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**ULTIMATE
GUIDE TO**

digital media



How to rip, organize, and stream all your
TV, movies, and music—**anywhere and everywhere**

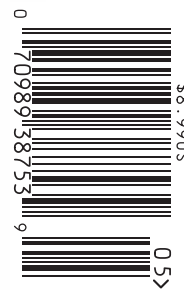
**IT'S A PHONE.
IT'S A LAPTOP.
IT'S BOTH!**

Tested: Motorola's
new Atrix 4G



**YOUR WEBCAM
IS LOUSY!**

Upgrade your
videochat with 6
superior HD cams



HOW TO Build and Overclock a Fast, Cheap AMD System



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Living in a Low-Fi World

Inspired by this month's cover story, I spelunked into the nether regions of my back closet to explore all the CDs and DVDs I've collected over the last 20 years. You know the closet I'm talking about—it's the musty dark one that's stacked with boxes full of, erm, stuff.

My first Commodore 64! My D&D character sheets! Strat-o-Matic Baseball! Wing Commander II! My high school letterman's jacket—jeez, was I really that skinny in 1984? And finally, seven three-ring binders full of 60 CDs each and three binders loaded with 60 DVDs each.

The movies are classics that I bought at the dawn of the DVD spec rollout. *Apocalypse Now*. *Sid and Nancy*. *Enter the Dragon*. *The Godfather*. My CD collection ran a little weirder, but I had totally forgotten about the massive collection of John Coltrane discs I spent years collecting. (BTW, If you ever want to stare insanity in the mouth, try listening to Coltrane's *Live in Japan* album—or even one song—in its entirety.)

You can now find most of these albums and songs online, which got me thinking: How would Coltrane feel about his music being accessible to anyone at pretty much anytime? I bet Mr. Coltrane would be thrilled at the ubiquity of his songbook but would be absolutely horrified at how bland it all sounds via digital download.

I threw *Live at Birdland* and Blue Note's remastered *Blue Train* into the portable CD player I also found in the back closet. (That's why you keep old technology!) Wow, the audio quality. In this day and age of 128Kb/s MP3s, the clarity of these original recordings feels like a crisp, clean breath of fresh air.

Thirty-six hours later, I was still listening to Coltrane, Johnny Cash, the Cure, and a whole bunch more. But now I was ripping all these albums to my archives. In lossless format, of course.

In this month's Quick Start lead story, Gordon investigates Intel's intentions for Light Peak data I/O technology, now named Thunderbolt. One of Intel's PR reps stated that one impetus for Thunderbolt is the fact that we're all amassing increasingly vast amounts of digital media and the fidelity of this media is constantly increasing—thus requiring faster data-transfer bandwidth. We should all pray that this increased fidelity applies to the music Apple, Amazon, and everyone else is peddling.

Oh, one final note: It took longer than I expected for 10 of you to find the three pigs in last month's issue. We gotcha on this one: A lot of people referenced the cover pig and the pig on the cover story's opening spread. That's the same pig, though! For the list of winners, check out the Comments section on page 94.

George Jones

THE MOST INTERESTING STORIES IN THE WORLD

Thunderbolt Revealed!
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LETTERS POLICY Please send comments and questions to george@maximumpc.com. Include your full name, city of residence, and phone number with your correspondence. Unfortunately, George is unable to respond personally to all queries.

THE NEWS

Intel Launches Light Peak, aka Thunderbolt

Promising high-speed cable technology is embraced by Apple, but others remain skeptical —GORDON MAH UNG

Even before its official debut, Intel's Light Peak technology had its share of controversy, but now that it's finally here, dubbed Thunderbolt, the critics aren't ready to put away the slings. After its launch, the *New York Times* opined, "Is Thunderbolt really a Thunderbolt?" Slate.com wondered if it was "a worthless grasp at the past" and questioned why Intel would even pursue a wired solution in an age of wireless. Others have called it FireWire 2.0 (an allusion to FireWire's failure to win the standards war).

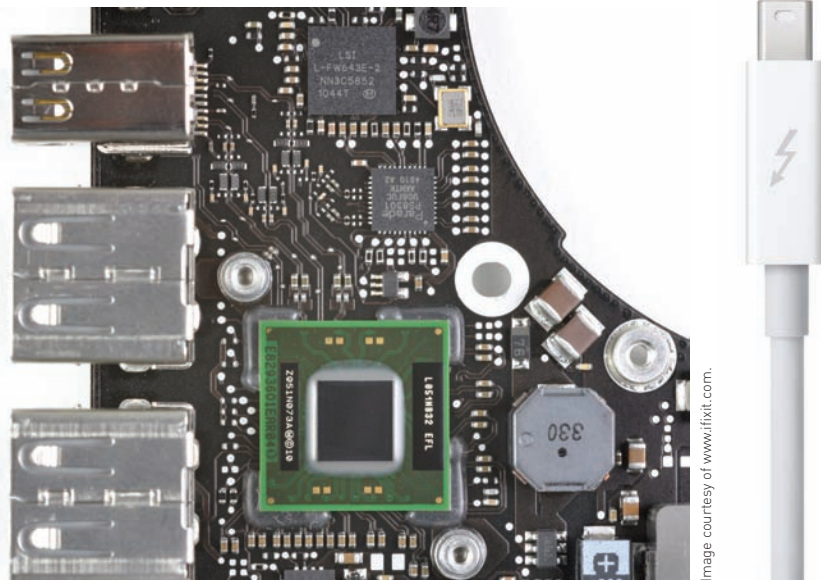
Thunderbolt is essentially one cable to rule them all: a slim, super-fast cable that can move 10Gb/s in data in both directions in each of its two channels, and it's probably capable of even higher speeds.

But if Thunderbolt is so fast, why all the player hating? Certainly, some of it is pure industry cattiness. And despite Intel again reiterating that it will support USB 3.0 in future chipsets, many still see Thunderbolt as a direct competitor to the common, nonproprietary, low-cost standard.

The way the company has rolled out Thunderbolt hasn't helped. When Intel created USB, SATA, and many of the technologies it pioneered, it created standards bodies, licensed its designs royalty-free, and built coalitions before going forward. There is no standards body for Thunderbolt and no third-party chip. Today, only Intel can make Thunderbolt controller chips and details of the protocol are still guarded.

But most of the acrimony comes from supporters of the year-old USB 3.0 standard. Ever since Intel showed off Light Peak in 2009, USB 3.0 supporters have accused Intel of dragging butt on native chipset support so Thunderbolt could mature.

The company responded that it will support USB 3.0 in future chipsets and noted that some of the earliest USB devices from 15 years ago still work if you plug them in today. "We



The first Thunderbolt chip debuted inside Apple's newest MacBook Pro.

recognize that you don't throw that kind of eco-system under the bus," said Intel spokesman Dave Salvator. "We are committed to it."

But, Salvator said, the company looked forward in time and saw that in three, five, or 10 years, the amount of media people collect wouldn't get any smaller, and the resolutions would become ever higher.

Apple was the test bed for Thunderbolt because the company was willing to jump in with both feet, he said, and despite other vendors being absent from the launch, they are interested.

The major OEMs that *Maximum PC* spoke with declined to disclose whether they will support Thunderbolt. Several motherboard vendors, however, did say they planned to add the controller to professional-class motherboards

and possibly enthusiast boards as a value-add.

One reason Intel may be taking unilateral action today is for speed. Shane Rau, an analyst with IDC, said that by going it alone, Intel can avoid the design-by-committee road bumps that can slow technology launches to a crawl.

Cost will certainly be an issue if Thunderbolt is to eventually supplant USB, FireWire, eSATA, and external PCI-E. Intel wouldn't disclose the cost of the Thunderbolt controllers but it's likely in excess of \$10. By comparison, USB 3.0 host controllers vary from \$2 to \$5, with costs dropping rapidly.

"Short to midterm, USB is going to be here and there is enough opportunity for USB 3.0 to be worthwhile," Rau said. "But there is not going to be a USB 4.0."



TOM HALFHILL

Electrons vs. Photons

I've seen the light, and it's dark. Intel's new Thunderbolt technology, formerly code-named Light Peak, is making its debut as something more like Copper Peak. Instead of the futuristic fiber-optic cables we were promised, we're getting plain old copper cables that would be passably familiar to Thomas Edison.

Score another victory for electrons. They may be tiny, but they're wily. (Ahem.) Not easily will they be shoved aside by photons (which, after all, are massless). Someday, fiber optics will replace most of our copper, but that day has not yet arrived.

Who snuffed out the light in Light Peak? One culprit is Intel's intrepid Light Peak engineering team, which managed to wring more throughput from copper than expected. Thunderbolt combines PCI Express with DisplayPort on a single serial cable with two bidirectional channels, providing 10 gigabits per second per channel. That performance matches Intel's initial goal for an optical cable.

Such speeds are not new for copper—10-gigabit Ethernet has been around for years—but sustaining that performance over long cables without data errors is difficult. Consequently, Thunderbolt's copper cables are limited to about 3 meters. For longer runs, Intel will introduce extended optical cables later this year.

The other culprit working against photons is cost. Electrical connections are cheaper than optical connections, which matters a lot to the PC industry's razor-thin profit margins. It's not that copper wire is cheaper than glass fiber. It's that photons can't replace electrons entirely. Microprocessors and memory chips are electrical circuits, which need electrons. Although optical cables can carry data signals as photons, each cable termination requires a special interface chip that converts photons into electrons or vice versa.

It turns out that Intel is the only source for Thunderbolt interface chips, because Thunderbolt is Intel's proprietary technology. It's a "standard" only in the sense that anyone can implement Thunderbolt on a computer, display, or peripheral—if they buy the chips from Intel. Lack of competition tends to keep costs higher.

Thunderbolt is more thunder and less lightning than many people expected. Still, it's an important step toward a photonic future.

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

AMD's New Dual-GPU Tested

Radeon HD 6990 takes performance crown—for now

AMD's dual-GPU cards have come a long way in the past several years. The original Radeon HD 3870 was noisy, ran hot, and didn't always perform up to snuff. Since then, AMD's Catalyst driver suite has substantially improved the performance and breadth of CrossFire-supported games.

AMD's latest dual-GPU card, the Radeon HD 6990, is essentially two Radeon HD 6970 GPUs built onto one card. Despite being fully 12 inches long—like its predecessor, the Radeon HD 5970—the HD 6990 looks a little less imposing than the 5970. Maybe it's the center-mounted fan, which visually breaks up the huge mass of the cooling shroud. Still, it's a big, heavy card that will only fit in larger PC cases, so make sure your case has the room for it.

While the base core clock speed of the HD 6990 is 830MHz (down from the 880MHz of a 6970), the full 6970 has been replicated, complete with 3,072 total shader ALUs, 192 texture units, and 4GB of GDDR5 running at 1,250MHz. A physical switch automatically overclocks and over-volts the card back to 880MHz, so each 6970 runs at full stock speed.

At full throttle, our test bed containing the overclocked HD 6990 used 528 watts—more power than we've ever seen from a



The foot-long Radeon HD 6990 isn't compact, power-stingy, or subtle. It's just fast.

single graphics card. The card itself, when overclocked, consumes up to 450W, which requires serious voltage regulation.

All that power is put to good use, though. The Radeon HD 6990 handily smacks the fastest single-GPU videocard, Nvidia's GTX 580, as well as AMD's previous dual-GPU champ, the HD 5970. So for the moment, AMD gets to hoist the PC graphics performance crown onto its brow.

At \$700, the HD 6990 doesn't come cheap, especially considering that a single Radeon HD 6970 costs around \$360. But fame and GPU fortune can be fleeting, and at press time, rumors abounded about Nvidia's dual-GPU offering, which may even be available by the time you read this. —LC

BENCHMARKS

	Radeon HD 6990 (stock)	Radeon HD 6990 (overclocked)	EVGA GTX 580 SC	Radeon HD 5970
3DMark 2011 (Extreme)	3,259	3,404	2,021	2,509
3DMark Vantage Perf	27,495	27,854	23,888	24,654
Unigine Heaven 2.1 (fps)	50	53	36	28
Crysis (fps)	61	61	36	44
BattleForge DX11 (fps)	100	101	78	73
Far Cry 2 / Long (fps)	149	151	122	114
HAWX 2 DX11 (fps)	143	146	158	102
STALKER: CoP DX11 (fps)	89	92	58	54
Just Cause 2 (fps)	71	71	52	55
Aliens vs. Predator (fps)	77	80	44	49
F1 2010 (fps)	87	86	72	80
Metro 2033 (fps)	39	38	26	20
Power@ idle (W)	160	160	141	169
Power @ full throttle (W)	477	528	395	364

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



THOMAS MCDONALD

Stupid Advertising Tricks

Hey kids! Wanna cheese off Mom? Then play an M-rated video game!" That's the juvenile, completely irresponsible message of EA's "Your Mom Hates This" advertising campaign for Dead Space 2, which was inexplicably approved by the ESRB. Whenever gaming begins to earn a modicum of mainstream acceptance and respectability, something remarkably stupid and pointless comes along to make us look like twits and make a farce of the ratings system.

The commercial, which quickly went viral, shows moms ("from the heart of conservative America") reacting with horror to video of the game.

In other words, EA is stereotyping an entire gender, class, political ideology, and region in order to sell a few more copies of the game. I guess news that women, moms, conservatives, and middle-Americans play games hasn't yet reached Redwood City.

Who is the audience for this ad? Are there that many adults who still want to provoke their moms by their choice of video recreation, or is this just a direct appeal to underage gamers? Are game companies serious about keeping violent content out of the hands of minors, or just "serious" in a wink-wink, you-really-need-this-game-to-be-cool way?

This is just a trite way of reinforcing a generation's sense of its own coolness, and rational adults should balk at such shameless manipulation. Attempting to exploit the generational divide in order to sell a few more copies of a game is crass marketing at its worst. The idea of "consumption as rebellion" is nauseating in itself.

But I think I'm most bothered by the implicit message that games are only for hip kids. I'm 42 and I loved Dead Space 2. It's a game that has no need whatsoever to demean itself with this kind of childish appeal. The ad actually sells the game short.

I'm sure people would be offended by all kinds of things that I enjoy and believe. Who cares? It's one thing to like certain kinds of mature entertainment, but quite another to drag them out into the public square and then jeer at those who are offended.

Thomas L. McDonald is an editor at large for *Games* magazine and blogs at soppaming.blogspot.com. You can follow him on Twitter at StateOfPlayBlog.

Mobos Arrive with Sandy Bridge Fix

There's been a lot of moaning and groaning about consumers' inability to buy motherboards for Intel's Sandy Bridge CPUs, but ultimately, the issue may have been a tempest in a teapot.

Major motherboard vendors are now shipping boards with the updated "B3" step of the chipset. MSI, Asus, and Gigabyte are among the vendors currently offering the corrected boards. To help reassure consumers afraid of getting non-fixed boards, vendors are labeling the products with B3 stepping logos. While board vendors say it should be almost impossible to even get a B2 motherboard, the B3 label will help mitigate any confusion. —GU

Amazon Enters Streaming Scene

We all knew it was only a matter of time before Amazon took on Netflix by streaming movie and TV content. But rather than debut the service along with a monthly subscription plan similar to Netflix's—or even Hulu's, for that matter—Amazon is offering it as an added bonus to Amazon Prime members. So now, in addition to getting free two-day shipping on items purchased through Amazon.com for \$79 a year, Prime members also get instant-streaming access to 5,000 movies and TV shows at no additional cost. The commercial-free content is viewable through Amazon Instant Video on a PC or Mac, or over an Internet-enabled TV or compatible set-top box, such as the Roku or Unbox video players. —KS



Seagate Joins 3TB Fray

Seagate has joined the ranks of hard drive manufacturers offering 3TB hard drives for consumers. The 3TB Barracuda XT has 64MB of cache, a 6Gb/s SATA connector, and five platters spinning at 7,200rpm.

In order to create partitions larger than 2.1TB, it's necessary to have all of the following: a 64-bit post-Windows XP OS, a UEFI bootloader, and a machine capable of GPT partitions. Most people don't have all of those yet, so Seagate is making available its DiscWizard software, which will help legacy users create multiple partitions sufficient to use all available space—no hardware add-on necessary. —NE



Windows Late to Tablet Party

Optimized OS is a long way off

Citing “people with knowledge” of Microsoft’s plans, Bloomberg reports that there won’t be a truly tablet-oriented version of Windows until 2012’s back-to-school season, leaving Google and Apple to duke it out.

Those same sources say that public testing of a new version of Windows will begin at the end of this year. In the meantime, Microsoft is trying to tweak Win7 with more features geared towards touch screens. —PL



New SandForce Drives Coming

Next-gen controller, blistering speeds

Preliminary samples of consumer solid-state drives using SandForce’s next-generation SF-2000 series SSD controllers have appeared. SandForce, whose SF-1200 controllers were the brains of many of 2010’s top-performing SSDs, announced in February the release of two new product lines: the SF-2200 and SF-2100 series.

According to SandForce, SF-

2200 controllers use 6Gb/s SATA and will have sustained read and write speeds near 500MB/s, while SF-2100 controllers are limited to around 250MB/s by way of a 3Gb/s SATA connection. The new controllers also have improved encryption features.

Consumer drives using second-gen SandForce controllers are expected from OCZ, Corsair, and others. —NE

WB Rents Movies over Facebook

In what could become a trend, Warner Bros. is testing Facebook as a means to rent its movies, starting with *The Dark Knight*. Facebook users can now go to the movie’s official Facebook page and rent a digital download for 30 Facebook Credits, or \$3. Users have 48 hours to watch the movie, while maintaining full Facebook functionality. WB says other titles will follow. —KS



Blu-ray Media Gets a Boost

The relatively high cost of a 50GB optical-storage disc becomes a lot more palatable when the disc is rewritable. That’s what you get with Verbatim’s new BD-RE DL media—the first of its kind. So if you tire of all the high-def video and audio you burn to a disc this year, you can take comfort in knowing that the disc is rewritable up to 1,000 times. Street price for the media is \$55 for a 10-pack. —KS

BYTE RIGHTS



QUINN NORTON

TPP/IP Error: Rights Not Allowed

The secretive Anti-Counterfeiting Trade Agreement is a done deal. Negotiated, written, and even released where hoi polloi like us can read it, on the U.S. Trade Representative’s website. It’s still awful, calling for more parts of the DMCA to be worldwide, but not as awful as it was. Thanks to the efforts of groups like Public Knowledge and EFF, and New Zealand, which has taken the strange position of not criminalizing the normal behavior of its citizens, it was toned down. ACTA is now all packed up with a little bow waiting for legislatures to approve it, but the companies behind it have already left it like last week’s tuna sandwich.

Turns out the 37 nation trade-maximalist agreement is, like, so five minutes ago. The new hotness in oppressive copyright regimes is the Trans-Pacific Partnership Intellectual Property chapter, cleverly hidden under the unsearchable acronym TPP IP. Yes, Google, I really did mean TPP IP.

This time around, our trade reps are going after the Pacific Rim. Outlandishly huge damages, copyright extensions that will be spry when Halley’s Comet returns, and DMCA-style anticircumvention laws that criminalize watching DVDs on Linux is just the start. TPP goes further. It calls for software patent protection and tries to establish technical incoherencies like copyright protection for temporary copies. This is a fancy way of saying that rights holders can either charge you extra for the contents of your cache files, slap DRM on them, or both. It’s like everything bad about IP in one steaming pile and about as close as current technology can get to letting the studios charge you for thinking about a movie.

It’s done in our name, but authored by PhRMA, MPAA, and the U.S. Chamber of Commerce. It’s a harmonizing treaty, so they’re poised to ram it down the throat of whatever tiny nation provides the thinnest excuse for the copyright holders, then come back to our congress, pleading trade agreement as an excuse to pass even stricter laws. Someday we should try to get our name back.

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

THE LIST

7 Libations Beloved by Nerds

7 WHITE RUSSIAN

Hey, man, there's a beverage here!



6 ROMULAN ALE



VODKA MARTINI

5 SHAKEN, NOT STIRRED; IT'S THE FIRST MIXED DRINK MOST OF US EVER HEAR ABOUT. PRETTY TASTY, TOO.

4 SONIC SCREWDRIVER

It fixes everything! Blue Curacao and water.

3 PAN-GALACTIC GARGLE BLASTER

Earth recipes abound for this *Hitchhiker's* staple; we prefer the one at Knuckle Salad (<http://bit.ly/fGqh18>).

2 BLUE DOLPHIN

Designated driver? According to our sources, some bartenders will give you water if you ask for a Blue Dolphin. (Results may vary.)



1 THE OVERCLOCKER

Maximum PC's signature mixed drink consists of chocolate stout, dark spiced rum, and espresso. May cause system instability.

DEATHMATCH

x86 vs. ARM

In many ways, x86 was never meant to be here still. Experts predicted that RISC (reduced instruction set computing) architectures would banish the quaint PC processor more than two decades ago. But in the end, that lowly desktop x86 processor won out. Workstations, servers, and even supercomputers run

on x86 today. Yet the battle isn't over. Everyone agrees that x86's biggest challenge today is the RISC-based ARM chips that rule smartphones and tablets. Could RISC ultimately end up winning the war? We take a hard look at the biggest threat to x86 to come along. —GORDON MAH UNG



x86

ROUND 1

POWER CONSUMPTION ARM's big selling point has always been power consumption. Typical ARM chips in smartphones consume power in the milliwatt range. Intel's most power-sipping Atom processors are still in the 2 watt range of power consumption. That may not sound like much, but it's a world of difference in mobile devices such as tablets. Interestingly, ARM power consumption and performance is starting to creep up, while Intel's x86 chips are creeping down. Will the two meet in the middle and finally nullify ARM's long-standing advantage? Perhaps one day, but today there's simply no contest. **WINNER: ARM**

ROUND 2

PERFORMANCE Pitting x86 against ARM in performance is like jumping into the ring against Mike Tyson in his prime. It's gonna be a beat down and someone might even lose an ear. Want proof? More than 86 percent of the world's top 500 supercomputers run on x86. Yes, there's talk of ARM scaling up to desktops and supercomputers (Nvidia's Project Denver seems to have the most promise), but those days, if they ever come, are far away. **WINNER: x86**

ROUND 3

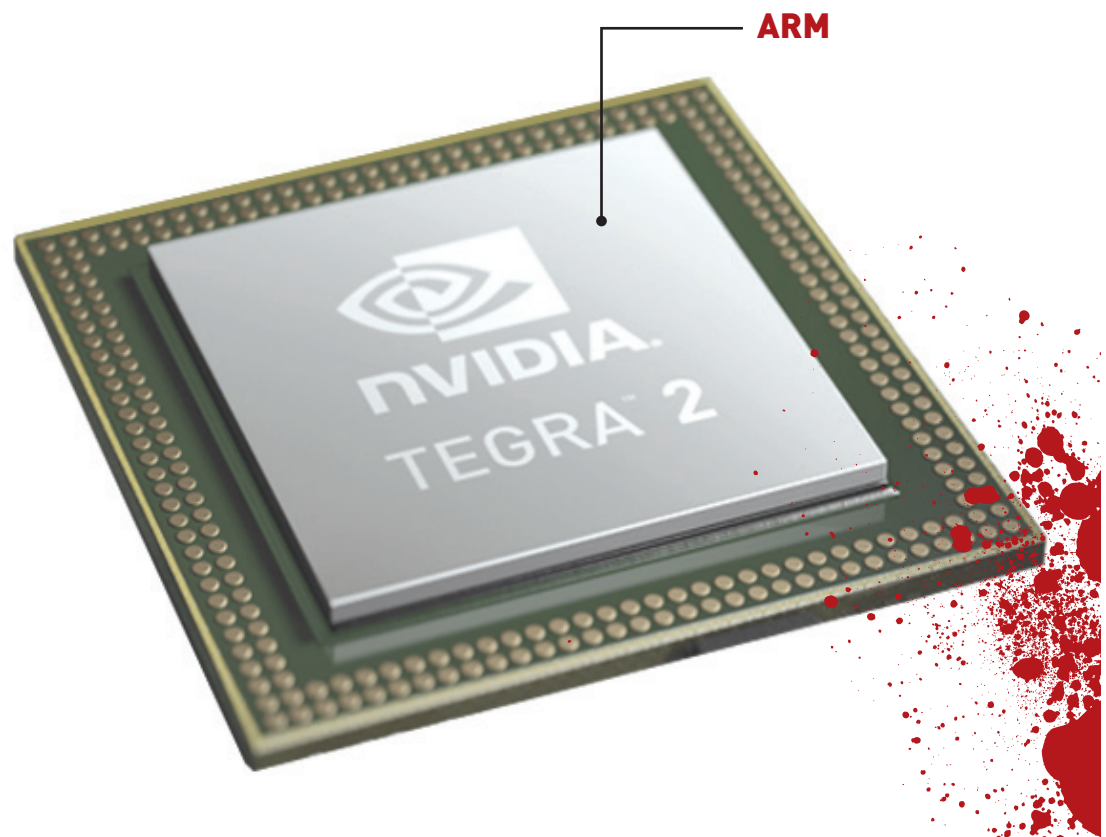
CODEBASE Despite Intel having multiple lines of x86 CPUs and AMD pushing several generations of its own processors, x86 is still pretty generic. The same code will run on an Atom as runs on a Core i7—it'll just be a hell of a lot slower. But at least it works and developers don't have to rewrite apps to run on various x86 products. On the other hand, ARM is fragmented beyond belief. Yes, it's an ARM chip, but because everyone seems to add their own special sauce, not all code will run everywhere. Owners of Android-based phones can attest to how flakey new apps tend to be—some of that comes from the variances in ARM chips. **WINNER: x86**

ROUND 5

INSTALL BASE If people are consuming fewer PCs every year, the numbers don't bear it out. When folks talk about an x86 sales slump, they really mean growth rates are ratcheting back, from, say, 6 percent to 4 percent in a quarter. Generally, more than 300 million x86 CPUs are sold every year, which is no small sum. The problem is that while x86 CPUs breed like humans, ARM chips breed like insects. This year, close to 5 billion ARM chips are forecast to ship. Before you reach your desk in the morning and boot your PC, you've probably already used five devices running ARM processors. **WINNER: ARM**

ROUND 4

ARCHITECTURE Modern ARM processors implement two-issue, out-of-order, super-scalar designs that are pretty much on par with their x86 contemporaries' architecture. Of course, modern x86 chips are four-issue, out-of-order, super-scalar designs that pack on far more performance-minded features than a typical ARM chip. The problem is that both CPU families are scaled for the devices they run in. A typical ARM lives and runs fine in a phone or tablet or printer, but try pushing a fully featured OS with an ARM and you're going to have issues. X86 chips, meanwhile, are stellar in desktops and notebooks but really don't scale down to tablets or phones yet. **WINNER: TIE**



And the Winner Is...

Make no mistake, ARM-based devices are the most serious threat to the hegemony of the x86 processor in its history. Yes, x86 has always prevailed before. It has all but eliminated competing designs in desktops, workstations, and servers, but ARM's attack comes in the form of smartphones that get upgraded or replaced every 18 months and from

tablets that appear poised to all but decimate the notebook market. As purveyors of maximum computing, we'd have liked to call this for the x86, but frankly, we're not sure how this one is going to turn out, so for now, we're calling it a **tie**. If this feels like a loss, take heart in the fact that neither Microsoft nor Intel will give up easily.

This month the Doctor tackles...

▶ Upgrading a microATX

▶ Busting Dust

▶ Inbox Synchronization



Upgrading microATX

I bought a Gateway GT5628 back in 2008, and I'm looking to upgrade the video but having a hard time finding a replacement for my GeForce 8500 GT. The PC has a 2.4GHz Core 2 Quad Q6600, 4GB of RAM, two x1 PCI-E slots, and a PCI slot. I'm currently using a 24-inch HP 2310 monitor at 1920x1080 on DVI, but the games are really choppy when set that high. What is your recommendation for a good GPU upgrade that would get me better frame rates than what I'm using right now? Thanks!

—Cesar Ponce

Cesar, nearly any GPU on the market will get you a better frame rate than what you're using now. However, upgrading to a better graphics card will almost certainly necessitate getting a new PSU. The GeForce 8500 GT you're currently rocking draws just 40W of power, and your PSU is only 400W. Newer, more powerful GPUs use a lot more juice—upwards of 140W at *idle*. To get great performance at 1920x1080, you don't need a top-of-the-line card, but you do need to spend a little bit of money, and what you get depends on your budget—both for a GPU and for a PSU.

Your PC is a micro-tower with a microATX motherboard. There ain't much room for a bigger PSU, so if you get a more powerful PSU, you either need to get

one that is no larger than your current PSU or get a larger case. And if you have a bigger case, maybe you should get a newer motherboard, too—if not now, then eventually.

If you're not keen on a big upgrade, pick up a budget AMD card like the Radeon HD 5570. It's a single-slot card that eats just 39W of power but has full DX11 support and should be way faster than your 8500 GT.

If you're looking for a GPU you can transfer to a new rig when you build one, go for a midrange card like Nvidia's GTX 560 Ti or AMD's Radeon HD 6870, and get a 600W or higher PSU to go with it (just make sure it'll fit into your case first, if you're not upgrading to a bigger case). That way you're already halfway to your next build when the time comes to upgrade to a new mobo and CPU.

Embiggening Partitions

Last month I installed Windows 7 on my newly built computer. During the installation process I was asked to partition my drives. The installation wizard told me I needed a minimum of (I believe) 14.6GB for the install, so I made my C: partition 15GB. I tried to repartition after the installation (since I ran out of room), but wasn't able to. If I uninstall Windows

7 and reinstall it, will I be able to use the same product key?

—Cameron Day

Provided your hardware stays the same, you should have no problem using the same product key, as it is now keyed to the fingerprint of your hardware. For what it's worth, you shouldn't have a C: partition less than 40GB for Windows 7. You can also try resizing your C: partition using a free partition tool like Easus Partition Master (www.partition-tool.com). Be sure to defrag first! As long as you have free space on your drive you should be able to expand the partition with no problems.

not all, of the dust from a computer? Or even better, is there some kind of dust repellent paint that computer cases, mobos, cards, etc. could be designed with to prevent the dust from adhering to the inside of cases?

—Jeff Grimes

Dust is pretty much inevitable wherever there are people, and your ability to minimize it depends on how much control you have over the environment in which the computers are kept. If you're the kind of tech who parachutes into the homes of hoarders and the computer-illiterate in hopes of rescuing

AN AIR FILTER IN THE COMPUTER ROOM CAN KEEP YOUR RIG'S INSIDES FROM GETTING DUSTY

Dust Bustin'

As an allergy sufferer and computer tech, all these dusty computers are making my life miserable. I love working on computers but hate the dust! I do as much as I can to prevent breathing the dust—using masks, vacuums, and so forth—but it is unavoidable. Every time I crack open these dust-collection boxes, I'm amazed and sickened by what builds up in there.

Do you know of any devices on the market that would remove most, if

maltreated hardware, our advice is to stock up on Claritin and face masks. However, if you *do* have some environmental control, consider an air filtration system with a HEPA filter in the room where the computer is kept. By filtering dust out of the air, you're minimizing dust that can sneak into the computer.

Many modern cases also come with removable dust filters over their intake fans, which can cut down on dust, though you'll need to remove the dust from the filters regularly or starve your case of air. Positive air

pressure can help prevent dust drifting into the case. Of course, the easiest way to prevent dust from getting sucked into a computer is to keep the room clean—and if the room is carpeted, try keeping the computer on top of the desk rather than under it.

Synchronizing POP Mail

Is there a way to keep my email automatically synchronized between two computers? I have a home computer and a work computer and each one has a different set of emails, depending on which computer was used when the email was downloaded from the Comcast server. These computers are in different cities and therefore are not connected together on a home network. Right now I'm using Outlook 2003, and I would be open to using something different in order to get my email synched up.

—Tom Schmitt

Normally, we'd say to use IMAP to keep your mail synchronized between multiple computers, but Comcast—for some reason—doesn't allow IMAP access to its email accounts. Comcast only supports POP access. Fortunately, there are a few ways around this. The first is to use Gmail to access your Comcast mail—you'll be able to retrieve email from Comcast via POP3 and also send mail from your Comcast address from within Gmail. The instructions that follow are customized for Comcast users, but should be usable with any custom

domain (in the images, we're using Thatwasthejoke.com as an example).

If you already have a Gmail address, log in to that. If you don't, you can create one. Once you've done that, go to Mail Settings and click the Accounts and Import button. In the "Check mail using POP3" section, click "Add POP3 email account." In the pop-up box, enter your Comcast email address and then click Next. On the next screen, enter the username and password for your Comcast email, then enter mail.comcast.net as your mail server. Select "Always use a secure connection (SSL) when retrieving mail." Then click Add Account. You should now be able to retrieve your Comcast email from within Gmail.

To send mail from this account, go back to the Mail Settings > Accounts and Import screen. Under "Send mail as," click "Send mail from another address" and enter that address in the pop-up box. You can choose to either send outgoing email from Gmail's servers or Comcast's. Gmail is easier, but if you want to send through Comcast's servers, use smtp.comcast.net and port 587. Gmail will send a verification email to your Comcast address. If you've done the first step correctly, that email should show up in your Gmail box shortly.

If all you want to do is access the same emails between computers, that's all there is to it! Your Gmail box will keep all of your Comcast email in one place and will look the same no matter where you log in—

It's easy to set up your Gmail to automatically retrieve email from a POP3 address (we used our own, but this also works for Comcast).

For custom domains, it's often better to send your outgoing mail through the domain's own SMTP servers—it looks more professional.

home, office, or on the road. If, however, you want local copies of your email and you want to use Outlook, read on.

Go back to Mail Settings and click the Forwarding and POP/IMAP tab. Under IMAP Access, click Enable IMAP. Click the Configuration Instructions link, and you should get to a help page that'll give you instructions for setting up

Gmail to work with Outlook 2003. It's a little messy, but the end result is that your Comcast email should show up in your Outlook inbox and stay synchronized between computers. Of course, you could just skip that step and use the Gmail web interface, which is what we prefer to do. ☺



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

digital media

Ditch the discs!
We show you
how to rip,
convert, store,
and stream all
your media—
while retaining
the highest
possible level
of quality

**BY ROBERT HERON
AND TIM FERRILL**

The Ultimate Guide

Listen up, mediaphiles, because this might just be the last time we tackle the preservation of physical media in the hallowed pages of *Maximum PC*.

Yes, the times are changing. Yes, we've cut back on purchasing CDs, DVDs, and BDs lately. Yes, we still have plenty of discs lying around in jewel cases on dusty shelves or in enormous three-ring binders. And yes—most definitely yes—we want to be able to access all these movies and songs from our PC, television, and our shiny new smartphone.

Is it legal to rip your own media? Mostly. In the United States, the circumvention of copy protection and playback control systems is prohibited by the Digital Millennium Copyright Act (DMCA). However, recent "fair use" rulings have relaxed the circumvention rules in specific cases. Our take is that as long as you're not pirating the content, you're good, but for a fairly complete rundown of the most current interpretation of the DMCA, point your browser to <http://bit.ly/fDiOit>.

As always, we're curious to hear about the tips, tricks, software, and apps you use in your pursuit of the perfect media library. Tell us your deepest secrets at comments@maximumpc.com.



ILLUSTRATION BY ADAM BENTON

Rip All of Your Media

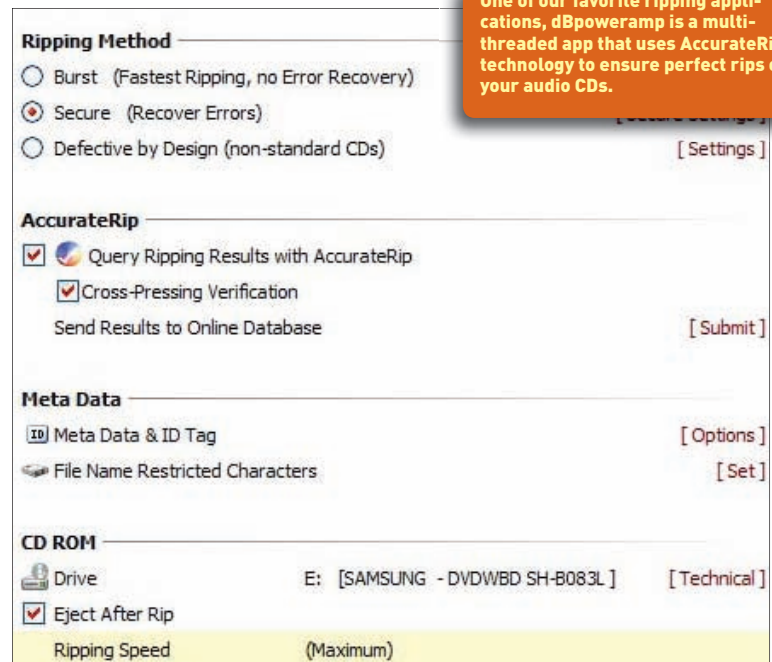
The first step is to transform your collection of CDs, DVDs, and Blu-ray discs into files that can be played on the platform of your choice

Before we start blindly converting discs into files, take a moment to consider where and how the resulting files will be used. You may be interested in converting disc-based content for playback on a specific platform such as a PC, smartphone, portable player, HDTV, or game console. Or, you may want to simply archive a disc so that there is no sacrifice in features or quality.

For either scenario, the choice of file format is crucial. An ISO image is perfect for storing a complete copy of a particular disc, and these image files are easily played on a PC or on some stand-alone players. However, that same file may be too large or simply incompatible with a device like a smartphone or game console. Likewise, container, or “wrapper,” file formats, such as MKV (Matroska) and AVI (Audio Video Interleaved), can comprise any number of encoded audio/video (AV) file formats that may or may not be compatible with a particular player. See the “AV Formats” sidebar on the facing page for our guidance, but as a general rule, if you are unsure of the target platform (or there are several) for your disc collection, you should losslessly archive your media so that you can convert it into whatever file format is desired at a later date.

HOW TO RIP AN AUDIO CD

Sure, you could use iTunes or Windows Media Player to create lossy or lossless encodes of your favorite CD audio tracks. However, if you want to ensure that your rips are 100 percent error free, then you need an application that supports AccurateRip (www accuraterip.com), which verifies each ripped track against an Internet database that contains data on more than 1.7 million audio discs. AccurateRip is supported by our favorite free and paid ripping applications—Exact Audio Copy (free, www.exactaudiocopy.de) and dBpoweramp Reference (\$38, www.dbpoweramp.com).



.com). These programs also support hardware error detection (C2), which helps ensure precise positioning of the drive’s read head in relationship to the CD data track.

We’re partial to dBpoweramp Reference for its inclusion of a batch ripper and batch audio-conversion tool, which includes extensive and easily updated audio codec support. The batch audio converter is ideal for tasks such as converting a collection of losslessly encoded FLAC tracks into the Apple Lossless format for your iPhone and into Ogg Vorbis for use with other media players. It’s also superb at finding and filling in metadata, such as artist name, song title, and album art information.

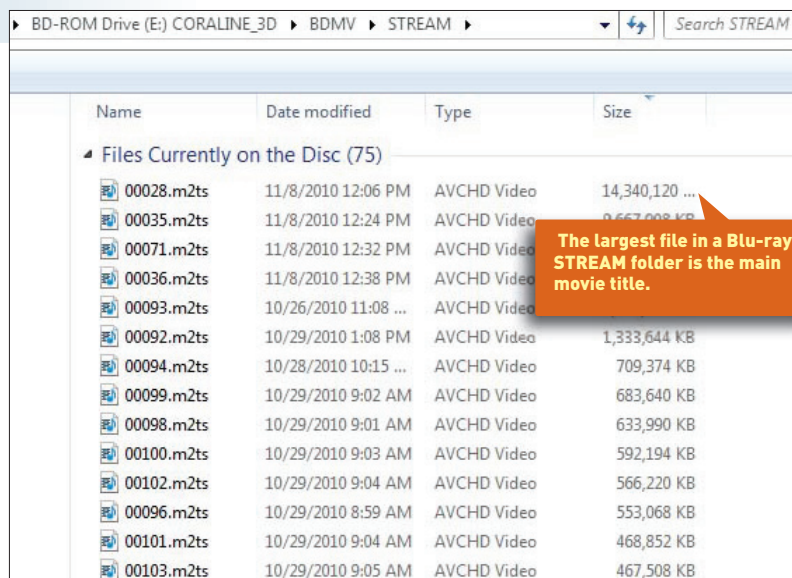
Finally, dBpoweramp’s Codec Central website (<http://bit.ly/hdKdtd>) is the place to go for one-click installations of the most popular audio codecs. To preserve your folder structure when batch-converting an audio archive into other formats, set the output folder to the

desired destination (your work folder), and then select Dynamic Naming and change it to: [origpath]\[origfilename].

HOW TO RIP DVD VIDEO

Nowadays, decrypting DVD-Video is a painless task and the antiripping technology that some discs employ is easily circumvented. Tools such as the free DVDFab HD Decrypter (www.dvdfab.com/hd-decrypter.htm) and AnyDVD HD (\$110 for a two-year subscription, www.slysoft.com/en/anydvdhd.html) offer one-click options for dumping the contents of a DVD-Video disc to a folder on a hard drive. This folder structure can then be written back to a recordable DVD or to an ISO image file using a free tool like ImgBurn (www.imgburn.com).

You can also convert ripped DVDs to various file formats using freely available encoding tools such as HandBrake (<http://handbrake.fr/>) or RipBot264 (<http://bit.ly/h3j6h8>). HandBrake’s native support of DVD



Name	Date modified	Type	Size
Files Currently on the Disc (75)			
00028.m2ts	11/8/2010 12:06 PM	AVCHD Video	14,340,120 ...
00035.m2ts	11/8/2010 12:24 PM	AVCHD Video	0,667,008 KB
00071.m2ts	11/8/2010 12:32 PM	AVCHD Video	
00036.m2ts	11/8/2010 12:38 PM	AVCHD Video	
00093.m2ts	10/26/2010 11:08 ...	AVCHD Video	
00092.m2ts	10/29/2010 1:08 PM	AVCHD Video	1,333,644 KB
00094.m2ts	10/28/2010 10:15 ...	AVCHD Video	709,374 KB
00099.m2ts	10/29/2010 9:02 AM	AVCHD Video	683,640 KB
00098.m2ts	10/29/2010 9:01 AM	AVCHD Video	633,990 KB
00100.m2ts	10/29/2010 9:03 AM	AVCHD Video	592,194 KB
00102.m2ts	10/29/2010 9:04 AM	AVCHD Video	566,220 KB
00096.m2ts	10/29/2010 8:59 AM	AVCHD Video	553,068 KB
00101.m2ts	10/29/2010 9:04 AM	AVCHD Video	468,852 KB
00103.m2ts	10/29/2010 9:05 AM	AVCHD Video	467,508 KB

file folders makes it slightly easier to use, but RipBot264 can get the job done by pointing the program at the main movie's first VOB file (they are approximately 1GB) located in the VIDEO_TS folder—it will find and assimilate any related VOB files automatically.

One particularly handy feature of AnyDVD is its ability to bypass DVD encryption without actually ripping the disc. With AnyDVD running in the background, the contents of the inserted DVD can be accessed directly by any of the aforementioned tools. AnyDVD also offers the option to rip a DVD directly to an ISO image file that can be mounted in a virtual DVD drive, such as SlySoft's free Virtual CloneDrive program (<http://bit.ly/fe4deK>). When used in combination with the My Movies for WMC program (www.mymovies.dk), you'll be able to pull down your entire movie archive in a stream. Some multimedia player programs such as VLC (www.videolan.org) and even some stand-alone players support the playback of DVD ISO files.

When backing up a DVD movie to a single-layer DVD-R (DVD5), you can improve picture quality by ripping only the main movie, deselecting unneeded audio tracks (stereo instead of 5.1-channel audio helps, too), and deselecting captioning information (also known as "Subpicture"). Finally, there is no reason to transcode DVD video into a resolution greater than 720x480 (the format's native resolution).

HOW TO RIP BLU-RAY VIDEO

Blu-ray's constantly updated protection schemes require ripping software that's regularly updated. Once again, we'll use DVDFab and AnyDVD HD. One thing we

particularly like about AnyDVD is that it allows for the playback of Blu-ray movies on PCs that lack a protected video path. One convenience here is that the main movie on a BD often consists of a single .m2ts file located in the .../BDMV/STREAM/ subdirectory. Sort by file size and it's usually the largest one. Once decrypted, this .m2ts file can be transcoded with free tools like HandBrake or RipBot264.

Ripping a 3D Blu-ray movie is a little trickier. A complete ISO image of a 3D Blu-ray movie will play just fine on a PC running 3D-compatible player software, such as ArcSoft's TotalMedia Theater 5, Corel's WinDVD 2010, or CyberLink's PowerDVD 10. If you are interested in transcoding 3D Blu-ray video, DVDFab offers paid options for one-click conversions into a variety of popular file formats. (The feature is available to try free for 30 days, but it will watermark the output.)

Don't spend extra for Blu-ray movies that include a "digital copy" for use with compatible mobile devices. You can often achieve better picture quality, a smaller-size file, and wider compatibility by transcoding the movie's .m2ts file yourself. HandBrake has a convenient selection of encoder presets that are particularly great at this task. The program's picture tab allows you to adjust the output resolution of your encodes, and the video tab provides quality controls that can be used to target a specific bitrate or file size.

If you plan to transcode Blu-ray video into a highly compressed format to save storage space, plan on reducing the video resolution as well—a 35GB Blu-ray rip at 1080p converts quite nicely into a much smaller 720p file. Make sure to set the width to 1280 under the picture-size setting.

AV FORMATS

Choosing the Right File Format

Not surprisingly, choosing the right AV file formats to convert to largely depends on the devices you own. Here's some general guidance based on common usage.

MOBILE DEVICES

Video: The MPEG-4/H.264 AV formats are ideal for most mobile devices, including the iPhone and Android-based products. When possible, encode using H.264 (MPEG-4 AVC/Part 10) video and two-channel LC (Low Complexity) AAC audio, as this combination provides good quality and compression and wide support. Common H.264 container file extensions include .mp4, .m4v, and .mov.

Audio: Android-based phones lack native support for most popular lossless audio formats (WAV is not a useful option). Android devices do, however, support the free Ogg Vorbis format, which produces superior musical reproduction vs. other lossy formats using similar bitrates—particularly when encoding with lossless channel coupling [Ogg quality-level "-q 6" or greater]. For iPhone/iPad audio, Apple Lossless sounds the best, but you can save storage space by going with high-bitrate LC AAC.

DLNA

The only required formats in the spec are JPG pictures, two-channel LPCM audio, and MPEG-2 video. Several optional media formats are also available, and MPEG-4 with AAC audio is becoming increasingly popular. DLNA for mobile devices requires the support of MPEG-4 AVC (aka H.264) video with LC AAC audio—a format easily created with free tools like HandBrake.

XBOX 360

We recommend AVI and DivX—these containers are the only formats that support Dolby Digital audio (2.0 and 5.1 channel). Using H.264, the encoding resolution can go as high as 1080p30 at up to 10Mb/s, but audio must be two-channel LC AAC.

PLAYSTATION3

The PS3's lack of support for DTS audio (in files) makes playback of some ripped content problematic. Transcoding DTS audio into two-channel LC AAC ensures excellent compatibility, but surround sound (5.1 channel) is no longer an option. Files with AC3 audio (Dolby Digital) are playable on the PS3, but the video must be transcoded into MPEG-2 if not already in that format. Another workaround for these types of files is to use a real-time transcoder application such as PS3 Media Server.

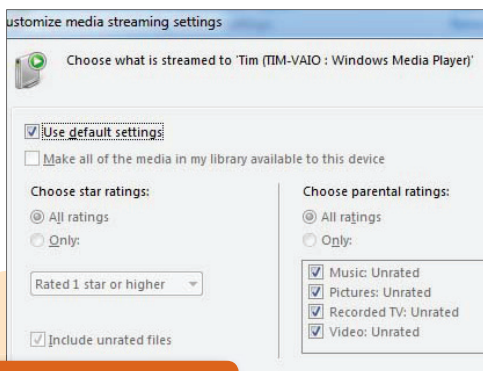
Store Your Media Library

How to choose the right storage method and make the most of the hardware you already have on hand

As hardware prices continue to fall, cost is no longer the barrier between you and obscene amounts of storage. The real puzzle is choosing a storage method that makes your library accessible to other devices on your network. Let's take a look at different options for both storing your media and sharing it throughout your network.

SHARE FILES ON YOUR PC

Right or wrong, the classic method of sharing your media across multiple devices is the good old-fashioned file share. Windows 7 does a better job of making this user friendly with HomeGroups. Using a HomeGroup, you can create a relationship between multiple Windows 7 PCs using a single password. This allows you to share your music, pictures, and videos among multiple computers with ease. In conjunction with Windows Media Player, a HomeGroup also allows



If you have children and/or sensitive content, use the advanced settings to specify media types and potential ratings.

you to turn your PC into a DLNA (Digital Living Network Alliance) digital media server (DMS), making your content

available to a wide range of playback devices, such as your gaming system or TV.

HomeGroups can be managed in the Network and Sharing Center control panel. In addition to allowing access to your digital media, HomeGroups also handle your Document and Printer

sharing. In the Media Streaming options you can choose what types of media you share and what devices on your network are allowed to access your media library.

If you're serious about streaming your PC-based media, be sure to familiarize yourself with the Stream menu in Windows Media Player 12. You can use it to allow devices to play media from your local hard drive, and you can easily allow remote control of Windows Media Player itself. (For Windows XP or Vista users, the same functionality can be achieved using Windows Media Player 11 or 12, though the configuration process isn't as intuitive.)

Using your PC as your media server will also allow you to use advanced features that may not be possible using other solutions. For example, one of the optional fields for music and video is the Parental Rating field. Assuming these fields are populated, you can control which playback devices on your network can access which ratings. For example, you could specify that the kids' computer could only see media with a maximum rating of PG-13, while the home theater system could play any rating. Media that doesn't fit your prescribed rating simply doesn't appear in the library.

NETWORK ATTACHED STORAGE (NAS)

A NAS appliance is one of the most cost-effective methods for centralizing your media. For a few hundred dollars you can purchase a solution that will provide you with multiple terabytes of storage. If you're really serious about streaming your media to your TV or home theater, you should focus on NAS options that are certified DLNA digital media servers.

A NAS that is a certified digital media server will perform all of the heavy lifting in terms of indexing your media and creating a library structure that is accessible from other DLNA devices on your network. Promise Technology's SmartStor Zero (\$290, www.promise.com) offers two drive bays and effortless setup and installation. Performance is snappy—the included Gigabit Ethernet coupled with multiple RAID options (assuming you're using multiple drives) make it a solid choice in our book. Other NAS devices we've reviewed favorably over the last year include Seagate's BlackArmor NAS 220 (<http://bit.ly/baeM6j>) and Qnap's TS-239 Pro Turbo NAS (<http://bit.ly/fX3WUD>).

One other feature we like about NAS is that many manufacturers have

partnered with established cloud services or have created their own means of allowing you to access your media from anywhere via laptops, phones, and tablets.

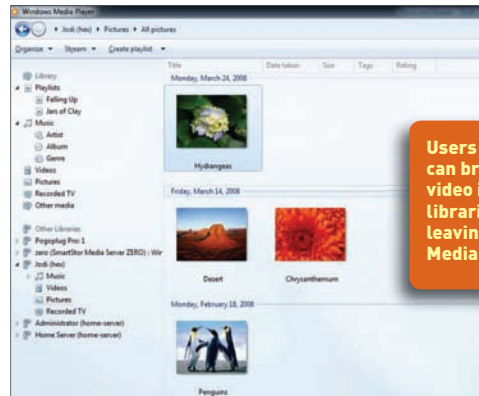
WINDOWS HOME SERVER

Our only real concern regarding WHS 2011, beyond the removal of the Drive Extender feature, is support. In light of HP's decision to cancel its WHS product line, will Microsoft continue to support the OS? Assuming that it does, and assuming that you live in a Windows-centric world, this remains the premium choice for creating and managing a centralized media library.

Native support for DLNA comes in Windows Home Server 2011, but there are a plethora of software tools for folks using previous versions. Additionally, Windows Home Server allows you to configure access from outside your network, giving you the ability to download and even stream content located on your server.

Most off-the-shelf Windows Home Servers come with a preinstalled DLNA stack, making configuration a breeze. If you already have or are rolling your own custom-built server, there are several options for making your library accessible to DLNA devices; Twonky Server (\$20, www.twonky.com) and TVersity (free, www.tversity.com) are our recommendations for turning your Home Server into a DMS.

The biggest upside to using Windows

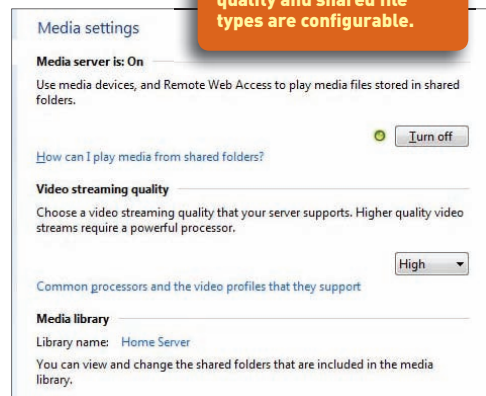


Users on the network can browse music and video in shared media libraries without leaving Windows Media Player.

Windows Home Server 2011 features a built-in DLNA digital media server. Options pertaining to video quality and shared file types are configurable.

Home Server as your centralized storage solution is how well it integrates with the Windows 7 computers that you already have in place. Windows Home Server will actually integrate into the Libraries feature of Windows 7, making it easy for anyone to add music or pictures to your library without having to learn a new UI. An added bonus is that if you're using Windows Media Center, all of your recorded TV can also be automatically dropped onto your home server, making storage and sharing of new TV episodes an automated process.

For detailed instructions on building out a home server, point your browser to <http://bit.ly/fyoHmG>.



MEDIA ORGANIZATION

How Do You Organize 4TB of Data? Diligently!

Regardless of your storage method, you'll initially want to spend some time making sure you have an optimized file hierarchy for your library. When accessing your content through DLNA, your media will be structured automatically using metadata such as ID3 tags, but you'll want to perform some fine-tuning in order to make sure everything is easy to locate. There may also be situations where you simply want to move the files and folders around, in which case you will want to have everything organized in a uniform manner.

How you use file names and folder structure is up to your personal preferences, but planning ahead and keeping it consistent is a must. For any sufficiently large collection of files, well-crafted folder hierarchies help keep things

organized and accessible. Some examples of optimum folder structures for AV file collections include:

- ./.../Media/Video/Movies/DVD
- ./.../Media/Video/Movies/HD
- ./.../Media/Video/TV
- ./.../Media/Audio/Music/[File Format]/Artist/Album/Track

It's also a good idea to create a work folder for your ripped AV output that is separate from your carefully organized archive collection. Things can get messy quickly if a ripper/encoder application hiccups and scatters tracks/files across numerous folders. It's much easier to contain and clean up such a mess if it is limited to a noncritical work folder.

Stream Your Media

How to share and access your media library from a variety of devices across your network—and beyond!

Here's where all your hard work, organization, and emphasis on fidelity pays off. TVs, Blu-ray players, PCs, mobile phones, and tablets are just a few of the devices that can easily gain access to a DLNA-certified digital media server. The good news is that finding a DLNA device to play your media is a really simple process. These days, most consumer electronic devices support DLNA out of the box, making this a fairly painless process.

DLNA AND WHY YOU SHOULD USE IT

The primary function of the Digital Living Network Alliance (DLNA), strictly speaking, is to provide a standard method of streaming music, video, and pictures to various devices around your home. The DLNA standards specify profiles that fulfill different roles in the streaming process. As an organiza-

tion, DLNA members include industry heavyweights such as Microsoft, Sony, Samsung, and Panasonic.

DLNA was spawned from Universal Plug n Play Audio Visual (UPnP AV) and uses web standards such as HTTP, XML, and SOAP to move data between devices. The real benefit of the standard is that the technology is open, which means that devices from competing manufacturers will be compatible. Currently, there are more than 9,000 DLNA-certified devices with more being added every day. Since DLNA is recognized as an international standard and is backed by the biggest manufacturers of consumer electronic devices in the industry, it's a safe bet that DLNA will be around for a while.

OPTIMIZE YOUR DLNA SETUP

The networking aspect of DLNA may be your biggest technological hurdle in getting everything working effectively. DLNA-certified products are going to have to be networked in order to communicate, and extending your network to your home theater system can be... trying.

Wireless networking offers convenience, but the trade-off in most cases is reduced performance and stability when compared to a wired network connection. In addition, many DLNA-certified products don't support wireless networking, so an Ethernet converter or gaming adapter may be required. Performance on your network can be a key issue with DLNA, especially if you want to stream a video in HD with six channels of audio. To give you an idea of the data involved, the bitrate for DVD quality video is around 9.8Mb/s, while a Blu-ray comes in at around 40Mb/s.

On paper, a 54Mb/s 802.11g network should be enough to handle

anything you throw at it, but with interference or distance, that number usually drops dramatically.

DLNA ALTERNATIVES

DLNA isn't a great solution for streaming video from a service like Hulu or Netflix, and it's not a technology for mirroring your computer's display on your HDTV. A better solution for mirroring your display is Intel's Wireless Display (WiDi) technology. WiDi uses an integrated chip in a compatible laptop to talk wirelessly to an adapter that is connected to your TV. The requirements for WiDi are strict; the hardware has to be preinstalled in a laptop, and only Netgear and D-Link currently offer adapters.

Testing WiDi with a Sony VIAO EA Series laptop and a Netgear PTV1000 WiDi adapter revealed the major upside of WiDi—it's a completely seamless experience. Running the client application on a compatible laptop will scan for available adapters and show you previous connections. Once the adapter is selected, you are only a couple clicks away from displaying your laptop screen on your TV.

Another more affordable option that works surprisingly well is Warpia's StreamHD product, which uses USB Ultra-Wideband (UWB) to transmit up to a 1080p signal (and digital audio) over line-of-sight distances up to 30 feet. We'll have a full review next month, but so far we're impressed with the quality of the wireless signal.

CORE COMPONENTS OF DLNA

Once you have your digital media server built and populated with your media library, there are a couple methods for browsing and playing back your media. The most popular role for playing back media from a DMS is that of a digital media player (DMP). With a DMP you can find your server, browse the content library, and select media for playback. Any number of devices

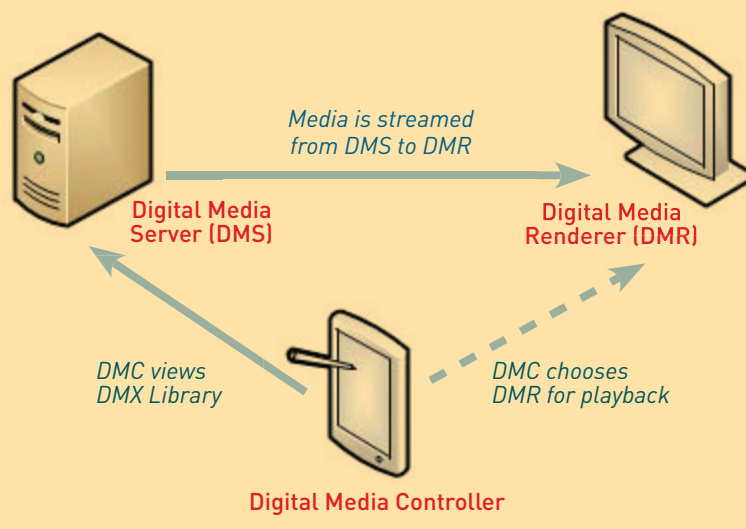


HOW IT WORKS

DIGITAL MEDIA PLAYER



DIGITAL MEDIA CONTROLLER



TOP: A DLNA-certified digital media player is used to browse and play media stored on a digital media server.

BOTTOM: A digital media controller can browse a digital media server and play music and videos to a digital media renderer.

can function as a DMP—from popular gaming consoles like Sony's PS3 and Microsoft's Xbox 360 to tablets like the iPad to TVs and Blu-ray players. When you use Windows Media Player to browse a media library other than your own, the PC you are browsing with is functioning as a DMP, while the device hosting the library is acting as the DMS.

The other popular scenario with DLNA utilizes the digital media server as the source for media, but uses two separate means for selecting and playing the media. A digital media controller (DMC), which could be a PC or a mobile device, browses the server and selects the media. The DMC then sends the music or video to a digital media renderer (DMR) for playback. Classic examples of a DMR would be the Xbox 360 or a DMR-capable HDTV.

Here are some practical examples of DLNA at work:

➔ **Playing Video in Windows Media Player** In Windows Media Player 12, you can quickly and easily browse your locally stored media. Additionally, WMP will recognize DLNA digital media servers located on your network. When using Windows Media Player in Library mode, you can view digital media servers on your network under Other Libraries. From there you can simply drill down in the tree view to select the video you wish to play.

➔ **Playing music to a home theater receiver** If your home theater receiver supports DMR functionality, like the Onkyo TX-NR807 (\$1,000; www.us.onkyo.com) receiver we tested, it's a cinch to queue a playlist to access within Windows Media Player. Clicking the Play tab at the top of the window will toggle the playlist pane, onto

BEYOND THE LAN

5 Ways to Access Your Media Library from the Internet

1 WINDOWS HOME SERVER The introduction of a Windows Home Server onto your network introduces a plethora of additional functionality. One of the coolest features is the ability to download or stream all of the documents and media stored on your home server from the web. Beyond that, Windows Home Server will even facilitate a Remote Desktop session to any capable member PC on the network, all from a single web page. **\$100**, <http://bit.ly/fm9fKq>

2 POGOPLUG It's really hard to describe the PogoPlug in just a few sentences, but essentially it's a cloud-centric NAS appliance. The PogoPlug hardware itself doesn't contain storage, but that is easily remedied with the four USB ports. The free My PogoPlug service will provide you with a web-based method for accessing your files and also makes sharing those files with others a breeze. Free PogoPlug mobile applications are available for iOS, Android, BlackBerry, and WebOS devices. **\$99**, www.pogoplug.com

3 ORB LIVE Orb Live is based on a software install on your PC called Orb Caster. In addition to indexing the media files on your PC and sharing them to your mobile device, Orb will allow you to watch live TV on your iPhone or Android device through a connected PC with a TV tuner card. Orb Live can also transcribe ESPN3 and other Internet TV so that it's watchable on your phone and provide you with live access to compatible webcams that are attached to the host PC. An Orb plugin is available for Netgear's ReadyNAS Ultra line of products. Mobile apps come in both free versions with limited functionality and full versions for \$9.99. Yes, it's awesome. **Free (\$10 for mobile apps)**, www.orb.com/orblive

4 TONIDO Blending the best of both worlds, Tonido offers both hardware and software solutions to take your media to your own personal cloud. Most of the applications are free, including the mobile clients. The hardware solution is a low-powered home server dubbed the TonidoPlug, which features a single USB port, and costs \$99. **Free**, www.tonido.com

5 SKIFTA If you use an Android device, Skifta is an absolute must-have. Not only does Skifta function as a DLNA-certified digital media controller, but in conjunction with a PC-based application, it will allow you to remotely connect and stream content from any DLNA digital media server on your home network. Netgear also shows Skifta some love with an add-on for ReadyNAS Ultra appliances. To top it all off, Skifta lets you push your remote stream to a digital media renderer wherever you are. **Free**, www.skifta.com

which you can drag music to build your playlist. If your DMR is on the network, the Play To menu at the top of the pane will be enabled. Choosing your receiver from the menu will send your playlist to the DMR. This scenario works equally well with other DMRs, like an Xbox 360.

➔ **Using a mobile device to start a video on your TV** The scenario that will earn you the most geek cred is using a mobile device to play media stored on your digital media server to your DMR-capable TV. Using free DLNA software like Fusion Stream for iPhone/iPad (itunes.apple.com) or Skifta for Android (www.skifta.com), you can select

and browse digital media servers on your network. After choosing a video, the software-based digital media controller then allows you to choose the digital media renderer on which to play the video.

➔ **Displaying pictures from your phone to a TV** Many of us have experienced the situation where we have pictures located on our phone that we want to share with a group of people. With a DMR-capable TV, such as the Samsung Series 7 HDTV, you can simply share the pictures from your phone or tablet to the big screen, making it possible for the whole family to view your handiwork. One hurdle is

the limited number of TVs that function as a digital media renderer, as opposed to those supporting the digital media player role. Skifta for Android allows you to get around this by serving as an intermediary DMS, so you can browse the mobile device itself using a TV that supports the DMP role.

➔ **Watching video on your phone or tablet** How often do you have a desire to watch a movie, only to find that someone else is using the TV? As an alternative, you can use a tablet to browse the digital media server that is hosting your videos, select a movie, and begin watching it on the tablet's screen. Some

BEYOND CDs, DVDs, AND BDs

Life after Media: 6 Cloud-Based Alternatives

Everybody knows about Netflix and Pandora, but there are a host of other online content providers that offer high-quality (even HD) content for little to no cost. These six services grant you a wealth of content no matter where you are—as long as you have an Internet connection.

AMAZON VIDEO ON DEMAND

Yes, that Amazon. Amazon is becoming a sleeper in the digital content space; it has been adding to its digital content selection for years now and offers digital versions of movies and TV episodes for rental or purchase. Amazon is also making a move in the subscription market with Amazon Prime. Subscribers get unlimited access to more than 5,000 commercial-free movies and TV shows, and this number will grow over time. The service, initially formed to give subscribers unlimited free shipping on all purchases,

costs \$79 per year. Many Internet-capable TVs and set-top boxes, including Roku, support Amazon Video On Demand, even at HD resolutions.

\$79, www.amazon.com/prime

HULU PLUS

We've covered this one before, but it's so ubiquitous that it bears repeating. Hulu Plus's premium

service gives you the ability to watch Hulu on devices like the iPhone/iPad and Roku set-top boxes. The other primary benefit of a Hulu Plus subscription is the ability to watch the full current season of TV shows. Monthly subscriptions cost \$7.99, and a one-week free trial is available. **\$7.99/month, www.hulu.com/plus**

ESPN3

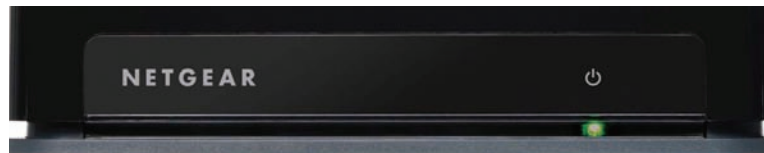
If you haven't been paying attention, ESPN is one of the most technologically advanced media entertainment companies in the universe. From 3D television broadcasts to state-of-the-art web apps, ESPN is constantly pushing the boundaries of technology. ESPN3 is one of the biggest streaming



DLNA software solutions will even allow you to download videos or music for later use offline.

DLNA-CERTIFIED PRODUCTS

With upward of 9,000 DLNA-certified products, it can be a chore to find devices that fulfill the different roles you need. DLNA has a couple of tools to help with this process. First, DLNA-certified products all carry the DLNA logo. Many products will support DLNA without being officially certified, though in the case of computers and mobile devices, the certification is based on software capabilities and is gener-



In conjunction with an Intel Wireless Display-capable laptop, Netgear's PTV1000 adapter will allow you to mirror your PC's display to your HDTV.

ally only an indication that the device manufacturer pursued the certification.

DLNA also has a web-based tool allowing you to search for specific devices based on manufacturer, role, and model. This database lists every

DLNA-certified product and what roles and media types the device supports.

You now only have one very important step left: Kick back and enjoy your media! ⏻

video endeavors to date. While it offers archived video, ESPN broadcasts much of its content live. Offering features such as picture-in-picture, live score updates, and bookmarked time-lines to allow you to find the key moments in your game, ESPN3 is a "must bookmark," in our minds, for sports fans. And, as if that weren't enough, ESPN has partnered with Microsoft to bring ESPN3 to the Xbox 360 for Xbox Live Gold subscribers. The only real caveat to ESPN3's world domination is its licensing structure. ESPN3 is free to use, as long as your Internet service provider has a partnership with ESPN.

Cable or high-speed pkg required, www.espn3.com

BITBOP

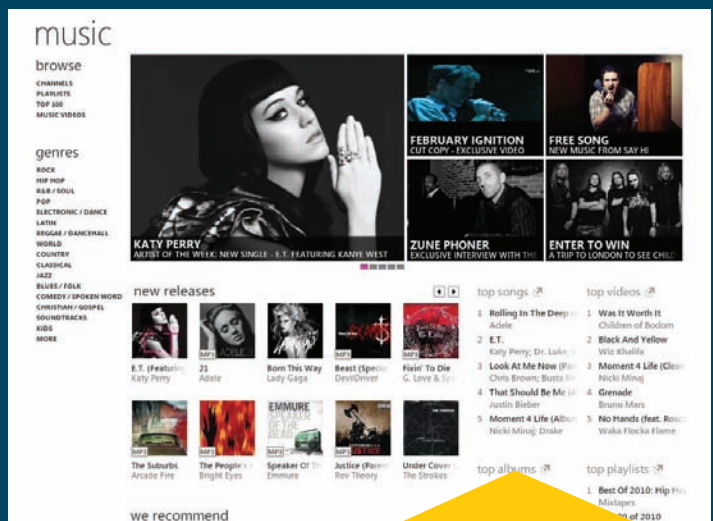
Billed as an alternative to Hulu Plus, Bitbop is a streaming video service for mobile phones backed by Fox Mobile. Supporting Android, Windows Phone 7, and BlackBerry, Bitbop provides access to many popular TV

shows, some of which are not available on other services. The service will run you \$9.99 per month, with movies available on a pay-per-download basis. Unlike many other streaming video options, the Bitbop application will allow you to download content so that you can watch it later.

\$9.99/month, www.bitbop.com

SLINGBOX

Sling Media is another innovative company with an established presence. Its Slingbox product doesn't remove the need for a cable or satellite TV provider. Instead, it feeds off of and further enables your TV dependency. There are two components to the Slingbox system. The Slingbox itself is a piece of hardware that connects to your TV service and your home network. The second component is an application for your mobile phone or tablet. The point of the system is to allow you to view live TV from your home on your mobile device from anywhere you have Internet connectiv-



ity. There are currently two hardware options—the Slingbox Pro-HD and the Slingbox Solo. Mobile applications exist for all of the major mobile platforms. **\$180 Slingbox Solo / \$300 Slingbox Pro HD, www.slingbox.com**

ZUNE PASS

Microsoft's music and video store, Zune, offers digital downloads for prices comparable to the competition. The Zune Pass is one of the hidden gems in media streaming and purchas-

ing; this subscription-based service gives you the ability to download or stream unlimited music from the Zune library. In addition to the free content, you are allowed to download and keep 10 free tracks per month in MP3 format. Zune is available for PC, Xbox 360, and Zune HD, but is especially powerful with Microsoft's Windows Phone 7 devices, as you can download and stream music over the air. **\$14.99 per month / \$150 per year, www.zune.com**

lights, webcam,

ACTION

We round up nine high-end and midrange stand-alone webcams to find the best one for your needs **BY KEN FEINSTEIN**

Don't think you've got it good with that dinky cam built into your laptop. Whether you're exploiting that five-second window of opportunity on ChatRoulette, posting your latest Polka performance to YouTube, or catching up with your folks over Skype, a good webcam can make all the difference. An external cam doesn't just offer vastly superior video and audio quality. The flexibility of being able to freely maneuver and position the device opens up lots of possibilities, letting you take photos and video of more than what happens to be right in front of your laptop screen.

For this roundup, we've gathered together a collection of the best mid-to-high-end webcams. Each of them delivers at least 720p resolution and none cost more than \$100. Though

they all look similar on paper, each has its own strengths and weaknesses. Our goal in this roundup is to help you pick the best cam based on how you intend to use it.

Webcams aren't usually used in a brightly lit lab, so we didn't test them there. First, we recorded a video in good natural light at the highest resolution supported by the camera. Then, we did a Skype session in an office in both good and poor lighting conditions. Finally we recorded some audio in a noisy room. We based our final verdicts on each camera's performance in these tests, as well as the flexibility of its hardware design, quality of its bundled soft-

ware, and overall ease of use.

If you're more interested in recording what goes on when you're *not* around, a stand-alone Internet-enabled camera might suit your needs best. We also review two of these cams, which make it surprisingly easy to monitor your home or office.

W!





What to Expect from a Webcam

Key features to consider when shopping around

RESOLUTION All these webcams videoconference at 720p (1280x720), and some are capable of recording video at 1080p (1920x1080). We don't recommend, though, filming your next major motion picture with a cam attached to your laptop. For high-quality 1080p recording, a stand-alone HD camcorder is a better bet. Although each manufacturer gives a megapixel figure for photos, we don't recommend any of these cams for more than quick snapshots.

OPTICS We found the biggest optical issue came with autofocus. Though all but one of the cameras include this feature, each manufacturer tweaks its autofocus to do best in certain lighting conditions and scenes. This makes some cameras more suitable for some purposes than others. We've tried to highlight these differences in the reviews.

BUILT-IN MIC In our view, audio quality matters as much as video, so we paid close attention to it in our tests. All the cams work as a USB microphone, whether you're capturing video or not, so a good microphone does double duty. Some cameras include audio features like stereo recording, an omnidirectional mic, or noise cancellation.

COLOR SETTINGS AND FACE-TRACKING All the cams let you tweak the color, contrast, etc. Some include optional modes to improve the appearance of skin tones. We found this made us look like pink trouts, but some users may appreciate a rosy glow. Face-tracking is another optional feature that's more likely to induce vertigo in your audience than appreciation for your ever-centered grin.

COMPATIBILITY All the cameras use USB 2.0. Though we tested the cameras using Windows 7 and Windows Vista, the Logitech and Creative cams also work in Macintosh and Linux environments.

FORM FACTOR You need just the right angle to look your best, and our favorite webcams allowed us to pivot the camera up and down and right and left to find that sweet spot. It's also important for a camera to attach easily to a laptop or monitor and to stand freely on a variety of surfaces.

BUNDLED SOFTWARE Each manufacturer bundles a suite of utilities along with the webcam. These let you tweak the camera settings, capture video and still images, and perform tricks with your camera that range from the productive (display a JPG or PowerPoint presentation) to the slapstick (make yourself look like a talking Walrus).

Creative Live! Cam Socialize HD AF

Little cam with some tricks up its sleeve

Creative's Live! Cam was one of the smallest and lightest of the cams we tested. That's a plus for portability, though its inflexible clip for mounting to a monitor and its inability to swivel right and left made it a little inconvenient to position. Image quality was in line with the other cams in its class, both in good and poor lighting conditions.

Two features, though, really caught our attention. First, the noise-cancelling microphone did a good job of reducing background noise. This could be important if you cam or use VoIP in a noisy environment. Second, a clever feature in the bundled software will display an image file or PowerPoint slides in your video stream; this works with whatever videoconferencing software you're using.

Creative's light little cam offers some useful features and solid performance.



	VERDICT	
CREATIVE LIVE! CAM \$70, www.creative.com		

Logitech HD Webcam C510

Offers excellent audio and video quality

The C510 is designed for portability; it folds up into a tight little package and even comes with a carrying case. It mounts easily on a monitor and can rotate all the way around, as well as move up and down. Logitech touts its RightSound technology, and the C510 did the best in our tests at reducing ambient noise. Video performance, too, was in the top tier for this class, delivering crisp, detailed video in all light conditions. It was the only cam in this roundup not to include autofocus, but frankly, we found autofocus to be as much of an annoyance as a help in many of the cams we tested.

The bundled software offers a clean, easy-to-use interface, making it an ideal choice for your less tech-savvy relatives, and even includes motion detection for simple monitoring of the area around your PC.

This light, well-designed cam is an ideal choice for one-to-one desktop video conferencing.

HP Webcam HD-3110

Looks clunky but is flexible and versatile

The HD-3110 looks a bit boxy and bulky for a mid-range cam. Even if it does remind you of your grandma's Buick from the 1980s, it makes up for its lack of style with functionality. The clip works well, and once mounted on your monitor or desk, it pivots, offering a full range of motion. The buttons on the front let you take photos or start and stop video recording; this comes in handy if you need a quick snapshot or video of something and don't want to juggle your mouse and/or look at the screen when capturing the image.

Video and audio quality were good, though not quite at the top of the heap. We found that the cam performed better at typical videoconferencing tasks than recording full-motion video. The bundled software is licensed from ArcSoft, and though full-featured, it gets confusing since the features are divided among several different apps.

Though it didn't offer quite the best performance in some areas, the utilitarian design and low price make the HP-3110 a camera worth serious consideration.



■■■	VERDICT	9
LOGITECH HD WEBCAM C510		
\$60, www.logitech.com		

■■■	VERDICT	8
HP WEBCAM HD-3110		
\$50, www.hp.com		



Microsoft LifeCam HD-5000

Flexible, light cam can stand up almost anywhere

The HD-5000 doesn't look like any other cam in this roundup, and from our tests, that's mostly a good thing. The extremely light device sits on a flexible base with a flared bottom. This lets it perch on a monitor or laptop screen in almost any position, or stand free almost anywhere—a bed, an armchair, maybe even your lap—without toppling over. In a brazen act of self-parody, though, Microsoft put a button on the top that has one, and only one, function—to launch Microsoft's own Internet Messenger.

The bundled software lets you configure the camera, record video, and take snapshots. In addition, downloading Microsoft's Live Essentials lets you do video editing and conferencing. Video quality was excellent, except in low-light situations, where it had difficulty with autofocus.

The HD-5000 physical design makes it an attractive cam if you're usually in a well-lit location, though the software bundle isn't as full-featured as its competitors'.



■■■	VERDICT	8
MICROSOFT LIFECAM HD-5000 \$50, www.microsoft.com		

HP Webcam HD-4110

Solid high-end cam but not one of our favorites

Much of what we liked—and didn't like—about the HD-3110 (page 35) carries over to its higher-end and sleeker counterpart, the HD-4110. It sports three buttons you can use to snap photos, take video, or launch your favorite conferencing app. Its flexible base is even easier to use and attach than the HD-3110's, and the camera moves freely in all directions. The same bundled software includes a variety of applications and utilities, but we'd prefer them better integrated into an easy-to-manage whole.

In terms of performance, this camera is capable of 1080p recording, rather than the 720p of the HD-3110, but we doubt that will come in handy, especially since the camera's autofocus didn't perform well taking videos of fast action. It did do well, though, in low-light situations and in our web-conferencing tests. The audio couldn't compare to the high-end competition from Microsoft and Logitech.

Though a capable camera, in this price range, we prefer what Logitech and Microsoft have to offer.



■■■	VERDICT	7
HP WEBCAM HD-4110 \$90, www.hp.com		

Logitech HD Pro Webcam C910

Outstanding video and stereo audio but bulky and inflexible

The C910 is much bigger and heavier than the other high-end cams in this roundup. It's also less flexible; attached to your monitor or set on your table, it can swivel up and down, but not left and right. The sacrifice in flexibility, though, comes with outstanding performance. This camera can record at 1080p resolution, and in our tests, it produced the best video in all lighting conditions.

It's the only cam in the roundup to offer stereo microphones, and so far Logitech's free video-conferencing software, Vid HD, is the only one that supports this feature. If you're willing to use that app or are looking for a cam to record videos to upload later, this is a very useful feature for adding audio depth to your videos.

We strongly recommend this cam if you need to record high-quality video and audio or do group videoconferencing, but we think a lighter, more flexible cam is better suited to desktop video calls.



VERDICT

LOGITECH HD WEBCAM PRO C910
\$100, www.logitech.com

9

Microsoft LifeCam Studio

Beautifully designed cam with very good performance

Microsoft's LifeCam Studio looks almost identical to HP's HD-4110, from the cylindrical shape to the flexible base. In our view, though, Microsoft's got the upper hand. For one thing, the omnidirectional microphone produced some of the most natural, noise-free audio of any cam we tested. For another, the LifeCam Studio is unique in this roundup for including threading for a tripod—a feature you may not use every day, but when you need it, it makes all the difference.

Video quality was very good, though the cam suffered from the same problem as Microsoft's lower-end HD-5000: difficulty with autofocus in low light. Otherwise, the unit performed well, though the included software bundle lacks some of the extras offered by competitors.

This very thoughtfully designed cam offers good video and audio features and is one of our favorites for desktop videoconferencing.



VERDICT

MICROSOFT LIFECAM STUDIO
\$100, www.microsoft.com

9



Options for Surveillance

IP-based webcams let you keep tabs on things across the Internet

Unlike standard webcams, which connect to your PC via a USB cable, stand-alone network cameras connect directly to your local network via a wireless connection or Ethernet. They are ideal for monitoring your home or office remotely, whether to check on security or to see whether the cat's eaten your parakeet. We tested and evaluated two of these cameras based on ease of setup, features, and overall video and audio performance.

D-LINK DCS-930L WIRELESS N NETWORK CAMERA

If you had any lingering doubts that we're living in the age of surveillance, the DCS-



D-Link's indoor Internet camera is ridiculously easy to set up.

930L should dispel them. Never has it been so easy to watch what's going on when you're not there. Once you follow the simple instructions in the installation CD to set up the wireless networking and your account with My D-Link, you can place this light little box almost anywhere indoors. Then, wherever you are in the world, you can log into D-Link's website by way of a web browser, iPhone, or Android phone and see what's going on. More advanced users can set up the camera to upload video to a local or remote file server, either continuously, or in response to motion detection.

Video quality is passable and audio quality isn't any better, but this isn't designed for taking charming home movies. It also doesn't include infrared lights, so it won't be able to record in the dark.

It's cheap, it's easy, it's flexible, and it works. What more can we say?

■■■	VERDICT	8
D-LINK DCS-930L WIRELESS N \$120, www.dlink.com		

Y-CAM BULLET

While D-Link's DCS-930L is designed to be placed anywhere in your home or office, the Y-Cam Bullet is a big, heavy outdoor cam designed to be bolted to the wall. If you have what it takes to make that happen and run electricity to it, you'll have yourself an amazing piece of surveillance equipment. Connecting to your network wirelessly or through Ethernet, the Y-Cam delivers excellent video and audio recording capabilities. It even has a speaker, so you can interact with whomever wanders onto your property. The infrared LEDs not only look way cool, they let you see in the dark up to 50 feet.

Setting up the camera takes a little technical know-how but was surprisingly straightforward, and we like how a full set of features allows you to record video



For an honest-to-goodness outdoor video camera with an impressive feature set, the Y-Cam Bullet is relatively low-priced.

locally or remotely and to view the footage over the Internet.

The relatively low price and excellent features make this a very attractive surveillance camera if you have the handyman chops to make it happen. ⤴

■■■	VERDICT	8
Y-CAM BULLET \$500, www.y-cam.us		

Malware Viruses on contact

BY PAUL LILLY

Which AV product is up to the task of keeping your PC squeaky clean and immune to malware?

In some ways, visiting cyberspace is kind of like entering a crowded subway car during the peak of flu season. You're surrounded by all sorts of germs—in the form of trojans, spyware, viruses, rootkits, etc.—just looking for a vulnerable host to invade and feed on. Once you're infected, these pests can wreak havoc on your system, swiping your personal information and passwords, annihilating your credit rating, and stealing your identity. To avoid a potentially virulent attack, you need to take precautions.

Smart computing habits—like never downloading unexpected email attachments—are your first line of defense, but that's not always enough. The best way to protect yourself is with a serious immunity booster, which is exactly what all-in-one security suites provide. Based on our prior antivirus roundups, it's no longer a question of whether an all-encompassing antivirus package can provide adequate protection on all fronts, but which one does it best?

To find out, we're pitting the 2011 versions of last year's top five performing AV applications against five security suites we've never before reviewed. The two exceptions are ESET Smart Security, which hasn't been overhauled since our last roundup, and Kaspersky Internet Security 2011, which we already evaluated and gave a 9 verdict / Kick Ass award to for its rich (and useful) feature-set and insane level of protection. If the product you're interested in didn't make the cut, don't fret; we'll continue to run stand-alone AV reviews in future issues. In the meantime, we're anxious to see if any of these suites are as capable as Kaspersky at protecting your PC's health.



Wouldn't it be great if we could ward off both human and computer viruses in one (gooey) swoop?

How AV Makes the Grade

To earn a passing score, security suites have to excel in each of these five subjects

SYSTEM PERFORMANCE AND SCAN SPEED

We don't spend hours tweaking our rigs to have sloppily coded software muck with system performance. That's why we're holding these suites accountable by looking at the overall performance picture. Compared to a clean install, we're looking at things like boot times, PCMark Vantage benchmarks, file-transfer performance, and system resources. And, of course, we're also interested in how long it takes to complete a system scan.

ANNOYANCE

A security suite that's constantly bombarding us with pop-ups and benign alerts

can be just as bothersome as the malware it's protecting us from. Your home security system doesn't tell you every time a car or person walks by your home, and likewise, AV software should only interrupt you if there's real trouble. We also take into account how easy (or hard) it is to navigate the UI.

PRICING

Most power users will bleed their PayPal accounts dry funding a hardware upgrade, like a dual-GPU videocard or smoking-fast solid-state drive. But why shell out any money on security software when there are so many free options available? That's up to this year's contenders to answer, and to keep them honest,

we're also including two completely free AV scanners.

FEATURES AND IMPLEMENTATION

Eight of the 10 AV apps in this year's roundup are full-fledged security suites. What separates these packages from regular antivirus software are the extra components, from enhanced spyware protection to spam controls, and whatever else each vendor decides to stuff in the box. But equally important is how meaningful these features are and how well they're integrated. Think of it as the difference between ABS brakes, which we'll take when shopping for a car, versus an air freshener, which doesn't add any value. The same concept applies.

VIRUS DETECTION

We've had success separating the wheat from the chaff in the past, so we're not changing things up drastically here. We start by subjecting each AV app to synthetic spyware and virus tests provided by www.spycar.org and www.eicar.org. Next we romp around the web's more treacherous destinations looking for trouble. We cap off our in-house testing by lobbing our own collection of malware grenades, which we've added to this year. Finally, we evaluate the results of independent testing labs, like Virus Bulletin (www.virusbtn.com), AV-Comparatives (www.av-comparatives.org), and AV-Test (www.av-test.org).

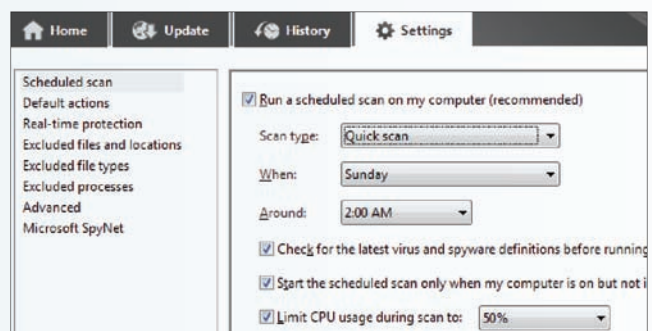
Microsoft Security Essentials 2.0 Low on options, high on protection

Microsoft didn't even bother to announce a version upgrade from 1.0 to 2.0, and at a glance, you wouldn't be able to tell the difference. But make no mistake, Microsoft's team of mechanics tweaked the scan engine and made some other changes underneath the hood.

Let's talk performance. Last year's version plodded through our files without any sense of urgency, and the speed didn't pick up during subsequent scans. This time around, the scan engine didn't waste time investigating clean files that hadn't been altered. The result is that a laborious 27-minute scan was reduced to less than eight and a half minutes the second time around. Still not great, but MSE's at least headed in the right direction.

MSE leaves a smaller footprint than an Oompa-Loompa. We recorded a boot penalty of just 10 seconds, and things only improved from there. Copying a 3GB collection of files to our local drive took the same amount of time with or without MSE installed, and memory usage increased only a few percentage points.

Version 2.0 manhandled our updated collection of malware and sailed through another round of testing from Virus Bulletin, earning its second consecutive VB100 award on the Windows 7 platform. And unlike before, version 2.0 keeps the Windows Firewall in check and alerts you if it's turned off. We just wish there were more to play with. You won't find nearly the same level of customization as a paid security suite. MSE lets you configure a scheduled scan, for example, but you can't schedule a Quick scan one day and a Full scan on another. It's also frustrating that you're unable to pause scans, only cancel them outright.



MSE provides a handful of options for scheduled scans, but doesn't include the ability to set up two different types (Full and Quick) on different days.

With an improved scan engine and the same stellar protection as before, Microsoft Security Essentials is still the freebie AV app to beat.

	VERDICT 8
MICROSOFT SECURITY ESSENTIALS 2.0 Free, www.microsoft.com/Security_Essentials	

Norton Internet Security 2011

An antivirus for geeks, not newbs

With the release of NIS 2011, it's apparent Symantec is still trying to shed its lingering image in power-user circles as a resource pig, perhaps a little too hard at times. The new user interface is sleek and sexy with plenty of configuration options to drill into, but it's also a little daunting for less savvy PC users. It's the polar opposite of Microsoft Security Essentials, and if you're experienced with computers, that's great. Your Aunt Agnes, however, probably won't make heads or tails out of it all.

The main window provides on/off switches for a variety of modules, and if you dive into the Settings menu, you'll find a whole bunch of additional tools. It's sheer overload for Aunt Agnes, who won't understand the difference between Browser Protection, Safe Surfing, and Download Intelligence, all of which appear on the main interface. Hover over any of these, however, and Norton does a serviceable job explaining what they are.

Unlike last year's version, trying to trip up NIS with our malware samples proved futile. Symantec upgraded its SONAR technology, which pays close attention to how a program behaves rather than relying solely on virus definitions. The idea is to catch zero-day threats that slip into the wild, and it worked beautifully with our contaminated archive. NIS also shields against potentially harmful web-sites, though you can still truck through if you suspect it's a false positive.

Installing Norton had no impact on our test bed's boot time, and system



Norton's redesigned UI wins on sex appeal but suffers from a case of information overload.

scans were among the fastest of the bunch. We're beating what's left of a dead horse at this point, but this isn't the same Norton from three-plus years ago. Our only real complaint is that Symantec perhaps caters a little too much to enthusiasts and risks alienating some mainstream users.

	VERDICT	
NORTON INTERNET SECURITY 2011 \$70 (1 Year, 3 PCs), http://us.norton.com		

McAfee Internet Security 2011

A valiant shot at redemption that clanks off the back rim

Like Norton, McAfee's struggling to overcome an unflattering reputation among the tech-literate in hopes of expanding its user base beyond the OEM crowd, and last year's completely retooled version went a long way toward that goal.

Not much has changed in the 2011 version. It's still easy to navigate, comparatively light on resources (versus pre-2010 versions), and malware detection is still a mixed bag. McAfee started off strong by breezing through our initial spyware and virus tests, and we nearly finished bombarding the suite with our expanded collection of dirty files without incident. But when a zero-day test file slipped past McAfee undetected, our test bed gave up the ghost and entered a BSOD loop we couldn't fix. McAfee isn't the only program that had trouble recognizing the file; we uploaded it to Virus Total (www.virustotal.com) and only 12 out of 42 virus scanners flagged it as malicious. Nevertheless, McAfee's behavioral-based scanning didn't detect anything was wrong, and that's troubling.

We turned to the malware experts to see if our findings mirrored theirs. Virus Bulletin denied McAfee a VB100 award because it let a virus from its WildList—a list of currently active viruses in the wild—slip through undetected, and according to AV-Test.org's test results, McAfee performs below the industry average in protecting against zero-day threats. Not good.

McAfee isn't without merits. The two-way firewall is incredibly easy to configure, and for mobile warriors, the 2011 update adds CPU monitoring intended to improve battery life. It does this by delaying automatic definition updates and



Like many antivirus suites, McAfee uses a color-code system. A green bar means all systems are go. If anything needs your attention, it will turn red.

other background tasks when the system disk is in an idle state. And contrary to popular assumption, McAfee had little impact on system performance. Kudos for all that, but when the rubber meets the road, McAfee's airbag may fail to deploy, sending you crashing through Windows.

	VERDICT	
McAfee INTERNET SECURITY 2011 \$40 (1 year, 3 PCs), http://home.mcafee.com		

Panda Internet Security 2011

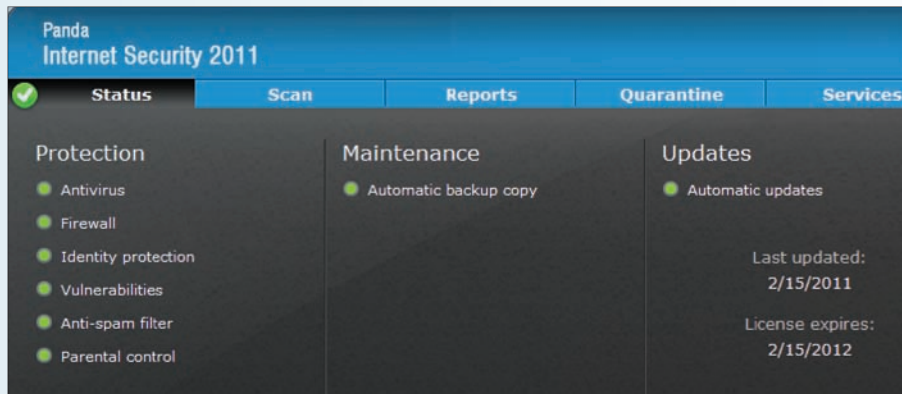
Puts the pain on malware, but is also painfully slow

Panda holds a ton of promise, and if it weren't for a few niggling issues, we'd anoint it our favorite security suite. But there are some things that just can't be ignored, like the same persistent pop-ups we complained about in the 2010 release. It started from the get-go with Panda reminding us that we still needed to activate the program (even though we hadn't previously been prompted). Shortly after, another pop-up appeared imploring us to register, something that is usually optional. In this case, our choices were to go ahead and register or be reminded at a future date (one day, one week, or one month), with no option to disregard it forever. Bad Panda!

Panda does its due diligence in alerting you to potential threats, but it overreacts to your home network, at least at first. Less savvy computer users may end up inadvertently blocking file shares, thinking that the pop-up represents a real danger when in fact it doesn't.

Our other issue is with Panda's pokey scan engine. Panda subjects certain files to its Collective Intelligence database in the cloud, and a company representative warned us this would slow down scanning. It did, but the real problem is with Panda's poor file-caching algorithm, which shaved only 26 seconds off a second system sweep that wasn't that fast to begin with.

That's what we don't like about Panda, but there are plenty of redeeming qualities. We were told to expect improved boot times over time, and that's what we saw. Initially, Panda added 15 seconds to startup, but after several reboots, Panda settled down to five seconds over a clean install. We also dig the repainted UI. It's mostly an aesthetic change from last year's



Panda's new UI now includes a virtual keyboard as an added precaution against keyloggers.

version, but still packed with features—like a home network manager, ID theft protection, remote access, and more—all thoughtfully arranged.

When we fed Panda our malware samples, it chewed them up like a real panda bear chomps on bamboo. It also zipped through AV-Test.org's much larger collection of malware, scoring higher than the industry average in each of four virus categories. And as an added layer of protection, Panda now includes a virtual keyboard, in case you're paranoid about keyloggers.

Panda's not the fastest security suite, nor is it always well behaved, at least at first. But if you can overlook its flaws, it will protect your system unconditionally.

	VERDICT 8
PANDA INTERNET SECURITY 2011 \$60 (1 year, 3 PCs), www.pandasecurity.com	

TO PAY OR NOT?

Which Level of Antivirus Security Is Right for You?

When it comes to PC security, there's no such thing as one size fits all. If you're particularly cautious, more than a little computer savvy, and a little bit lucky, you could get by without any antivirus software at all, and while we don't recommend it, we know plenty of people willing to roll the dice.

A better option for penny-pinching power users is to install free antivirus software

supplemented by the occasional antispyware sweep.

There's nothing wrong with rolling your own security setup, but if you want more protection, you're going to have to pay for it. There are several advantages to fee-based antivirus. One is that these apps typically roll spyware and virus scanning into one, so there's no need to install a separate program. Another common trait is more frequent

definition updates, sometimes referred to as pulse updates. And while it varies by vendor, paid antivirus apps may include phishing protection, flexible scheduled-scan options, gaming modes, and other tools and services.

You'll notice we focus most of our attention on so-called Internet security suites, but since most vendors offer AV software à la carte, what do you gain by

leveling up? In most cases, the major addition is a more powerful firewall than what Windows provides. It varies by vendor, but security suites might also include enhanced identity-theft safeguards, antispyware protection, parental controls, online backups, and other features you may or may not find valuable. It's important to do your research to avoid overpaying for security.

BitDefender Internet Security 2011

A powerful antivirus suite you can take home to meet the parents

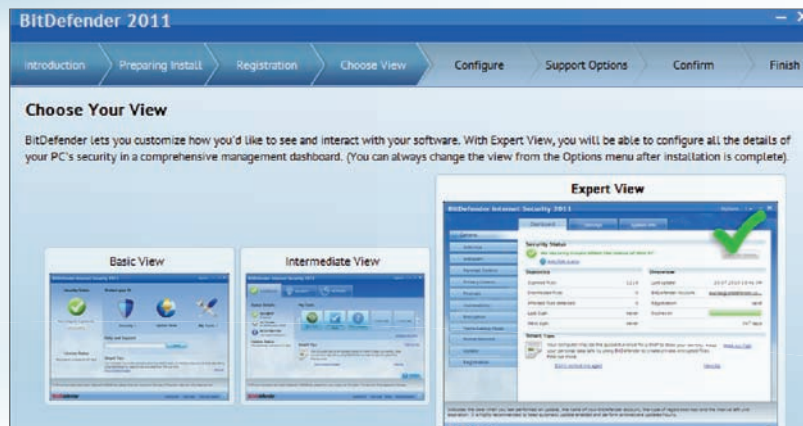
BitDefender flies in the face of conventional wisdom in more ways than one. Like most security suites, BIS runs the risk of spreading itself too thin by combining antivirus, antispyware, antiphishing, a firewall, parental controls, antispam, and more into a single package. That's a challenge in and of itself, but BitDefender also attempts to cater to computer users of all skill levels, whether you consider yourself a beginner, intermediate, or expert. A tough challenge, but BitDefender proves up to the task.

BitDefender prompts you to choose your level of expertise during installation, with each option sporting a different dashboard. You're given a glimpse of each UI along with a short explanation before you commit, but can also select a different layout if you later change your mind. What's great about this is that you can slap the Basic View on your parents' rig and not have to worry about them inadvertently pushing a button they shouldn't, and use the Intermediate or Expert layout on your own machine. The Intermediate UI is a step up from Basic in that you can customize the dashboard with up to

14 scrollable icons (Basic has three), while the Expert layout throws everything plus the kitchen sink *and* all the plumbing at you.

None of this would matter if BitDefender went belly up the

first time you encountered a virus, but in our testing, it stood



Last year's version of BitDefender also included different layouts to choose from, but they weren't as slick or user friendly as they are now.



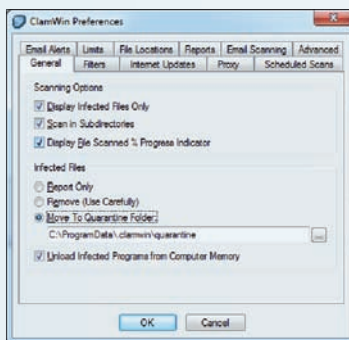
BITDEFENDER INTERNET SECURITY 2011
\$50 (1 year, 3 PCs), www.bitdefender.com

VERDICT

9

ClamWin Free Antivirus

You'll wish it weren't free so you could ask for a refund



If ClamWin finds a virus, it doesn't actually eradicate it unless you change the default setting from "Report Only" to "Remove" or "Move to Quarantine Folder."

every file you download, or set up a rigorous automated scan schedule. But even that's a chore, because you have to configure a separate schedule for every drive/partition in your system. And it doesn't help matters that ClamWin's

It's hard not to look a gift horse in the mouth when you're told it's a potential thoroughbred capable of racing in the Kentucky Derby, but later find out it's limping on two legs short of a set and isn't even fit for making glue. That's what we think about ClamWin, a free, open-source antivirus program that comes saddled with "gotchas."

The main problem with ClamWin is it doesn't offer any kind of real-time protection. It's strictly an on-demand scanner, so your only chance of avoiding infection is to either manually inspect every

file. It also zipped through our test bed's hard drive like it was late for a date, reducing a little more than a six-minute scan to less than two minutes the second time around. There's even a vulnerability scan that combs your system looking for unpatched software, missing Windows updates, and weak passwords.

Last year we concluded that "we'd always know we settled" with BitDefender, and now we're wondering why we'd settle for anything else.

scan engine moves at a snail's pace. Oh, and it won't bother analyzing files larger than 100MB unless you change the default setting, nor is it configured to actually delete or even quarantine malware by default.

Actually, we should be careful of using the term "malware." ClamWin cowers under the blanket when you surf the web, leaving you susceptible to spyware, phishing attacks, browser hijacks, adware, worms, and anything else that requires a real-time scanner. And despite the developer's claims that "you will be as safe as with a commercial antivirus" so long as you scan suspicious files before opening them, ClamWin gave a handful of our virus samples a clean bill of health. Grrr!

If you insist on using ClamWin, if only to support the open-source community, supplement it with Clam Sentinel (free, <http://bit.ly/fayEdZ>), an add-on that sits in the system tray and offers basic real-time scanning. You also better be rocking Windows Defender or some other antispyware program so you're not naked on the web.



CLAMWIN FREE ANTIVIRUS
Free, www.clamwin.com

VERDICT

3

ZoneAlarm Extreme Security

Has all the right ingredients, but the recipe needs work

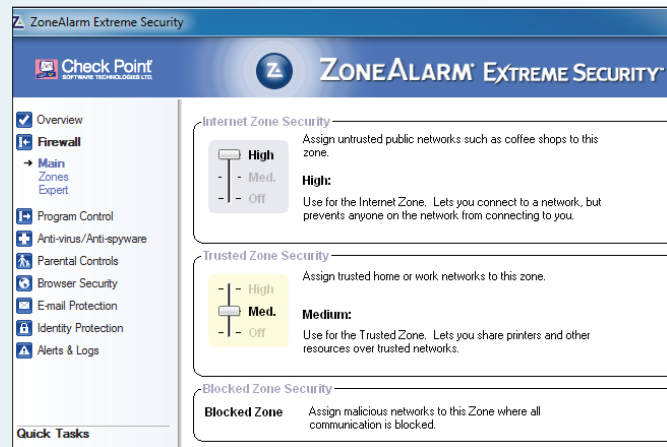
Sharing the spotlight with ZA's well-known firewall is Kaspersky's integrated scan engine. Kaspersky earned a 9 verdict and a Kick Ass award last year, and in our eyes, pairing its scan engine with ZA's firewall is like hiring Chuck Norris and Bruce Lee as your personal bodyguards. If only they had come dressed for the job.

Getting acquainted with the text-heavy UI takes a little work. The main window consists of a center panel outlining the status of the firewall, antivirus/antispyware, antiphishing, and browser security modules. This is flanked by a column of options on the left-hand side and a right-justified panel housing additional services, each of which redirects you to a web page to download and configure. It's not the worst interface in the world, nor is it particularly swank. To perform anything other than a Quick Scan, for example, you have to drill into the antivirus menu, select Advanced Options, highlight Scan Modes under Virus Management, and then select a new default option, which applies to both manual and scheduled scans.

The integration of ZoneAlarm's ForceField software adds an additional layer of security while cruising the web, but only if you're driving IE or Firefox. If you are, ZA will scan every download before it touches your desktop, as well as give you the option of loading your browser in a virtual filesystem. Doing so redirects unsolicited downloads away from the OS and encrypts keystrokes, effectively jamming keyloggers. Huzzah!

All this protection adds up to a slightly heavy package. PCMark performance took a hit, and boot times jumped all over the place, finally averaging plus-six seconds (compared to a clean install), but occasionally would take much longer.

We found downloading updates a sometimes laborious waiting game, though this is only a potential problem if you have reason to check for updated definitions rather than let ZA do it for you. As malware detection goes, Check Point's decision to integrate Kaspersky predictably turned out to be a good one, though it's not as hurried as the fastest-performing scanners.



ZoneAlarm does a fantastic job managing its two-way firewall, which offers up a boatload of customizations for networking ninjas.

ZoneAlarm caught our entire collection of malware, and Kaspersky's antivirus engine continues to earn high marks from independent testing labs.

It's too bad ZA discriminates against Chrome, which is quickly picking up market share. And we wish it were a little more nimble. Otherwise, the pairing of a powerful firewall along with one of the best AV scan engines is a winning combination.

	VERDICT	
ZONEALARM EXTREME SECURITY \$60, (1 year, 3PCs), www.zonealarm.com		

SECURITY SUPPLEMENTS

Picking up Where Antivirus Leaves Off

Smart computing habits and antivirus software go a long way in fending off the bad guys, but it doesn't make you invincible. For mission-critical setups or just extra peace of mind, you have to take security to the next level. Wipe the sweat from your brow, Charlie, because we've come up with a three-step supplemental program to lock down your system tighter than Fort Knox.

The first thing you need to do is download and install Secunia PSI (free, www.secunia.com). This nifty application audits every inch of your system for unpatched software that could potentially expose it to attack. Secunia PSI provides a threat rating for all of your outdated programs, and includes links to the latest patches.

Step two involves adding

another layer of protection to Internet activities. BufferZone Pro (free, www.trustware.com) works its mojo by isolating all web-based activities in a virtual bubble. When it's active, a red border surrounds your browser or IM client, and if you download and install an infected file, it gets written to a virtual folder, not your OS.

The third and final step is to install a virtual machine,

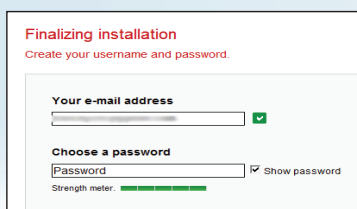
like VMWare Player (free, www.wmware.com) or Windows Virtual PC (free, <http://bit.ly/3fAC9>). While BufferZone Pro protects your system at the application level, a VM isolates your entire OS. It's the ultimate sandbox for experimenting with potentially harmful software or surfing the web willy-nilly; if you screw up and fall prey to attack, just nuke your VM and create a new one!

BullGuard Internet Security 10

Tough like McGruff, but puts leash on system performance

When you first install BullGuard, you're prompted to select a notification level. One of the two choices clamps a muzzle on BullGuard, stifling alerts the program can figure out on its own. The other promises more notifications so you'll always know what the mutt is up to. We say mutt because BullGuard is another security suite that builds on top of someone else's scan engine. We saw this with Zone-Alarm (reviewed on the previous page), which chose to go with Kaspersky, while BullGuard fetched BitDefender's scan engine, another solid choice.

Initially, however, we feared BullGuard's bark would be worse than its bite. During the final stage of installation, you're asked to create a username and password. The password shows up in plain view unless you uncheck the "Show password" box, but more disconcerting is the so-called "strength meter." All this does is evaluate how many characters you've entered.



Don't pay any attention to BullGuard's password strength meter, which gives all eight-character passwords a maximum strength rating.

We typed "Password" and registered a full five bars on the strength meter, even though that's arguably the weakest eight-character password you could possibly choose. It's a minor gripe, but the feature could give greenhorn users a false sense of security.

Surfing the web was another story. BullGuard went into attack mode and sank its teeth into malicious downloads, a credit to its behavioral-based scanning. And when we chucked our own collection of malware onto the desktop, we might as well have thrown BullGuard a meaty bone, because the outcome was the same.

We paid a heavy price for all this protection, and we're not talking about skillra. Startup time never seemed to settle down after several reboots, taking an additional 32 seconds over a clean install. BullGuard was one of the few AV programs to noticeably affect file transfers, and the low PCMark score is a concern. These issues drag down an otherwise well-trained security companion.

	VERDICT	7
BULLGUARD INTERNET SECURITY 10 \$60 (1 year, 3 PCs), www.bullguard.com		

Webroot Internet Security Complete

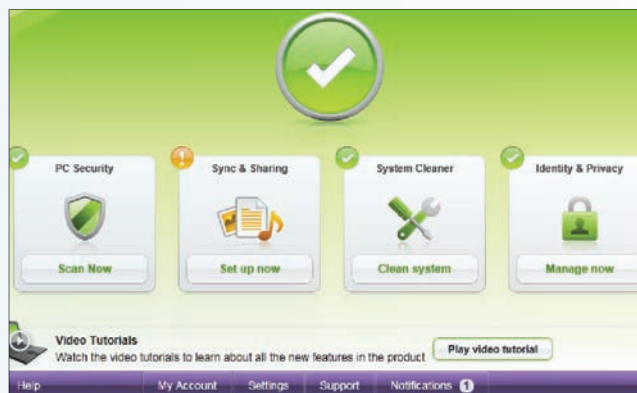
An intelligent interface with a dopey scan engine

Webroot used to focus its attention solely on system utilities and antispyware programs, such as Spy Sweeper, arguably its most popular product. Starting in 2006, Webroot widened its security net and now offers a fleshed-out lineup of antivirus products, the one reviewed here being its flagship suite.

In making the transition from antispyware specialist to an all-encompassing security vendor, Webroot didn't build its own scan engine and instead uses one provided by Sophos, a well-known security lab. This comes wrapped in a clever UI that's one of the best we've seen. Webroot lays out the program's four main functions—PC Security, Sync & Sharing, System Cleaner, Identity & Privacy—within easy reach via four large squares. A green checkmark or yellow exclamation point in the upper left corner of each square gives you a quick status report. Hovering over a square expands it to show additional information, like the next scheduled scan, as well as a link to edit settings. Clicking a box brings up a tabbed menu that consolidates all the advanced features into a single, manageable window. It's a brilliant design with an intuitive flow.

Curiously missing from Webroot's top-of-the-line security software are parental controls. In the plus column, Webroot includes 10GB of online storage, about five times as much as most other suites offer, and something we might actually use. We also appreciate Webroot's quiet nature, as it doesn't bombard you with pop-ups or silly questions it can figure out on its own.

Webroot did a good job thwarting spyware and zero-day threats, but toward the end of testing, it fell for one of the oldest tricks in the book by letting a fake AV program take control of our test bed. Even a safe-mode scan proved futile. The high RAM use didn't earn any brownie points, either.



Green and purple is a garish combination, but the color scheme is about the only thing Webroot gets wrong with the UI.

	VERDICT	6
WEBROOT INTERNET SECURITY COMPLETE \$80 (1 year, 3 PCs), www.webroot.com		

F-Secure Internet Security 2011

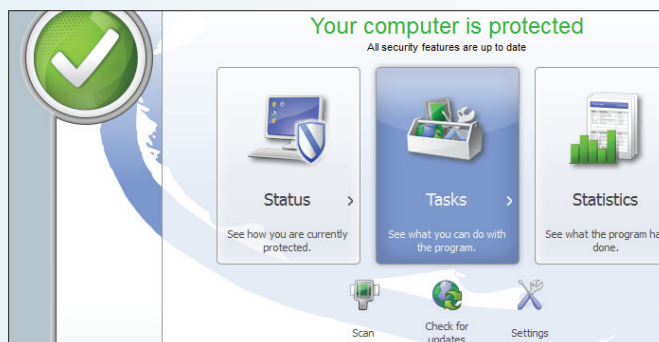
Easy-to-drive antivirus that's faster than a Formula 1 race car

F-Secure caught lightning in a bottle, poured it into its scan engine, and then built a security suite around it. When we say this scanner's fast, we mean buckle up, hold on to the seat of your pants, and hope you don't get whiplash. F-Secure's scanner sped through our test bed in just three minutes and 18 seconds the first time around, which is nearly twice as fast as the next-quickest AV suite and more nimble than the second, optimized scans of 60 percent of the other apps in this roundup. During a second scan, F-Secure zipped through our files in a mere 45 seconds.

At that pace, we have to wonder if F-Secure is racing simply to come in first or if it can actually detect viruses, too. As it turns it out, it can. We threw a variety of foul files at F-Secure and hit up a handful of websites serving zero-day malware. The reason we do this is to test both the scan engine and the software's behavioral analysis. So how did F-Secure do?

F-Secure's sprightly scanner closed the lid on our boxful of contaminants, blocked most malicious websites, and stopped most suspicious downloads from doing any harm. The lone exception was a polluted installer that contained adware. For everything else, F-Secure kept our test bed out of harm's way, although it oftentimes required a reboot to do so.

On the usability scale, F-Secure sports an intentionally dumbed-down interface based on the mantra that less is more. New users won't find the layout intimidating, and while advanced options are hidden behind the main



F-Secure is one of the easier AV programs to use, mostly because it doesn't afford a whole lot of fine grain control.

window, advanced users who love to micromanage every last detail will ultimately feel a little shortchanged. ⚡

F-SECURE INTERNET SECURITY 2011
\$60 (1 year, 3PCs), www.f-secure.com

VERDICT

8

AV Programs Compared

	MSE	NORTON	MCAFFEE	PANDA	BITDEFENDER	CLAMWIN	ZONEALARM	BULLGUARD	WEBROOT	F-SECURE
FEATURES										
EMAIL SCANNING	NO	YES	YES	YES	YES	NO	NO	YES	YES	YES
IM SCANNING	NO	YES	YES	YES	YES	NO	NO	YES	NO	NO
SPYWARE PROTECTION	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES
ROOTKIT PROTECTION	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES
HEURISTICS	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
FIREWALL	NO	YES	YES	YES	YES	NO	YES	YES	YES	YES
IDENTITY PROTECTION	NO	YES	NO	YES	NO	NO	YES	NO	YES	YES
SPAM CONTROLS	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
PARENTAL CONTROLS	NO	YES	YES	YES	YES	NO	YES	NO	NO	YES
PERFORMANCE										
SCAN 1 (MIN:SEC)	27:04	7:15	9:52	7:47	6:10	14:27	5:59	6:36	10:51	3:18
SCAN 2 (MIN:SEC)	8:25	2:03	4:08	7:26	1:55	13:51	4:58	1:00	3:19	0:45
PCMARK	9,350	8,784	8,236	9,249	8,914	9,039	8,717	7,645	8,359	8,857
BOOT (SEC)	+0	+0	+5	+5	+7	+1	+6	+19	+10	+14
FILE TRANSFER (SEC)	+0	+0	+1	+2	+5	+0	+3	+5	+0	+5

Our test bed is an Intel Core i7 930 on an Asus P6X58D Premium, with 6GB Corsair DDR3/1333, a Radeon HD 5850, a Western Digital Caviar Black 1TB 7,200rpm, and Windows 7 Professional 64-bit.

WHITE PAPER

UEFI

The Unified Extensible Firmware Interface is faster, more modular, and CPU-independent compared to the BIOS. So what's taking so long for it to arrive? **-BILL O'BRIEN**

After 30-plus years it's still ticking, but the clock has just about run out for the BIOS (Basic Input and Output System), which forms a critical interface for the hardware inside our PCs.

You could easily draw the conclusion that the BIOS was never meant to last this long.

Think back to the miserly requirements of a Clinton-era PC, which only had parallel and serial ports, a floppy disk drive, a keyboard, and a screen. Now expand that universe to include hard drives, tape drives, scanners, gigabytes of memory (hardly envisioned at the onset of personal computing), TV tuners, and everything else that's been added over the last 30 years. Right—any notion of “basic” is long gone.

By all accounts, UEFI is the answer to the BIOS's obsolescence. For starters, it gives you the more compliant Guide Partition Table (GPT) filesystem, which uses 64-bit values to up its storage ceiling to 9.4×10^{21} bytes, or 9.4 zettabytes (ZB).

What else does UEFI offer? And how does it work? We'll answer that below.

A WORLD OF DIFFERENCE

Hit the Del key or the F1 key or whatever key your BIOS manufacturer has designated to send you into the BIOS setup and you're presented with a rather bleak landscape. It's a basic monochrome text format with a minimal interface and no mouse control. The BIOS issues a set of vestigial drivers to kick the onboard firmware into life and then hands off to the operating system, which loads more robust drivers as needed.

Unlike the BIOS, which is locked to an x86 processor speci-

fication, UEFI is CPU-independent. As you've probably already seen, it uses a much richer GUI with full mouse control, but the initialization process is a bit more complex.

UEFI begins its platform initialization (PI) with a pre-EFI initialization (PEI) using a system's CPU cache as its call stack while it issues pre-EFI initialization modules (PEIMs). These modules initialize and describe some permanent memory—as much as needed to accommodate the environment they find themselves in—which allows them to store and recall the instructions they need to operate with.

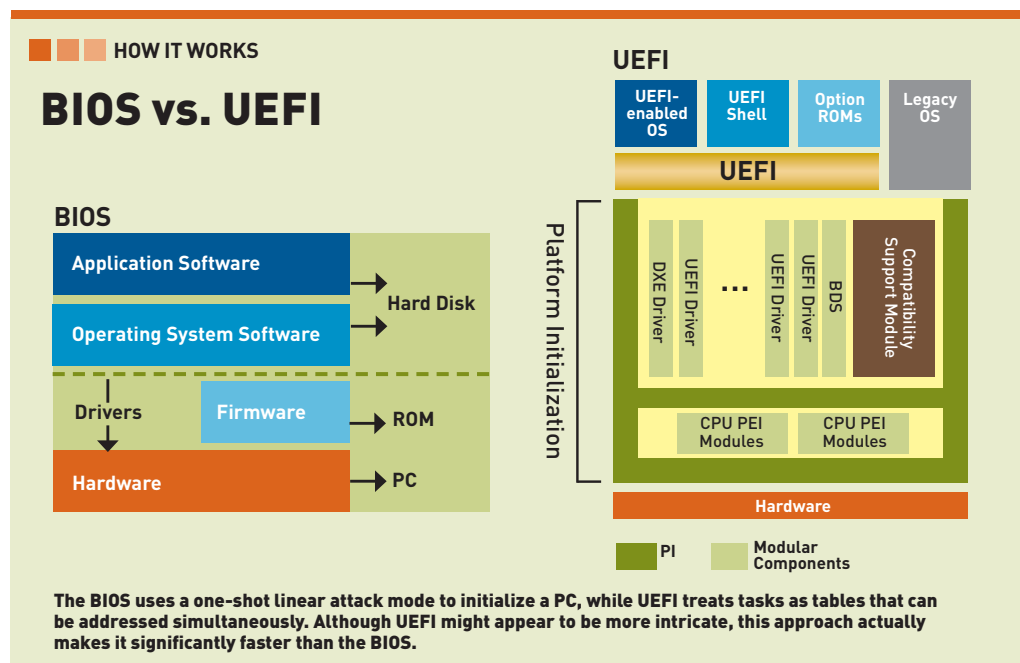
Because it knows exactly what the system surrounding it looks like, the BIOS is a one-way, “Here, take this” operation. By contrast, UEFI mounts a search-and-explore mission to determine its operating parameters and its hardware environment. It then reserves memory to hold its needed instruction set and passes operations off to the driver execution

environment (DXE). The closest approximation is that the PEI is almost BIOS-like in that it is the lightest level of execution, while the DXE does the heavy lifting.

Once this occurs, platform initialization then takes over to initialize a UEFI OS and shell (if implemented by the device manufacturer), as well as to interface with any option ROMs and any legacy OS that might be present.

The UEFI shell is an interesting construct. It's meant for developers and programmers and provides them with a command area in which automated code can be executed. (Remember “autoexec.bat”?) The shell provides a framework that's more modern than was found in the 1980s.

One other major difference between BIOS and UEFI environments is upgradability. Upgrading a BIOS is a tedious, nerve-wracking process that's inaccessible to everyday PC



Flip Ultra HD

The Flip Ultra HD is a handy little device that combines portability and ease of use with damn-fine movie quality for a device of its size. With the help of our handy-dandy heat gun and some of the tiniest screwdrivers you've ever seen, we were able to pry the lil' guy apart. Here's what we found inside.

users. UEFI greatly changes this—its environments can be upgraded or added to by including a simple UEFI partition on nonvolatile storage. The initialization routines will read the data in that partition and adjust the UEFI shell to include the additional instructions. That means no more AFUDOS (or similar) BIOS EEPROM erasing/rewriting schemes. On the production side, UEFI doesn't use machine mode, as do traditional BIOS implementations. Instead, it's written in C. While we can argue the theoretical efficacy of one versus the other, generally speaking, C allows for much quicker turn-around times for development.

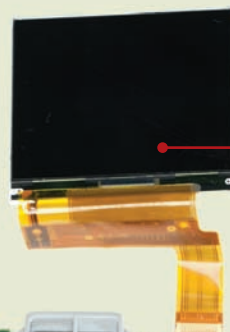
Although UEFI may seem more complex, much of what it does is the simultaneous handling of many events in a tabular format at the same relative time. That parallel approach makes for a faster boot time compared to the BIOS's linear bump-and-run approach.

ARE WE UEFI YET?

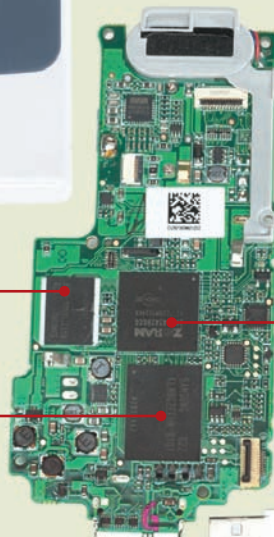
The short answer is no. Although EFI/UEFI has been circling overhead for about 10 years, it hasn't landed in great numbers yet. Some say that's due to the stigma of being associated with Intel's Itanium chip; others mumble that open-source (the real meaning of the "U" in UEFI) projects always take longer. More likely is that BIOS makers have invested time and money over the last several years to make their product compliant with current computing needs—at least as compliant as possible—so they have no vested interest or incentive for moving forward. UEFI, for its part, has become a great developer's tool. It permits software/driver developers to play the what-if game without all the encumbrances of re-writing the BIOS each time. This success, some have argued, may have moved UEFI away from the mainstream.

In its favor, however, the upcoming IPv6 protocols, along with >2TB hard drive deployments, will speed up the adoption process. (Speed up, of course, is a relative term in computing. As an example, IPv6 is in its twelfth year of nonadoption.)

Like an ice age, it may look like the glacier is off in the distance, but sooner or later, you'll wake up to find UEFI at your front door. If you're reading *Maximum PC*, it's highly likely that the next motherboard or PC you purchase will have it. ⏻



LCD SCREEN The Flip's 2-inch, 320x240 LCD screen is transfective for better visibility outdoors.

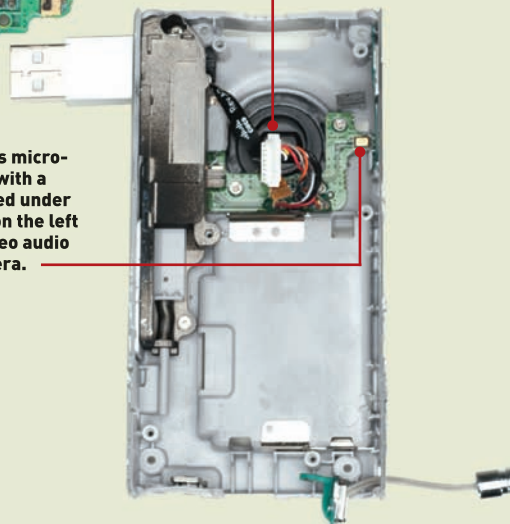


RAM The Zoran chip uses a single 1Gb Samsung DDR2 DRAM while processing video or stills.

FLASH STORAGE A single 8GB Samsung flash chip handles storage.

DIGITAL CAMERA PROCESSOR The brain in the Flip is a Zoran Coach 12P that handles the encoding chores and digital image stabilization. The Coach 12P also reduces noise in low-light situations and helps reduce the rolling-shutter artifacts that plague CMOS sensor-based cameras.

LENS The tiny lens in the front of the flip is a fixed-focus, 1.5m lens at f/2.4 (not bad for low light) with a 2x digital zoom.



MICROPHONE This microphone, combined with a second one situated under the plastic panel on the left side, handles stereo audio recording in-camera.



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

HOW TO

Step-by-Step Guides to Improving Your PC

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GOOGLE CHROME INSTANT

Have you heard about Chrome Instant?

The latest version of Google's browser includes a feature that extends the "instant" functionality recently added to Google search into the Chrome URL bar. That means that as you begin to type a URL, Chrome guesses what page you're trying to get to and automatically loads it in the browser. If it guesses wrong, just keep typing and Chrome will continue trying to guess the site, loading new pages as it goes.

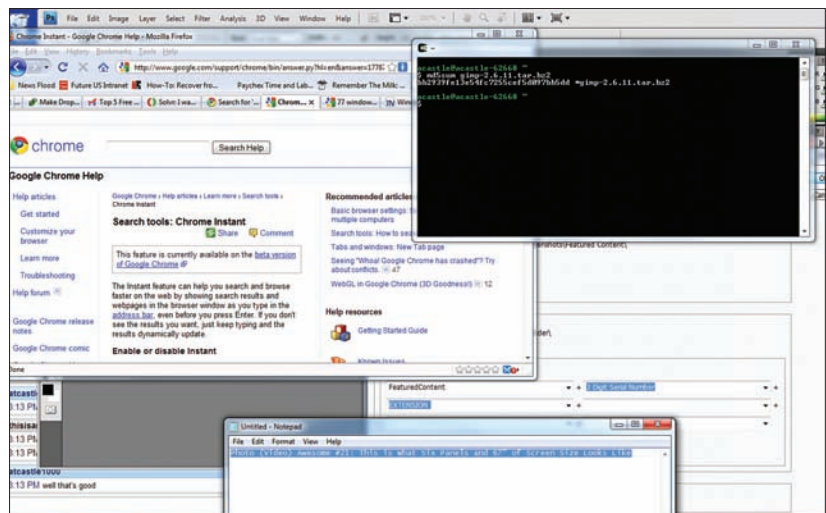
I was skeptical at first, but combined with Chrome's blazing-fast render speeds, this feature has already made my browsing a lot faster.

To try out Chrome Instant, you'll need to run the beta version of the browser, which is available at <http://bit.ly/bPtjHL>. Once you've installed it, just click the wrench icon at the right, and choose Options. The checkbox to turn on Instant is in the Search section under the search-engine selection drop-down.



ALEX CASTLE
ONLINE MANAGING EDITOR

WINDOWS TIP OF THE MONTH



Simplify Your Workspace

It can be easy to let your workspace get overwhelmed with extra windows. Press the Windows key + D to bring your desktop to the forefront. If you want to keep only one window open, select it and press Windows key + Home.



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

Use Windows 7 Speech Recognition

Using a pen and paper is so yesterday. The same goes for typing. Come on people: We've been hunting and pecking for more than 100 years! Where's the progress? Our thoroughly modern civilization deserves a progressive method for data input. If you haven't already embraced the speech-recognition features baked into Windows 7, it's about time that you did. The future is now. Let us show you the way. —SEAMUS BELLAMY

1 TAKE CONTROL

To get started with Windows 7's speech recognition, open your Start menu and click the Control Panel button.



Now, select the Ease of Access group and open up Speech Recognition (image A).

2 SET UP YOUR MICROPHONE

While you could elect to start using Windows 7's speech recognition without any preparation, we advise against it. If you've dabbled with voice-based computing before, you know that while the technology has made leaps and bounds, it's still pretty far from perfection. In order to save your sanity and have the best experience possible, it's essential that your microphone is set up correctly. From the Configure Your Speech Recognition window, select Set up Microphone.

You'll be asked to select what microphone you want to use. Depending on the type of microphone you choose, the Microphone Setup Wizard will suggest the optimum distance and configuration for you to use. You'll then be given the opportunity to set your audio level.

3 TEACH YOUR COMPUTER TO UNDERSTAND YOU

Now that you've taken the time to set up your microphone, it might be worthwhile to ensure that your computer can understand what you're saying. Look to the Configure Your Speech Recognition window once again and select Train Your Computer to Understand You. In doing so, you'll be walked through a tutorial that spoon-feeds you a number of phrases. By speaking each of the phrases into your microphone, you'll give Windows 7 the information it needs to

understand the commands that you're no doubt keen to give it.

Work your way through the tutorial and adjust your speech and diction as needed. It might be a pain having to alter the way you speak to meet Windows' needs, but it's not nearly as

painful as having your operating system do something contrary to your wish every time you issue a voice command.

4 USE A CHEAT SHEET

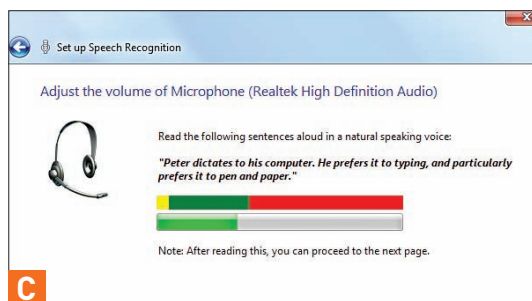
Your PC might understand you, but do you speak its language? Using Windows 7's speech-recognition features goes a lot smoother if you know how to boss around the application. Fortunately, Microsoft has put together a handy guide to get you started (image B). The guide includes information on a number of topics, including common speech recognition commands, dictation, keyboard commands, and how to enter special characters or punctuation marks.

To access the cheat sheet, turn to your Control Panel's Speech Recognition pane and click Open the Speech Reference Card. The reference card is printable, and we suggest you print it. After all, there's no shame in using training wheels until you can ride a bike on your own, right? Same goes for computing reference material.



5 PUT IT ALL TOGETHER

Now that you've rented the hall and hired the band, it's time to make your PC's speech-recognition software dance. From the Speech Recognition pane, select Start Speech Recognition. You'll once again be walked through the selection and setup of your microphone (image C)—after all, practice makes perfect. You'll also be asked whether or not you'd like to use Windows 7 speech recognition's manual or voice-activated modes. For a full-on *Star Trek* computing experience, we suggest giving voice activation a try. That's about it; have fun and welcome to the future!



Compile Software from Source Code

As a Windows user, you're probably used to software that comes in a user-friendly package. If you want to install a new program, it's usually a matter of running `setup.exe`, or occasionally a .msi installer. Because of this, a lot of Windows users panic when faced with the prospect of installing a file from source code. Well fear not, because it's not that difficult. We'll walk you through a source code install, step by step.

—ALEX CASTLE

1 INSTALL CYGWIN

There's more than one way to compile source code on a Windows machine, but Cygwin is our go-to application for getting Unix-like control on a PC. For a complete look at how to get started with Cygwin, check out our introductory how-to from the October 2010 issue, now available online at <http://bit.ly/9ynEBI>. For now, here are the basics you'll need to know.

You can find the Cygwin installer online at www.cygwin.com—download and run it. During the install, you'll be asked to select which packages to install; make sure the Devel package is selected (image D). Finally, when you install Cygwin, remember what

To allow you to check the integrity of the tarballs, here are the MD5 sums of the latest releases:

File	MD5 sum
gimp-2.6.0.tar.bz2	e5ac955fee8b376d431e4693027d7640
gimp-2.6.1.tar.bz2	2fa176d1da75575ce88b01019d014744d
gimp-2.6.2.tar.bz2	3664d12f26447c0edc3f611987b9bf2d
gimp-2.6.3.tar.bz2	39c30867511b79391eb9177ce86c8b79a
gimp-2.6.4.tar.bz2	4e8185e40ab06559ce6dd5ef61b3e83b
gimp-2.6.5.tar.bz2	cd13050bc6bde6d8d8fd38eff6276033
gimp-2.6.6.tar.bz2	23d880dd09cd62e936ed04666a53f8e4
gimp-2.6.7.tar.bz2	77ed86a8de9b48587efb24f2b115ad38
gimp-2.6.8.tar.bz2	a4d9462c9420954824a80c9b1963f9d9
gimp-2.6.9.tar.bz2	e5d0cc6f3ce127e51d7f3d3124b16a99
gimp-2.6.10.tar.bz2	b92710ad9f1b52fec98554d765473819
gimp-2.6.11.tar.bz2	bb2939fe13e54fc7255cef5d097bb5dd

```
rcastle@rcastle-62668 ~$ md5sum gimp-2.6.11.tar.bz2
bb2939fe13e54fc7255cef5d097bb5dd *gimp-2.6.11.tar.bz2
rcastle@rcastle-62668 ~$
```

you select for a home directory, because that's where you'll be doing the following steps.

2 (OPTIONAL) CHECK THE MD5 HASH

One of the great things about open-source software is that you can verify that what you're compiling is exactly what it's

meant to be and hasn't been tampered with or damaged on its way to your computer. The most common method of verification is with an MD5 hash, which takes a large document (a bunch of source code, for instance) and creates a nearly unique 256-bit string of characters. By making sure that your code produces the same MD5 hash as the original, you know that the two are identical.

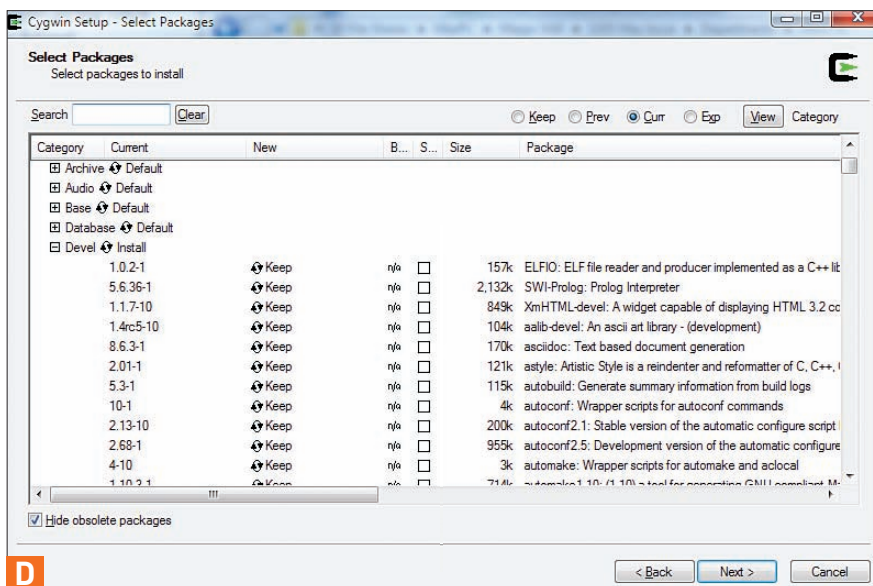
Most sites that provide source code will also provide the MD5 code right alongside it (image E), so you can verify the code if you download it from a mirror. To generate an MD5 code from the file that you've downloaded, just use the `md5sum` command in Cygwin, like this: `md5sum gimp-2.6.11.tar.bz2`

Where in this case, "gimp-2.6.11.tar.bz2" is the name of the file we want to verify. It will output a hash (image F), and you can quickly check to make sure that it matches the one posted on the source website.

3 INSTALL AND DECOMPRESS THE INSTALLER

Source code usually comes in a file with a name like "gimp-2.6.11.tar.bz2," which can seem like quite a mouthful, but it's actually not all that complicated. The numbers after the name of the file are version numbers, so you'll want to grab the latest (stable) source code. The ".tar" part of the file indicates that this is a "tarball" archive file, which is opened with the `tar` command-line program. Unlike common Windows archive formats like .zip and .rar, .tar is uncompressed. For transferring large files (like source code) over the Internet, a compression scheme is used—hence the final part of the filename, ".bz2," which indicates the compression algorithm used on the tarball.

Once you've got the file downloaded to your Cygwin home directory, you can unzip it using the `tar` command. Here's how you would decompress the example GIMP




```

gimp-2.6.11/po-python/nl.po
gimp-2.6.11/po-python/hr.po
gimp-2.6.11/po-python/lt.po
gimp-2.6.11/po-python/LINGUAS
gimp-2.6.11/po-python/ca@valencia.po
gimp-2.6.11/po-python/or.po
gimp-2.6.11/po-python/sl.po
gimp-2.6.11/po-python/uk.po
gimp-2.6.11/po-python/gl.po
gimp-2.6.11/po-python/fa.po
gimp-2.6.11/po-python/eo.po
gimp-2.6.11/po-python/Makefile.in.in
gimp-2.6.11/po-python/bg.po
gimp-2.6.11/po-python/pt.po
gimp-2.6.11/po-python/az.po
gimp-2.6.11/po-python/ChangeLog
gimp-2.6.11/po-python/xh.po
gimp-2.6.11/gimpdefs.msc
gimp-2.6.11/ChangeLog
gimp-2.6.11/ChangeLog.pre-1-0
gimp-2.6.11/README
gimp-2.6.11/LICENSE
acastle@acastle-62668 ~
G $ cd gimp-2.6.11

```

source code bundle we downloaded: `tar xjvf gimp-2.6.11.tar.bz2`

The “xjvf” tells the tar program how to decompress the file we downloaded. You should be able to use the same command for any source code you download, unless it ends with “.gz,” which is a different compression scheme and has to be unzipped with the command: `tar xzvf`

Once you’ve executed the command, tar will extract all files in the tarball to a new directory created inside of the one you’re currently in, named after the file. Switch to that directory (image G) with the cd command: `cd gimp-2.6.11`

4 READ!

As much as we would like there to be a one-size-fits-all guide to compiling source code, there are actually minor differences in how many programs compile. Because of that, most every program comes with an INSTALL file, which is a text document that details what you’ll need to do to install the software (image H). Frequently, this will include a list of package dependencies. The Devel package that you installed with Cygwin includes the most common packages used in building from source code.

5 CONFIGURE, MAKE, MAKE INSTALL

If the install file doesn’t specify differently, the basic steps that make up most source code builds are as follows. Execute all commands from within the directory that you extracted the tarball’s contents to: `./configure`

This command runs the configure script (image I), which gets your computer ready to build the software. It will tell you if you’re missing anything. For instance, running the configure script for GIMP revealed that we were missing the necessary

babl and gegl software—both of which can be easily downloaded and installed from their own source code—all within Cygwin.

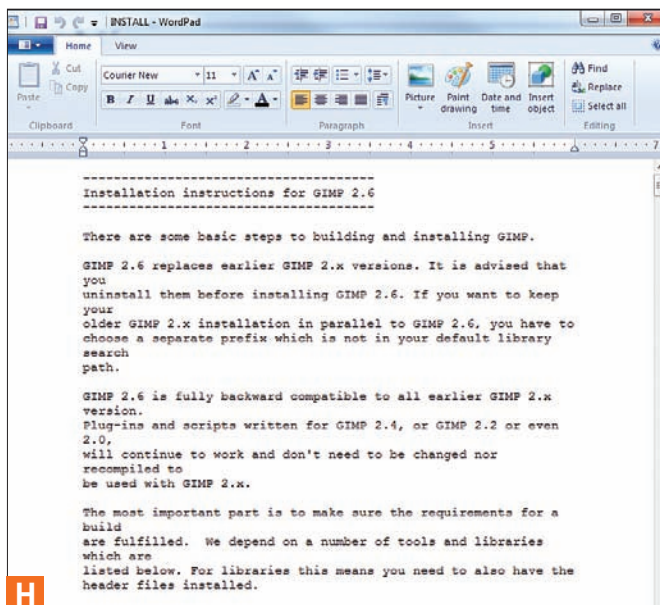
Once the configure script has completed, and not returned any major error, you can actually compile the program by running the following command: `make`

That one’s pretty simple, right? This command simply tells the make program to begin compiling the source code in the directory you’re currently in. This step may take a while, depending on the complexity of the program you’re compiling and the speed of the computer. In the process it’ll output a whole lot of intimidating-looking text to the shell, but it’s not anything you have to understand.

Finally, once make has completed successfully, you can run the final command: `make install`

This simply takes the compiled program and actually installs it, putting files where they belong in your filesystem.

And, like that, you’re done. Of course, it’s very likely that you’ll run into an error or two along the way (open source isn’t exactly synonymous with user friendly) but there are a lot of communities online dedicated to helping you find out what went wrong, and a simple Google search can frequently turn up an answer to any problems you might encounter.



```

~/gimp-2.6.11
gimp-2.6.11/po-python/LINGUAS
gimp-2.6.11/po-python/ca@valencia.po
gimp-2.6.11/po-python/or.po
gimp-2.6.11/po-python/sl.po
gimp-2.6.11/po-python/uk.po
gimp-2.6.11/po-python/gl.po
gimp-2.6.11/po-python/fa.po
gimp-2.6.11/po-python/eo.po
gimp-2.6.11/po-python/Makefile.in.in
gimp-2.6.11/po-python/bg.po
gimp-2.6.11/po-python/pt.po
gimp-2.6.11/po-python/az.po
gimp-2.6.11/po-python/ChangeLog
gimp-2.6.11/po-python/xh.po
gimp-2.6.11/gimpdefs.msc
gimp-2.6.11/ChangeLog
gimp-2.6.11/ChangeLog.pre-1-0
gimp-2.6.11/README
gimp-2.6.11/LICENSE
acastle@acastle-62668 ~
I $ cd gimp-2.6.11
acastle@acastle-62668 ~/gimp-2.6.11
./configure

```

Batch Process Files in Photoshop

For anyone who deals with images on a regular basis—whether they're photographers, bloggers, or digital artists—Adobe Photoshop is an indispensable tool. And while the program can be used to make extensive alterations to a single photo, there are times when what you want is to make more simple alterations to lots of photos. Fortunately, Photoshop makes that easy. Here's how you can use the batch-processing capabilities in Photoshop to kick-assify all your photos at once. —ALEX CASTLE

1 CREATE AN ACTION

The basis of Photoshop's batch processor is always an action—a predefined set of commands that can be set to run on any picture. Photoshop comes with a set of built-in actions ranging from the mildly useful (Sepia Toning) to the downright befuddling (Molten Lead? Really?). But unless your job down at the boardwalk Old West photo booth requires you to apply sepia tone en masse, you're going to want to be able to create your own actions.

Here's how you create an action: First,

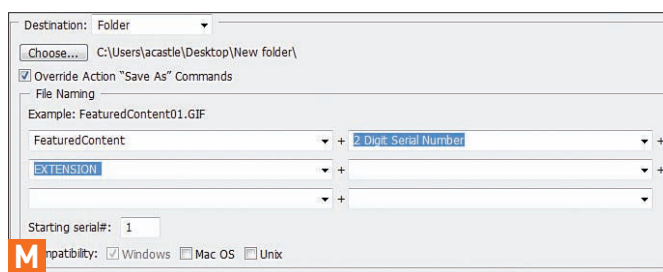
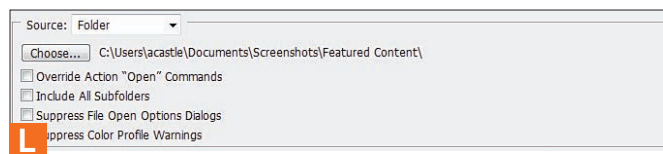
open a file like the ones you will want to batch process. To record an action, you'll have to have an image to perform that action on.

Next, open up the Actions window (image J) if it's not already visible. It will appear as a tab next to the History browser. Then, click the Create New Action button at the bottom of the Actions window (it looks just the same as the Create New Layer button). You'll be asked to give your action a name (pick something descriptive), and then the action will start recording.

Carefully perform the action or set of actions that you'll want to apply to all photos in the batch. When you're done, either save the image (if you want to overwrite the original) or save it to a new location, close the file (but not Photoshop), and hit the Stop Recording button in the Actions pane. You don't have to save and close the image as part of the action—the batch processor can do that automatically—but by making it part of the action, that action becomes more useful if you want to use it as a stand-alone macro.

2 BATCH PROCESS YOUR FILES

Now that you've got your action recorded, you're almost ready to go. Group all of the images you want to process into a single folder, and start the Photoshop batch processor by clicking File > Automate > Batch.



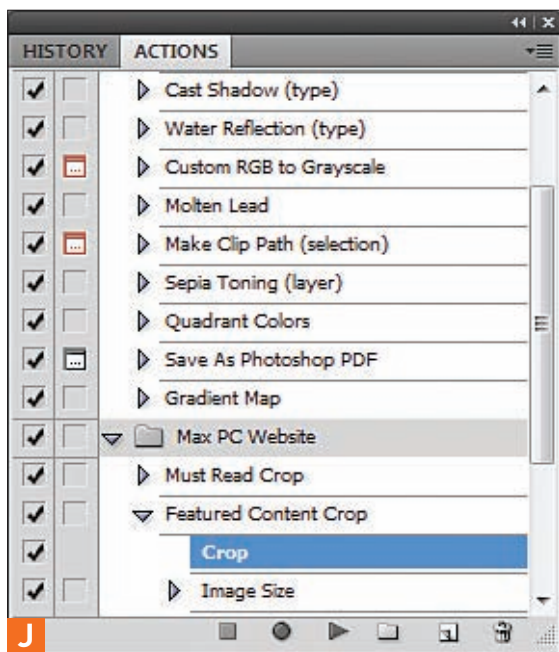
This will open the batch processor itself, which has three sections you should worry about.

The first section lets you select the action to apply to all images (image K). If you stored your action in any set other than the default one, you'll have to select that set from the first drop-down list.

The second section is where you define the input for the batch processor (image L). Frequently this will be a folder, though you can also perform an action on all images open in Photoshop.

The third section tells Photoshop what to do with the images the action outputs (image M). If your action has its own save process built in, you can select None. If it doesn't, choose Folder to output all your processed photos to a folder. Even if your action includes a save, you can choose to overwrite it by checking the Override box. The six drop-down boxes in this section allow you to define a naming convention for the files the batch process will output.

Once you've got all three sections filled in, you're set. Just click OK, and Photoshop will open every file in the input folder, apply your custom action, then save the result to the output folder. It's a little complicated the first time, but can save you a ton of time over the long run. ⏻



LENGTH OF TIME
2 HOURSLEVEL OF DIFFICULTY
INTERMEDIATE

BUILD IT

An AMD/CrossFire Powerhouse

Can we build an AMD machine—*any* AMD machine—that can compete with an Intel-powered rig?



NATHAN EDWARDS
SENIOR ASSOCIATE
EDITOR

THE MISSION In the forever war between CPU vendors, AMD and Intel have traded places many times—one leads, then the other. Since the advent of Intel's Core i7, though, AMD hasn't been able to touch the performance of Intel's high end, and Sandy Bridge further increases the gap. But, well, you can't buy Sandy Bridge motherboards at the time of this writing—something about a bad chipset—and I've been meaning to build an AMD-powered machine for a while now—with CrossFire, even. Why? Partially because I can, but I also want to witness the performance delta firsthand.

Just for kicks, I'm also going to put some effort—and money—into making this system pretty. I'm not going to add lots of flashy lights (though I thought about it); instead, I'm focusing on the case itself and the wiring inside. The result, hopefully, will be a rig I can be proud of, inside and out.

INGREDIENTS

✓ Case/PSU NZXT Phantom www.nzxt.com	\$140
✓ PSU Silverstone Strider Gold 750W www.silverstonetek.com	\$190
✓ PSU Cables Silverstone PP05 short-cable kit www.silverstonetek.com	\$25
✓ Mobo MSI 890FXA-GD70 us.msi.com	\$200
✓ CPU AMD Phenom II X6 1090T Black Edition Thuban 3.2GHz www.amd.com	\$200
✓ Cooler Cooler Master Hyper 212+ www.cooler-master.com	\$30
✓ RAM Corsair CMP4GX3M2A1600C8 4GB kit DDR3/1600 www.corsair.com	\$70
✓ Optical Drive Plextor PX-B320SA BD-ROM www.plextor.com	\$100
✓ Hard Drive 2TB Seagate Barracuda XT www.seagate.com	\$170
✓ Solid-State Drive 256GB Samsung 470 Series www.samsung.com	\$500
✓ GPU Two Asus EAH6870 DirectCU Radeon HD 6870 in CrossFireX www.asus.com	\$440
✓ OS Windows 7 Home Premium 64-bit (OEM) www.microsoft.com	\$99
✓ Misc NZXT individually sleeved cables (CB 24P, CB 8P, CB 43SATA, 2x CB 6V, 2x CB 8V) www.nzxt.com	\$54
✓ Zip ties	\$2
Total	\$2,220



Choosing the Hardware

Advocates of AMD's Phenom chips cite their low power consumption and high overclocking potential—oh yeah, and you can get a 3.2GHz hexa-core for 200 bucks. Indeed, the cost of the Phenom II X6 1090T that I chose, plus a fancy CrossFireX-enabled MSI 890FXA-GD70 motherboard, was only \$400 total. This had the makings of an inexpensive build, until I added two Radeon HD 6870 videocards, a 7,200rpm 2TB Seagate Barracuda XT hard drive, and a \$500 256GB Samsung solid-state drive. Why these parts? Thanks to a recent price drop, two 6870s in CrossFireX cost less than a single GTX 580, and they help me maintain the theme of AMD solidarity. I chose the drives with performance in mind, plain and simple.



SUBMIT YOUR IDEA Have an awesome idea for Build It? Let us know at comments@maximumpc.com.

Since a clean-looking, aesthetically pleasing build was also part of the plan, I sprang for NZXT's white Phantom



Silverstone's PP05 short-cabling kit works with any of its modular PSUs to avoid clutter in smaller cases.

chassis, which looks gorgeous on the outside, has plenty of fan mounts, and is roomy enough that, even when loaded with two videocards, my build won't look cramped. To make it look even cleaner, I'm modifying my Silverstone Strider Gold 750W PSU with Silverstone's short-cabling kit and some of NZXT's fancy, individually threaded power-cable extenders. Throw in a Blu-ray drive, 4GB of RAM, a copy of Windows 7, and Cooler Master's famed Hyper 212+ CPU cooler (yes, it works on AM3!) and we're in business.

1 INSTALL CPU, COOLER, AND RAM

AMD CPUs, unlike their Intel counterparts, still have pins on them, so be careful not to bend them when you place the CPU carefully into its socket. Make sure to align the triangle on the upper left corner of the socket with its counterpart on the CPU, then lower the lever that secures the CPU.

Next, remove the motherboard's built-in cooler retention mechanism by unscrewing the four silver Phillips-head screws, and then remove the black plastic structure and its backplate. Most AMD coolers don't require this,

but our Hyper does. Align the Hyper 212+ backplate with the four mounting holes, then put the mounting pins through the holes and secure with the hex nuts using the hex bit included with the cooler (image A). Apply a small amount of thermal paste to the CPU, then follow the Hyper's instruction manual to secure the heatsink to the mounting pins. Tighten the spring screws until they're no longer easy to tighten.

At this point you should add the RAM to the two slots closest to the heatsink, then clip the heatsink fan to the RAM side of the heatsink (so it blows through the cooling fins toward the back of the mobo) and plug it into the CPU_FAN header.



2 PREP THE CASE

Remove both side panels from the case, as well as the top and front fascia. Set them aside for now. The NZXT Phantom comes with a rat-ton of hard drive trays. In fact, there's a whole extra bay taking up room at the bottom of the case where we could be fiddling with PSU cables. Let's remove it. Flip the case onto its front so the bottom of the case is visible. Unscrew the four Phillips-head screws at the center of the case's base (image B), then flip the case so the rear of the motherboard tray is visible and remove the six screws you see in the center. Then you can remove that whole hard drive bay.

You should also install the motherboard I/O shield at this point. Be sure to install it from the inside of the case, facing out, and make sure all nine ATX mounting holes in the case have standoffs in them.



3 INSTALL MOBO AND GPUs

With your case lying on its left side, place the motherboard into it. Align the I/O ports with the holes in the I/O shield and the mounting holes with the case's standoffs (image C). Install using screws from the Phantom's screws pouch. Now might be a good time to connect the front-panel HD_Audio, USB, and power connectors.

Remove the first two PCI-E slot covers, as well as the fourth and fifth. Align the first GPU with the first PCI-E x16 slot and lower it into place, pressing down firmly so it engages with the slot (image D). Secure it with two thumbscrews. Because of the enormous coolers on Asus's EAH6870 DirectCU videocards, we can't use the second PCI-E x16 slot. Instead, we'll put the second GPU in the third PCI-E slot, using expansion-ports 4 and 5 (image E). Once both GPUs are secure, attach the CrossFire connector.



4 INSTALL FANCY POWER CABLES

Before we add the PSU, we're going to prewire our individually threaded power cables so they run behind the motherboard tray. If you're skipping the individually threaded cables and PP05 kit, skip this step. Attach the 24-pin ATX connector to its socket (image F), then push the other end through the nearest rubber-grommeted hole in the mobo tray. Attach the 8-pin ATX aux power cable to its socket, then run it up into the hole at the top of the motherboard tray and behind the mobo. Same for the four 6-pin cables for the video-cards (image G); attach them all first and then route them behind the motherboard.

5 MOUNT THE DRIVES

Now it's time to install the drives. Just slap the optical drive into whichever bay you'd like (we used the bottom-most optical bay) and secure it by clicking the slider on the lock mechanism to the front (image H).

The Phantom's hard drive trays are like nearly every other case's trays—the 3.5-inch drive pops right into its bay, while the 2.5-inch drive needs to be secured with screws (image I). Slide the drive trays back into the bay. Connect with the fancy 4-pin-to-3-SATA connector from the NZXT kit; garnish with SATA cables (image J).



6 INSTALL PSU AND CONNECT CABLES

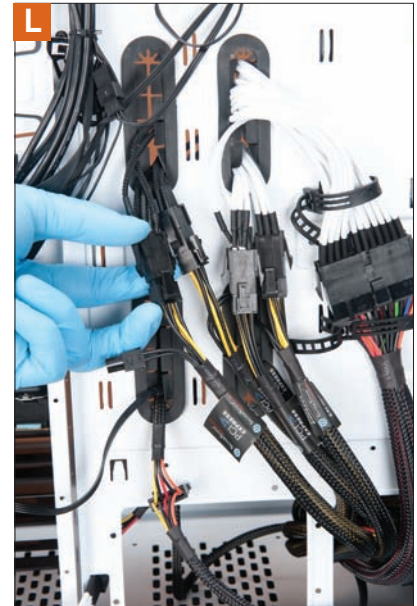
Because wiring's such a big part of this build, we've saved the PSU for the end. By now, everything should be installed *except* the PSU, and the motherboard and GPUs should be connected to individually threaded power-cable extenders that are routed behind the motherboard tray.

The Strider Gold 750W PSU comes with standard-length modular cables preinstalled; remove those. Install the PSU into the chassis and plug in the short cables from the PPO5 kit (image K). You should only need the two ATX power connectors, four 6-pin PCI-E cables, one SATA power connector, and one two-plug Molex power connector.

Run the two ATX power connectors and four PCI-E power connectors through the giant hole at the bottom of the mobo tray and bring them up to connect to the individually sleeved cables (image L). Utilize zip ties and the cable tie-downs available to you.

Almost done! Be sure to connect 4-pin power

connectors to your front-panel fan connectors and 4-pin-to-3-SATA hard drive connectors, and be sure to connect front-panel, SSD, HDD, and Blu-ray SATA cables to the motherboard. Double-check that all your power connectors are in place, as well as your front-panel connectors. Replace the case's right side panel and top and front plastic molding, being sure to remove the optical bezel for the slot the Blu-ray player occupies. Connect your two side-panel fans to their connectors and replace the left side panel. Connect your monitor, keyboard, mouse, and power cable, and you should be ready to install Windows. Glorious.



The AMD Rig in Action

At stock speeds, my AMD-powered rig doesn't do so well compared to *Maximum PC's* standard zero-point machine. This isn't surprising; the Intel machine has a faster clock speed and more virtual cores (thanks to HyperThreading) than my rig. That gives it the edge in both single-threaded and multithreaded apps. That ain't fair.

But I didn't build this rig to run at stock speeds. After a few false starts, I got the 3.2GHz 1090T CPU running at a stable 3.8GHz. This was my second attempt at overclocking this rig; the first resulted in a bad smell and a fried motherboard somewhere around the 4GHz mark. I replaced the motherboard and got a stable 3.8GHz overclock.

The extra clocks really helped narrow the gap between this rig and our zero-point: At 3.8GHz, the AMD machine ran Lightroom 12 percent faster than the zero-point, came within 10fps of the zero-point in Far Cry 2, and exceeded it in STALKER. Thanks to multi-threading, the zero-point still won in Vegas and ProShow Producer, but the gap was much narrower after our overclock.

The 1090T in my rig overclocked impressively (and has potential to go even further), but for multithreaded applications, a quad-core with HyperThreading seems to beat out a higher-clocked six-core without.

BENCHMARKS: BUILD-IT 3.2GHz

	ZERO POINT	
Vegas Pro 9 (sec)	3,049	4,982 [-39%]
Lightroom 2.6 (sec)	356	355 [-0%]
ProShow 4 (sec)	1,112	1,674 [-34%]
Reference 1.6 (sec)	2,113	2,615 [-19%]
STALKER: CoP (fps)	42.0	42.8
Far Cry 2 (fps)	114.4	98.8 [-14%]

BENCHMARKS: BUILD-IT 3.8GHz

	ZERO POINT	
Vegas Pro 9 (sec)	3,049	4,246 [-28%]
Lightroom 2.6 (sec)	356	319
ProShow 4 (sec)	1,112	1,493 [-26%]
Reference 1.6 (sec)	2,113	2,229 [-5%]
STALKER: CoP (fps)	42.0	42.9
Far Cry 2 (fps)	114.4	105 [-8%]

ALTERNATE CONFIGURATIONS

There are several points at which your build can differ from mine. Skip the individually sleeved power cables and the Silverstone PPO5 short-cable kit, and you can save almost \$80. Dropping the SSD size from 256GB to 64GB puts space at a premium but saves another \$370. Swapping the 4GB of DDR3/1600 for 8GB of DDR3/1300 costs only \$20 more. And so forth.

The goal of this build was to experiment—both with an AMD configuration (which we haven't done in a long time) and with CrossFire, which we also haven't done for a while. With the overclock I achieved, the AMD rig performed soundly.

The secondary goal was to build a beautiful rig, and in that sense I definitely succeeded. Just look at that gut shot.

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 1750MHz, 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.

Our AMD Machine Is a Looker

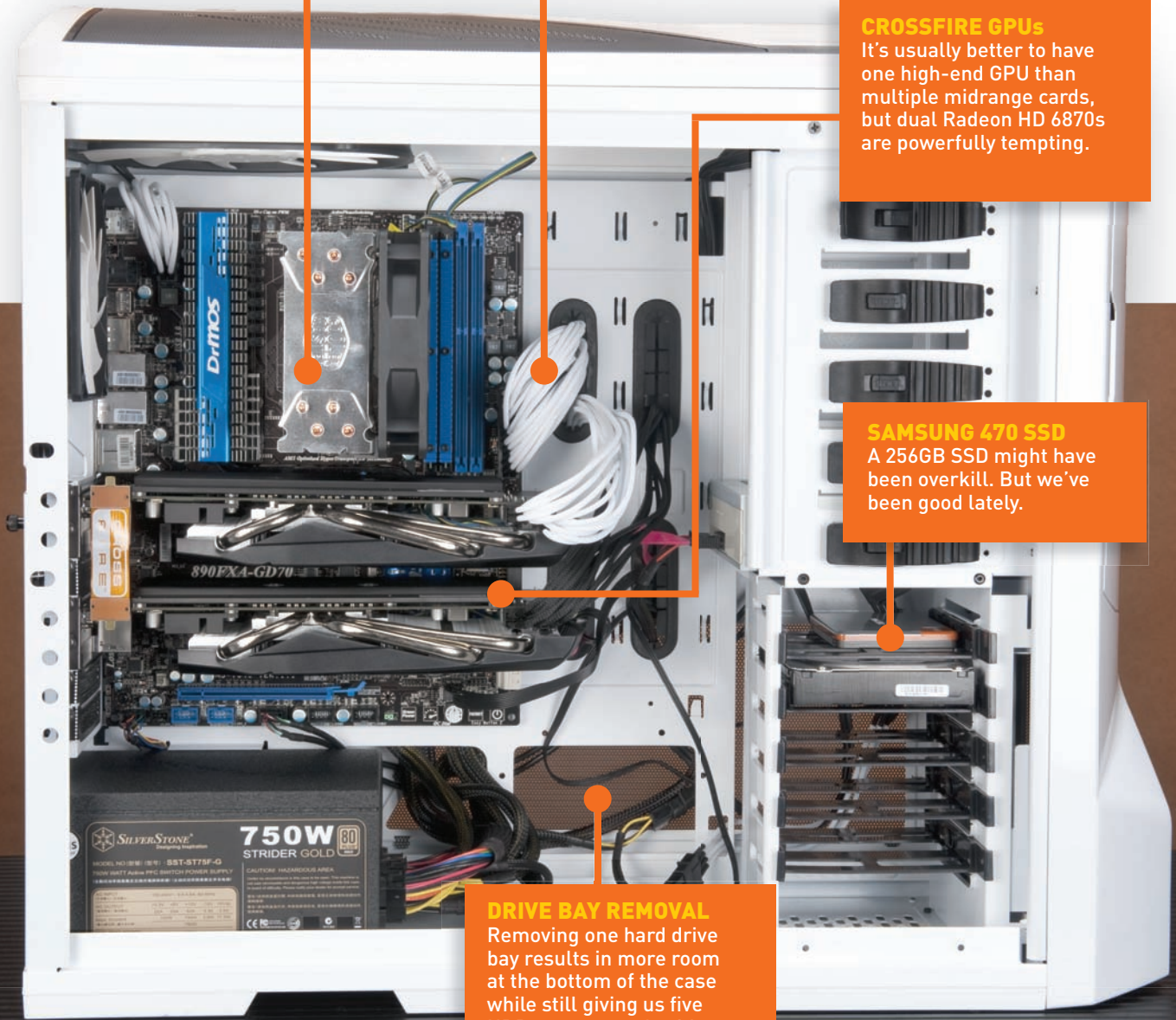
COOLER MASTER HYPER 212+ It remains our go-to entry-level cooler, and it's compatible with both AMD and Intel builds.

FANCY WRAPPING Individually sleeved cables eliminate visual clutter from the inside of the case.

CROSSFIRE GPU_s It's usually better to have one high-end GPU than multiple midrange cards, but dual Radeon HD 6870s are powerfully tempting.

SAMSUNG 470 SSD A 256GB SSD might have been overkill. But we've been good lately.

DRIVE BAY REMOVAL Removing one hard drive bay results in more room at the bottom of the case while still giving us five HDD trays to work with.



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Tested. Reviewed. Verdictized.

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Velocity Micro Raptor Signature Edition

The last ride of the LGA1366 is still a fast one

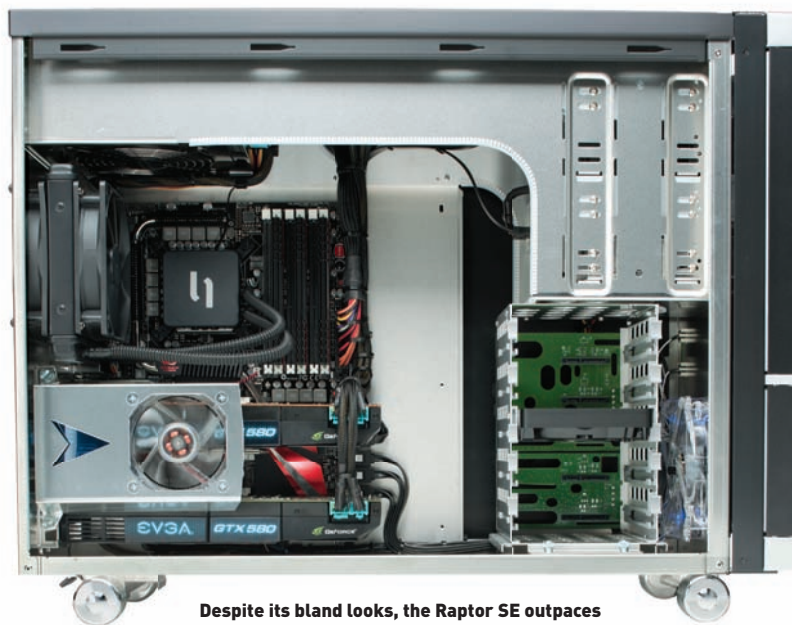
The bell may toll for LGA1366, but at least Intel's premier performance socket isn't going down without a fight. The fight, in this case, is the new hexa-core Core i7-990X, which is at the heart of Velocity Micro's Raptor Signature Edition PC.

The new CPU boasts a slight clock bump up from the 980X's 3.33GHz to 3.46GHz. With Turbo Boost, the 990X will take the cores up to 3.73GHz. So why even build on LGA1366 at all when its sibling, the LGA1155-based Sandy Bridge, offers such kick-ass performance for an ass-kicking price?

Well, if you haven't heard, there was a bit of a screw up with the P67 chipset that made it nigh impossible to get an LGA1155 motherboard for a couple of months. So it's no surprise that Velocity Micro took this opportunity to drop the Raptor SE on us. Besides the 990X, the Raptor SE sports a pair of GeForce GTX 580 cards, a 120GB OCZ Revo SSD, a 2TB Hitachi HDD, a Blu-ray combo drive, and 12GB of Patriot DDR3/1600 RAM. The CPU is mounted in an Asus Rampage 3 Formula board, and cooling comes courtesy of a CoolIT Eco 2 liquid cooler.

It all makes for an impressive system—one that can go toe-to-toe with the Falcon Northwest and Digital Storm rigs we reviewed in February and April, respectively. Both of those systems used a Sandy Bridge Core i7-2600K paired with two GeForce GTX 580 cards.

In performance tests, the Raptor SE pulled in some good numbers. The most significant wins were in Sony Vegas Pro 9 and the MainConcept



Despite its bland looks, the Raptor SE outpaces sexier boutique rigs.

Reference encoder. Reference saw the Raptor SE achieve a 10 percent boost over the wick-edly fast Digital Storm Black Ops Enix. In fact, the Raptor SE's performance in the Reference encoder was damn close to that of the \$10,000 dual-Xeon-based AVADirect that we reviewed in the Holiday issue and just edged out the Dream Machine 2010. Not bad.

More impressive still was the Raptor SE's performance in Sony Vegas Pro 9, where it broke a record set way back in August by an Origin PC box—another hexa-core Core i7 rig.

In gaming, the Raptor SE also represents LGA1366 well. It turned in frame rates slightly faster than the Falcon Northwest and pulled even with the Digital Storm Black Ops Enix, which featured an even higher clock speed.

So what's the rub? The price. Intel's pricing of the quad-core Core i7-2600K near \$300 makes it the steal of the century. Yes, the Core i7-990X has

six cores and will hammer multithreaded applications with a vengeance. But it's also \$1,000. That pushes the price of the Raptor SE significantly beyond the \$4,300 Falcon Northwest Mach V. Not to mention the \$3,500 Digital Storm Black Ops Enix.

We shouldn't downplay hexa-core performance, though. The truth is, the hexa-core chip will still run rings around the quad-core Sandy Bridge parts—but you'll need applications that will exploit its 12 threads. If you're someone who regularly uses a video editor, encoder, 3D modeling app, engineering app, or another workstation-level app, the hexa-core LGA1366 is worth the stretch. However, for all others, a quad-core Sandy Bridge is simply too much of a bargain to ignore. Despite this, we won't rob Velocity Micro of its deserved kudos. The system is fast, stable, and can hang with the best boxes.

—GORDON MAH UNG

SPECIFICATIONS

Processor	Intel 3.46GHz Core i7-990X overclocked to 4.7GHz
Mobo	Asus Rampage III Formula
RAM	12GB DDR3/1600
Videocard	Two GeForce GTX 580 in SLI
Soundcard	Onboard
Storage	128GB OCZ Revo, 2TB Hitachi 7,200rpm
Optical	Lite-On Blu-ray burner, 22x DVD burner
Case/PSU	Lx-W

BENCHMARKS

ZERO POINT			
Vegas Pro 9 (sec)	3,049		2,021
Lightroom 2.6 (sec)	356	269	
ProShow 4 (sec)	1,112	828	
Reference 1.6 (sec)	2,113		1,373
STALKER: CoP (fps)	42.0		88.9 [+112%]
Far Cry 2 (fps)	114.4		185.1

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 1750MHz, 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.

■ ■ ■
VERDICT 9

VELOCITY MICRO RAPTOR SIGNATURE EDITION

+ A-WING

Hexa-core performance; tri-SLI ready.

- B-WING

Pricy; understated looks.

\$5,500, www.velocitymicro.com

AVADirect Clevo P150HM

At long last, a Sandy Bridge notebook!

By now, Intel's Sandy Bridge CPUs need no introduction. Since their debut late last year, the procs have been on the hot list of every red-blooded power user. But getting at them hasn't been easy. Particularly the mobile parts, which hadn't even hit the market in new notebooks before the now-infamous SATA 3Gb/s port issue brought product flow to a grinding halt.

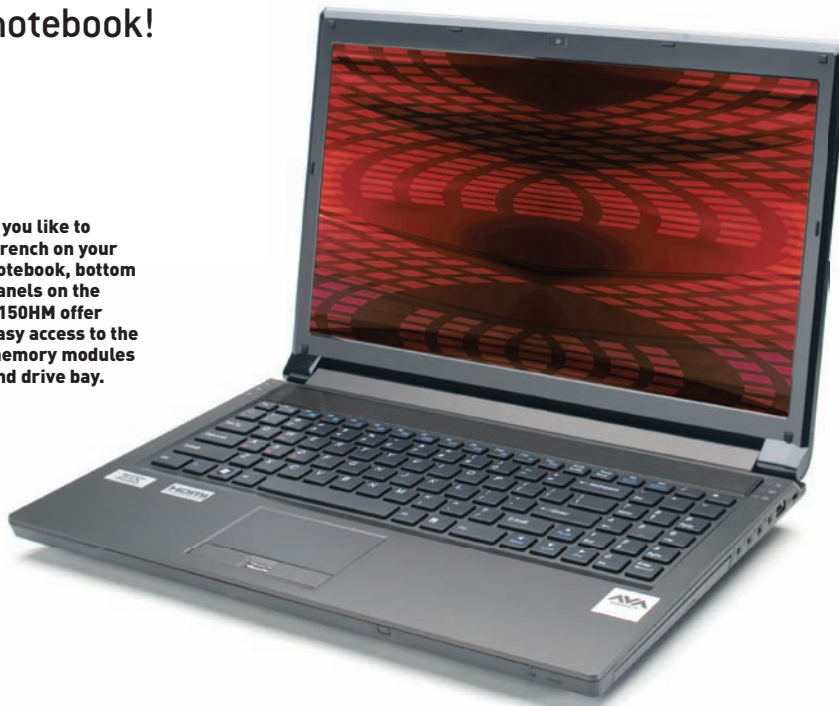
Thanks to AVADirect, however, our days of waiting and wanting are over. The company's 15-inch Clevo P150HM features a shiny new 2.2GHz Core i7-2720QM. It's not the fastest proc in the SB mobile lineup, but you're still looking at four cores, eight threads, and a maximum Turbo frequency of 3.3GHz. If that sounds promising, peep the benchmarks.

For our new zero-point notebook, we appointed the Asus G73Jw-A1 that we reviewed in January 2011. That machine's 1.73GHz Core i7-740QM will provide a good marker for how this new generation of CPUs performs against last-gen Nehalems. And based on the performance of the Clevo P150HM, there's no need for nostalgia. While the Core i7-2720QM isn't quite 30 percent faster than our zero-point's proc in base clock speed, it enjoyed leads ranging from 46 percent to 70 percent in the computing benchmarks—such is the power of Turbo Boost 2.0.

While all Sandy Bridge chips have a graphics core right alongside the CPU core on the same die, it gets no love in the Clevo P150HM. Graphics are handled solely by a GeForce GTX 485M, which performed admirably in our gaming tests. It bested our zero-point's GTX 460M by more than 30 percent in both Far Cry 2 and Call of Duty 4. When we bumped up the resolution in FC2 to the notebook's native 1920x1080, keeping all settings at Ultra High, the frame rate barely dropped, hitting 66.9fps.

It would have been nice if the notebook

If you like to wrench on your notebook, bottom panels on the P150HM offer easy access to the memory modules and drive bay.



came with Nvidia's Optimus technology, so when graphics-card power wasn't called for, the Sandy Bridge GPU could take over and conserve some power. The P150HM surely would have lasted longer in our battery rundown test. Still, by exceeding two hours during DVD playback, it did better than many other similarly configured rigs.

While not as big and burly as the last few Clevo notebooks we've reviewed, the 15-inch P150HM is far from dainty. Aesthetically it's no-nonsense—plain black rubberized surfaces, a full-size island keyboard, and an unobtrusive smattering of blue LED indicator lights. Its simplicity is offset by a glossy LCD screen framed by a glossy black bezel.

Its simple looks are also offset by its price. But what you're paying for are all the internal goodies. Besides offering killer

computing and mobile graphics performance, the P150HM gives you 256GB of fast SSD storage and a Blu-ray drive to boot. Indeed, this machine could ably serve as a primary computer. —KATHERINE STEVENSON

SPECIFICATIONS

CPU	2.2GHz Intel Core i7-2720QM
RAM	8GB DDR3/1066MHz
Chipset	Intel HM65
Drives	Crucial C300 256GB SSD
Optical	Matshita Blu-ray burner
GPU	Nvidia GeForce GTX 485M
Connectivity	HDMI, DVI, USB/eSATA, Ethernet, two USB 3.0, two USB 2.0, FireWire, headphone, mic, S/PDIF out, speaker out/line in, 9-in-1 media reader, webcam, Bluetooth, 802.11g
Lap/Carry	6 lbs, 15.6 oz / 9 lbs, 3 oz

BENCHMARKS

ZERO POINT			
Premiere Pro CS3 (sec)	899	526	
Photoshop CS3 (sec)	131	84	
Proshow Producer (sec)	876	597	
MainConcept (sec)	1,782	1,148	
Far Cry 2 (fps)	48.5	67.3	
Call of Duty 4 (fps)	62.2	84.3	
Battery Life (min)	96	124	

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



VERDICT **9**

AVADIRECT CLEVO P150HM

+ PECAN SANDY

Mobile Sandy Bridge rocks; gaming doesn't get much better on a single-GPU notebook.

+ SANDY DUNCAN

Optimus-like technology would have been nice; glossy screen isn't for everyone.

\$2,825, www.avadirect.com

XFx Radeon HD 6950 1GB XXX Edition

XFx doubles the fan and juices the clock speed of the HD 6950

The original Radeon HD 6950 cards shipped with a 2GB frame buffer, and you can still get those if you want. But some manufacturers have begun shipping the HD 6950 with 1GB of video memory, which is a fine fit for the current generation of 1080p displays.

XFx has taken the 1GB 6950 a step further, juicing up both the GPU and memory clocks and adding a custom cooler that XFx says will keep the card cooler and run more quietly than the default AMD-designed cooler. The new cooler uses a pair of propeller-bladed fans that turn more slowly than the paddle wheel fan in the reference cooling system.

The XXX Edition's core clock speed is 830MHz, almost 4 percent over the 800MHz reference clock; the 1,300MHz memory is clocked about 8 percent over the reference 1,200MHz memory frequency. The XXX Edition has the usual set of



The dual fans on XFx's Radeon HD 6950 push more air and make less noise than the single fan on the reference model.

BENCHMARKS			
	XFx Radeon HD 6950 XXX 1GB	MSI N560 GTX-Ti	Reference Radeon HD 6950 1GB
Shader Units*	1,408	384	1,408
Texture Units	88	64	88
ROPs	32	32	32
Power Connectors	2x 6-pin	2x 6-pin	2x 6-pin
Core Clock Frequency	830MHz	880MHz	800MHz
Memory Clock Frequency	1,300MHz	1,050MHz	1,250MHz
Frame Buffer Size	1GB	1GB	1GB
Memory Interface	256-bit	256-bit	256-bit
Price	\$290	\$250	\$250-\$290

* Nvidia and AMD shader cores are not directly comparable.

BENCHMARKS		
	XFx Radeon HD 6950 XXX 1GB	MSI N560 GTX-Ti
3DMark 2011	5,005	4,519
3DMark Vantage Perf	19,344	19,482
Unigine Heaven 2.1 (fps)	25	26
Crysis (fps)	33	29
BattleForge DX11 (fps)	59	54
Far Cry 2 / Long (fps)	88	102
HAWX 2 DX11 (fps)	76	127
STALKER: CoP DX11 (fps)	46	44
Just Cause 2 (fps)	39	42
Aliens vs. Predator (fps)	37	32
F1 2010 (fps)	62	52
Metro 2033 (fps)	16	17
Power@ idle (W)	141	130
Power@ full throttle (W)	290	305

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

outputs, including a pair of DVI connectors (one of which is only single-link), one HDMI 1.4a port, and a pair of Mini DisplayPort connections. The logical competition for this card (given its price point and features) is a card like MSI's N560GTX-Ti, built around Nvidia's GTX 560 Ti GPU.

The Radeon has the edge over the GeForce card in texture units (88 to the GTX

560 Ti's 64) and memory clocks (1,300MHz versus 1,050MHz), but the MSI GTX 560 Ti card costs less—by around \$40. What we care about most, though, is how the card performs—not how it looks on paper. We popped the XFx card into our standard graphics test system and hammered on it with our benchmark suite.

As you can see, the XFx card fared a bit better than the MSI card on average, though the MSI N560GTX-Ti card scored a few wins of its own. The XFx card uses a touch more power at idle, but a little less when running flat out. The XXX Edition seems a little quieter than the reference

HD 6950, but you can still hear the dual fans spin up under load. The frequency of that noise isn't as annoying as the stock fan's noise, though.

Is the XFx card worth \$40 more? Part of that price difference is due to the XFx limited lifetime warranty, which is transferable if you resell the card. Ultimately, it depends on what you want in a graphics card. If you're just playing PC games on a single 1080p display, the 560 Ti is a great choice. If you want more than two displays and a little more juice in your gaming, then go for the HD 6950 XXX Edition. —LOYD CASE

VERDICT 9

XFx RADEON HD 6950 1GB XXX EDITION

<p>+ OLYMPUS</p> <p>Solid performance with a good warranty and lots of output connectors.</p>	<p>- HADES</p> <p>Pricier than the competition; draws more power.</p>
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[\\$290, www.xfxforce.com](http://$290, www.xfxforce.com)

Fatal1ty P67 Professional

For professional use only

Celebrities and athletes have great sway over how and what we buy. Cars that win NASCAR races peak consumer interest. Gear that we see experts and athletes use on TV generates far more interest than run-of-the-mill hardware.

So for people who want a board optimized for a badass gamer like Jonathan “Fatal1ty” Wendel, it makes sense to buy his Fatal1ty P67 Professional motherboard.

Obviously, Fatal1ty didn’t buy a motherboard company. The board is actually made and supported by the Asus spin-off, Asrock. Once known as a budget board company, Asrock these days certainly hasn’t been churning out budget products. Given Fatal1ty’s influence, it’s no surprise that the Professional targets devoted gamers. It supports up to three ATI GPUs in CrossFireX mode and Nvidia in SLI mode—but, alas, there’s no tri-SLI support courtesy of an nForce 200 chip like we saw in the Gigabyte P67A-UD7 board we reviewed last month.

Perhaps one of the most intriguing features of the board is its Fatal1ty USB 2.0 mouse port that allows you to tune the polling rate from 125Hz to 1,000Hz (Fatal1ty, BTW, prefers a 500Hz poll rate). It’s a cool feature for folks who really need to tune their mouse to match a particular game’s frame rate. For Joe 12-pack playing pickup games of Call of Duty: Black Ops, we wouldn’t expect miracles. More troubling: We tried several top-flight gaming mice, including a SteelSeries iKari, CM Storm twin-laser Sentinel Advance, and a Microsoft SideWinder, and none of the mice—which incidentally feature adjustable DPI rates—would work with the port. The port did, however, work with an older, non-adjustable Razer Pro and a \$6 Dell mouse.

In another first, the Fatal1ty P67 Professional features the Etron USB 3.0 host controller chip, instead of the NEC (now Renesas) chip we’ve seen in other boards. Etron promises higher throughput, but does it deliver? Yes and no. Using a very fast OCZ

Enyo USB 3.0 drive as our target, the Etron chip was faster than boards that use just the NEC controller. But boards such as Gigabyte’s P67A-UD7, using the NEC+VIA combo, offered slightly better performance. Expect more on this in the future.

In pure performance, the Fatal1ty board hangs right there with other P67 offerings from the top-tier board makers. Like those, the Professional boots fine with 3TB partitions, thanks to its UEFI. The UEFI interface is OK—although you’ll have to make your tweaks with a background image of Fatal1ty glaring at you the whole time. It’s on par with MSI’s UEFI interface, but both trail behind Asus’s super-polished UEFI interface.

Overclocking was also fine—when done from the UEFI. We had less luck with the included OC utility, which would occasionally blue-screen from simply dialing up the multiplier for the 2600K part to 4.5GHz. The same overclock from the BIOS gave us no issues.

And while it’s not a problem per se, it’s a bit odd that the board features a parallel ATA port and floppy port in this day and age. We don’t know why Asrock bothered to waste real estate on these legacy ports.

Overall, the Fatal1ty is a solid board that offers a ton of features for the money. As we said, Asrock has traditionally been associated with budget and ultra-budget boards, but this should make other board makers take notice. —GORDON MAH UNG

■ ■ ■
VERDICT
9

FATAL1TY P67 PROFESSIONAL

<p>+ IMMORTAL</p> <p>Good USB 3.0 speed; tunable mouse port.</p>	<p>- MORTAL</p> <p>Special mouse port doesn't work with some mice.</p>
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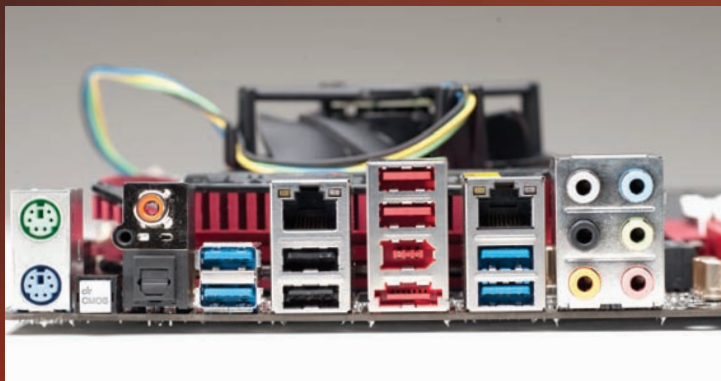
\$250, www.asrock.com

BENCHMARKS

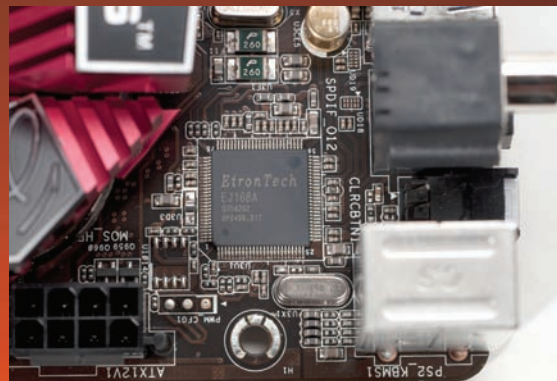
	Fatal1ty Professional Series	Gigabyte P67A-UD7	Asus P8P67 Deluxe
PC Mark Vantage 64-bit	11,326	10,556	11,250
Everest Ultimate MEM Copy (MB/s)	21,382	21,324	25,128
SiSoft Sandra RMA Bandwidth (GB/s)	15.7	15.6	15.7
3DMark Vantage Overall	15,188	14,471	14,845
Valve Particle test (fps)	179.0	178.0	180.0
Resident Evil low-res (fps)	132.5	131.3	132.0
HAWX low-res (fps)	243.0	234.0	244.0
HD Tune Pro Sustained Read (MB/s) Marvell 6Gb/s Controller	233.0	237.0	208.0
HD Tune Pro Burst Marvell (MB/s)	171.0	174.0	157.0
HD Tune Pro Sustained Read (MB/s) Intel 6Gb/s Controller	264.7	267.1	256.7
HD Tune Pro Burst Intel (MB/s)	178.0	191.2	170.0
HD Tune USB 3.0 (MB/s)	177.0	180.0	155.6

Best scores are bolded. For our tests, we used a 3.4GHz Core i7-2400K, an EVGA GeForce GTX 285, 4GB of DDR3/1333, a Western Digital Raptor 150, and Windows 7 Professional. SLI compliance was tested with two GeForce GTX 580 cards. For USB 3.0 performance, we used an OCZ Enyo, and for SATA 6Gb/s, we used a Crucial C300 SSD.

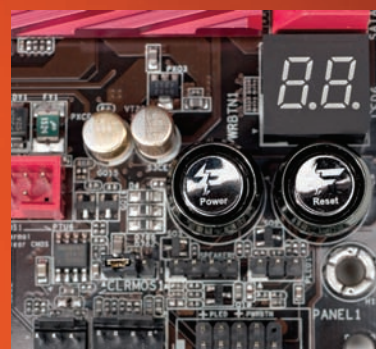
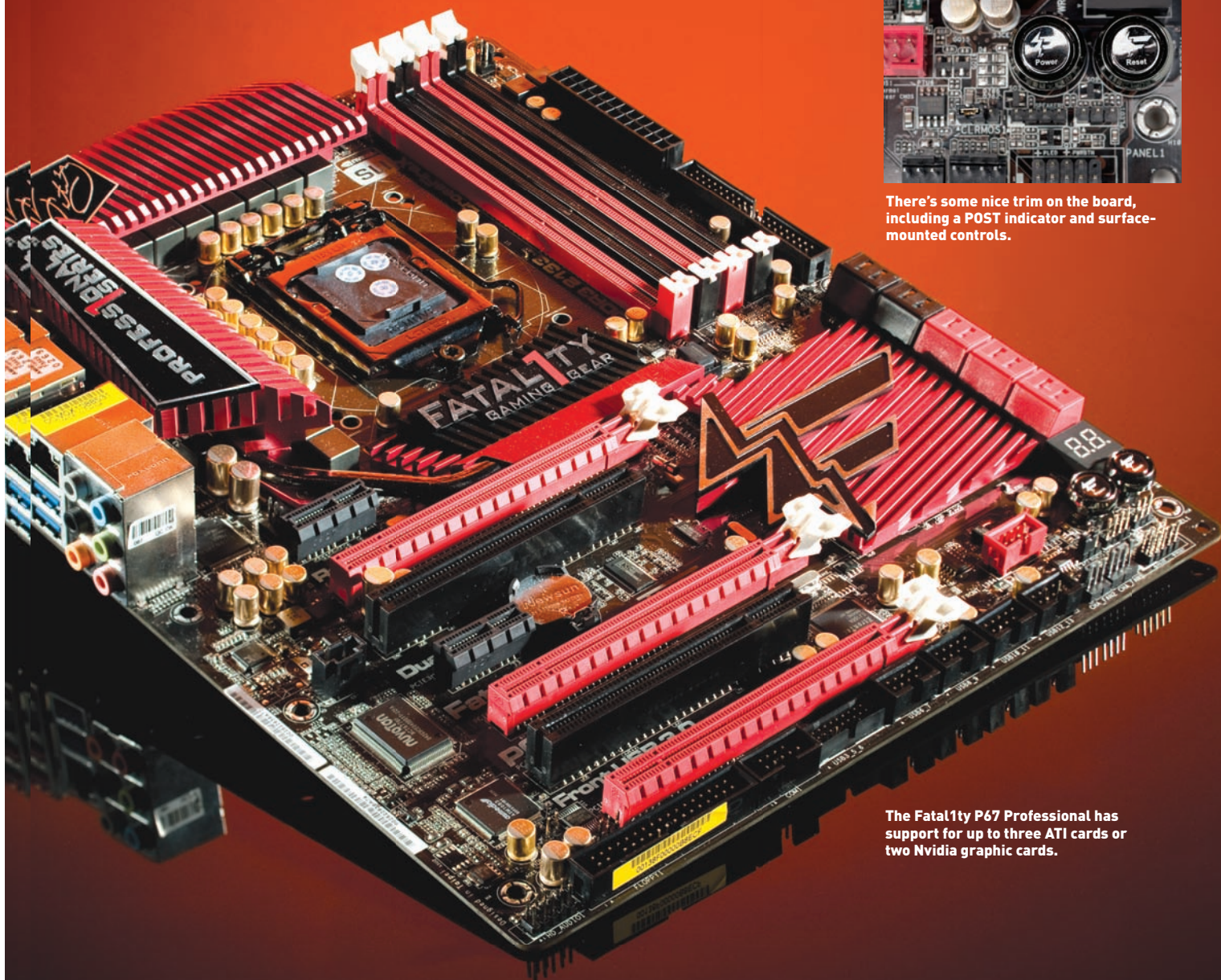




The Professional features a tunable USB 2.0 mouse port.



The Etron controller is truly faster than a standard NEC's USB 3.0 host controller.



There's some nice trim on the board, including a POST indicator and surface-mounted controls.

The Fatal1ty P67 Professional has support for up to three ATI cards or two Nvidia graphic cards.



Antec's Kühler series looks just like Corsair's earlier coolers, and there's a reason for that.

Liquid-Cooler Partner Swap

Once again, Antec and Corsair battle for CPU cooler supremacy

Closed-loop liquid CPU coolers occupy a middle ground between water- and air-cooling systems. Traditional water-cooling setups offer better cooling than air, but installation and maintenance can be a chore. All-in-one setups offer most of the cooling power of a custom configuration with the maintenance-free appeal and easy installation of an air cooler. For the past few years, Corsair and CoolIT have been warring for the liquid-cooling market, but recently, well, things have changed. Both are still in the game, but today's contenders are new systems from Corsair and Antec. Both target the market segment now held by Corsair's H50 single-fan cooler. —NATHAN EDWARDS

ANTEC KÜHLER H2O 620

If it weren't for the branding on the Kühler H2O 620's fan and water block, you'd be forgiven for mistaking it for a Corsair product. Its mounting bracket is the exact same one used in Corsair's Hydro H50 and H70 cool-

ers, while its radiator looks like the H50's and the pump unit looks like the H70's. Is this a case of industrial espionage?

The answer is less sordid, but still full of intrigue. The reason that the Antec Kühler H2O 620 looks like Corsair's last two coolers is that, well, that's basically what it is. Antec has tapped Asetek, the OEM behind the Corsair H50 and H70, for its Kühler series, which feature's Asetek's newest pump unit and radiator.

While the new pump unit and radiator might look familiar, the Kühler 620 sports some features that are distinct from its Corsair-branded predecessors. First, its liquid-bearing tubes are smooth and rubbery rather than corrugated and plastic-feeling, and they feel more flexible. Second, the little plastic adapters that let you swap the mounting bracket between LGA 775, 1155/1156, and 1366 are green and blue instead of black. Finally, the radiator fan plugs into a lead on the pump unit, and the pump unit plugs into the CPU_FAN header. Previous coolers had

both the fan and pump plug into the motherboard, which can lead to confusion. This system eliminates that confusion.

Installation of the Kühler 620 is easy. The 12cm fan and radiator mount in place of your case's rear exhaust fan, and the pump/heat-exchanger unit is held tight against the CPU by a familiar backplate/clamp combination. The clamp has a series of barbs around the edge that correspond to ledges around the pump unit; once the pump unit is against the CPU, you turn the cooler a few degrees to match the barbs and ledges, then tighten the mounting mechanism to the backplate. We only had one slight issue—it's very easy to overtighten the mounting screws and strain the blue 1156/1366 screw adapters on the mounting bracket.

Once installed, the Kühler H2O 620 performed well. At 100 percent CPU load on all cores using Intel's custom Lynnfield thermal utility, the Kühler brought our over-clocked CPU to 65.75 C—slightly cooler than Corsair's H60, and 2 C cooler than the H50.



You might not realize that the H60 was designed by CoolIT, because it doesn't have a superfluous LCD screen.

At idle, though, the Kühler was the worst of the bunch, at 38 C with zero CPU activity. None of the liquid coolers outperformed our dual-fan Prolimatech Armageddon, our air-cooling champion.

The Antec Kühler H2O 620 performs better than the Corsair H50, which is built on the same framework, and the Corsair H60, which isn't. It's also \$5 cheaper than the former and \$10 cheaper than the latter. This is a whole lot of cooling with not a lot of noise, for not a lot of dough.

	VERDICT	9
ANTEC KÜHLER H2O 620 \$70, www.antec.com		

CORSAIR HYDRO SERIES H60

Earthquakes. Volcanoes. The dead rising from the grave. Human sacrifice. CoolIT and Corsair working together. You get the point. If you had asked us last year whether the two would ever bury the hatchet, we'd have laughed. And we'd have been wrong. At CES this year, Corsair announced a partner-

ship with CoolIT, and the Corsair H60 is the first fruit to come out of that collaboration. Whether Corsair's embrace of CoolIT drove Asetek into the loving arms of Antec, or the other way around, is a matter for speculation.

The business end of the Hydro H60 doesn't look much like Corsair's H50 or H70, but it doesn't look like CoolIT's Eco or Vantage A.L.C. coolers either. The pump and heat-exchanger unit is square, not round, and it's only around an inch thick, unlike CoolIT's previous efforts. It also lacks an LCD screen, though it does include a 2-pin connector that will allow the H60 to be controlled by Corsair's upcoming Link system-control software (built from the bones of CoolIT's Maestro). Both the fan and pump unit of the H60 plug into the motherboard—the fan into the CPU_FAN header and the pump into any other header. We swear previous coolers had it the other way around.

The barb-and-ledge mounting system used by the Corsair H50 and H70 (and Antec's Kühler 620) is replaced in the H60 by a simpler mechanism for Intel CPUs—four double-ended thumbscrews screw through the mounting holes into a universal back-

plate, and the H60's mounting holes fit over the top. Four more thumbscrews tighten the H60 against the CPU.

In our cooling test, the H60 outperformed its predecessor, the H50, by a little more than 1 C at full burn, but was slightly hotter than the H50 when the CPU idled. On the other hand, the H60's idle temperatures were slightly lower than those of Antec's H2O 620.

The H60's performance puts it squarely between the H50 and Antec's 620 at both burn and idle temperatures. The H60 really isn't about performance, though—Corsair's H70 is still the best liquid-cooling loop for that. Instead, the H60 represents a first step for Corsair and its partnership with CoolIT. It prepares the way for more CoolIT-built Corsair coolers (we're guessing the H80 will have a double-thick radiator and two fans), as well as Corsair's upcoming Link software. Whether the Corsair H60 is worth the \$10 premium over the Antec H2O 620 will largely depend on whether you plan on buying into the Link platform when it becomes available.

	VERDICT	8
CORSAIR HYDRO SERIES H60 \$80, www.corsair.com		

BENCHMARKS

	Antec H2O 620	Corsair Hydro H60	Corsair Hydro H50	Promatech Armageddon Air Cooler (2 fans)
Idle (C)	38.5	37.5	36.25	35
100% Burn (C)	65.75	66.75	68	62.5

Best scores are bolded. Idle temperatures were measured after an hour of inactivity; load temperatures were measured after an hour running Intel's internal Lynnfield thermal testing utility at 100 percent load. Test system consists of Intel Core i5-750 overclocked to 3.2GHz on an Asus P7P55D Premium board in a Corsair 800D case with stock fans. Temperatures taken with HWMonitor.

Creative Sound Blaster X-Fi Titanium HD

This stunning soundcard makes a solid case for discrete audio

Audiophiles, hear this: The amazing Asus Xonar Essence STX finally faces a true competitor.

Creative's Sound Blaster X-Fi Titanium is startling in several ways. A gaming and music enthusiast's audio card, this X-Fi is ready for Windows 7 (and Vista) out of the box and comes armed with Creative Alchemy, which restores multichannel positional audio for legacy Windows XP and Vista games. Watch out, though: The sheer fidelity of the card's output will really make you notice any shortcomings in the quality of your speakers' or headset's sound. Another thing you'll notice: Its analog outputs don't include an option for more than two speakers. Users of 5.1 or 7.1 systems without optical or digital audio inputs or a decoder will probably want to think about another soundcard because of this.

Our test bed's crispy-clear Logitech Z-5500 5.1 kit is, thankfully, equipped to handle what the X-Fi Titanium HD has to offer, as are our Phiaton headphones.

To test this beast, we stayed in the real world, employing careful listening tests and comparing the clarity and accuracy of the card to Asus's triumphant Xonar Essence STX. We played a dozen games and listened to countless hours of music, including CDs, ripped MP3s of various bitrates, and a studio-quality, 24-bit, 96kHz DVD of the Flaming Lips' recent album *Embryonic*.

The games proved the card is a true player's paradise. *Dead Space* and its sequel, which you could easily argue have the best sound design in gaming history, both sounded atmospheric and creepy with an impressive-sounding range of effects across all sound spectrums, and the positional audio was perfectly accurate through both a two-cone headset and the Z-5500. *Mass Effect 2*, *Call of Duty: Black Ops*, *BioShock 2*, the underrated reboot of *Medal of Honor*, and *Dead Rising 2* all sounded tip-top as well. Alchemy even made oldies-but-goodies like *The Lord of the Rings: Battle for Middle Earth 2* sound snappy and vibrant.

Musical tastes vary, as do file formats,



Trust us on this one—your ears will thank you.

bitrates, and studio mastering. It would be impossible to list all the bands and songs we tested, but we hit every genre from ambient to experimental noise. To say we were blown away doesn't do justice to how impressed we were with the audio this card pumped out.

It's important to note that low bitrate rips are quite obviously tinny, with sizzle in the cymbal crashes—a card of the X-Fi Titanium HD's prowess really exposes the flaws in an audio file. Our 320Kb/s MP3 rips, however, sounded fantastic, and the Lips' studio-quality double album was so full of life, we noticed details in the music we never detected listening to a CD of the same material.

The card installed quite easily. The control software is typical Creative stuff (if you've used past generations of X-Fi cards, the Creative Console will be familiar from the outset). The X-Fi Titanium HD's operational amplifiers are force-fit rather than soldered in, which means they're replaceable; the card encodes Dolby Digital and DTS for HTPC purposes; it supports ASIO 2.0 for outstanding recording quality.

The only thing it doesn't support, which might be a stickler for gamers, is Windows XP and prior versions of Microsoft's ubiquitous OS. The Titanium HD was designed from the ground up for the audio driver stack of Windows Vista and 7.

So, is it better than the Xonar Essence? Honestly, we couldn't detect a difference. Both cards are of such high quality that a purchasing decision will probably be determined by pricing, brand loyalty, or simple personal preference.

At its street price, which hovers in the \$160 to \$170 range (far lower than its MSRP of \$300), gamers might stick with the crummy onboard audio that comes with every motherboard—but real audiophiles will find the Sound Blaster X-Fi Titanium HD a rewarding purchase. —JOEL DURHAM JR.

SPECIFICATIONS

Frequency Response	10Hz–90kHz (10Hz–46kHz via headphones)
DAC Resolution	24-bit, 192kHz (24/96 via headphones)
Signal-to-Noise Ratio	122dB max; 115dB min
Ports	1/8-inch mic, 1/8-inch headphone; L/R RCA (with included stereo RCA-to-3mm adapter) line out; optical in/out.



VERDICT **9**

SOUND BLASTER X-FI TITANIUM HD

FLAMING LIPS

Close to perfect sound; excellent game support in Windows Vista and 7.

POLYPHONIC SPREE

Expensive; analog-out ports for only two channels; reveals speaker/headphone weaknesses.

\$300, www.soundblaster.com

Motorola Xoom

But for a lack of app support, this tablet would kick ass

The Android tablet is like one of those genetically engineered super-species from a sci-fi thriller. Each successive generation is smarter, faster, and bigger than the one before it, and the pace of evolution gains momentum with each iteration. The Dell Streak wasn't a viable challenger to any device in the tablet universe, but the Samsung Galaxy Tab showed the potential of what an Android tablet could be. Now the Motorola Xoom—almost a de facto reference device for the new Android Honeycomb OS—emerges as an evolutionary leap forward, and a direct threat to the iPad's top-of-the-food-chain status.

Pixel for pixel, the Xoom's 10.1-inch display isn't quite as bright and saturated as the iPad's, but we love its higher-res 1280x800 resolution, and its widescreen aspect ratio. Because the aspect ratio is 16:10, HD movie content (limited to 720p) fills nearly the entire visible display with practically zero letterboxing. Relative to the iPad, the Xoom also has a significantly thinner black border around its viewable display area. But the main benefit of the Xoom's display is that it's larger than 7 inches, the previous high-water mark for Android tablet screens. Certain tap-computing tasks like web browsing, touch typing, and gaming come alive once you graduate from 7 to 10 inches.

Besides its large display, the Xoom's outward-facing hardware features are ostensibly standard for an Android tablet. That said, the tablet's rear-mounted, 5-megapixel camera impressed the hell out of us with sharp image quality. Even better, the rear camera can shoot 720p video, and when married to the pre-installed Movie Studio app, it turns the Xoom into a robust, all-in-one video production device. Almost unfathomably, Movie Studio comes with no documentation of any kind, but it's quite a deep app for a freebie, letting you insert individual photos, an audio soundtrack, titles, special effects, and frame-by-frame transition effects.

The Xoom's 1GHz, dual-core Nvidia Tegra 2 processor helps propel the Honeycomb OS and various Android apps to iPad-surpassing performance levels. We found application response to be fluid and zippy—especially in the new browser, where screen draws are faster than on the iPad. You also get 1GB of system memory (the iPad includes just 256MB), and 32GB of storage (as well as the option to add another 32GB when the



The Tegra 2-powered tablet simply screams.

MicroSD card slot is activated by a future software update).

The new browser includes tabbed windows, which should be nonnegotiable for a 10-inch touch device. And, like the other built-in Honeycomb apps, the browser includes a contextual options menu, providing direct links to extra functionality and software settings—options that iOS often hides in an OS-level menu. Indeed, from the Android OS itself to all its various apps, Honeycomb gives you a higher degree of customization and user autonomy than iOS. This is most vividly illustrated in Android widgets, which provide app-like functionality and streaming data right on your desktop, with no app launching necessary.

Besides lacking Flash support (at least until Adobe releases Flash Player 10.2 for Android), only the slim pickings of truly good titles in the Android app market hold the Xoom back from iPad-annihilating status. Yes, we love the Xoom and can see using it as our primary tablet—until we need an app that's only available for iOS. The Xoom proves that Honeycomb can be a superlative tablet platform. Android developers: The ball's in your court. —JON PHILLIPS

SPECIFICATIONS	
OS	Android 3.0 (Honeycomb)
Processor	1GHz dual-core Nvidia Tegra 2
Memory	1GB DDR2
Storage	32GB onboard; 16/32GB via MicroSD pending software update
Display	10.1-inch, 1280x800, 150ppi
Cameras	2MP front; 5MP back with dual LED flash
Connectivity	3G (with 4G support pending software update); Wi-Fi 802.11 a/b/g/n; Bluetooth 2.1; proprietary power connector; Mini USB 2.0, Mini HDMI
Weight & Dimensions	1.6 pounds; 9.8x6.6x0.5 inches

VERDICT 9

MOTOROLA XOOM

+ ZOOM THE TV SHOW	+ ZOOM THE MOVIE
High-res screen; speedy proc; killer camera features; Honeycomb OS, web browser, and widgets.	No Flash support (yet); bleak app offerings.

\$800 off-contract, \$600 with 2-year contract, www.motorola.com

Enermax Hoplite

Some beauty in this beast

From the outside, the Enermax Hoplite doesn't really stand out. Its generic industrial look has been done before, and better—it owes a lot to Cooler Master's HAF series, by way of example. What it lacks in the looks department, however, it makes up for with ease of use. Couple that with a \$100 price tag and a pretty spiffy LED-enabled front fan, and you've got yourself a deal. Kind of.

The Hoplite is a mid-tower chassis that is painted black throughout. The side panels are made of sleek, lightweight steel, while the front and top panel (now with a built-in SATA dock!) are made of matte plastic, lined with steel mesh underlain by screen. The front panel offers two USB 2.0 ports, an eSATA port, and the standard audio jacks.

The case itself is actually quite small, measuring 8.25 inches wide by 19.3 inches high by 18.5 inches deep, narrowly beating the already small Thermaltake V9 BlacX Edition we reviewed in March. The Hoplite can accommodate both ATX and microATX motherboards. Its hard drive cage has room for four toolless 3.5-inch bays and two 2.5-inch bays, and the front of the case conceals two hotswap SATA trays. Despite the Hoplite's relatively small size, it can fit a full 12.2-inch GPU, though this should definitely be one of the final steps in your build, as trying to work around the massive GPU in such a small form factor can be cumbersome.

The case comes stock with just two fans—a variable-speed 12cm front fan with blue and red LED lights and a slide-out dust filter, and a 12cm rear fan. The LED lights are customizable via a switch on the front panel—you can set them to blink on and off, blink in a circular pattern, or stay on. The top panel can accommodate two 14cm or 12cm fans, and the side panel can take either two 12cm fans or one 20cm fan.

The motherboard tray features five rubber-grommeted cable-routing cutouts that allow for easy cable management. The mobo tray also has one of the largest CPU backplane cutouts we've ever seen in a case, plus a cutout near the PSU to route power cables behind the case. Our test build was easy, fast, and organized. Given the Hoplite's impressive cable-routing options, it's kind of a shame that the left side panel doesn't have a window so you can ogle your highly organized innards. You'll have to make do with mesh.

So is the Hoplite worth the price tag? It depends. For the price, it's far less feature-laden than cases like the Thermaltake V9 BlacX Edition, which sports an additional top SATA dock (of better build quality, no less), a front-panel USB 3.0 port, and a 23cm top exhaust fan—but no cable-routing cutouts in the motherboard tray. Where the Hoplite really shines is organization—the five cutouts make constructing a polished and professional-looking computer easy and fast. Whether or not the Hoplite is a good deal for you will depend on whether you value those cable-management features more than the fancier hardware other \$100 cases provide. —ALAN FACKLER



The five rubber-grommeted routing cutouts in the mobo tray make organization a snap.

		VERDICT 7
ENERMAX HOPLITE		
+ STEEL	+ STEEL	
Cool LEDs and removable dust filter on front fan.	Industrial look doesn't really work for us; no side window; flimsy top-panel SATA dock.	
\$100, www.enermax.com		

Top panel SATA docks are convenient and all, but this one is pretty flimsy.



The hard drive cage has room for four toolless 3.5-inch bays and two 2.5-inch bays.



The Hoplite takes most of its cues from Cooler Master's HAF series but adds a cool front LED, too.

Mvix Minix 890GX-USB3

Small, powerful, and flexible

Nothing illustrates our problem with MSI's E350IA-E45 mobo (reviewed last month) better than the Mvix Minix 890GX-USB3.

Manufactured for Mvix by J&W, the Minix pretty much solves the primary issue we had with MSI's Fusion-based motherboard: While the MSI board featured a soldered-on CPU in the form of a Fusion E-350, the Minix is far more traditional in that you pair your board with the processor that best suits your needs.

In this case, Mvix gives you an AM3 socket with standard AMD cooling brackets. This lets you run a standard cooler. However, lower-profile cooling units we tried, such as the Silverstone NT07, were an extremely tight fit, to the point where the heatsink literally sat on one of the caps and jumpers. Not good.

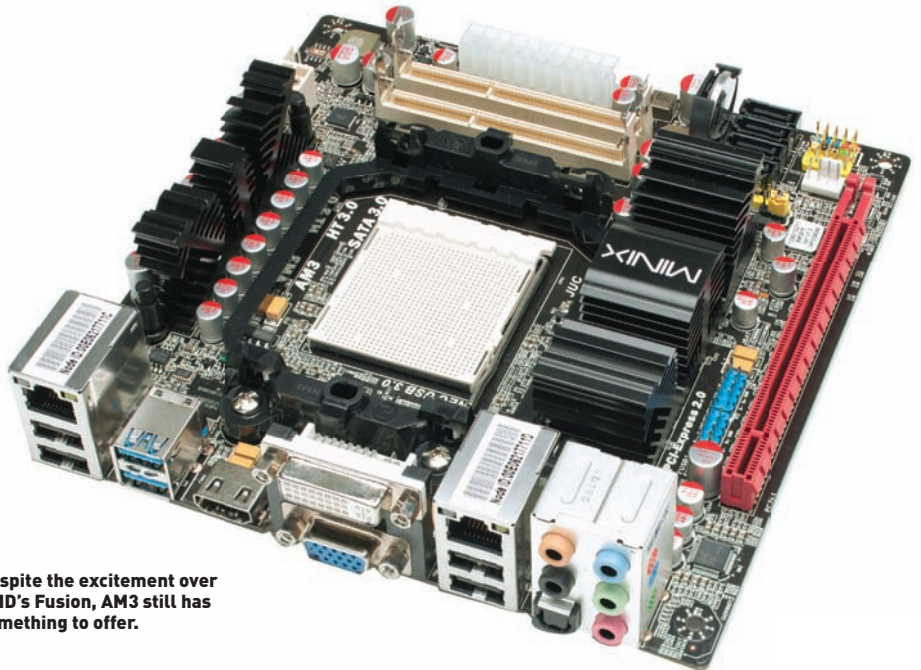
In the features department, Mvix hits all the highlights. There's AMD's 890GX chipset with the SB850 south bridge, an NEC USB 3.0 controller, the Realtek audio codec, and not one, but two Gigabit ports powered by Broadcom PHYs. Why two? Mini-ITX boards often find themselves pulling duties in odd places, and dual Gigabit ports could accommodate the board's use as a home-brew router or NAS.

We like that Mvix includes built-in 802.11n. We know a USB dongle is an easy fix, but this is extremely convenient. It's also a feature MSI neglected.

We tested the Minix 890GX-USB3 with an AMD energy-efficient, 65-watt, 2.6GHz Phenom II X4 910e. Interestingly, Mvix says the board is Phenom II X6 ready, but rates the board for a maximum of 95 watts. We know of no Phenom II X6 processors that have TDP ratings of less than 125 watts. While those are worst-case scenario ratings by AMD, we'd rather err on the side of caution and stick with a 95-watt or lower proc.

Booting the board with the Phenom II and 4GB of RAM, we realized exactly what's wrong with both Fusion and Atom—their x86 performance. Simply put, the Phenom II gives you "real" x86 performance and never feels bogged down. With both Atom and Fusion, Windows 7 doesn't feel responsive enough.

In graphics, however, the newer Fusion part does outpace its sibling. This gaming prowess (at low resolutions anyway) isn't al-



Despite the excitement over AMD's Fusion, AM3 still has something to offer.

BENCHMARKS

	Minix 890GX-USB3	MSI E350IA-E45	Dell Inspiron Zino	Polywell Giada Ion-100	Asrock Vision 3D
CPU	2.6GHz Phenom II X4 910e	1.6GHz E350	1.5GHz Athlon X2 3250e	1.3GHz Atom 330	2.4GHz Core i3-370M
GPU	Integrated Radeon HD 4290	Integrated Radeon HD 6310	Integrated Radeon HD 3200	Integrated Nvidia Ion	GeForce GT425M
Photoshop CS3 (sec)	150	438	449	552	162
Main Concept (sec)	1,806	4,604	7,080	8,858	2,452
3DMark 2003	5,269	6,403	2,540	3,371	17,394
Quake III (fps)	284	193	192	118	537
Quake 4 (fps)	37	43	29	29	112

Best scores are bolded. All tests were run on Windows 7.

ways reflected in our benchmarks. The higher clock speed and faster x86 performance of Phenom II made the older Athlon 64 core in Fusion look far weaker than it actually is. The good news is that the 890GX had just enough juice to run all of the HD video we threw at it. In areas where the 890GX was lacking in graphics performance, its faster x86 cores made up for the shortcoming.

This brings us back to our original premise: Fusion boards with soldered-in CPUs lock you into that CPU, er, APU performance. Traditional boards like the Minix let you run a processor of your choice, be it a 35-watt power-sipping proc or a high-clocked multicore jobbie. Our take is that flexibility is a valuable commodity in a motherboard. Of course, there is also the matter of price. With

a street price of \$200, the Minix 890GX-USB3 is about \$60 more expensive than comparable MITX AM3 boards from Asus and Zotac.

—GORDON MAH UNG

VERDICT 7

MVIX MINIX 890GX-USB3

<p>+ HOBBITS</p> <p>Nicely outfitted with HDMI, DVI, and Wi-Fi.</p>	<p>- JOHN BOBBIT</p> <p>Very pricey compared to competitors.</p>
---	--

\$200, www.mvixusa.com

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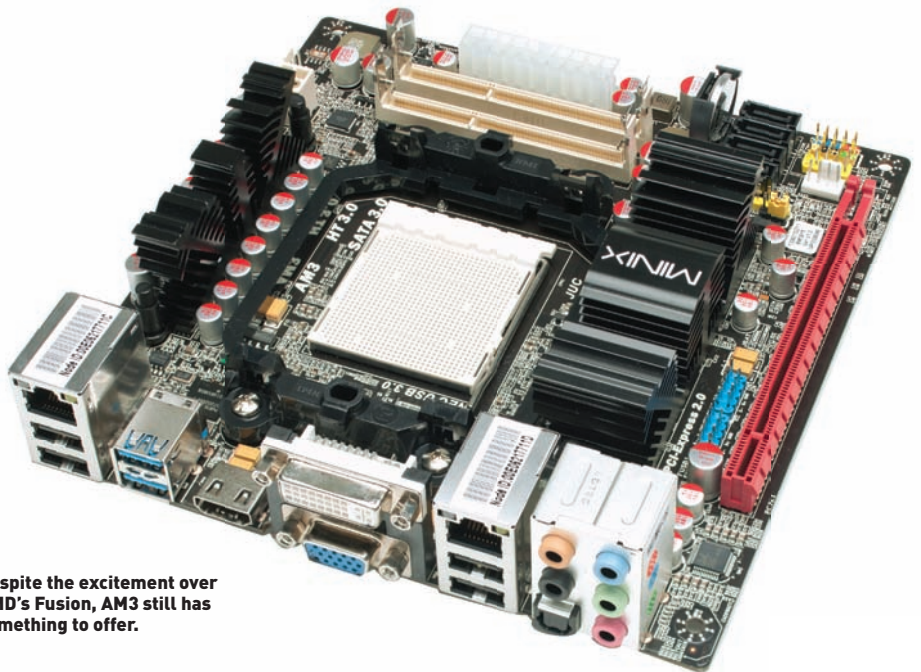
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—GORDON MAH UNG

VERDICT 7

MVIX MINIX 890GX-USB3

+ HOBBITS Nicely outfitted with HDMI, DVI, and Wi-Fi.	- JOHN BOBBIT Very pricey compared to competitors.
--	---

\$200, www.mvixusa.com



The Atrix 4G has a multitouch, capacitive, 4.1-inch, 960x540 screen with 275 pixels per inch. It also can shoot video in 720p, with 1080p support coming in a future software update.



The Atrix 4 laptop dock offers up a 1366x768 screen and a battery charger for the phone itself, but in-dock performance is lackluster.



The Atrix's laptop dock is like a combination of Google's CR-48 and a MacBook Air.

Motorola Atrix 4G

A GeForce GPU? That's a scary-fast smartphone

As far as referendums on Nvidia's new Tegra 2 processor go, Motorola's and AT&T's Atrix 4G is a success. It throws off beastly performance and also manages to greatly reduce power consumption. However, when viewed as a referendum on the ARM architecture's potential to scale up and supplant x86 in laptops and desktops—or even run Windows—the outlook isn't quite as promising.

First the basics. This is the fastest phone we've ever tested. In our benchmarks, the 1GHz dual-core Tegra 2 CPU and GeForce ULP GPU helped the Atrix best even Samsung's very fast Epic 4G in most of our tests. The Maximum PC Lab is just starting to benchmark phones, but it's clear that Nvidia just dropped notice on the mobile world. Even more surprising is the lack of strain this performance puts on the Atrix's 1930mAh battery. This is the first Android phone we've been able to run for almost two days straight out of the box.

A LAPTOP WITHOUT THE LAPTOP

All of the information and data above take a backseat to the Atrix's true intent of allowing us to work and play without an x86-based desktop or laptop. You can plug the Atrix into the proprietary \$400 laptop dock depicted here—which lacks a CPU and storage and has only a chiclet keyboard, touchpad, battery (that automatically charges your phone), and an impressive 1366x768 screen—and bang, you have a laptop. Well, kind of.

Mac-style shortcuts allow you to launch full-screen applications such as Firefox, a media player, and even Citrix's client software from the dock-top. Most intriguing, however, is Mobile View, which virtualizes the Atrix 4G in its entirety—apps, games, buttons, and everything—in a window on the laptop dock's screen. Mobile View allows you to operate your phone with a mouse and keyboard on the big screen. You can even make and receive phone calls on speakerphone in this mode.

The fact that this works at all merits praise. We expect that

in two years' time, all major phones and operating systems will sport similar functionality. Unfortunately, in practice the Atrix's Webtop mode is not quite ready for prime time. The most noticeable flaw is the worst kind of problem to have: slowness. We're talking slower-than-netbook slow.

This is compounded by other discomforts, such as not being able to use QuickOffice's productivity apps—word processor, spreadsheet, etc.—in full-screen mode. Thankfully, you can use Google Docs, or any other web-based application, in full-screen mode. But this begs the question: If you're just going to use this laptop dock as a glorified web browser and phone charger, wouldn't you be better served with a tablet, or a Chrome OS-equipped laptop?

Despite these shortcomings, as far as pure phones go, the Atrix is outstanding. And its docking capabilities are literally the first of its kind. We're not going to penalize the phone for an optional dock, but just know going in that attempting to replace your laptop with the seemingly unholy hybrid here may leave you wanting more. —GEORGE JONES



MOTOROLA ATRIX 4G

VERDICT

9

+ MATRIX

Super-fast smartphone performance; superior battery life; eliminates the need for a PC.

- GIMMICKS

Laptop dock performance is netbook slow; no 4G unlimited data plans.

\$500 (\$200 with plan), \$400 laptop dock, www.att.com

BENCHMARKS

	Motorola Atrix 4G	Samsung Epic 4G	Motorola Droid 2	HTC Incredible
CPU	1GHz Nvidia Tegra 2 dual-core	1GHz Samsung Hummingbird	1GHz TI OMAP	1GHz Qualcomm Snapdragon
RAM	1GB	512MB	512MB	512MB
Screen	4-inch, 540x960 Pentile TFT	4-inch, 480x800 Super AMOLED	3.7-inch, 480x854 TFT	3.7-inch, 480x800, S-LCD
Battery	1930mAh	1500mAh	1500mAh	1300mAh
An3DBench	7,177	6,595	6,144	4,880
FPS2D (fps)	58.0	54.6	60	57
Linpack (fps)	36.92	8.0	14.49	33.52
NenaMark1 (fps)	40.1	38.8	22.9	14.3

Best scores are bolded.

Ooma Telo and Handset

Don't limit your cable cutting to your cable provider

It's no secret that the number of minutes the average American spends talking on his or her home phone has been in steep decline in the last few years. The truth is that for most of us, the landline is more neglected than one of Octomom's children.

Despite that trend, many of us still cling to the comfort of a dial tone at home. That's where Ooma's Telo comes in. Offering a stand-alone VoIP service that's essentially free (other than the taxes to the Man), this sleek device is a home phone alternative that lets you flip the bird at Ma Bell.

For most folks, setting up the Telo is fairly easy—although we hit a snag during installation. Normally, the Telo is the first



The \$50 Ooma handset increases call quality but lacks a headset jack.

Cheapskates rejoice, Ooma's Telo is here to make you smile.

device plugged into your modem. This lets it control the flow of data so that if you're making a voice call while hitting a heavy torrent, the call quality isn't disturbed. In the case of our static IP setup, though, we had to run the Ooma plugged into our router instead.

Ooma has an optional \$50 DECT 6.0 handset that syncs to the Ooma unit. It gives you higher "HD" quality voice than a standard phone. The Ooma handset has one glaring flaw, though: no jack for a corded headset. You can also use the Ooma with your existing phone system by connecting it directly to the wall jack. This will put a dial tone on every jack in the house. It's a bit tricky, and the company's own FAQ says you risk bricking the unit if you don't do the procedure correctly.

From here, you fire up a browser, create an account, punch in the address you want your 911 calls to go to, and start making calls. You get typical landline features such as voicemail, caller ID, and call waiting.

Calls anywhere inside the U.S. are "free" and "unlimited." While calls are generally unlimited, the company maintains a technical limit of 5,000 minutes, which it can enforce if it finds out you're using the phone for commercial purposes. Free also has some asterisks hanging over it. International calls will be charged against a prepaid account, but generally it's fairly affordable depending on where you're calling. All Ooma-to-Ooma calls are free.

Originally, Ooma service was free of taxes, until the Man stepped in. Taxes vary depending on your location, but in our case, it worked out to roughly \$3.50 per month. Ooma also offers a premium service for \$10 a month, which tacks on Bluetooth support that lets you use the cell's headset or your cell phone itself. Also



An optional Bluetooth dongle can be plugged into the Ooma, but you'll have to pay extra for the feature.

included are Google voice extensions, text or email notification of voicemail, voicemail to text, do not disturb, an instant second line, community blacklists, and other features.

With Ooma, you can have landline-like, or better, quality for less than the cost of a large latté every month. It's definitely cheaper than Vonage if you can forego the extra features and primarily make calls within the U.S.

Is it as bulletproof as your landline? No. In a power outage you're SOL, and an Internet outage would sideline you as well. But frankly, since every household has a cell phone or three, do you still need that kind of reliability? The real risk is if Ooma implodes, but the company appears quite stable.

Now if we could just get broadband for \$5 a month, we'd be in cheapskate heaven.

—GORDON MAH UNG

VERDICT		9
OOMA TELO AND HANDSET		
+ PIN DROP	- CAN YOU HEAR ME NOW?	
Cut your landline cost to \$3.50 a month.	Hooking it up to your existing phone line can be problematic.	
<small>\$250, www.ooma.com</small>		

Microsoft Arc Touch Mouse

Microsoft's latest mouse redefines portable

The Arc Touch Mouse is the latest in the Arc line—a series of surprisingly design-minded peripherals from Microsoft. The Arc Touch takes the already high-concept line into the stratosphere with a design so innovative that it's almost worth a buy for novelty's sake alone.

What makes the mouse so creative? For starters, the form factor is unlike anything you've seen before. Designed for portability, the Arc Touch starts off as a perfectly flat, thin slab—ideal for slipping into the pocket of a laptop bag. When you want to actually use the mouse, you flex it, and it snaps into a full-size arch-shape mouse, reminiscent of the previous Arc Mouse. The mouse automatically turns on when arched and off when flat. The whole snap-bracelet-style process is oddly satisfying.

Because the mouse is designed to be perfectly flat when not in use, it doesn't have a traditional scroll wheel. In its place, the Arc Touch has a small, touch-

sensitive strip between the left and right buttons. To scroll up or down, you flick your finger up or down the strip, and you double-tap to click. Even better, the touch pad is equipped with a small rumble mechanism and a speaker, which it uses to provide tactile and auditory feedback to simulate rolling an actual wheel. It's a little gimmicky, but the feedback actually does make it easier to scroll using the pad without looking.

The Arc Touch is wireless, and a strong magnet holds the super-low-profile USB dongle to the mouse when not in use.

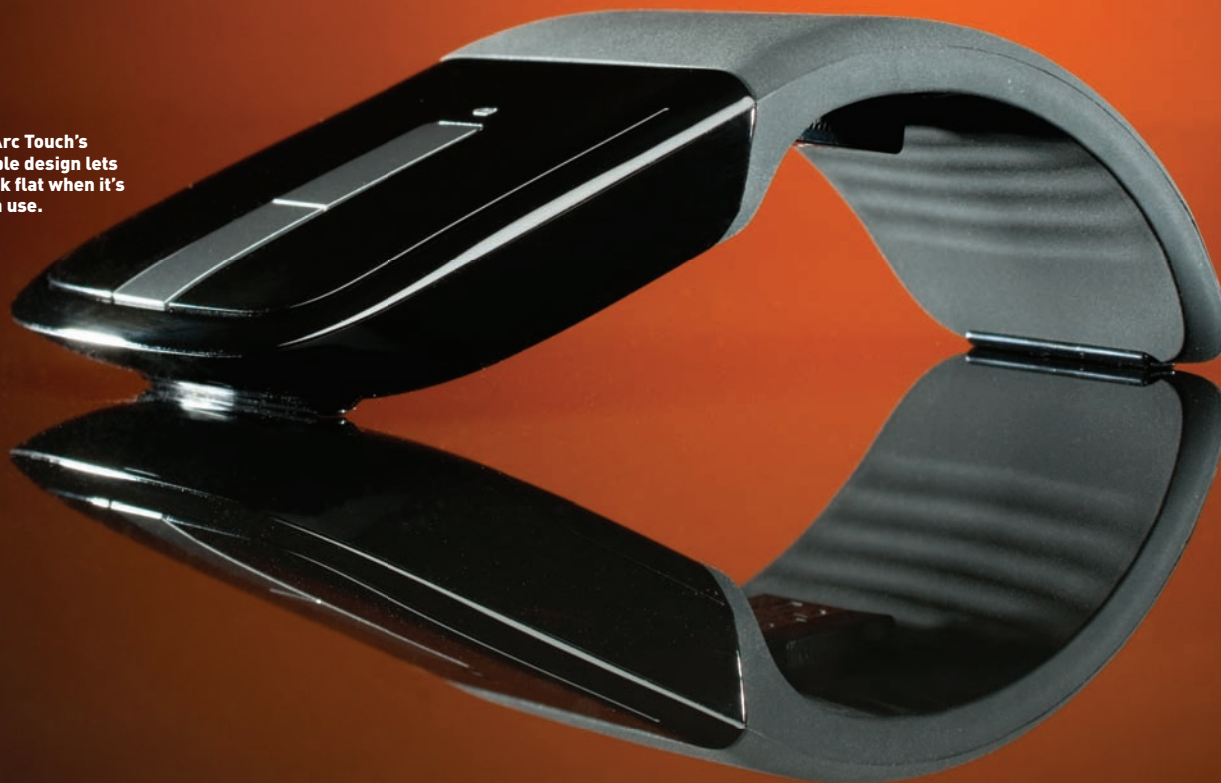
So that's all very cool—does that mean we recommend the Arc Touch unconditionally? Not necessarily. If you're looking for strong mouse fundamentals, the Arc Touch falls flat in a few places. For one, it's not ergonomic at all. It's not totally uncomfortable, mind you, but it feels just how you'd expect a smooth arc to feel as a mouse. Also, it's only got the two

■ ■ ■		VERDICT	8
MICROSOFT ARC TOUCH MOUSE			
+ ARC REACTOR	- ARC FLASH HAZARD		
Innovative, stylish design; full-size mouse, yet surprisingly portable.	Not ergonomic; only two real buttons; not suited at all for gaming.		
\$70, www.microsoft.com			

main mouse buttons and the touch pad. If you've become used to the almost-standard thumb-side buttons, you're going to miss them with the Arc Touch.

If you want a solid, ergonomic mouse for extended use, you should probably look elsewhere. However, if you're looking for a portable mouse with a full-size feel and a head-turning design, the Arc Touch might be your rodent. —ALEX CASTLE

The Arc Touch's flexible design lets it pack flat when it's not in use.



Dragon Age II

Tightened focus results in one of the best RPGs ever

Like *Origins*, *Dragon Age II* is a 50-plus-hour epic with a deep, complex combat system and a well-defined supporting cast. But it also wears its mythology proudly, confident in its goal of charting the rise of a complete and utter badass: you.

The first time you control Hawke—the hero—is in an opening flashback to your family’s escape from the Darkspawn attack on Lothering, which occurred in the first game. *Dragon Age: Origins*’ free battlefield camera is now gone, but at least the mouse-wheel scroll still grants the zoom you need to see the full field. Pausing, issuing a set of orders, then sitting back and watching the chaos unfold remains a joy that never gets old.

The story fills in the gap between this flashback battle and a decade later. The world of Thedas has always been a dark one, full of bigotry and fascism. While it felt like the first game missed a huge opportunity by glossing over this, it seems like the game’s designers have finally come to terms with the world they’ve constructed. *Dragon Age II* has some genuinely dark quest lines driven by moments of tension and tough decisions that not only feel contextual, but will leave you thinking about them.

Nearly all of the game events occur in the city of Kirkwall, which delivers deeper insight into the world’s complex political situation. There’s a constant back-and-forth over conflicting views, and you are free to come down on either side of any given scrap. You’ll talk endlessly with your friends about your



Dragon Age II has restricted the use of a free camera during combat. Outside of this, the progression remains the same: Pause, queue up some orders, and watch the bloodbath.

decisions—what would have happened if you’d killed person X or saved person Y?

You’ll also talk about who they slept with. Did you meet a new party member? Chances are you could have boned them. Thankfully, most of your companions are more enjoyable because their incidental conversations are ruder, funnier, and just plain better.

Combat is rapid and satisfying, but it’s also more intricate than in *Origins*. Each companion has a set class, but from there, specialization is up to you. Cooldown periods are just as integral as before, but the abilities themselves are now flashier and lightning-fast. New skills and spells exist for every class, but the Rogue class in particular has been revamped to be more combat effective through the use of exploding-flash backstabs, backflips, and more. There’s enough newness that you’ll find yourself consistently rotating

your party members. That’s sacrilege in a lot of RPGs, which typically demand a standard party to succeed, but it’s sensible here because everyone’s abilities are so much fun to experiment with and develop.

From what we’d seen leading up to release, we hadn’t anticipated *Dragon Age II* being much of a traditional or even worthy sequel to *Origins*. But the interesting design decision to limit the game’s context—the world and the politics—appears to have freed Bioware to fill the series with more character and vitality than any game in recent memory. Is this the best RPG of this decade? Nine more years will tell, but for now, yes. —RICH MCCORMICK



Much like its predecessor, *Dragon Age II* has no shortage of impressive moments.



DRAGON AGE II

VERDICT **9**

+ MAGE

Visually impressive; remarkable storytelling; improved combat skills.

- PHAGE

No free camera during combat; limited scope.

\$60, dragonage.bioware.com, ESRB: M

Bulletstorm

The *Citizen Kane* of shooting guys in the face

Bulletstorm is a big-armed, bigger-brained contradiction. On one hand, it's about a band of hulking space pirates who can't go two sentences without shouting some (admittedly hilarious) variation on a certain male organ. The game is juvenile and ridiculous, so it only makes sense that it'd have game mechanics to match, right? Wrong. Behind Bulletstorm's barrel-chested bravado is a quiet brilliance—a reinvention of the FPS genre as we know it. It's just a shame that—despite what its title may imply—Bulletstorm doesn't quite manage to completely pull the trigger.

See, Bulletstorm's contradictory nature doesn't stop with its dual personalities. The game's central selling point—the creativity-fueled “skillshot” system—is an amazing idea on paper, but its tremendous potential is only able to leak out in tiny drips *precisely because* it's in Bulletstorm. Here's how it works: Each time you kill an enemy, you're assigned a certain number of points. The amount you gain, however, depends on how you introduce your enemy to his maker. So let's say you get a headshot. Well, the skillshot system's going to be about as impressed with that as Simon Cowell is with anything in the world, so why not mix things up a little? Let's reel the guy in with your leash, give him a nice boot to the face, chain a mine to his torso, and then slide-kick him into some open electrical wiring. And if it makes it easier on you, let's pretend he's Simon Cowell.

The end result is comically brutal, wonderfully satisfying, and—most importantly—tons of fun. There are hundreds of creatively named skillshots, too, so it's like Pokemon,



Normally, if your screen looks like this, you're doing something very, very right.



Console port or not, this game is absurdly gorgeous.

only thousands of times more disturbing. Here's the problem, though: Bulletstorm's levels are extremely linear and scripted—sometimes literally forcing you to aim and shoot exactly where the developers want. Other times, the game serves you the optimal skillshot on a silver platter, allowing you to kick off an obvious chain reaction in the name of scripted spectacle. In those cases, it's actually to your *disadvantage* to be creative, which defeats the purpose of the skillshot system altogether.

Most troubling, however, is the fact that many levels—while visually stunning and interestingly themed—simply aren't very inventive. Your options for skillshots, then, often boil down to “kick that guy into a spiky/electrical object,” “kick an explosive barrel at a bunch of guys,” or “send that guy plummeting into an abyss,” over and over and over.

Multiplayer, meanwhile, isn't quite what you'd expect, but it's much better for it. Basically, it's horde mode, but with a focus on brain-

bending, head-exploding team skillshots. After all, considering the amount of havoc one Bulletstorm player can wreak, imagine what'll happen with three. It is, however, surprisingly tactical, stopping you dead in your tracks if your score's not high enough.

At the end of the day, then, Bulletstorm's definitely not a bad game. Far from it, in fact; it's a gore-spattered blast of a time. Unlike many of today's grim, gray shooters, it aims for pure, unfiltered fun and nails it right between the eyes. However, it falls a few steps short of greatness—a problem compounded by the fact that the campaign's only about seven hours long. Of course, it's supposed to be replayable in pursuit of better skillshots, but the aforementioned stifling linearity and run-of-the-mill level design mean you probably won't be chomping at the bit for a second helping.

—NATHAN GRAYSON

BULLETSTORM		VERDICT 7
+ EMILY DICKINSON	+ DICK DASTARDLY	
Surprisingly brainy skillshot system; crass-but-hilarious sense of humor.	Scripted level design limits skillshot system; short length; little replayability.	
\$60, www.bulletstorm.com , ESRB: M		

LAB NOTES

Adventures in Overclocking

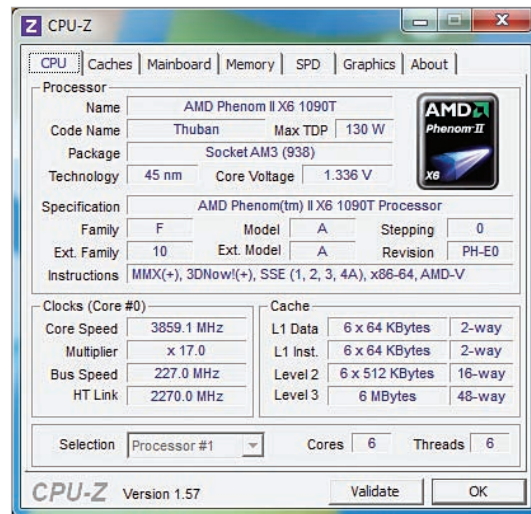
Overclocking helps, but adding cores helps more

The AMD machine I built for this month's Build It section (page 62) almost didn't get overclocked. The first motherboard we used was an early engineering sample, which could explain why a voltage regulation module died with a bad smell at a measly 4GHz multiplier overclock. We dug up a production version of the same board and this time adjusted both clock speed and front-side bus to produce a stable 3.8GHz.

Even overclocked, though, my six-core Phenom II X6 1090T was more than 25 percent slower than the zero-point's quad-core 3.5GHz Core i7-920 in both Vegas Pro and ProShow Producer. Much of that comes from Intel's superior Nehalem microarchitecture, but some of it is the result of HyperThreading. Despite the beating the hexa-core suffered, cheapskates can take heart: The Phenom II X6 1090T has six cores at 3.2GHz, overclocks easily, and costs just \$200. A six-core Intel 3.2GHz Core i7-970, though far faster, will set you back \$600.



NATHAN EDWARDS
SENIOR ASSOCIATE
EDITOR



AMBER BOUMAN
ONLINE FEATURES EDITOR

In conjunction with testing out a six-monitor setup using Samsung's 23-inch MD230 1080p panels, I'm also looking forward to getting two more displays in-house: one of AOC's Aire Black LED monitors and NEC's impressive-looking 30-inch Multisync PA301W.



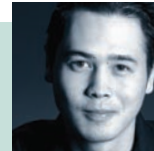
GEORGE JONES
EDITOR-IN-CHIEF

I put Nvidia's 1GHz dual-core Tegra 2 mobile CPU through its paces while testing Motorola's Atrix 4G smartphone. This ARM Cortex-A9 derivative is freaky fast, but politely sips battery power. More CPU tests to come, but it looks like Nvidia has a winner on its hands.



KATHERINE STEVENSON
DEPUTY EDITOR

I'm finally starting to receive notebooks featuring the new generation of mobile processors. This month, I tested a desktop replacement built around Intel's Sandy Bridge. Next month, I'll test a rig from the opposite end of the spectrum—an ultra-budget, ultraportable using AMD's new Fusion proc, which should effectively put Atom-based netbooks out of business.



ALAN FACKLER
ASSOCIATE ONLINE EDITOR

The Motorola Xoom is here, and it's a game changer. This thing is sleek, sports a wicked-high resolution, and features a dual-core processor to power the heavy lifting of Android 3.0 (Honeycomb). I have yet to spend more than a few minutes at a time with it, but the interface is smooth, and snappier than any Android tablet I've ever used. Exciting.



GORDON MAH UNG
SENIOR EDITOR

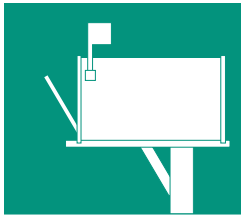
I'm about to review another LGA1366 motherboard—perhaps the last that I'll review before the curtain drops on the X58 chipset and LGA1366 socket. The really big question is whether Intel will replace the socket with a new one. No one knows for sure, but it appears to be a possibility as motherboard vendors have told me they think it'll happen.

We tackle tough reader questions on...

▶ Plasma vs. LCD

▶ LGA2011

▶ Thomas McDonald



Plasma vs. LCD Request

Thank you for the Plasma vs. LCD Deathmatch (March 2011). One thing that puzzled me was that you left out any discussion of motion/refresh rate/frame rate (interpolated). There is a lot of conflicting information on the Internet, and it would have been nice to get a discussion from a reliable source.

—Bill Spotz

Online Features Editor Amber Bouman Responds:

We didn't include refresh rate in the Plasma vs. LCD Deathmatch for one simple reason—it doesn't matter. The short explanation is this: Refresh rates need to be high in LCDs in order to combat motion blur, which is an unfortunate side effect of the LCD technology. Because Plasma uses an entirely different technology to display images, it doesn't produce motion blur and hence doesn't

require a high refresh rate to correct it. However, if you're big into numbers, consider this: Most plasmas have what is known as a sub-refresh rate of 600Hz, while LCDs usually top out at 480Hz.

LGA2011, Anyone?

I've been planning to put together a high-end performance PC. Should I go ahead with an LGA1366 setup or wait for LGA2011? Do you have any idea when it will be released, and is it true that it will come with four memory channels, as well as 40 PCI-E 3.0 lanes? I've also read rumors that it will be backward compatible with LGA1366 cooling solutions.

—Robert Dsouza

Senior Editor Gordon Mah Ung Responds:

If you have the option, it's probably worth waiting. I know that as of two months ago, Intel was struggling with the question

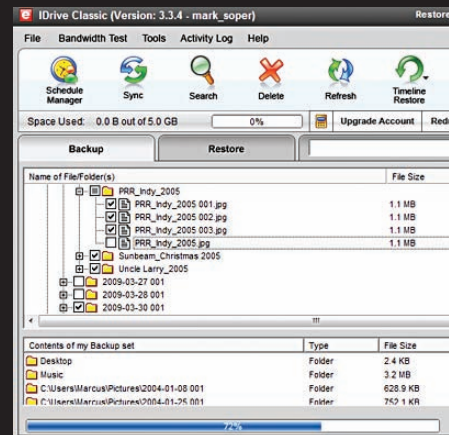
of whether to release it for consumers, but I suspect the company will. I'm basing this on the fact that motherboard companies have been telling me that they're proceeding as though it will happen. I also think that even though Intel's extreme parts are low volume, Intel likes the halo-effect from having über-

performance CPUs. Since the chips are Xeon transplants, it's not like there's much added R&D cost. As to whether LGA2011 will be quad-channel with 40 lanes of PCI-E 3.0, it's quite possible since the chipset is also transplanted from workstations.

NOW ONLINE

The Backup Plan: 5 Cloud-Based Backup Services Examined

From Google's Gmail and Google Docs to Microsoft's Windows Live and Adobe's Acrobat.com, more and more personal computing is taking place in "the cloud." And while online docs are great, we're excited about the next frontier in online services: cloud backup. If you want to keep all your data backed up online, hit <http://bit.ly/hjrQA4> for a feature-by-feature breakdown of five leading services.



PIGS... ON... PAGE

We got buried in responses to our "find the pig" contest (Ed Word, April 2011), but a number of you got suckered into our trap. The pig on the cover and the one featured on page 24 were in fact the same pig. The three pigs we were looking for were: that pig, plus the pigs on page 45 (the end-of-story bug) and page 47. The first 10 readers to get it right were: Andy Freese, Christopher Gerrish, Victor Cheung, John Kelso, Neil Kaufenberg, Anthony Roth, Stephen Fuchs, Carlos Lara, William Cookson, and Noah Wagner. Congrats, guys—you are now the proud owners of two Maximum PC commemorative coins!



APPLICATION TIPS WINNERS

We're all about giving away coins this month. We also received a bunch of responses to our request for coin-winning tips in our March issue ("Powered Up")—so many that we decided to publish a full-fledged story with your suggestions. To see the story, and the winning entries, point your browser to <http://bit.ly/hL7Tys>.



Rage Against the McDonald

Thomas McDonald makes the case in your March issue (Game Theory, "Stuck in Neutral") that the FCC has overreached with its recent net neutrality rules and that the free market should decide how much we pay for Internet access. What Mr. McDonald has failed to recognize is that one size—and more importantly, just one style—is the only option for Internet connectivity that many customers have. Unlike DSL and wireless carriers, which are often available in a range of service speeds, cable providers usually don't let users choose how much bandwidth they want to buy, but rather what that bandwidth carries. And in areas where cable is the only viable option, that means fewer content choices for consumers.

Allowing a provider to charge extra to deliver competing content is exclusionary and monopolistic. Of course, this is nothing new with cable providers—for decades they have been forcing consumers to take what they get or pay more for additional channels. In

that regard, the free market already failed decades ago with sweetheart deals.

—Kip C. Anderson

Rage Against the McDonald, Part Deux

Is Thomas McDonald for real? He asserts that if you think the FCC should regulate the Internet, your naiveté is sweet and infantile. The market isn't perfect, far from it. We still haven't seen the worst results to come from the disastrous Telecommunications Act of 1996 and the resulting acceleration of concentration of media ownership. Yes, regulation is difficult to get right, but an unrestrained market inevitably produces ruinous concentrations. The longer such practices continue, the harder it becomes to undo the damage because the invested interests become more powerful. The 1996 Act was particularly insidious, as Wikipedia explains: "The Act was claimed to foster competition. Instead, it continued the historic industry consolidation, reducing the number of major media companies from around 50 in 1983 to 10 in 1996 and six in 2005. An FCC study found that the Act

had led to a drastic decline in the number of radio station owners, even as the actual number of commercial stations in the United States had increased." Even bad government regulation is better than utter corporate capitulation.

—Mechtheist

After Thinking About This for a While...

In your August 2004 issue, you debunked the myth that a speaker's magnetic field can cause data loss. That makes sense, but can the vibrations from high-powered speakers cause any problems?

—Mike Golden

Senior Associate Editor Nathan Edwards Responds:

The magnetic field from a speaker is far too faint to cause data loss in magnetic media, but vibration is another matter. It's certainly possible for significant vibration to cause read/write errors in spinning media, but a desktop speaker setup—even a powerful one—probably isn't enough. If you make a habit of stowing your laptop on a stadium subwoofer, though, you might want to invest in an SSD. ⚡

COMING IN MAXIMUM PC'S FUELED BY GRIFFIN BLOOD

JUN ISSUE

The Great Guide to Google

We're a wee bit smaller than Google, but that's not stopping us from researching and writing a complete guide full of tips, tricks, and analysis of all of the Internet giant's applications and services.

SSD Smackdown!

Senior Associate Editor Nathan Edwards tells us that a host of new SSD controllers are on the verge of being released, so it's time to round up these doggies. One will be named champion!

Browser Wars, Episode IX

With new versions of Firefox, Internet Explorer, and Chrome either just out or on the way, it's high time we handicapped each browser's odds for succeeding. Performance testing, tips, and verdicts are coming next month.



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

HIGH-END CPU

Core i7-990X

Intel's 3.46GHz Core i7-990X is simply the fastest CPU for highly multithreaded tasks. Yes, its sibling, the cheaper-than-hell 3.4GHz Core i7-2600K, is a steal, but even that next-gen chip can't touch the 990X when the workloads can hammer all 12 threads that the six-core 990X gives you. With Intel's predictable pricing of the 990X at \$999 (why not call it the 999X?), there's simply no reason to buy the 3.33GHz Core i7-980X, which also costs \$999. www.intel.com



THE REST OF THE BEST

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

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

■ **High-End Motherboard**
Asus P8P67 Deluxe
www.asus.com

■ **LGA1366 Motherboard**
Asus Rampage III Extreme
www.asus.com

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

■ **Price-No-Object GPU**
EVGA GeForce GTX 580 SC
www.evga.com

■ **Performance GPU**
Asus ENGTX570
www.asus.com

■ **Budget GPU**
XFX Radeon HD 6850
www.xfxforce.com

■ **Capacity Hard Drive**
Western Digital Caviar Black 2TB
www.wdc.com

■ **Performance Storage**
OCZ Vertex 2 100GB SSD
www.ocz.com

■ **Air Cooler**
Cooler Master Hyper 212+
www.cooler-master.com

■ **High-End Cooler**
Prolimatech Armageddon
www.prolimatech.com

■ **Blu-ray Drive**
Plextor B940SA
www.plextor.com

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

■ **Wi-Fi Router**
Netgear WNDR3700 V1
www.netgear.com

■ **Speakers**
Corsair SP2500
www.corsair.com

■ **Gaming Mouse**
Madcatz Cyborg R.A.T.7
www.cyborggaming.com

Games we are playing

■ **Bulletstorm**
www.bulletstorm.com

■ **Call of Duty: Black Ops**
www.callofduty.com/blackops

■ **Dragon Age II**
dragonage.bioware.com

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

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