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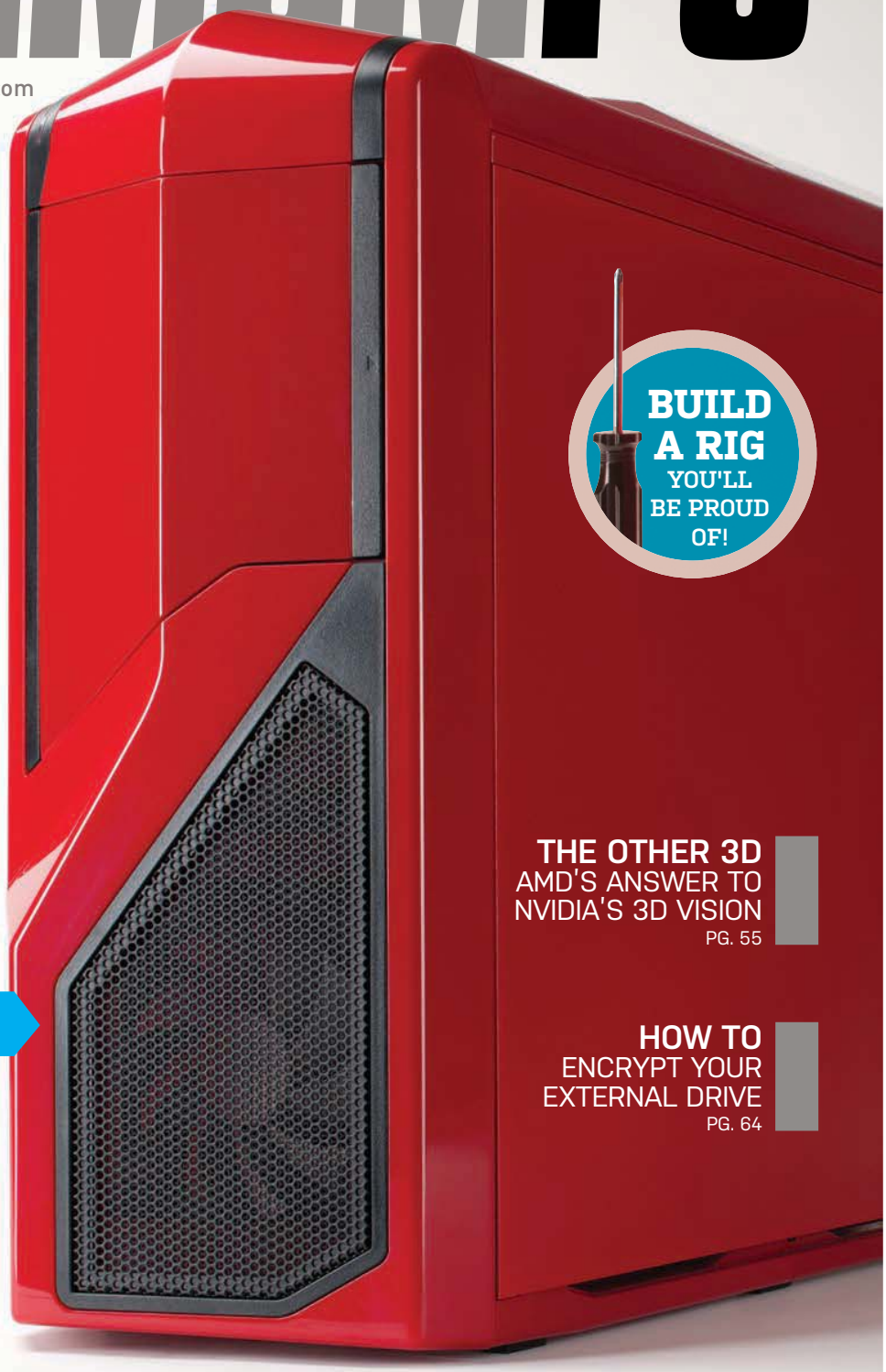

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Gordon Mah Ung

MICROSOFT WINDOWS STILL RELEVANT

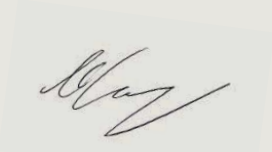
ON THE EVE of Windows 8 Consumer Preview, it was no surprise that pundits across the spectrum yawned in unison: The majority of experts have already bought into the PR storyline that Microsoft and Windows are "doomed," "irrelevant," and part of the legacy PC infrastructure that we're watching shrink in the rear view mirror.

That, dear nerds, is a crock of bantha dung (which, by the way, is blue like the blue milk they produce). It's not that I'm a partisan of Microsoft Windows, but it is the lingua franca of our world. For the record, I just literally blew away an install of Windows 8 Consumer Preview on a netbook and instead installed the latest release of Ubuntu because the Metro Interface would not support the netbook's resolution. For now I'm running W8CP on a virtual machine, which sadly has far more power than the netbook I first ran it on. My early gut check? I'm no fan of it in its current state, but it's a beta, folks.

Still, I'm here to tell you that any pundit, expert, or self-proclaimed "technorati" or "digerati" who proclaims that Windows is irrelevant is a flaming idiot. As ZDNet's Ed Bott pointed out, Windows Vista has more market share than every version of OS X and Linux added up when you look at what's being used to browse the Internet. And that's the sucktastic Windows Vista, which we all mercilessly railed against.

Global shipments of tablets, which the pundits will say have ostensibly replaced the notebook or desktop PC, reached 67 million units last year. Impressive. How did the irrelevant Windows do? My own rough calculations had put it at about 641,025 copies of Windows 7 sold every day in 2011, but that was way off. Analyst firm Gartner pegged PC sales last year at closer to 364 million, with 400 million on track for this year. In fact, the PC is so irrelevant that there are more than 1 billion PCs in use today, with many projections putting the number of PCs in use by the middle of this decade at 2 billion.

This isn't just a numbers game, though, as we can all launch number missiles at each other to support our arguments. The truth is that the PC and Windows are so far from being irrelevant you would literally have to have your picture under the word "imbecile" in the dictionary to believe that. It's not that there is no battle. No, it's on, y'all, and it's an epic battle unlike any we've seen to date, but to say that Windows is irrelevant is the height of dumb-assery.



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

↘ submit your questions to: comments@maximumpc.com

THE NEWS

Windows 8 on ARM

Everything you need to know about Microsoft's push into non-x86 architectures

IN EARLY FEBRUARY, Microsoft finally opened up about Windows on ARM. It's not quite the same thing as Windows 8 for x86. Here's what you need to know.

IT'S NOT WINDOWS 8

Windows on ARM (WOA) isn't Windows 8. It'll have a lot in common with Windows 8, including the same visual style, a large shared code base, and the ability to run the same Metro apps (if they're developed using the WinRT Metro API), but WOA isn't backward compatible. Applications have to be specifically compiled for ARM, so WOA can't run x86 apps, even in emulation. The good news is that you'll be able to buy apps in the Windows Store that work on both x86 and ARM, and you'll only have to pay once to install them on up to five systems.

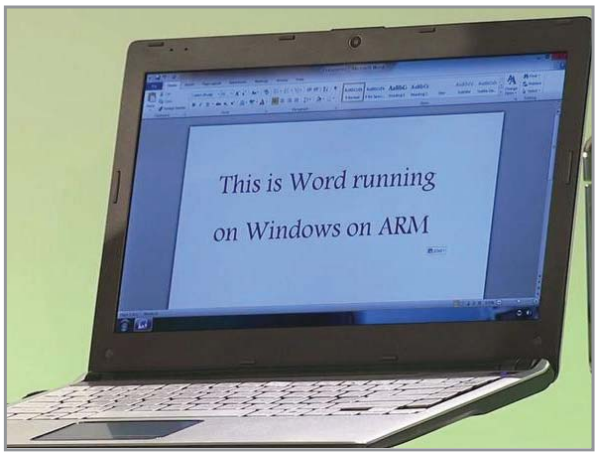
IT'S A NEW, PORTABLE PARADIGM

You don't turn off tablets, and since WOA is aimed at the tablet market, it is being designed to go into Connected Standby mode, like a smartphone with the screen off, instead of totally powering down.

All WOA systems will receive software, firmware, and driver updates through Windows Update. This won't be easy, given how many variations there are of ARM hardware. Even Windows Phone 7 has begun to fragment as Microsoft struggles to maintain a common set of features across dozens of different phone implementations, despite strict hardware restrictions that Microsoft tried to impose.

More interestingly, Microsoft says that *all* WOA apps will come from the Windows Store—so no more downloading apps from the web or installing from a disc. No word yet on whether you'll be able to sideload apps, à la Android, or whether Microsoft is moving into a walled-garden approach for Windows on ARM.

Both WOA and Windows 8 will include an in-place restore function—essentially a factory data reset—allowing for an OS refresh whenever you feel the need.



Windows on ARM will ship with Office and a desktop environment to use it in.

IT COMES WITH OFFICE

Windows on ARM will ship with versions of Word, Excel, PowerPoint, and OneNote that run using the desktop interface (not Metro). It remains to be seen if the Office version included with Windows on ARM is feature complete, or if upgrades will be offered to unlock advanced features. No mention was made of Outlook.

WOA's desktop interface will allow you to use the familiar Office interface, as well as Windows Explorer and a desktop version of Internet Explorer 10. It'll be a lot like the desktop on your x86 machine, except none of your old apps will work on it.

IT'S NOT REPLACING WINTEL

Windows on ARM isn't a replacement for the x86 Windows environment, as Microsoft takes pains to explicate. Windows on ARM is an important release for Microsoft, but the company made it clear that it's more engaged with Intel and AMD than ever before. Here is a direct quote from the Microsoft blog: "We could not be more excited or supportive of the new products from Intel and AMD that will be part of Windows 8—across a full spectrum of PC form factors including tablet, notebook, Ultrabook, all-in-one, desktop, and more that all take advantage of the new capabilities of Windows 8 while Windows 8 takes advantage of new features in hardware."

Both Windows 8 and WOA should ship concurrently before the end of 2012. That doesn't mean Microsoft's hardware partners will be ready with ARM devices on day one, but they should be.

Stay tuned for more info, as well as hands-on previews, before Windows on ARM launches. **–Justin Kerr and Nathan Edwards**

Study Calls Bunk on Data Throttling

Wireless carriers would have you believe that data throttling is necessary to prevent bandwidth hogs from congesting networks. But a new study suggests that it might be nothing more than a ploy to get grandfathered unlimited users to switch to a tiered plan.

Validas, a company that analyzes cell phone bills for a living, combed through data from over 55,000 mobile phone bills in 2011. It found that data throttling appears to have little impact on easing network congestion.

"When we look at the Top 5 percent of data users, there is virtually no difference in data consumption between those on unlimited and those on tiered plans—and yet the unlimited consumers are the ones at risk of getting their service turned off," Validas states in a blog post.

Interestingly, Verizon Wireless customers subscribed to an unlimited plan use less data than those rocking a tiered plan, according to Validas. The same isn't true for AT&T, though the disparity is less than a gigabyte. **–PL**

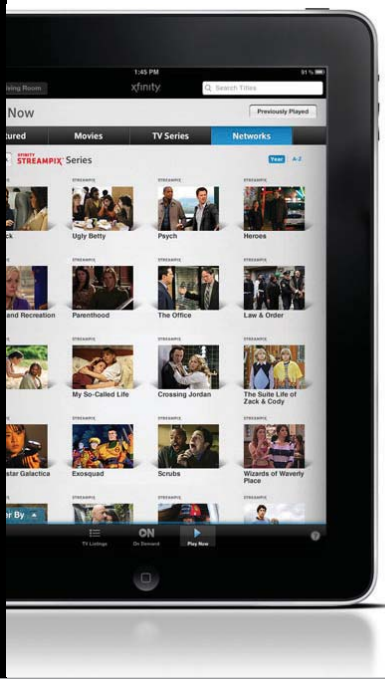
2011 Data Consumption of the Top 5% of Data Customers (GB)

Source: Validas

Ivy Bridge Delayed, Slightly

Intel says its new 22nm CPU using 3D transistors is delayed, but not enough to matter. Responding to rumors that the chip, code-named Ivy Bridge, would be delayed until this summer, the company says the delay is but "a few weeks," and that the CPU is on track for a spring 2012 release.

For most PC users, the delay of Ivy Bridge won't affect much, as Intel is still firmly in control of the processor market on PCs. Besides the use of the radical 3D transistors, Ivy Bridge is supposed to bring a healthy increase in graphics performance over today's CPUs with graphics. Intel hasn't publicly confirmed model numbers, but the parts are expected to slot in over today's Sandy Bridge processors, with the top-end 3.5GHz quad-core Core i7-3770K replacing the Core i7-2700K, and the 3.4GHz Core i5-3570K replacing the current Core i5-2500K. The parts should be backward compatible with existing LGA1155 boards. **–GU**



Comcast Enters Netflix Territory

Subscribers to Comcast TV will now have the option of receiving Xfinity Streampix—a new video streaming service that augments Comcast's existing video-on-demand options with prior seasons of TV shows and older movies. The streaming content will be available via set-top boxes as well as through Comcast's mobile apps. Streampix will be free to top-tier subscribers, but will cost an additional $4.99 a month for everyone else. It will not be available to Comcast's Internet-only subscribers, however. That, plus its relatively limited streaming library, make it unlikely that Streampix will do much harm to Netflix' market share. **–KS**

Tom Halfhill
Fast Forward

NEXT-GENERATION WI-FI

HERE WE GO AGAIN. The next-generation Wi-Fi standard isn't quite final, but some companies are already announcing products based on preliminary specifications. Should you buy something that could be bricked if the specs change?

My advice: It's probably a safe bet, but don't bother. Waiting until late 2013 or 2014 will get you a reliable wireless router designed to final specs—and you'll probably save money, too.

The new standard, 802.11ac, is sometimes called "Gigabit Wi-Fi" because it can exceed one gigabit per second. Broadcom calls it "5G Wi-Fi" because it's the fifth-generation wireless-networking standard. (Don't confuse Broadcom's 5G with the unrelated cellular-telephony generations, which are currently moving to 4G.) Broadcom has already announced the first 802.11ac transceiver chips based on preliminary specs.

On paper, 802.11ac is about 6 to 11 times faster than today's 802.11n, pushing throughput as high as 6.93 gigabits per second. Actual throughput will likely be much lower, but gigabit speeds are realistic for home routers. The new standard boosts performance using several techniques, including wider channels, more simultaneous data streams, and denser modulation.

It also shifts signals into the 5GHz radio band. Today, 802.11n works either in the crowded 2.4GHz band or at 5GHz, but most Wi-Fi traffic remains at 2.4GHz. Although the higher band is roomier, less crowded, and should have less interference, it also has less penetration through obstructions. To compensate, 802.11ac simplifies radio beamforming, which focuses signals on the most optimal path.

The bottom line is that 802.11ac is fast enough to distribute multiple HD video streams to multiple devices throughout a good-size house. Today's 802.11n can handle HD video but sometimes stutters. The new standard should have enough throughput for smooth delivery—when it's fully baked.

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

Thomas McDonald
Game Theory

WHEN A GAME ISN'T A GAME

FOR MANY YEARS I have written, in these pages and elsewhere, my reasons for not considering games as "Art". Short version: It has to do with what Aristotle would call the *telos,* or the ultimate purpose, of any given thing. Although modern games draw in many elements which, taken discreetly, could be considered art—writing, graphics, music—the defining characteristic of *a game*, that essential thing that makes something a game, is the gameplay.

And common sense tells us this much: Gameplay is not art. Certainly, to take a single example, chess is not art. A chess board may be art, or a set of chess pieces, but not chess itself, not even a particularly elegant set of moves, such as Anderssen vs. Kieseritzky. The design of BioShock may be art, or the writing, or the music, but they are merely handmaidens of the gameplay. Play is BioShock's *telos*, its reason for being.

But what happens when you take all of the elements of modern game design—graphic design, exploration, music, storytelling—and then remove the actual gameplay? What is the *telos* of that creation?

I don't really know, but it's a question that's been on my mind lately thanks to Dear Esther, a game without gameplay. It's essentially a short story that unfolds though first-person navigation of a 3D environment. (It started life as a Half-Life mod.) The superb score and atmospheric visuals provide an emotional canvas which is filled gradually with disconnected slices of narrative as you roam a mysterious island. There is no interaction whatsoever: merely triggers.

Is it any good? No, not particularly: The writing is awkward and pointlessly obscure, and the integration of the environment with the narrative elements doesn't seem to have any real purpose.

Dear Esther is, however, something more important than "good": It's interesting, and that's rare these days. Even as the narrative and prose elements fail, the atmophere remains strong, offering a kind of semi-interactive multimedia mood piece. It points to the potential of exploratory narratives that use conventional game elements in new ways.

You can follow Thomas McDonald on Twitter: @StateOfPlayBlog.

Raspberry Pi Preorders Sell Out in Hours

The Raspberry Pi—a $35 board the size of a credit card that can play 1080p H.264 video and run XBMC or Fedora Linux—went up for preorder on February 29 and sold out within hours. The Raspberry Pi comes in $25 and $35 versions, and the latter ships with a 700MHz ARM-based Broadcom SoC, 256MB of RAM, an SD card slot, HDMI and RCA video and audio out, Micro USB for power, two USB 2.0 ports, and an Ethernet port. The cheaper version eschews Ethernet and the USB ports.

Will the Raspberry Pi seize the HTPC and low-cost computing markets? Time will tell, but we're pretty excited about its potential. **–NE**

GPU Sales Down but Not Out

Discrete graphics card sales fell off a cliff at the end of last year but it's not the end of the GPU world, according to analysts at Jon Peddie Research.

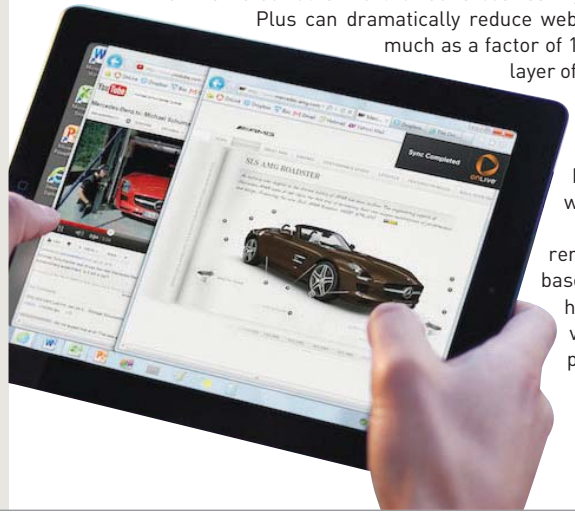
Sales of graphics cards were down 6.5 percent between the third and fourth quarters of 2011, the firm says. Even worse, year-to-year sales between the fourth quarters of 2010 and 2011 were down 13.7 percent. JPR says the hard drive shortage, weak economy, and the encroachment of tablets all contributed to the bad numbers. Despite the dour news, Peddie says higher-performance discrete cards continue to show demand as well as continued growth in Asia, where consumers value discrete graphics more than Americans do. **–GU**

OnLive Desktop Plus Brings IE9, Adobe Flash to iPad

OnLive kick-started its hosted Virtual Desktop Infrastructure service last month with the launch of the OnLive Desktop app for iPad. While OnLive Desktop launched in the form of a free, as-available service, the company announced a couple of subscription plans for folks interested in priority access to a cloud-based Windows 7 desktop, and more. One of those subscription plans is now available.

OnLive Desktop Plus costs $4.99 a month and provides all the features included in the standard (read: free) version, albeit on a priority basis. However, that's not the only advantage it has over the standard version. OnLive Desktop Plus includes a full Flash browser (Internet Explorer 9). The company is promising gigabit-speed accelerated browsing, which it says is "faster than any consumer browsing experience we know of."

"For you that means—whether you're on Wi-Fi or 4G (Android LTE tablets coming soon!)—you can expect even the most elaborate Flash websites to load in seconds, even if it would have taken your home computer minutes to load the same page," wrote OnLive founder and CEO Steve Perlman on the company's official blog.



Perlman also touts the browser's cost-saving potential: "OnLive Desktop Plus can dramatically reduce web browsing data usage by as much as a factor of 10 or more, since only the top layer of the current view of a website is sent over your local Internet connection. So you get the world's fastest mobile browser, at quite possibly the world's best value."

While Desktop Plus is currently only available to U.S.-based iPad users, the company has plans to expand the service to other countries and platforms. **–PC**

Quinn Norton
Byte Rights

TRACKING DO NOT TRACK

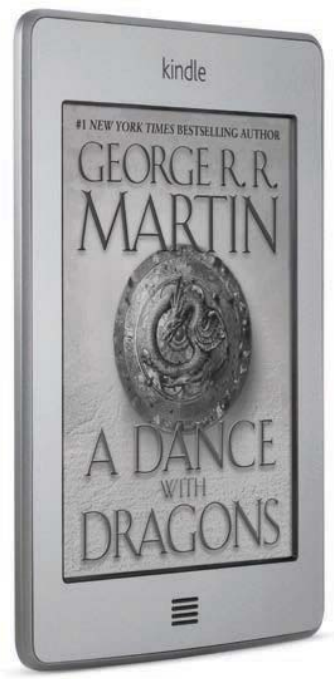
THE WONDERS of the net—that we have access to near the sum of human knowledge and endless community—have come to have a simple cost: the total loss of privacy and autonomy to advertisers who see everything that makes you who you are as a handle for controlling your buying behavior. This is the practice of targeting ads. Beyond the indignity of being examined and reduced, it's just icky.

Beyond manually clearing cookies and history, using ad blockers, and other technical evasion moves, there has never been a way of saying back to the network, "I'd rather you didn't do that," and advertisers have often claimed that consumers want targeted ads and a nonsentient second life in databases. Gee, who doesn't love ads?

Fortunately, net wunderkinds Chris Soghoian and Dan Kaminsky have a little more insight into being a human. They've proposed a browser header called Do Not Track—a simply technical solution to the social problem of how to tell advertisers (and their regulator, the FTC) that, no thanks, you don't want everything you do online tracked by hundreds of ad companies. Like a robots.txt that goes the other way, from client to server, it creates something of an exclusion for you. You'd get more ads you don't want, as opposed to ads you don't want that are kind of creepy.

Do No Track, named to be reminiscent of the beloved Do Not Call list that's also maintained by the FTC, is a proposal that's been adopted by all the major browsers to let people tell the incredibly invasive advertisement profiling industry where they can put their databases. The details are still being worked out, but Do Not Track is becoming a reality, and it's time to pay attention, instead of continuing to ignore the uncomfortable database doppelgänger following you around the net.

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



Penquin Pulls Titles from Ebook Lending Program

Publishers can be squeamish about ebooks, and doubly so when it comes to lending ebooks. So it's not surprising that Penguin Books has decided to pull its content from OverDrive, the digital lending system used by more than 7,500 U.S. libraries. Penguin previously removed its titles, only to bring them back a few days later. This time, however, the change appears permanent.

OverDrive itself has come under fire for its use of DRM, but this was the only way the company could get nearly 1,000 publishers on board with its library lending system. Sadly, that wasn't enough for Penguin, which didn't like that patrons were able to download content over the air. The publisher preferred a system where books would need to be downloaded to a PC, then synched to a device.

Penguin joins Simon & Schuster and Macmillan in eschewing ebook lending, but Random House continues to make its entire catalog available for lending through libraries. **–RW**

IBM Brings Quantum Computing Closer

In late February IBM announced it had made several breakthroughs toward practical quantum computing. Unlike normal bits, which can be either on or off (having a value of 1 or 0), quantum bits, or qubits, can hold values of 1, 0, and both at once. This allows a huge increase in the number of possible calculations per second.

IBM's breakthroughs focus on increasing the amount of time a qubit can hold its state. IBM got a 3D superconducting qubit to hold its value for 100 microseconds. It also got a two-qubit CNOT gate to grant a 95 percent calculation success rate over 10 microseconds. While practical quantum computing is still years away, these breakthroughs bring it closer to reality. **–NE**

GEEK TESTED & APPROVED

iTouch Touchscreen Gloves

In the cold, winter months our dependence on touchscreen technology (be it our smartphone, tablet, or the ATM machine) collides (bitterly) with our desire to keep warm. Our choice has been to mash futilely at the screen with a gloved paw or use bare, freezing fingers to get our digital fix. With iTouch Touchscreen Gloves ($10-$50, www.itouchscreengloves.com) we're freed from such compromises. Sporting special conductive yarn in the fingertips, the Touchscreen Gloves give you full touchscreen functionality while keeping your mitts toasty. **–KS**

THE LIST

7 WAYS TO FIGHT PIRACY WITHOUT DRM

7 BAKE IN DETERRENTS

Instead of crippling illegally obtained copies of the game, Croteam made Serious Sam 3 a miserable experience for pirates by inserting into the mix an indestructible pink scorpion hell-bent on destroying them.

6 PROVIDE BETTER SUPPORT AND QUALITY CONTROL

A lot of pirates justify their pillaging of digital goods when a product doesn't perform as it was intended to. Developers would do well to adopt Blizzard's "it's done when it's done" mentality and sit on their products until they're able to vouch for the performance.

5 PEAKS

By routinely doling out fresh in-game content to paying customers, development houses provide consumers with a compelling reason to pay for their wares.

4 STANDARDIZE INTERNATIONAL/REGIONAL RELEASES

By giving consumers what they want simultaneously on an international level, developers could strike another reason for illegally downloading an application from the litany of excuses pirates use.

3 LOWER THE COST OF DIGITALLY DISTRIBUTED SOFTWARE

Placing a software product in a physical marketplace is a costly undertaking, no matter how you cut it. Were software developers to dramatically lower the price of their digitally distributed wares, it'd be an uphill slog for pirates to complain about the market value cost of what they're swiping.

2 ACTIVELY ENGAGE THE COMMUNITY

Listen to your customer's frustrations and concerns, and, whenever possible, provide them with the help they need and deserve. As the old adage suggests: Respect earns respect.

1 NUKE THEM FROM ORBIT (IT'S THE ONLY WAY TO BE SURE)

If there's a final, definitive solution to online piracy that doesn't in some way involve Digital Rights Management, it has yet to be found. We can only hope that when such a solution is implemented, it's one that's as just to a product's paying end users as it is to the companies that designed it.

HEAD TO

BY ALEX CASTLE

Razer Naga Epic vs. Mad Catz Cyborg M.M.O. 7

The one-size-fits-all gaming mouse is a thing of the past. Game peripheral makers, facing an increasingly crowded market, have finally acknowledged the existence of massively multiplayer online RPGs—a genre of game that's popular, growing, and has its own unique control requirements. If you go hunting on the web, you can easily find a half-dozen high-end gaming mice specifically for MMOs, but save yourself the trouble; we're going to take a head-to-head look at the cream of the crop: old-guard Razer's Naga Epic versus up-and-comer Mad Catz' Cyborg M.M.O. 7.

Round 1: Buttons

The main thing that separates an MMO mouse from a regular gaming mouse is the button layout. Where a shooter requires mostly speed and accuracy, an MMO also requires quick access to many hotkeys and abilities—meaning you're going to want a lot more buttons than a normal mouse.

The Naga takes an unsubtle approach to the button issue. It slaps 12 buttons, touch-tone style, on the left side of the mouse. It's a lot to work with, but it also takes some real practice to hit any one of those buttons with your thumb, without looking. If a tight grid was the best way to lay out buttons, the Atari Jaguar would have become the model for modern gaming controllers. Unsurprisingly it did not, and a more organic method of distributing buttons across the entire controller won out. Incidentally, that's exactly what you'll find on the M.M.O. 7.

Winner: M.M.O. 7

Round 2: Software

It's hard to fault either Mad Catz or Razer for the software suites behind the M.M.O. 7 or Naga. Both mice work just fine out of the box, but require configuration software to get the most out of their many, many buttons. Each allows for custom profiles, with on-the-fly sensitivity switching.

Both software suites allow you to customize the color of the mice's LEDs (the Naga's logo, wheel, and buttons glow, while the M.M.O. 7's two main buttons can be set to different colors), while neither mouse has internal memory for onboard profile storage.

Additionally, both Razer and Cyborg offer add-on software for World of Warcraft, which allows you to bind skills and abilities to buttons on the mouse from within the game.

Winner: Tie

Round 3: Feel

This one's a close call—both mice offer exceptional build quality, as well as customization options to fit any hand. The Naga Epic features Razer's trademark hyper-ergonomic design, with a silky rubberized finish and big, satisfying left- and right-click buttons. The mouse comes with three swappable pinky-plates, which let you change the shape of the mouse to your liking.

Those features would be enough to blow any mouse other than the Cyborg M.M.O. 7 out of the water. Where the Naga offers three side plates, the M.M.O. 7 has three switchable side plates, swappable palm rests, and adjustable dimensions and weight. All that on top of a solid metal base make the M.M.O. 7 the most sturdy and (when properly customized) comfortable MMO mouse you can buy.

Winner: M.M.O. 7

Round 4: Sensor

Technically, the Cyborg M.M.O. 7 has a higher-precision sensor, at 6,400 dpi to the Naga's 5,600, but isn't it about time we all admitted to ourselves that the dpi arms race has gone too far? You're not going to be able to feel any difference, because nobody but the most jacked-up Counter-Strike kiddies would ever set their sensitivity all the way up to 5,600, anyway. Both mice feel perfectly responsive, and have on-the-fly dpi switching, so you can always find just the right sensitivity setting.

Both are laser mice, of course, and track well on just about any surface. A mouse pad's preferable, but as long as you're not trying to play on your glass coffee table, any surface will do.

Winner: Tie

We love the aesthetics of the Naga Epic, but couldn't they have given the buttons a little room to breathe?

The Cyborg M.M.O. 7 is so customizable it comes with a built-in Allen wrench.

Round 5: Additional Features

The M.M.O. 7's most interesting new feature is the "ActionLock" system, which allows you to hold down a mouse button without having to physically press it, designed for games that use the mouse buttons for movement or mouselook. It's a clever idea, though we found that it hindered us more than it helped, as we often found ourselves accidentally pressing the ActionLock button.

The Naga Epic, on the other hand, has an additional feature that's quite useful: hybrid wired/wireless design. The mouse comes with a nifty little charging dock for when you're not gaming, and if it ever runs out of juice in the middle of a session, you can plug the dock's cable directly into the mouse and keep playing.

Winner: Naga

And the Winner Is...

It's a close call, but we have to side with the **Cyborg M.M.O. 7**. Razer's offering is a great mouse, and we'd be more than happy to wield it around Azeroth or Alderaan, but the button layout and customization options just aren't as impressive as Mad Catz' (for a full review of the Cyborg M.M.O. 7, turn to page 89). Of course, every person's hand shape and play style are unique, so your mileage may vary. We strongly doubt you'd be disappointed with either mouse.

DOCTOR

THIS MONTH THE DOCTOR TACKLES...

>Free vs. Subscription Antivirus
>SSD Suckage
>Flagrant Errors

AV Free or Die!

My computer's antivirus program, Norton 360, recently expired. Should I pay for a different antivirus program or just download a free program like Avira and combine it with a free anti-malware program like Malwarebytes? Is paid antivirus software worth it?

—Anderson Wu

THE DOCTOR RESPONDS: Our resident AV expert Paul Lilly weighs in: "I think it's worth it, because of how quickly new threats are released. The paid security suites typically offer more protection, not just from viruses, but spyware, identity theft, etc. Depending on the suite, you also get the added benefit of pulse updates throughout the day, as well as reputation-based scanning (Norton's Insight technology, for example), where files are analyzed based on their behavior on a collection of machines, not just your own. There are some good free options out there, like Microsoft Security Essentials and AVG, but a paid security suite just brings more protection and more tools to the table."

The rest of the staff is split: Gordon uses Kaspersky (paid), while Katherine and Nathan run Microsoft Security Essentials, along with Secunia PSI to keep their software patched and regular Malwarebytes scans. Alex, the rogue, doesn't use AV at all, but does use Malwarebytes.

Move SSD to the Suck File

I am tired of reading about the merits of placing just your OS on an SSD. In theory this sounds like a good idea, but in practice it isn't that easy. I recently bit the bullet and built a new rig with Windows 7 on an SSD. Instead of the euphoria I expected, it was more like a nightmare. Applications really have a tough time dealing with moved user profiles and program files, as do their associated uninstallers, resulting in full OS reinstalls just to get rid of all the pesky remnants left behind. I finally gave up, put everything on a spinner, and moved my SSD to the suck file.

Has anyone actually succeeded at this with all their applications and not just a game or two? I think it's overdue for *Maximum PC* to present a revisited step-by-step working solution to installing your OS on an SSD. You guys always throw in the SSD as if it's obvious and simple without explaining your process. You guys are the only ones I would trust to present a truly workable plan, so how about it?

—Ken St. John

With Secunia PSI, you can monitor your programs to make sure they're always fully patched and up to date. Combine it with antivirus for best results.

THE DOCTOR RESPONDS: Our recommendation for OS-only SSDs came from a time in which most people, if they bought an SSD at all, could only afford a 40GB one, which is just barely enough room for Windows 7. And we agree: It took a lot of fiddling and symbolic links to get the drive to behave. These days, however, 120GB SSDs can be found for as little as $130, and that's enough space to install Windows and many programs (and a few games) without messing around with install locations at all. We do still recommend that you keep your documents and media on a mechanical drive (and map your Libraries' default file locations to that drive), but you shouldn't be trying to keep programs off of your SSD—you'll miss out on the benefits of having one.

Sacrificial RAM or Smaller Cooler?

I have a Rampage IV Extreme motherboard with eight sticks of Corsair Dominator RAM, but the heat spreaders bump up against the underside of my Phanteks CPU cooler. I could remove the heat-spreader fins from four of the RAM DIMMs to make it work, or I could get a new CPU cooler. Do you have a suggestion for a cooler that can fit in this tight configuration and do a great job?

—Tad Bauer

↘ submit your questions to: doctor@maximumpc.com

THE DOCTOR RESPONDS: We were impressed with the NZXT Havik 120 ($55, www.nzxt.com) from last month's Sandy Bridge-E cooler roundup—it fits on your board easily with four DIMMs installed, but even if you have Dominator RAM in all eight slots, you'll be able to squeeze the Havik 120 in there—barely. RAM with shorter heatsinks will, of course, be fine.

Bad File or Bad Box?

My PC is doing a weird thing. Once a day (sometimes more), my computer screen will freeze and make a humming noise through the speakers and I have to restart the computer. I believe it's a corrupt file issue. I've tried reseating everything, ran disk defrag as well as scannow, reinstalled my videocard drivers, and ran a diagnostic on the memory. Help!

—David Ortiz

THE DOCTOR RESPONDS: David, although it's still possible a corrupt file or bad sector on the HDD is causing your problem, the Doctor would rank that possibility very low on the list. What you are experiencing is a hard lock on your machine, with the loud buzzing or humming sound being the last gasp of the audio subsystem before the entire system crashes. In the old days, the soundcard would be blamed, since it was the last thing to act up before a hard lock. Your problem, though, is likely related to other hardware. You didn't state the details of your PC, so here are a few things to look at. First, if you're overclocking, stop: Restore CPU, GPU, and RAM to their default timings. If the problems continue, start looking at the three most likely culprits: failing RAM, system overheating, or a substandard power supply. Let's go over the free checks first. Download and burn a copy of Memtest+ (www.memtest.org) to a bootable disc. Once you've burned the ISO to disc, boot to it and let it run a diagnostic test on the RAM. Memtest+ will run the RAM through many industry-standard patterns to test the RAM for issues. If it passes, great. If it doesn't, start trying to isolate which DIMM is bad by running the test on each individual DIMM or even each individual DIMM slot (remember to completely power down and unplug or switch off the PSU before removing or installing RAM). If the RAM passes, move on to cooling.

> “I'M TIRED OF READING ABOUT THE MERITS OF PLACING JUST YOUR OS ON AN SSD

Make sure your CPU fan isn't jammed, broken, or full of dust, and check your GPU's fan for obstructions. Either of those fans overheating can cause a hard lock. Try running your computer without a side panel. If it runs fine with the side panel off, you'll need to add supplementary cooling. You may also want to check that your CPU's cooling fan is properly installed, and if you have extra thermal paste, you may want to remove the

AD

heatsink and reinstall it with fresh thermal paste. If all those are clear, move on to power. Are you finding that the hard locks are occurring on hot days? Your PSU may be failing. Low-end no-name PSUs sometimes run fine for a few months before starting to fail.

If at this point you are still getting hard locks, consider removing components one by one. If you have a soundcard, pull it. If you have integrated graphics on the motherboard and a GPU, pull the GPU and run the integrated graphics to see if it continues to occur. Still crashing? Download a copy of Ubuntu (www.ubuntu.com) and burn it to disc. Boot from the Ubuntu disc and see if you can reproduce your crash. If you can't, it may indeed be an OS or driver issue, which means you get to start troubleshooting your OS. If all else fails, consider a clean install.

Help Fix My Random BSODs

I finally built a new computer to replace my Pentium 4 machine. I'm now running an Asus P8Z68 Pro-V Gen 3 with a Core i5-2500K, 8GB of Corsair Vengeance DDR3/1600, a Corsair Force 3 180GB SSD, a WD 1TB HDD, a Hyper 212 Evo, and an XFX Radeon HD 6870 .

The new rig is awesome, except it crashes all the time. Firefox crashes and I get infrequent blue screens or just hard restarts. Firefox's crashes seem to be directly tied to the Flash plugin. It's not uncommon for me to have several tabs with videos queued up.

It's much harder to pinpoint any causes or precursors related to the system crashes. It just crashed while I was watching a video with VLC. I haven't had any crashes while playing games or running Prime95 for hours. I never had crashes on my old rig. True, it was past its prime, but it was reliable.

The crashes are infrequent but occur often enough to get me to write in. After all, many of the components are Best of the Best, so I definitely value any advice. Is there a way to isolate potential bugs, or can a voltage get screwed up and make the system skip?

—Sean M.

THE DOCTOR RESPONDS: Your new machine should be stable. It sounds like you have ruled out any CPU thermal issues, since you say it will pass Prime95. Two immediate issues come to mind: First, test it with Memtest+ (free at www.memtest.org). This should help you rule out defective RAM as an issue. Second, early firmware revisions for SandForce-based SSDs, like the Force 3, were reported to cause random blue screens and hard locks under certain situations. Try updating your SSD firmware to version 1.3.3.

[SECOND OPINION]

BEWARE RAMDISK!

It was interesting to read your recent RAMDisk how-to (March 2012). After building a new PC several months ago, I test drove RAMDisk. My build is an Asus Z68 board, Core i7-2600, 16GB RAM, and an Intel SSD. Installation was fine, and I moved my Internet temp files to the RAM drive, a common recommended use. Unfortunately, my system became unstable with numerous file corruption issues. Win7 also started giving me validation errors, which I assume happened because Windows saw a new drive at every reboot. After uninstalling the RAM drive my system has been rock solid. I don't know if the problems were software or hardware, such as incompatibility with a UEFI BIOS, but users should be aware of possible issues. Furthermore, despite the blazing speed, power users with a new-generation SSD will feel no benefit of a RAM drive for system files. Access and read times on new SSDs are near instantaneous anyway. The primary benefit of a RAM drive might only be for editing video or other large files. But I could never test this due to system instability.

—Randy Pace

EXT3 IN WINDOWS 7

In your March 2012 Ask the Doctor column, there was a question about reading EXT2- or EXT3-formatted drives on Windows. You recommended the Ext2 IFS utility from www.fs-driver.org. However, there's a small issue: It doesn't work with Windows 7 and it doesn't support EXT3, either. The question specifically mentions Windows 7, so maybe it's not the ideal solution.

A quick search found Ext2Read (sourceforge.net/projects/ext2read), which works well enough for me, even if it doesn't mount the drives as Explorer-browsable.

—Ryan O'Hara

AD

BUILD A PC ON ANY BUDGET

BY GORDON MAH UNG

FROM $500 TO $2,100—WE SPEC OUT THREE PCS TO FIT ANY POCKETBOOK

We won't blow smoke up your PSU: Spending more money on a PC generally gives you a better computing experience. But that doesn't mean that anything short of an exotic $7,000 PC can't be fun and fulfilling, and it doesn't mean that folks on a very lean budget are doomed to a piss-poor computing experience. So for anyone who isn't flush with cash, we've laid out three nicely configured PCs—one for every budget.

The first is a sub-$500 rig that offers more gaming performance than a top-of-the-line gaming GPU... from 2007. The second PC, for just $1,300, is an everyman's PC that's sure to make Joe the Nerd a happy camper. The third PC is an honest-to-goodness enthusiast-class PC at the down-to-earth price of $2,100.

If you're itching to build a rig, the time to do it is now!

PICK YOUR PC POISON

The beauty of a PC is scale—in both performance and price

THE WHAT RECOVERY?! PC

We all have friends who will stand in line for hours and lay down top dollar for the latest brushed-aluminum gadget, but the truth is, for a lot of people, the recovery ain't here—not by a long shot.

For these folks, every dollar is precious and even a $700 PC seems extravagant. But we didn't want tough times to quash the hopes of an aspiring PC builder. Thus we set out to see what's possible at the $500 mark. Mind you, this would be the second-cheapest PC we've ever spec'd out. The cheapest was the $340 Ultra Budget PC from the September 2011 issue, but that was essentially a calculator on steroids. For this box, we wanted better-than-integrated graphics, if possible. We'll admit right now that hitting our goal was a tall task given today's hard drive prices and the cost of the OS, but we thought it a worthy effort. What's interesting is that once you get into the $500 range, every component has to be weighed carefully and justified. Were there corners cut and risks taken? Certainly. You can't eat Doritos without getting synthetic cheese all over your hands, but the final product ain't bad.

The light at the end of the economic tunnel might just be a train.

THE SWEET SPOT PC

Have you heard of that PC hacker named Goldilocks? She wandered into the Maximum PC Lab one day when no one was around, started using the What Recovery?! box, and immediately proclaimed it was "too damned low-budget for her needs." She then wandered over to the high-end Tax Refund PC and again turned up her nose in disapproval. "Why the hell would I pay a premium for LGA2011 when I'm never going to need quad-channel memory or buy a $600 hexa-core chip?!?"

Well G-locks, the Sweet Spot PC is just the right PC for you, and most enthusiasts, for that matter. At roughly $1,300, it's fast without being overkill, it's stylish without being ostentatious. It also hits all the modern enthusiast must-haves: must have super-fast SSD, must have upgrade path to next-generation CPUs, and must have support for a future multi-GPU upgrade. Hell, it even overclocks nicely without disturbing the church-mouse-quiet nature of the box. This is a sweet box for the price and probably enough machine for 80 percent of folks. It's so nice, in fact, that most of you probably don't need to look at the Tax Refund PC at all.

As Goldilocks would say, "It's *just* right...."

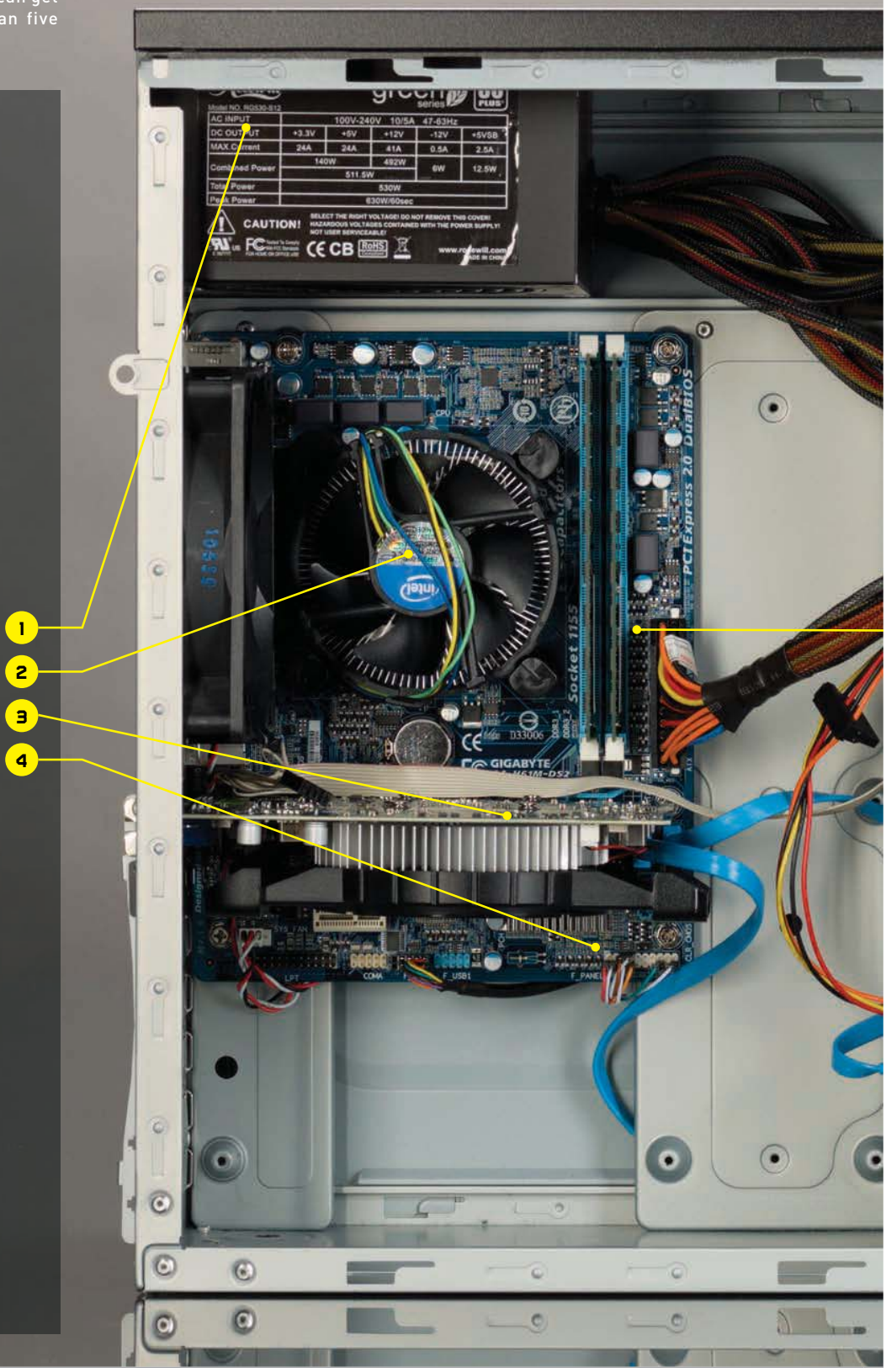
THE TAX REFUND PC

We didn't know when we started spec'ing out our high-end build that the average tax refund in the United States is $2,100. So when our PC ended up at that price point, we knew the configuration was right on target. Sure, those of you whose heads were turned by the promise of our Sweet Spot PC are scoffing at the frivolity of the extra cubits we dropped on this box. But we actually think of the Tax Refund PC not as the PC you need, but the PC you want. First, it's faster. From compute-bound chores to gaming, that extra $800 gets you eight threads instead of four, the current reigning champ in single-GPU graphics, and the ability to play and burn Blu-rays. This is also the only machine here that will let you run more than four cores. Granted, not everyone needs six cores, but if you're the kind of person whose livelihood relies on a speedy PC, having the ability to upgrade to a six-core Sandy Bridge-E processor today or even an eight- or 10-core with Ivy Bridge-E tomorrow, makes this box worth its weight in silicon. If that's not enough... it's red!

The PC you want, not the PC you need.

THE WHAT RECOVERY?! PC

At this price, most people expect sucktastic integrated graphics, but we prove you can get your (moderate) game on for less than five Benjies.



1 PSU/CASE

The first compromise you always make with any budget box is the PSU. Here, we go with a bundled Rosewill 450-watt PSU that came free with the Rosewill R218 case. We don't normally trust free power supplies, but we're comforted by the fact that the unit carries a one-year warranty and the website is based in the U.S.

2 CPU

To get below $500, a budget CPU was key. For that, we turned to Intel's 2.4GHz Celeron G530. We know, you're thinking, "Celeron! Whaa?" Relax, this isn't a warmed-over Pentium III core; it's actually a Sandy Bridge chip. Well, a Sandy Bridge chip with a lot switched off—there's no Hyper-Threading, no QuickSync, and no Turbo Boost 2.0. The cache is also a bit smaller at 2MB vs. 3MB for a standard dual-core SNB part, but it's not a bad CPU.

3 GPU

Integrated graphics is normally a typical component of ultra-budget boxes. While Intel and AMD's integrated graphics have come a long way, they still, well, stink when compared to a discrete card. Gigabyte's HD 7750 easily makes a monkey out of any integrated graphics out today—and it sips power, which is crucial given our freebie PSU.

4 MOTHERBOARD

We had to make a compromise with our Gigabyte GA-H61 mobo, but it's probably fine. The problem relates to Intel's H61 chipset, which deletes support for SATA 6Gb/s speeds (thanks, Intel!). However, the board does get us into LGA1155 for $54, and is someone with an ultra-budget box really going to buy a $200 SSD, anyway? Probably not.

THE PARTS LIST

CATEGORY	NAME	PRICE	URL
CPU	Intel 2.4GHz Celeron G530	$45	www.intel.com
GPU	Gigabyte Radeon HD 7750	$109	www.gigabyte.com
OS	64-bit Windows 7 Home Premium	$99	www.microsoft.com
Mobo	Gigabyte GA-H61M	$54	www.gigabyte.com
RAM	4GB Kingston DDR3/1333	$23	www.kingston.com
HDD	500GB Western Digital Caviar Blue	$88	www.wdc.com
ODD	Samsung SH-222	$17	www.samsung.com
Case/PSU	Rosewill R218 w/450 watt PSU	$50	www.rosewill.com
Cooler	Stock	$0	
TOTAL		$485	

5 RAM

A pair of 2GB Kingston DDR3/1333 DIMMs does the job. The Celeron actually throttles the RAM to DDR3/1066, but it's tough to even find that clock RAM today.

6 HARD DRIVE

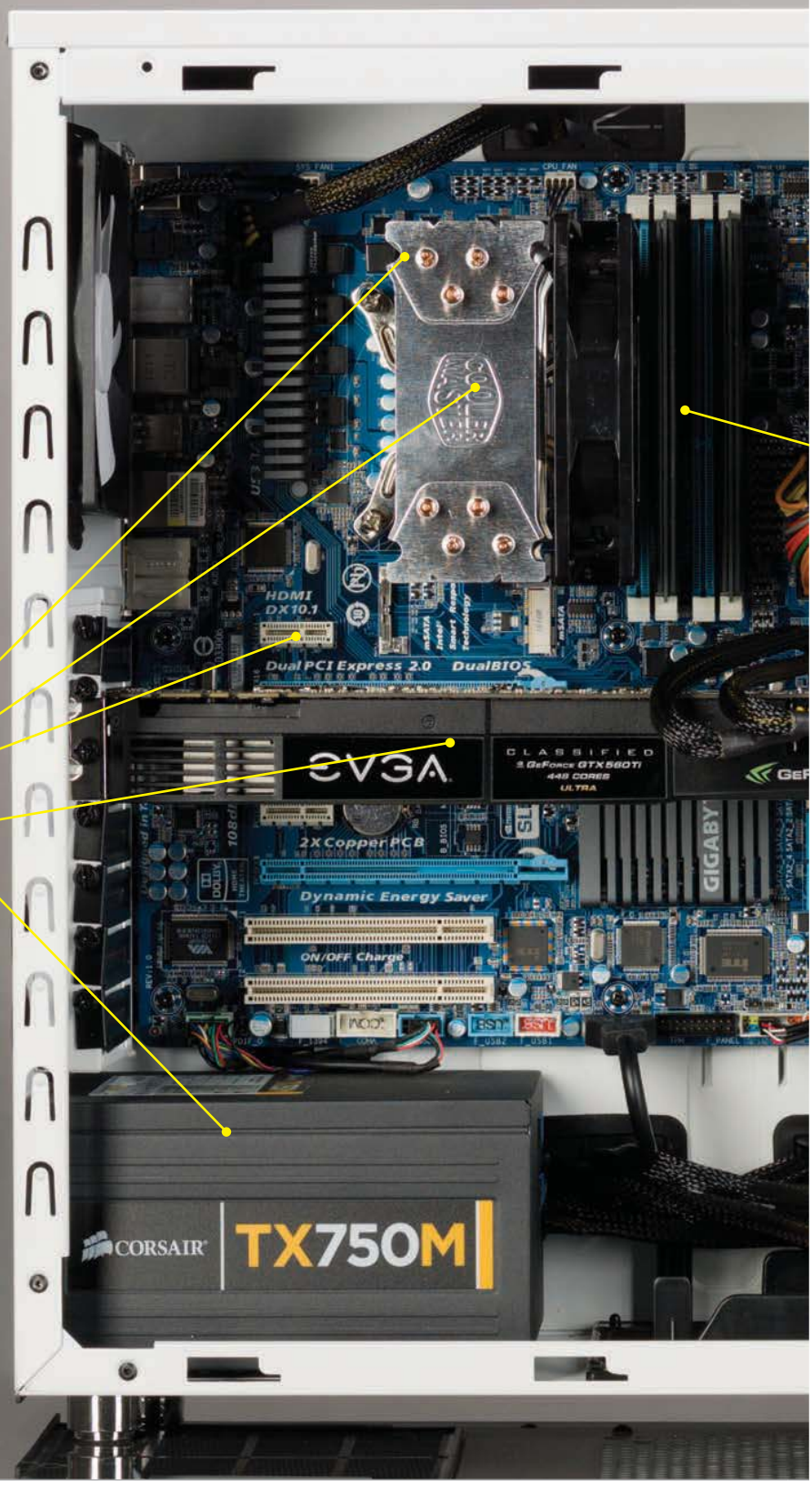
For $20, we could have doubled our capacity with a WD Caviar Green, but we opted for a 500GB WD Caviar Blue because we believe that having a 5,400rpm primary boot drive is too painful. No, it's not a Black drive, but at least it runs at 7,200rpm.

OS

Today's youths probably wonder why the tech world once trembled at the mere mention of Microsoft's name. Our budget build lays it out nicely, though: When broken out as a percentage, the $99 spent on Windows 7 Home Premium is 20 percent of the system budget.

THE SWEET SPOT PC

This rig is just right for most people's budgets, offers just the right amount of performance, and just the right acoustics, too



1 HEATSINK

Cooler Master's Hyper 212 Evo continues to offer the best cooling at a price that doesn't break the bank, or the ears, and lets us maintain our 4GHz overclock in peace and quiet.

2 CPU

On Valentine's Day we sent flowers and chocolate to Intel's 3.3GHz Core i5-2500K. Yes, we love it *that* much for giving us so much joy and happiness for so little money. We took the chip from its stock 3.3GHz to a very moderate overclock of 4GHz to keep within our plan for a fast and quiet PC.

3 MOTHERBOARD

News flash: You can get a cheap LGA1155 board, but you can't get a cheap board that supports SLI and CrossFireX. Gigabyte's GA-Z68XP-UD3 is about the lowest-cost board around that still gives us the capability to run SLI or CrossFireX while offering all of the Z68-goodness such as QuickSync and SSD caching.

4 GPU

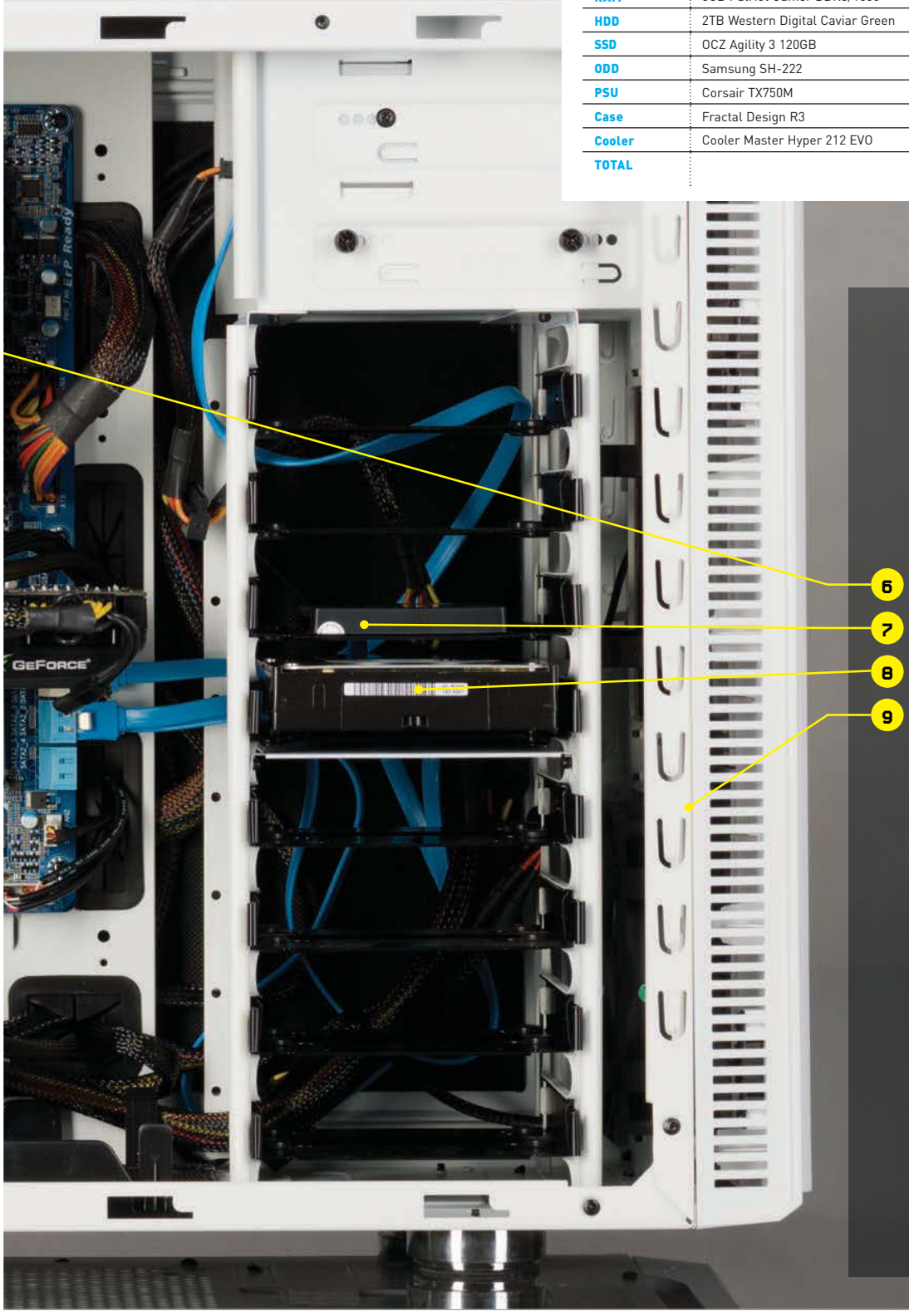
EVGA's GeForce GTX 560 Ti 448 is perhaps the best bang for the buck right now without leaping beyond $300 for a GPU. Ours, for example, can be found on sale or with rebates for $269. Don't confuse it with the FTW or Classified editions, which fetch a bit more.

5 PSU

Corsair's TX750M gives us enough juice to support a second GPU in the future, and with rebates it's a darn good deal.

THE PARTS LIST

CATEGORY	NAME	PRICE	URL
CPU	Intel 3.3GHz Core i5-2500K	$225	www.intel.com
GPU	EVGA GeForce 560 Ti 448	$269	www.evga.com
OS	64-bit Windows Home Premium	$99	www.microsoft.com
Mobo	Gigabyte GA-Z68XP-UD3	$155	www.gigabyte.com
RAM	8GB Patriot Gamer DDR3/1600	$42	www.patriotgaming.com
HDD	2TB Western Digital Caviar Green	$129	www.wdc.com
SSD	OCZ Agility 3 120GB	$136	www.ocztechnology.com
ODD	Samsung SH-222	$17	www.samsung.com
PSU	Corsair TX750M	$115	www.corsair.com
Case	Fractal Design R3	$99	www.fractal-design.com
Cooler	Cooler Master Hyper 212 EVO	$35	www.coolermaster.com
TOTAL		$1,321	



6 RAM

A pair of 4GB Patriot DDR3/1600 DIMMs hits the price/performance ratio for us and is low-profile enough to fit under the cooler.

7 SSD

What's not to love about the OCZ Agility 3 drive? It packs 120GB of MLC NAND, has a SandForce 2 controller, and can be found for a mere $130 after rebates.

8 HDD

With the OS running off of our speedy SSD, we fell back on an affordable and quiet 2TB WD Caviar Green drive for storage duties.

9 CASE

It used to be that $99 got you a razor blade shaped like a case, but Fractal Design's R3 (on sale from $109) is simply an amazingly well-designed, elegant case that's quiet as hell.

OS

For this config, we're going to save $30 by buying 64-bit Windows 7 Home Premium, but anyone who expects to run more than 16GB should buy Windows 7 Professional instead.

THE TAX REFUND PC

They say money won is sweeter than money earned. If that's true, then any tax "refund" is about as tasty as okra covered in cod liver oil. Still, we can't complain about the PC we get out of it.

1 COOLER

The push-pull configuration of NZXT's Havik 120 gives our Tax Refund PC top-notch cooling at an affordable price. With the auxiliary cooling we're running, we pushed our Core i7-3820 to 4.7GHz effortlessly.

2 CPU

Intel's 3.6GHz Core i7-3820 gets us to LGA2011-land without having to sell pints of blood, and despite its lack of a "K" or "X" designator, it still overclocks nicely. We took our chip from its stock 3.6GHz to 4.7GHz on air with no issues in our benchmarks at all.

3 MOTHERBOARD

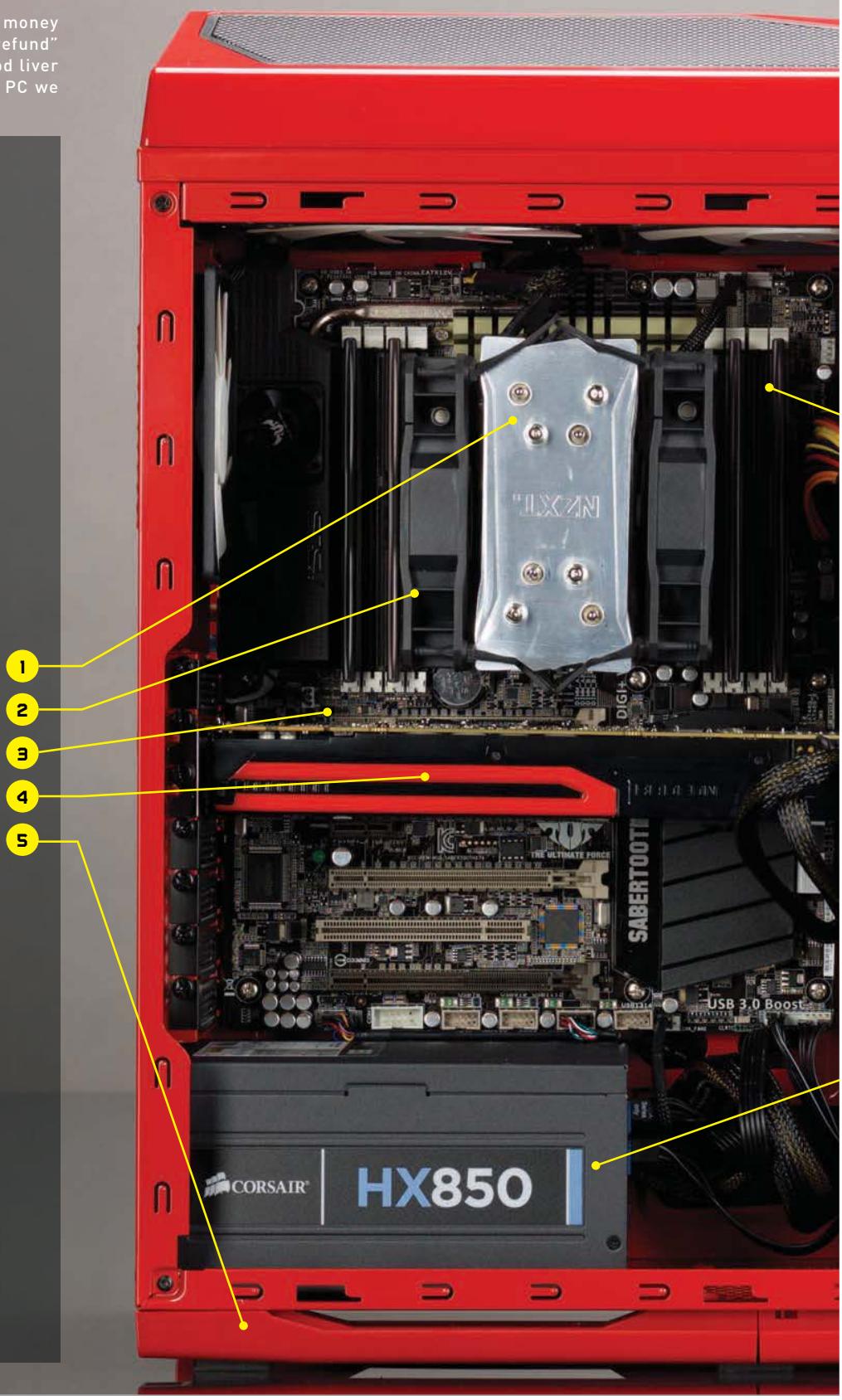
X79-based motherboards aren't cheap, but at least you get features. Asus's Sabertooth X79 gives us multi-GPU support, a nifty BIOS update feature that doesn't require a CPU, and a ton of thermal sensors.

4 GPU

AMD's Radeon HD 7970 gives us the single-fastest GPU in the Tri-state area, is the first to offer native PCIe 3.0 speeds and DX11.1 support, and can even be considered power-friendly for its class.

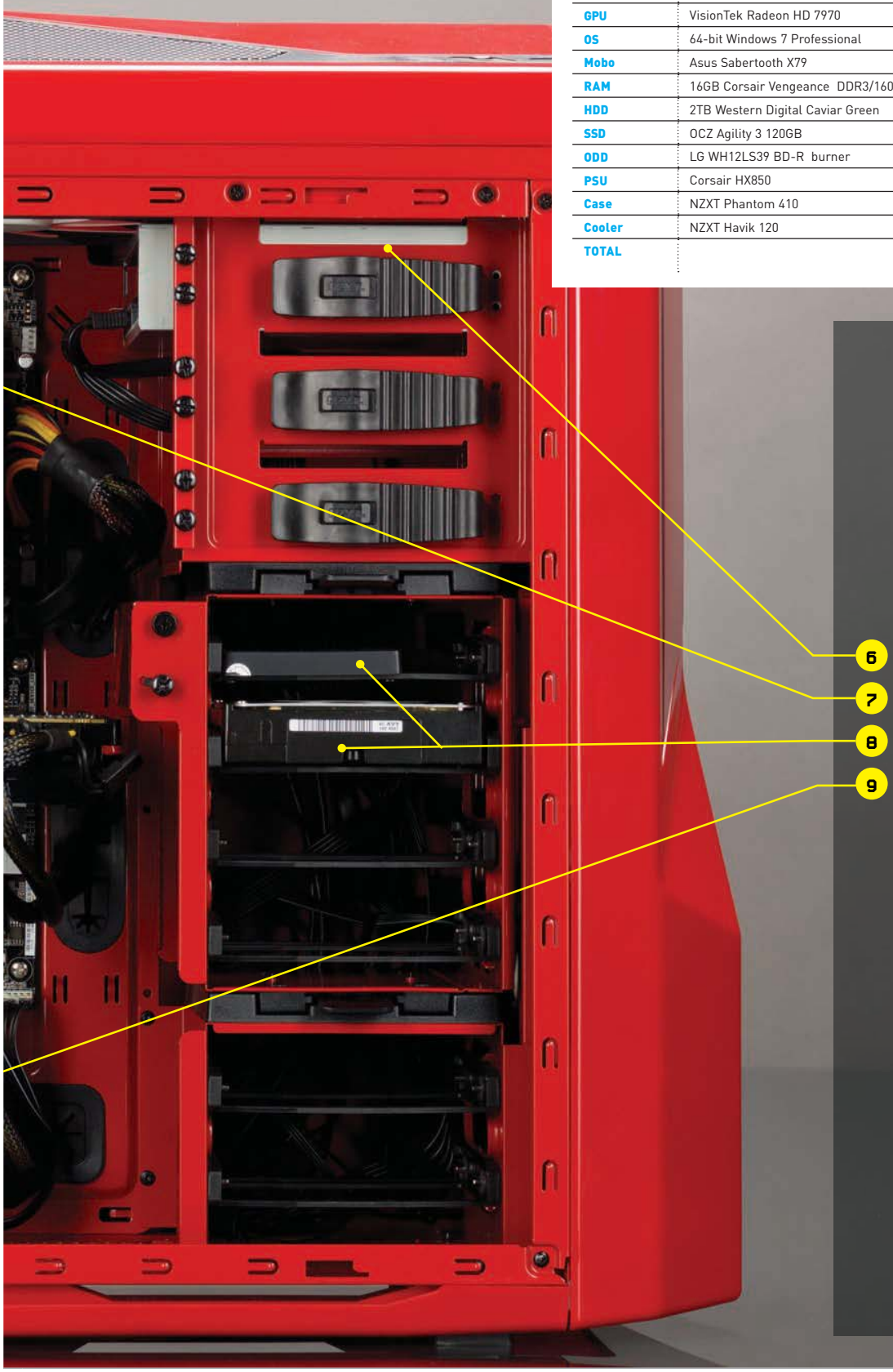
5 CASE

It's hard not to see the NZXT Phantom 410 and think of the Emperor's badass Royal Guard. A Royal Guard who doesn't take a coffee break while he's being thrown down an exhaust shaft, that is. The Phantom offers front-panel USB support, fan options galore, and tidy cable routing, too.



THE PARTS LIST

CATEGORY	NAME	PRICE	URL
CPU	Intel Core i7-3820	$320	www.intel.com
GPU	VisionTek Radeon HD 7970	$550	www.visiontek.com
OS	64-bit Windows 7 Professional	$129	www.microsoft.com
Mobo	Asus Sabertooth X79	$329	www.asus.com
RAM	16GB Corsair Vengeance DDR3/1600	$90	www.corsair.com
HDD	2TB Western Digital Caviar Green	$129	www.wdc.com
SSD	OCZ Agility 3 120GB	$136	www.ocztechnology.com
ODD	LG WH12LS39 BD-R burner	$80	www.lg.com
PSU	Corsair HX850	$160	www.corsair.com
Case	NZXT Phantom 410	$99	www.nzxt.com
Cooler	NZXT Havik 120	$55	www.nzxt.com
TOTAL		$2,077	



6 ODD

If you spend more than 2K for a box, it would be a shame not to be able to play Blu-ray discs; this LG drive lets us do that, and burn BD-Rs at 12x and DVDs at 16x.

7 RAM

In a really fun world, we'd be running 32GB using four 8GB DIMMs, but 8GB DIMMs have pulled a Where's Waldo act on us. Until they surface, we'll settle for the 16GB of Corsair DDR3/1600 Vengeance RAM using four 4GB DIMMs.

8 HDD/SSD

To keep our budget within reason, we simply cloned the storage options from our Sweet Spot PC. Yes, a much larger SSD would be attractive, but we think the 120GB SSD plus 2TB HDD combo is pretty tough to beat for the cash today.

9 PSU

Corsair's new 850HX is a single-rail design, offers 80 Plus Silver certification, and, more importantly, should provide enough horsepower to run two Radeon HD 7970 cards if you ever want to up your frame rate.

OS

Both of the lower-end rigs tap 64-bit Windows 7 Home Premium, but for any eight-DIMM motherboard, we recommend investing a bit more for 64-bit Windows 7 Professional, which doesn't have an artificial limit of 16GB. With 4GB DIMMs and eight DIMM slots, we don't want to leave memory capacity on the table.

OUR BUILDS MEET THE BENCHMARKS

Price lists are all well and good, but performance is where a config pays off

First, let's talk about how we priced our PCs. The figures we used are not made up. They were live prices from various etailers at the time of purchase. We also factored in rebate savings. Yes, some of you may cry foul at that, but if you do your part, rebates can actually save you money. The prices will also vary. For example, the Fractal Design R3 was on sale at a certain web store for $99. In fact, it's often on sale, but by the time you read this, it's possible it could have climbed up by $10. The prices of hard drives, too, can fluctuate greatly from day to day, and sometimes hour to hour. Still, the pricing templates are pretty close to what you can get and you can perhaps do even better.

For performance, we ran our standard system benchmark suite against all the PCs and also ran an additional battery of tests on the low-end PC so we could compare it to the more economical builds we've done over the last year or so.

THE WHAT RECOVERY?! PC

Of the three boxes here, the lowest-cost PC was the most challenging. There are simply so many compromises made to get it under $500 that most would say it's almost not worth the sacrifice in features. In fact, for many folks, taking our $667 PC from the August 2011 issue (bit.ly/AiC3YM) and upgrading it with a Radeon HD 6850 and an Asus P8H67-M (the original Gigabyte board is no longer offered) will yield better general performance for just a couple hundred bucks more than this budget box. You should also take a good look at our AMD-based machine from the March 2012 issue (bit.ly/ypvMJz), which takes the budget to about $830 for a very respectable PC. But recognize that $830 is a world away from $480 to many people.

For what it's worth, our sub-$500 PC ain't bad. It slaps around the $340 box we built in September 2011 (bit.ly/wuAVgD)—if you think $500 is tough, $340 is a serious kick in the performance nads. The Sandy Bridge-based Celeron G530 eats the $340 machine's Fusion APU as an appetizer and uses its single stick of RAM as a toothpick. In encoding, the Celeron G530 takes a quarter of the time as the $340 box, and in gaming it saw about eight times the performance as the integrated chip. But how does WR?! compare against something stouter? Say, the Core i3 2100-based $667 PC? Not exactly great. The Celeron G530 is about 30 to 50 percent slower than a Core i3 part in most of our application and encoding tests, and its lack of Hyper-Threading hurts it. You've got to take the Celeron for what it is: It isn't agonizingly Atom-slow, but it's certainly no Core *ix* chip. If we had more cash to spend, that would be one of our first upgrades.

> OUR SUB-$500 PC SLAPS AROUND THE $340 BOX WE BUILT IN SEPTEMBER 2011

If you're wondering whether an integrated GPU would make more sense, we'd say it depends on your needs. AMD's A8 X4 3850 probably has the best IGP out today, yet it still only hits 3,702 in 3DMark Vantage. The HD 7750 spits out 8,664, which puts it in a better ballpark for light-duty gaming. For comparison, we dug around on the Internet and found people with scores of 7,000 using overclocked Core 2 Quads and Radeon HD 3870 x2 cards. We also found people reporting 3DMark Vantage scores in the 5,500 range with GeForce 8800 GTX cards.

Yes, a fatter GPU almost always helps, but it's not always that simple. Dropping in a fatter GPU means having to think about a fatter PSU, too. Once you've crossed that line, you start to upgrade the case, the motherboard, and, well, you might as well build our Sweet Spot PC instead, or the $830 PC from our March 2012 issue.

Don't let this totally get you down. We ran our normal benchmarks on this budget box and were frankly surprised we could run everything. Both of our gaming benchmarks, for example—Far Cry 2 and STALKER: CoP—are run at 2560x1600. The HD 7750 managed both—not with stellar frame rates, mind you, but managed nonetheless. We don't even attempt these tests on machines with integrated graphics.

THE SWEET SPOT PC

This PC is pretty much perfect just as it is. Sure, a 480GB SSD would be nice, as would a 7,200rpm drive, but this machine is just right for most enthusiasts who don't want to sink two paychecks into a PC. OK, if we had to throw a bit more cash at it, a Core i7-2600K/2700K and its extra threads would really help with the multithreaded task battle. Lack of Hyper-Threading, in fact, is probably the main contributor to the performance delta between this machine and the Tax Refund, and the reason even our elderly (but admittedly far more expensive) zero-point box holds its own in some tests against the Sweet Spot. As it is, the Sweet Spot is from 11 percent to 32 percent slower than

> THE ONLY REASON WE DIDN'T RUN WITH CORE I7-3930K NOW IS BECAUSE OF THE PRICE PREMIUM IT'S FETCHING TODAY

the Tax Refund PC in our application tests. The biggest gap is in Sony Vegas, which is a thread monster.

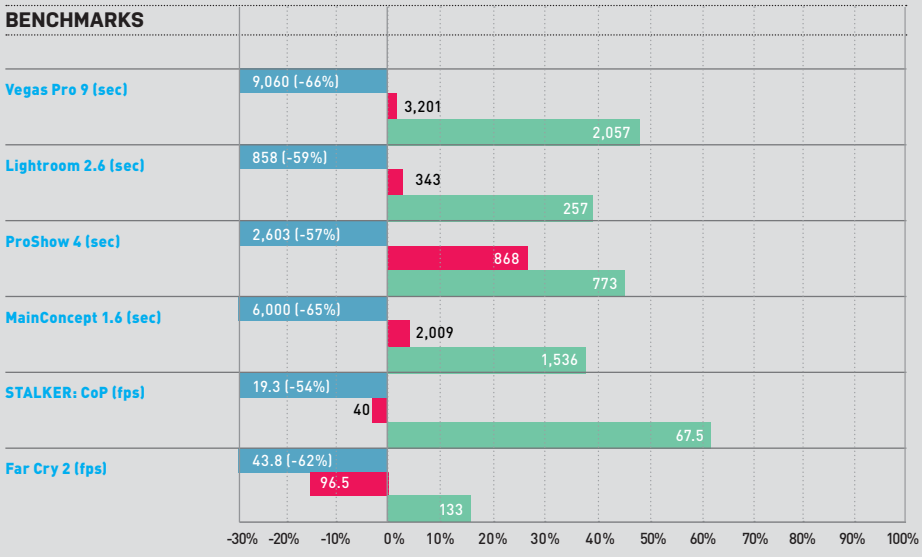
In gaming, it's also a given that a $270 GPU is not going to outbox a $570 GPU. In our STALKER: CoP test, the GeForce 560 Ti 448 was at a 41 percent disadvantage. In Far Cry 2, where it's more about the CPU, the GeForce 560 Ti 448 was only 27 percent slower. What would be a nice step up in graphics for this moderate machine? We'd probably spring for the Sapphire Radeon HD 7950 OC card that's reviewed on page 80. At $480, it's the cheaper alternative to Nvidia's top-end GeForce GTX 580 and not as cost-prohibitive as a full-tilt Radeon HD 7970 card. Beyond that, we'd probably look at amenities such as the same Blu-ray burner used in the Tax Refund PC.

THE TAX REFUND PC

There is no free lunch, and getting performance costs money. If you want a faster computer, you have to pay for it. Thus, it's no surprise that the fastest PC here also happens to be the most expensive. But how much faster?

Compared to the Sweet Spot, the Tax Refund PC gave us up to 47 percent faster rendering times in Sony Vegas Pro 9, as well as 33 percent more speed in Lightroom and 31 percent more out of MainConcept in video encoding. In gaming we saw a 69 percent bump in STALKER: CoP and 38 percent in the more CPU-limited Far Cry 2 benchmark. We also ran an overall 3DMark 2011 on Xtreme and the Tax Refund PC produced 44 percent higher frame rates. Heaven 2.5 saw a 144 percent boost in frame rates. But you know this, man: More money spent on hardware means more performance.

We know what you're thinking, though: What else would we do with this box? Since anyone interested in the Tax Refund PC is already pushing his or her PC pretty hard in content creation tasks, a natural step would be to reach for a six-core Core i7-3930K chip. The only reason we didn't run with it now is because of the price premium it's fetching today. The chip would normally be less than $600 but a mysterious shortage of the CPUs has seen the 3930K selling for more than $725 on the few stores you can even find it. The usual storage updates also apply here, such as a 480GB SSD and 7,200rpm HDD, but those are mostly personal choices. If you're looking for pure fun, filling all eight DIMM slots with 32GB of RAM and running a 24GB RAM disk isn't quite as crazy as it sounds. Those bent on high-resolution gaming at 2560x1600 may want to consider dropping in a second Radeon HD 7970 card.



How much faster or slower is each PC against a top-of-the-line PC from three years ago? We compared each build against our standard zero-point box (it's specs are below). The bars illustrate how each box performs against it.

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

GET THE BEST OF THE CLOUD

BY JAMIE MIDDLETON

WHICH COMPANY HAS THE ONLINE SERVICES AND CONTENT THAT ARE RIGHT FOR YOU?

Cloud computing is no longer the future—it's here. As if you need to be told that! Chances are, you already use web-based email; store some or all of your music, photos, or videos online; and stream movies and TV shows to your living room straight from the Internet. Indeed, we are slowly being encouraged to store less and less of our content on our own hard drives, and instead entrust it to the servers of a few corporate giants. Whether you're uploading photos and movies to Facebook, videos to YouTube, saving and sharing work in Google Docs, downloading music using your iTunes account, or reading books using your Kindle, your details and data are mainly held in the cloud, and it's a trend that's picking up steam. It's going to affect you in other ways, too, as more and more companies—and even government entities—are considering the use of cloud computing to provide the hosting and compute power for their services. Using the cloud is often cheaper, more adaptable, and, surprisingly, more reliable than running their own servers.

There's probably no other area right now where the cloud's potential is more evident than in entertainment. This year has seen many companies competing to offer cloud services to buy, store, and stream your entertainment collections. You aren't just backing up your content to the cloud—you often haven't downloaded it at all. With all your music, films, and books stored on a cloud server, you can stream them to your Internet-connected devices—all you need is a browser to access your entertainment services wherever you are.

So which company should you turn to for your cloud computing services? To whom should you entrust your beloved music, video, and book collections? And what else are these companies planning that will make your life more secure, easier, and stress-free in the future? We've taken a close look at four major players in the burgeoning field of personal cloud services—Amazon, Microsoft, Apple, and Google—to find out which one is right for you, or will be soon.

GOOGLE GOES THE DISTANCE

No other company has embraced cloud computing to the same degree

Samsung's original Series 5 Chromebook didn't make a big splash, but a second gen of browser-based Chromebooks is on the way.

GOOGLE'S OFT-STATED MISSION is "to organize the world's information and make it universally accessible and useful," and what better way to do this than by putting everything online? But nowadays Google isn't just about information—it's also about applications that can store, display, and manipulate that information in useful ways.

Google has been moving everyone onto its cloud web servers for years. If you use Gmail, Google Docs, Google Calendar, Picasa, or YouTube, you are already putting your data onto its cloud servers. With only a login between you and your content on any Internet-connected device, Google can truly lay claim to not only seeing the future of computing as web-based, but actually making it happen.

Google makes no bones about this. The company's approach is summed up by Robert Whiteside, head of Google Enterprise UK, Ireland, and Benelux: "Google is taking a '100 percent web' approach to all our services and solutions, meaning we believe applications will be browser based and hosted in the cloud, rather than in a desktop environment."

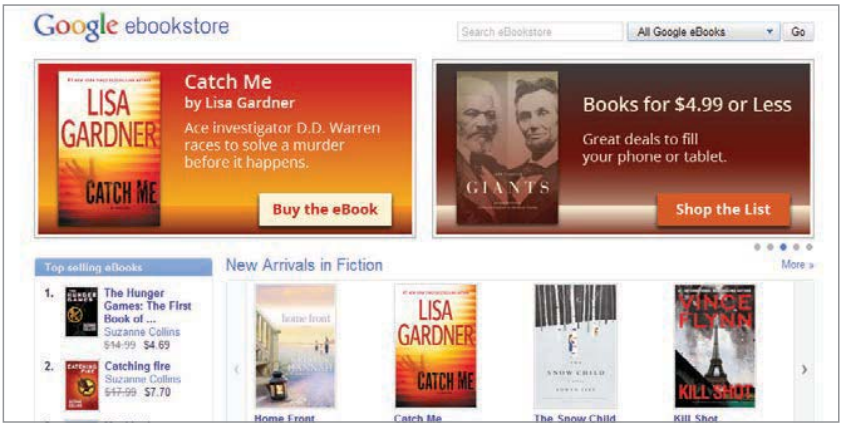
Google's cloud computing is already a success. As Whiteside is keen to point out, "Over 4 million organizations use Google Apps, our flagship cloud product." And that number is increasing by 5,000 companies every day (up from 3,000 a day last year). Google is even stealing the march on companies targeting businesses, with cloud-based collaborative office products that even Microsoft can't match.

Cloud, What Cloud?

Google has been very good at getting ordinary people to use cloud computing without them thinking of it as such. Most people accept the usefulness of Gmail and Google Calendar without worrying that the data contained on these services is saved in one of Google's server farms dotted around the world. Google is so reliable (it has a non-failure rate of 99.948 percent—approximately a mere seven minutes of downtime a month) that people don't even think about backing up their emails or Google Docs to their PCs.

Most companies see the cloud as a backup solution, but Google was one of the first to see further than that. In 2009, Google Docs came out of beta and allowed anyone to create documents in the cloud via a web browser for free. When Google Docs first appeared it was clunky and felt half finished, but now the documents it produces are customizable, shareable, and available to numerous people for editing in real time—perfect for a work or collaborative project scenario. Google has blazed a trail that has left companies like Microsoft desperate to catch up.

It isn't all altruistic, of course. The more



Google sells ebooks from all the top publishers and offers digital editions of millions of public domain titles for free.

THE QUIET CHROMEBOOK REVOLUTION

GOOGLE'S CLOUD COMPUTER IS A SLOW STARTER, BUT IT COULD BE THE FUTURE

If there's ever any doubt which company is the true champion of cloud computing, Google need only hold up a Chromebook running Chrome OS. It's the only company to produce a computer with an operating system that gets almost all its functionality from the Internet. For the Chromebook, Google teamed up with Acer and Samsung to produce low-powered netbooks that, when switched on, are essentially full-screen web browsers that only run web apps. It really is a revolutionary idea—so much so that when the devices were first released, Sergey Brin hailed Chromebooks as a "new model of computing."

Chromebooks have only minimal local storage, so you can't install programs like Microsoft Outlook, Word, or Adobe Photoshop. But, Google argues, why would you need to when you can, and probably already do, use online programs with these functions for your day-to-day needs? Web apps will let you create documents and spreadsheet, edit pictures, and watch movies—all you need is an Internet connection. The simple nature of the Chromebook makes it very fast to turn on, too —in a mere eight seconds you'll be ready to surf the Internet.

We've seen this before, of course. This is the idea of the thin-client: an underpowered computer you could take from workstation to workstation in an office so you can work anywhere, with office servers providing the processing grunt as opposed to the devices themselves. However, here the Internet provides the connection to the servers, making the whole world your office.

Still, the Chromebook's uptake has been very limited. It could be that the world, and the Internet, isn't ready for solely web-connected devices. There are other issues, too. The price of the Chromebook isn't that much lower than a normal netbook, and normal netbooks have the advantage of being able to run all the web apps a Chromebook can, but also let you install other programs onto it. The fact that you always need an Internet connection could also be severely limiting in certain situations.

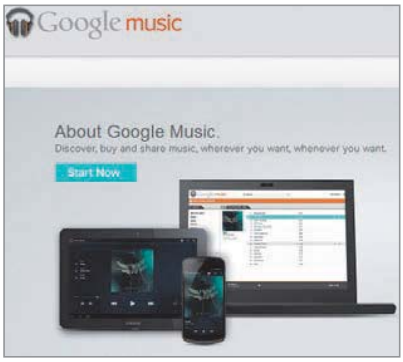
But as working in the cloud becomes more prevalent, so too could the Chromebook. Updates to Chrome OS can be automatically added to the Chromebook via the Internet, ensuring you have the latest version of the OS at all times. As Sergey Brin said at the Chromebook's launch, "Ultimately the most precious resource is the user's time. I think the complexity of managing your computer is really torturing users." The fact that most of the processing is done in the cloud extends the battery life to 8.5 hours, and if you lose your Chromebook, all your data, photos, and files are still merely a login away.

eyes Google gets looking at its web apps as opposed to desktop programs, the more money it can make. Hence the fact that Google has made so many cloud-based apps. The company is adding to the list all the time; for example, there are Google Maps, Google Mail, Google Earth, Google Docs, Google Blogger, Google Site Manager, Google Contacts, and the business offering Google Apps. All these fill a niche, and often provide a free solution, whereas before you would have had to buy a program or do without.

The downside to this is that Google also has a record of letting its less popular services dwindle away. These include Google Wave, Google Buzz, Google Labs, Google Health, and Google Powermeter. This may seem like a sensible move if few people are using them, but it no doubt alienates those who do.

Content Is Key

Google knows that to keep people coming back, it needs to give them access to cloud-based entertainment as well as services—hence new additions like Google Books, Google Music, and the video rentals now available from the Android market and YouTube. Google has always dabbled with content—its ownership of YouTube and Picasa attests to that, as do its projects that aim to digitize books that are out of print and out of copyright, but now it wants you to rent or buy directly from Google, while still keeping the products in the cloud.



The Google Music cloud streaming-music service directly competes with Amazon Music and Apple's iTunes.

With Google Books, the company has made hundreds of thousands of ebooks from the world's largest publishers available for sale online, as well as more than 2 million public domain ebooks for free. These books are then stored in the cloud and accessible via any web browser. A video rental app available through the Android Market lets you rent any of thousands of movies and watch them in any browser at any time within 30 days of purchase, with a 24-hour active period once you hit play. A similar service is available from YouTube.

Google Music (available only in the U.S.) lets you buy from a list of 13 million songs. You can also upload up to 20,000 songs to its online library, and the service will automatically upload any music you add to your computer's music folders. This means you can then play these songs from any device with an Internet connection—you can access your music wherever you go. This service is free, whereas Amazon and Apple charge an annual fee to store music not bought in their stores.

The future is the cloud, and Google has the infrastructure, the money to spend on research, and the vision to ensure it continues providing free apps that are game-changing. It's not only keeping up with the trends in cloud computing, with free and paid-for entertainment, it's ahead of the curve, producing products like Chrome OS that rely solely on the web for their functionality. Google is clearly the one to watch for the future of the cloud, and with Microsoft, Apple, and Amazon following it closely, the need to keep innovating will ensure that Google keeps producing services and content with the potential to forever change how you use your computer.

APPLE'S ANSWER

iCloud is nice—if you're strictly devoted to Apple products

BEFORE STEVE JOBS DIED, he made a very strong statement at the Worldwide Developers Conference keynote in San Francisco. "We're going to demote the PC and the Mac to just being devices," he said. "We're going to move your hub, the centre of your digital life, into the cloud." He was talking about the introduction of iCloud, a service that will automatically update all your Apple documents and iTunes purchases across your suite of Apple devices. Download a track from iTunes on your iPhone and it will be waiting for you on your Mac. Take a picture on your phone and you can show people the result almost instantly on your iPad. Start a presentation in Keynote at home and it will be waiting on your Mac at work. It uses the almost-always-connected nature of these devices in an integrated way. As Jobs said, "Today it's a real hassle and very frustrating to keep all your information and content up to date across your devices. iCloud keeps your important information and content up to date across all your devices. All of this happens automatically and wirelessly, and because it's integrated into your apps you don't even need to think about it—it just works."

There should, however, have been a caveat to this. He was only talking about iOS devices—iOS 5 specifically. Poor old iOS 4 and Snow Leopard users aren't part of Apple's new iCloud gang, and neither are those who don't use Apple's software on their PCs. Apple has always enjoyed ring-fencing its content to its own software and devices, and the iCloud experience is only for the iTunes set. If you have an Android phone, you won't be using these new services any time soon. Similarly, although you can get iCloud support for iTunes on your PC, this isn't the same as just logging in to a browser-based version. You won't be able to listen to your music at work if your IT department won't let you install iTunes on your office desktop machine, for example.

Apple-only Documents

iCloud isn't like Amazon Cloud Drive, Dropbox, or SugarSync, which will let you back up anything. Only files created by iCloud-supporting applications will be synchronized to all your devices. Neither is iCloud as free and easy as other cloud storage apps, which usually offer browser versions that let you download any of your files by logging in to a website. Although there's a website for Apple's service at **www.icloud.com**, this just lets you see your mail, contacts, and calendars. You can't stream your entertainment content from the site—it's more of a backup for when things go wrong, giving you access to Apple's Find My iPhone service or merely letting you use the site to upload documents created on iCloud-enabled apps like Pages, Numbers, and Keynote but not edit them online.

Of course, if you only use the latest Apple devices, these issues won't worry you and iCloud will be a fantastic free extra that puts the cloud to work for you. Some of the services are really fun and useful. Take Photostream, for example, the newest version of which takes the last 1,000 photos from your Apple device, saves them online for you to see on iCloud, and downloads them to all your devices when you switch them on. iCloud will also let you pause supported games on your iPad and then continue them later on your iPhone.

The free 5GB of iCloud storage for mail, documents, and other backups isn't to be sneezed at, although it's not as generous as some other companies' offerings.

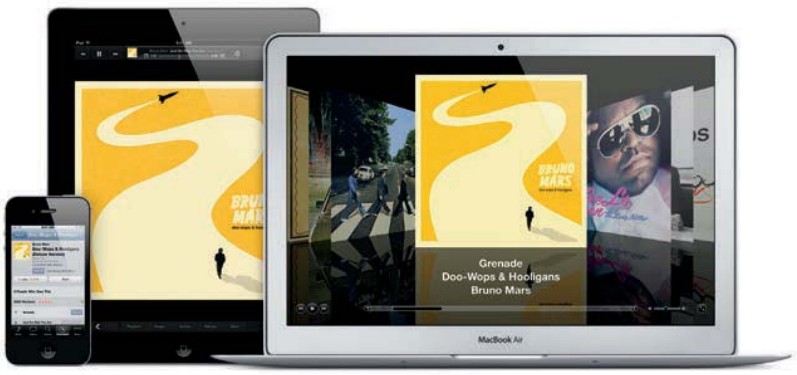
That said, this limit isn't affected by any content bought from iTunes, so your Apple-bought music, apps, and books are stored separately. Photostream photos don't count toward this 5GB, so the offer is more generous than it first seems.

Your Music in the Cloud

iTunes in the Cloud lets you redownload previously purchased content on to your newer gadgets at no additional cost, so everything you've bought is available on all your devices.

iTunes Match will scan your entire iTunes library and replace each song not bought via

iCloud lets you access anything you've bought on iTunes from any of your Apple iOS 5 devices.



With iTunes in the Cloud, you can redownload previously bought content.

iTunes (music you have ripped from a CD, for example)—even low bitrate versions—with 256Kb/s, DRM-free AAC versions. These can then be downloaded or streamed to all your other iOS 5 products, basically putting your entire music library onto all your Apple devices. iTunes Match is a subscription service. Unlike Google Music, which is free, Apple charges $25 annually to upload and store music not purchased through iTunes. On the other hand, it's a very fast service compared with Amazon and Google's offerings—backing up your entire collection will take hours rather than days. No song is excluded, either; you can manually upload any song not listed in the 20 million–strong iTunes library.

Another unusual thing about iTunes Match is that Apple has obtained permission for the service from all the major music labels. Google and Amazon have gone for a more "suck it and see" approach, describing their services as hard drives in the cloud and not seeking permission for the content—or only striking deals with some labels. Google and Amazon argue that the tunes are just data, but it could be said that Apple is on a more sound legal footing. It wouldn't be fun to upload your collection to Google or Amazon and then have access denied due to a legal ruling.

The Death of MobileMe

It's no secret that Apple has a poor record when it comes to cloud computing. iCloud started as iTools in 2000, and became a much-mocked subscription service called MobileMe in 2008. MobileMe is now being discontinued, to the chagrin of some dedicated users, with subscribers being transferred to iCloud. They are gaining all its new services, but losing some older MobileMe-only ones like the Gallery, iDisk, and iWeb publishing services.

Although iCloud is a revolution compared to these earlier offerings, Apple still isn't exploiting the full power of cloud computing. For Apple it's all about the content—movies, TV, books, and music. Microsoft and Google are all about online collaborative services, where people use the cloud not just for synching, but for shared document creation online, while Apple has stuck to using it for content delivery. The cloud means you no longer have to plug your iPad into your Mac to update it—it happens automatically and out of sight. This is admirable, but leaves a big hole in its functionality. Where are the online versions of Pages, Notes, and Numbers? Why can't people collaborate on these programs using the cloud? Anyone who needs this kind of service has to go to another company for it, and that may yet be to the detriment of Apple.

In fact, it's already starting to show—Microsoft boasted that in November 2011, Hotmail was being used on 2 million iOS 5 devices, and was growing by 100K users per day. This may change once the full impact of iCloud is felt, or may be due to legacy use as more people switch to Apple from Microsoft devices, but Apple should be worried that people are sticking to its competitors' services.

A Restricted Hard Drive

At the iCloud launch, Steve Jobs noted that "a lot of people think the cloud is just a hard drive in the sky." Clearly a lot of people do, and with iCloud, Apple has challenged this idea by using the service to store Apple-only documents. Integration is key to true cloud computing; no one company can provide everything you want to do on a computing device. There has to be an opening for other companies' technologies, or people start to look elsewhere for a less restrictive service.

This is a common complaint leveled at Apple. The cynical see iCloud as just another way to encourage people to buy more Apple devices, but is that really any different from the restrictions demonstrated by Amazon's Kindle Fire, or the bundling of all of Google's services from your Google home page? Admittedly, the limits are a lot more delineated with iCloud, but if you have more than one iOS 5 device, there is little doubt that the convenience offered by iCloud and its associated services will be very attractive. If you only use Apple hardware and software, iCloud will give you everything you need.

WHAT WILL iTV BE?

EXPECT VOICE AND GESTURE-CONTROLLED CLOUD-BASED ENTERTAINMENT

Rumors about a new smart TV from Apple began flying after a mention of it appeared in Steve Jobs's biography. He reportedly told his biographer, "I'd like to create an integrated television set that is completely easy to use. It would be seamlessly synched with all of your devices and with iCloud. It will have the simplest user interface you could imagine. I finally cracked it."

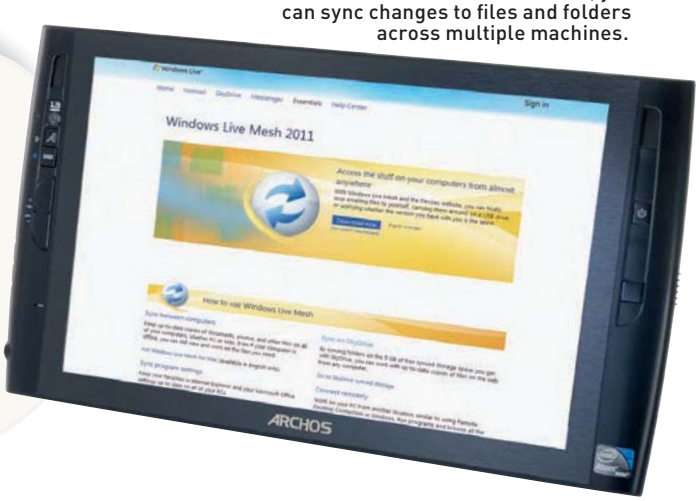
It's no secret that Apple wants to repeat its success with music players, phones, and tablets. Television is the last screen-based medium it has to tackle, but the company has always said that in order for TV to work the way Apple wants, it would have to be re-created from the bottom up. There are hints that such an undertaking is underway, with some reports claiming that Apple has already started the manufacturing process for the screens, and that a TV could appear as early as 2012.

The rumor mill has it that the "iTV" will be voice-controlled, no doubt using Siri-like technology, letting you change channels, move through an image gallery, and access functions like answering phone calls and editing videos. There's also evidence that it may be gesture-controlled, revealed in an Apple patent detailing a "real-time video process control using gestures."

An Apple TV device already exists—a tiny cloud-based box released four years ago, which Apple described as "an easy-to-use and fun way to wirelessly play all your favorite iTunes content from your Mac or PC on your widescreen TV, including movies, TV shows, music, photos, and podcasts." It never really caught on, but if Apple can create a simple and elegant TV to match the iPhone and iPad, its customers will never need to use anything else, leaving the company in a very strong position, indeed.

MICROSOFT MAKES UP GROUND

It's got the business and personal cloud apps, but is it doing enough with entertainment?



With Microsoft's Live Mesh, you can sync changes to files and folders across multiple machines.

MICROSOFT HAS A HISTORY of leading the field with cloud services, having launched MSN Messenger back in 1999 and Hotmail in 1997. Back then, getting a service like email for free was surprising, and for the average person, the ability to access email from any Internet-connected computer was groundbreaking. In fact, because of this, Hotmail was launched on July 4, Independence Day, to highlight the fact that it offered you independence from ISP-based email.

Those days are long past, and Microsoft has spent years playing catch-up with other cloud services, like those offered by Google. Microsoft originally dismissed the likes of Google Docs as nothing to worry about, but that is clearly not the case. Microsoft has stepped up its game in the last few years and may yet be a cloud computing force to be reckoned with.

Being last to the party isn't always a bad thing, especially if you happen to own the suite of office applications used by most of the world. Google may have made inroads into that audience, but people have trusted Microsoft with their office documents for decades. All Microsoft needs to do is offer the functionality that makes Google Docs so attractive, but designed to look like a trusted product.

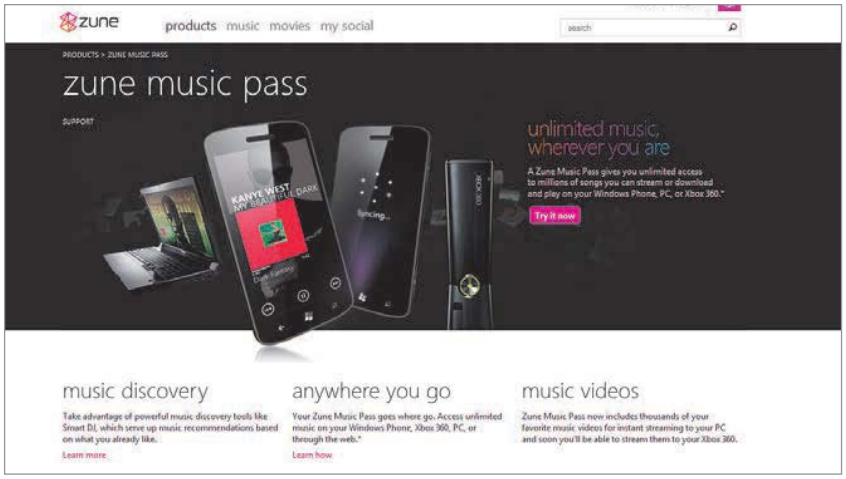
Office Online

This is where the paid-for versions of Microsoft 365 and the free personal consumer service SkyDrive with Web Apps come in. Microsoft 365, launched in June 2011, is the latest version of the clumsily named Business Productivity Online Suite (BPOS). It's a subscription-based online version of Microsoft Office, offering online collaboration and document sharing for businesses. Microsoft 365 is Microsoft's answer to Google Apps, albeit a more expensive one. There aren't a lot of figures available for its uptake yet, but in November 2011, Office division chief Kurt DelBene said, "We are seeing positive momentum for Office 365. Customers are adopting Office 365 eight times faster than our previous service, and it's on track to become one of the fastest growing offers in Microsoft's history."

Of more interest to the ordinary user are SkyDrive and Live Mesh. SkyDrive has been around since 2007, and offers 25GB of free online storage via Windows Live. It also lets you use Web Apps—cut-down versions of tools like Excel and Word—to collaborate online with others in the creation of Office documents. However, Web Apps don't offer the real-time collaboration that Google Apps do. For example, you won't see characters on the screen as people type them; instead you're frozen out of the piece of the document where someone is typing, and you can only see those changes once that person hits save and you refresh your screen.

But the actual look of Web Apps is one most of us are used to seeing in Office. It takes a lot of effort for people to learn new icons and new styles, so Microsoft still has the upper hand, at least in the familiarity of its product.

Live Mesh is a handy free service that lets you sync your files across multiple PCs and locations. Just download the Live Mesh client onto each PC you use, assign the folder you want to sync, and whatever changes you make to documents in that folder will be automatically synched to your SkyDrive and to the other PCs in your "mesh" when they are switched on.



Zune Music Pass lets you stream music and music videos to devices like Windows Phone 7 phones, Xbox 360s, PCs, and Zune MP3 players.

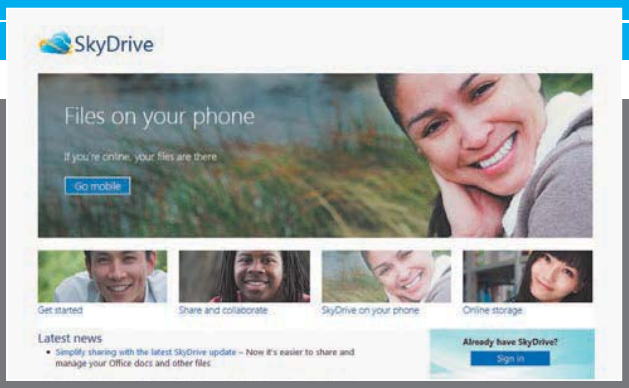
THE FUTURE OF SKYDRIVE

SKYDRIVE FUNCTIONALITY IS BEING BUILT INTO WIN 8, AND MAY BECOME PLATFORM AGNOSTIC

Microsoft is determined to make cloud computing work with the development of SkyDrive, its online storage service. This is probably because it is planning to integrate SkyDrive functionality into Windows 8, in much the same way Apple has integrated iCloud into iOS 5. However, here the emphasis is on services and storage rather than content, and Microsoft has been working hard to get SkyDrive ready in time. "SkyDrive has been around since 2007, and was simply not built for the modern web," said group program manager Omar Shahine on the Windows blog in June 2011. "Browser modernization has really opened up the window for us to rethink and re-architect how we build our websites."

Shahine sees SkyDrive as a "file cloud," or put another way, "a file-centric view of cloud storage presenting your information to you in a traditional file- and folder-based metaphor." Basically, this means it looks like a normal file browser, but online. Shahine wants to use all the latest web tools to make SkyDrive's user interface as functional as possible yet still pretty, to mirror the look of a typical Windows application.

To achieve this, Microsoft has reinvented SkyDrive using HTML5 and CSS3, providing an interface not usually present in cloud services. "We took advantage of modern browsers and HTML5 to make SkyDrive faster, easier to navigate, and more beautiful for viewing photos," said Shahine. "We got the chrome out of the way to let your photos fill the browser. We added tasteful animation using CSS3 that brings photos to life and presents them in their original aspect ratio, and with the new best-fit grid your pictures are laid out so you can see them all, even panoramas." Microsoft has even done away with the advertising pane to allow more file information to be seen by the user.



There are big changes in store for SkyDrive, but can Microsoft do enough to make it more attractive than its competitors' offerings?

Other functionality has been added, too, so you can pin SkyDrive to your IE9 taskbar, giving you access to its contents from the browser. You can also save documents to your SkyDrive directly from Office 2010.

Perhaps most exciting is what Microsoft has planned for SkyDrive in the future. In addition to the 25GB of free online storage (a move that mirrors Apple's iCloud offering), there are rumors that Microsoft is on the cusp of offering unlimited capacity on SkyDrive for your photos and Office documents. A Microsoft job posting also hints at SkyDrive and its products soon being available outside the Microsoft fold. If the description of the developer post is anything to go by, apps may be developed for SkyDrive clients for Windows, iOS, and Android. This may mean that Microsoft is finally understanding that non-device-specific sharing and streaming is what true cloud computing should be all about.

Despite these steps, SkyDrive still has a way to go before people will be totally happy with it, especially when store-and-sync online services like Dropbox and SugarSync don't have any of SkyDrive's problems, such as limits on the number of files you can move or delete at a time, or the 100MB size limit on files when you are meant to have 25GB to play with. However, with Microsoft and the product development team behind the service making the right noises, it may well be one to watch in the future.

All Work and No Play

Increasingly, Microsoft is being seen as the business side of cloud computing, but if Apple and Google let you work as well as play, Microsoft could soon find itself left behind. Not that it doesn't have entertainment-streaming cloud services—Zune Pass is a cloud-based evolution of Microsoft's Zune media players, which were designed as the company's answer to the iPod. It's a subscription-based service that lets you stream music and music videos to devices like Windows Phone 7 handsets, Xbox 360 consoles, Windows PCs, and Zune MP3 players. It lets you download TV programs and rent videos, too.

At Zune's launch in 2010, Craig Eisler, corporate vice president of Microsoft's Interactive Entertainment Business Group said, "The integration between Zune, Windows Phone 7, and Xbox Live is an exciting advance in our entertainment offering. Zune enables users access to the entertainment they want, wherever they want it—and now, more people than ever will be able to enjoy the freedom and flexibility that the Zune service offers."

Well, not quite wherever they want it. Zune can only be used on four Microsoft devices and doesn't support Android or iOS. Although there is an online version of the service at **www.zune.net**, it doesn't work in a web browser—you need to be on a machine with the software installed. It's expensive too, costing $9.99 a month for the music streaming service, with an extra charge for TV and video rental.

Xbox Live without the Xbox

Microsoft has other online content available via Xbox Live, letting you watch movies and TV using your Xbox 360 or Windows Phone 7 handset. It hasn't taken these technologies fully into the cloud, but there are rumors that Xbox Live may be integrated into Windows 8. Speaking to the *Seattle Times*, Microsoft vice president Mike Delman said, "Live has been successful on the Windows Phone. Live will be built into the PC. It will be the service where you get your entertainment."

There are more developments coming for Xbox Live. According to some sources, Microsoft's developers are looking at services like OnLive, which prove that high-powered gaming can be delivered to mobile devices over the Internet, and may be planning something similar. As Microsoft cloud developer Brian Prince said at the GDC China conference, "You will be seeing things in the Xbox platform that are cloud-specific. I'm already doing it, it's really exciting, but I can't tell you about it or else I'll get fired."

So the future of cloud computing could be rosy for Microsoft, even if its present isn't much to shout about. We aren't writing off Redmond just yet, but we would probably look elsewhere for most of our cloud services at the moment.

THE AMAZON WAY

From retailer to cloud pioneer to major player in content streaming

Amazon's Kindle Fire puts all of the company's digital content within easy reach of consumers.

AMAZON HAS A STRONG track record in the sphere of cloud computing, and is rapidly expanding its online services in the U.S. No longer just an online shop, albeit a huge one, Amazon is diversifying into areas that could help you enjoy online services that are better than, on a par with, or totally unique from the biggest players in cloud computing. Today it's one of the largest providers of cloud services in the world, challenging the likes of Google and Apple, and even beating them to the punch by launching new services like its music-streaming Cloud Player. It's also championing a cloud-powered web browser called Silk, which uses Amazon's servers to load web pages so your device doesn't need to.

Amazon could easily own cloud computing in the future, in much the same way it has in the past. It was one of the first major companies to open up cloud computing to the masses more than nine years ago. This wasn't through cloud services like webmail or online document creation, but by renting out storage space and raw computing power. In 2002, with Amazon Web Services (AWS), the company opened up the power of its unused servers to companies and individuals. It made sense—why should the company pay for all the server space and processing power that wasn't being used when there was a desperate need for it by others?

Later it refined this offering with Amazon EC2 (Elastic Compute Cloud), which allowed anyone to rent Amazon's spare server capacity by the hour. This is a truly adaptable service that lets companies expand and contract to match demand for their services without having to pay for extra servers that may be redundant the following month. It's a flexible service that saves people money as customers are only charged for what they use, and its adaptability means businesses can grow in line with their needs without costly infrastructure investment. Despite concerns about storing private or business data in the cloud, EC2 has grown at an astonishing rate.

Cloud Outage

In fact, some people's fears about the reliability of the cloud were apparently realized in April 2011 when an Amazon outage closed many sites, including Foursquare, Reddit, and Quora, some of which were down for days. Amazon released this statement after the outage: "We know how critical our services are to our customers' businesses and we will do everything we can to learn from this event and use it to drive improvement across our services."

We're only in the first few years of the major uptake of cloud computing, so there are likely to be more teething pains, and there seems to be little you can do about them other than having a backup system of your own—which does seem to defeat the purpose of using cloud computing. Tellingly, no cloud computing firm currently offers insurance against lost data. Despite this, a global study carried out by IBM in 2011 found that more than 60 percent of organizations plan to "embrace cloud computing over the next five years."

But Amazon isn't all about business and web development. In 2011 it extended its cloud computing reach to include other, more personal services. It's catching up with (and even overtaking) the other big cloud players like Google and Apple by offering online video streaming through Instant Video, online book offerings through the Kindle, music streaming through its new Cloud Player, vetted apps through its Android app store, and personal online storage through its Cloud Drive service.

Amazon Is on Fire

The company has also released a modified Android tablet in the form of the Kindle Fire, which lets users store purchased media like books, films, music, and apps in the cloud, and access them on Amazon mobile devices. Amazon is cementing its journey from an online store to an entertainment destination. It has embraced this challenge in a big way, not only providing places for content to be streamed from, but even creating its own content—it has become a publisher of its own books.

This could change publishing forever, with fewer intermediate steps between author and reader. As top Amazon executive Russell Grandinetti told the UK *Times*, "The only necessary people in the publishing process now are the writer and

reader." With the release of Amazon Music Player in the U.S., there's speculation it may soon do the same with music.

Amazon is muscling in on the turf of Apple and Google, and it's going about it in a very competitive way. Amazon is so keen to get you using its cloud services to buy its online content that it's even willing to subsidize the cost of its device to get you using it. The Kindle Fire costs over $10 more to make than its $199 price tag. In much the same way that Sony and Microsoft subsidize their game consoles in the hope they will recoup their money on games and services, Amazon has brought out a very low-cost tablet that is so integrated with the shop's selection of books, music, and other content, you may never need another media provider.

Amazon's Cloud Drive gives account holders 5GB of free space to back up important files.

Let's Go to the Movies

Amazon's first foray into cloud entertainment was with Amazon Unbox in 2006, which allowed users to rent and purchase movies and television shows over the Internet. That service was later renamed Amazon Video on Demand in 2008, and now bears the moniker Amazon Instant Video. Amazon further upped its presence as a cloud entertainment provider when it began making free online streaming of select TV shows and movies part of its Amazon Prime subscription service. Prime initially offered members just free two-day shipping on Amazon.com purchases, but now throws in unlimited access to a growing catalog of digital video content, as well as the ability to borrow one free Kindle book a month. Prime members pay $79 a year, but as with the Kindle Fire, Amazon is incurring a loss, to the tune of $11 per member annually, according to a recent article on Time.com. So what does Amazon get in return? For one thing, it has helped Amazon's streaming service get noticed amid Netflix' near-total dominance—even more so after Netflix began charging its subscribers extra for streaming content, sending many of them looking for an alternative. As Netflix learned, but then forgot, the value-add of getting something extra for free is a powerful tool in building customer loyalty. Furthermore, once a customer is perusing Prime's library of free video content, they're a mere click away from the far more vast selection of TV and movies available through Amazon Instant Video proper, where content is available for sale or for rent. The situation in similar for the Kindle book loan.

Cloud Music

When it comes to streaming music from the cloud, Amazon was a surprise early adopter. It beat Google and Apple by releasing Cloud Player in March 2011. It's an impressive service, letting users back up pretty much their entire music collections to Amazon's servers. Users can then access it from computers and Android devices. As Amazon's vice president of music and movies Bill Carr said, "Our customers have told us they don't want to download music to their work computers or phones because they find it hard to move music to different devices. Now, whether at work, home, or on the go, customers can buy music from Amazon MP3, store it in the cloud, and play it anywhere."

Amazon account holders in the U.S. can get Cloud Player free with 5GB of storage, but if they buy an MP3 album from Amazon the storage allotment increases to 20GB. Music bought from Amazon doesn't count toward your storage limit.

So how does Amazon license the music stored on Cloud Player? Simple—it doesn't. As Amazon's director of music Craig Pape explained, "We don't need a license to store music. The functionality is the same as an external hard drive." Amazon's Cloud Drive was introduced at the same time as Cloud Player. It gives U.S.-based Amazon account holders 5GB of online space free, allowing them to back up their most important documents and photos to the cloud.

So is Amazon the future? There do seem to be gaps in its online offerings. For example, there are no email services or online apps for the creation of spreadsheets or documents. But when it comes to online content, it has most bases covered.

AMAZON SILK BROWSER

IT USES THE CLOUD FOR THE HEAVY LIFTING INVOLVED IN SURFING THE WEB

Cloud computing has the power to turn underpowered devices into lightning-fast PCs by doing the processing in the cloud and then displaying the results on your screen. This is already turning the world of gaming on its head with the introduction of Microsoft's OnLive, but now Amazon has applied it to web browsing. Released with the Kindle Fire, the Amazon Silk browser builds on a concept first seen in Opera—preloading the contents of commonly browsed pages on Amazon's servers to avoid putting strain on the device doing the browsing. Silk can also decide how much work to do for you. If it notices you're in an area of low Internet bandwidth, it will push more work onto Amazon's servers.

What's more, typically, when loading a web page containing numerous components like ads, videos, Flash, and so on, it takes a little while for the page to load, as each request for each service or process has to load before the next one can be dealt with. Because of the vast cloud computational power behind Amazon's browser, instead of waiting for one request on a web page to finish loading before starting the next, Amazon Silk can load all the processes simultaneously. It will also remember the experience of other users going to the same page, and will provide the end result of the process direct to you rather than reinitiating the process for your request.

There are concerns, however—when a company as large as Amazon is so closely monitoring the surfing habits of its users, it naturally raises questions about just what data the company will keep once it has a log of exactly what each user is looking at on the web every day, and in what ways that data will be used.

AMD's 3D GAMBIT

AMD enters the stereoscopic 3D arms race with its HD3D technology

BY MATT HANSON

STEREOSCOPIC 3D might not be to everyone's tastes, but it's certainly a lucrative business. For the past few years Nvidia has enjoyed a virtual stereo-3D monopoly on the PC with its 3D Vision technology, but AMD has belatedly entered the ring with its own technology called HD3D.

For those folks who have heavily invested in Nvidia's technology, it might be too little, too late. But AMD's new offering introduces a number of innovations that make it worth considering—even if you think stereo 3D is just an expensive way to get a headache.

OPEN PLATFORM

The biggest attraction of HD3D is AMD's commitment to making it an open platform that supports many different standards. Unlike Nvidia's approach, where you're tied to Nvidia 3D Vision–certified hardware, HD3D's open ecosystem should allow for a more diverse choice.

It's pretty encouraging that AMD seems to have identified one of consumer stereoscopic-3D's biggest problems, and the reason why so many of us have so far held back from embracing stereo 3D: the vast and confusing array of incompatible 3D standards. If AMD's mission with HD3D is to allow us to buy 3D hardware from various different manufacturers, without us having to worry whether it will all work together, that can only be a good thing for us consumers—and might lead to more of us setting up our rigs for 3D.

HOW IT WORKS

When it comes to three-dimensional gaming, the bulk of the stereo horsepower comes from the HD3D driver. The driver uses a quad-buffer to produce stereo 3D. Usually, with non-stereo 3D graphics (monoscopic), the driver uses double-buffering. This is where the GPU renders content to one specific place in memory, known as a buffer. At the same time, a second buffer is used to deliver the display output of the GPU to a monitor or other display. Quad-buffering essentially doubles this, producing two images—one for the left eye and one for the right—for every frame generated.

AMD's Direct3D engineering team produced an API that supports OpenGL and DirectX 9, 10, and 11. AMD's open approach allows middleware partners, such as DDD and iZ3D to convert games from monoscopic to stereoscopic. This takes some of the pressure off AMD to ensure games are compatible with HD3D and has led to an already impressively long list of compatible games.

LAUNCHING INTO HD3D

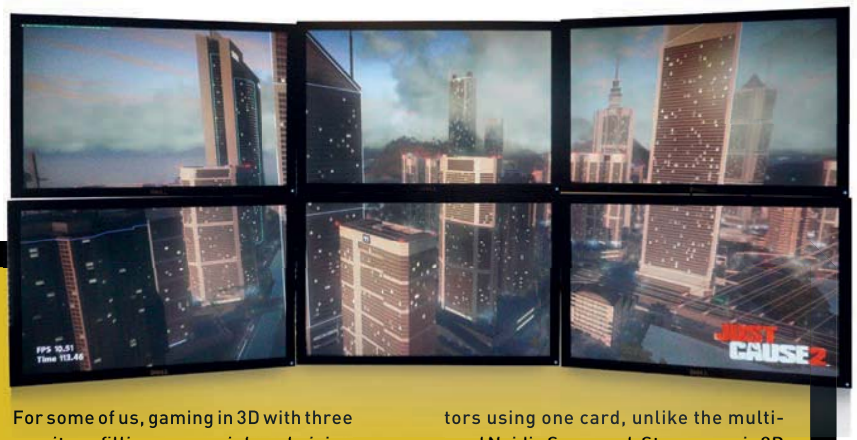
If you want to set up HD3D, the first thing you need to do is to make sure you've got a supported Radeon graphics card. The ATI Radeon HD 5000 series using Catalyst 10.10 or later and AMD Radeon HD 6000 series or above are compatible. You can also use HD3D if you have an HP Envy 17 3D with an ATI Mobility Radeon HD 5850, an MSI Wind Top AE2420 all-in-one with ATI Mobility Radeon HD 5730, or a Lenovo IdeaPad Y560d with an ATI Mobility Radeon HD 5730.

You'll also need a 3D-capable display, such as a 3D monitor, TV, or projector. There are plenty of supported devices—for a full list, go to bit.ly/zSso0i. If the display is a 3D TV or a 3D projector, then it needs to support HDMI 1.4a, and you'll need an HDMI 1.4a cable. Unless you can afford a glasses-free 3D display, you'll need the chunky eyewear, too.

You'll also want DDD's TriDef 3D for AMD HD3D driver, or the iZ3D 3D driver for 3D gaming. Thanks to AMD's partnership with the middleware driver makers, you can get 50 percent off either driver if you have HD3D-compatible hardware. Make sure you have the latest AMD Catalyst 10.10 software or later from AMD's website.

Install either the DDD TriDef 3D or iZ3D drivers and select either "AMD – AMD HD3D Technology (HDMI 1.4a)" or "120Hz 3D Devices." You'll then need to set your desktop resolution to 1920x1080, 24Hz or 1280x720, 60Hz. Using either TriDef 3D or iZ3D you need to select the game profile and point the software to the game's executable file, and then launch the game itself from inside the 3D software.

AMD has outsourced a lot of the work involved in creating compatible games to the third-party middleware companies iZ3D and DDD. Headline games include Call of Duty: Modern Warfare 2, Mass Effect 2, and World of Warcraft, and are included in a growing list of compatible games. You can be pretty confident that the biggest new releases will be compatible, but for a full list of compatible games go



MULTI-SCREEN 3D

Immerse yourself in gaming over multiple 3D monitors

For some of us, gaming in 3D with three monitors filling our peripheral vision is the ultimate experience. If you want to achieve this higher plane of gaming existence, you currently need to use Nvidia's 3D Vision Surround.

For this you need from two to four 3D Vision–compatible Nvidia GeForce GTX cards in SLI mode or a single dual-GPU card. Nvidia's multiple-GPU solution provides the graphics power necessary for producing stereo 3D over three displays.

AMD's Eyefinity initially looks a lot cheaper than this—you can display monoscopic content over three monitors using one card, unlike the multi-card Nvidia Surround. Stereoscopic 3D content, on the other hand, proves more of a problem—the resources needed to display 3D content on three screens is too much for a single card. At the time of this writing there's no official support for HD3D using AMD Eyefinity. This may change, but for the time being AMD's reliance on third-party drivers and open standards means there are some workarounds to get stereo 3D on multiple monitors, but their results aren't consistent. For the time being at least, Nvidia's tech is still the way to go.

You'll need *at least* an HD 6870 videocard to play the latest games in stereoscopic 3D.

to the iZ3D (www.iz3d.com/games) and TriDef websites (bit.ly/ rBmQCo).

It's not all down to third parties, though. AMD is working directly with game developers on native support for HD3D. This year AMD teamed up with Eidos to support native stereo 3D in Deus Ex: Human Revolution. This meant that Eidos rendered images for both the left eye and the right eye in game, and was able to utilize HD3D's quad-buffer without the need for middleware. Hopefully, as the HD3D standard gains popularity, more games will include native support as they are released.

So how does AMD's plucky little David compare to Nvidia's Goliath? In terms of performance and raw power, Nvidia's head start in stereo 3D certainly gives 3D Vision the edge. HD3D's reliance on the HDMI 1.4a specification leaves it with a maximum TMDS throughput of 10.2Gb/s, allowing for 1080p gaming at 24 frames per second for each eye, or 720p at 60 frames per second. This is a lot lower than 3D Vision Surround's dual-link DVI connection capable of resolutions up to 5760x1080 over dual monitors. AMD hopes that as more new monitors begin to support DisplayPort 1.2, HD3D will be able to get around HDMI 1.4a's limitations with a bandwidth of 17.28Gb/s—enough for 1080p at 60 frames per second per eye.

HD3D VS. 3D VISION

AMD's embrace of open standards really sets HD3D apart from Nvidia's 3D Vision. Not being tied to specific hardware and standard restrictions gives us far greater scope to build a 3D-capable rig that meets our needs. It can also be more cost effective—not only can we shop around for the best components at the best prices, we can also avoid some of the hidden costs associated with Nvidia 3D Vision. You don't need a proprietary 3DTV Play driver to play 3D Blu-rays, and you don't have to rely on expensive USB emitters. You do need to pay for third-party middleware drivers, though.

Still, there is enough potential in HD3D to get us excited about its future, and to cause Nvidia some concern over 3D Vision's future.

SPEC'ING OUT YOUR SETUP

Know what to buy for your 3D purposes

As we've mentioned, one of the biggest selling points of HD3D is its flexible support of open standards, which gives you far greater choice when it comes to the gear you use with it. This can also work out to be cheaper if you scour the Internet for the best prices. Of course, this much larger range of compatible products means that you need to think hard about what you want to use HD3D for, and pick the right products that suit your needs.

If you're going to use HD3D for 3D gaming, then you're going to want to shop for a card that's beefy enough to handle the latest releases in stereo 3D, like the Radeon HD 6870 or better. For best results with PC gaming, you'll also want a decent 3D monitor—and make sure it has DVI, HDMI 1.4a, or DisplayPort 1.1 inputs. You'll need some compatible 3D glasses, too—visit bit.ly/zSso0i for a complete list of options.

If you're planning to use HD3D for 3D media, then you'll need to seek out a decent graphics card that can support large displays like HDTVs, and it needs to have an HDMI 1.4a output. You'll also need a compatible 3D TV or monitor, as well as the chunky glasses. Your PC must have a Blu-ray drive installed to watch Blu-ray 3D films, and you'll need software such as CyberLink PowerDVD 11 in order to read the disc.

WHITE PAP

BY BILL O'BRIEN

Molybdenite

This mineral could lead to breakthroughs in integrated circuit manufacturing

The three primary and interrelated goals in the design and manufacture of microchips are to render them faster, smaller, and less expensive. As transistors get smaller, electrons have shorter distances to travel, which makes the chip faster. And as chips get smaller, more of them can fit on a single silicon wafer, which reduces the cost of each chip.

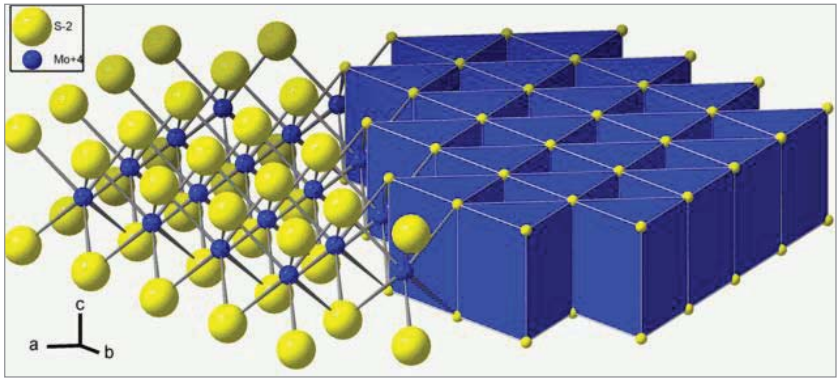
The roadblocks to those objectives are heat (the result of electrons traveling at higher speeds) and, perhaps surprisingly, Moore's law, which predicts that the number of transistors on an integrated circuit will double every 18-24 months. The raw materials and the manufacturing processes in use today are struggling to meet those challenges, but a common mineral called molybdenite could be the great electronic hope.

MOLLY-WHA?

The appearance and texture of molybdenite (it's pronounced muh-lib-duh-not) leads many observers to mistake it for lead or graphite. In fact, it wasn't recognized as a distinct mineral until 1778. For the next 100 years, molybdenite was used primarily as a source material for molybdenum, which is used to harden metal. During World War I, for example, one-inch-thick molybdenum steel armor plating proved to be as effective as three-inch-thick manganese steel armor plating on British tanks.

In the modern electronics industry, silicon layers must be at least two nanometers thick to be effective (any less and surface oxidation begins to compromise the material's electrical properties). A layer of molybdenite can be as little as three *atoms* thick while remaining completely stable and controllable. According to Andras Kis, director at the Laboratory of Nanoscale Electronics and Structures (LANES) at EPFL (École Polytechnique Fédérale de Lausanne), molybdenite transistors are also more efficient, as they "can be turned on and off much more quickly, and can be put into a more complete standby mode."

Molybdenite has the added attraction of being abundantly available as a mineral here in the United States and elsewhere throughout the world.



Molybdenite's crystalline structure is similar to that of lead and graphite; unlike those minerals, molybdenite has the potential to replace silicon in the manufacture of integrated circuits.

WHAT MAKES MOLYBDENITE SPECIAL?

Last year's monarch of the microchip appeared to be graphene, a multitalented substance with the promise of applications across several genre of electronics stretching from chips to monitor screens (you can read more about it at bit.ly/wo88jY). While molybdenite can be processed using the same "sticky tape" method as graphene, molybdenite appeared to offer little-to-no additional advantage over graphene, so it lolled in the scientific outskirts.

That all changed when Kis and other scientists at the EPFL announced a breakthrough: "We have [improved] our molybdenite fabrication technique to make working transistors that can be turned on and off at reasonable single-digit voltages," said Kis. "We have also shown that we can incorporate some advanced features like high-k dielectrics—for example, HfO2, the material used in Intel processors today—and turn the transistor off using a local gate."

Neither of these features provides any unique insight beyond demonstrating the potential of molybdenite compared to graphene. The key distinction is that molybdenite can

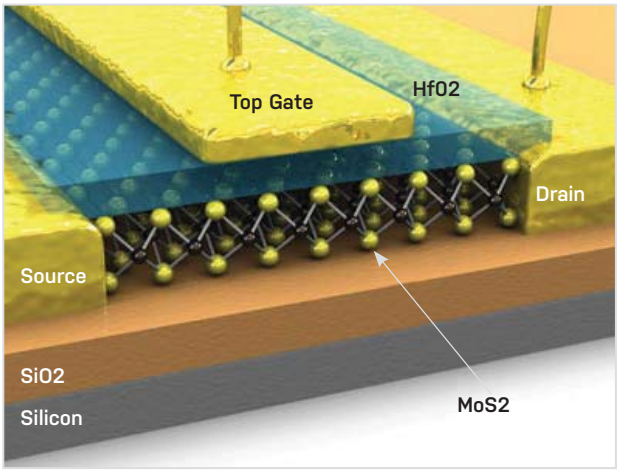
ER

> A LAYER OF MOLYBDENITE CAN BE AS LITTLE AS THREE ATOMS THICK WHILE REMAINING COMPLETELY STABLE AND CONTROLLABLE

be used to create a direct-bandgap semiconductor, while graphene has an indirect-gap design that must be engineered around. (With a direct-bandgap device, there is a straight path between the conduction and valance bands, which allows an electron to emit a photon directly. An indirect-bandgap prohibits photon emission because the electron must first pass through an intermediate state that causes a loss of momentum.)

That's important because solar cells, LEDs, and other photonic devices are easier to build when the device can exploit a direct-bandgap structure. As an indirect-bandgap substance, graphene simply doesn't have a desirable semiconductor profile, no matter what future applications it might have. While you can create a bandgap in graphene by slicing the material into thin ribbons, or by applying an electrical field to bi-layer graphene, that's a complicated process that will add to the cost of manufacture and ultimately to the price of the finished product. Molybdenite doesn't require that process, which should render it more cost effective than graphene.

Hardly a year has passed since graphene was crowned the electronics industry's wunderkind, so it might be premature to pronounce molybdenite its successor. But the ability to incorporate high-k dielectrics into a molybdenite transistor is an important indicator of the mineral's suitability to processor manufacturing. There's also the possibility that graphene and molybdenite could be used together: Graphene is quite strong, it's a great heat conductor, and it can be produced as an ultra-thin transparent film. A complimentary association between graphene and molybdenite to fabricate a product such as a photovoltaic cell could be a marriage made in a lab where harps and Gregorian chants provide background music.



Unlike graphene—last year's wonder material—molybdenite can be used alongside high-k dielectrics (the material Intel uses in its latest processors). Researchers are also looking at the possibility of using molybdenite alongside graphene.

SMALLER IS BETTER

So molybdenite makes it easier to build smaller semiconductors. Why is smaller better? As we mentioned at the outset, size goes hand in glove with speed and cost. When you reduce the distance between two endpoints, you effectively increase speed. If it takes six minutes to move a package a distance of one mile, for example, and you reduce the distance between point A and point B to a half mile, it will now take only three minutes to transport the package. You've effectively halved the transfer time, doubling the operational speed without making any meaningful change to the process itself. Do the same thing in electronics, and electrical signals will reach their destinations in half the time; but since there's no increase in physical speed, there's no increase in resistance-induced heat.

In economic terms, the more processor die you can squeeze onto a wafer, the lower the cost of each die. You can reduce the cost of die even further by increasing the size of each wafer.

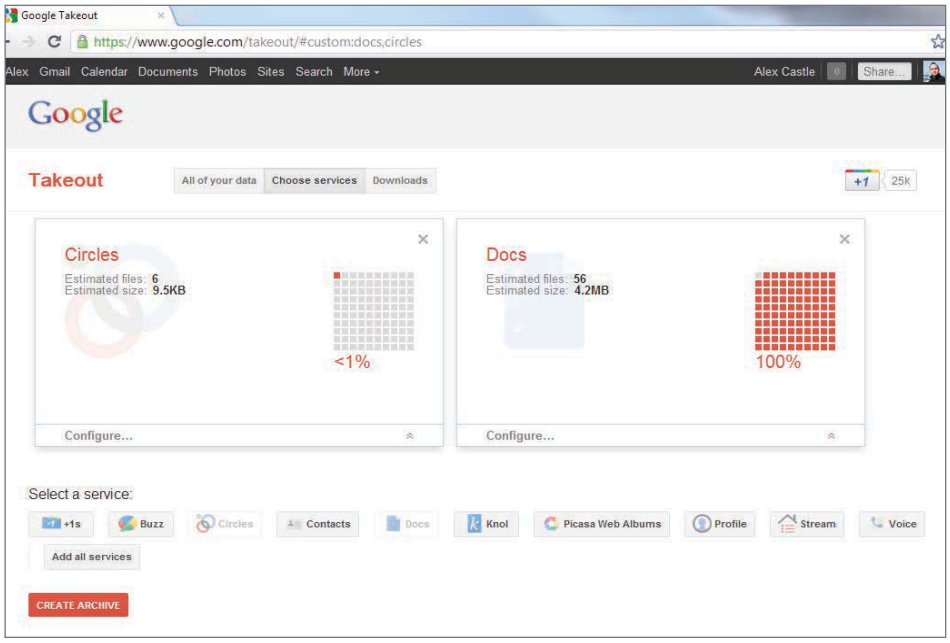
A BETTER MOUSETRAP?

Like mousetraps and mice, there will always be the next best thing. Molybdenite is definitely in the ascendancy, but will it last? Perhaps not. Australian and American physicists announced in February that they had built a working transistor from a single phosphorous atom embedded in—you guessed it—silicon. This development could lay the groundwork for the world's first quantum computer.

HOW TO

STEP-BY-STEP GUIDES TO IMPROVING YOUR PC

WINDOWS TIP OF THE MONTH

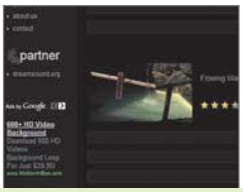


BACK UP YOUR GOOGLE ACCOUNT

What's the opposite of moving data to the cloud? Precipitating it? Whatever it is, you can download a local copy of all your data from all of Google's services (except for your Gmail inbox) by going to www.google.com/takeout and logging in to your account.

MAKE - USE - CREATE

64
Add a Padlock to External Drives



66
Use Amazing Video Backgrounds

ALEX CASTLE
ONLINE MANAGING EDITOR

WEB APPS FOR SECURITY

THIS MONTH one of our how-to articles looks at Conseal, an application that encrypts your external USB storage. The interesting thing about Conseal is that although it has a local component, most of your interaction with it is done on the web. This means you're out of luck if your computer isn't connected to the Internet, but it provides several benefits that only a web app can provide, such as remote termination and detailed usage logs.

Here are some other utilities that work great as web apps:

Password protection – Online services like LastPass are great for storing your passwords securely on the web.

Virus scanners – We wouldn't give up our AV suite, of course, but online virus scanners are a great tool when working on someone else's computer, or just for a second opinion.

Remote desktop – Our favorite tool for remotely controlling a PC is LogMeIn, which lets you take control of your home PC from any browser, anywhere.

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

Add a Padlock to External Drives

–Nick Odantzis

YOU'LL NEED THIS

CONSEAL

This software will encrypt your USB hard drives and let you remotely destroy the data they contain if they fall into the wrong hands. Get it from www.consealsecurity.com.

PORTABLE HARD DRIVES are convenient, but there's always the risk of one being dropped and lost somewhere. Then what happens? Someone spies your shiny-looking device lying around, picks it up, and decides to have a look at everything on it. If you've got confidential documents saved, they could fall into the wrong hands.

To prevent this you need to encrypt your drives, ensuring that only you can read what's on them. It sounds tricky, but it isn't—Conseal does all the work for you. There's a trial at www.consealsecurity.com. Bear in mind that the trial is active for 15 days, and the full version, which encrypts up to five drives, is $30.

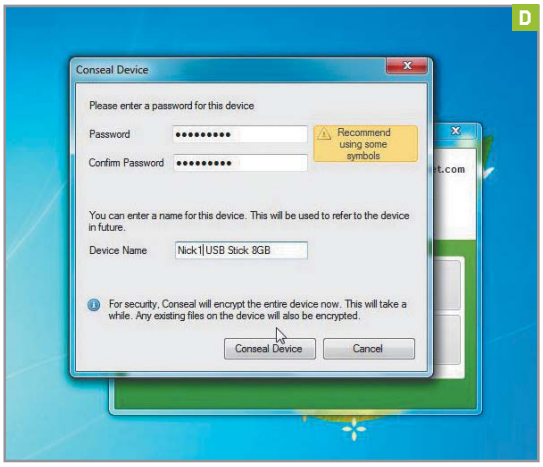
1 TO BEGIN, INSTALL THE FREE TRIAL You'll need to enter your email address, and then check your inbox for a message containing your password. Head back to the Conseal site and click Customer Log-in. Type your email and password **(image A)**, and then click Log in to access your Conseal management console.

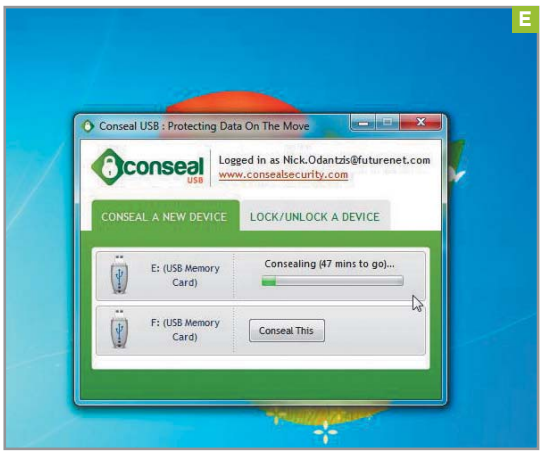
» Start protecting your USB drive by clicking "Conseal new device" in the menu on the bottom-left **(image B)**. The software that you need in order to encrypt the drive will begin downloading, so save this to your PC and double-click to install. During the installation process, you'll be asked to enter your login details once again.

2 ENCRYPT YOUR DRIVES On the next screen you'll see a list of all the USB drives connected to your PC. Only the drive letter will be listed, so if you're not sure which drive you are Consealing, go to Start, click Computer, and open the drive to check it. Now, simply click Conseal This next to the name of each drive currently connected to your computer **(image C)**.

» When you click Conseal This, a new window will appear asking you to give a password for the drive you're Consealing **(image D)**. Enter a password, and then enter it again for verification. Give the device a distinctive name so you can quickly distinguish it from other similar drives on the website, and click Conseal Device to begin encryption.

» Click OK when you're asked to install the Conseal security component—this only needs doing once for each drive. Click Yes when a security prompt appears, and then go make a cup of tea. The encryption process can take between 10 minutes and a couple of hours to complete, depending on how big the drive is **(image E)**.

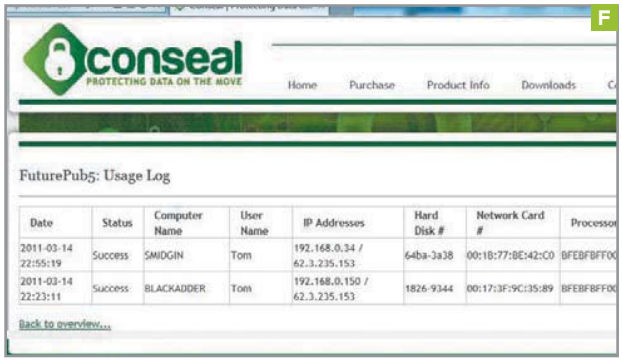


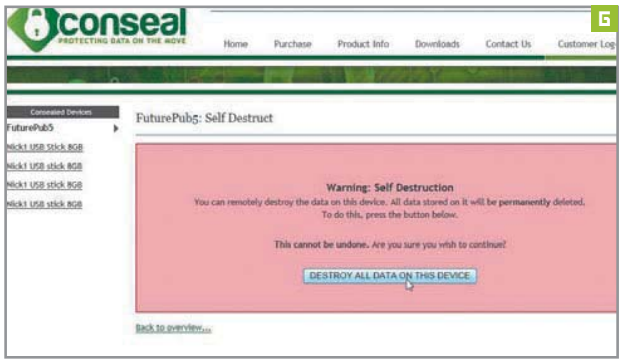


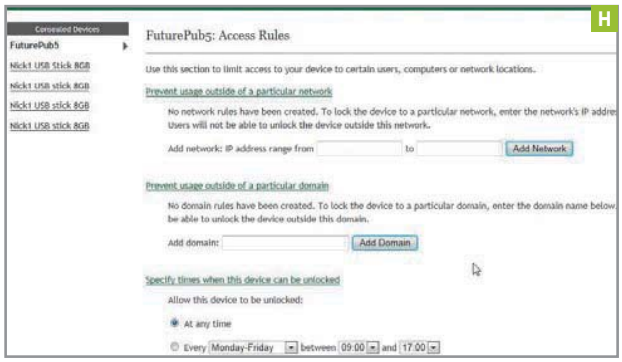
3 MANAGE YOUR DRIVES When this is finished, your drive will be password-protected, so only you can access the documents on it. Should you lose it, there's the option of destroying it remotely, but before you do that, check to see if someone else with access has used it—click "View history in detail" in the Management console **(image F)**.

» If you're sure it's fallen into the wrong hands and someone has attempted to unlock your USB drive, you can destroy it from your desktop. Simply go to your customer login and sign in, then select the lost device and click "Self-destruct device" **(image G)**. This will render the drive unusable, but don't take this step lightly—you'll never be able to get it back.

» You can rest easy now that you know how to encrypt your USB drives and destroy them remotely if the worst happens. If you want to give other people access to your protected USB drive, simply select the device from the Management console and click Configure Access to add them to the Allowed Users list **(image H)**.







Use Amazing Video Backgrounds

–James Stables

YOU'LL NEED THIS

VIDEOS
You can use your own creations or download pre-made files. The video should be brief, and of high enough resolution to look good onscreen.

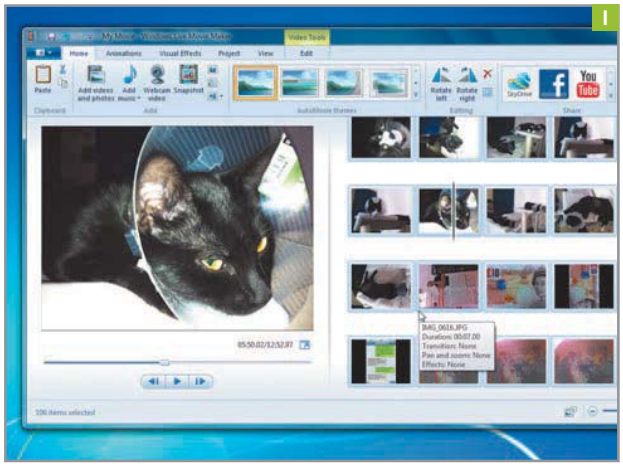
DREAMSCENE
Download the animated desktop tool from bit.ly/9nFLnB.

NOTHING WILL MAKE your computer look fresher than a great desktop background, but what if your background were a video? Back in the days of Windows Vista Ultimate, Microsoft developed Windows DreamScene, which let users liven up their everyday computing with animated wallpapers.

Microsoft removed the feature for Windows 7, but there are tools available that let you restore it. What's more—unlike in Windows Vista—you can add any MPEG or WMV video, not just those Microsoft has released, so your choices are limitless. We'll show you how to swap your lifeless wallpapers for moving masterpieces.

1 PREPARE YOURSELF Before we get into the nuts and bolts of installing DreamScene, you need to prepare your videos. If you don't have a video editor, you can download Windows Live Movie Maker **(image I)** free from bit.ly/ijzWm9. Keep your movie clips brief and remember that the program only supports MPEG and WMV videos.

» You can find the DreamScene binary all over the Internet, but it's safest to download it from a reputable source. We recommend the Windows Club software repository at bit.ly/9nFLnB **(image J)**. The application comes in 32-bit and 64-bit flavors, but they are both bound in the same executable file, so just click and go.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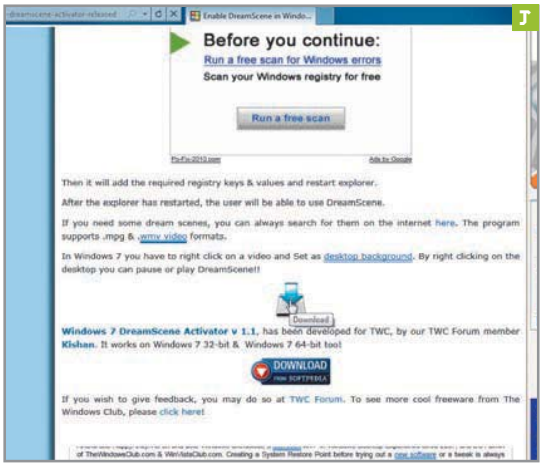
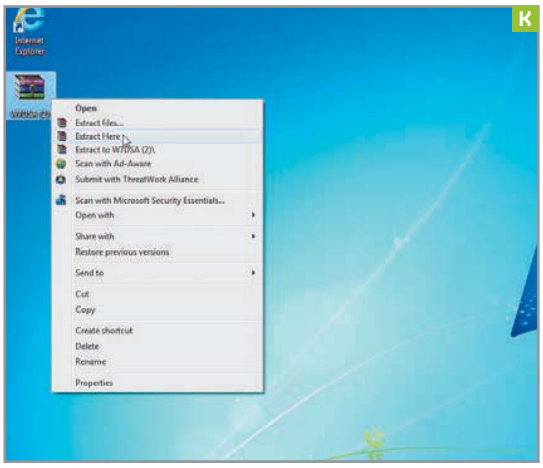
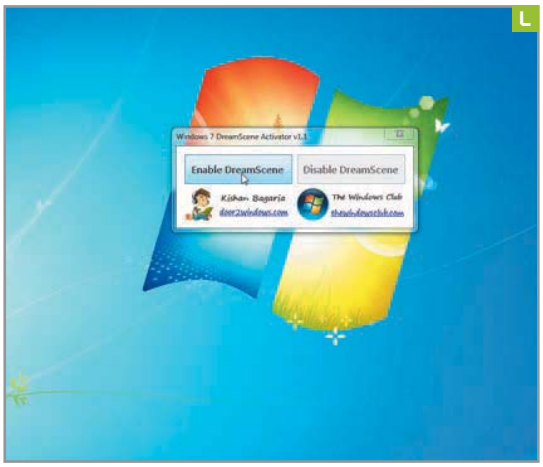


J

2 INSTALL DREAMSCENE When you've retrieved, extracted, and executed the all-important DreamScene file **(image K)**, you might receive an unhandled execution error message during installation. This is a known issue and nothing to worry about. If it happens, just click Continue and the process should continue as normal.

» To start using the DreamScene program, right-click the file called Windows 7 DreamScene Activator 1.1 and choose "Run as administrator." This is an essential step. A box will then appear with two simple options: Enable or Disable DreamScene **(image L)**. Click Enable and the relevant registry changes will be made to enable it on your machine.



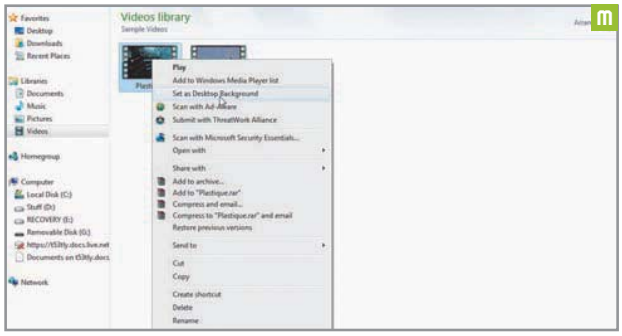


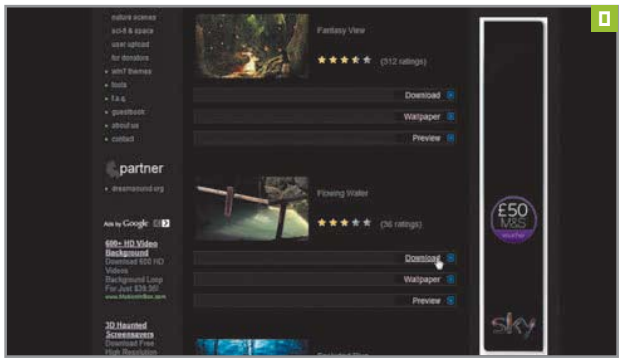
3 USE DREAMSCENE With the installation complete, you now need to find an MPEG or WMV video file to use. Windows 7 comes with a sample video, which you'll find in the Videos folder **(image M)**. (Click Start, choose your Documents folder, and then select Videos > Sample videos.) Right-click your chosen video and choose "Set as background."

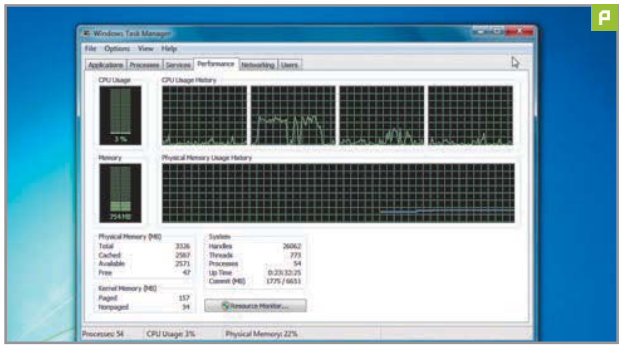
» Your new video file will now start playing on your desktop. The clip will run on an infinitely repeating loop. As good as this looks, it can be distracting and performance draining, so you'll want to turn it off again at times. To do this, just go back to a normal theme by right-clicking the desktop and choosing Personalize **(image N)**.

» While the animals in the sample videos folder are fun, their appeal is bound to run thin after a while. Luckily, you can find lots more DreamScene videos online. Visit www.dreamscene.org **(image O)** to find a wide selection of compatible and rather lovely looking videos that you can download and use as wallpaper.

» Performance-wise, DreamScene can be a resource hog, so it's a good idea to monitor how the program is using your system resources **(image P)**. It's also worth considering the impact an increased workload will have on mobile battery life. We recommend disabling the video desktop as a matter of course before you take your laptop on the road.







BUILD IT

NATHAN EDWARDS **SENIOR EDITOR**

New Life for a 3-Year-Old Rig

Updating an early X58 machine, part one

LENGTH OF TIME: **1 HOUR**

LEVEL OF DIFFICULTY: **BASIC**

THE MISSION Way back in the recession-bound depths of 2009, we skipped our normal balls-to-the-wall Dream Machine build in favor of three more modest PCs. Rather than a $10,000 ode to excess, we built rigs that actual people would build. Our $1,400 midrange system, which we called the Budget Surplus, was kitted out with an Intel Core i7-920 overclocked to 3.5GHz on a Gigabyte GA-EX58-UD3R motherboard with 6GB DDR3, a 1.5TB boot drive, and the finest in dual-GPU technology: a Radeon HD 4870x2.

The Budget Surplus is showing its age—nearly three years old! I've had many people with similar systems ask if it's time for a new rig, but I'm hesitant to recommend a major upgrade before Ivy Bridge and Ivy Bridge-E come out.

Rather than going all-out on a new machine, I'm going to bring our 2009-era box into the present day with a few upgrades that'll make the machine feel new again, and that I'll be able to bring with me when I do bite the bullet and purchase a new CPU and motherboard.

The rig that was our Budget Surplus, circa August 2011.

STRATEGIC MANEUVERING

AS I MENTIONED ABOVE, I'm not going for a whole new build here. I just want to wring some more life out of my X58 system. The Core i7-920 is still a good CPU, with four cores and multithreading, and the ability to overclock like a champ. Plus, with Ivy Bridge and Ivy Bridge-E on the horizon, it doesn't make sense to upgrade my CPU just yet.

The motherboard is a weird one: It was a budget board in mid-2009, and though it has triple-channel DDR3 support, it only has four DIMM slots instead of the usual six. The fourth DIMM slot, if used, will up the total amount of memory at the expense of bandwidth. When we built the machine, we used three 2GB DIMMs for 6GB total. RAM is cheap these days, and four 4GB DIMMs only cost a tiny bit more than three 4GB DIMMs, so I'm going to buy a 16GB kit and use three of the DIMMs, keeping the fourth in reserve for when I change motherboards later. That still gives me 12GB of RAM—double what this machine had before.

As much as I'd like an SSD, I don't want to spend a fortune just yet, so I'll wait until the eventual platform upgrade. Until then, I'm sticking with the hard drive, optical drive, case, and PSU from the old build, since they're still going strong. Well, the hard drive was replaced with a 1TB Caviar Black at some point, but since that happened in the indefinite past it doesn't count. I will add a $30 USB 3.0 PCIe expansion card, because I like USB 3.0 and that's the only way I'll get it without a motherboard upgrade.

The graphics card, on the other hand, is *four* years old, sucks power, and doesn't even support DirectX 11, so that's gotta go. I'm replacing it with a brand-new Sapphire Radeon HD 7950 (reviewed on page 80). At $480, it's cheaper and faster than a GTX 580, supports DirectX 11, and draws less power than the ancient card it replaces. With Sapphire's aftermarket heatsink, it's also much cooler.

The original configuration called for Windows 7 Release Candidate, but I'm operating under the assumption that anyone who still uses X58 would have updated to a real version of Windows 7 when the RC stopped working, so I don't count Windows 7 as an upgrade. Total cost for the RAM, USB 3.0 card, and GPU? Just $605.

Sapphire Radeon HD 7950 OC 3GB

16GB Corsair Vengeance DDR3/1600

Western Digital WDBFNJ0000NNC-WASN

INGREDIENTS

	BUDGET SURPLUS	NO BS UPDATE		
	EXISTING HARDWARE	**UPGRADED PART**	**URL**	**UPGRADE PRICE**
Case	Thermaltake Element S		www.thermaltakeusa.com	
PSU	Corsair 850TX		www.corsair.com	
Mobo	Gigabyte GA-EX58-UD3R		www.gigabyte.us	
CPU	Intel Core i7-920 @3.5GHz		www.intel.com	
Cooler	Thermalright Ultra 120E-1366		www.thermalright.com	
GPU	Diamond Radeon HD 4870 (x2)	Sapphire Radeon HD 7950 OC 3GB	www.sapphiretech.com	$480
RAM	6GB Patriot Viper DDR3/1600	16GB Corsair Vengeance DDR3/1600	www.corsair.com	$95
Optical Drive	Samsung SH-223F CD/DVD burner		www.samsung.com	
Hard Drive	1TB WD Caviar Black		www.wdc.com	
OS	Windows 7 Home Premium 64-bit		www.microsoft.com	
USB 3.0 PCIe Adapter		Western Digital WDBFNJ0000NNC-WASN	www.wdc.com	$30
Optional		Arctic Silver ArctiClean / Arctic Silver 5	www.arcticsilver.com	($23)
TOTAL				$605 ($628)

1 TEARING IT DOWN

BEFORE I BEGAN the upgrade process, I uninstalled the drivers for the old videocard. Next I powered down the system and started the upgrade. The first thing I did was remove the old GPU and RAM from the system. I also took this opportunity to remove the heatsink, clean off the old thermal paste, and reapply it. It's a good idea to do this every year or so, which I've been bad about. I used Arctic Silver's ArctiClean two-step thermal compound remover ($10, www.arcticsilver.com) and Arctic Silver 5 ($13, www.arcticsilver.com). I also took this opportunity to move the heatsink fan from pull configuration to push in order to give it some distance from the rear exhaust fan, which was creating a bit of noisy turbulence.

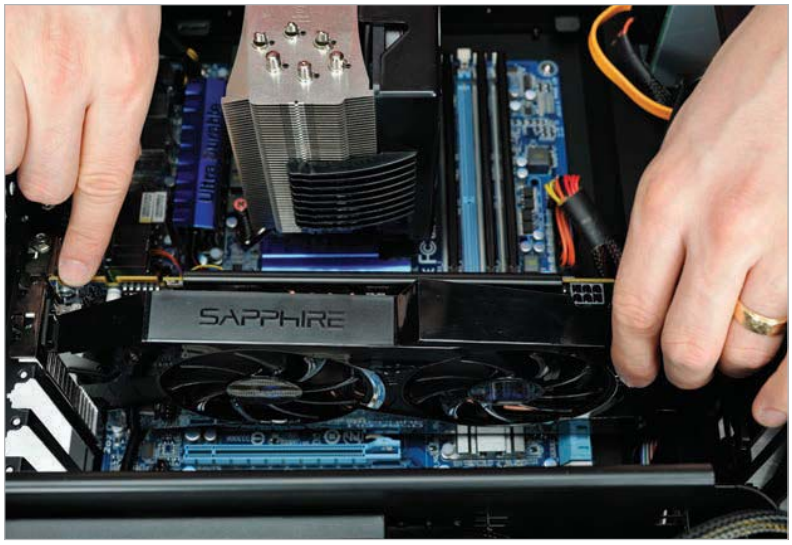
ArctiClean's two-step process makes quick work of cleaning caked-on thermal paste. Then apply a small dab of new thermal paste and put the cooler back on.




2 TIDYING UP

WHILE THE SYSTEM'S EMPTY, it's nice to do some dusting and rewiring. The Thermaltake Element S doesn't have the cable-routing features we take for granted in more modern cases, but it does have a few routing cutouts, as well as a cover to hide the shameful non-modular power supply cables. We did a good wiring job when we built the thing, but, well, it's been a while. Stuff happens. It's not a big effort to take a few minutes and clean up. The motherboard power cables, for example, can be wired behind the motherboard tray.

There's not much room behind the motherboard tray, but the Element S does provide for some cable-routing options between the mobo and drive trays



3 WE CAN REBUILD IT

ONCE THE CASE was nice and tidy, it was time for the upgrades. I put the new RAM in the three white slots (I could install the fourth DIMM in the blue slot, but I'd take a bandwidth hit). The USB 3.0 PCIe adapter can go in either of the top two x1 PCIe slots, and the videocard in the top x16 PCIe slot. I connected two 6-pin power connectors, closed up the case, and booted to see how much of a difference the new components make.

Install as directed. Call me in the morning.

1. The CPU cooler fan is still moving air toward the rear of the case, but now it's on the front of the cooler.

2. This PSU cable cover is from the time before modular PSUs were common.

3. I moved the front intake fan up one slot to provide a simpler airflow path to the videocard.

PHASE ONE COMPLETE

SINCE THE BUDGET SURPLUS machine's CPU was already overclocked to 3.5GHz, I didn't see any meaningful change in benchmarks that measure processing performance—all CPU-bound benchmarks were within 3 percent of their original scores. Our benchmarks aren't really designed to measure memory size, either, so I didn't see a big change from that upgrade, but in daily use, 12GB of RAM is better than 6GB, and hell, it's cheap!

Gaming benchmarks were a different story. "Wait," I hear you cry, "You mean to tell me a brand-new $480 Radeon 7950 outperforms a videocard from mid-2008?" Shocking, but true—the Sapphire HD 7950 was twice as fast in Stalker: Call of Pripyat (which the dual 4870s had to run in DirectX 10 mode) and 35 percent faster than the old setup in the DirectX 10 Far Cry 2.

If you're like me, you rarely go three years without updating a single component, and you don't replace *every* part of your PC when you do update. This upgrade is designed to be the first step in a two-step process: The next step will include a CPU, cooler, and motherboard at the very least, and an SSD and a new case if I'm feeling fancy. All the parts I bought for this upgrade (save the USB 3.0 adapter, which will be rendered superfluous) will carry over into the new build, as will the PSU and drives.

The two-step upgrade process serves two purposes: It spreads the financial pain of upgrading into two discrete chunks, and it gives me a performance boost on my current rig. Rather than using a slow machine for longer, I get a slightly faster machine now and another speed boost later. Don't think I'll forget about this build, either—check back in a few months when I do the second half of this upgrade. We'll ponder the Ship of Theseus paradox. You can Google that.

BENCHMARKS

	BUDGET SURPLUS	NO BS UPDATE
Vegas Pro (sec)	3,223	3,234 (0%)
Lightroom 2.6 (sec)	382	394 (-3%)
ProShow 4 (sec)	1,224	1,184 (3%)
MainConcept 1.6 (sec)	2,260	2,268 (0%)
STALKER: CoP (fps)	29.4	60.3 (+105%)
Far Cry 2 (fps)	88.5	118.5

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

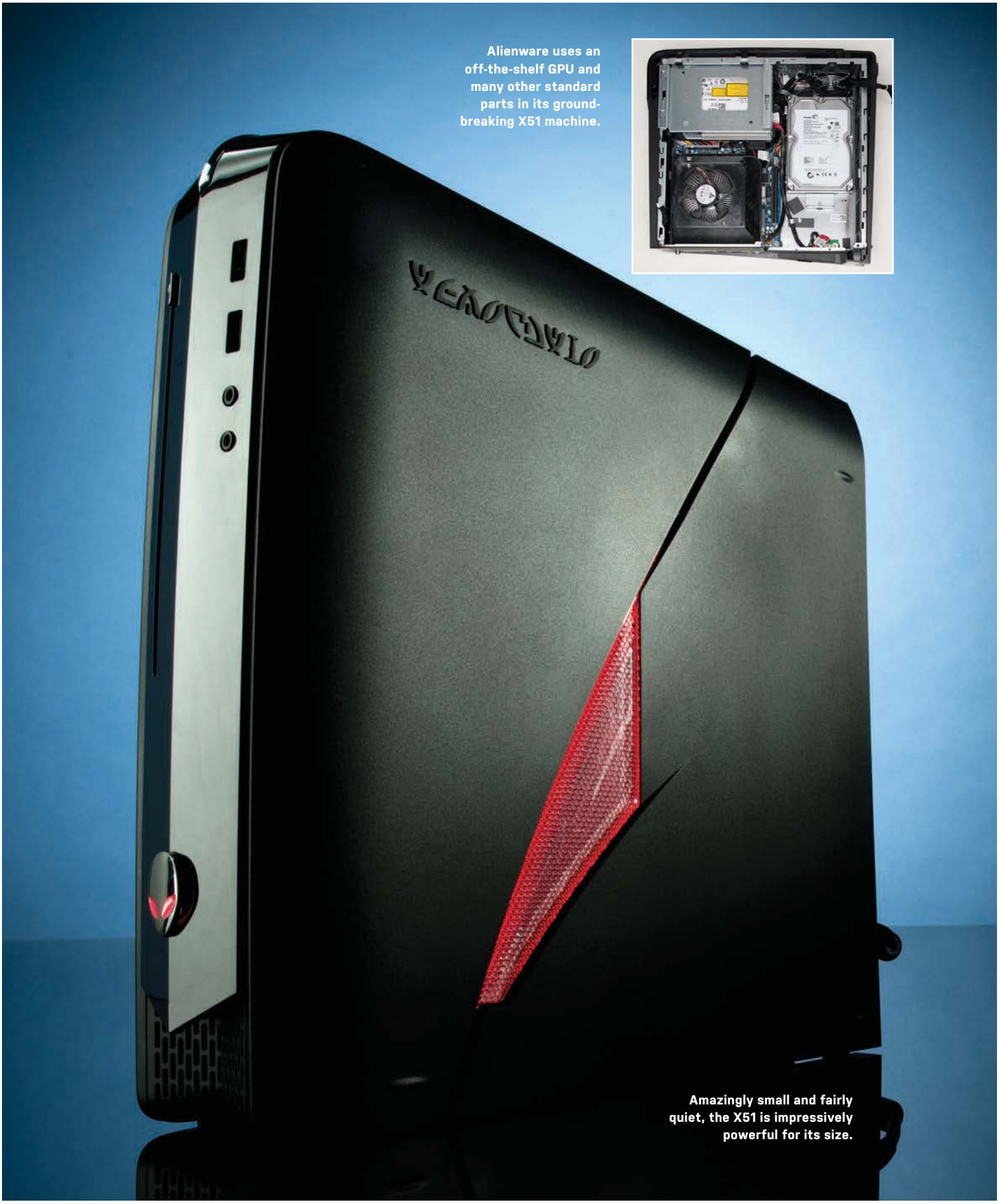
Our Budget Surplus machine consists of a quad-core 2.66GHz Core i7-920 overclocked to 3.5GHz, 6GB of Corsair DDR3/1333 on a Gigabyte X58 motherboard, with an ATI Radeon HD 4870x2 graphics card, a 1TB WD Caviar Black drive, and 64-bit Windows 7 Professional.

REVIEWS

TESTED. REVIEWED. VERDICTIZED.

INSIDE

XIGMATEK AEGIR
PAGE 83



Alienware uses an off-the-shelf GPU and many other standard parts in its ground-breaking X51 machine.

Amazingly small and fairly quiet, the X51 is impressively powerful for its size.

Alienware X51

Move over game console, a PC is here to take your job

DON'T BLINK, it's not a game console. It's something far better—a PC that's as small as the original Xbox 360 and PlayStation 3 with the promise of pretty good gaming performance, too.

As we all know, making things small, fast, and also affordable is no easy feat. Yet Alienware engineers somehow managed to smash real graphics into a standard slimline tower without tacking on a huge price tag.

To be frank, this isn't the first attempt at a small, powerful PC with a slimline shape. The X51 reminds us very much of Voodoo/Hewlett-Packard's Firebird PC from 2009 (review at **bit.ly/Delqq**). The Firebird's main failing was relying primarily on notebook technology for its GPUs, which killed upgrades.

Alienware doesn't make this mistake with the X51. The company uses mostly off-the-shelf components, such as a desktop 3GHz Core i5-2320 CPU and DIMMs instead of SO-DIMMS. Most importantly, Alienware cleverly folds a standard double-slot GeForce GTX 555 into the case. The GTX 555 is basically a lightweight GTX 560 and features 288 CUDA cores instead of 336, a 776MHz core clock instead of 810MHz, and a narrower 192-bit memory interface instead of 256-bit. More to the point, it's off-the-shelf, so you can drop in any dual-slot card within the power and thermal limits of the chassis and PSU. Alienware initially said the PC could accommodate a GTX 580, but has since pegged its max capability to a GTX 560 non-Ti. For what it's worth, the PC looks like it could easily fit a 560 Ti and probably even a 570—but we haven't tested whether either setup would run reliably.

Alienware's OEM muscle is apparent in the X51's use of Nvidia's Optimus technology, which lets you switch between the integrated graphics or discrete card automatically. We haven't seen this anywhere in a desktop system. On the discrete card, the machine would peak at about 150 watts, and while running integrated, we saw power consumption drop to 60 watts—not much more than the box's idle consumption of about 50 watts. That's a healthy power savings, and we'd love to see such technology elsewhere. Speaking of power, one of the ways Alienware was able to open up space to fit a standard two-slot GPU was by using an external power brick. Two models are available, a 230-watt and a 330-watt brick (and we hope Alienware will add even more powerful bricks down the road).

How does the X51 perform? Not surprisingly, it doesn't set any speed records. We wouldn't expect it to, considering its small size and modest power consumption, but it's definitely not pokey. In gaming, it seems to offer a respectable frame rate for most games and just enough pep to run high-end titles. BF3, for example, is probably best run at medium or high settings, depending on your frame rate threshold.

Are there more powerful small form factor boxes out there? Certainly. Both the CyberPower LAN Party Evo and the Falcon Northwest FragBox from our July 2011 SFF roundup are spec'd with hotter hardware. To be fair, both were also two to four times as expensive as the Alienware—and boxier, too. We have to tip our hats to the Alienware X51; it offers a hell of a lot of performance in a truly console-size box. Between the Optimus technology, the size, and the price, we suspect it's just the first of many such Xenomorphs to come. **–GORDON MAH UNG**

VERDICT **9**

Alienware X51

+ X-WING Powerful console-size PC with Nvidia Optimus technology.

– CLOUD CITY PATROL CAR Needs bay for SSD; lacks SATA 6Gb/s support and front USB 3.0 ports.

$950, www.alienware.com

BENCHMARKS

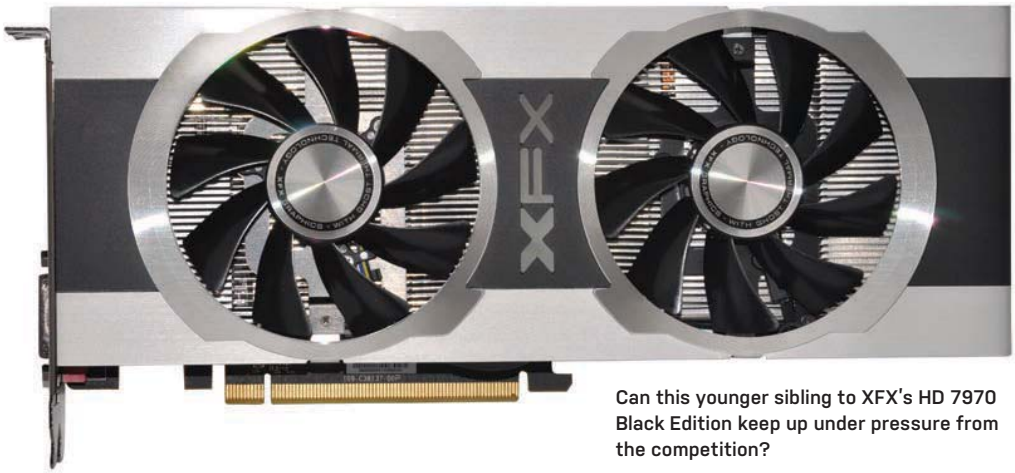
	ZERO POINT	
Vegas Pro (sec)	3,049	3,900 (-22%)
Lightroom 2.6 (sec)	356	436 (-18%)
ProShow 4 (sec)	1,112	1,140 (-2%)
MainConcept (sec)	2,113	2,632 (-20%)
STALKER: CoP (fps)	42.0	20.7 (-51%)
Far Cry 2 (fps)	114.4	57.5 (-50%)

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

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

SPECIFICATIONS

Processor	Intel Core i5-2320
Mobo	Custom Mini-ITX using Intel H61 chipset
RAM	8GB DDR3/1333
Videocard	GeForce GTX 555
Soundcard	Onboard
Storage	1TB Seagate 7,200rpm HDD
Optical	DVD+RW burner
Case/PSU	Custom Alienware / 330W power brick



Can this younger sibling to XFX's HD 7970 Black Edition keep up under pressure from the competition?

Radeon 7950 Faceoff

Two implementations of AMD's second-tier GPU do battle

AMD recently released the Radeon HD 7950 GPU, the less expensive follow-up to its killer high-end Radeon HD 7970. As with the previous-generation HD 6000 GPUs, the 7950 uses the same GPU as the 7970, with one functional core disabled. The 7950 draws less power and is clocked lower than the 7970. In stock trim, the 7950 is clocked at 800MHz, but we got our hands on two overclocked 7950s at 900MHz, albeit with different memory clocks. Priced at less than $500, the 7950s are the obvious competitor to Nvidia's GeForce GTX 580. Which graphics solution deserves your dollars? **–LOYD CASE**

SAPPHIRE RADEON HD 7950 OC

AMD's reference HD 7950 board sets its core clock at 800MHz and memory at 1,250MHz, using the default cooling system. Sapphire takes this reference board, adds dual 12cm fans, and juices the core clock to 900MHz. The memory clock remains at 1,250MHz—but that's 3GB of 1,250MHz GDDR5. Priced at around $480, it's worth seeing how the card compares with Nvidia's GTX 580. Note that we've also included results from the XFX Radeon HD 7970 for your reference, but excluded that card from the direct comparisons.

For direct comparison we turned to two different versions of the GTX 580—the slightly overclocked EVGA GTX 580 SC with 1.5GB of GDDR5 and the ultra-beefed-up EVGA GTX 580 Classified with 3GB of video RAM—as well as the XFX Radeon HD 7950 Black Edition reviewed next.

The Sapphire card ships with a slight memory bandwidth disadvantage compared with the XFX card (5GB per second versus 5.5GB/s) due to running its GDDR5 frame buffer at the reference clock speed. This shows up in a few benchmarks, where the Sapphire card places just a little behind the XFX card, but the differences are pretty small.

Like the XFX card, Sapphire uses a nine-blade fan design for the two fans, but the overall look of the card suggests hints of Chobham armor, unlike the XFX card's more streamlined, clean appearance. Output ports are standard: a pair of Mini DisplayPort connectors, one HDMI 1.4a port, and a dual-link DVI connector.

Overall noise levels are low, despite the dual fans, yet the card seems slightly noisier than either the HD 7970 reference card or the XFX HD 7970 Black Edition reviewed earlier. It may be that the Sapphire HD 7950 GPU is working harder to hit good frame rates, or the cut-down GPU is running a little hotter than the HD 7970s, which are probably binned parts.

The card did win out on idle power. System idle power is a scant 115W, lower than any high-end card we've tested, including AMD's previous HD 6970. The Sapphire card only needs a pair of 6-pin connectors; total system power pushes up to just to 288W, making the Sapphire HD 7950 OC the most power-efficient of all the high-end cards. You could probably run this card with a good 500W power supply, or even a pair of them in CrossFireX with a good 700W unit.

The Sapphire card costs a little less than the XFX card, idle power is a little lower, and Sapphire doesn't skimp on the display adapters. That makes it a pretty good deal, given its overall performance level compared to the much hotter and more power-hungry GTX 580s.

Sapphire Radeon HD 7950 OC

$480, www.sapphiretech.com

XFX RADEON HD 7950 BLACK EDITION

Unpacking the XFX HD 7950 Black Edition caused a bit of déjà vu. The card bears a strong resemblance to its big brother, the HD 7970 Black Edition (reviewed April 2012), clad in svelte brushed aluminum. If graphics cards dressed up for black tie galas, then the XFX Black Edition is ready to attend.

XFX pushes the reference clocks higher than stock, hitting 900MHz for the core clock and 1,375MHz for the memory clock. The additional memory cycles translate to a peak memory bandwidth of 5.5 gigabytes per second—the same as the HD 7970, and higher than the 5GB/s of the stock 7950. The question is: Can the GPU keep up? There's always

Sapphire slaps dual fans and a higher core clock on AMD's new Radeon HD 7950.

a balance between memory bandwidth and how much of that bandwidth the GPU cores can actually use. Plus, as more games become shader- and tessellation-intensive, bandwidth isn't as big a part of the equation.

In our performance testing, the XFX Black Edition mostly tied with the Sapphire HD 7950, which ran at the same core clocks, but slower memory clocks. The XFX card did post higher scores in a few benchmarks, but we're talking low single-digit differences for the most part. However, both system idle power and peak power on the XFX card are a bit higher than on the Sapphire card. Noise levels are marginally higher, too.

XFX has stopped including adapters inside the box, instead charging extra if you need a Mini DisplayPort-to-DisplayPort or a single-link DVI connector. So even if you have a DisplayPort-capable monitor, you may end up shelling out for a dongle to connect the card. Given that the Black Edition is priced about $10 higher than the Sapphire HD 7950 OC, which does include a set of adapters, this move is disappointing.

Overall, the XFX Radeon HD 7950 is a solid card, offering excellent performance in its class. It's only marginally faster than the Sapphire HD 7950 OC, however, and if you don't have the cables and adapters for your particular monitor, you'll need to spend a little more. Overall, the nod goes to Sapphire this time, since Sapphire's whole package seems a little more well-rounded. Still, this is one fast card, and if you build one into your gaming rig, you won't be unhappy about the performance.

VERDICT 8

XFX Radeon HD 7950 Black Edition

$490, www.xfxforce.com

BENCHMARKS

	Sapphire HD 7950 OC	XFX HD 7950 Black Edition	XFX Radeon HD 6970	EVGA GTX 580 SC	EVGA GTX 580 Classified	XFX Radeon HD 7970 Black Edition
Price	$480	$490	$350	$480	$560	$600
3DMark 11 Perf	7,475	**7,556**	5,750	6,747	7,321	8,393
3DMark Vantage Perf	31,269	**31,331**	24,453	26,936	28,559	32,813
Unigine Heaven 2.5 (fps)	**28**	**28**	17	22	23	29
Shogun 2 (fps)	**26**	**26**	19	22	24	29
Far Cry 2 / Long (fps)	90	**92**	75	85	**92**	100
HAWX 2 DX11 (fps)	111	113	73	120	**128**	120
STALKER: CoP DX11 (fps)	**33**	**33**	25	28	29	39
Just Cause 2 (fps)	44	45	31	41	**48**	50
Batman: Arkham City	49	**51**	36	45	47	53
Metro 2033	19	**20**	14	15	17	18
DiRT3	54	**55**	44	50	55	64
Core / Memory Clocks	900 / 1250	900 / 1375	880 / 1375	797 / 1013	855 / 1053	1,000 / 1,425
System Power @ idle (W)	**115**	119	126	140	140	124
System Power @ full throttle (W)	**288**	290	296	344	385	349

Best scores are bolded. Our test bed is a 3.33GHz Core i7 3960X Extreme Edition in an Asus P979X Deluxe motherboard with 16GB of Corsair DDR3/1600 and an AX1200 Corsair PSU. The OS is 64-bit Windows Ultimate. All games are run at 2560x1600 with 4x AA except for the 3DMark tests.

SPECIFICATIONS

	Radeon HD 7950	Radeon HD 7970
Manufacturing Process	28nm	28nm
Transistor Count	4.31 billion	4.31 billion
Reference Core Clock	800MHz	925MHz
Frame Buffer	3GB GDDR5	3GB GDDR5
Memory Clock	1,250MHz	1,375MHz
Memory Data Rate	5.0 gigapixels/s	5.5 gigapixels/s
Memory Bandwidth	240GB/s	264GB/s
Memory Bus	384-bit	384-bit
Stream Processors	1,792	2,048
Compute Performance	2.87 single-precision TFLOPs	3.79 single-precision TFLOPs
Texture Units	112	128
Texture Fill Rate (peak)	89.6 gigatexels/s	118.4 gigatexels/s
ROPs	32	32
Z/Stencil	128	128
Maximum Board Power	200W	250W
Idle Power (active)	15W	15W
Idle Power (long dark)	3W	3W

D-Link DIR-827 Wi-Fi Router

Cool features don't make up for mediocre performance

D-Link's DIR-827 is priced like a premium product, but it doesn't perform like one.

D-LINK'S DIR-827 WI-FI router boasts two features that our current favorite router, Netgear's WNDR4500, lacks: a USB 3.0 port and an SD media card reader. Both products are dual-band models with radios operating on the 2.4- and 5GHz frequency bands, respectively. The DIR-827, however, supports only two simultaneous 150Mb/spatial streams on each band, where the WNDR4500 supports three.

D-Link positions the DIR-827 as a media router, optimized for streaming audio and video and delivering exceptional performance for online gaming. It's the big brother to the single-band DIR-657 we reviewed in the December 2011 issue. Like that model, this one is fully DLNA compliant and features Ubicom's excellent quality-of-service engine that assigns higher priority to data packets associated with those types of apps.

We expected the DIR-827 to be slower than Netgear's best because it's outfitted with only a 2x2 antenna array (two transmit and two receive), whereas the WNDR4500 boasts a 3x3 array. And while the WNDR4500 costs $30 more than the DIR-827, we didn't expect D-Link's router to be more than 50 percent slower in most of our test locations (although the DIR-827 did beat the WNDR4500 when the client was in close proximity).

We were also disappointed in the DIR-827's range. It delivered very poor throughput on the 2.4GHz frequency band when our client was in our media room (35 feet from the router), and it couldn't reach the client at all when the client was outdoors (60 feet from the router). Its performance was only marginally better on the 5GHz band, delivering respectable performance at close range, while all but crapping out in more challenging circumstances. It's not unusual for a 5GHz router to fail to reach our client at its outdoor location, but this one couldn't maintain a connection to our client in our media room, either.

There's only one USB port, so you'll need to choose between sharing a printer or sharing storage. You'll need to install D-Link's SharePort utility on each client either way, and only one client will be able to access an attached device at a time. We used a 500GB, USB 3.0 Western Digital My Passport drive to evaluate the DIR-827's NAS functionality and came away impressed with its read speed while accessing a collection of small files over our wired network. Write speeds, on the other hand, were only slightly faster than Netgear's WNDR4500. We were also surprised to see that the D-Link was slightly slower than the Netgear when transferring a single large file (2.79GB) back and forth across our network, even though the Netgear is limited by USB 2.0 ports.

If your PC doesn't have an SD card reader, the ability to take the card out of your camera and plug it straight into the router is a cool feature; but we'd rather have decent wireless throughput and acceptable range. In the end, our opinion of the DIR-827 is no higher than our opinion of the DIR-657: We can't recommend either. –MICHAEL BROWN

VERDICT **6**

D-Link DIR-827 Wireless Router

+ JOEY RAMONE DLNA certified; USB 3.0; SD Card reader.

– JOEY LAWRENCE Crappy wireless throughput and range; only one USB port; must use SharePort utility to share an attached printer or storage.

$145 street, www.dlink.com

WIRELESS BENCHMARKS

	2.4 GHz Band		5 GHz Band	
	D-Link DIR-827	Netgear WNDR4500	D-Link DIR-827	Netgear WNDR4500
Bedroom 1, 10 feet (Mb/s)	**114.0**	105.0	109.0	**155.0**
Kitchen, 20 feet (Mb/s)	72.1	**149.0**	48.0	**97.3**
Patio, 38 feet (Mb/s)	26.5	**54.7**	8.5	**36.7**
Home Theater, 35 feet (Mb/s)	10.5	**39.6**	n/c	**3.10**
Outdoors, 85 feet (Mb/s)	n/c	**5.7**	n/c	n/c

WIRED BENCHMARKS

	D-Link DIR-827	Netgear WNDR4500
TCP Throughput (Mb/s)	**942.0**	930.0
PC to NAS, small (sec)	**102.3**	125.3
PC to NAS, large (sec)	366.7	**343.0**
NAS to PC, small (sec)	**46.7**	418.7
NAS to PC, large (sec)	177.0	**104.3**

Best scores are bolded. TCP throughput measured using JPerf. NAS tests consist of copying a single 2.79GB file and a folder containing of 659MB worth of files and folders to and from a USB 3.0 drive attached to the router. N/C indicates no connection at that location. Additional benchmarking methodology at bit.ly/r5USfh.

The Xigmatek Aegir doesn't look innovative, but it doesn't have to.

Xigmatek Aegir

Direct-contact heat pipes, and then some

WE HADN'T HEARD much from Xigmatek in a while until last month's LGA2011 cooler roundup. In that review roundup, we tested the company's budget Gaia cooler and found it roughly equivalent to the Hyper 212 Evo—which is a good thing. Now we've got our hands on the Aegir, a direct-contact heatsink with more fins, more fans, and more oomph.

The Aegir has a strange heat pipe configuration: Six copper heat pipes rise through its 4.6-inch stack of cooling fins, but only four have direct contact with the CPU heat exchanger. The other two heat pipes are set into channels at the *top* of the heat exchanger, above the two center direct-contact heat pipes. They don't contact the CPU directly. They don't even touch the heat pipes that touch the CPU. Xigmatek calls this "Double Layer with Heatpipe Direct Touch," or DLHDT. Catchy!

Many coolers designed before the launch of Sandy Bridge-E have LGA2011 support added after the fact, and not always well. With some coolers, we had trouble putting sufficient mounting pressure on the heatsink, leaving the cooler's LGA2011 performance lagging compared to other platforms. That isn't a problem with the Aegir: Even on LGA2011, the mounting crossbar clamps down so far we worried we'd break our motherboard. But we didn't, and thanks to the pressure, the Aegir's four lower direct-contact heat pipes got plenty of, well, direct contact with the CPU's heat spreader.

The Aegir ships with one 12cm brushless PWM fan, held on by the same dinky rubber pegs we complained about in last month's review of the Xigmatek Gaia. The pegs clip into the cooler's fins and pull through the mounting holes on the fan, and the Aegir ships with eight pegs—enough to attach an additional fan.

Not that you'll need it. On our LGA2011 test system (a Core i7-3960X overclocked to 4.2GHz on an Asus P9X79 Deluxe motherboard in a Thermaltake Level 10 GT chassis with its stock fans on high), the Aegir pulled down one of the lowest stress-test temperatures we've seen—a mere 71 C after an hour of thermal stress. That's lower than any air cooler we've tested on this system.

You need only look at the success of Cooler Master's Hyper 212 coolers to see that direct-contact heat pipes can lead to very good coolers. The Aegir's larger fin stack, two additional heat pipes, and greater mounting pressure combine to give it excellent performance.

The Aegir's mounting system isn't our favorite, though we can't argue with its effectiveness, and its fan mounting system is downright annoying. It also lacks the eye-catching appeal of more exotic coolers. But for sheer performance at a reasonable price, the Aegir is a winner.

–NATHAN EDWARDS

VERDICT 9 KICK ASS!

Xigmatek Aegir

EGGROLL Solid mounting bracket; great performance.

AGGRO Annoying rubber fan mounts; not much to look at.

$65, www.xigmatek.com

SPECIFICATIONS

Dimensions HxDxW (inches, with fan)	6.5x3.7x5.2
Weight (with fan)	1 lb, 12 oz
Heat Pipes	Six copper (four direct-contact)
Stock Fans	1x 12cm PWM
Add'l Fan Support	1 (rubber mounts included)

BENCHMARKS

	Xigmatek Aegir	CM Hyper 212 Evo	Noctua DH-14
Ambient Air	24.8	**23.8**	25.2
Idle Temperature	**33.8**	36.2	34.1
Burn Temperature	**71**	74	72.3

All temperatures in degrees Celsius. Best scores bolded. All tests performed using an Intel Core i7-3960 at 4.2GHz, on an Asus P9X79 Deluxe motherboard with 16GB DDR3/1600, in a Thermaltake Level 10 GT with stock fans set to High.

Samsung Galaxy Nexus

Ice Cream Sandwiched between the flavors of last month and next month

A slightly contoured display and stark detailing give the first Android 4 phone a minimalist, chic look.

IN THE TRADITION of the Nexus S, which was the first Android Gingerbread phone, Samsung has constructed an elegantly simple, yet powerful, phone to show off the stock version of Google's latest OS, Android 4 Ice Cream Sandwich (ICS). Android function buttons are now onscreen only; the bottom bezel holds just a white notification LED. A complete rundown of ICS would require its own article, but this full Android redesign merges tablets and phones into one OS with many improvements. For example, the more detailed Settings are available from the Notifications menu, you can swipe items out of the Recent Apps menu, and an unlock screen swipe to the left takes you straight to the camera, which, like many of the stock apps, is also greatly improved.

The 5MP camera certainly falls behind the times in specsmanship, where 8MP is soon to be replaced by 12MP as the standard for top camera phones. Yet it works fast and has tap-to-focus, a super-bright flash, and an elegant software interface that lets you easily share/upload photos to any of the compatible apps on the phone right from the photo playback screen.

With the same processor and price, the Motorola Droid Razr offers stiff competition to the Galaxy Nexus—both 4G LTE phones on Verizon. The Galaxy Nexus is slightly thicker and longer than the Razr, but it manages to pack a larger display (4.65 inches compared to 4.3) into a frame that's not as wide as the Razr. The curvy Galaxy Nexus also feels more comfortable to hold than the boxy Razr.

We love the size and 1280x720 resolution of the Galaxy Nexus's HD Super AMOLED display, but compared to the very saturated colors and high contrast of the Razr screen (also an AMOLED), the Galaxy Nexus looks a bit muted and washed out. That makes it somewhat irritating for long periods of reading, and not as beautiful for photos and videos.

Besides ICS, perhaps the greatest attraction of the Galaxy Nexus is its lightning-quick operation. The dual-core 1.2GHz CPU in combination with ICS simply screams. Sceen swipes, menu pull-downs, page scrolls, app launches, and other functions fly by as fast as you could want. Although it has the same CPU/RAM as the Droid Razr, the Galaxy Nexus bested the Razr in most benchmarks, perhaps because of the untampered-with OS. Besides two small Verizon apps you can disable in Applications Settings, ICS comes pretty much bone stock, giving performance nuts a clean experience.

The Galaxy Nexus scored a data-speed win over the Razr, as well. Although both run on Verizon's 4G LTE network, in side-by-side tests, the Galaxy Nexus averaged 11-18 percent faster in data download and upload speeds.

Of course, so much 4G use sucks a battery dry. The Galaxy Nexus's replaceable 1850 mAh battery lasted a full 24 hours of light use but only 8-12 hours when we ratcheted up the calling, texting, browsing, video streaming, etc. New battery settings in ICS break down the percentage of battery use by function/software, so you can tweak your settings. (Hint: Lower display brightness for the greatest savings.)

There's no doubt that the Galaxy Nexus is a deserving marquee phone for ICS. However, it does feel as if Samsung/Google intentionally held back some high-end hardware for the privilege of accessing ICS early. Lack of connections and memory card expansion (although the 32GB storage is nice), as well as 2010 camera hardware specs suggest as much. At least we get NFC technology inside, although Verizon hasn't enabled Google Wallet yet. As much as we can recommend the Galaxy Nexus, the upcoming quad-core Galaxy S III will more likely be the Android phone to beat this year.

–MARKKUS ROVITO

VERDICT 8

Samsung Galaxy Nexus

+ MILKY WAY Large HD display; screaming-fast performance; non-skinned Ice Cream Sandwich OS; NFC equipped.

– 3 MUSKETEERS No microSD slot; no HDMI-out; Google Wallet not yet equipped; last-generation camera hardware; low display contrast.

$300 on Verizon 2-yr contract, www.samsung.com

SPECIFICATIONS

OS	Android Ice Cream Sandwich 4.0.2
Processor	1.2GHz-dual core TI OMAP4460
Display	4.65-inch, 1280x720, HD Super AMOLED
Capacity	32GB storage; 1GB system RAM
Cameras	1.3MP webcam front; 5MP rear w/LED flash and autofocus
Video	720p video capture
Connectivity	Wi-Fi, Bluetooth 3.0, 4G LTE, Micro USB 2.0, NFC
Battery	3.7V Li-ion, 1,850 mAh
Dimensions	5.33x2.67x.37 inches, 5.1 oz.

That fancy aluminum chassis is a magnet for fingerprints.

Akitio SK-3501 Super-S3

USB 3.0 hard drive enclosure with plenty of ports, little appeal

LAST FALL'S flooding in Thailand caused massive devastation and the loss of hundreds of lives. Much less importantly, it also caused many hard drive factories to shut down temporarily, leading to a huge drop in HDD production. Drive prices are coming back down, but for some capacities cost is still prohibitive—which makes upgrading a little less tempting, never mind purchasing a portable drive for backup.

Of course, you can do your part by recycling and repurposing an old drive. And you can make that drive mobile with an enclosure like the Akitio SK-3501 Super-S3, which comes with myriad connection options and lets you give your old drive the new lease on life it deserves.

The Akitio SK-3501 is a basic-looking hard drive enclosure made of aluminum that's a magnet for greasy fingerprints and good for scratching up whatever it's resting on if you forget to attach the rubber feet. Mounting a drive inside of it requires a lot of screwing—that is, four screws to seat the drive into the internal base, and then four screws to bind the internal base to the external frame. Despite its price, the package and presentation actually feels cheap.

Inside, the hard drive connects via standard SATA power and data connectors, and the outside of the enclosure contains eSATA, USB 3.0, and two FireWire 800 ports. With this many ports, there's a gaggle of controllers jammed into the unit, including an LSI FW843 for FireWire, an Oxford Semi OXUFS944SE FireWire/eSATA/USB 2.0 controller, and a PLX OXU3100 USB 3.0-to-SATA chip.

We're not 100 percent sure how the drive maps to the ports through the controllers, but since neither the Oxford nor the PLX chip supports 6Gb/s SATA speeds, you'll be limited to 3Gb/s SATA speeds no matter which connection you use. That's not a big deal for anyone running a mechanical drive, but high-performance SSD users may have to keep looking. Unfortunately, we haven't seen a USB-to-SATA chip yet that supports SATA 6Gb/s speeds.

You can drop any 2.5-inch or 3.5-inch mechanical or solid-state drive into the SK-3501. We first benchmarked the Akitio enclosure using a 3TB 7,200rpm Hitachi Deskstar 7K3000 drive across the USB 3.0 and USB 2.0 ports. No surprise: USB 3.0 crushes its predecessor with read and write speeds of 96MB/s and 74Mb/s, respectively, vs. 31MB/s reads and 25MB/s writes across USB 2.0. But what happens with a faster drive? To find out, we dropped a speedy OWC Mercury Pro 240GB SSD into the SK-3501 and saw 184.4MB/s read speeds and 178MB/s writes via USB 3.0. We then threw that same SSD into an Asus 2.5-inch USB 3.0 enclosure sporting an ASMedia ASM1051E chip. In the Asus enclosure, the OWC SSD put out 206.6MB/s reads and 175.7MB/s writes—substantially faster in read tests and slightly slower in writes. We also ran the Akitio enclosure with the OWC drive in eSATA mode, and there we saw the Akitio's best performance: 262MB/s reads and 237MB/s writes. We know the OWC drive is capable of pushing 480MB/s reads and 300MB/s writes, so it's official: The Akitio enclosure won't hit 6Gb/s SATA speeds.

It's nice that the Akitio enclosure offers so many connection options—it goes a little way toward explaining its high price. Most folks in a PC-only world don't need FireWire 800, but those who will use the drive to transfer files between a Mac and PC could. And if you need to, you can daisy chain another drive via the same connection without additional software. But $150 is a terribly steep price to pay for an external enclosure, even with the fancy aluminum shell. For that money, you can buy a USB 3.0 external drive *with* a 1TB hard drive included. Or you can just get a bigger PC chassis, move your rig into it, and connect your spare hard drive via internal SATA. **–FLORENCE ION**

VERDICT 6

Akitio SK-3501 Super-S3

+ AKIRA Lots of connection options; fits any standard hard drive.

– A KILLA Bulky, outrageously expensive, and limited to 3Gb/s SATA speeds.

$150, www.akitio.com

The latest budget NAS from Netgear sacrifices performance and features for cost, but there's still value to be had.

Netgear ReadyNAS Duo v2

Platform shift hobbles Netgear's latest 'prosumer' NAS

THE CPU WARS aren't just about x86 procs, PCs, and phones. The second version of Netgear's ReadyNAS Duo makes the move from an older Sun SPARC chip to ARM, and the transition isn't pretty.

Netgear's ReadyNAS Duo v2 uses a single-core Marvell 1.6GHz ARM processor and 256MB of memory. Two sliding hard drive bays are hidden behind the front door and support two drives in capacities up to 3TB each. The ReadyNAS Duo v2 ships in three configurations: empty, half populated (1TB), and fully populated (2x 1TB). We tested the last option, which came with two Seagate Barracuda 7200.12 drives. The chassis is steel and aluminum, not plastic like some other two-bay NAS devices.

The ReadyNAS Duo v2 supports JBOD, RAID 0, RAID 1, and X-RAID2 drive configurations. X-RAID2 is a configuration from Netgear that allows for dynamically expanding your volume by adding more drives—a carryover, one assumes, from Netgear's larger NAS boxes, as it's not useful in a two-bay NAS. The back of the NAS features two USB 3.0 ports, a single Gigabit Ethernet jack, and a power plug that connects to an external 60W power supply. A USB 2.0 port is located on the front of the device, along with the power button and LEDs to indicate drive and USB status. A single 9cm case fan on the rear of the NAS takes care of cooling while keeping the noise level to a low hum.

Netgear uses two utilities for managing the ReadyNAS Duo v2: RAIDar is a PC-based tool used to scan your network for ReadyNAS devices and provides shortcuts to configure or browse your NAS. RAIDiator is the web utility used to configure and monitor your NAS. Out of the box, the ReadyNAS Duo v2 supports DLNA, allowing you to stream music, pictures, and video to a wide range of devices. The RAIDiator console also allows you to create scheduled backup jobs that can target NAS shares, USB drives, or PC shares. These backups can be stored in either NAS shares or connected USB drives, and can be easily configured to run on a schedule or manually when the device's backup button is pressed.

We weren't expecting the ReadyNAS Duo v2 to smoke our benchmarks, but the numbers were still a bit underwhelming compared to most of the units from our November 2011 roundup. Copying a single 2.79GB file averaged 54 seconds writing to the NAS—about half the speed of the speedier units from our November shootout. Copying from our NAS to our PC took about 42 seconds—about 30 seconds slower than those units. Our 659MB collection of smaller files and folders took 18 seconds to write and 14 seconds to read. To be fair, the shootout featured far-pricier four-bay units (most with x86 processors) and in practical use we found the ReadyNas v2's performance to be more than acceptable, particularly for the price.

Netgear's move to ARM has as much of an impact on software options as performance—which is to say, not a good one. ReadyNAS devices usually have access to a wide range of add-ons from Netgear or third parties via the community at ReadyNAS.com, but the vast majority aren't compatible with the ARM-based ReadyNAS Duo v2 and ReadyNAS NV+ v2. The most notable add-ons that are available are ReadyNAS Photos II, a tool that provides an easy method for sharing your photo collection, and ReadyNAS Remote, which allows you to remotely access the files on your NAS from your PC or iOS/Android device.

The biggest problem for the ReadyNAS Duo v2 is the competition. Synology's DS212j, for example, ships diskless for $200—the same price as the diskless ReadyNAS Duo v2, but the Synology has more functionality and greater add-on support, since Synology hasn't just switched CPU platforms. Granted, the Duo v2 has USB 3.0 ports, and the Synology doesn't. The Duo v2's switch to ARM may have its benefits, but it breaks add-on compatibility and leaves the Duo v2's software ecosystem playing catch-up. **–TIM FERRILL**

VERDICT 7

Netgear ReadyNAS Duo v2

NETHACK Two USB 3.0 ports make for easy expansion; strong build quality.

NET NANNY ARM platform limits add-on availability and performance.

$300 (as configured), www.netgear.com

You might suffer through a few installation headaches, but Ceton's InfiniTV is the best way we know of to record cable TV .

Ceton InfiniTV 4 USB

Turn a Win7 PC into a four-tuner HD DVR

WATCHING AND RECORDING digital cable TV on your PC should be simple. Modern CPUs and videocards pack considerably more processing power than what you'll find in even the highest-end DVR your cable company provides; and hard drives—while temporarily pricey, due to the flooding in Thailand—offer plenty of recording capacity.

In short, there is no *technical* reason why every interested TV viewer shouldn't be able to enjoy this harmonious technological convergence. Ceton's InfiniTV 4 USB certainly does its part, rendering the process as easy as can be, considering DRM issues restrict you to using Windows 7 (Linux users need not apply) and subscribing to your local cable company (satellite TV viewers need not apply).

In an ideal world, hardware like this would work seamlessly. You'd buy a multistream CableCard from your favorite retailer, plug it into your InfiniTV, connect the InfiniTV to your coax cable and to your PC's USB port, and—bam!—your PC would be transformed into a four-tuner DVR vastly superior to anything any cable company offers today. In reality, the process is nowhere near that simple.

First, you'll need to visit your cable company's office, because that's the only way to acquire a CableCard. Second, you'll need to schedule an appointment during which your service provider will either install and configure the card for you, or work with you over the phone while you do it yourself. Your service must be configured through the company's main office, and CableCard installations can be tricky—especially if the customer-service rep isn't familiar with the process. The cable companies don't like CableCard and would like to see the technology dry up and blow away.

Be that as it may, it was at this step that the InfiniTV impressed us most. Ceton provides a software utility that performs a comprehensive diagnostic test on the cable connection, including detailed suggestions as to what problem might be preventing the card from working properly. We relayed this useful advice to the cable companies' tech support during our self-install and were able to set up the device with only two calls.

The process of configuring Windows Media Center didn't go as smoothly. We needed to uninstall and reinstall the software and edit the registry in order to get Microsoft's PlayReady DRM to function properly. We also encountered headaches getting video to play on an external TV. After those hiccups, we had a good experience. Ceton recommends using a PC with at least a 2GHz dual- or quad-core processor and 4GB of RAM, which is relatively modest by today's standards. We didn't notice any substantial slowdown while testing with such a system, even while recording four HD television shows simultaneously. Video quality was excellent, and you can stream live or pre-recorded video to other Windows 7 PCs or an Xbox 360 over your home network.

The InfiniTV 4 USB is a solid product bound by restrictions—no Linux support, restrictions on what you can do with recordings, and so on—that are beyond Ceton's control. Our installation experience was less than perfect, but yours might be better. If you have a home-theater PC and hate renting inferior equipment from your cable company, this is the best alternative out there. **–KEN FEINSTEIN**

VERDICT 8

Ceton InfiniTV 4 USB

+ WHITE NOISE Records four HD channels simultaneously; eliminates equipment leases; excellent configuration utility.

– STATIC Difficult to install; requires Windows 7 Home Premium or above.

$ 300, www.cetoncorp.com

Cyborg M.M.O. 7 Gaming Mouse

Mad Catz takes its winning formula in a new direction

WE HAVEN'T TRIED to hide our enthusiasm for Mad Catz' high-tech Cyborg line of gaming mice—we've been big fans of the line since the R.A.T. 7 launched two years ago. Now, the folks at Mad Catz are expanding the Cyborg line into the new and thriving MMO-specialized peripheral market, and we've tested the result: the Cyborg M.M.O. 7.

On the most basic level, the design of the Cyborg R.A.T. has been left unchanged. It's still built on a solid metal base, and it's still extremely customizable. The palm rest can be slid forward or backward to adjust the length of the mouse, and can be swapped out to change its texture or height. The thumb-side flange can be pivoted and adjusted forward and backward, and the pinky plate can be swapped out for a textured sideplate or an additional flange (pictured). The mouse comes with five removable 6-gram weights, giving you a lot of control over how heavy it is. In short, it's still the most comfortable mouse we've tested, when properly adjusted.

What sets the M.M.O. 7 apart from previous models is the button layout. As with most MMO mice, the M.M.O. 7 features many more buttons than your standard gaming mouse—perfect for binding the myriad hotkeys found in most online games. The thumbpad gets the greatest concentration of buttons, with two standard forward and back buttons, three additional large buttons, and a directional rocker, which can also be clicked down, for a total of 10 possible button presses, all at the tip of your thumb. The rest of the mouse features three additional buttons, two scroll bars, a dpi button, and a profile button. In all, the M.M.O. 7 has about as many buttons as you could possibly ask for, arranged in a way that makes them all accessible without sacrificing ergonomics and control.

An original feature on the M.M.O. 7 is the pair of "ActionLock" buttons located to either side of the scroll wheel. Clicking the left or right ActionLock button changes the behavior of the left or right mouse button. When ActionLock is engaged, clicking the mouse button a single time will cause the button to behave as though it were held down, until the button is clicked again. This feature is designed for games that use a held-down mouse button for camera or movement controls, and could be a big help for players using such a control scheme. Our only beef with the mouse was that we occasionally hit the ActionLock keys by accident while aiming for the main mouse buttons.

Software support for the M.M.O. 7 is strong, as well, with a capable profile editor as well as a World of Warcraft add-on that lets you bind hotkeys mid-game.

We're not going to recommend this mouse over the standard R.A.T. for non-MMO gamers, but Cyborg's base offering is still our favorite, and the MMO flavor's got tons to offer fans of the genre. **–ALEX CASTLE**

VERDICT 9 KICK ASS!

Cyborg M.M.O. 7 Gaming Mouse

+ MASSIVE Great construction and customizability; plenty of buttons; sharp looks.

– ASS-IVE A little too easy to accidentally hit ActionLock buttons.

$130, www.cyborggaming.com

Subtlety. Restraint. Minimalism. These are just some of the words that *don't* apply to the Cyborg M.M.O. 7.

Spiny-toothed lizard vs. giant warhammer. No contest

Kingdoms of Amalur: Reckoning

God of Warcraft: The Lootening

LIKE SO MANY long-form fantasy RPGs, the troubles afflicting the inhabitants of Amalur can all be blamed on the actions of a single mad gnome. Stupid gnomes.

This time one of them has decided to build a device called the Well of Souls to bring people back from the dead. You are its first and last success. It's conveniently exploding when you wake up, so your first task in this combat-heavy third-person adventure is to escape the collapsing caverns that house the device before striking out into the Faelands, an idyllic land under threat from a bonkers elfin king and the dark god he's trying to summon.

There are a few problems to deal with before you can consider saving the realm. Returning from the dead has consequences—being alive when you shouldn't has supposedly jolted your character out of the grooves of fate, giving you the ability to change the fate of those around you. In theory, at least.

In reality, at points in the story you're told that dicing up murderous creatures has saved the lives of those they were "destined" to kill, but these moments are entirely dictated by the plot. Your ability to mess with fate never has any real impact on your adventuring.

While you can't actually wreak havoc on the natural order, your supposed ability to do so attracts the interest of the great and powerful. It's not long before you're recruited by the High King of Summer, the leader of the good Fae, and sent off on a journey east to the crystal palace built by the evil King of Winter, leader of the bad Fae, to thwart his crazy plan.

Getting to him will take a long, long time. Your quest will take you through a series of wide open zones, each of which contains a central hub town. These vary from small clusters of huts to small forts, and all contain half a dozen villagers standing under yellow exclamation marks, ready to send you on quests to slay monsters or retrieve valuable items. You can choose to follow the main quest strand, which will lead you on a linear path through the Faelands, or you can linger and take your pick from a number of dull side quests. Alternatively, you can join one of Amalur's five factions and complete their individual storylines for greater rewards.

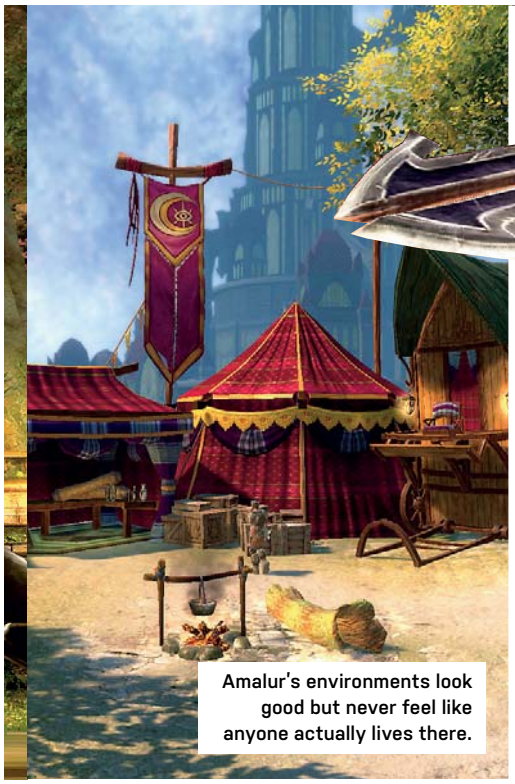
Whatever you decide to do, it will involve hitting a lot of monsters, and hitting monsters is what Amalur does best.

MIGHT AND MAGIC

You can gradually unlock three skill trees as you slay foes and complete quests. Might will give you more attacks with longswords, greatswords and 5-foot mallets. The Finesse tree will let you sneak more effectively, and make you more efficient with knives. The Sorcery tree will unlock some powerful spells and increase your damage with chakrams: sharp circular boomerangs.

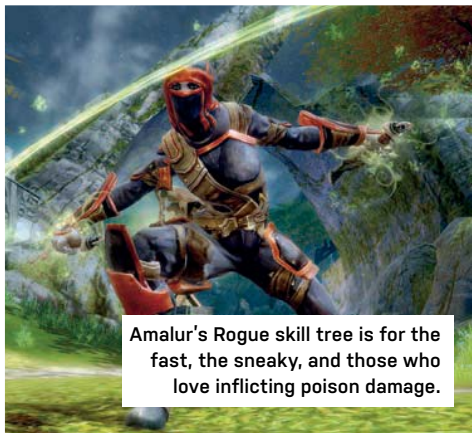
You can specialize in sneaking, smashing, or spellcasting by equipping the relevant destiny card. These will further boost relevant skills, increasing melee damage if you're a fighter and improving your mana pool as a spellcaster. It's a flexible system—you can visit NPCs to reset skill points and equip a different destiny card to change your specialty. As you grow more powerful, you'll unlock dual-class destinies that let you wield a wider range of weapons more effectively.

Amalur's willingness to let you try out



Amalur's environments look good but never feel like anyone actually lives there.

Not just a goodsword. That there's a *greatsword.*



Amalur's Rogue skill tree is for the fast, the sneaky, and those who love inflicting poison damage.

all its toys is one of its best points. All of its weapons are fun to play with, and high-level magic can be supremely satisfying.

You'll commonly fight groups of half a dozen enemies. Weapon swings are tied to the left mouse button, and special abilities like spells to the right. The latter can be switched by selecting from a taskbar. Judicious amounts of rolling and blocking are needed to dodge attacks and set up combos. With a few skill points in the right tree, melee weapons gain charged-up heavy blows and new combos from rolling and blocking stances.

As a longsword specialist we'd commonly knock a foe flying with an upsweep, keep them in the air with a series of slashes, and then spike them with a magical ground stomp. If you prefer a more acrobatic style, Faeblades can be wielded with blinding speed. Magic is more sluggish, but deadly. Mystic staffs give off waves of elemental energy when swung. These keep enemies at bay as you wind up devastating shock spells to finish them off. Advanced spells can draw all of the enemies in the room into one place—the perfect precursor to the awesome meteor strike spell, which drops a great hunk of space junk on their heads.

If you get into trouble, you can activate your fate gauge, which slowly fills with each kill. When the gauge is full you can slow time to obliterate a field of enemies in moments, and execute the last one for a big XP boost. It's a good way to win tricky boss fights.

Stealth is comparatively weak. You can adopt a sneaky stance to creep through dungeons unseen. As you tiptoe close to enemies, their awareness meter will fill up. If it maxes out, they'll attack. With enough skill invested in sneaking, you can get close enough to execute enemies with a showy stab. It works as it should, but sneaking around picking off enemies just isn't as fun as dropping a meteor on them.

There are a few niggles. The tendency to get trapped in combos while attacks are coming in can be frustrating, as can the interruption and knockback attacks that some enemies will constantly spam your way. For the most part, it's a decent, satisfying combat system, but alone it can't sustain Amalur for the 30-plus hours it takes to finish.

KLEPTO AND SON

Expect to find a lot of loot as you wander the world. Every road is lined with flowers that can be harvested to make potions. Almost every enemy drops loot, and there are chests everywhere.

The constant trickle of new armor and weaponry is addictive for a while, and there are plenty of ways to tweak your character for combat, but this can't spice up the bland world you'll be fighting through, or add any depth to your story.

For a character whose alleged talent is the ability to change your own fate, you'll be making few decisions with any consequences. Big decisions at the end of faction quest lines offer the illusion of choice without changing the world in a meaningful way. Beyond wiping out its wildlife, there aren't many opportunities to leave your mark on Amalur, and there's something rigid and mechanical about the way its quests are dished out in clumps. We found ourselves clearing zones as we would in an MMO, turning in batches of completed missions as fast as possible so we could quickly move on and see something new.

The idea of playing a character free from fate is a nice one, but the straightforward quests, predictable cartoon character design and a lack of choice in quests stop Amalur from fashioning these ideas into an absorbing and coherent world.

BUFF AND GRIND

Kingdoms of Amalur is just too long. With a faster main quest and the filler quests removed, the scenery would change faster and progression would feel less like a grind. Extra care could have been given to making each area feel more interesting instead. The verdant forests and sunny plains are pretty, but always derivative. It doesn't feel like a place where people live, and there's no sense of discovery to exploring its lands. If you're looking to hit things, level up, and manage a steady stream of loot drops then Amalur delivers, but with Skyrim and The Witcher 2 still fresh in our minds, Amalur's world, story, and inhabitants can't compete. It's good fun for a while, but ultimately forgettable. –TOM SENIOR

VERDICT **7**

Kingdoms of Amalur: Reckoning

LONG SWORD Satisfying combat system; interesting story—if you can find it.

LONG BORED Too long; too much filler; unmemorable.

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

LAB NOTES

ALEX CASTLE **ONLINE MANAGING EDITOR**

Are Portable Game Consoles Dead?

The PlayStation Vita is out—is there a market for it?

THERE'S BEEN A lot of chatter about Sony's new portable console, the PlayStation Vita. Some of it is about the hardware (excellent), or the display (gorgeous), or the launch lineup (impressive), but most of it is about whether this is a device that even needs to exist. With smartphones now sporting big, high-res screens and able to render impressive graphics, is there room in the market anymore for a dedicated handheld gaming console?

I say there is. Though some games on smartphones look fantastic (Epic's Infinity Blade, for instance), there's just no getting around what I like to call "the button problem." Like the Kinect, touchscreens enable a lot of interesting gameplay possibilities, but without physical controls, much of the game design space we've opened over the last 30 years is completely lost. If Angry Birds isn't enough for you, and you're looking for sophisticated, modern gaming on the go, get a Vita.

Gordon Mah Ung
Deputy Editor

Believe it or not, I was quite surprised by the performance I saw in the $109 Gigabyte Radeon HD 7750 that I used in this month's $485 What Recovery?! PC. On some benchmarks it was faster than a top-flight videocard from just a few years ago. The real challenge, however, will come with Ivy Bridge, which we will pit against this card.

Katherine Stevenson
Editor-in-Chief

After reviewing the first four ultrabooks to market in our February 2012 issue, I've been anxiously awaiting newcomers—you know, all the models that have presumably learned from the first crop's missteps. In the last couple of weeks I've received two high-profile additions to the category: HP's Folio 13 and Dell's XPS 13. Both are very attractive, and each brings some unique features to the table. Can they topple the Asus Zenbook's standing? Stay tuned for my reviews next month.

Nathan Edwards
Senior Editor

I'm curious about Windows Phone, and I'm especially interested in how the next version meshes with Windows 8 and Windows on ARM. I'll have to wait to find out, though: When my Droid Incredible kicked the bucket this month, I got a Galaxy Nexus. The 4G battery life is *terrible*, but Android 4.0 is, without question, the best mobile OS I've ever used.

Richard Koscher
Art Director

My first experiences with my newly built PC have been quite good. When I first turned it on, it made a rattling sound, and I immediately thought, "That never happens with my Macs." My instinct was to bring it back to the Lab and have Gordon fix it. However, having built this machine, I knew it was fixable. After I took off the side panel, I immediately saw the problem: a wire caught in the fan. Fixed. It was that easy. No need for a trip to the Genius Bar.

LETTERS

WE TACKLE TOUGH READER QUESTIONS ON...

> Gaming Rig Sans GPU
> Bonding Over a Review
> Why to Buy a Mac

If Discrete Graphics Didn't Exist

I know graphics cards are simply the best way to go these days for 3D graphics, but just say for a moment that they *do not* exist. (Yeah, I know, life itself would cease to exist.) So if you absolutely had to build a new gaming rig without a discrete graphics card, what mobo and CPU combo would be the best way to go? Just a new IT student and hobbyist PC geek looking for something new to try.

—Johnathan Marsh

DEPUTY EDITOR GORDON MAH UNG RESPONDS: That's a very difficult proposition, Johnathan. Gaming rig and discrete graphics go together like peanut butter and jelly. Without the separate GPU, it's one bland sandwich, and I would sincerely recommend that you sacrifice other items to get a competent GPU in place. If I had absolutely no choice though, my pick would be one based on AMD's Llano, the fastest of which is the A8-3870K part at $135 in volume pricing. This would be paired with a board using AMD's FM1 socket and, this is also key, RAM that will clock up to high levels. Since the APU relies on the system RAM, you want RAM that can provide as much bandwidth as possible, so put out a little more for DDR3/1600 or DDR3/1866 RAM. If I had a little more time, I'd probably wait a few months to see if Intel's Ivy Bridge CPU has what it takes, and I'd also want to wait for AMD's Trinity chip, which will also up the 3D gaming performance.

CUT, COPY, PASTE

→ In the April 2012 Build It section, we incorrectly listed the hard drive as a 3GB Seagate Momentus. We should have said 3GB Seagate Barracuda.

→ In our "73 Amazing Websites" feature in the April issue, we recommended Pintrest.com, when we should have said Pinterest.com.

Thanks for Star Wars: TOR Review

To my dearest David Murphy and the rest of the *Maximum PC* staff: Your Star Wars: The Old Republic review (March 2012) brought much joy and jubilation to my already tech-swooning soul. Honestly, I thought I was going crazy when all of these other magazines, websites, and TV shows were giving this hollow shell of an MMO 9 out of 10, 10 out of 10, and other vomit-inducing high verdicts. I'm not some Star Wars hater, either; in spite of the prequels, I still faithfully stand by what once was both magical and wonderful to me. However, a bad MMO is a bad MMO, so listen up BioWare: Slapping MMO on a box and erecting servers that can barely host more gamers than most LAN parties do does not prevent your still-in-beta videogame from being "single player." There! I said it! I thought I was the only person on this planet who could see that. Thankfully, *Maximum PC* could see it too. Cheers for that!

—Corey Eisner

CONTRIBUTING WRITER DAVID MURPHY RESPONDS: Thanks for the kind message, Corey. I can't speak to why other reviewers felt that the game was worthy of the higher scores they were giving it—that's not to say they were wrong, per se, as all reviewers tend to notice (or not notice) different elements when evaluating a product. But it does emphasize just how important it is to find reviewers or editorial outlets that gel with your personal tastes when you're researching a particular piece of hardware (or game). I'm glad to see that you and I agree about The Old Republic; let's make it Facebook official.

PC: Piece of Crap

I'm a former PC user. I've built PCs for myself and friends. I've helped other friends fix their constantly broken PCs.

Yet all I heard from my friends and family is, "Macs cost too much." Call 1-800-wah-hhhh. Yes, the startup costs are more, because it costs more for an item of quality. Macs and iOS devices hold their value much longer. I bought my first Mac, a Mac Mini, in 2004. I bought an iMac in 2007 and gave the Mac Mini to a friend in 2008... she's still using it! And it runs just fine, thank you very much. I now have an iMac, a MacBook Pro, two iPads, uncounted iPods, and three iPhones in my household. And they all work great constantly, in contrast to three Windows-based laptops that are always breaking down or screwing up something.

My second iPhone was

↘ submit your questions to: comments@maximumpc.com

an iPhone 4. I had it a year, sold it, then bought an iPhone 4S. I got $5 more for my iPhone 4 than I paid for the iPhone 4S! Quality, Gordon.

Now many of my friends are converting to Macs and iOS devices. Gee, I don't seem to get quite as many calls for computer help as I did before... I wonder why?

There's a reason Windows-based computers are called "PCs." It stands for "Piece of Crap".

—Barry Edwards

DEPUTY EDITOR GORDON MAH UNG RESPONDS: As long as you are suggesting that we all base our decisions on anecdotal stories, here are some of my own. My friend's older MacBook failed after three years. She fixed it by buying a new MacBook Pro. About four months into that notebook's life, it failed during an OS X update with "kernel panic." The "Genius" at the Apple store said her mainboard had failed, and they would have to replace it. She'd have to leave it there and would be without it for a while. That didn't sound right to her, so she went home and did a system restore—oh sorry, Time Machine—and it works fine. Keep in mind, this was the second issue that stopped her new MacBook Pro dead in its tracks and required "Genius" help.

I have a relative who switched from a perfectly functional but very elderly P4 PC to a brand-new Core 2 Duo iMac. I don't have enough space in the magazine to chronicle all of his problems, but let's just say the case file is pages long. It took a year of bringing it in to the Genius Bar every few weeks for Apple to finally relent and replace the unit.

You know what's really cool? I still use an IBM ThinkPad manufactured in late 2005 as my primary notebook. I've upgraded most of the parts in it and it's happily humming along with 64-bit Windows 7 Ultimate (I wanted BitLocker), and I'm sure it will run Windows 8. If the Gordon on Counter-Earth had an Apple notebook of that vintage, it would have been a PowerBook G4. Oh guess what, Apple hasn't supported that OS in years. No problem, just "fix it" by throwing it away and buying a new one.

I actually own an iPod Classic 160GB, the model that many reviewers on Amazon say is a pile of junk because of the way it crashes constantly—just like mine. My personal favorite is, when updating iTunes, it deletes my optical drives, forcing me to dig into the registry to get them to work again.

I recently was wondering if all the stories I had heard of Macs "always" working were true, so I did a search of the simple phrase "problem with MacBook." I think Google found 52,500,000 results.

So, yes, I totally agree that using personal anecdotal stories of success and failure are perfectly valid ways to judge a product and that constantly screaming that the product is perfect and everything is sunny all the time is a way to portray that nothing is wrong at all.

[NOW ONLINE]

THE 30 BEST TECH COMMERCIALS OF ALL TIME

In 2008, Microsoft smacked us upside our collective dome with a TV commercial campaign featuring comedian Jerry Seinfeld and Redmond commander-in-chief Bill Gates. Although those spots ended up a disaster, and there have been plenty of other stinkers throughout the years, not all tech commercials have been bad. In fact, some have been downright great.

We've put together a list of 30 of the funniest, smartest, and most effective tech ads on TV—check them out at bit.ly/z7LOIK.

[NEXT MONTH]

COMING IN MAXIMUM PC's

WE'RE ALL WEARING PAJAMA JEANS JUNE ISSUE

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The Consumer Preview is here! We'll show you how to install it on your PC without doing damage to your current OS, and then we'll walk you through its most noteworthy new features.

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Learn how to build a microATX gaming rig that won't break your budget or your desk.

Hot New Hardware!

We can't say what it is, but next month, we'll be taking the wrapping off some exciting new gear that you will definitely want to know about.

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HARDWARE

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Midrange Display
LG E2370v
www.lg.com

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

THE GAMES WE'RE PLAYING

The Elder Scrolls V: Skyrim
www.elderscrolls.com/skyrim

Battlefield 3
www.battlefield.com

Batman: Arkham City
www.batmanarkhamcity.com

Star Wars: TOR
bit.ly/tVffnz

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