame the single-player component is such a betrayal of everything the series has accomplished.

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

Chrome OS Unveiled

It's both less and more than we expected

The long-awaited unveiling of Google's Chrome OS came in mid-November, as the company showed off its upcoming operating system based on the Chrome browser for the first time. So, what's the deal with Chrome OS? It's a netbook-oriented, open-source operating system that uses the Chrome browser as its interface.

Based on code from Linux, WebKit, Ubuntu, and Moblin, Chrome OS is open-source but will have fairly strict hardware requirements—expect netbook-like specs but with SSDs only: no mechanical hard drives. You can't install new programs to a Chrome OS machine's root, so it won't take the place of Windows. Instead, Chrome OS will run web apps. All your data will live on the cloud—you'll log into the machine using your Google account, and your data, settings, and web apps will sync to the device. The SSD will be used for cache, so the Chrome device can be used offline if necessary. The kernel and browser will be digitally signed, so the OS will be able to check itself at boot.

As the specs and web-app-only limitations indicate, Chrome OS is designed for secondary machines such as netbooks. You won't be able to run stand-alone programs, dual-boot the OS, or run it on your gaming rig. While these restrictions seem to limit Chrome OS's appeal, consider the success of the iPhone.

Will your next netbook OS be Chrome? Wait a year and see. **–NE**

The only apps that will run on Chrome OS are web apps.

MAN CONFESSES TO DVD RIPPING

Turns himself in to police to gain legal clarity

Henrik Anderson, a Danish citizen, turned himself in to police, confessing he had broken Danish antipiracy laws by breaking the Digital Rights Management (DRM) on more than 100 legally purchased DVDs. He did so because he wants some clarification. It seems, under Danish law, it's OK to copy, and at the same time, not OK to copy.

Danish law allows owners of digital media to make private, noncommercial copies of works they own. *And* it prohibits owners from making such copies without the rights holder's consent if the copying circumvents DRM.

Anderson initially sought clarification from the Danish antipiracy outfit Antipiratgruppen: Was he a criminal or not? Antipiratgruppen never got back to Anderson on whether he would be prosecuted, so he took, for him, the next logical step: He turned himself in. Anderson wants a trial so the law can be clearly established. **–BS**

BYTE RIGHTS

QUINN NORTON

Read 'I Agree' to Continue

Ah, the humble End User License Agreement. You tear through them, you click "I agree," but what exactly are you agreeing to? I don't actually know, because like you, I never read them.

Claiming to read all your software licenses is the reverse of masturbation—90 percent admit they don't do it, and the other 10 percent are liars. It's hard to get through a whole day without agreeing to the occasional complex contract, we definitely couldn't get through the day if we read them.

These days, companies claim to sell us their EULA in lieu of just selling us their software, to give themselves powers over their software the law doesn't give them. How much power? No one exactly knows. This last-mile legislation by companies has met with mixed response when it goes to court.

Where companies use EULAs to obviously subvert state or federal law, judges don't like them much. Take First Sale, the legal principle that lets you resell a copyrighted item you bought, like a book or CD. Many courts have held that if it looks like a sale, that's what it is, and your first-sale rights stand, whatever the EULA says—especially if you never agreed to it. When Autodesk kept sending DMCA notices to eBay regarding seller Timothy Vernor's re-sales of their software, he (and nonprofit consumer advocacy group Public Citizen) sought to get the court to declare what he was doing legal. Since he never so much as installed the software, the court has been pretty sympathetic, ruling against Autodesk.

But in other cases, where the seller did the clicking on an agreement, the courts have sometimes held that they lost first sale by contract law, sometimes by copyright law, and sometimes not at all. The pre–software age precedent is pretty clear about a strong first-sale right, but software makers over the last 25 years have had a lot of opportunity to get judges used to the idea that they can sell their product yet write their own conditions on it. With software companies writing the law, what do we need Congress for, anyway?

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

8 Ways to Green Your PC—and Help Save the Planet

8 LOOK FOR HARDWARE WITH 'GREEN' COMPLIANCE LOGOS

7 USE A SMART POWER STRIP TO STOP ELECTRICITY VAMPIRES

6 USE SLEEP/STANDBY MODE

Reduce your PC's footprint.

5 RECYCLE OLD PCS

Recycle that Pentium III, don't just trash it.

4 MEASURE YOUR POWER CONSUMPTION

Use a watt meter to figure out what's using too much juice.

3 STOP OR LIMIT DISTRIBUTED-COMPUTING CLIENTS

Seti@Home is great, but running your CPU full bore uses power.

2 USE A NAS FOR ALWAYS-ON TASKS

Let your power-sucking rig rest at night and use a low-power rig for FTP serving.

1 TURN IT OFF

Go fly a kite.

This month the Doctor tackles...

Upgrade is a Relative Term

P55 or X58?

Protected Audio Path

'Upgrade' Is a Relative Term

I have an Asus P5L-MX motherboard and have wanted to upgrade the CPU for some time. Right now, I have a single-core Intel Celeron D with a Prescott core. I've pretty much maxed out the overclocking possibilities (I've gone from a stock 2.66GHz clock to 3.47GHz) and now I want to replace it with something better.

I want to keep the motherboard, however, which slightly complicates matters. As I recall, multicore processors were just catching on around the time my mobo was made. The documentation says it can support dual-core CPUs, and it has an LGA775 socket. I'd like to know whether it can take a quad-core or higher CPU, and if so, which ones (or if not, which dual-core CPU)?

—Andrew Lambert

Andrew, your motherboard's 945 chipset doesn't support quad-cores. You can, however, drop in a decent dual-core, like the Core 2 Duo E6700, which you can find online for around $130. It's going to be a fairly substantial upgrade to the machine you have, without breaking the bank. If the E6700 is too spendy, your board also supports some other Core 2 Duo chips—the E4300 through E6700. You'll almost certainly need to update your BIOS to take advantage of any dual-core, though. For the full list of CPUs supported by the P5L-MX, go to http://bit.ly/rXmpz. Asus's support page offers BIOS downloads and a flashing utility.

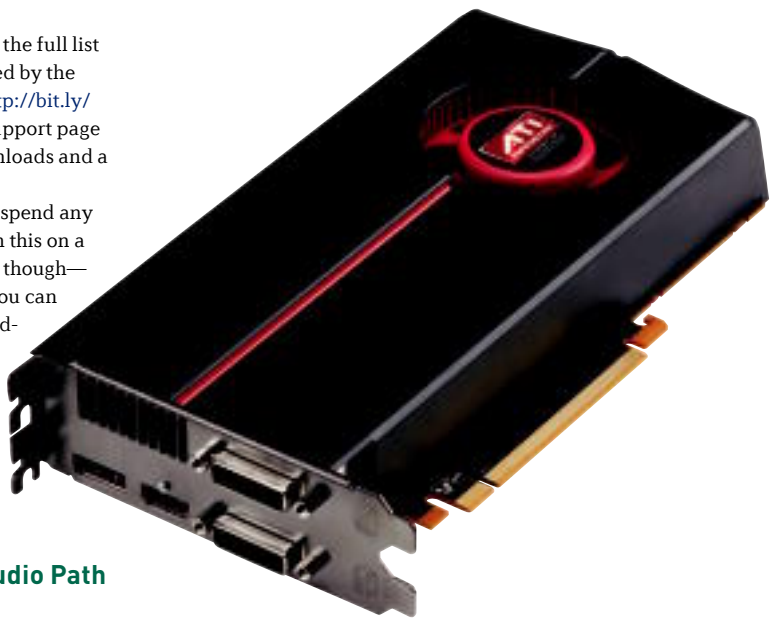
We wouldn't spend any more money than this on a machine this old, though—for about $250, you can buy a decent quad-core Phenom or Athlon II and a new motherboard, while still using your other old components.

Protected Audio Path from GPU?

I'm in the process of piecing together an HTPC that will run Windows 7 Home Premium. I'd like to be able to connect the HTPC to my receiver via a single HDMI cable. Are there any videocards available that will send both video and TrueHD audio via an HDMI cable, or do I have to use the Asus Xonar HDAV 1.3 Slim that was reviewed in the November issue?

—Ed Yeich

Ed, ATI's Radeon HD 5000 series—at press time, that includes the 5750, 5770, 5850, 5870, and 5970—are the only graphics cards that include a protected audio path via HDMI, including support for Dolby TrueHD. Nvidia's GTX 200 series will send audio over HDMI (via SPDIF), but doesn't support a protected audio path. The good news is that the cheapest graphics card that has a protected audio path, the Radeon HD 5750, is about $150—only about $20 more than you'd have to put out for the Xonar HDAV 1.3 Slim, anyway.



ATI's Radeon HD 5000 series, like this Radeon HD 5770, are the only consumer graphics cards that currently offer protected HD audio, including 7.1-channel Dolby TrueHD, over HDMI.

Stuck In the 4GB Morass

I want to know if 32-bit Windows 7 will limit how much system memory I can install. I know that 4GB is the maximum that 32-bit Windows XP will recognize. Is this the same for Windows 7? Do I need to buy 64-bit if I want to install more than 4GB memory?

—Anthony Roth

We're afraid so, Anthony. The 4GB RAM cap is a limitation of most 32-bit OSes—except for Starter, which is limited to 2GB. Additionally, Microsoft has imposed some arbitrary memory limits on its 64-bit versions, from 8GB in Home Basic to 192GB in Ultimate, Enterprise, and Professional. As you probably suspected by now, there are ways to bypass the 4GB RAM limit for 32-bit operating systems using Physical Address Extension—32-bit Windows Server 2008 can support up to 64GB of RAM, but Microsoft sticks to the 4GB RAM limit on consumer versions.

P55 or X58?

I'm planning my next build, and I'm having a hard time deciding between a motherboard with the X58 chipset or one with P55. Is triple-channel RAM worth paying extra for? I plan to keep this PC for three years (until the motherboard warranty expires) and I'm worried that in three years there'll be 9x-channel RAM or something crazy like that. I'm a heavy gamer but I don't do anything else that requires a ton of memory—I don't use AutoDesk or Maya.

—Damien Marsh

Damien, although the memory bandwidth on X58 contributes to some performance advantages over a P55, the Doctor doesn't think that that in itself warrants the extra coinage. What may be of more value to you, however, is X58's ability to run dual x16 PCI-Express at full x16 PCI-E 2.0 data rates. The P55 platform inherently limits dual x16 physical slots to running at x8 PCI-E 2.0 speeds. Keep in mind, that's still plenty of bandwidth, but the X58 will likely have some advantage at ultra-high-resolutions in games that need the bandwidth in multi-GPU scenarios. X58's other ace in the hole is its ability to support the upcoming six-core Core i9 CPUs due early next year. P55 isn't supposed to support those procs. Those processors, however, are likely to be very expensive, so if you don't plan on spending $900 for a CPU, then you don't have to worry about that, either.

Videocard Overkill

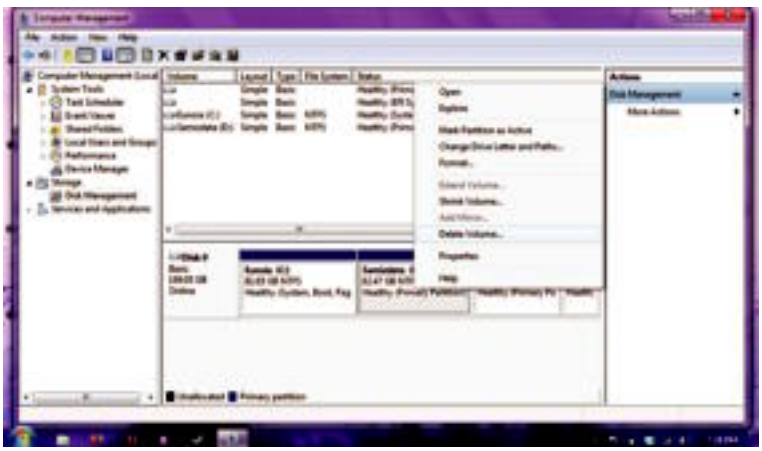
I have two older systems: an Asus A8V-VM board with an Athlon X2 4800+ at 2.5GHz, 4GB of OCZ Platinum DDR/400 RAM, and a GeForce 6200 in a PCI-E x16 slot; and an old OEM eMachines board with an Athlon X2 6000+ at 3.0GHz, 4GB of OCZ Platinum DDR2/800, and onboard GeForce 6100 graphics, with an empty PCI-E x8 slot.

I want to upgrade one of them with a Radeon 5000 series to hold me over until I can put together a Lynnfield system. My concern is that both of these boards only have a PCI-E 1.0a slot. Would I notice any real performance difference between the Radeon HD 5750 vs. the 5970? Or would I just be wasting my money on the higher-end card?

—Tim Brown

Tim, neither system will let you get the maximum performance out of either card—you'll be limited by the CPU. If you're serious about building that Lynnfield machine soon though, it's worth spending money on a bigger card, as you'll see a substantial performance difference between the 5750 and 5970 on a modern machine, assuming you have a relatively large display—the 5970 really starts to shine when you run games at resolutions of 1920x1200 or greater.

MICROSOFT HAS IMPOSED SOME ARBITRARY MEMORY LIMITS ON 64-BIT VERSIONS OF WINDOWS 7



Windows' built-in Disk Management tool is sufficient for basic tasks, like deleting or resizing old partitions.

Remove Old Windows Installs

I just bought and installed Windows 7 Pro. Previously, I was dual-booting Windows 7 RC and Windows XP on a 500GB split-partitioned drive. Windows 7 Pro is on a new 320GB HDD.

How do I remove Windows XP and 7 RC from the boot selection screen and just have the computer boot straight into Win7 Pro with no selection screen?

Once I take care of that, I want to remove the partition and use the 500GB HD as data backup. All my data stored on the partitioned drive has been moved over to either the C: drive (7 Pro) or another 320GB HD installed or an external HD.

—Jeff W

We'll take this one step at a time. Your MBR likely resides on the drive your first two installs are on, so you need to move it to the new drive. First, power down your computer. Disconnect the 500GB drive with your old Windows installs on it, so only your Windows 7 Pro drive is connected. Now find your Windows 7 installation DVD, and boot from it. Once you're past the keyboard and language setting screens, click Repair Your Computer and go to the command prompt. Enter `bootsect /nt60 C:\` to repair your master boot record. Restart your computer. It should boot right into your Windows 7 installation.

Once you've done that, you can move to the second (and easier) part. Shut down your computer again and reconnect the old partitioned drive. Boot into the BIOS and make sure your first boot priority is the drive with your Win7 Pro install, then boot into that. Go to Computer Management (you can type it into the Start Menu's run box), then Storage, then Disk Management (Local). You'll see entries for all your physical disks. Right-click one of the partitions you want to remove and select Delete Volume, then do the same for the other. You should then have a drive with 500GB of free space. Right-click that free space and select New Volume; follow the prompts to create a new NTFS partition. Format the drive and you're good to go.

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.


Super
rite-writer

HOW TO BUILD AN AWESOME PC FOR $647!

Need a new PC, but don't have a ton of cash? We'll show you how to build a machine that can do anything—from browsing the web to playing games to encoding video—for a mere $647

BY WILL SMITH AND GORDON MAH UNG

In many respects, it's more difficult to build a great cheap PC than it is to build a more expensive one. In fact, the less money you have to spend, the more vital it is that every dollar delivers measurable value. With that in mind, we sat down with one simple goal: to build the best inexpensive, multipurpose PC that we would want to use ourselves. We didn't start with any particular budget, but at every turn we shaved as much from the cost as we could—trimming the fancy case, ditching an unnecessary 800W PSU, and scuttling the spendy Core i5 CPU.

The result is an incredibly lean, but still powerful machine featuring a quad-core CPU, a GPU capable of playing anything on a 22-inch panel, and... well, you'll have to flip the page to see the rest. Rest assured, though, this is a machine that would be welcome in any of our homes, whether we're playing games, editing video, touching up photos, ripping movies, or simply surfing the Internet. Oh yeah, we'll also show you how to assemble the components like a pro, one easy-to-follow step at a time.

And just to keep the whole thing good and honest, we stopped by our local Best Buy and bought the best comparably priced system they had, which we pitted against our ultra-budget machine in a steel-cage match to the death. Want to see who wins? You'll have to turn the page....

Parts of the Whole

The key to building a killer budget PC is knowing where you can and can't cut costs

STOCK AMD CPU COOLER While there are definitely better coolers out there, when you're operating on a tight budget you can't beat the low, low price of $0. The stock cooler that comes with the boxed retail version of a CPU is more than sufficient—at least until you're ready to start overclocking. Stock coolers even come with a pre-applied thin layer of thermal paste, so you need not spend an extra penny.

SEAGATE 500GB BARRACUDA 7200.12 OK, OK, we know 500GB is a little thin, especially in the days of $75 terabyte drives. But a bigger hard drive is a relatively simple upgrade down the road, and the single-platter Barracuda 7200.12 performs well, despite its low price and modest capacity. It's not as speedy as some of the 2TB drives out there, but for $55, can you really complain that much?

SAPPHIRE RADEON HD 5770 Oh, times are good when you can get technology so current it still has that new PC smell on it. In this case, it's the scent of our ATI Radeon HD 5770 and its DirectX 11 capability. As we wrote this, DX11 titles were just starting to trickle out. Even without DirectX 11, this card is a capable performer in DX9 and DX10 games, too.

ROSEWILL R220 An all-aluminum, toolless masterpiece of design the Rosewill R220 is not. It is an eminently serviceable budget mid-tower that will hold all the hardware you'll ever need in your cheap PC. You should definitely beware of sharp edges when working in this humble enclosure, but you needn't worry about your rig overheating, thanks to the case's many fan mounts. And you won't find a better looking case for $20.

COOLER MASTER RS-460 The one place you shouldn't scrimp is the power supply. Sure, there are cheaper generic supplies, but do you really want to trust your precious PC to a power supply that's leftover Cold War surplus? We don't think so. The RS-460 provides ample power for our budget PC, and includes all the necessary connectors, including a 6-pin PCI Express power connector.

PARTS LIST*

	PART	PRICE	URL
CPU	AMD Athlon II X4 620	$99	www.amd.com
Motherboard	Gigabyte GA-MA74GM-S2	$57	www.gigabyte.us
Memory	Patriot 4GB DDR2/800	$85	www.patriotmem.com
Videocard	Sapphire Radeon HD 5770	$166	www.sapphiretech.com
Hard drive	Seagate 500GB Barracuda 7200.12	$55	www.seagate.com
Optical drive	Samsung SH-S223C	$26	www.samsungodd.com
Chassis	Rosewill R220	$19	www.rosewill.com
Power supply	Cooler Master RS-460	$35	www.coolermaster.com
Operating system	Windows 7 Home Premium OEM	$105	www.microsoft.com
TOTAL COST		**$647**	

* All prices are from NewEgg.com as of press time.

GIGABYTE GA-MA74GM-S2 MicroATX is normally anathema to folks who consider themselves power users, but when you're trying to build a budget badass, it's one compromise you should consider making. After all, besides the GPU, what other add-in boards do you use anymore?

AMD ATHLON II X4 620 Intel may have introduced the first quad-core for the PC, but AMD's the one who brought it down to a price the average Joe could afford. For $99, the Athlon II X4 620 offers the best bang for the buck available today.

WINDOWS 7 HOME PREMIUM OEM Since the release in October, Windows 7 has received nearly universal acclaim, and for good reason. This is the best version of Windows Microsoft has ever shipped. With kick-ass security and the speed and reliability of Windows XP, there's no reason to buy another operating system—especially when you can buy the OEM edition of the OS for just $105.

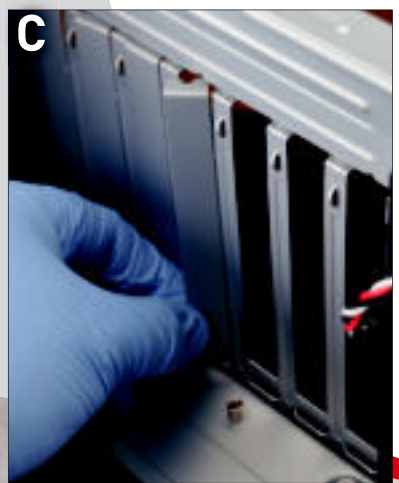
PATRIOT 4GB DDR2/800 If technology were a theme park, RAM would be the old-fashioned wooden roller coaster. First, it was so damned cheap that consumers would cry tears of joy whenever picking up 2GB sticks. Now, the roller coaster is headed back up that rickety track and consumers are wondering how high it will go. Fortunately, we got ours at a somewhat decent price—but who knows what it'll cost in a month?

SAMSUNG SH-S223C While there are higher-rated 24x DVD-RW drives out there, in the real world, where there's no 24x media, Samsung's SH-S223C is still a top dog. With great burning and reading performance, and the best DVD ripping speeds we've tested yet, this is the DVD-RW drive to beat. You say you wanted Blu-ray in your uber-cheap machine? It just ain't worth the money, honey.

1 Prepare the Case

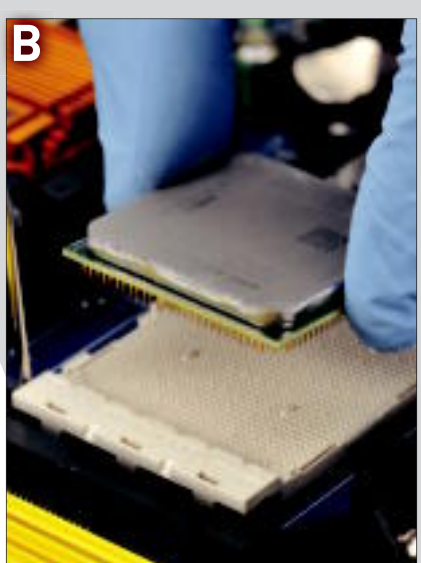
The very first thing you'll need to do when building your new PC is prepare the case. Remove both of the sides and put them someplace they'll be safe (and unscratched) and then grab the bag of fittings that came with the case. In there, you'll find several hex-sided motherboard standoffs, which are threaded to mount in the holes on the case's motherboard tray. Assuming you're using the exact same hardware we did, you'll need three standoffs to supplement the ones already built into the tray. Grab your motherboard and eyeball it to make sure you put the standoffs in holes that line up with the holes on your motherboard.

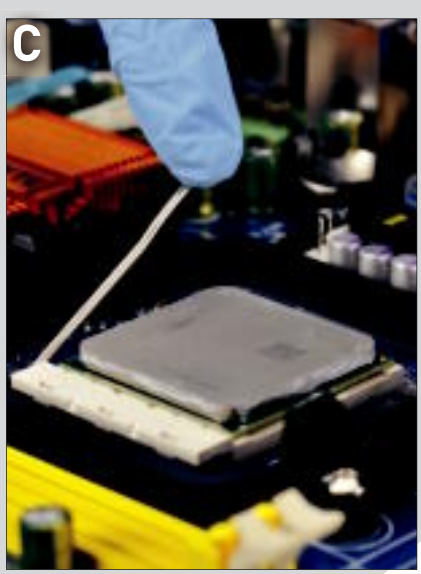
Once you've found the proper spots, screw the standoffs into the motherboard tray, giving them a final twist with a pair of pliers (or your fingers) to lock them in place (image A). Then use a screwdriver handle to pop the ATX backplane connector out of the case, and replace it with the one that came with your motherboard (image B). It snaps into place from the inside, but you may need to loosen or remove the 12cm fan that sits directly above it to get enough clearance. Finally, you can remove any unneeded expansion slot covers from the case—you'll need the second and third slots from the fan for your GPU when it's time to install it. To remove each cover, simply wiggle it back and forth until it breaks loose (image C).



2 Install the CPU

Before you install your CPU, you should make sure you're grounded relative to the machine and components. Either use an antistatic strap or make sure your skin remains in contact with a ground while you work on the machine. Before you can drop the CPU into the socket, you'll need to lift the retention arm (image A). Then look at the bottom of the CPU. If you compare the layout of the pins on the bottom of the CPU to the socket layout, you'll see it can only fit one way. Line it up parallel to the motherboard and carefully lower it into the socket (image B), being extremely careful not to move the CPU from side to side or insert it at an angle—that can bend the pins. Finally, you'll want to lock the lever back in place beside the socket (image C).





3 Install Memory

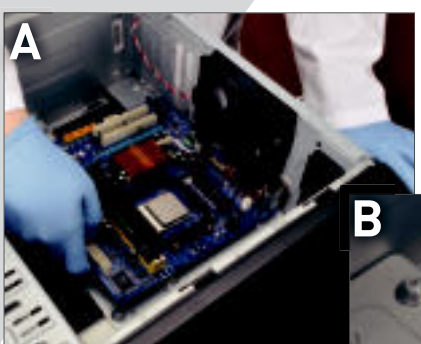
Installing memory is relatively simple but requires more force to install than most components. For that reason, we typically recommend installing the RAM when the motherboard is on a flat surface, before it's in the PC. It's a good idea to lay the mobo on the plastic bag or foam lining that it shipped in to protect it from shock. To install the RAM, make sure the retention clips are in their fully unlocked position, then line up the notch in the RAM module with the keyed part of the slot (image A). When it's lined up properly, follow the guides on the side of the slot to gently slide the module into place, applying even pressure across the top of the module. Finally, make sure that the retention clips are locked in place (image B). Repeat the process for the second module.

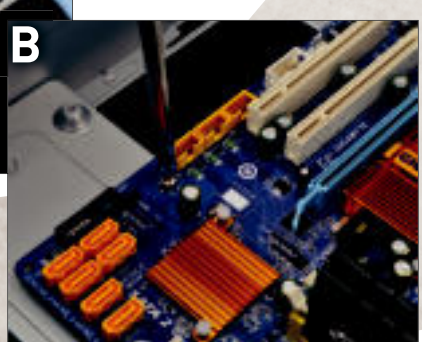
4 Mount the Mobo

Next, you'll need to mount the motherboard in the case. Before you slide it in, check the back of the ATX backplane connector and make sure that any excess pieces of metal won't block your ports. This is a fairly common rookie oversight that requires almost complete disassembly of the PC to fix, so you don't want to miss it. If you find any obstructions, simply fold them up into the inside edge of the case.

After that, it's time to carefully lower the motherboard into the case (image A). Make sure your ports line up with the holes in the ATX backplane, and double-check that there are motherboard standoffs behind all the mounting holes on your motherboard. Once you're sure everything is good, you can start screwing down the board using the screws that came with the case (image B). We recommend starting in one corner, then screwing down the opposite corner, and working around the board until everything is locked in place. It's important that you don't overtighten—using too much force can damage your motherboard.

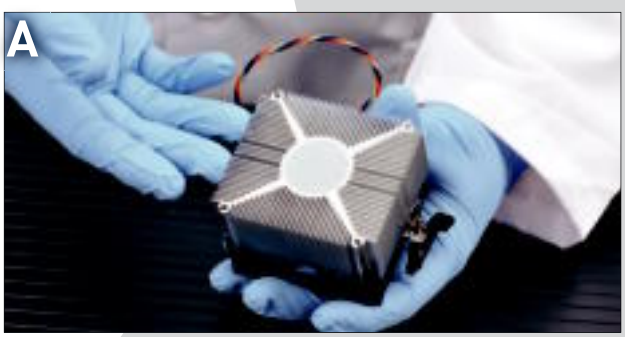
Finally, you'll need to connect the front-panel headers (image C). Consult the motherboard manual to find the exact location of the front-panel power, reset, and light connectors. The power and reset switches don't require a particular orientation, but the lights do—as a general rule, the colored wires are positive, while the white wires are negative. You should also connect the USB header and front-panel audio cables now, as well. They're clearly labeled on the board and keyed to only work in the proper orientation, so it's difficult to mess this up.

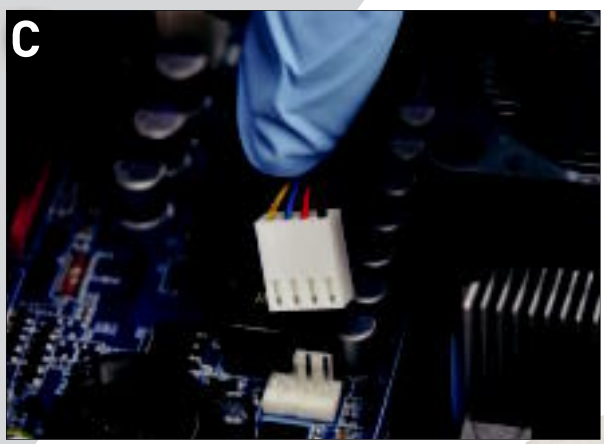




5 Mount the Cooler

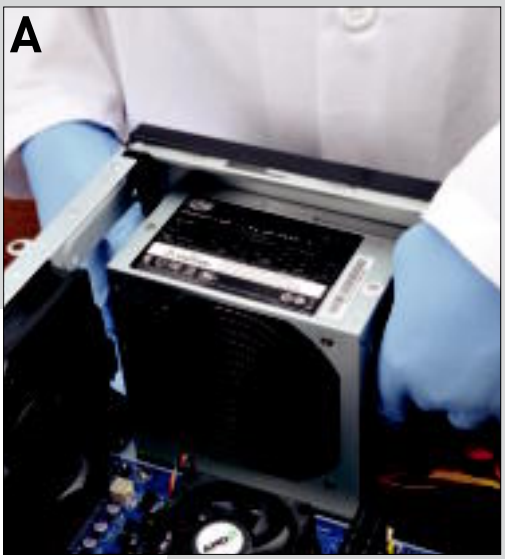
If you bought a retail CPU, which we recommend for first-time builders, you won't need to fool with thermal paste—there's already a thin layer of thermal paste on the bottom of the CPU cooler (image A). Remove the protective cover from the paste—if it has one—and position the cooler so its lever is on the same side of the socket as the PCI slots. Use your fingers to hook the clips on the lever over the nubs on the black plastic retention bracket (image B). Then if you flip the lever, it should cinch the entire cooler down onto the CPU and the retention bracket. If it doesn't, you need to release the lever and try again because the clips probably popped off one of the nubs. Finally, connect the fan's 4-pin power lead to the motherboard power connector labeled CPU_FAN (image C). If your fan connector has only three pins, you can still connect it to the 4-pin motherboard header, you just need to make sure the notch on the back of the connector lines up with the guide on the motherboard header.





6 Install the Videocard

With the motherboard, CPU, and cooler firmly locked in place, it's time to add the videocard to your system. Before you can put the videocard in its slot, you'll need to unscrew the goofy card-retention device on the back of the PC (image A). Once that's removed you can line up the edge of the videocard with your board's PCI Express slot—it's blue—and gently press down on the edge of the card until it slides into the slot (image B). Affix it in place using either the hooptie retaining clamp that came with the case or a more traditional screw. Th- you're ready to move on to the next step.



7 Install the PSU

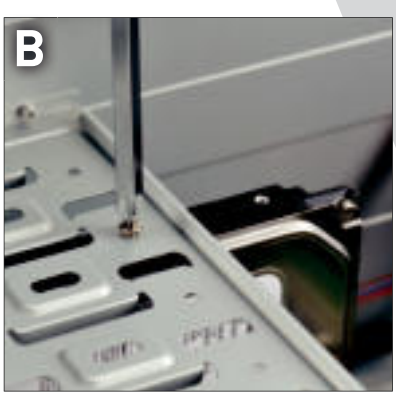
You're almost done! Next, you'll need to install your power supply. It goes into the top of the case, fan-side down, and is secured from the outside of the case with four screws—our PSU came with them. Slide the power supply into its appointed spot (image A), making sure the holes on the PSU line up with the holes in the case. We recommend starting one or two of the screws with your fingers before you tighten any of them down, to avoid warping the case. Once the PSU is locked in place, you'll need to connect three power leads—the large 24-pin connector that goes into the motherboard's main ATX power connector (image B), the 4-pin supplemental power connector that's by the CPU, and the PCI Express power connector that plugs into the end of the videocard.

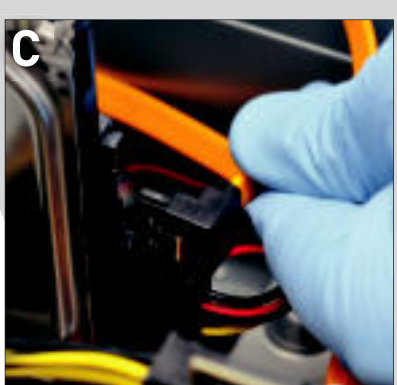
8 Install Drives and Windows

The final step is connecting the drives—you'll need to mount and connect both the hard drive and the optical drive. First, connect both of your SATA cables—you should have received two with the motherboard. Plug them into the ports labeled SATA 0 and SATA 1 on the mobo (image A). It's easier to do this before you mount the hard drive; otherwise accessing the ports can be difficult.

Cheap cases rarely include any fancy drive-mounting mechanisms, and this one is no exception. You'll need to screw in both your hard drive and optical drive using old-fashioned screws. There's no trick, but you'll need access to both sides of the case. Slide the hard drive in with the connectors on the motherboard side, then screw it into place (image B). Connect the SATA and power cables to the drive. Repeat with the optical drive, making sure the front bezel of the drive lines up with the front bezel of the case before you mount the screws. Connect the optical drive's SATA and power cables.

At this point, you should connect your new PC to a monitor, keyboard, mouse, and power; then give it a test boot. If everything goes well, you should be ready to install Windows. Simply drop the Windows 7 disc in your optical drive, reboot the machine, and follow the onscreen prompts. Because Windows 7 is relatively new, it includes chipset drivers out of the box, but you'll need to download the most recent videocard drivers from ATI.com or Windows Update (www.update.microsoft.com) before you can start using the machine in earnest.





Our $647 PC vs. the Competition

We matched our machine against a range of others to determine its relative value

To see how our budget box holds up, we compared it to four other machines of varying configurations. First up was a $650 HP Pavilion we purchased at Best Buy. The machine is damn-near the equal of ours, with an Athlon II X4 620, 400GB hard drive, DVD burner, and MicroATX motherboard (albeit using a GeForce chipset). The key difference between the two is the HP machine's use of integrated GeForce graphics in the chipset and 6GB of DDR2 instead of 4GB. The second competitor was the Recession Special PC we built for the September 2009 issue. With its 2.8GHz Phenom II X3 720 (overclocked to 3.6GHz), 4GB of RAM, and Radeon HD 4870, the Recession Special still has some pep, even though it's just a tri-core. It also cost $800 once the cost of a release version of Windows 7 Home Premium was factored in. The third box we used for comparison was our circa-2007 zero-point box. Featuring a 2.66GHz Intel Core 2 Quad Q6700 CPU, 4GB of DDR2/800, a WD Raptor 150, and dual GeForce 8800 GTX cards in SLI, it was a very impressive $2,000 rig in its day. The final machine we grabbed was our current zero-point machine: Featuring a 2.66GHz Core i7-920 (overclocked to 3.66GHz) 6GB of DDR3/1600 and a single Radeon HD 4870 X2, it's no wonder it's the ruler we use to measure the performance of even the most powerful PCs.

How did our modest rig stack up? Pretty well, all told. First up: gaming. Against the store-bought Pavilion with its integrated GeForce graphics, it was the slaughter you would expect. Our $647 box could actually play games, while the integrated graphics ticked along at single-digit frame rates. In applications, the results were a little odd. While our $647 rig was slightly faster than the Pavilion in MainConcept and ProShow, the store-bought machine pulled ahead by 10 percent in Photoshop CS3 and Premiere Pro CS3. Why? Frankly, we can't explain it. We expected the benchmarks to be very close, but a 10 percent difference indicates that the HP had some advantage that either comes from its chipset or its hard drive. The additional 2GB of RAM shouldn't make that big of a difference in those tests. Perhaps there is some secret sauce HP gets from being the world's number-one PC maker.

Against our older Recession Special, the tests were mostly even, which, in our book, makes it a win for the $647 machine. That's because the recession special was overclocked nearly 800MHz to 3.6GHz. The fact that the quad-core drew blood on a few benchmarks proves that having more cores does matter. Still, in the mostly single- and dual-threaded apps, it was hard for our Athlon II to bridge the 1GHz gap between it and the tri-core Phenom II. Of course, there's probably some overclocking headroom on our $647 machine, especially if you have an extra $35 to spend on a decent aftermarket cooler, such as the Cooler Master Hyper 212 Plus. Even more interesting was the showdown between our new rig and our previous $2,000 zero-point machine. The $647 machine was actually faster in two benchmarks and drew ties in two others.

Though it costs nearly the same as our hand-built rig, HP's Pavilion P6210Y PC couldn't compete with our machine in gaming.

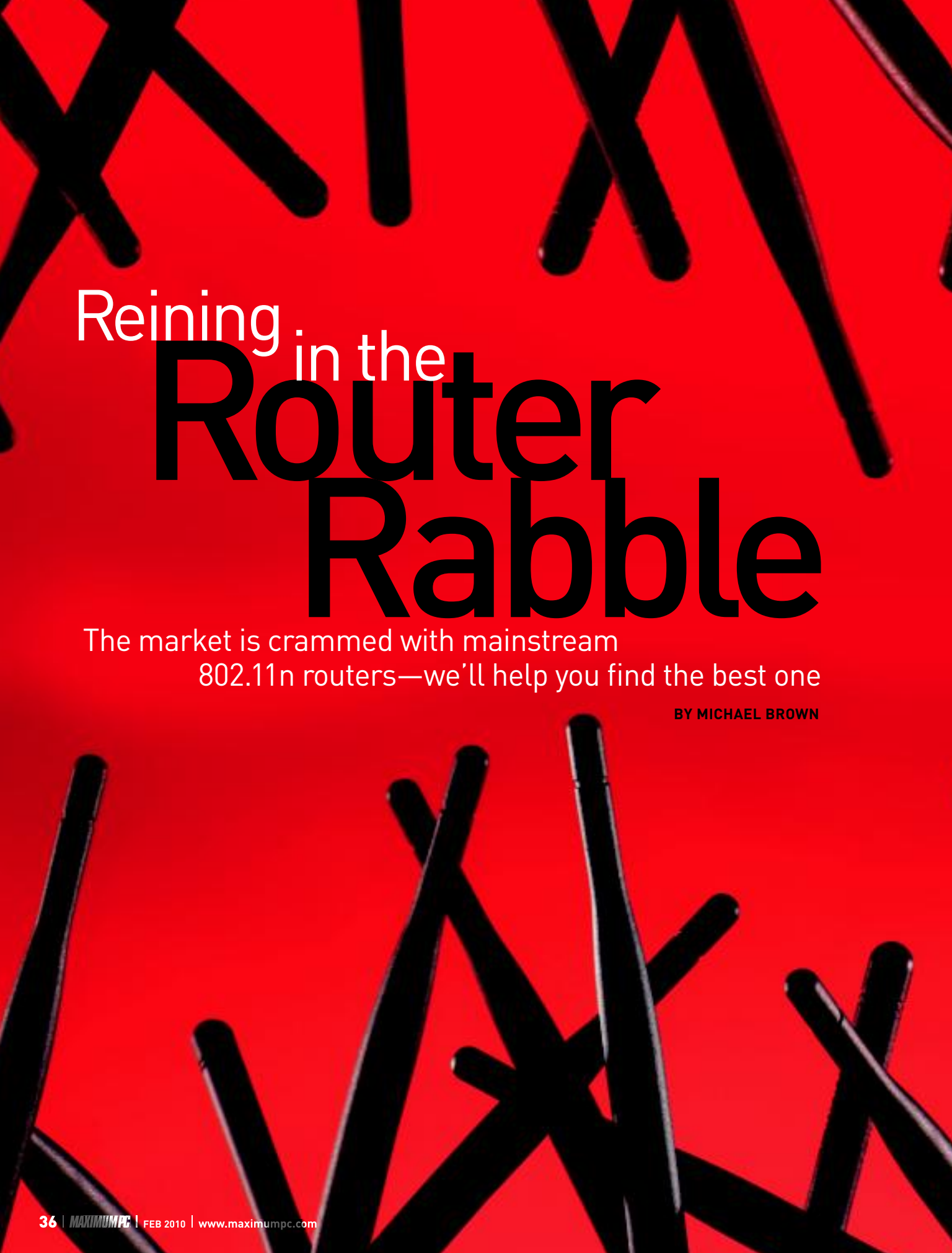
Not surprisingly, there was no contest when we compared our $647 PC with the current Core i7-powered zero-point machine. Our budget box was pretty much half the speed of the current zero-point in everything. Of course, it was also a hell of a lot cheaper.

What's the upshot? You can build a decent all-around machine that even plays DirectX 10 games for less than $650. Enjoy!

BENCHMARKS

	MPC $647 PC	HP $650 Pavilion	DM2009 Recession Special	MPC Zero Point 2007	MPC Zero Point 2009
Premiere Pro CS3 (sec)	1,052	947	1,103	1,026	496
Photoshop CS3 (sec)	178	161	150	143	94
ProShow (sec)	1,184	1,235	1,258	1,229	513
MainConcept (sec)	1,806	1,856	1,755	2,054	977
Crysis (fps)	20	1	22	29	37
Unreal Tournament 3 (fps)	97	6	111	106	198
Approx. Price	$647	$650	$800	$2,000	$1,500

All benchmarks are run on the 64-bit version of Windows 7 Home Premium. Gaming benchmarks are run at 1920x1200 resolution with no antialiasing.



Reining in the Router Rabble

The market is crammed with mainstream 802.11n routers—we'll help you find the best one

BY MICHAEL BROWN

In our last router roundup, way back in November 2007, we wrote, "We're months away from a final IEEE 802.11n standard." We never imagined that months would stretch into nearly two years before that standards body would finally finish ironing out all the details. But now that the spec has been ratified, 802.11n routers abound—and their prices have dropped dramatically.

Back then, the average price of the 802.11n Draft 2.0 routers that we reviewed—all of which had single-band radios—was $130. The average street price of the six single-band 802.11n routers in this batch has dropped to less than half that. The even better news is that the cheapest router in this roundup also delivered the best real-world performance.

You'll want to consider features as well as benchmark numbers, of course. If you have complex routing requirements, you'll want a model with tweaker-friendly firmware. And if you rely on VoIP for telephone service, play online games, or stream video over your wireless network while downloading files using BitTorrent, you'll want a router with robust quality-of-service features. One of the models we tested allows you to share a printer over your network; another boasts advanced parental-control features.

And then there's the certification issue to consider: Each of the routers in this roundup implements features of the IEEE 802.11n standard, but not all of them carry the Wi-Fi Alliance's 802.11n certification logo. We'll go into more detail about this in our buyers guide.

Read on for our full review of six of the latest mainstream 802.11n routers on the market.

Buyers Guide

What to look for in a Wi-Fi router

WI-FI ALLIANCE CERTIFICATION

Any router with an "n" in its name is capable of delivering raw data rates of 300- to 450Mb/s, right? Wrong. The Wi-Fi Alliance awards 802.11n interoperability certification only to routers that support two or more spatial streams (each stream is capable of a raw data-transfer rate of 150Mb/s). Single-stream client adapters can be certified as 802.11n, but the Wi-Fi Alliance awards only 802.11a, 802.11b/g, or 802.11a/b/g certification to single-stream routers. Any product that previously qualified for 802.11n Draft 2.0 certification can be automatically certified to be in compliance with the final standard. When in doubt, check which logo appears on the box.

SWITCH SPEED

Nearly every wireless router has an integrated switch for making hardwired Ethernet connections. You need to move upscale to get a gigabit switch, though; each of the devices in this roundup has WAN and LAN ports that are limited to 100Mb/s speeds. A narrow WAN port isn't a big deal (even screaming-fast FiOS connections top out at 50Mb/s downstream), and you probably won't miss a gigabit switch unless you're running a NAS box or a server.

QUALITY OF SERVICE

Quality of service (QoS) refers to the router's ability to assign different priorities to the various types of traffic moving over the network. Wi-Fi Multimedia (WMM) is a QoS baseline because the router must have it in order to be certified by the Wi-Fi Alliance. WMM is designed to prioritize network traffic passing through the router according to four criteria (provided the appropriate bits are embedded in the packets before they're put on the network). Voice traffic receives the highest priority, followed closely by video traffic. Packets carrying a "best effort" flag come next, followed by packets identified as "background."

Better routers include more robust QoS features. They might let you prioritize traffic by application (so that packets related to an online game are favored over BitTorrent downloads or web-browsing activity, for instance), or by IP or MAC address or Ethernet port (so that a specific device gets higher priority than anything else on the network).

STORAGE OPTION

An increasing number of routers support USB storage devices. Some models support true NAS (network-attached storage) functionality, so that computers on the network can access the drive just like any other storage device. Others provide access to the storage only through a built-in FTP server.

PRINTER OPTION

Some routers can function as a printer server, allowing you to share a single USB printer with every PC on your network. Support for multifunction printers is elusive, however; you can typically share the printer function over the network, but not the scanning or fax features.

PARENTAL CONTROLS

We're not big fans of this feature (we believe it affords a false sense of security because kids will figure out how to circumvent it anyway), but parental controls do at least allow you to put temporary roadblocks in front of unsavory websites, and they make activities such as peer-to-peer file sharing more difficult to pull off.

IN THE LAB

Our Testing Methodology

We tested the routers in this story at Maximum PC North, a 2,800 single-family home in a rural area of Northern California. Each router was paired with the vendor's matching USB wireless client adapter plugged into a laptop client. The router was placed on a shelf in one of the bedrooms, and we used the freeware benchmark utility IPerf (with the Jperf Java front end) to measure TCP throughput between two end points, with the client end point placed at three locations inside the house and three outside it.

We configured each router to operate in 802.11n-only mode (if that option was available). We used WPA2 security with AES encryption and enabled channel bonding. The home is located on a 10-acre parcel and is well isolated from any neighboring wireless networks that might be operating nearby. We retested Trendnet's TEW-639GR single-band 802.11n router, which scored a solid 8 verdict in our review in the Holiday 2009 issue, and used it as our zero point. You'll find a raft of additional details about our testing methodology and environment at http://bit.ly/16w270.

Trendnet's TEW-639GR single-band 802.11n router, reviewed in our Holiday 2009 issue, delivered the best throughput in four of our six test locations, so we used it as our basis for comparison.

ASUS RT-N13U

Strong feature set; crap performance

Asus isn't a huge player in the router market, but the company has come up with a few noteworthy models in the past few years. We'd happily count the RT-N13U as one of them if it delivered reasonable throughput or decent range.

This was the only router we tested that was capable of sharing a USB printer, and while Asus claims it can support multifunction devices, it guarantees compatibility only with the ones the company has tested. We plugged in an Epson Stylus NX515 and could print documents, but we couldn't get the scanner function to work. (You'll find a list of supported printers at http://bit.ly/mVqT4). The RT-N13U was also the only router we tested that was capable of hosting a USB hard drive, but the router permits only FTP access to that storage.

Several of the routers we examined had firmware that enabled them to be configured as wireless access points, but the RT-N13U was the only one that could also be converted into a wireless repeater. In this mode, the router operates like a wireless bridge, but one that can serve wireless clients. Repeaters send and receive at half speed, however; only a masochist would use the slug-slow RT-N13U in repeater mode. www.asus.com

VERDICT **5** $60

Asus has developed a terrific graphical user interface for the RT-N13U's firmware.

BENCHMARKS

	ASUS RT-N13U	TRENDNET TEW-639GR
Kitchen, 20 feet (Mb/s)	38.9	**106.0**
Enclosed Patio, 38 feet (Mb/s)	20.0	**57.1**
Bedroom, 60 feet (Mb/s)	8.1	**51.3**
Media Room, 35 feet (Mb/s)	4.5	**11.1**
Outdoor 1, 90 feet (Mb/s)	N/C	**4.8**
Outdoor 2, 85 feet (Mb/s)	N/C	**9.0**

TCP throughput measured using IPerf. N/C indicates no connection at that location. Best scores are bolded.

Belkin N Wireless F5D8236-4

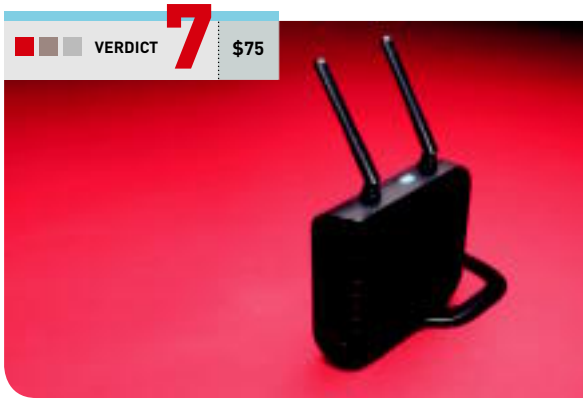
The short ranger

Router manufacturers have a bad habit of assigning the same names to several different products, or completely changing a router's underlying architecture and changing only the version number. Belkin has two routers it calls N Wireless (and a third called the N+ Wireless). For the record, we reviewed its model F5D8236-4.

The N Wireless is very short on features, but it turned in first- or second-place performances at four of our six test locations. It delivered TCP throughput of 76.2Mb/s with the client in the kitchen, 38.1Mb/s on the outdoor patio, and 20.3Mb/s in the double-walled media room. (Its throughput in the media room was two to five times faster than everything other than the D-Link DIR-615). Once we moved the client to our more distant outdoor locations, however, the router and client couldn't maintain a connection at all.

The router can be configured to operate as a wireless access point. It also supports UPnP, so it should play well with other UPnP devices, but it's extremely limited in terms of manual configuration. Its QoS settings are limited to enabling or disabling Wi-Fi Multimedia, for instance, and you can't change its settings for port range forwarding or triggering. www.belkin.com

VERDICT **7** $75



Belkin's basic, no-nonsense N Wireless router surprised us with its strong close-range performance.

BENCHMARKS

	BELKIN N WIRELESS	TRENDNET TEW-639GR
Kitchen, 20 feet (Mb/s)	76.2	**106.0**
Enclosed Patio, 38 feet (Mb/s)	38.1	**57.1**
Bedroom, 60 feet (Mb/s)	18.0	**51.3**
Media Room, 35 feet (Mb/s)	**20.3**	11.1
Outdoor 1, 90 feet (Mb/s)	N/C	**4.8**
Outdoor 2, 85 feet (Mb/s)	N/C	**9.0**

TCP throughput measured using IPerf. N/C indicates no connection at that location. Best scores are bolded.

D-Link DIR-615 (Rev. B2)

The B is for bargain

VERDICT **9** $40

D-Link's DIR-615 carries a $70 list price, but most of the retailers we checked were selling it for around $40 when we wrote this feature. At that price, this router is an absolute steal.

The DIR-615 was slower than our zero-point, Trendnet's TEW-639GR, in four of our six test locations, but it and the Belkin N Wireless were the only models in this group fast enough to wirelessly stream high-definition video to our media room. And unlike most of the rest of the field, it had no problem delivering usable bandwidth to the client in both of our long-range outdoor test locations. Taking the zero-point out of the equation, Belkin's N Wireless router was faster at the two locations where the client is closest to the router, but the DIR-615 was faster than everything everywhere else.

In addition to speed, the DIR-615 offered a more complete feature set than any other router we tested. You won't find some of the latest features, such as the ability to operate a guest network or share a USB printer or storage device, and its integrated switch is limited to 100Mb/s, but the DIR-615 does offer UPnP support, D-Link's vaunted QoS Engine, and a host of features you typically see only in high-end routers. www.dlink.com

There's plenty going on under the hood of D-Link's DIR-615 wireless router.

BENCHMARKS

	D-LINK DIR-615	TRENDNET TEW-639GR
Kitchen, 20 feet (Mb/s)	71.4	**106.0**
Enclosed Patio, 38 feet (Mb/s)	31.0	**57.1**
Bedroom, 60 feet (Mb/s)	32.2	**51.3**
Media Room, 35 feet (Mb/s)	**24.3**	11.1
Outdoor 1, 90 feet (Mb/s)	**15.7**	4.8
Outdoor 2, 85 feet (Mb/s)	5.8	**9.0**

TCP throughput measured using IPerf. N/C indicates no connection at that location. Best scores are bolded.

RECYCLE

What to Do with Your Old Router

Don't toss your existing router in the trash when you bring home a bright, shiny new model; convert it into a wireless access point, switch, or bridge.

Plug a PC into one of the old router's LAN ports. Open a web browser, type in the router's IP address, and log in. Your network must have only one DHCP server, so disable the server on the old router. Now, assign the old router an IP address that's outside the new router's DHCP server range.

Unplug the computer, place the old router where you need it, and connect it to the new router with an Ethernet cable (use the LAN ports at both ends). If stringing Ethernet cable isn't convenient, consider using power-line networking modules. You now should be able to connect to the new access point by typing the access point's IP address into a web browser on any computer on your network. In addition to having a new wireless access point, you can also use the old router's remaining LAN ports as a wired switch.

If you have a device that depends on a wired Ethernet connection, but dragging Cat5 cable to it isn't practical and you don't want to use power-line modules, convert your old router into a wireless bridge. This will most likely require third-party replacement firmware (DD-WRT, Sveasoft, and Tomato are the most popular options). Install and configure the firmware and position the router where needed. You'll be able to make wired connections this way, but clients will not be able to make wireless connections to the bridge.

You can convert most wireless routers into a wireless access point by turning off the DHCP server in the firmware.

Linksys WRT120N

Buyer be aware

We hope Linksys's marketing effort with the WRT120N won't blossom into an industry trend, but we know it will. Linksys advertises this router with the tagline "Step up to the speed of Wireless-N!" Read the data sheet, however, and you'll find this: "Complies with IEEE 802.3u, 802.11g, and 802.11b standards, and [is] compatible with *some* 802.11n features" (emphasis ours). The 802.11n standard has achieved sufficient brand recognition that many consumers won't look past the N in the product's name, and they'll fail to notice that the Wi-Fi Alliance certification logo on the WRT120N's box extends only to 802.11b/g.

Yep, this is a single-stream router, and the benchmark numbers reflect that design: The WRT120N achieved less than half the throughput of our zero-point router, Trendnet's TEW-639GR, in our kitchen, bedroom, and patio tests. It did beat the snot out of Trendnet's other router, the TEW-652BRP (reviewed on the next page), but the Trendnet's street price is nearly half that of the WRT120N.

As with most of the competition in this category, the WRT120N is devoid of advanced features such as USB ports for storage or printer sharing, but it does offer better-than-average QoS features, and you can tweak most of its firmware settings. www.linksys.com

VERDICT **5** $63

The WRT120N comes with the free basic version of Cisco's Network Neighborhood software.

BENCHMARKS

	LINKSYS WRT120N	TRENDNET TEW-639GR
Kitchen, 20 feet (Mb/s)	45.4	**106.0**
Enclosed Patio, 38 feet (Mb/s)	23.7	**57.1**
Bedroom, 60 feet (Mb/s)	17.8	**51.3**
Media Room, 35 feet (Mb/s)	10.7	**11.1**
Outdoors 1, 90 feet (Mb/s)	0.7	**4.8**
Outdoors 2, 85 feet (Mb/s)	N/C	**9.0**

TCP throughput measured using IPerf. N/C indicates no connection at that location. Best scores are bolded.

Netgear WNR2000

It gets better with range

Unlike the Linksys WRT120N, Netgear's WNR2000 *does* carry the Wi-Fi Alliance's 802.11n certification, but that logo didn't help this router perform any better in our benchmark tests. On the other hand, this was one of the few routers able to maintain a usable connection in both of our long-range outdoor tests.

Netgear's router was barely faster than the Linksys at close range, delivering anemic TCP throughput of just 47.1Mb/s, compared to the WRT120N's equally paltry 45.4Mb/s. But the WNR2000 was slower than the rest of the field with the client on the patio (TCP throughput of 14.7Mb/s), and its performance dropped to the single digits when the client was located in the bedroom and in the media room (5.1- and 5.0Mb/s, respectively). We wouldn't recommend this product to anyone interested in wireless media streaming unless the client is very close to the router.

Netgear's Live Parental Controls, powered by OpenDNS and included at no additional cost, will present the best challenge to kids looking for the seamy side of the web. Engaged at its highest setting, the router automatically blocks access to not only pornography sites, but also video- and music-sharing services, gaming sites, Facebook, MySpace, and other sites Netgear defines as "general time wasters." www.netgear.com

VERDICT **6** $70

If you're sensitive about how your gear fits in with your decor, Netgear's unremarkable WNR2000 won't call much attention to itself.

BENCHMARKS

	NETGEAR WNR2000	TRENDNET TEW-639GR
Kitchen, 20 feet (Mb/s)	47.1	**106.0**
Enclosed Patio, 38 feet (Mb/s)	14.7	**57.1**
Bedroom, 60 feet (Mb/s)	5.1	**51.3**
Media Room, 35 feet (Mb/s)	5.0	**11.1**
Outdoor 1, 90 feet (Mb/s)	**5.4**	4.8
Outdoor 2, 85 feet (Mb/s)	2.2	**9.0**

TCP throughput measured using IPerf. N/C indicates no connection at that location. Best scores are bolded.

Trendnet TEW-652BRP

Move along, there's nothing to see here

Trendnet's TEW-652BRP looked promising in our first benchmark test, with the client in the kitchen and closest to the router. Achieving TCP throughput of 68.4Mb/s put it in third place behind Belkin's N Wireless and D-Link's DIR-615. Performance went downhill from there, with the TEW-652BRP placing fifth, fourth, and last in our patio, bedroom, and media room locations, respectively. It couldn't maintain a connection to the client at all in our most distant outdoor tests.

Feature-wise, the TEW-652BRP is about as basic as they come. You can establish routing rules for special applications, such as games, but QoS features are limited to the minimum required to achieve Wi-Fi Alliance certification.

This model boasted the lowest street price, $35, of all the routers we tested, but it's no bargain. In fact, if you don't need wireless routing, Asus's pathetically slow RT-N13U is the better value, thanks to its support for printer sharing and USB storage. In reality, though, we've never met someone who bought a wireless router and didn't use its wireless networking capabilities. The real bottom line is that you could spend just a few extra clams and step up to the D-Link DIR-615, which delivers exponentially better performance and a much stronger feature set. www.trendnet.com

VERDICT **5** $35

Trendnet makes some very good routers; the TEW-652BRP isn't one of them.

BENCHMARKS

	TRENDNET TEW-652BRP	TRENDNET TEW-639GR
Kitchen, 20 feet (Mb/s)	68.4	**106.0**
Enclosed Patio, 38 feet (Mb/s)	15.1	**57.1**
Bedroom, 60 feet (Mb/s)	12.1	**51.3**
Media Room, 35 feet (Mb/s)	3.5	**11.1**
Outdoor 1, 90 feet (Mb/s)	N/C	**4.8**
Outdoor 2, 85 feet (Mb/s)	N/C	**9.0**

TCP throughput measured using IPerf. N/C indicates no connection at that location. Best scores are bolded.

TWEAK IT

How to Boost TCP Throughput

If your environment is crowded with wireless access points or your client is at the extreme edge of your router's range, you might be able to increase the router's throughput by reducing its fragmentation threshold. The router will slice up any frames larger than that threshold and send the fragments separately. Since any lost fragments will be smaller than the entire frame, resending them will require less time.

Any changes should be matched by a change to its RTS (Request to Send) threshold. The router will send an RTS signal to the client before sending any frame that's larger than the RTS threshold. The router will then wait until the client sends a CTS (Clear to Send) signal before transmitting the frame. This RTS/CTS exchange minimizes interference and reduces the need to retransmit frames by informing all the stations on the network that a frame exchange is about to occur.

Finding the sweet spot is a trial-and-error process. We significantly boosted TCP throughput from a D-Link DIR-615 router to our client (with 60 feet, one insulated interior wall, and two insulated exterior walls in between) by making incremental changes to these values until TCP throughput stopped increasing and began to go in the other direction.

We eventually increased the router's TCP throughput to the client at that location from 4.4Mb/s to 15.2Mb/s by changing the RTS threshold and fragmentation threshold from their default values of 2,346 bytes to 1,200 bytes each. Bear in mind that settings and results will vary by router. You should also know that changes benefiting a distant client's throughput can be detrimental to the throughput of a client operating closer to the router. When we moved the client back to our kitchen location, for instance, its TCP throughput dropped from 71.4Mb/s with the router's default settings to 21.5Mb/s after our tweaks. That's still plenty fast for web browsing.

One alternative to tweaking the router's settings is to use a high-gain wireless network adapter, such as Hawking Technology's dish-shaped HWDN1, at your distant location. Read our review at http://bit.ly/4dMNDu.

Introducing Clarkdale

Intel's next-generation CPU arrives, ringing in the era of the integrated graphics core

BY GORDON MAH UNG

In the Intel galaxy, the CPU is an inexorable black hole. A gravity well so strong that nothing can escape it as it consumes every function of the PC.

Don't believe us? Witness add-in MPEG-2 decoders, hardware modems, hardware-accelerated soundcards, and Ethernet controllers, all of which have been swallowed by the all-powerful CPU. With Intel's last CPU, the Lynnfield LGA1156 processor, the memory controller and even PCI-E functions were eaten by the CPU, too.

Now with Intel's new Clarkdale (and its mobile equivalent, Arrandale) the company is taking the first step in trying to eat a gas-giant of functionality by moving a GPU core directly inside of the CPU.

But not only is Clarkdale the first Intel chip with graphics, it's also our first glimpse at a CPU using Intel's new, smaller-process technology. Current Core i7 and Core i5 CPUs are based on the original 45nm Nehalem design that Intel introduced more than a year ago. Clarkdale uses a newer 32nm process that is part of the Westmere family. For the most part, Westmere is an evolutionary step forward and a simple die-shrink of Nehalem, but Intel did add some interesting performance enhancements.

Read on for details about what makes Clarkdale unique.

CLARKDALE DESKTOP LINEUP

	CORE I5-670	CORE I5-661*	CORE I5-660	CORE I5-650	CORE I3-540	CORE I3-530
Base Clock	3.46GHz	3.33GHz	3.33GHz	3.20GHz	3.06GHz	2.93GHz
Turbo Clock	3.73GHz	3.60GHz	3.60GHz	3.46GHz	N/A	N/A
Cores / Threads	2/4	2/4	2/4	2/4	2/4	2/4
Cache	4MB	4MB	4MB	4MB	4MB	4MB
Socket	LGA1156	LGA1156	LGA1156	LGA1156	LGA1156	LGA1156
Memory Controller	Dual channel DDR3/1333	Dual channel DDR3/1333	Dual channel DDR3/1333	Dual channel DDR3/1333	Dual channel DDR3/1333	Dual channel DDR3/1333
TDP	73 watts	87 watts	73 watts	73 watts	73 watts	73 watts
Volume Price	$284	$196	$196	$176	$133	$113

**Graphics core runs at 900MHz*

HEY, YOU GOT GRAPHICS IN MY PROCESSOR

Until now, PC graphics have either resided in the PCI-E slot or in the motherboard's core-logic chipset. With Clarkdale, Intel moves the GPU core directly into the CPU socket. It does this by packaging a new 45nm GPU core alongside the 32nm compute core, connecting the two via a high-speed QPI. It's a method reminiscent of the company's first quad-core proc, the Core 2 Extreme QX6700. Back then, Intel took a shortcut to quad-core land by combining two 65nm dual-core Core 2 Duo dies to make a "quad-core." While chip purists scoffed that the multichip package was an inelegant hack, and AMD fanboys called it cheating, the move gave Intel a year-and-a-half lead over AMD to store shelves. (Interestingly, a parallel scenario exists today: AMD is working on its own integration of GPU and CPU, dubbed Fusion. As before, AMD's plan is far more ambitious and elegant in its integration of GPU and CPU functionality. That product won't see the light of day until 2011. See more on AMD's Fusion efforts in our sidebar on page 49.)

PUT PLAINLY, INTEL'S INTEGRATED GRAPHICS HAVE STUNK UP THE JOINT FOR YEARS

Clarkdale's setup puts most of the logic in the GPU, which has a built-in single x16 PCI-E 2.0 controller, as well as the memory controller for both the graphics and compute core. Why use a multichip package instead of building a 32nm chip with graphics in it? It's likely a matter of cost, technology, and timing. This move, again, gets Intel a CPU with graphics capability more than a year before AMD will deliver its version.

GOT SPEED?

You probably only care about one thing: How fast is the GPU inside the chip? By rough estimates, it's about 1.5x times faster than the graphics in a current Intel G45 chipset found in most laptops and mainstream motherboards. If that sounds great, remember that Intel's integrated graphics history hasn't been stellar. Put plainly, Intel's integrated graphics have stunk up the joint for years and it's probably an insult to graphics cards to actually call Intel's integrated parts graphics accelerators. A 3-year-old $65 discrete graphics card with a hairball jammed in the fan is slightly faster than what you get from the G45 chipset. In fact, we've long blamed Intel's subpar integrated graphics for helping to push mainstream gamers to console gaming.

Intel's reasoning is that if people are buying systems with integrated graphics, they probably don't care about graphics. Sadly, that's probably true. Mainstream consumers browse the web, use Microsoft Works, and don't play anything more graphically intensive than Yahoo Bingo before heading down to the social hall for a game of bridge with Madge, Maude, and Betty.

Intel bluntly says the graphics core in Clarkdale is definitely not meant for hardcore gamers. We wholeheartedly agree. We first tested the Clarkdale using 3DMark Vantage on default and after getting a score of 0, abandoned all hope of it being capable of serious gaming.

To see if it was even capable of playing more moderate games, we fired up Left 4 Dead 2 and found the frame rate almost playable at 800x600 with the graphics set on maximum ugly. Borderlands at 1280x1024 was also over the Clarkdale's head, but almost playable at a mobile phone resolution of 800x600. We did actually see 60fps in Counter Strike: Source at 1280x1024, with somewhat compromised graphics. Still, that's better than nothing. As easy as it is to make fun of integrated graphics, it's a moot point for someone who doesn't play games.

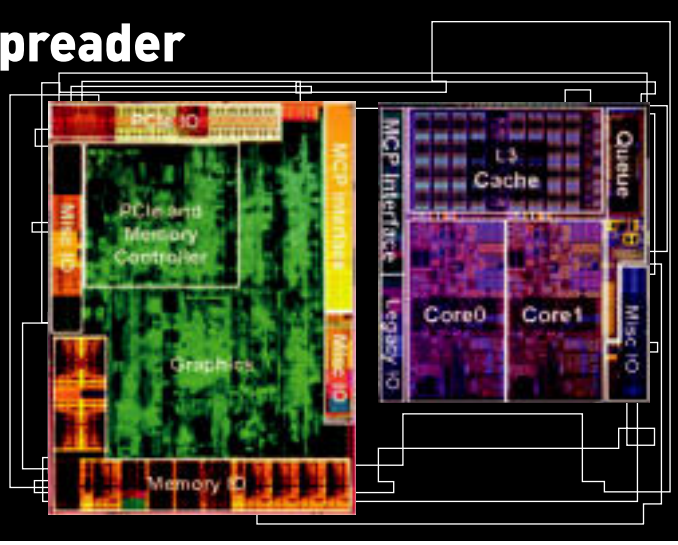
MAKES GOOD WITH MEDIA

While Clarkdale may not shine in gaming, it certainly holds its own at media acceleration. Intel paid attention to the shortcomings of the Core 2's G45 chipset. When released, the G45

TRANSISTER COUNT

Under the Clarkdale Heat Spreader

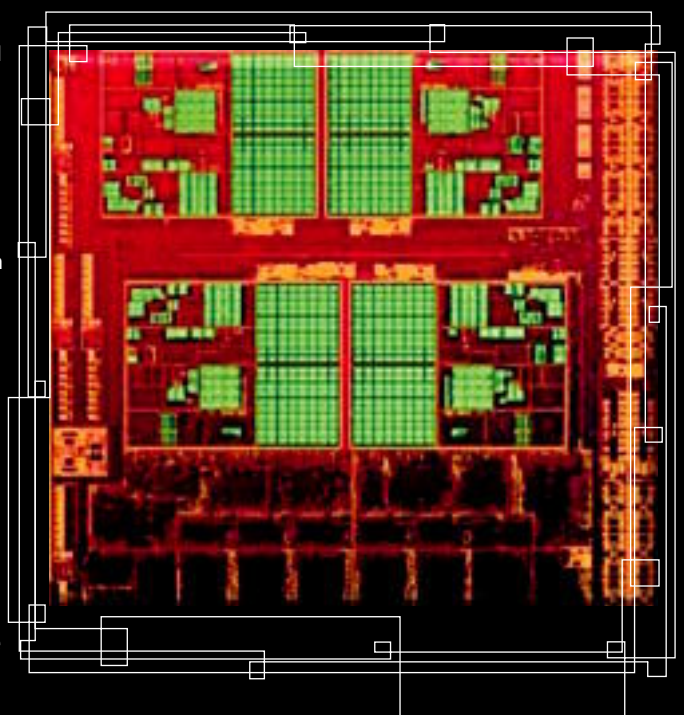
The transistor count and die size of a CPU have long been a fascination of chip addicts trying to glean insights about a processor's capabilities. With Clarkdale, the simple question of how many transistors it packs gets quite complicated since there is now a GPU under the heat spreader, too. We dug into the spec sheets of the new processor and found out that the new 32nm core measures a very diminutive 81mm² but packs 383 million transistors. The 45nm GPU is 114mm² yet has just 177 million transistors in it. So the short answer is 560 million transistors.



FUSION

AMD's Take on the Hybrid Processor

AMD hasn't been in the CPU hunt for several years, but that could change in 2011, when the company's combination CPU and GPU is released. AMD calls its hybrid part an APU, or accelerated processing unit, and it looks to be a far more elegant approach than Intel's method of jamming a graphics core and a compute core into the same CPU package. AMD's Fusion platform is a true integration of the functions of a CPU and GPU. And we don't mean simply because both are built on the same contiguous die. AMD's vision is to closely enmesh the strengths of the GPU at running parallel code with the strengths of the CPU for general-purpose code. The first part is code-named Llano and will feature 1 billion transistors—roughly twice the number of transistors of Intel's Clarkdale—and support for DirectCompute and OpenCL, which will let applications leverage the parallel portions of the APU for such tasks as encoding. Compared to Clarkdale's GPU-in-a-CPU trick, Fusion appears to be far more forward-thinking. However, recall that AMD's Phenom also seemed elegant and advanced when compared to Intel's clunky Core 2 Quad. Though cruder, the Core 2 Quad was still faster, which is all that will matter in 2011 when Fusion hits the shelves.



accelerated Blu-ray content but it was short on features. Clarkdale adds a new sharpness filter, 24Hz refresh rates, HDMI 1.3a with Deep Color support, lossless Dolby TrueHD and DTS HD audio, and even dual HDMI output. With a 3.33GHz Core i5-661 Clarkdale, we were able to watch a Blu-ray disc with the processor running in its SpeedStep low-power mode.

By moving the GPU into the CPU, beefier centralized cooling can be used to keep both parts cool. (Unified cooling has even greater ramifications for notebooks with Arrandale). The relocation of graphics and PCI-E in the core also reduces the core-logic chipset from a north- and south-bridge design to a single chip. This lets board vendors design more compact boards with greater capability than traditional chipset-based graphics. If you don't care about games, Clarkdale could let you build an extremely small yet Blu-ray-capable HTPC that can outperform many budget quad-cores.

One thing home builders will need to remember, though: Clarkdale is a unique part that could make shopping for a motherboard confusing. Today, pretty much any motherboard with integrated graphics will work with any CPU that fits into the LGA775 or AM3 socket. With Clarkdale, not only will you have to pair it with an LGA1156 board, but you'll also need to make sure it supports the graphics capabilities of the CPU. And if you decide to, say, replace the Clarkdale with a quad-core Core i7 in a year, you will also have to install a graphics card to the system because you've just yanked out the GPU with the old CPU. You should be able to run Clarkdale in motherboards that don't have graphics ports on back but the GPU will be disabled.

CLARKDALE AS CPU

But enough about the GPU. The real gem here is the 32nm Westmere core in Clarkdale. Why? It basically gives us a preview of the performance we'll see next year when Intel releases quad-core and hexa-core CPUs based on the Westmere core. So far, we like what we see. For starters, the CPU offers six new instructions to accelerate Advanced Encryption Standard encryption and decryption. In addition to that, Westmere retains Intel's auto-overclocking mode, now called Turbo Boost. Originally dubbed Turbo Mode when Core i7 was first released, the feature has been fine-tuned to its current Turbo Boost iteration (yes, we know, Knight Rider's KITT had a Turbo Boost, too).

One thing we're not too impressed by is the CPU's memory performance. In Clarkdale, the dual-channel DDR3 memory controller resides in the GPU side, and it's apparently not up to the snuff of the memory controllers in 45nm Core i7 and Core i5 parts. With our Clarkdale sample CPU, memory bandwidth was about 25 to 30 percent lower than with a 45nm part. Latency was also significantly worse at 82ns in the 32nm Clarkdale versus 53ns in a 45nm Core i7-870. Why? We suspect it's the result of having one memory controller manage both graphics and compute cores, but it's not really clear to us yet.

Still, it's easy to imagine what you can get if you put six of the Westmere cores along with a better triple-channel DDR3 memory controller and a high-thermal budget in the Core i9 next year.

Clarkdale in Action

After running the benchmarks, we declare it the fastest dual-core ever!

For our testing, we used an Intel DH55TC motherboard, 4GB of Corsair DDR3/1333, a Core i5-661, a Western Digital Raptor 150, and 64-bit Windows Vista Home Premium. Our benchmarks consisted of a standard suite of 3D rendering, encoding, photo editing, gaming, and memory-bandwidth and -latency benchmarks.

To be frank, we didn't expect much from the Core i5-661. After all, a dual-core CPU in a quad-core world is asking for a beat-down, right? We've seen overclocked Core 2 Duo's get spanked or barely break even with far lower-clocked quad-cores, so we didn't think this was much of a match. Well, as Gomer says, "Surprise, surprise, surprise!"

The 3.33GHz Core i5-661 is actually faster than AMD's budget quad-core, the $99 2.6GHz Athlon II X4 620, as well as its own sibling, the 2.33GHz Core 2 Quad Q8200. Against both chips, the Core i5-661 plowed ahead in the multithreaded tests thanks to its Hyper-Threading, and was significantly faster in gaming thanks to its Turbo Boost. So mark it an eight for dual-cores, dude.

The battle wasn't so easy once we compared Clarkdale with CPUs in its own price range. At roughly $200, the Core i5-661's real competition is against the $266 2.83GHz Core 2 Quad Q9550, the $200 2.66GHz Core i5-750, and the $200 3.2GHz Phenom II X4 965 Black Edition. Surprisingly, the 2.83GHz Core 2 Quad didn't surpass Clarkdale in everything. While the Core 2 Quad was faster in multithreaded tasks, the higher clocks of the Core i5-661 gives it the edge in gaming. So if you're still not convinced that Core 2 is dead, this should give you another sign.

Against the Core i5-750 and the Phenom II X4 965 BE, the dual-core Core i5-661 is clearly outclassed. Since all three CPUs are $200, we had to wonder if Intel didn't fire a blank when pricing the Core i5-661. Sure, it's a good chip for folks looking to build an ultra-quiet and ultra-small home theater PC, but it simply can't run with the other $200 chips. The chip should really be priced about $30 to $40 cheaper.

We were far more interested in seeing how the lower-clocked Core i5 and Turbo Boost–denied Core i3 Clarkdales would do, but that wasn't possible. Our Intel board didn't allow us to underclock our sample processor and none of our P55 boards had BIOSes that support the new chip yet.

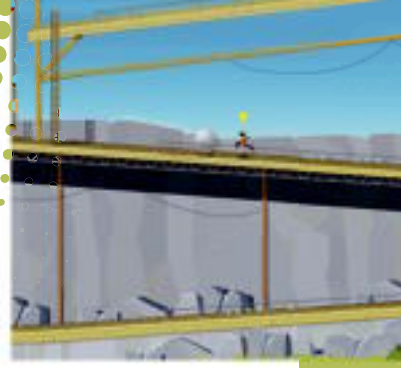
The upshot is that Clarkdale is the fastest dual-core today—and competitive with quad-cores, too. That's damned impressive, and a testament to the power of the new Westermere core. Based on this glimpse of next year's six-core Core i9, we can tell that it's going to be a monster.

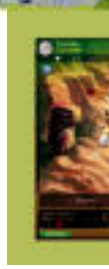
The problem is the pricing on the Core i5 dual-cores. With more competitive quad-cores priced the same, the Core i5-661's only advantage is in HTPC or small formfactor designs.

BENCHMARKS

	3.33GHz Core i5-661	2.6GHz Athlon II X4 620	2.33GHz Core 2 Quad Q8200	3.2GHz Phenom II X4 965 BE	2.66GHz Core i5-750	2.83GHz Core 2 Quad Q9550
Volume Pricing	$196	$99	$163	$195	$196	$266
Main Concept Reference 1.0 (sec)	1,717	1,772	1,976	1,388	**1,337**	1,644
Premiere Pro CS3 (sec)	837	899	888	733	**620**	741
Cinebench 10 64-bit	10,812	9,941	10,184	14,083	**14,442**	12,280
Handbrake iPod Classic (sec)	1,569	1,559	1,681	1,220	**1,198**	1,366
PCMark Vantage 64-bit Overall	6,802	5,792	5,299	6,824	**7,208**	6,241
POV Ray 3.7 b33	2,150	2,334	2,191	**3,045**	2,773	2,669
Photoshop CS3 (sec)	**122**	165	146	123	128	132
ProShow Producer (sec)	1,045	1,224	997	911	**700**	862
Everest Ultimate MEM Copy (MB/s)	9,244	10,028	7,397	10,246	**14,684**	7,455
Everest Ultimate MEM Latency (ns)	82.3	52.5	66.7	54.3	**30.9**	64
Sisoft Sandra RAM Bandwidth (GB/s)	12	12.3	7.2	12.7	**16.8**	7.2
Fritz Chess Benchmark	13.07	12.93	13.79	17.04	**17.38**	16.97
3DMark Vantage Overall	14,848	13,727	14,260	14,544	**14,947**	14,681
3DMark Vantage CPU	38,149	36,269	36,863	40,679	**44,066**	40,644
Valve Particle Test (fps)	107	71	81	95	**124**	99
Valve Map Compilation (sec)	152	157	163	125	**121**	129
Crysis CPU 10x7 Low (fps)	118	83.1	99.5	104	**147**	119
Resident Evil 5 Fixed DX10 (fps)	90.7	69.5	69.5	89.2	**109.4**	83.8
Resident Evil 5 variable DX10 (fps)	142.9	113.7	112.2	140.2	**160**	133.9
World in Conflict (fps)	168	137	155	160	**266**	159
WinRar 3.20 (sec)	889	1,067	1,110	805	**706**	868

Best scores are bolded.

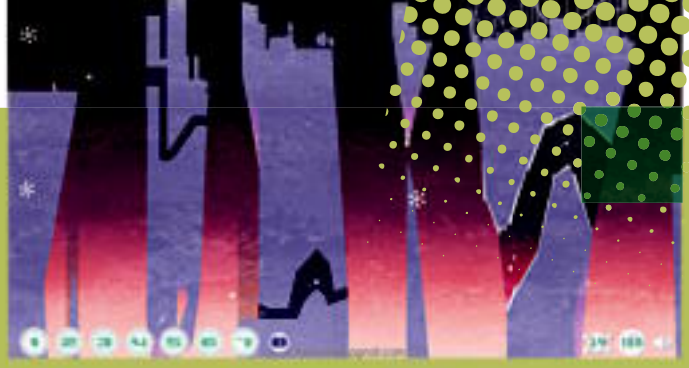




Casual Encounters

When you don't have the time or resources to commit to a full-fledged FPS, strategy game, or RPG adventure, a fun, fast, browser-based game is sure to satisfy. We reveal our favorites—both current and classic **BY ROB SMITH**

Five minutes here, a lunch break there, the urge to procrastinate. The free browser-based Flash game has evolved with the technology, producing some high-quality time-killers that can interrupt the most productive of days. With volume comes choices. But you don't want to waste time browsing—you need the definitive go-to guide to the best of what's out there. We did the leg (hand and mouse) work for you. Many sites collect hundreds of these free games—check out Kongregate.com, Armorgames.com, Gamebrew.com, as examples—but scan our list and you'll be on the road to fun, free entertainment in no time. Plus, for a hint of nostalgia, or to get your feet wet with casual gaming, spend some quality time with classics of the genre, collected in our list of all-time favorites.



SHOOTER

Dark Base III

Alien slaughter-fest

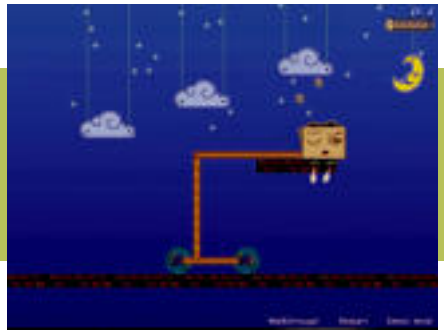
This top-down shooter franchise has been successful enough to spawn sequels, which says plenty about its quality. RPG-style level-up mechanics let you improve your abilities and arsenal, which is vital given the rampaging indigenous life forms intent on eating you and your hired-mercenary help. Mission progression lets you take on optional tasks that flesh out the story and provide further opportunities to earn experience and level up. http://bit.ly/4vlfw9

PUZZLE

Wake Up the Box

Fun with physics

What else are you going to do when you find a box napping on a ledge? Prod him awake using the weight and shape of various pieces of wood in a physics-based puzzle, naturally. Mixing spatial challenges, occasional speed tests, and creative thinking, each of the 20 levels provides a unique test. If you get stuck, watch the handy video walkthrough of the optimal solutions. http://bit.ly/4mdLBA



PAIN INFLICTOR

Flakboy

Happy to be the gun, spike, mine test subject

Figuring out the most effective method of delivering extreme damage to poor Flakboy proves incredibly engaging. Poor guy is scared of a yellow duck, which sets him in motion within a confined room outfitted by whatever spikes, mines, guns, and trampolines your cash allotment affords you to buy. The eight levels each require you to inflict more damage, which forces you to try new weapons as they unlock. Then set the duck loose and watch Flakboy smear the walls with his own blood! http://bit.ly/91cngL

COLLECTIBLE CARD GAME

Kongai

Whip 'em good

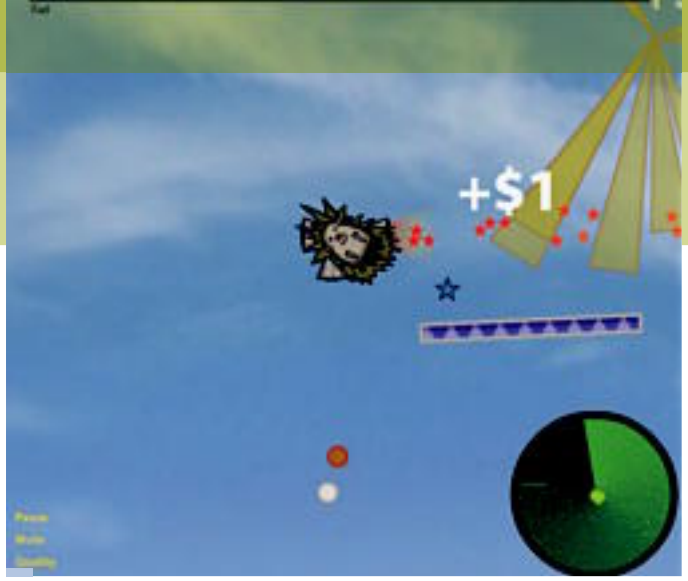
This collectible card game is blended with Street-Fighter-like beat-'em-up mechanics and painted with a classic high-fantasy cartoon-art style (i.e., uber-buff dudes and improbably proportioned ladies). You start with three cards, which you're likely to pick for the artwork since the mechanics take some learning. After a few practice bouts, you earn new cards and compete in ranked matches against other folks. Very, very compelling for Magic: The Gathering types who want a free option. http://bit.ly/36lKjT

FLINGER

Hedgehog Launch

Not a bird or a plane, but a hedgehog

One hedgehog. One elastic launch contraption. Strap-on rocket packs. It all adds up to an obvious recipe for throwaway fun chasing your high score. Launch the hedgehog skyward then hope you hit the floating coinage. The loot is then used to buy upgrades to the rockets, better launch velocity, a radar device (largely ineffective, as it turns out), and more. Then you launch again. And again. And upgrade. And launch. And you'll still be launching 10 minutes after you decided to stop. http://bit.ly/YtsEf



DEFENDER

Desktop TD Pro

Stop the critters scurrying across your desk

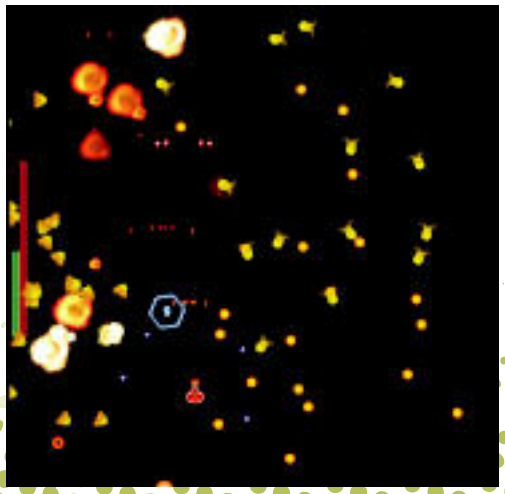
Tower defense has become the defining casual-game genre for its classic simple-but-deep mechanics, puzzling challenges, and characteristic "just one more go" play sessions that last into the wee hours. And this is one of the best. Inviting in its simple premise and early level setup, and then excruciating in the grip of vast strategic options as you place tower types, upgrade as you earn cash, and try to stop the enemies from exiting the arena. Give it five minutes; it'll repay you in hours. http://bit.ly/W1CbR

THINK GALAGA

Red Fluxion

Remember to blink

Your tiny ship has plenty of firepower. Lasers blasting vertically; shots dispersing horizontally; homing missiles navigating towards targets. So many targets. Within moments, space is jam-packed with colorful shapes dispatching swarms, streams, and swirls of damaging objects not necessarily directed at you, but in such sufficient quantities to fill the blackness of space with their color. And that's before you get to the monstrous boss battles that often require fine mouse control amid the manic shooting gallery action. http://bit.ly/3ct7Nu



DEMOLITION

Crush the Castle

Flinging rocks for fun and profit

Armed with a powerful trebuchet, it's your mission to launch projectiles at a castle until you bring the structure crashing down around the heads of the inhabitants. Kill 'em all, then move on to the next castle. The game's 24 castles test your skill at timing the launch for the right speed and trajectory and mixing up ammunition options, which upgrade as you progress. Complete them all, then have a go at designing and testing out your own castle conundrums. http://bit.ly/jJURI

ONE PUZZLE

This Is the Only Level

A many-trick pony

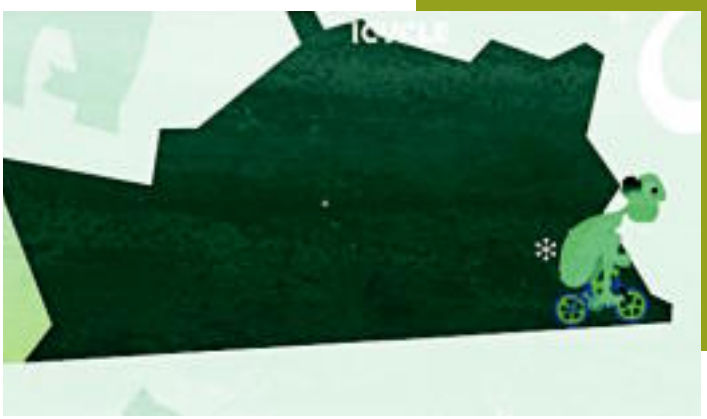
Thirty identical levels. Sounds like a hoot, right? But an incredible variety of invention makes each level a thoroughly unique or stylized challenge. This isn't about using different routes from entry to exit, but interpreting the word clue to fathom the trick to solving a given level. When you have to refresh your browser to unlock a level, you know this is something a little bit different, a little bit special, and worth several do-overs to earn faster times and fewer deaths. http://bit.ly/28wq8R

NUDE BIKING

Icycle

Is this for total aerodynamics?

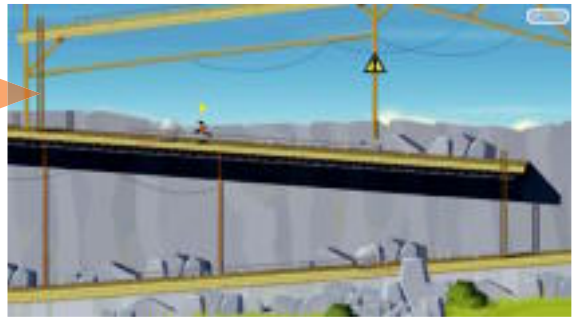
Riding along deadly ice caps, across crumbling mountains, through volcanic tunnels, and amid collapsing buildings is dangerous enough. Doing it in the buff? Weird. But "naked guy riding a bike" captures the attention quicker than "random dude on BMX adventure to collect frozen soap bubbles." And it's totally compelling as the scale shifts for each level—shrinking the character to a few pixels in some cases—as he overcomes the obstacles to make the exit. Some levels are cunningly challenging, others a ride in the park. Naked. www.dampgnat.com/icycle



MAIL DELIVERY

Finwick

Beyond the call of the mailman's duties



Delivering mail seems like such a mundane summer-vacation student job. Not in Finwick, where helping the Royal Mail (evidently set in England) can be very dangerous. This side-scrolling platform and puzzle game is framed by a story told in quick dialogue blurbs between characters and set among beautifully drawn (if deadly) forests, factories, and construction sites. Controlling a second character adds further puzzle challenge as you set platforms in motion and create safe routes to deliver one piece of mail. http://bit.ly/LyRUk

ESCAPE

Canabalt

Free running

Now this is extreme parkour… in black-and-white, pixel-graphics form. You're escaping (from what is unclear) through buildings, across construction cranes and rooftops, at blistering Uwain Bolt–plus-plus speeds, hitting just one jump key to skip over obstacles or leap through windows and across gaps between buildings. Scored purely on the distance you make before face-planting into the side of a building, you'll keep trying for that longer run, pushed by the pounding sci-fi movie soundtrack pumping in the background. www.adamatomic.com/canabalt

TREASURE HUNT

GraveShift 2: The Sewers

Does not stink in the least

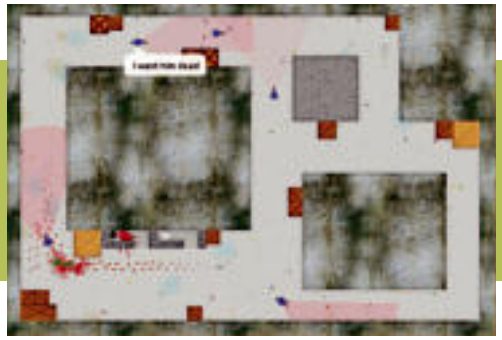
The isometric 3D puzzle-adventure game has been around for eons, and this one brings a colorful style to its Indiana Jones–wannabe character. You have to navigate through the sewers, picking up gold along the way, fighting off the rats, skeletons, and more. These sewers are dangerous, with spike pits and other traps adding to the challenge as you try to recover King Krump's treasure. The terrific art style makes it easy to spend hours exploring and figuring out how to retrieve each piece of treasure. http://bit.ly/6tLw6x

STEALTH

Ultimate Assassin 2

Metal Gear Flash

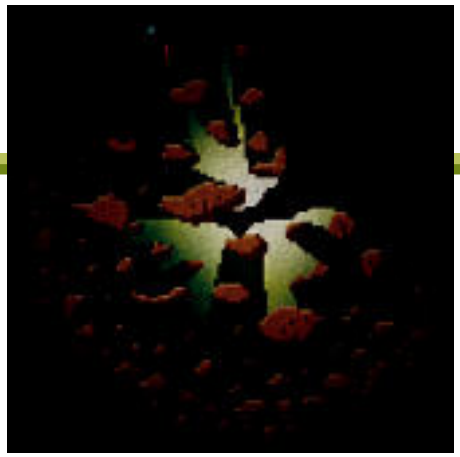
This top-down stealth-action game recalls memories of early Metal Gear sneak, stab, hide, and escape gameplay. It's extremely challenging as you move your assassin after the green "boss" target through 18 levels. Guards shine their torches and move through the environment in random directions. Your assassin can call on a brief invisibility (so long as you don't move) and speed-burst to elude danger. After the hit, wait for the mission bar to fill before the exit is revealed, and hope the bad guys don't spot the body and sound an alarm that sends them into a fast-moving frenzy. http://bit.ly/11aelf



CONCEPTUAL

Small Worlds

From small beginnings great worlds grow



An entry in the Casual Gameplay Design Competition, this quirky exploration game packs tons of style into its simple stick-character and block-graphics presentation. From an initial camera view zoomed in on your pixel "dude" you move around the world as the camera pans back to reveal its shape, paths, and direction to the exits. It's more a game of wonder at the concept than a speed, movement, or puzzle-solving challenge, but still well worth your attention. http://bit.ly/2AKQA7

POINT-AND-CLICK ADVENTURE

A Dralien Day

Lose yourself in a puzzling journey

This tale of a dragon's emergence from an egg and his travels through puzzle-infested environments is classic point-and-click adventure fare. Those big doe-eyes implore you to help the little fella through each area. Rather than pixel-searching for clickable objects, each interactive element in a scene is handily highlighted, so it's easy to find the puzzles even if it's not so easy to solve them. A full walkthrough is available if you happen to get stuck. http://bit.ly/78ykPQ

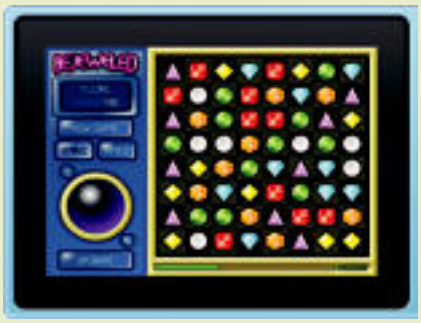
Casual Game Classics

Free Flash games have evolved over the years, but some of the best of all time have probably contributed to more lost office productivity than Rick-rolling and dancing hamsters put together

Bloons

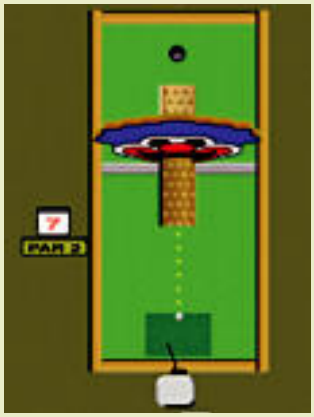
A monkey armed with darts popping balloons? Sounds like the perfect game concept. It's also thoroughly addictive as you work through the steadily increasing difficulty levels, aiming to pop the target number of balloons as new obstacles (and power-ups) are introduced.
http://bit.ly/18fA42

Bejeweled



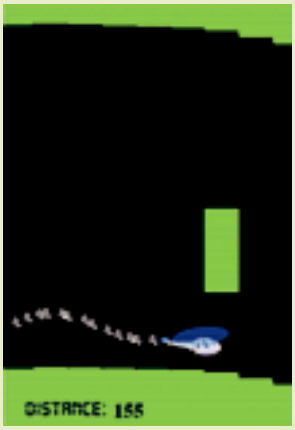
Possibly the greatest detriment to office productivity since Minesweeper! Who would have thought that matching sets of three gems would prove to be so utterly addicting? This classic puzzler has spawned a huge number of clones and sequels, and continues to be played in offices the world over. www.popcap.com

Mini-Putt



A quick 18 holes of mini golf can turn into hours of effort to bring your score down as low as possible. In this classic variant you judge angles and speed to putt the ball around, through, or over obstacles and into the hole.
http://bit.ly/YxAMp

Helicopter



Maybe the sound of constant mouse-clicking will make coworkers think you're being incredibly productive (or have some kind of crazy twitch). You keep the helicopter flying by pressing the mouse button, and release it to let it drop. Now just see how far you can make it through the tunnels while avoiding the obstacles.
http://bit.ly/ZiDzl

3D Pong

See ball, hit ball with paddle. Repeat. Now three full, unforgiving dimensions. www.3dponggame.com

Fantastic Contraption

What a head scratcher. The simple premise of building machines is actually a deceptively addicting physics puzzler. You place the pieces of the contraption and hope your choices make it, well, fantastic. It's easy to spend hours figuring out some of the later-level conundrums.
www.fantasticcontraption.com

HOW TO

Step-by-Step Guides to Improving Your PC

THIS MONTH

74 ESSENTIAL FIREFOX TRICKS
76 BITTORRENT TWEAKS
79 PLAY CLASSIC PINBALL GAMES

TWEAKING VS. UPGRADING

NORMAN CHAN
ONLINE EDITOR

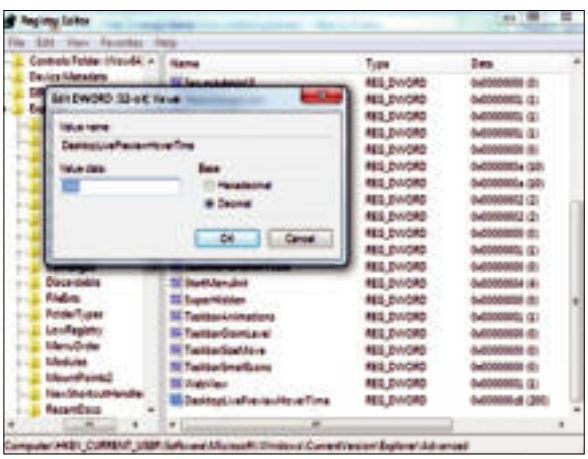
Iteration is one of the most important facets of software development. The process of taking an existing application, evaluating its shortcomings, and then improving it bit by bit—that's how we continually get new and better products. Oftentimes, though, a software publisher will release a new version of a product (that it can charge full price for), while there's still room for improvement in the last full release.

Take Windows, for example. Windows 7 has a great new UI and fresh features, but that isn't to say you can't get some of its functionality in Vista with free add-ons and tweaking utilities. EnhanceMyVista (http://bit.ly/85N39D) is a free app that'll add a Windows 7–like taskbar to Vista, VistaSwitcher (http://bit.ly/8dLSDO) beefs up the Alt-Tab capabilities, and users have even found ways to import Windows 7 themes into Vista (http://bit.ly/8qXDJw).

The point isn't that Windows 7 isn't worth your dollars, but that you should take a close look at what your needs are before paying for an upgrade. Tweaking and making iterative improvements to "old" software never hurts, especially when it's free!

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



Speed Up Aero Peek

Using Aero Peek to preview open programs in the taskbar is useful, but the cascading window effect is a little slow. Speed it up with a registry hack. Open RegEdit and browse to HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Explorer\Advanced\. Create a new DWORD key named DesktopLivePreviewHoverTime. Double-click it and change its decimal value from 500 (milliseconds) to 200. Restart Windows to put this into effect.

Essential Firefox Tricks

Mozilla's browser is a big threat to Microsoft not just because it's fast and full of unique features, but because it's also extremely customizable. Add-ons, style scripts, and hidden preferences let you personalize your Firefox experience to meet your tastes and needs. You may know about hidden Easter eggs like the about:robots page, but we're going to show you some other relatively unknown tricks for this super browser. –NORMAN CHAN

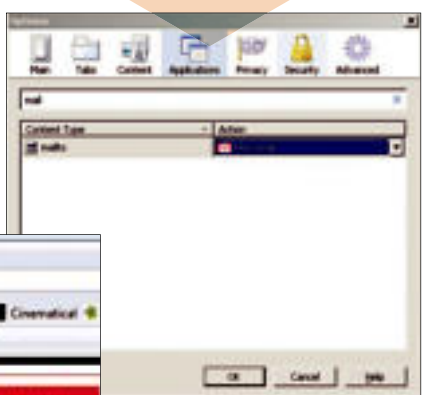
UNDO CLOSED TABS WINDOWS

This feature has actually been around since before Firefox 3, but we're often surprised by how many people don't know about it. Firefox stores a record of every open and closed tab in all windows for each browsing session. So if you accidentally closed a tab, you can bring it back by pressing Ctrl+Shift+T. The restored tab retains its surfing history as well, and you can bring back old tabs even after you've opened several new ones in the interim.

USE GMAIL AS YOUR DEFAULT MAIL APPLICATION

When Firefox 3 was released, one of the new features was the option to associate HTML protocols with web applications, such as launching a webmail service when clicking a mailto: link. Unfortunately, at the time of launch, only Yahoo's mail client was officially supported, and users had to either use extensions or manipulate some Javascript code to make Gmail the primary mail handler. The current iteration of Firefox includes Gmail in the web app client list, and here's how you turn it on.

Go to Tools > Options, and select the Applications tab. This is a list of protocol and content associations, with the respective plugins for each type of content (e.g., MP4 video). In the search field, type mailto. Then, in the Actions drop-down menu, select Gmail as your default client. The next time you click an email link, Firefox will open Gmail in a new tab to send an email.



3 QUICK LOCATION BAR FIXES

▶ Always Show the GO Arrow By default, the Go arrow on the far right of the location bar only shows up if the bar is empty or if you've typed in a new URL. To make the button stay visible, go to your user Profile directory (C:\Documents and Settings*username*\Application Data\Mozilla\Firefox\Profiles\ in Windows XP), navigate to the Chrome subdirectory, and create a new blank file called userChrome.css.

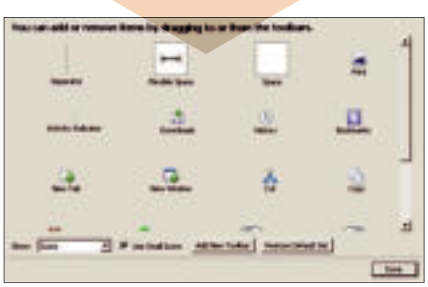
This file lets you make style-sheet changes to Firefox. Open up the file with Notepad and type the following at the end of the file: #go-button { visibility: visible !important; }

Restart Firefox to put this change into effect.

▶ Disable the RSS Feed Button If you're not a fan of web feeds, you have no need for the RSS button at the end of the location bar. Disable it by opening up the Chrome.css file you created before in your Profile directory, and add the following line: #feed-button[feeds] { display: none !important; }

Restart Firefox to put this change into effect.

▶ Use Small Location Bar Icons The location bar itself isn't terribly tall, but every pixel counts when you're using a tiny-screen netbook or have stacked additional toolbars like the Booksmarks bar or a StumbleUpon bar. Shrink the location bar



by right-clicking any toolbar and clicking the Customize option. At the bottom of this screen, check Use Small Icons.

OPTIMIZE SPELL CHECK

Firefox's built-in spell checker is useful for using web content-management systems like Wordpress for blog entries or Google docs, but the default setting only spell checks mulitple-line fields. To enable single-line spell checking (e.g., for Google searches), change the about:config preference to layout.spellcheckDefault = 2.

Additionally, you can add different language dictionaries to the spell-check database by picking and installing the packages from Mozilla's language packs page (http://bit.ly/4FSfnM). Right-click any multi-line text field and you can choose to alternate between different languages for spell checking.

And in case you've ever unintentionally added a word to the Dictionary, you can remove the entry by opening the persdict.dat file stored in your user Profile directory. Using a text editor like Notepad, delete the line containing your unwanted word, and save the file.

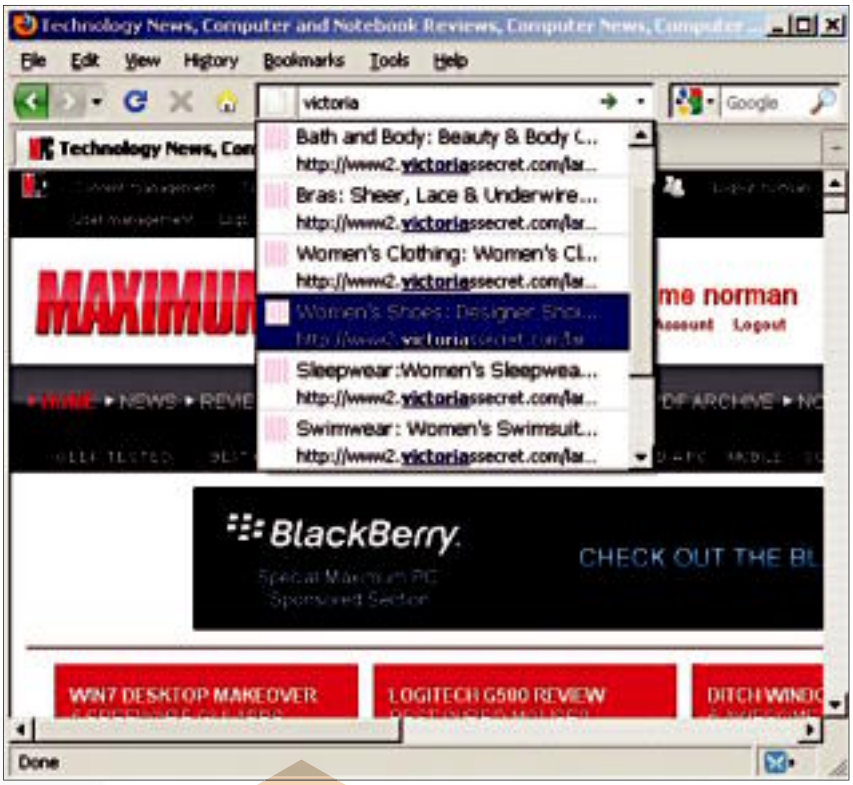
4 SCROLL WHEEL SECRETS

▶ Open a link in a new tab by hovering over it and clicking the middle mouse button.

▶ Close a tab by hovering over the top of the tab and clicking the middle mouse button.

▶ Hold Shift and scroll your mouse wheel to move forward or backward through your history.

▶ Enlarge or shrink the size of text on a page by holding Ctrl and scrolling up or down.

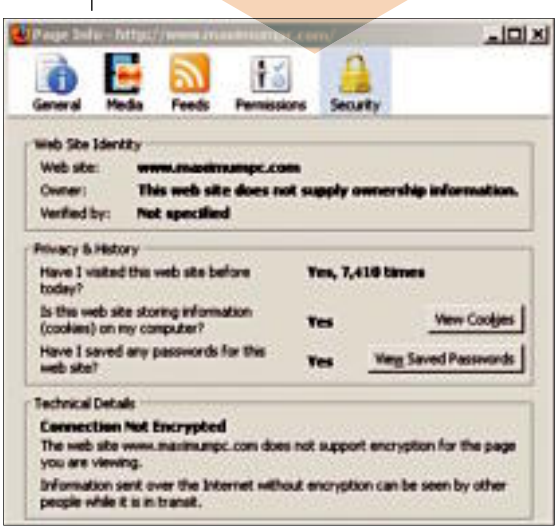


MANAGE AUTO-COMPLETE SUGGESTIONS

Forget to turn on private-browsing mode and leave an embarrassing site in your URL history? You can delete individual auto-complete suggestions by hovering your mouse over the suspect URL and pressing the Delete key (not back space) on your keyboard. The same trick also works for stored search history in your search bar, or any other auto-complete forms like user login.

MAKE USE OF THE FAVICON

The favicon—a website's shortcut icon—is pretty to look at, but for the most part, pretty useless. Firefox lets you click the favicon next to a site's URL in the location bar to display identity information, but most sites don't utilize this feature. However, you can use the favicon as a quick way to access and manage stored cookies for specific websites. Just hit the More Information button after clicking a favicon to open up that site's page information window. Here, you can view and delete individual cookies for just this site, and even access saved passwords stored for users. Be warned, this is a sneaky way for someone to steal your email password if they're using your computer.



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http://bit.ly/8Kj9mV

BitTorrent Tweaks

BitTorrent, as you're probably already aware, is a decentralized peer-to-peer file-sharing protocol ideal for transferring large files. The way it works is, when you're downloading a massive file, bits and pieces of the file will be uploaded at the same time from different peers to improve your overall download speed. Typically, BitTorrent allows for a more efficient and faster file transfer than traditional direct-connect P2P software. Using uTorrent, our favorite BitTorrent app, we'll show you some tricks to make the most of this popular file-sharing protocol. –PAUL LILY

OPEN UP ACCESS THROUGH YOUR ROUTER AND FIREWALL

If you can't seem to connect to any Torrent seeders or peers, or if downloads always trudge along at a snail's pace even when there are a ton of seeders, don't despair. You probably just need to configure port forwarding for your uTorrent client, or whatever BitTorrent client you're using.

In a nutshell, port forwarding is a way for your router to forward IP addresses from an external location—in this case, seeders and peers—to an internal address, which is your PC. To find out which port uTorrent is trying to use, open Options > Preferences > Connection. Make sure that both the "Enable UPnP port mapping" and "Enable NAT-PMP port mapping" checkboxes are marked. While you're here, you can also check "Add Windows firewall exception." Take note of the number next to the Random Port button.

Now that you know the port number uTorrent is trying to use for incoming and outgoing traffic, it's time to configure your router. Access your router's administrative controls by firing up your web browser and typing 192.168.1.1 into the address bar and hitting enter. You'll be prompted for your username and password, which will vary depending on your router make and model.

You should now be in your router's control panel. If you're using a Linksys router, click Applications & Gaming > Port Range Forward (once again, if you're using a different router, consult www.portforward.com to find the port forwarding procedure). Choose a blank row and type uTorrent in the Application field. Type the port number you recorded earlier in both the Start and End fields. Change the protocol to Both (TCP and UDP), and be sure to check the Enable box. Save and exit.

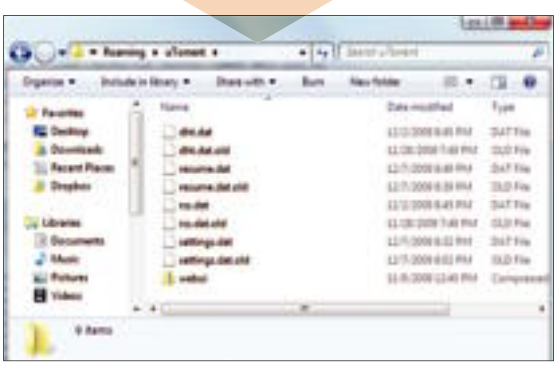
Slow or broken connections could also mean your firewall is blocking client access. To manually create an exception for uTorrent in Windows Vista and 7, go to the Start menu and type in Firewall to open up Windows Firewall. Click Action and select New Rule, which will bring up the New Rule Wizard. Select Program as the Rule Type and hit Next, then click the Browse button to find and enter the path to your uTorrent client (C:\Program Files\uTorrent\uTorrent.exe, by default). Keep the default settings as you click through the wizard.

MANAGE TORRENTS REMOTELY

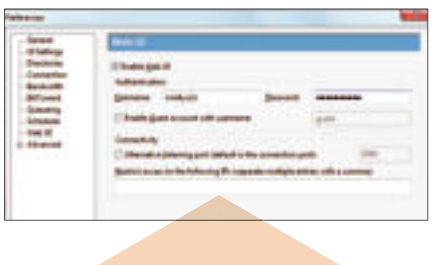
One way to access uTorrent from a remote location is to install a remote desktop client like LogMeIn (http://bit.ly/6oaqKH), which gives you access to your PC through a web interface. But if you want to control uTorrent while away from home and not at a personal or office desktop, there's a way you can do that, too. uTorrent offers a WebUI that gives you access to all of your BitTorrent downloads along with the ability to add or remove torrents. Here's how to set it up.

First, download the latest version of WebUI (http://bit.ly/79TKG9). Bear in mind that this is a beta release, meaning instability could rear its ugly head, although we never ran into any problems. Rename the downloaded file webui.zip.

We need to place the webui.zip file in the same location as uTorrent's settings.dat file. In Windows 7, this is in the C:\Users*username*\AppData\Roaming\uTorrent folder. In earlier versions of Windows, the default path is C:\Documents and Settings*username*\Application Data\uTorrent. If you can't find it,



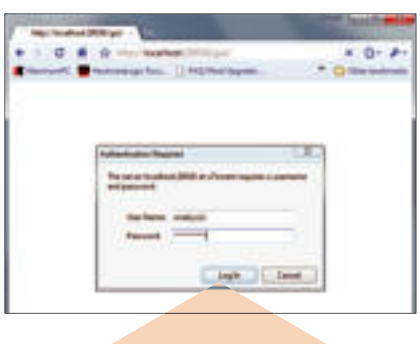
or if the directory doesn't exist, try searching for settings.dat.



If you're running a stand-alone or portable version of uTorrent, you'll find the settings.dat file in the uTorrent.exe folder.

The next step is to enable WebUI in the uTorrent client. Go to Options > Preferences and you should now see a WebUI entry. Click it and then check the Enable WebUI checkbox. Type in a username and password and check Enable Guest Account with Username. Hit Apply, but don't exit out of the menu just yet.

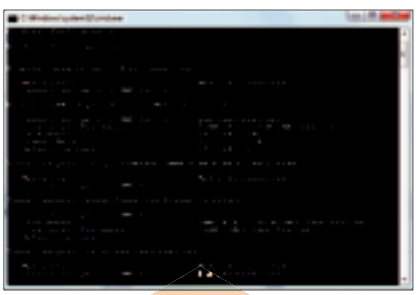
If you don't remember the port number you used to configure port forwarding earlier, go back into the Connection tab and make note of it once again. We're going to need this in the next step.



Let's verify that you followed the steps correctly. Open your browser and type http://localhost:port/gui/, substituting *port* with your chosen port number. If WebUI installed properly, you should be prompted for a username and password. Enter your username and password to get to the WebUI interface.

Of course, the whole point of this is to manage your BT downloads from a remote location and not from the same PC you installed uTorrent on.

You'll need to know your IP address, which you can retrieve from WhatIsMyIP.com. Use your IP address to login remotely, substituting it in place of localhost. For example, if your IP address is 12.34.56.789 and the port you recorded earlier was 12121, you would type in http://12.34.56.789:12121/gui/.



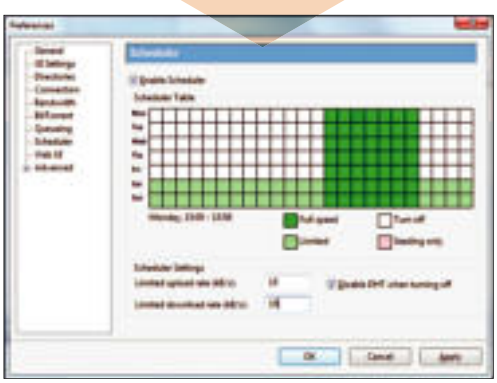
Note that this may not work if you try to access your client PC from another computer within your home network. Instead, you'll need the local IP address assigned by your router. For example, http:192.168.1.133:12121/gui/. You can find your PC's internal IP by opening up the Command Prompt (Start > Run > CMD) and typing `ipconfig`. Use the IPv4 address to get to uTorrent's WebUI.

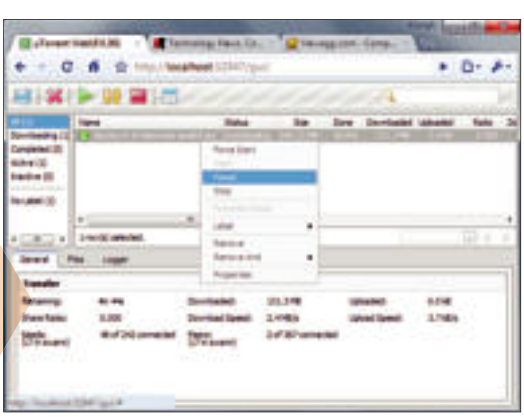
SET UP AN AUTOMATED THROTTLING SCHEDULE

We're not too keen on having our ISP choke our BitTorrent bandwidth, but that doesn't mean we're entirely opposed to throttling. We just want it to occur on our own terms, not someone else's. Fortunately for us, uTorrent's built-in Scheduler makes this super easy. With the Scheduler, we can configure uTorrent to automatically kick on at night when we're fast asleep. That way, we'll have all the bandwidth we need during the day and still wake up to a finished download in the morning.

To set up a schedule, go to Options > Preferences > Scheduler. Click the Enable Scheduler checkbox, which will light up the grid in green. There's a handy legend right below the grid that tells you what the colors mean: dark green boxes tell uTorrent to download and upload at full speed, light green boxes tell uTorrent to only use a set amount of bandwidth (which you can configure), the white box is used to indicate when you want uTorrent to remain idle, and the light gray box tells uTorrent to seed (upload) only.

Because we use our computer during the day, we want uTorrent to go comatose during those hours. We also like to unwind and frag our friends after a full day of work, and that can sometimes last until late at night. So to play it safe, we're giving uTorrent the green light (literally) to do its thing from 1 a.m. until 8 a.m., but not during any other hours.





As you highlight a square, it will tell you what one-hour time slot it is for. To save time, you can click and drag multiple squares rather than clicking each one individually. Once you're finished, you should have something that resembles the screenshot above.

Play Classic Pinball Machines

We've shown you how to use MAME software to play classic arcade games (http://bit.ly/8LsvbM), but there's also software for pinball enthusiasts to play classic pinball machines. We show you how to set up free pinball software to get your flipper fix. –ALEX CASTLE

VISUAL PINBALL

Visual Pinball (www.vpforums.org) is a physics simulation program that allows you to play original and recreation pinball tables. The tables' geography, artwork, and gameplay are rendered faithfully, and the physics engine delivers a top-notch pinball-playing experience. The latest release is version 9.0.3, although many tables still only work with version 8. It's worth the upgrade, though, for the enhanced physics in version 9.

Visual Pinball is also a powerful editor for creating your own tables. The Visual Pinball community has used this editor to recreate many classic pinball tables.

PINMAME

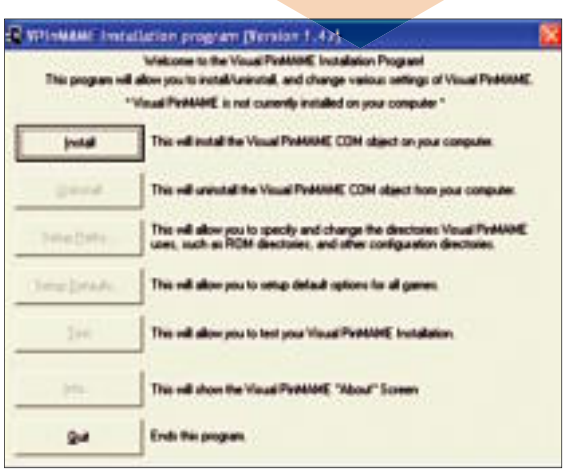
PinMAME, as the name suggests, is the pinball analog to traditional MAME. Where MAME simulates the electronics inside of old arcade machines, PinMAME simulates the boards inside of pinball machines. This means that PinMAME is needed, in conjunction with Visual Pinball, to simulate more sophisticated pinball machines. Visual Pinball simulates the physics and the table, and PinMAME simulates the electronics inside, which, most importantly, run the LED scoreboard.

Both programs need to be installed, along with several other resource packs. Fortunately, this process is made a lot easier if you use the all-in-one installer provided at VPForums.org (http://bit.ly/6neFPJ).

INSTALL THE SOFTWARE

Download the VP Installer linked to above, and run it. It'll first run the Visual Pinball installer; use the default settings, and at the end, make sure the Install VPinMAME box is checked before you press Finish.

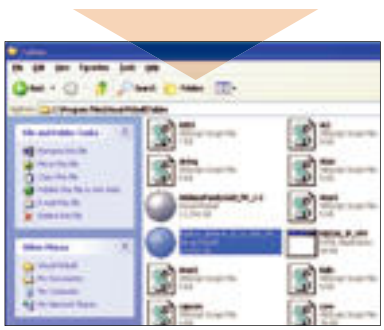
When the VPinMAME Installation program pops up, click the Install button. When the Installation program has no buttons grayed out, you're ready to install some tables and launch Visual Pinball.



DOWNLOAD TABLES

Although downloading pinball tables is subject to some of the same legal sketchiness as arcade machine ROMs, it's generally not as much of an issue since most of the companies involved have been defunct for a long time, or have given their explicit or implicit approval to the Visual Pinball community. As such, table recreations and ROMs are freely available for download at VPForums.org or at the sites of individual table makers, such as JPSalas (http://bit.ly/7p81ZN).

You need two things to play most tables: a table (.vpt) file, and a ROM. Generally, both can be downloaded from the same site. For instance, to find a table on VPForums.org, just open the 4:3 Table Downloads menu, then click VPM Recreations under Visual Pinball 9. Then, to find its accompanying ROM, just click ROMs in the same menu, also under Visual Pinball 9.



Both files come zipped, but (and this is *important*) you need to unzip the table file, and *only* the table file. Drop the unzipped table file in the tables folder in your Visual Pinball directory, and the zipped ROM in the roms folder in your pinMAME directory (itself a subfolder of the Visual Pinball directory).

Once you've got everything in the proper place, it's time to launch Visual Pinball. When you run the executable, an empty editor window opens. Choose File > Open and select one of the tables you downloaded. Then, either click Table > Play or click the Play button in the editor toolset.

Once the game launches, the default controls are as follows:

- 5 – Insert coin
- 1 – Start
- Enter – Pull back plunger
- Left or right shift – Left or right flipper
- Z or / – Left or right nudge

LEARN MORE AT
MAXIMUMPC.com
http://bit.ly/6YC4Mc

WHITE PAPER

LCD Technologies Compared

Discover what separates the IPS and VA LCD monitors from inferior TN models –MICHAEL BROWN

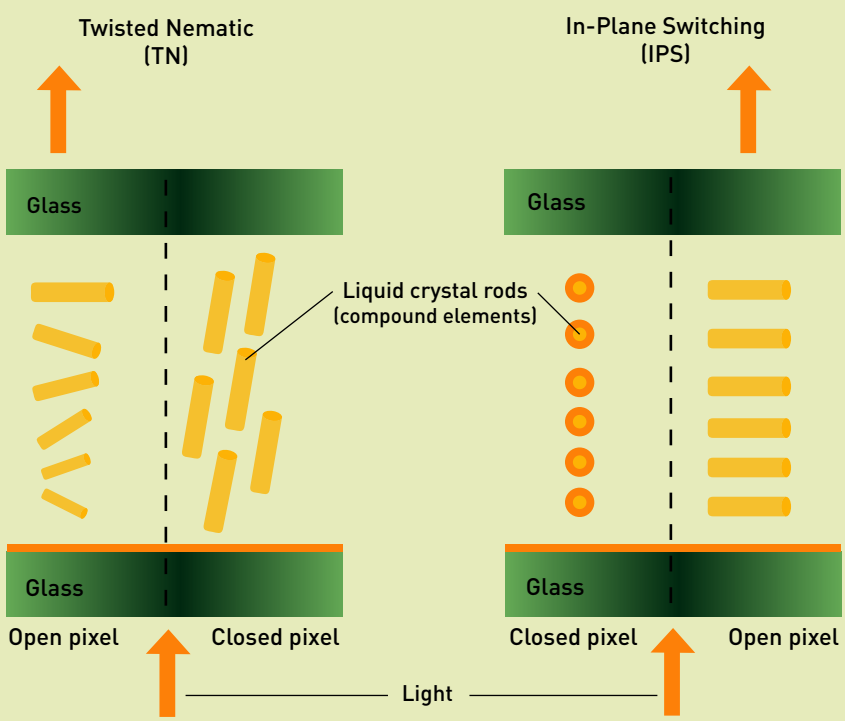
The performance of an LCD monitor ultimately depends on how its liquid crystals are manipulated to channel light. We'll examine the three most common technologies: Twisted Nematic (TN), In-plane Switching (IPS), and Vertical Alignment (VA).

Each of these three technologies creates a pixel using a cell of liquid-crystal molecules controlled by a thin-film transistor. Liquid crystals are used because they're capable of effecting light as though they're a solid, while exhibiting the malleability of a fluid. In a color LCD, each pixel is subdivided into three cells, or subpixels, which are colored red, green, and blue, respectively, by additional filters. These cells are arranged in a matrix of rows and columns sandwiched between two panes of glass, with a polarizing film on the exterior side of each pane.

A light source, such as a cold cathode fluorescent lamp or an LED grid, is placed behind the first glass panel. Light waves from the backlight follow the alignment of the liquid-crystal molecules, but they must pass through the two polarizing filters before reaching the surface of the display. Light waves must be oriented perfectly parallel to the first filter to pass, but since the second filter is oriented perpendicular to the first, no light will pass unless it's reoriented first.

HOW IT WORKS

Liquid Crystals Bend Light Waves



Voltage causes the liquid-crystal molecules in a twisted-nematic display to reorient vertically to block the passage of light. In an in-plane switching display, the molecules block the passage of light until voltage reorients them parallel to the panel.

TWISTED NEMATIC LCD

In a twisted-nematic (TN) display, an electrically conductive polymer is applied to the two glass substrates on the sides opposite the polarizing filters. Horizontal grooves are pressed into the polymer material on one panel and vertical grooves are pressed into the other. The rod-shaped liquid-crystal molecules are sandwiched in between, so that the molecules adhering to the panel with vertical grooves possess a north-south orientation while those closest to the panel with horizontal grooves are oriented east-west. The molecules in between are forced into a helix-like pattern.

As the light waves follow this helix, they twist 90 degrees to become parallel to the second polarizing filter, passing through it to create a white pixel. A TN panel has a very low power requirement because it produces a white pixel in its "off" state (meaning no voltage is required to reach that state). When voltage *is* applied, the liquid-crystal molecules realign vertically, so the light waves are no longer twisted. In this state, light cannot pass through the polarizing filters and a black pixel is created.

Twisted-nematic LCDs have become the most common consumer display because they're relatively inexpensive to manufacture and they feature very low response times (response time, measured in millisec-

onds, describes how quickly a display can reorient its liquid-crystal molecules and register that change on the screen. The faster a display's response time, the less likely it will suffer from motion-blur and ghosting artifacts.).

TN LCDs have a number of shortcomings, with their inability to display a full 24-bit color palette (256 shades each of red, green, and blue per pixel to produce 16.7 million colors in total) at the top of the list. TN displays use only six bits per color (64 shades each of red, green, and blue per pixel to produce 262,144 colors in total). TN displays rely on either dithering (combining adjacent pixels to produce a shade a single pixel can't produce) or frame rate control (rapidly cycling a pixel through a series of shades to trick the eye into perceiving a given color) to simulate shades they can't produce natively. TN displays also have narrow viewing angles because the vertically oriented molecules tend to scatter light waves.

IN-PLANE SWITCHING (IPS) LCD

An in-plane switching (IPS) LCD applies voltage to both ends of the liquid-crystal molecules, which moves the crystals in parallel to the display panel, rather than perpendicular to it, as a TN panel does. This requires two transistors for each pixel, which increases the panel's manufacturing cost. The panel's increased transistor count also blocks more of the transmission area, so a more powerful backlight is needed to compensate. The stronger backlight consumes more electrical power, which renders this technology a poor choice for most notebook computers running on battery power.

The parallel orientation of the liquid-crystal molecules in IPS displays scatters much less light, which endows these monitors with a much wider viewing angle than TN models. IPS monitors represent color using eight bits per component, which enables them to produce a true 24-bit color palette with 16.7 million shades without resorting to tricks such as dithering or frame rate control.

IPS displays typically suffer from slow response time, which renders them inappropriate for fast-paced applications such as gaming. But manufacturers have focused on this issue and there are several IPS models on the market with response times as low as six milliseconds. Variations on IPS technology include Super-IPS (S-IPS), Advanced Super-IPS (AS-IPS), and Horizontal IPS (H-IPS).

VERTICAL ALIGNMENT (VA) LCD

The liquid-crystal molecules in vertical-alignment LCDs are naturally aligned perpendicular to the substrate. In the absence of voltage, light waves from the backlight pass uninterrupted through the liquid-crystal molecules but are blocked by the second polarizing filter to produce a black pixel. When voltage passes between the two polymer layers, the liquid-crystal molecules reorient themselves so they're horizontal to the substrate. The light waves are now twisted parallel to the second polarizing filter, so a white pixel is produced. VA LCDs are cheaper to manufacture than IPS displays because, like TN models, they require only one transistor per pixel.

A variation on this technology, Multi-Domain Vertical Alignment (MVA), delivers more consistent brightness over a range of viewing angles. MVA LCDs divide each cell into four regions (domains) and use protrusions on the glass substrate to pre-tilt the liquid-crystal molecules in the desired direction. Less-expensive VA and MVA panels deliver six-bit color and use dithering or frame rate control to simulate larger color palettes; upscale models deliver true eight-bit color. Other variations on vertical-alignment technology include Patterned Vertical Alignment and Super Patterned Vertical Alignment.

LIQUID CRYSTALS ARE USED BECAUSE THEY'RE CAPABLE OF EFFECTING LIGHT AS THOUGH THEY'RE A SOLID, WHILE EXHIBITING THE MALLEABILITY OF A FLUID

REVIEWS

Tested. Reviewed. Verdictized.

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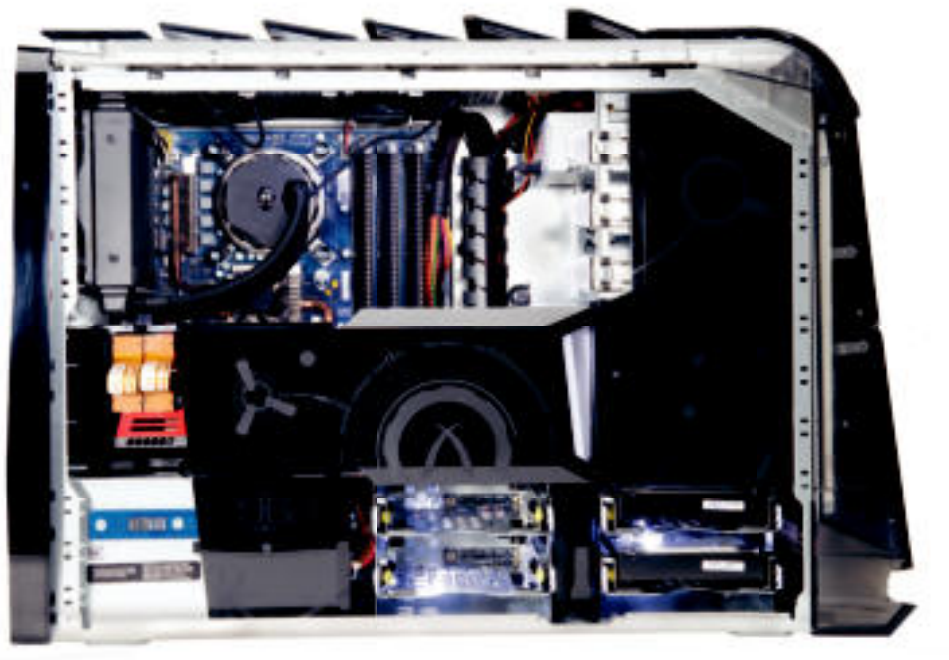
Alienware Aurora ALX

A Xenomorph might be involved



The Aurora ALX sports programmable perimeter lighting and top venting that opens as the case warms up.

One of the PC's weaknesses is the tendency to be generic. That's certainly not a weakness of Alienware's new Aurora ALX. Using a new redesigned chassis, there's no way your Aurora ALX will be confused with a bland black box.

And how could it, given its signature Xenomorph look? Previous Alienware cases have felt like rebadged commodity cases, but this new case is clearly unique. When we plugged the PC into the wall socket, the set of ventilation vents on top slowly flapped open and closed—as though the ominous black creature were alive and just took a breath.

Getting inside of the case added to the mystery. Like a caveman hammering away on a flying saucer with a rock, we just didn't know how to open the thing. We finally found that lifting the very last ventilation flap unlocks the side hatch. With the door off of the blowing, pulsing, and breathing Aurora ALX, was it alien technology we saw? Fortunately, it was more Earth-bound. Inside, we found a water-cooled Core i7-975 Extreme Edition on a custom Micro ATX X58 motherboard. Graphics were in the hands of the latest hotness, two CrossFired ATI Radeon HD 5870s. Along with 6GB of RAM and a Blu-ray combo drive, there wasn't much wanting in the rig. We do take issue with the storage configuration, which comprises two 1TB drives in RAID 0, with no local backup drive. Scary. However, we like the mounting system, which gives you easy access to drives.

Also quite cool is the Aurora's new lighting system. Multicolor LED lights are embedded in the case, and the lights on the included keyboard and mouse can be changed in Windows to pulsate or even alert you if you have email waiting. The same application also lets you control the vents on top. It's well done and far beyond what you can get from the typical boutique vendors, whose main customization is exotic paint.

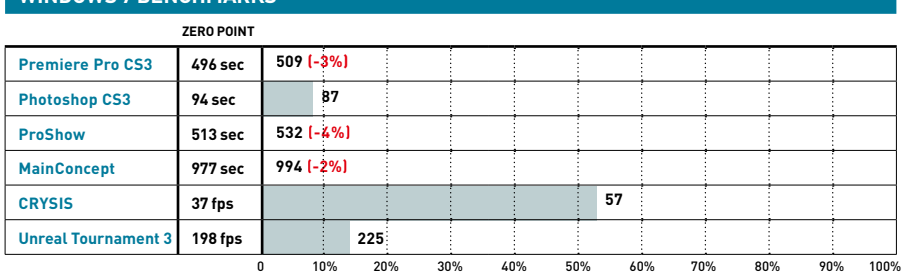
This would be nothing without performance behind it, and the Aurora's stock clock Core i7-975 performs as you'd expect it to. It's plenty speedy but by no means a record breaker, especially when compared to the spate of 4GHz 975 rigs we've tested. The vast majority of those systems, however, pushed the $7,000 to $9,000 mark. The Aurora ALX is practically a bargain at $4,200. Compared to its direct peers, though, the Aurora ALX poses an interesting dilemma. Falcon's $4,800 Talon system (reviewed in January) is faster, thanks to its overclocked 3.83GHz Core i7 and quad CrossFire configuration, but it's also an LGA1156 system. The Aurora ALX is LGA1366, so when Intel comes out with its hexa-core Core i9 next year, the ALX can take the upgrade—the Falcon cannot.

That puts the ALX in a good place for folks who want a unique machine—without any of the hassles that can crop up with overclocking. **—GORDON MAH UNG**

SPECIFICATIONS

Processor	Intel 3.33GHz Core i7-975 Extreme Edition
Mobo	Custom X58
RAM	6GB Corsair DDR3/1600
Videocard	Two ATI Radeon HD 5870 in CrossFire mode
Soundcard	Integrated Realtek
Storage	Two 1TB 7,200rpm in RAID 0
Optical	Blu-ray combo drive
Case/PSU	Cosmic Black ALX chassis/875 watt PSU

WINDOWS 7 BENCHMARKS



Our current desktop zero point 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 64-bit Windows 7.

VERDICT 8

ALIENWARE AURORA ALX

+ PROBIOTICS	− PROBED
Truly unique chassis with multicolor perimeter lighting.	Needs backup drive for storage; outperformed by overclocked machines.

$4,250, www.alienware.com

Chumby One

Doesn't everyone need an Internet-connected alarm clock?

The original Chumby—a beanbag with a touch screen, a speaker, and an always-on Internet connection using Wi-Fi—was an interesting hybrid of an always-on smartphone, a digital picture frame, and an old-fashioned alarm clock. The new Chumby One updates the original hardware with a few new features, strips away a few others, and comes in at a much cheaper price of $120 (the original was $200).

For lack of a better term, the Chumby is an information appliance. Using the web interface at Chumby.com, you can configure the device to show pretty much any info that's available on the Internet, from the local weather to your Facebook news feed to the latest from popular gossip sites. Heck, you can even set it to simply show the current time. On top of that, the Chumby One includes a programmable alarm clock, which makes it perfect for your nightstand.

There are a few additions to the Chumby One, including an FM tuner, a much-needed volume knob, 2GB of internal storage, a slightly faster ARM-based CPU, and an optional lithium-ion battery (to keep the Chumby running even when the power is out). What went away? The second USB port (the Chumby One features just one powered USB port, suitable for charging devices) and the stereo speakers (the One is mono-only). The integrated accelerometer, touch screen, stereo audio jack, and snooze button remain the same.

Despite the loss of stereo and a USB port, the hardware upgrades and price drop make the Chumby One a compelling upgrade for existing Chumby users. The faster CPU makes the Chumby One feel much more responsive than the previous version. The USB port on the back is perfect for charging a phone or eBook reader, or you can use a USB thumb drive to put your favorite tunes or photos on the machine's internal 2GB microSD card for use later.

Sure, you could stick your Chumby on your desk or in the kitchen, but given its ability to wake you to MP3s, Internet music streams, your favorite Pandora station, or your favorite FM radio station, the Chumby makes a kick-ass alarm clock. After all, who wouldn't want to arise to the dulcet tones of Gordon Mah Ung's Rant of the Week (only available on *Maximum PC*'s No BS Podcast)? **–Will Smith**

CHUMBY ONE

VERDICT 9

+ BUD BARCLAY	– CHET MORTON
Amazing alarm clock; supports thousands of widgets and apps; FM radio is handy; new battery and faster CPU.	We miss the second USB port and stereo speaker; available only in white; no beanbag.

$120, www.chumby.com

The new Chumby One is a fancified Internet appliance (read: alarm clock) that features a new hard-plastic design, a faster CPU, and an FM tuner.

The XFX Radeon HD 5970: two 5870 GPUs, two gigabytes of GDDR5, a card that's more than a foot long.

XFX Radeon HD 5970

DirectX 11 CrossFire on a stick

The recipe: Take two of the fastest GPUs on the planet capable of running DirectX 11, specially chosen for their low voltage leakage. Toss in two gigabytes of high-speed GDDR5 memory. Mix all ingredients into a card with high-end Japanese solid capacitors and a souped-up thermal dissipation system. The result: the XFX Radeon HD 5970—a GPU so yummy, you may even go back for seconds.

While the product name doesn't hint at the card's dual-GPU nature, there's no mistaking the presence of two graphics chips when you check out the back of the board. Then there's the sheer size of it: At more than 12 inches, you'll need a high-end PC case that's deep enough to handle this monster. You'll need a beefy power supply, too, since the HD 5970 burns 294W at full throttle—and that's if you don't overclock it. The good news is the card consumes just 42W at idle, less than double the idle power of a single HD 5870, thanks to an enhanced deep-sleep mode for the slave GPU.

AMD built in a number of enhancements over its previous dual-GPU effort, the 4870 X2. The card now sports a full-length vapor chamber mounted on the back of the board, which enables the card to support up to 400W of heat dissipation—enough headroom for some serious overclocking. A simplistic overvolting tool is available on AMD's website, allowing you to tweak the voltage setting a little higher in order to push clock speeds—albeit at the expense of additional power consumption.

The HD 5970 does make a few compromises in order to shoehorn 4 billion transistors worth of GPUs onto one card. Core and memory clocks are lower than on the single-GPU Radeon HD 5870, at 725MHz and 1,000MHz, respectively (versus the HD 5870's 850MHz and 1,200MHz). AMD has built in lots of overhead, so if you have good case cooling and a suitable PSU, you can push the clock speed much higher if you want. One other compromise is the use of a mini-DisplayPort connector. This kept all three display connectors on one expansion slot cover, so that a full-height exhaust could be added to the second slot cover.

OK, so the card is physically large and burns nearly 300W at full throttle. But does it perform? Yes, Virginia, this card does indeed deliver the goods. It's the fastest single graphics card we've ever tested. At $600, this card had better be fast. XFX's limited lifetime warranty, complete with the ability to transfer said warranty when you resell the card, eases that financial pain a bit.

What you get for your six C-bills is an incredibly speedy graphics card that delivers tremendous gaming performance and doesn't eat kilowatts when idle. So if what you want is the fastest graphics card you can buy, then the XFX Radeon HD 5970 is the card for you. Just make sure your case can handle it. —LOYD CASE

MAXIMUM PC KICK ASS!

XFX RADEON HD 5970

VERDICT 9

+ FULL HOUSE	− BUSTED FLUSH
Incredible gaming performance; very low idle power usage; XFX's excellent warranty.	So big you need a huge PC case to hold it; pricey; eats power at full bore.

$600, www.xfxforce.com

BENCHMARKS

	XFX Radeon HD 5970	GeForce GTX 295	XFX 5870	EVGA 285 GTX SSC	Radeon HD 4870 X2
3DMark Vantage Performance	**21,202**	19,342	17,089	13,941	14,458
3DMark Vantage Extreme	**12,537**	9,241	8,312	6,276	6,574
Hawx (fps)	**102**	93	68	62	78
Far Cry 2 / Action (fps)	**76**	62	62	47	67
Far Cry 2 / Ranch Long (fps)	**113**	73	74	56	77
Battle Forge / DX10 (fps)	**60**	33	47	46	36
Crysis / DX10 (fps)	**44**	29	32	22	33
Resident Evil 5 (fps)	**131**	115	100	87	126
X3: Terran Conflict (fps)	**106**	100	101	93	101
STALKER: Clear Skies (fps)	**52**	40	36	27	38

Our test bed consists of an X58 chipset motherboard, an Intel 3.3GHz Core i7 975 Extreme Edition, 6GB of DDR3, and Windows 7 Ultimate in 64-bit. All games were run at 1920x1200 with 4x AA.

Silverstone Raven 2

The chassis world turned topsy-turvy (again!)

The Raven RV02's motherboard placement simplifies everything, from cable routing to airflow.

Like its older and larger sibling, the Raven RV01 (reviewed April 2009 as part of our full-tower roundup), Silverstone's Raven RV02 is an all-black steel and plastic chassis with a defining feature: The motherboard orientation is rotated 90 degrees from the standard layout. But the Raven RV02 is even less orthodox than the RV01, which seems positively pedestrian by comparison. Unlike its full-tower predecessor, the RV02 is deeper than it is tall—25 inches deep by 20 inches tall by 8.3 inches wide, so it sits low to the ground. The front of the case is chunky stealth-inspired plastic, but is much more restrained on the RV02 than on the RV01, with a garage door–style front bezel. The side panels and frame are steel, and the case is black inside and out.

Building a system in the RV02 is a vertiginous experience. At first glance, nothing seems to be in the right place—the right-side panel has an optional plastic window, while the left-side panel is the one behind the motherboard tray. Furthermore, not only do the PCI expansion slots and I/O shield mount to the top of the case, but so does the power supply, which sits to the right of the motherboard at the back of the case, and is held in place by four screws, a Velcro strap, and a plastic bracket. The case's five 5.25-inch bays and 3-inch-bay hard drive cage sit at the front of the case. The hard drive cage isn't as user-friendly as we're used to seeing—to install a drive, you must first remove eight thumbscrews, take out the cage, and use four long screws to attach the drive to the rubber shock-absorbing mounts in the cage. Thankfully, four of the optical-drive slots use Silverstone's familiar toolless retention mechanism.

It still takes its design cues from a stealth bomber, but the RV01's little brother is considerably less chunky-looking.

The coolest drive-related feature in the Raven RV02, however, is the SSD mounting bracket. It's just a plastic bracket you can install your SSD on, but it mounts between the optical bays and the left side panel, within a few inches of a hole in the motherboard tray that's perfect for routing SATA cables.

The odd layout of the Raven RV02 has two clear advantages: First, cable routing is much easier. The power supply is right next to the top of the motherboard, so routing the motherboard power connectors is easy. The front-panel connectors enter the chassis right next to the bottom of the motherboard where they need to be plugged in, and the hard drive cage is right next to the motherboard's SATA ports. The case isn't particularly roomy, but with a little bit of effort, you can wire up a very nice-looking case.

The second advantage to the layout is in cooling. Three 18cm dual-speed fans draw in air at the base of the case, and hot air exits from the top of the case, aided by a 12cm fan. All air in the case flows from the bottom to the top. The hard drives are mounted vertically to aid airflow, the fans have easily removable dust filters, and the PCI expansion slot covers are vented. The fans are individually controlled by switches at the top of the case, and even on high speed (1,000rpm), they're quiet. Even with the side panel removed, we could barely tell they were running.

The second iteration of the Raven proves that the rotated motherboard design is more than a gimmick—it makes airflow and cable routing better, and takes weight off of motherboard's PCI-E slots. The RV02 isn't perfect; the hard drive cage in particular is unnecessarily unfriendly, and you'll have to remove the center fan to mount extra-long graphics cards. But it's a great mid-tower that doesn't take up a lot of vertical room, has great airflow, and shows plenty of attention to detail. —NATHAN EDWARDS

VERDICT 9

SILVERSTONE RAVEN RV02

+ RAVEN	− WRITING DESK
Great airflow; filtered fans; innovative motherboard placement; somewhat compact.	Hard drive cage seems lazy.

$200, www.silverstonetek.com

Asus SBC-04D1S-U

A DVD/BD combo drive for folks on the go

In December, we reviewed Plextor's PX-B320SA combination Blu-ray reader/DVD burner and found it a worthy product for the dual purpose of writing DVD discs and watching Blu-ray movies. But that internal drive does little good for folks who do all their computing on a laptop. For them, Asus's SBC-04D1S-U combo drive could be the answer.

The SBC-04D1S-U external drive is not only slim and stylish, but also very portable, measuring approximately 5.5x6x1 inches and weighing less than 1.5 pounds, and it takes up little room on a desktop when perched vertically in its included stand.

Unfortunately, despite its conveniences, the SBC-04D1S-U doesn't sport quite the same performance muscle as its internal counterparts. The SBC-04D1S-U, which connects to a PC using a dual-head USB 2.0 cable (included with the drive), is capable of writing to DVD+/-R at 8x—the internal combo drives we've tested, Plextor's included, are rated at 16x. Put into real-world terms, Asus's drive wrote 4.38GB of data to a DVD+R in 10:46 (min:sec) compared with the Plextor's time of 5:20. With double-layer media, the Asus drive is rated at 4x while the Plextor drive is rated at 8x—the Asus took 29:36 to write 7.96GB of data to a DL disc, while the Plextor took just 16:58.

In our DVD ripping test, the gap between the two combo drives only widened. Asus's external drive took 30:42 to copy a movie DVD to the hard drive; Plextor's internal drive took 10:47. Interestingly, the two drives found parity in the task of Blu-ray ripping. In fact, the Asus SBC-04D1S-U did slightly better, ripping the contents of a BD movie disc in 45 minutes, compared with the Plextor's 47 minutes. Admittedly, this is probably the test of least value since most people are apt to use a transcoding program to make archival copies of Blu-ray, which introduces other variables besides drive speed.

So we've established that Asus's SBC-04D1S-U won't get you the same level of performance you'd get with a good-quality internal combo drive such as Plextor's PX-B320SA. But if an internal drive is not an option, the Asus SBC-04D1S-U will perform its DVD and BD functions adequately while providing a space-saving, portable formfactor—certainly, its most valuable asset.

—KATHERINE STEVENSON

BENCHMARKS

	Asus SBC-04D1S-U	Plextor PX-B320SA
DVD+R Write Speed Average	6.03x	11.99x
DVD+R Read Speed Average	6.14x	**12.07x**
Access Times (random/full)	147/307ms	**111/210ms**
DVD+DL Write Speed Average	3.80x	**6.86x**
DVD Ripping (min:sec)	30:42	**10:47**
BD Ripping (min:sec)	**45:00**	47:00

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, whereby we time how long it takes to copy the contents of a dual-layer DVD/ BD to a VelociRaptor hard drive.

VERDICT 8

ASUS SBC-04D1S-U

+ CHAMPAGNE	− SHAM WOW
Small, stylish, portable formfactor; adequate performance.	Inferior performance to an internal drive; high price.

$150, www.asus.com

A starburst design on the SBC-04D1S-U lights up blue when the drive is in operation.

Verizon Droid by Motorola

iPhone-killer this is not, but it's a big step in the right direction

Motorola's Droid is full of firsts: It's the first smartphone on Verizon powered by Google's Android OS, it's also the first Motorola smartphone to use Android, and it's the first phone in the United States that ships with version 2.0 of the Android OS. Unfortunately for Motorola, all of the good news about the phone is centered on the OS, while any ill tidings regard the hardware.

There's a lot to like about the latest version of the Android OS. The ability to leave frequently used applications running in the background is a welcome change for long-time iPhone users. Whether it's a Twitter client, instant-messaging app, or simply your email, this is the Android OS's main competitive advantage over Apple's product. Of course, you shouldn't discount the value of a powerful API that allows app developers to tightly integrate their offerings with the phone. For example, Android's default Facebook app automatically adds information from your Facebook friends' profiles to your Contacts list—including phone number, current email address, and even their profile picture. This type of integration makes services like Google Voice even more useful than they are on their own—if you install Google Voice on an Android phone, you can choose whether to use VoIP or cellular minutes on every call, pick which phone number your caller sees, and even manage calling groups on the phone. In that regard, Android really is a revolution.

However, Motorola's implementation of the hardware has some problems. The core phone functionality is sound: Battery life is acceptable (1.5 days under normal usage), the voice quality is excellent, and we love the haptic touch buttons on the phone's front. Most of all, the 3.7-inch, 854x480-pixel capacitive screen is lovely—and welcome to anyone accustomed to the iPhone's relatively low-res 320x480 screen. The omission of multitouch functionality, however, is a big letdown. No multitouch makes the onscreen keyboard much more difficult to use than it should be. We also find that the default Home screen application doesn't make particularly good use of all those extra pixels—it includes room for just 12 app shortcuts (the iPhone fits 20).

Furthermore, the Droid's hardware keyboard should be a huge advantage over both the iPhone's onscreen keyboard and the tiny keyboards on the face of other smartphones. Unfortunately, the keys are too small and flat for most people to use without staring intently at the phone, and they're lined up in a square grid instead of the more traditional offset layout used for most QWERTY keyboards. We don't understand why Motorola devoted fully 15 percent of the space on the keyboard tray to an eight-way D-pad that you'll rarely use when that space could have been used to make the hardware keyboard good. While the Android OS's onscreen keyboard is decent, if Motorola is going to increase the size and weight of the phone to include a hardware keyboard, we want one that's usable.

Android still needs a few additions to qualify for best-in-class—a better way to manage and automatically close open applications is desperately needed, for instance—but as far as we're concerned, it's the most exciting mobile OS today. That said, we highly recommend waiting for better hardware before making the leap to Android. —WILL SMITH

VERDICT **7**

VERIZON DROID BY MOTOROLA

+ R2-D2	− C-3PO
Android 2.0 is impressive; the screen is glorious; app-to-OS integration is revolutionary.	Terrible, terrible keyboard; no multitouch; no tool to manage background applications.

$300 w/contract, $560 no-commitment, www.motorola.com

What's sleek, shiny, and has the worst keyboard we've ever had the misfortune to use? That would be the Droid by Motorola.

HP Mini 311

Ion graphics can't turn this netbook into a gaming rig

The Mini 311's Nvidia Ion graphics are wonderful, but the keyboard feels like quicksand.

To say that netbooks have historically been hobbled by Intel's integrated graphics is to unfairly ignore their slow single-core CPUs, 1GB RAM maximum, miniscule keyboards, and awkward screen resolutions. It's an unfair assertion, of course—netbooks came into existence to be cheap, portable, low-powered machines. But the definition of netbook has been stretched, to the point where HP's new Mini 311, while still considered a netbook, has an 11.6-inch 1366x768 screen, Nvidia integrated graphics, a large keyboard, and can support up to 3GB of DDR3 RAM, for less than $500.

At first, the Mini 311 looks a lot like any other 11.6-inch netbook on the market: Intel Atom processor, 1GB of RAM, 3 USB ports, and a somewhat squashed keyboard. But the RAM is DDR3/1333, not the typical DDR2/667, and it's soldered to the mainboard, leaving a SODIMM slot free for an additional 2GB of RAM. The screen has a maximum resolution of 1366x768, significantly better than the standard 1024x600—for one thing, websites and programs built for 1024x768 won't break. And thanks to the Ion platform, the Mini 311 can display 720p HD video, and output 1080p over the HDMI port—that's right, a netbook with an HDMI port.

Aside from the graphics (and all that that implies) the rest of the Mini 311 is standard netbook fare, and non-graphics-related benchmark scores bear that out. Photoshop and MainConcept scores were within 5 percent of our zero point, as was battery life, which, at just over four hours, is good for anything with discrete graphics, but middle-of-the-road for netbooks. The Mini 311 played our Quake 3 benchmark at 142fps, compared to our zero point's 58fps. Quake 4 performance on a standard netbook is akin to watching a violent PowerPoint; the Mini 311 pushed out a playable 34fps. It suffered more on current-gen games—Left 4 Dead caps at 10fps when zombies are on the screen, and both Modern Warfare games chug along at a nearly playable 15fps. The Mini 311 isn't a modern gaming notebook—the single-core Atom CPU is too slow for that—but thanks to its Ion graphics and decent resolution, it can kind of play more modern games than its predecessors.

The Mini 311's shell is slim and attractive, with a white or black patterned lid and a silver-and-black chassis. The screen is bright and not overly reflective; in fact, our only real complaint with this netbook is its keyboard. It's big, true, with nice concave chiclet keys, but unlike the keyboard on the Mini 1000 series, the keys feel mushy and slick, rather than firm and matte, so typing is not as pleasant as it should be on a keyboard this big.

Though the Mini 311 is still hampered by the long-in-the-tooth Atom N280 processor, the Ion graphics make up for it. HD video and actual gaming capability on a netbook, plus HDMI-out and up to 3GB of DDR3 RAM? Heck yes. The Mini 311 is only the first in a doubtless long line of Ion-enabled netbooks, but if this is the shape of things to come, we're excited.

—NATHAN EDWARDS

SPECIFICATIONS

Processer	1.66GHz Intel Atom N280
Chipset	nForce 730i
Graphics	Nvidia Ion LE
Display	11.6-inch LED-backlit LCD@1366x768
RAM	1GB DDR3/1333
Storage	160GB HDD (5,400rpm)
Ports	Three USB 2.0, audio in/out, SD/multi-card reader, VGA, HDMI, 10/100 Ethernet
Lap/Carry	3 lb, 5 oz / 4 lb, 1.4 oz

BENCHMARKS

	ZERO POINT	
Premiere Pro CS3	708 sec	738 (-4.1%)
Main Concept	251 min	241
3DMark3	710	4,196 (+491%)
Quake 3	60.9 fps	142 (+133.2%)
Quake 4	3.6 fps	34.1 (+847.2%)
Battery Life (mins)	255 mins	251 (-1.6%)

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, a 160GB hard drive, Intel GMA950 integrated graphics chipset, and Windows XP Home SP3.

VERDICT 9

HP MINI 311

+ 411

Current-gen graphics; great screen; HDMI out; 1366x768 res; good build; supports up to 3GB DDR3.

– RENO 911

Mushy keyboard; still stuck with single-core Atom processor.

$470, www.hp.com

Patriot Torqx 256GB MLC SSD

Indilinx's controller propels Patriot to new heights

At what capacity point are enthusiasts ready to make the crossover from magnetic storage to solid state? For some, that mark is a quarter-terabyte. If that sounds like you, Patriot's new 256GB Torqx, featuring the hot Indilinx controller, could be the SSD you're after. We pitted the 256GB Torqx against the 128GB Torqx and Intel's second-gen 160GB X25-M SSD to find out which would be the new SSD king.

On our new Core i5 test bed, the 256GB Patriot Torqx significantly outperformed both its smaller sibling and Intel's X25-M—at least in sustained reads and writes. (To restore performance on the latter two drives to like-new levels, we used Patriot's and Intel's SSD-optimizing utilities on their respective drives before testing.) For the first time, we found a drive with average sustained reads and writes above 200MB/s—on the same platform, the 128GB Torqx averaged 178MB/s reads and 168MB/s writes, while the X25-M achieved 185MB/s and 94MB/s, respectively. These aren't quite the numbers we saw when we originally tested the 128GB Torqx or the X25-M, a difference we chalked up to the new test bed. Regardless, the 256GB Torqx surpassed both other drives in average sustained reads and writes, though Intel's drive is still the champion in random-write access times, as well as in our Premiere Pro and PCMark Vantage tests, where the 256GB Torqx lagged far behind. Strangely, the smaller-capacity Torqx also outperformed the 256GB in the latter two tests.

Both Torqx drives benefit from Patriot's updated firmware, which adds TRIM support to the drives, as well as a garbage-collecting drive optimizer for Vista and XP users. Older Intel- and Samsung-controlled drives were not upgradeable to support TRIM as of this writing, so Indilinx-controlled drives like the Torqx should be on top of any Windows 7 user's list.

With its phenomenal sustained reads and writes, low random-access times, easy firmware upgrading, TRIM support, and usable capacity, the 256GB Torqx is a compelling candidate for your next primary drive, though its unexpectedly bad PCMark Vantage HDD score—nearly 6,000 points lower than the 128GB version—robs it of the Kick Ass award enjoyed by its smaller sibling. And, of course, it costs $700—reasonable, but only in the land of solid state drives. —NATHAN EDWARDS

BENCHMARKS

	Patriot Torqx	Patriot Torqx (MLC)	Intel X25-M G2 (MLC)
Capacity	256GB	128GB	160GB
Average Sustained Transfer Rate Read (MB/s)	**200.5**	178.0	185.0
Average Sustained Transfer Rate Write (MB/s)	**200.0**	168.2	94.3
Random Access Read (ms)	**0.10**	**0.10**	.11
Random Access Write (ms)	0.29	0.29	**.06**
Premiere Pro (sec)	486	395	**370**
PCMark Vantage HDD sub score	16,775	22,225	**23,105**

Best scores are bolded. All drives tested on our new hard drive test rig: 2.66GHz Core i5-750 on an Asus P7P55D-Premium motherboard. HDTach 3.0.1.0, h2benchw, and Premiere Pro CS3 were obtained in Windows XP; PCMark Vantage scores were obtained in Windows Vista Home Premium 64-bit.

VERDICT **9**

PATRIOT TORQX 256GB MLC SSD

+ TORA! TORA! TORA!	− TORA BORA
Stupid-fast sequential reads and writes; competitively priced. TRIM support, plus optimization utility.	SSDs are still expensive. Benchmarks trail other drives.

$700, www.patriotmemory.com


256GB
Torqx

QNAP TS-239 Pro Turbo NAS

It's full of Linux!

The QNAP TS-239 Pro reminds us of nothing so much as an easier-to-use version of our home-rolled FreeNAS server (January 2010). Unlike most NAS boxes we've reviewed, with their little ARM embedded processors and 512MB of RAM, the TS-239 Pro packs a full gigabyte of RAM and a 1.6GHz Intel Atom processor. Furthering the impression that it's a mini computer is the VGA-out port, which, when combined with a USB keyboard, lets you configure the QNAP's Linux OS directly. Essentially, the TS-239 Pro is a two-bay Linux home server, with all the features you'd expect from a home or SMB NAS box, from UPnP and iTunes streaming to FTP and web servers—and even some features you wouldn't necessarily expect, like support for networked cameras.

Like most NAS boxes, the web GUI is the key to configuring and using the TS-239 Pro, and QNAP's web interface is better than most. The first screen you see when you log in offers wizards for creating groups, users, and shares, and configuring FTP access and backups. A side menu tree offers status, disk and hardware management, and more. System logs and S.M.A.R.T. disk info are easy to find.

The TS-239 ships with several shares enabled by default—helpfully, these all start with Q: Qmultimedia for media, Qweb for websites the NAS is hosting, Qusb for USB devices plugged into its two ports, etc. Both the included iTunes and UPnP media servers scan Qmultimedia out of the box, but you can change this. User and group permissions are one of the QNAP NAS's strengths; it's easy to set per-user permissions for files and folders, unlike some similar NAS boxes.

Like Synology's NAS, the TS-239 Pro doesn't ship with any drives by default. We tested ours with two 1TB Samsung Spinpoint HD103UJ drives in RAID 1. File transfers were quick, as you'd expect from a 1.6GHz processor and 1GB of RAM—we copied a 2.79GB file from our PC to the NAS in just one minute, 20 seconds, and 650MB of smaller files in 18 seconds—both faster than the Synology DS409+, with its ARM processor. Unsurprisingly, the Athlon X2 240 CPU and 2GB of RAM in our homebrew FreeNAS server (http://bit.ly/69D5ND) spanked the QNAP's transfer speeds, with our 2.79GB file transferring to the FreeNAS server in 53 seconds—nearly half a minute faster than the QNAP. Of course, the QNAP also consumes far less power.

While the web GUI is laid out differently from Synology's, the features offered are largely the same—although the Synology DS409+ is a little more feature-rich, with iPhone apps, support for more networked cameras, etc.—and useful if you need 'em; pointless if you don't.

We dig the locking drive trays and sleek style of the TS-239 Pro, but it gets a bit loud during file transfers. The TS-239 Pro has a powerful processor, plenty of ports, a great web interface, and a lot of options, though having only two drive bays means you won't be using RAID 5. At $500 for a two-bay NAS with no drives, it's approaching Windows Home Server prices, but the TS-239 has enough power (and enough features) that it's worth buying. **—NATHAN EDWARDS**

The drive trays on the QNAP TS-239 Pro feature locks, so miscreants can't take advantage of the easy-access bays.

BENCHMARKS

	QNAP TS-239 Pro	Synology DS409+	Homebrew FreeNAS
Size as tested	1TB (2TB in RAID 1)	3TB (2.25TB in RAID 5)	2TB
PC to NAS, small (min:sec)	0:18	0:22	**0:16**
PC to NAS, large (min:sec)	1:20	1:31	**0:53**
NAS to PC, small (min:sec)	0:18	0:18	0:18
NAS to PC, large (min:sec)	1:06	**1:00**	1:09

Best scores are bolded. We used the contents of Maximum PC's November 2007 CD for the small-file testing, and a single 2.79GB file for the large-file testing. All scores are averages of three transfer trials.

VERDICT 8

QNAP TS-239 PRO TURBO NAS

+ Q (007)	− Q (TNG)
Powerful CPU, highly configurable; locking drive bays; command line directly accessible via VGA and USB ports.	Not particularly quiet. Expensive.

$500 (no drives), www.qnap.com

Openmoko WikiReader

You *can* take it with you

The WikiReader is built entirely on free, open-source software.

How often do you access Wikipedia? How often have you wished you could access that information goldmine but couldn't because you were away from your computer and Internet connection? If the answer to both questions is "All the freakin' time!" you'll want to check out the WikiReader.

This wickedly simple device puts 3 million Wikipedia articles at your fingertips wherever you happen to be. While some would argue you can already do that with any smartphone and a Wi-Fi connection, you won't get your answers anywhere as fast as the WikiReader can deliver them. That's because a massive chunk of the Wikipedia is stored on a removable 8GB MicroSD card inside the device itself.

The WikiReader powers up in less than three seconds and delivers results even faster. It runs on two AA batteries, which the manufacturer (Openmoko) claims will power the gadget for a full year (based on 15 minutes of use each day). The device automatically powers itself off after two minutes of inactivity. Openmoko puts disposable alkaline batteries in the box, but environmentally conscious folk can replace these with the rechargeable variety.

Three buttons are arranged along the bottom of the bezel, but the WikiReader would be nearly as useful with just one. Pressing the Search button calls up an onscreen keyboard on the device's 3.5-inch capacitive monochrome touch screen so you can finger-type your query. We found the onscreen keys to be just about the right size for our fingers, but we wouldn't want them to be any smaller. Users with larger fingers might prefer using the eraser end of a pencil as a stylus. As you begin typing, a list of possible results appears in a column beneath the input area. Tap the word you're searching for and the Wikipedia article appears almost instantly. The History button displays a list of your most recent searches, while the Random button does just what you'd expect.

The touch screen responds to finger taps for entering text, selecting entries, and following hyperlinks to other Wikipedia entries, but it also responds to finger-stroke actions anywhere on the screen. To scroll through longer entries, just drag your finger tip up or down. The display is easy to read, but only if you have adequate light. We'd happily give up half the battery life in exchange for a backlight that rendered the WikiReader usable in more indoor environments, where the screen is also highly susceptible to glare. The device is perfectly legible in direct sunlight, on the other hand.

The WikiReader doesn't retain its current state when it turns itself off, but you can quickly return to your last search simply by pressing the History button and tapping the entry at the top of the list. Unlike the real Wikipedia, the WikiReader includes a parental-control option designed to shield youngsters from adult-oriented content. With the filter engaged, you must enter a password before the reader will display entries on certain topics, such as pornography. But this parental control is even more laughably ineffective than most: The filter prompted us for a password when we searched for the word "porn," for instance, but instantly displayed both the sexual and political definitions of the term "teabagger."

The WikiReader doesn't have a Wi-Fi radio or even a USB port, but you can keep its version of Wikipedia up to date by downloading new versions from Openmoko and writing them to a MicroSD card, or you can pay $29 per year to receive pre-updated MicroSD cards (online updates are available on a quarterly basis; cards are shipped twice each year). **—MICHAEL BROWN**

VERDICT **8**

OPENMOKO WIKIREADER

FREEWARE	SHOVELWARE
Take Wikipedia with you anywhere; fast; easy-to-use touch screen; long battery life.	No illustrations; no backlight; highly reflective glass screen.

$100, www.thewikireader.com

GlideTV Navigator

This remote looks weird, but fits comfortably in your paw

The Navigator's odd shape is one of its best attributes.

We hereby crown the new king of home-theater-PC remote controls. There have been many pretenders to the throne, including sticks and donuts (Gyration's over-complicated Media Center Remote and Hillcrest Lab's over-simplified Loop Pointer, respectively), miniature keyboards (Logitech's stylish but imperfect diNovo Mini), and full-size keyboards and mice (Microsoft's clumsy Wireless Entertainment Desktop), but from this day forward, GlideTV's Navigator will hold court in our media room.

The Navigator is an odd-looking device, but the genius in its design becomes apparent the moment you pick it up. The bowl-shaped bottom fits perfectly in your cupped hand, and your thumb naturally curves over the top, putting it in the ideal position to stroke the trackpad or press any of the backlit buttons. You can use both hands if you prefer, and an ambidextrous design makes it suitable for both right- and left-handed people.

The Navigator avoids the mistake of trying to handle a PC's every function in hardware, providing instead an easy means of accomplishing only the most common functions. You'll find dedicated buttons for managing Windows Media Center (volume, channel up/down, live TV, recorded TV, and electronic program guide), and for controlling media-player software (play/pause, fast-forward/rewind, skip-forward, and skip-back), of course. But the designers also provided equivalents for the right mouse button and the Enter, Escape, Back, and arrow keys that are too-often forgotten with other devices. There's also a search button and a button that calls up the GlideTV application itself (more on this later).

There are a limited number of button combinations available, too. Pressing the Function and logo buttons simultaneously, for instance, switches between the top-level applications running on your computer. Instead of cramming a too-small-to-be-useful keyboard into the remote, the Navigator relies on an onscreen keyboard for the few times you need to produce alpha-numeric inputs (for account logins or searches, for instance). Having said that, you'll still want to stash a cheap wireless keyboard nearby (under the couch, maybe?) for those time times you need to type more than just a few characters.

The Navigator's designers were smart not to force the device to handle every PC application, but they were equally wise not to rely on Windows or even Windows Media Center to deliver the best 10-foot user interface for every home-theater application. In fact, you can use the Navigator to control Boxee, the Hulu desktop, the SageTV set-top box, or even a Mac or PS3 (if you're using that gaming console as a Blu-ray disc player). For the record, we evaluated the device only on the PC.

Moving back to the PC, the GlideTV application provides one-click access to a variety of applications and websites in a series of customizable 4x4 matrices (you can choose which apps and sites appear here and in which order). You can also search the entire Internet using your search engine of choice, or you can limit searches to a particular site (if you want to find a specific TV episode on Hulu, for instance).

Going back to our experience with other HTPC controllers, only Logitech's diNovo Mini comes close to beating the Navigator—and that's only because of its keyboard. GlideTV's onscreen keyboard is about as good as that kind of software gets, but there's no way to get around the pain of drag-and-peck typing. In terms of web navigation and media-player transport control, the Navigator beats anything else we've tried. So, why are we withholding a Kick Ass award? GlideTV is selling the device with beta software. While the company deserves kudos for being up front about this, we don't think even early adopters should pay to be beta testers. —MICHAEL BROWN

VERDICT 9

GLIDETV NAVIGATOR

+ JESTER	− SYCOPHANT
Controls all the important HTPC functions; easy to use one-handed (right or left); simple.	No onscreen keyboard will ever be great; software is still in beta; pricey.

$150, www.glidetv.com

Call of Duty: Modern Warfare 2

All the elements of Modern Warfare, with 30 percent less fun

Modern Warfare 2 is full of gritty, "real-world" torture scenes that lack the appropriate message and only serve to highlight the vapidity of the single-player campaign.

There are a few signature characteristics of Call of Duty games—at least, the ones developed by series-creator Infinity Ward. First, the games feel real. The story unfolds as you play through a conflict as a few normal soldiers—regular guys on the ground who find themselves thrust into extraordinary events. They aren't supermen. The campaigns are plausible, even if they're fictionalized or set in the near future, reinforcing the feeling that the experience could take place in the real world. The third characteristic is that there's usually a deep, engaging multiplayer experience thrown in the game for free. Unfortunately, in this outing, Infinity Ward whiffed on all three counts, much to our dismay.

Let's start with the seven-hour single-player campaign. Instead of playing as normal grunts in this year's entry, you end up playing as junior varsity supermen—an American soldier who's always in the wrong place at the wrong time and the protégé of one of the characters you played in the first Modern Warfare. While none of the characters you play are named Jor-El, they're a long way from the untrained Russian conscript who was handed a single clip and chained to the guy with the rifle at Stalingrad in the first Call of Duty. This creates a sense of unreality that's reinforced by the game's ludicrous plot twists and completely unbelievable characters. (Warning, spoilers appear in the next paragraph!)

Let's run down the awful-cliché list: We have a power-mad terrorist intent on destabilizing the world, a warmongering American general at the center of a vast conspiracy, an old friend who returns from the dead, even more rogue nukes, good guys who must choose between following orders and saving the world, and the Russians invading the United States to cap the whole thing off. The result is a single-player game that feels like a bad mash-up of the action scenes from *24*, *The Rock*, *Black Hawk Down*, and pretty much every war movie that's come out in the last 10 years. Worse, the famed set-piece encounters that are another Call of Duty hallmark are almost all cribbed from the first Modern Warfare—with an added twist to "keep things fresh." While in the first game a squadmate grabbed your arm and pulled you into a chopper at the last possible second, here he misses the grab. In Modern Warfare, your Marine got nuked and you lived through his dying moments; this time, the nuke ends up being relatively harmless. There are a few high points—we especially liked visiting the International Space Station—but overall, single-player misses the mark.

The two-player co-op missions are significantly better than single-player, perhaps because they're discrete missions that don't have a ridiculous narrative connecting them.

And we haven't even gotten to the infamous airport scene yet, which feels like nothing more than a desperate attempt to generate controversy (and free publicity) in a game that needs neither. There's absolutely nothing profound or artistic about a scene that's essentially a non-interactive rail shooter.

The game's multiplayer is quite good, and uses the same RPG-lite perk and weapon-unlocking system as Modern Warfare. There are hundreds of hours of amazing multiplayer action in the $60 box. Unfortunately, the multiplayer component is marred by a lack of dedicated servers—while we love the match-making lobbies, we're never sure whether our awesome round is a result of our mad skills or a host ping advantage.

At $60, Modern Warfare 2 is more expensive than most PC titles, and if you're not interested in the multiplayer experience, the single-player and co-op missions just aren't worth the cash. The multiplayer is good enough to rate an 8 verdict on it's own, although with the option of customized dedicated servers it could have scored much higher. **—WILL SMITH**

VERDICT 8

CALL OF DUTY: MODERN WARFARE 2

+ THE HURT LOCKER	− TRANSFORMERS 2
Very compelling multi-player; weapons feel great; co-op is a great addition.	No dedicated servers; skip the single-player; recycled set pieces; the airport level.

$60, www.callofduty.com, ESRB: M

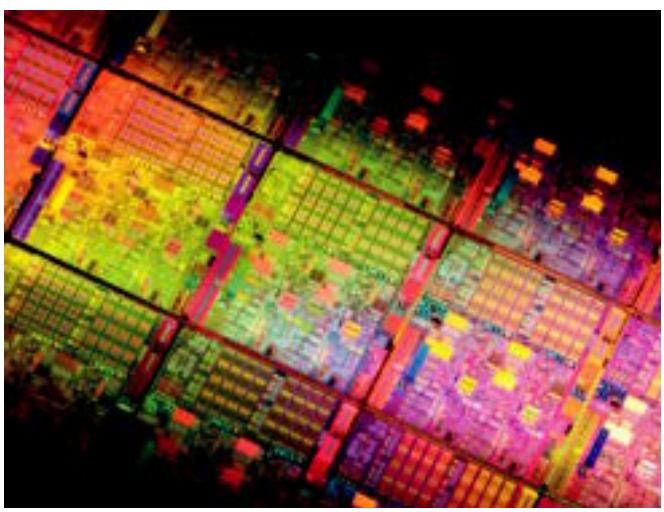
LAB NOTES

Core i9 Preview

What today's Clarkdale Core i3 tells us about tomorrow's Core i9 hexa-core

GORDON MAH UNG
SENIOR EDITOR

If you just finished reading my story on Intel's Clarkdale Core i3 and Core i5 dual-core processors, you got a mini preview of what's to come with Intel's hexa-core Core i9. Core i9 will use the same 32nm Westmere core found in the dual-core Core i3 and Core i5, but it will have three of them on the die, for a total of six cores. Intel will also add a new tri-channel memory controller to the die that's not included in the Core i3 and Core i5 versions. Hyper-Threading will be activated on Core i9, as will the new encryption/decryption instruction set. It will, of course, only fit in LGA1366 motherboards. Performance, if all goes well, is expected to be stellar and should lead the pack in multithreaded tests. I'm also going to bet that Intel will tweak its Turbo Boost algorithms so that code that will not exploit the 12 available threads will still run speedily.

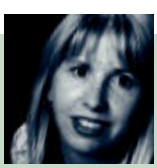


WILL SMITH
EDITOR-IN-CHIEF

After spending lots of time with the Droid this month, I've decided that the device's Android OS is more than worthy of replacing my precious iPhone, but the hardware is simply not up to task. I've grown used to the slim profile of the iPhone, which I doubt can be matched on a device that has a hardware keyboard. The perfect Android phone is out there, I just need to find it.

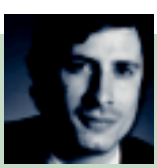
NORMAN CHAN
ONLINE EDITOR

Digital media streamers like the WD TV Live are hot—we've received three new ones to test just this month. Beyond differing hardware specs (Sigma vs. Realtek processors) and file-format support, the UI is arguably the biggest differentiating factor between the devices. I'm still waiting for a UI that perfectly balances intuitive navigation, robust file browsing, and user customizability.



KATHERINE STEVENSON
DEPUTY EDITOR

This month, a Toshiba Satellite T115 arrived on my desk. It's 11.6 inches and costs $450. Sounds like a netbook, right? But rather than featuring Intel's Atom processor, it features a 1.3GHz ULV Celeron—not to mention 2GB of RAM, a 1366x768 screen, and Windows 7. I'll report on the performance of this new compact, eminently affordable *notebook* next month.



NATHAN EDWARDS
ASSOCIATE EDITOR

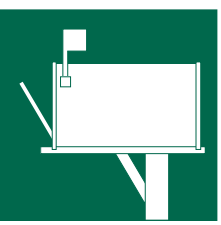
I finally got my hands on HP's Ion-equipped Mini 311 netbook, and it turns out that integrated Intel graphics chipsets weren't the only thing holding netbooks back. Even with Ion graphics and 3GB of DDR3, the Mini 311 couldn't manage to hit 20fps in any current game. Speedier dual-core Atoms are long overdue. Why should I have to sacrifice performance in my cheap PCs?

ALEX CASTLE
ASSOCIATE ONLINE EDITOR

Over the last couple of weeks, I've become absolutely absorbed in Call of Duty: Modern Warfare 2's multiplayer mode. On one hand, I miss dedicated servers and high player-counts, but on the other hand, I can't resist the edge-of-your-seat gameplay and endless supply of unlockable weapons and upgrades.

We tackle tough reader questions on...

AMD Gets Dissed?
Legacy Techs
Videocard Abuse



The Plural of Anecdote

A thought about your selection of the Patriot Torqx 128GB SSD as best performance hard drive (Best of the Best): After purchasing two for my workstation, I can attest to their remarkable performance. For five days, anyway—that's when one gave up the ghost. I went online to look into exchanging the bad unit when I stumbled upon many similar stories of early failure. I was surprised by the number of DOA and early deaths in drives of this type.

I don't think any product that has such a high failure rate deserves to be in the Best of the Best list. These SSDs are just not ready for prime time yet. I know that very soon they should completely supplant the spinning drive, but not if users can't trust the product. For now, I'm back to using my VelociRaptors for my OS.

—Curtis Sponsler

Associate Editor Nathan Edwards Responds: Sorry to hear about your drive, Curtis. Patriot says it hasn't had many issues with the Torqx series, though there are factors outside its control—bad batches, shipping damage, etc.—and that the rate of return is "really minimal" relative to the number of drives sold. We haven't had any Patriot drives fail on us, nor, in fact, any SSDs at all—something we can't say about VelociRaptors.

SSDs are still a pretty young technology, so we don't blame you for being cautious about them. You should RMA your drive—Patriot has a good warranty, and hopefully your replacement will be better. We're keeping the Torqx on our Best of the Best list for now—it doesn't look like the failure rate is any higher than the rest of the SSD market, though if that changes we'll certainly reconsider.

Where's the Love for AMD?

I run an Intel processor and I feel that Intel's chips have been superior to their AMD counterparts for some time. But correct me if I am wrong—it appears you favor Intel even more than I do. In your last issue (December 2009), there is an article on page 55 talking about the new AMD Athlon II X4 620, and I quote, "And at half the price of the Core i5, this one is an easy win for AMD." If that is the case, then why in the Best of the Best section, does the Core i5-750 still hold the title Best Budget Processor?

—Chris Mauck

Senior Editor Gordon Mah Ung Responds: While we applauded the $99 Athlon II X4 620, this comes down to how you define budget CPU. No one

NOW ONLINE

Top Vaporware Letdowns of 2009

It's hard to believe it's been almost a year since CES 2009, an event where we saw many innovative product and technology concepts that promised to revolutionize their respective markets. Well, with the year coming to a close, many of these products have yet to reach consumers' hands, and some have been cancelled outright. We review the 10 most notable technologies that, while heavily hyped, turned out to be vaporware in 2009. http://bit.ly/5iNHlI

disagrees that the Athlon II X4 is cheaper. However, nor does anyone disagree that the Core i5 is faster. While the Athlon II X4 is a better ultra-budget part, we think the Core i5's superior speed makes it worth a few extra bucks.

Legacy Technologies to Kill

After reading your "9 Legacy Technologies We Want To Kill" (Quick Start, December 09), I had some questions.

Why *are* we still using the BIOS? Didn't Intel come up with EFI as a replacement for BIOS? Why is there still a floppy port on motherboards? In a perfect world, shouldn't the integrated ports (SATA, LAN, FireWire, etc.) already have generic drivers embedded, ready for use out of the box? Finally, when you tell BIOS to configure a SATA port as IDE, will you still have the bandwidth the SATA port?

—R. Epps

Senior Editor Gordon Mah Ung Responds: EFI and UEFI have been around for some time, but few board vendors have adopted them. The reason? What's the point? UEFI seems to offer little over the traditional BIOS and most vendors don't see much return on investment yet from adopting the new pre-boot environment. Floppy ports? You got me. I suspect it's for industrial use where DOS is still employed, since most motherboards made in the last year or two have dropped Windows 9X support. The floppy port also gets some exercise from folks who need to install third-party F6 drivers for RAID or AHCI.

Configuring your SATA to IDE instead of AHCI will not impact the bandwidth. Intel's Adaptive Host Control Interface adds advanced functionality such as NCQ and hot swapping but does not increase bandwidth.

Why Doesn't Anyone Think of the Hardware?!

When I opened to the TOC of the January issue, I was shocked and a little disgusted to see a woman SMASHING videocards. I'm a lover of electronics and it hurt more than a little. The first thing that came to my mind was that I have a buddy who could have really used one of those cards.

I WAS SHOCKED AND A LITTLE DISGUSTED TO SEE A WOMAN SMASHING VIDEOCARDS

I know it's just a magazine and it's just a picture, but I couldn't help but think, I really wish I could have given one of them to him rather than seeing their demise under a 20-pound sledgehammer.

—Alex Shor

Editor-in-Chief Will Smith Responds: While I'm not typically a fan of destroying old hardware, we didn't destroy anything for that photo shoot that was newer than four years old and still working. Most of the boards had already let loose the mortal coil—either through overclocking experiments or the testing of third-party coolers. A few were even non-working mock-ups of final boards sent in strictly for photography. While there may have been a working GeForce 5000–series or Radeon 9800–era board, we wouldn't have destroyed good hardware needlessly. And you have to admit, it did make a pretty cool photograph!

Don't Bash the Boycott

In the January 2010 Quick Start you reported that the Modern Warfare 2 boycott failed. Stating that it sold 4.7 million copies across ALL platforms as evidence of the "failure" is misleading. Console gamers were mostly indifferent, not surprisingly, as their version didn't remove a bunch of features that were present in the previous version. PC gamers never expected the boycott to convince console gamers to avoid the game as the console experience wouldn't be significantly different from any other console game. The point is that the boycott did hurt overall PC sales. X-fire reports 86,000 PC players per day for the 2-year-old first Modern Warfare (COD4) and just 56,000 per day for the monster mega-blockbuster game of 2009 Modern Warfare 2. That's like finding out that more people were deciding to rent *Aliens* than were going to see *Avatar*.

—Adam Bernhardt

Associate Editor Nathan Edwards responds: It's true that X-fire's charts show more players for Modern Warfare than for Modern Warfare 2, but that doesn't necessarily mean the PC version was a failure, either. COD4 is now cheaper and has lower system requirements—not to mention that it's had a couple years' head start in sales. And according to Infinity Ward community manager Robert Bowling, the PC version of Modern Warfare 2 did better than its predecessor in terms of first-week sales. So while PC sales may account for a minimal percentage of total sales, Modern Warfare 2's PC version is far from a failure, boycott or no boycott.

LETTERS POLICY Please send your questions and comments to comments@maximumpc.com. Include your full name, city of residence, and phone number with your correspondence. Letters may be edited for space and clarity. Due to the amount of mail we receive, we are unable to respond personally to all queries.

NEXT MONTH

COMING IN

MAXIMUM PC's IN LIKE A HIPPO, OUT LIKE A HERRING

MAR ISSUE

50 Kick-Ass Websites

By now, you probably think you're pretty web-savvy. Well, next month, we're going to expose you to a slew of killer websites you've likely never heard of, but won't soon forget.

Know Your Digital Rights

Byte Rights columnist Quinn Norton queries legal experts about your rights online and regarding digital content.

Gaming Awards

Find out which PC games made the grade in our annual awards fete.

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HIGH-END VIDEOCARD

ATI Radeon HD 5970

What do you get if you put two of the fastest GPUs in the world on a single board, along with a whopping 2GB of GDDR5 memory? Only the *fastest videocard ever!* With Nvidia's fall refresh MIA, the HD 5970 is the only game in town. While the board sports two of the same GPUs as found on the 5870, they're clocked slightly slower, by default. Intrepid overclockers with a thirst for power can overclock their 5970s—but only if their PSU is beefy enough to handle the load. www.ati.com

THE REST OF THE BEST

High-End Processor
Intel 3.33GHz Core i7-975
www.intel.com

Midrange Processor
Intel 2.8GHz Core i7-860
www.intel.com

Budget Processor
Intel 2.66GHz Core i5-750
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LGA1366 Motherboard
MSI Eclipse SLI
www.msi.com

LGA1156 Motherboard
Gigabyte GA-P55-UD6
www.gigabyte.us

Socket AM2 Motherboard
MSI K9A2 Platinum
www.msi.com.tw

$250 Videocard
ATI Radeon 5850
www.ati.com

$150 Videocard
ATI Radeon 4870
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Capacity Hard Drive
Western Digital Caviar Black 2TB
www.wdc.com

Performance Storage
Patriot Torqx 128GB SSD
www.patriotmem.com

DVD Burner
Samsung SH-S223
www.samsung.com

Blu-ray Drive
Pioneer BDR-2203
www.pioneerelectronics.com

Full-Tower Case
Cooler Master ATCS 840
www.coolermaster.com

Mid-Tower Case
Silverstone Fortress
www.silverstonetek.com

Gaming Mouse
Logitech G9x Laser Mouse
www.logitech.com

Gaming Keyboard
Logitech G19 Keyboard
www.logitech.com

Games we are playing

The Saboteur
www.ea.com/games/the-saboteur

Dragon Age
http://dragonage.bioware.com

Team Fortress 2
www.teamfortress.com

Call of Duty: Modern Warfare 2
www.modernwarfare2.com

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

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